

Appendix A

Stormwater Engineering Evaluation – 2016

EA Project No. 14982.01

Topic: Stormwater Engineering Evaluation
Gude Landfill, Montgomery County
Author: William Brooks, P.E., LEED AP BD+C
Date: 4 April 2016

PURPOSE

EA Engineering, Science, and Technology, Inc., PBC (EA) prepared this Technical Memorandum to summarize the findings of the drainage analysis of the existing conditions at the Gude Landfill (the Landfill). The Maryland Department of the Environment (MDE) provided Montgomery County (the County) Department of Environmental Protection – Division of Solid Waste Services (DEP/DSWS) with a formal deficiency letter dated 22 April 2015, which outlined items that were to be addressed in the revised Assessment of Corrective Measures (ACM), including an engineering evaluation of drainage and infiltration at the Landfill. EA has obtained updated topographic survey information (aerial performed in April 2015 and supplemental field work in November 2015) to supplement previously obtained existing conditions information for the site to analyze current drainage conditions.

BACKGROUND

The County DEP/DSWS was directed by MDE to conduct a Nature and Extent Study (NES) of environmental impacts in the vicinity of and potentially resulting from the Landfill. The 2010 NES and the 2011 NES Amendment No. 1 that were prepared by the County and accepted by MDE described the nature and extent of impacts to environmental media and regulatory exceedances that have been identified during ongoing environmental monitoring at the Landfill. The NES also included a review of the site topography, stormwater infrastructure, and improvements to the Landfill's cover system and drainage network through 2011. The review concluded that the Landfill's topography and existing stormwater drainage structures minimized standing water (e.g., ponding) and infiltration into the waste mass. Following acceptance of the NES by MDE, an ACM was prepared and submitted in January 2014 to MDE. The ACM discussed findings of the NES and NES Amendment No. 1, but did not include an updated evaluation of site conditions. In a formal deficiency letter dated 22 April 2015, MDE requested an engineering evaluation of drainage and infiltration at the Landfill be performed as a revision to the ACM report.

STORMWATER ENGINEERING EVALUATION

EA utilized an updated topographic survey obtained by EA's subcontractor, Wallace Montgomery. The topographic survey was obtained using photogrammetric methods in April 2015 and is supplemented by a field run survey performed in November 2015. The 2015 survey information was also supplemented with prior survey information obtained by C.C. Johnson & Malhotra, P.C. in October 2009. The updated survey is shown in Figure 1 and Figure 2. The 2015 survey information was utilized by EA to perform a review of the current elevations of the landfill and an assessment on positive drainage throughout the site.

In addition, EA utilized the design drawings prepared by SCS Engineers (SCS) titled “Gude Landfill Post Closure Engineering Design and Management Tasks,” dated 1992.

As part of the NES, EA performed a condition assessment of the existing site stormwater management infrastructure. As part of the condition assessment, EA created a pre-inspection inventory list of existing site stormwater management infrastructure, which identified more than ninety (90) stormwater management devices from the SCS documents. The inventory included swales, berms, inlet structures, outlet structures, culverts, detention ponds, and sediment basins. During the November 2015 field survey, updated stormwater management infrastructure elevations were obtained. EA utilized this information in addition to the 2015 topographic survey information for hydrologic and hydraulic analysis.

Positive Drainage Review

EA performed a comparison between the 2015 topography and the previously obtained 2009 topography. Since 2009, the Landfill has been subject to approximately one (1) to two (2) feet of settlement, with more or less in localized areas, and is shown in Figure 5. As a result of the settlement, there are currently twenty-six (26) localized low points where positive surface drainage is not maintained. These locations are shown in Figure 4 and listed in Table 1 with coordinate values in Maryland State Plane, North American Datum 1983 (NAD 83). The total area of these twenty-six (26) locations is approximately eighteen thousand six hundred sixty-two (18,662) square feet (SF).

Table 1

Low Point ID	Northing (NAD 83)	Easting (NAD 83)	Area (SF)
LP-1	524,594	1,271,532	155
LP-2	524,658	1,271,732	1502
LP-3	524,730	1,272,079	984
LP-4	524,962	1,272,111	1820
LP-5	525,115	1,272,200	194
LP-6	524,726	1,272,285	1240
LP-7	525,166	1,272,541	2783
LP-8	525,307	1,272,731	403
LP-9	525,367	1,272,739	1463
LP-10	525,356	1,272,928	111
LP-11	525,166	1,273,255	1142
LP-12	525,041	1,272,987	96
LP-13	524,768	1,273,106	625
LP-14	524,627	1,273,057	24
LP-15	524,561	1,272,816	1401
LP-16	524,444	1,271,910	300
LP-17	524,496	1,273,238	82
LP-18	524,847	1,273,476	383
LP-19	524,542	1,273,716	1212
LP-20	524,450	1,273,775	41

LP-21	524,781	1,274,113	551
LP-22	524,879	1,274,509	457
LP-23	523,992	1,273,340	291
LP-24	523,919	1,273,441	603
LP-25	524595	1272650	728
LP-26	524813	1272917	71

Based on the 2015 survey information, the majority of the storm drain network has settled at approximately the same rate as the surrounding grade. However, the storm drain pipe A6 to A4 has experienced differential settlement which has now resulted in the pipe having a negative slope.

Drainage Map

EA developed a drainage area map (Figure 3) indicating drainage area boundaries to stormwater management infrastructure based upon the 2015 topographic survey and field run information. These boundaries indicate the catchment areas and flow directions for surface runoff from the cap. The drainage area boundaries were delineated based upon the updated contours and surface features collected in the 2015 survey. Boundaries were truncated at the property boundary or were terminated where no topography was collected. In other circumstances where contours did not clearly define a drainage feature, such as a ditch or graded bench, a boundary was interpreted based upon features shown in the design drawings entitled “Gude Landfill Post Closure Engineering Design and Management Tasks” prepared by SCS Engineers and dated 22 June 1992. Some drainage areas on the cap are captured and conveyed by storm drains that then discharge further downgradient at the Landfill perimeter or into another drainage area.

EA utilized HydroCAD (version 10) to prepare a hydrologic and hydraulic analysis on the runoff to storm drain structures. Peak discharges to structures and pipe capacities were determined. No pond or basin routing was performed. Based on MDE requirements, the design rainfall event analyzed was the twenty-five (25) year, twenty-four (24) hour storm event (six and two one-hundredths [6.02] inches). For the purposes of preparing the hydrologic model, it was assumed all soils would respond to runoff similar to an HSG D. This assumption is supported by the double ring infiltration analysis by Soil and Land Use Technology, Inc., which is included in the revised ACM. The drainage areas received by storm drain structures ranged from six one-hundredths (0.06) acres to eleven and ninety one-hundredths (11.90) acres. For the largest drainage area (eleven and ninety one-hundredths [11.90] acres) and a twenty-five (25) year, twenty-four (24) hour event, the maximum peak discharge rate was fifty-four and one-tenth (54.1) cubic feet per second (cfs) with a controlling discharge rate from the storm drain of approximately fifty-three and two-tenths (53.2) cfs. As a result, temporary ponding will occur at several structures during the rain event until such time the storm drain can convey the runoff. While the received peak discharge rate is greater than that which the storm drain can handle, the calculations show that any ponded water at the inlet will be fully conveyed within twenty-four (24) hours of the twenty-five (25) year rainfall event. For more frequent storms (e.g., one [1] and two [2] year events), the system will either convey the peak discharge rates during the storm event or convey the runoff in a shorter duration.

Stormwater Data Gaps

EA's subcontractor, Wallace Montgomery, was not able to locate several structures, likely due to vegetation. It is our understanding that structures were not removed since the 2009 survey and EA's 2009 field review of stormwater structures. For the purposes of the drainage area and positive drainage assessment, EA utilized the previously obtained information to supplement the 2015 survey data.

Recommendations

Since 1984 the County DEP/DSWS has maintained a landfill maintenance contract to perform site repairs to the Landfill, which is required to correct surface depressions and the resulting ponding of water. Based on the analysis performed above, all localized low points should be filled with low permeability material to an elevation such that positive drainage and a smooth transition with surrounding grade is restored. These areas should be stabilized immediately to minimize erosion. Should it be determined necessary in the field, a pilot channel or minor swale could to be constructed to assist in conveying flow to the nearest storm drain structure. These areas subject to fill should be assessed at least annually in the spring to determine if additional differential settlement has occurred. If additional settlement is observed, additional fill will be warranted.

Structures A6 and A4, as well as the eighteen (18) inch high-density polyethylene pipe, have settled such that the pipe does not provide a positive slope for drainage. The structures and pipe should be removed and replaced back to the original design slope as well as minimum surface cover. These two structures should be assessed at least annually (e.g., spring) to determine if additional differential settlement has occurred, and if so assess potential solutions. In addition, the County should continue to perform a semiannual inspection of the visible structures to determine if debris or other impediments may be present to dampen the conveyance of runoff through the storm drain.

A significant number of the existing surface features currently are experiencing heavy vegetative growth. It is recommended that vegetation be trimmed back in and around all inlets and outfall locations. Any woody vegetation present in outfalls or ponds should be removed. Vegetation present in swales should also be trimmed to minimize surface roughness (Manning's n) which will aid in the efficiency of the conveyance of flow.

As stated previously in the NES and NES Amendment No. 1, the County plans to maintain post-closure care monitoring and maintenance, which includes the inspection of the cover and drainage systems; collection and management of stormwater discharges onsite and offsite; and prevention of potential stormwater pollutant (i.e., non-stormwater) discharges. This, along with the recommended site work based on the 2015 stormwater engineering evaluation, should aid in maintaining positive drainage and reduce the potential for infiltration through the cover system into the waste mass.

Attachments:

Figure 1: Site Topography

Figure 2: Stormwater Structure Map

Figure 3: Stormwater Drainage Area Map

Figure 4: Areas of Localized Sumps

Figure 5: Settlement Exhibit



LEGEND

- 100 — EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- EXISTING PAVED ROAD
- EXISTING GRAVEL ROAD
- - - EXISTING TREE LINE
- x x x x EXISTING FENCE LINE
- - - SD EXISTING STORMDRAIN
- - - DRAINAGE AREA BOUNDARY
- - - DRAINAGE AREA BOUNDARY-BASIN
- - - EXISTING STREAM/RIVER
- - - TIME OF CONCENTRATION PATH
- - - LIMIT OF WASTE
- - - PROPERTY BOUNDARY

NOTES:
 1. STORMWATER STRUCTURES WERE LOCATED AND SURVEYED BY WALLACE MONTGOMERY IN NOVEMBER 2015 AND SUPPLEMENTED WITH INFORMATION FROM C.C. JOHNSON & MALHOTRA, P.C., ARE APPROXIMATE.

POINT NO.	POINT NO. TO	NORTHING	EASTING	RIM ELEV.	INV. IN.	INV. OUT.	DESCRIPTION
A0-OUTFALL	-	524233.21	1271417.59	-	-	402.77	60" HDPE
A1	A1A	524655.37	1271150.70	415.37	412.17	411.39	24" HDPE
A1A	A0	524655.39	1271150.98	415.62	410.19	-	24" HDPE
A1A	-	-	-	-	407.82	407.78	60" HDPE
A1B	A1A	524695.22	1271129.93	-	415.15	-	60" HDPE
A2	A1	524811.57	1271381.03	426.14	422.12	421.19	18" HDPE
A3	A2	524917.72	1271558.86	433.84	429.64	428.56	18" HDPE
A4	A3	525009.42	1271729	442.35	438.90	438.07	18" HDPE
A4	-	-	-	-	439.16	-	18" HDPE
A5	A4	525091.88	1271909.79	451.62	447.82	447.15	18" HDPE
A6	A4	525070.51	1271720.84	442.00	-	437.84	18" HDPE
A7	A5	525173.98	1272063.00	-	-	450.84	18" HDPE
C1-OUTFALL	-	524270.57	1274973.90	-	-	316.81	18" HDPE
C2	C1	524345.78	1274919.21	332.50	-	327.54	18" HDPE
C5-OUTFALL	-	525250.42	1274648.39	-	-	443.96	12" RCP
C6	C5	525269.53	1274664.88	-	445.28	-	12" RCP
D1-OUTFALL	-	525397.52	1274150.09	-	-	348.40	48" HDPE
D2	D1	525399.14	1274096.96	356.28	349.02	347.50	48" HDPE
D4	D2	524171.34	1273980.73	369.65	363.82	-	18" HDPE
D4	-	-	-	-	364.70	359.20	48" HDPE
D5	D4	524170.23	1273942.73	369.53	364.73	364.35	18" HDPE
D6	D5	523966.50	1273886.68	390.05	-	385.62	18" HDPE
E1	E2	525399.12	1273495.10	391.82	-	386.56	18" HDPE
E2-OUTFALL	-	523845.95	1273543.83	-	-	375.79	18" HDPE
F1-OUTFALL	-	524053.93	1272359.78	-	-	436.41	15" RCP
F2	F1	524033.06	1272337.08	-	437.13	-	15" RCP

POINT NO.	POINT NO. TO	NORTHING	EASTING	RIM ELEV.	INV. IN.	INV. OUT.	DESCRIPTION
H1-OUTFALL	-	524646.27	1273756.18	-	-	399.74	24" HDPE
H2	H1	524755.16	1273722.37	418.18	413.50	413.08	24" HDPE
H3	H2	524939.58	1273679.82	433.41	429.57	429.17	24" HDPE
H3	-	-	-	-	429.85	-	18" HDPE
H4	H3	525150.99	1273578.11	447.24	-	443.53	24" HDPE
H5	H3	524983.72	1273838.42	434.95	-	432.35	18" HDPE
H6	H7	525790.15	1272900.63	-	464.86	-	12" CMP
H7-OUTFALL	-	525820.62	1272874.61	-	-	464.01	12" CMP
H8-OUTFALL	-	525839.13	1272996.12	-	-	468.24	15" RCP
H9	H8	525889.97	1273020.41	-	469.03	-	15" RCP
I1-OUTFALL	-	524638.78	1273740.61	-	-	UNKNOWN(399.45)*	24" HDPE
I2	I1	524771.20	1273602.96	428.80	422.69	422.33	24" HDPE
I3	I2	524830.27	1273525.11	436.44	429.33	429.07	24" HDPE
I4	I3	524950.13	1273394.20	436.86	-	431.04	24" HDPE
I5	I4/SWALE	525085.28	1273098.64	-	-	446.04	24" RCP
I6	I5	525088.90	1273066.26	-	447.31	-	24" RCP
I9	I6/SWALE	525097.69	1272953.05	-	-	449.53	24" RCP
I10	I9	525111.16	1272810.15	-	456.31	-	24" RCP
J1-OUTFALL	-	524626.59	1273732.79	-	-	399.45	24" HDPE
J2	J1	524641.90	1273625.61	413.31	410.10	408.59	24" HDPE
J3	J2	524653.63	1273440.21	439.44	-	433.87	24" HDPE
J4	J3/SWALE	524658.04	1273374.83	-	-	441.62	24" HDPE
J5	J4	524661.51	1273333.96	-	443.33	-	24" HDPE
J7	J5/SWALE	524689.60	1273177.93	-	-	446.97	24" HDPE
J8	J7	524718.33	1273150.00	-	448.26	-	24" HDPE
J9	J3/SWALE	524564.85	1273316.81	-	-	441.74	24" HDPE

POINT NO.	POINT NO. TO	NORTHING	EASTING	RIM ELEV.	INV. IN.	INV. OUT.	DESCRIPTION
J9	J3/SWALE	524564.85	1273316.81	-	-	441.74	24" HDPE
J10	J9	524547.31	1273271.43	-	442.57	-	24" HDPE
K1-OUTFALL	-	524133.49	1271790.30	-	-	400.25	30" HDPE
K2	K1	524208.50	1271826.91	414.96	409.10	408.65	30" HDPE
K2	-	-	-	-	410.39	-	18" HDPE
K3	K2	524386.62	1272077.16	429.02	424.51	422.06	30" HDPE
K4	K3	524499.43	1272169.46	448.29	-	444.48	30" HDPE
L1-OUTFALL	-	524560.98	1272167.82	-	-	449.83	24" HDPE
L2	L1	524598.08	1272151.61	-	452.30	-	24" HDPE
P1	K2	524309.77	1271787.76	436.15	433.30	432.34	18" HDPE
P2	P1	524434.67	1271733.52	446.56	-	443.31	18" HDPE
R1	R2	525685.34	1273430.52	-	466.74	-	8" HDPE
R2-OUTFALL	-	525691.55	1273450.83	-	-	466.23	8" HDPE
S1-OUTFALL	-	524485.46	1273894.85	-	-	397.77	24" HDPE
W1-OUTFALL	-	523845.63	1273250.61	-	-	354.36	18" CMP
W2	W1	523907.12	1273273.27	-	363.58	-	18" CPP
Z1	Z4B	524381.55	1274011.05	404.00	400.54	400.08	24" HDPE
Z1A	Z1	524482.68	1274085.82	404.59	400.53	400.49	8" HDPE
Z2	Z1	524365.14	1274051.41	406.51	-	402.73	18" HDPE
Z3	Z4	524569.11	1274092.77	413.46	-	409.23	18" HDPE
Z4	Z4A	524567.77	1273985.85	413.19	409.05	406.20	18" TO 24" HDPE
Z4A	Z4B	54547.86	1273977.44	404.34	399.89	399.71	24" HDPE
Z4B	S1	524503.15	1273959.29	405.57	398.63	398.49	24" HDPE
Z4B	-	-	-	-	398.68	-	-

*ELEVATION UNKNOWN. ASSUMED BASED ON CONTOUR ELEVATIONS.

DESIGN INFORMATION	DESIGNED BY: LMP	DRAWN BY: LMO	CHECKED BY: MJC	PROJECT MANAGER: LJO	
REVISIONS	NO.	DATE	BY	DESCRIPTION	
SEAL					
CLIENT NAME GUDE LANDFILL ASSESSMENT OF CORRECTIVE MEASURES MONTGOMERY COUNTY, MARYLAND STORMWATER STRUCTURE MAP					
 EA Engineering, Science, and Technology, Inc., PBC Hunt Valley Center 225 Schilling Circle, Suite 400 Hunt Valley, Maryland 21031 (410) 584-7000					
DATE: NOVEMBER 2015					
PROJECT NUMBER: 1498201					
FIGURE 2					
SHEET: 2 OF 4					

FILE NAME: C:\PROJECTS\1498201 - GUDE LANDFILL - ASSESSMENT OF CORRECTIVE MEASURES - STORMWATER STRUCTURE MAP (LAYOUT) - REV. 11/17/2015 - 304.PLT

NOT FOR CONSTRUCTION



LEGEND

- 100 ——— EXISTING MAJOR CONTOURS
- EXISTING MINOR CONTOURS
- EXISTING PAVED ROAD
- EXISTING GRAVEL ROAD
- EXISTING TREE LINE
- EXISTING FENCE LINE
- SD ——— EXISTING STORMDRAIN
- DRAINAGE AREA BOUNDARY
- DRAINAGE AREA BOUNDARY-BASIN
- EXISTING STREAM/RIVER
- TIME OF CONCENTRATION PATH
- LIMIT OF WASTE
- PROPERTY BOUNDARY

NOTES:

1. THIS FIGURE REPRESENTS TOPOGRAPHY COMPILED BY WALLACE MONTGOMERY USING PHOTOGRAMMETRIC METHODS WITH PHOTOGRAPHY DATED APRIL 2015 AND SUPPLEMENTED WITH FIELD SURVEY PERFORMED BY C.C. JOHNSON & MALHOTRA, P.C., OCTOBER 2009 AND WALLACE MONTGOMERY FIELD SURVEY NOVEMBER 2015
2. HORIZONTAL DATUM IS NORTH AMERICAN DATUM OF 1983/91 (NAD-83/91). COORDINATE SYSTEM IS MARYLAND STATE PLANE, U.S. SURVEY FEET. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD-88) WITH ELEVATIONS SHOWN IN FEET.
3. THE PROPERTY BOUNDARY SHOWN HEREON IS FROM A PLAT PREPARED BY A REGISTERED PROPERTY LINE SURVEYOR OF THE STATE OF MARYLAND, IN COMPLIANCE WITH SECTION 3-108 OF THE REAL PROPERTY ARTICLE OF THE ANNOTATED CODE OF MARYLAND, EDITION 2005.
4. THE PROPERTY BOUNDARY REPRESENTS THE LANDS OWNED BY MONTGOMERY COUNTY, MARYLAND KNOWN AS THE GUDE LANDFILL WHICH IS A COMPILATION OF THREE DEEDS, LISTED BELOW, RECORDED IN THE LAND RECORDS OF MONTGOMERY COUNTY, MARYLAND, WITHOUT BENEFIT OF FULL TITLE COMMITMENT.
LIBER 2975 FOLIO 213
LIBER 4501 FOLIO 453
LIBER 5174 FOLIO 309
5. DRAINAGE AREA BOUNDARIES WERE DELINEATED BASED UPON THE CONTOURS AND SURFACE FEATURES COLLECTED IN THE 2015 SURVEY. BOUNDARIES WERE TRUNCATED AT THE PROPERTY BOUNDARY OR WERE TERMINATED WHERE NO TOPOGRAPHY WAS COLLECTED. DRAINAGE AREAS WERE ALSO DELINEATED TO DRAINAGE STRUCTURES WHERE CONTOURS INDICATED FLOW CONCENTRATIONS. IN OTHER CIRCUMSTANCES WHERE CONTOURS DID NOT CLEARLY DEFINE A DRAINAGE FEATURES, SUCH AS A DITCH OR GRADED BENCH, A BOUNDARY WAS INTERPRETED BASED UPON FEATURES SHOWN IN THE DESIGN DRAWINGS ENTITLED "GUDE LANDFILL POST CLOSURE ENGINEERING DESIGN AND MANAGEMENT TASKS" PREPARED BY SCS ENGINEERS DATED 22 JUNE 1992.

REVISIONS	NO.	DATE	BY	DESCRIPTION
DESIGN INFORMATION	DESIGNED BY:	LMP	DRAWN BY:	LMO
	CHECKED BY:	MJC	PROJECT MANAGER:	LJO
SEAL	PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND. LICENSE NO. _____ EXPIRATION DATE: _____			
GUDE LANDFILL ASSESSMENT OF CORRECTIVE MEASURES MONTGOMERY COUNTY, MARYLAND STORMWATER DRAINAGE MAP				
EA EA Engineering, Science, and Technology, Inc., PBC Hunt Valley Center 225 Schilling Circle, Suite 400 Hunt Valley, Maryland 21031 (410) 584-7000				
DATE: NOVEMBER 2015				
PROJECT NUMBER: 1498201				
FIGURE 3				
SHEET: 3 OF 4				

POINT NO.	DRAINAGE AREA (AC)	Q25 (cfs)	POINT NO.	DRAINAGE AREA (AC)	Q25 (cfs)	POINT NO.	DRAINAGE AREA (AC)	Q25 (cfs)	POINT NO.	DRAINAGE AREA (AC)	Q25 (cfs)
A0-OUTFALL	10.01	54.3	J3	2.32	10.5	H1-OUTFALL	6.85	38.4	D4	0.03	0.22
A1	0.77	4.7	J4-OUTFALL	1.86	7.7	H3	1.38	8.3	D5	2.31	11.39
A1A + A1B	0.57	3.2	J5	0.14	1.0	H4	3.87	21.5	F2	0.94	3.9
A2	3.25	18.1	J7-OUTFALL	1.72	7.6	H5	1.06	7.5	F1-OUTFALL	0.94	3.9
A3	0.90	4.5	J8	1.72	7.6	H6	0	0.0	R1	1.73	8.1
A4	0.81	4.7	J9-OUTFALL	0.83	4.3	H7	0	0.0	R2-OUTFALL	1.73	8.1
A5	0.49	3.1	J10	0.83	4.3	H8	0.35	2.0	C2	3.69	20.3
A6	0.28	1.8	I1-OUTFALL	14.74	67.0	H9	0.35	2.0	C1-OUTFALL	3.69	20.3
A7	2.95	15.8	I2	0.23	1.4	Z1	0.07	0.6	E2-OUTFALL	0.69	4.2
P1	0.17	1.1	I3	0.09	0.5	Z1A	UNKNOWN		E1	0.69	4.2
P2	0.65	3.3	I4	9.28	41.2	Z2	1.90	10.1	F2	0.94	3.9
K1-OUTFALL	7.99	48.6	I5-OUTFALL	10.12	25.0	Z3	0.41	2.5	F1-OUTFALL	0.94	3.9
K2	0.16	1.0	I6	2.74	14.4	Z4	0.22	1.3	W2	0.19	1.3
K3	0.12	0.7	I9-OUTFALL	2.05	10.6	Z4A	MANHOLE		W1-OUTFALL	0.19	1.3
K4	5.61	36.3	I10	2.05	10.6	Z4B	MANHOLE	54.1	SED BASIN B RISER	3.69	23.1
L1-OUTFALL	1.28	7.3	H2	0.54	3.2	D2	11.90	54.1	POND 1	31.25	144.4
L2	1.28	7.3	S1-OUTFALL	2.61	14.1	D1	11.90	54.1	DRY POND 3	30.20	134.2
J1-OUTFALL	5.52	24.2	C6	0.24	1.7	D9	POND OUTFALL IN				
J2	0.51	2.9	C5-OUTFALL	0.24	1.7	D6	0.06	0.4			

FILE PATH: G:\PROJECTS\1498201 - GUDE LANDFILL - STORMWATER DRAINAGE MAP.PBC [LAYOUT] PAPER - EFF: 4/7/2015 3:08 PM

NOT FOR CONSTRUCTION



- LEGEND**
- 100 ——— EXISTING MAJOR CONTOURS
 - EXISTING MINOR CONTOURS
 - EXISTING PAVED ROAD
 - EXISTING GRAVEL ROAD
 - ~~~~~ EXISTING TREE LINE
 - EXISTING FENCE LINE
 - |--- EXISTING STORMDRAIN
 - - - - - DRAINAGE AREA BOUNDARY
 - - - - - DRAINAGE AREA BOUNDARY-BASIN
 - EXISTING STREAM/RIVER
 - TIME OF CONCENTRATION PATH
 - LIMIT OF WASTE
 - PROPERTY BOUNDARY

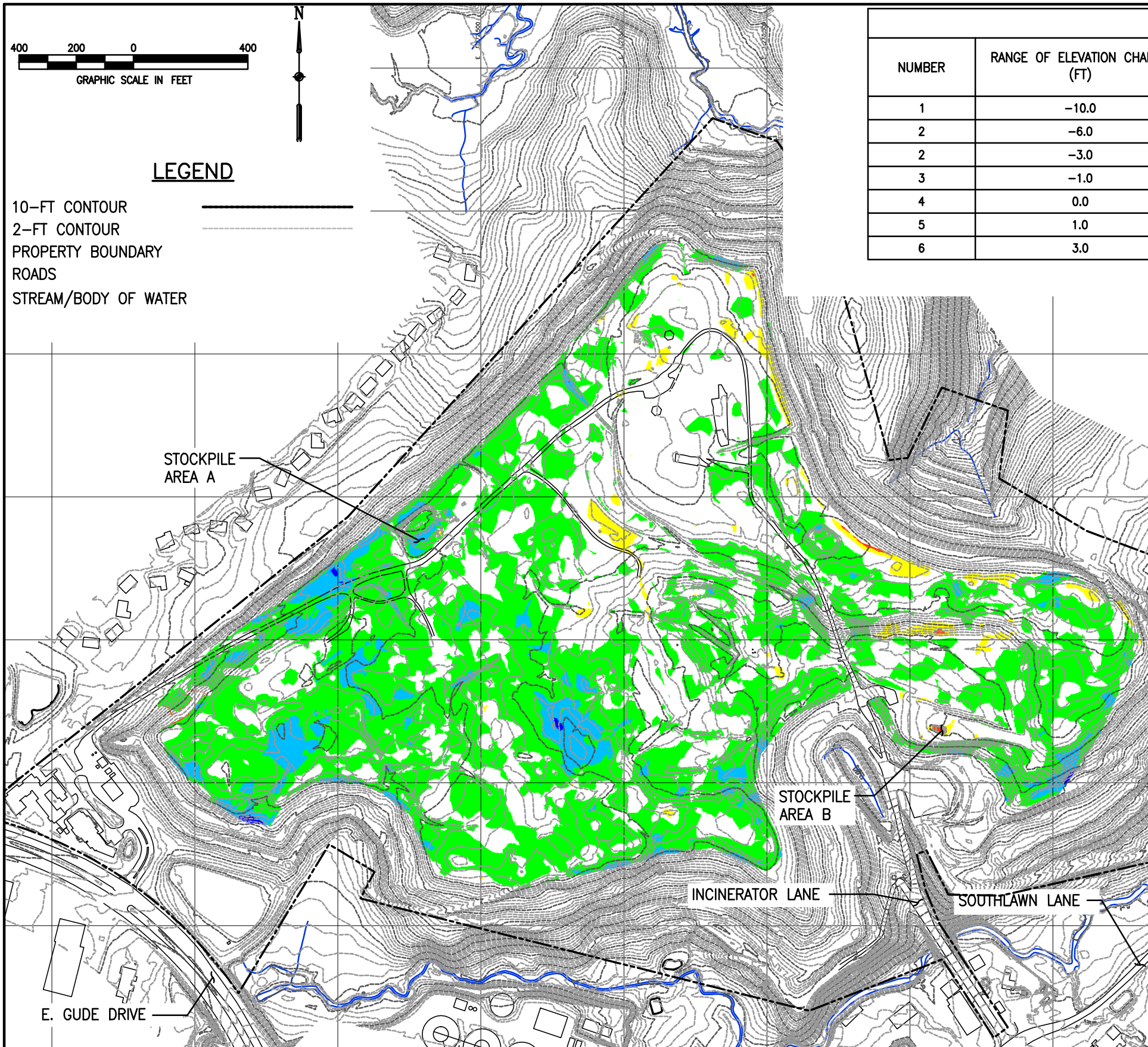
- NOTES:**
- THIS FIGURE REPRESENTS TOPOGRAPHY COMPILED BY WALLACE MONTGOMERY USING PHOTOGRAMMETRIC METHODS WITH PHOTOGRAPHY DATED APRIL 2015 AND SUPPLEMENTED WITH FIELD SURVEY PERFORMED BY G.C. JOHNSON & MALHOTRA, P.C., OCTOBER 2009 AND WALLACE MONTGOMERY FIELD SURVEY NOVEMBER 2015
 - HORIZONTAL DATUM IS NORTH AMERICAN DATUM OF 1983/91 (NAD-83/91). COORDINATE SYSTEM IS MARYLAND STATE PLANE, U.S. SURVEY FEET. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD-88) WITH ELEVATIONS SHOWN IN FEET.
 - THE PROPERTY BOUNDARY SHOWN HEREON IS FROM A PLAT PREPARED BY A REGISTERED PROPERTY LINE SURVEYOR OF THE STATE OF MARYLAND, IN COMPLIANCE WITH SECTION 3-108 OF THE REAL PROPERTY ARTICLE OF THE ANNOTATED CODE OF MARYLAND, EDITION 2005.
 - THE PROPERTY BOUNDARY REPRESENTS THE LANDS OWNED BY MONTGOMERY COUNTY, MARYLAND KNOWN AS THE GUDE LANDFILL WHICH IS A COMPILATION OF THREE DEEDS, LISTED BELOW, RECORDED IN THE LAND RECORDS OF MONTGOMERY COUNTY, MARYLAND, WITHOUT BENEFIT OF FULL TITLE COMMITMENT.
 LIBER 2975 FOLIO 213
 LIBER 4501 FOLIO 453
 LIBER 5174 FOLIO 309

LOW POINTS		
POINT ID	NORTHING	EASTING
LP-1	524594	1271532
LP-2	524658	1271732
LP-3	524730	1272079
LP-4	524962	1272111
LP-5	525115	1272200
LP-6	524726	1272285
LP-7	525166	1272541
LP-8	525307	1272731
LP-9	525367	1272739
LP-10	525356	1272928
LP-11	525166	1273255
LP-12	525041	1272987
LP-13	524768	1273106
LP-14	524627	1273057
LP-15	524561	1272816
LP-16	524444	1271910
LP-17	524496	1273238
LP-18	524847	1273476
LP-19	524542	1273716
LP-20	524450	1273775
LP-21	524781	1274113
LP-22	524879	1274509
LP-23	523992	1273340
LP-24	523919	1273441
LP-25	524595	1272650
LP-26	524813	1272917

DESIGN INFORMATION	DESIGNED BY: LMO	PROJECT MANAGER: LJO
	DRAWN BY: LMO	CHECKED BY: MJC
NO.:	DATE:	DESCRIPTION:
<p>GUDE LANDFILL ASSESSMENT OF CORRECTIVE MEASURES MONTGOMERY COUNTY, MARYLAND</p> <p>AREAS OF LOCALIZED SUMPS</p>		
<p>EA Engineering, Science, and Technology, Inc., PBC Hunt Valley Center 225 Schilling Circle, Suite 400 Hunt Valley, Maryland 21031 (410) 584-7000</p>		
DATE: NOVEMBER 2015		
PROJECT NUMBER: 1498201		
FIGURE 4		
SHEET: 4 OF 4		

FILE PATH: G:\PROJECTS\1498201 - GDE PHASE 2 AREA-WISE RESPONSES - 2015\1498201-AREAS OF LOCALIZED SUMPS\MEASUREMENT POINTS - 2015\LP.PDF, 3:16 PM

--- NOT FOR CONSTRUCTION ---



NUMBER	ELEVATION CHANGE		COLOR	AREA(ACRES)
	RANGE OF ELEVATION CHANGE (FT)	RANGE OF ELEVATION CHANGE (FT)		
1	-10.0	-6.0	Blue	0.1
2	-6.0	-3.0	Light Blue	5.3
2	-3.0	-1.0	Green	43.4
3	-1.0	0.0	Light Green	26.8
4	0.0	1.0	Yellow	9.0
5	1.0	3.0	Orange	1.7
6	3.0	10.0	Red	0.1

TOTAL: 86.4 ACRES

NOTES:

- THIS FIGURE IS GENERATED BY COMPARING TWO TOPOGRAPHIC SURVEYS – ONE FROM OCTOBER 2015 AND ONE FROM JUNE/OCTOBER 2009. AREAS THAT HAVE SETTLED OR OTHERWISE ARE LOWER TOPOGRAPHICALLY SINCE THE 2009 BASELINE SURVEY ARE DEPICTED IN BLUE AND GREEN COLORS. AREAS THAT HAVE BEEN DISTURBED AND ARE HIGHER TOPOGRAPHICALLY SINCE THE 2009 BASELINE SURVEY ARE DEPICTED IN YELLOW AND ORANGE COLORS.
- 2015 TOPOGRAPHY COMPILED BY AXIS GEOSPATIAL LLC. USING PHOTOGRAMMETRIC METHODS WITH PHOTOGRAPHY DATED OCTOBER 2015.
- 2009 TOPOGRAPHY COMPILED BY APPLIED MAPPING SOLUTIONS, INC. USING PHOTOGRAMMETRIC METHODS WITH PHOTOGRAPHY DATED 06/24/09 AND SUPPLEMENTED WITH FIELD SURVEY PERFORMED BY C.C. JOHNSON & MALHOTRA, P.C., OCTOBER 2009.
- TOPOGRAPHIC CONTOURS DEPICTED ON THIS DRAWING ARE FROM THE 2015 SURVEY.
- HORIZONTAL DATUM IS NORTH AMERICAN DATUM OF 1983/91 (NAD-83/91). COORDINATE SYSTEM IS MARYLAND STATE PLANE, U.S. SURVEY FEET. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD-88) WITH ELEVATIONS SHOWN IN FEET.
- THE PROPERTY BOUNDARY WAS LAID OUT AND THE PLAT THEREOF PREPARED BY A REGISTERED PROPERTY LINE SURVEYOR OF THE STATE OF MARYLAND, IN COMPLIANCE WITH SECTION 3-108 OF THE REAL PROPERTY ARTICLE OF THE ANNOTATED CODE OF MARYLAND, EDITION 2005.
- THE PROPERTY BOUNDARY REPRESENTS THE LANDS OWNED BY MONTGOMERY COUNTY, MARYLAND KNOWN AS THE GUDE LANDFILL WHICH IS A COMPILATION OF THREE DEEDS, LISTED BELOW, RECORDED IN THE LAND RECORDS OF MONTGOMERY COUNTY, MARYLAND, WITHOUT BENEFIT OF FULL TITLE COMMITMENT.
LIBER 2975 FOLIO 213
LIBER 4501 FOLIO 453
LIBER 5174 FOLIO 309

FILE PATH: Q:\PROJECTS\1498201 - GUDE PHASE 2 ACM\ACM REVISIONS - 2015\FIG 5 SETTLEMENT ANALYSIS.DWG [EA LAYOUT] PERRY, JEFF 4/7/2016 3:42 PM



GUDE LANDFILL
ASSESSMENT OF CORRECTIVE MEASURES
MONTGOMERY COUNTY, MARYLAND

SETTLEMENT ANALYSIS FIGURE

PROJECT NUMBER: 1498201	DESIGNED BY: LMO	DRAWN BY: WJV	FIGURE: 5
DATE: NOV. 2015	CHECKED BY: WRB	PROJECT MGR.: LJO	SHEET NUMBER: