Memorandum

October 18, 2018

To:	Grant Trigger, RACER	Ref. No.:	081613
From:	Beth Landale/Andrew Betts/bw/34	Tel:	248-893-3428
cc:	Cliff Lewis, RACER		

Subject: **Construction Summary – June 2018**
First Flush Basin – C (FFB-C)
Former Willow Run Powertrain Site
Ypsilanti, Michigan

Executive Summary

Based on information supplied to GHD and GHD's own observations during construction, FFB-C as constructed has:

- A liner that provides a complete barrier to groundwater infiltration
- Sufficient ballast on top of the liner to counter act the buoyance forces from the high water table
- Sufficient storm water storage capacity based on a qualitative analysis of ballast elevations and changes to the storm water catchment area.

1. Introduction

This memorandum serves to summarize GHD's review of FFB-C as constructed to date at the former Willow Run Powertrain site in Ypsilanti, Michigan. This includes review of the liner installation and testing, elevation review for determination of ballast volume and holding capacity of the basin and grouting of the rip rap adjacent to the energy dissipater pad. A summary of the work yet to be completed is included.

Attachment A presents a figure of the GHD's understanding of the catchment area for FFB-C as designed. It is our understanding that since design of FFB-C was completed several changes have occurred in the overall ACM storm water plan. This includes a decrease in the storm water runoff volume (decreased contributing drainage area) and an increase in the time of concentration to reach the basin (grass-lined swales); thereby the designed volume of the basin is likely oversized based on the constructed catchment area and swales.

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2. Liner

Due to the construction of the FFB-C within the water table, the basin was installed with a liner to prevent groundwater from infiltrating into the basin and storm water from exfiltrating out of the basin. Attachment B provides a detailed summary of the geomembrane installation and testing completed during the construction of FFB-C.

The 60-mil HDPE geomembrane was appropriately installed over the entire bottom and side slopes of FFB-C with quality assurance testing showing that the geomembrane installation and all seams were properly completed. Following completion of the geomembrane installation, dipole teste was used to find holes/punctures in the geomembrane. The testing discovered one small hole in the installed geomembrane and the located hole was repaired.

3. Elevation Verification

Elevation checks were completed at several stages within the construction of the basin. Attachment C provides an evaluation based on the latest survey information provided by the contractor for the top of ballast elevations. All of the surveyed elevations were located in the bottom of the basin, and therefore no verification of the side slopes or top of basin could be complete. On average, the survey points collected are within the acceptable tolerance. Overall, it appears that there is sufficient ballast placed in the basin to counter act the buoyancy forces. There are areas where there is more ballast than designed, which may affect the overall storage volume of the basin. The survey provides sufficient data to qualitatively determine that the basin is adequate as constructed due to the smaller drainage area and grassed swales constructed that should offset the area where there is additional ballast than was designed.

To quantitatively determine the storage volume, additional details on drainage area and additional survey of FFB-C would be required to create a final surface to calculate volume and definitively determine if the changes made to the site and the extra ballast offset each other. If ACM would like this completed, then GHD can provide a cost estimate to complete this work.

4. Grouted Rip Rap

Rip rap adjacent to the energy dissipater was grouted in-place in late September 2018. The method used to place the grouting into the rip rap involved dumping a slurry mix of grout overtop of the riprap and letting the mix flow into the void spaces. This method required a high slump mix of grout.

GHD was not present during the application of grout and did not get approval to verify elevations or configuration of riprap prior to grouting.

Several days after the completion of the grouting, GHD was made aware of standing water on the energy dissipater pad. Upon receiving photos of the situation (see photo below), it became apparent that the grouted riprap elevation was too high and forcing water to back up into the energy dissipater pad. This creates a few potential issues for future maintenance and pond performance as follows:

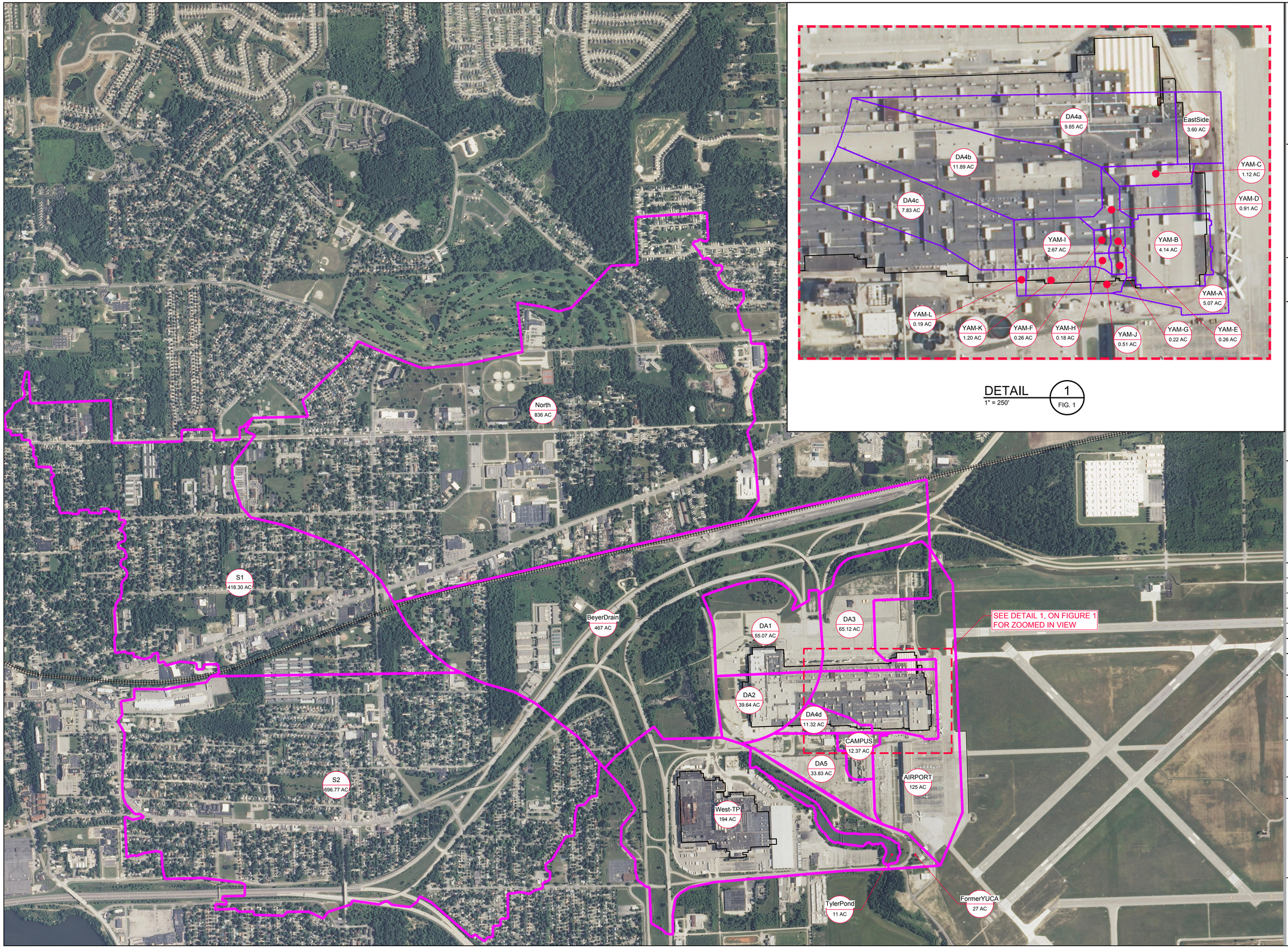
- Potential for freeze thaw to create cracks in the concrete
- Potential mosquito breading grounds
- Potential algae bloom location with potential to cause foul odors

GHD recommends that the riprap layer be lowered to match the design elevations to promote a positive grade in the low flow channel. This will require the break up and removal of the grouting and some of the ballast/riprap layer.

5. Remaining Tasks

Placement of separator fabric, topsoil, seeds, plants and mulch has been transferred from the RACER contact to a contract between ACM and Iafrate to complete. Final record as-built drawings also remain to be completed and should be the responsibility of the contractor.

Attachment A
Catchment Area



DETAIL 1
1" = 250'
FIG. 1

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N
0 400 800 ft

Client
RACER TRUST

Project
STORM WATER DIRECT DISCHARGE CONCEPT EVALUATION GM POWETRAIN WILLOW RUN

No.	Issue	Drawn	Approved	Date
-	-	-	-	-

Drawn **B.S.**	Designer **A.B.**
Drafting Check	Design Check **J.R.M.**
Project Manager **B.L.**	Date **Jun 8, 2017**
This document shall not be used for construction unless signed and sealed for construction.	Scale **1" = 800'**
Original Size **ANSI D**	Bar is one inch on original size drawing 0 1"

Project No. **81613-00**

Title
CONTRIBUTING DRAINAGE AREA TO TYLER POND

Sheet No.
FIGURE 3.1

Sheet **1** of **1**

Plot Date: 29 May 2018 - 9:00 AM Plotted By: Matt Wolfer CAD File: P:\drawings\81000s\81613\81613-REPORTS\81613-06(001)\81613-06(001)GN\81613-00(001)GN-WA002.dwg

Attachment B
Geomembrane Installation Summary

Memorandum

November 16, 2017

To:	Grant Trigger (RACER)	Ref. No.:	081613
From:	Rick Hoekstra/nc/7 CRA	Tel:	519-884-0510
CC:	Beth Landale, Andrew Betts, Matt Abdallah (GHD) Scott Adamowski (CRA Engineering)		
Subject:	**Summary of Geomembrane Installation and Testing** **First Flush Basin C, Willow Run Powertrain, Ypsilanti, MI**		

1. Background

As part of the Storm Water Control Design at the former GM Willow Run Powertrain facility in Ypsilanti, MI, a storm water pond called First Flush Basin C (FFB-C) was constructed at end of the diversion channel and prior to discharge to the existing 84-inch diameter storm sewer. Multiple factors influenced the final design characteristics of FFB-C.

- First, the basin location and overall configuration were mandatory to meet site planning and design requirements of the owner.
- Second, in order to meet storm water capacity constraints and Washtenaw County Water Resource Commission requirements, it was necessary to construct the basin below the existing groundwater table elevation. As such, the basin had to be lined to prevent potentially contaminated groundwater from entering FFB-C.
- Finally, to avoid wildlife hazard issues due to standing water near the adjacent airport, the basin was designed as a “dry” basin making the liner even more essential. To avoid infiltration of groundwater and to maintain a “dry” condition, appropriate installation of the liner system became the most critical component of the FFB-C construction.

The following summary reviews the work done to confirm the integrity of the liner as installed.

2. Geomembrane Specifications

The 60-mil high density polyethylene (HDPE) liner (geomembrane) was placed above the constructed subbase layer. The geomembrane was subsequently covered with sand to protect the geomembrane and stone ballast to prevent uplift by groundwater.

The technical specifications for the 60-mil smooth HDPE liner were presented in the project specifications (Section 31 05 20 Geomembranes). Quality control testing was completed by the liner manufacturer (GSE Environmental) prior to material delivery to the Site, which included thickness, density, tensile strength at

break and yield, elongation at break and yield, carbon black content, carbon black dispersion, puncture resistance, tear resistance, and asperity height. The manufacturer's data is presented in Attachment A, which was provided by the liner installer (Northern Seal) as a submittal that was reviewed and approved by GHD prior to placement.

For thickness, the 8 liner rolls delivered to the Site had average thickness values ranging from 58 to 62 mil, with minimum thickness values ranging from 57 to 60 mils. The minimum thickness values were all above 54 mils, so they met the specifications. Although the average thickness values were below 60 mils for 6 of the 8 rolls, the difference of 5% was deemed insignificant and still acceptable.

For density, all reported values exceeded the required 0.932 g/cc and therefore deemed acceptable.

For tensile strength at break, the 8 liner rolls had reported values ranging from 166 to 202 ppi, which were all below the required minimum value of 228 ppi listed in the specifications. As well, for elongation at break, the 8 rolls had reported values ranging from 462 to 620 percent, which were again below the minimum value of 700 percent listed in the specifications. However, the required destructive seam testing for peel and shear described in the specifications actually uses the values for tensile strength and elongation at yield (and not break), so the tensile strength and elongation at yield values are more important to evaluate.

For tensile strength at yield, the 8 liner rolls had reported values ranging from 142 to 163 ppi, which were all above the required minimum value of 126 ppi for 60-mil smooth HDPE liner. As well, for elongation at yield, the 8 rolls had reported values ranging from 17 to 18 percent, again above the required minimum value of 12 percent for elongation at yield. As all 8 rolls exceeded these minimum values, the tensile strength and elongation data were deemed acceptable for subsequent shear and peel testing.

For carbon black content and carbon black dispersion, all reported values exceeded the values listed in the specifications and therefore deemed acceptable.

For puncture resistance, the 8 liner rolls had reported values ranging from 146 to 150 lbs, with the minimum average value required in the specifications being 108 lbs. As for tear resistance, the 8 rolls had reported values ranging from 45 to 52 lbs, with the minimum value identified in the specifications being 42 lbs. As such, the supplied liner material is acceptable with regards to puncture and tear resistance.

In summary, the geomembrane brought to the site was deemed acceptable for use in lining the FFB-C basin.

It should be noted that a small amount of additional liner was required to complete the basin liner installation, which was provided separately by the liner installer. This supplemental 60-mil HDPE liner was considered acceptable by the third party quality assurance inspector (i.e., adequately similar to material used throughout the basin). The additional material was only used in areas that required repairs after destructive seam testing and was only placed above the 713-foot elevation (i.e., above the groundwater table).

3. Geomembrane Installation

Prior to geomembrane installation, the liner rolls were visually inspected by the field QA personnel from both GHD and the liner installer. The general contractor, Angelo Iafrate Construction (Iafrate), retained Northern Seal as the liner installation subcontractor, as well as CTI and Associates, Inc. (CTI) for construction quality

assurance (CQA). As part of the initial liner inspection, the product tags were removed from each liner roll to cross-check against the contractor's submittal and all rolls were accounted for.

During the geomembrane installation, the liner rolls were tracked as the geomembrane was deployed and the various panels were installed. A geomembrane installation log was maintained by CTI as the field QA technician indicating the roll numbers deployed, panel numbers assigned, measured panel dimensions, and approximate location. This information is summarized in the CTI report presented in Attachment B.

Geomembrane Seaming

The HDPE geomembrane panels were seamed together in accordance with the requirements of the project specifications (Section 31 05 20 Geomembranes, Part 3.5 Field Seaming). Seaming of adjoining panels was primarily performed using double-wedge fusion welding equipment, with an extrusion welder used when the fusion welder could not be used due to limited access and for very short seam lengths (primarily associated with repairs).

As part of the field quality control performed by the liner installer, test seams (i.e., trial or pre-welds) were required to be completed at the start of each work day and following the noon break (i.e., every 4 hours) for each piece of seaming equipment (double-wedge fusion and/or extrusion welders). Field seaming activities were not conducted on the placed liner panels until the test seams passed for both peel and shear. If a test seam failed, that particular piece of seaming equipment was not used for field seaming until the deficiencies were corrected (i.e., reducing or increasing the speed, adjusting temperature, etc.) and a successful seam test was performed. The CTI report presents a summary of the trial weld test seam results for the installed 60-mil HDPE geomembrane.

As field seams were completed on the installed geomembrane, non-destructive seam testing was performed in accordance with the specifications. The liner installer was required to perform non-destructive testing over the full length of each installed seam by air pressure testing of the enclosed channel between the two sides of the double-wedge fusion weld. For single welded (extrusion) seams, vacuum box testing was performed in lieu of air channel testing. Passing results were obtained for all non-destructive seam tests. A summary of the non-destructive (air pressure) seam testing results is presented in the CTI report.

A further component of field seam testing involves the performance of destructive seam testing of the HDPE liner installation at a frequency of approximately 1 sample per 500 lineal feet of field seam. As identified in the specifications, a section of liner seam was cut out by the liner contractor, with one quarter of the sample being tested in the field, one quarter being held and sent for laboratory testing if the field test passed, one quarter being provided to CTI as QA consultant, and one quarter retained by GHD as an archive sample. Each destructive seam test was completed on the HDPE liner by cutting the sample into ten 1-inch test coupons and testing five coupons for shear and five coupons for peel using a calibrated field tensiometer. Upon receipt of passing field test results, the next sample for each destructive seam test was sent to the testing laboratory at TRI Environmental, Inc. in Austin, TX for confirmatory testing. The results of the field destructive seam tests are presented in the attached CTI report.

Destructive Seam Testing Results

As previously mentioned, upon completion of field destructive seam testing, duplicate samples were sent for laboratory testing. During 7 days of liner installation, 14 destructive seam samples were collected, 11 from

fusion welded seams and 3 from extrusion welded seams. As with the field destructive samples, peel and shear testing was performed on five coupons each and the results are summarized in the attached Table 1.

For two of the 14 samples, the initial destructive seam tests failed for peel strength and/or incursion. As a result, additional samples were collected on either side of the failed samples for retesting at the laboratory. Upon receipt of passing results, the associated sections of failed seams were capped and extrusion welded to cover over the failed seams and complete the liner installation. The following summarizes the procedures implemented in the field to address the two destructive seam test failures:

DS-009 This sample was collected from an extrusion welded seam located in the northwest corner of the basin. The seam was part of the repairs performed for a previous destructive seam sample of a fusion weld. The laboratory testing showed that 2 of the 5 tested coupons failed for peel strength (less than the Geosynthetic Research Institute (GRI) Test Method GM 19 value of 78 ppi), with these same 2 coupons also failing for peel incursion (greater than GM 19 value of 50%).

Upon receipt of the failed test results, two additional destructive seam samples were collected on extrusion welded seams performed immediately before and after the initial destructive seam sample location. The results for DS-009A (after) passed the GM 19 criteria for both peel and shear strength and incursion. However, the results for DS-009B (before) still failed, with 1 of 5 tested coupons failing for peel strength and all 5 coupons having peel incursion of 100%.

As there were only a few short lengths of extrusion welds performed prior to the DS-009B retest location (i.e., on that same day), it was decided not to collect another “before” destruct sample. At this point in time, the liner installer capped all extrusion welds performed prior to the passing DS-009A location, back through DS-009, DS-009B, and to the beginning of the extrusion welds completed that day. No further destructive seam testing of these extrusion welds was performed (although non-destructive vacuum box testing was performed).

DS-013 This sample was collected from a double fusion welded seam located in the southeast corner of the basin. This seam extended from the outlet structure at the bottom of the basin to the top of slope and involved several different triangular shaped panels against the east side of panel #43 (to fit the liner around the curve). As such, the wedge welder was required to track over several panel connections. The laboratory testing results showed that although all 5 of the tested coupons passed for peel strength (for both side A and side B testing), 2 of the 5 tested side A coupons failed for peel incursion (greater than GM 19 value of 50%).

Upon receipt of the failed test results, two additional destructive seam samples were collected, 10 feet before (or upslope) and 10 feet after (or downslope) the initial destructive seam sample location. The results for DS-013A (after) showed 2 of 5 side A coupons failing for peel incursion and 1 of 5 side B coupons also failing, while the results for DS-013B (before) showed 3 of 5 side A coupons failing for peel incursion.

At this point, a field decision was made to not collect any further A (after) samples as this fusion seam extending down the slope to the outlet structure was the last fusion seam performed with that particular double-wedge welder. However, two additional B (before) samples were collected to delineate the extent of the failing seam. DS-013B1 was collected at the top of the slope (near

the anchor trench), while DS-013B2 was collected (on that same day) at the top of slope for the previous seam, just in case the results for DS-013B1 showed continued seam failure. But these final destruct samples both passed for peel and shear strength as well as incursion.

Thereafter, the liner installer completed the liner installation by capping the entire fusion weld from the outlet structure to the top of slope (DS-013B1), with no further destructive seam testing of this final extrusion weld (although non-destructive vacuum box testing was performed).

4. Leak Location Survey (Dipole Testing)

Upon completion of the liner installation for the entire FFB-C basin, 12 inches of sand was placed over the liner to protect it from heavy equipment damage. The sand material was placed over the liner using a dozer, but ensuring no contact of the dozer tracks with the liner by keeping the dozer on the sand and pushing sand ahead of the dozer blade (effectively dozer always kept on top of 12-inch sand layer). This sand layer also facilitated the subsequent placement (after dipole testing) of 46 inches of stone ballast for hydraulic uplift prevention. However, as the placement of the sand cushion layer involved dozers to push and place the sand over the liner, there is an inherent risk for damage to the liner which is often unnoticed as the work progresses.

A technology that is becoming more common for confirming the integrity of a complete geomembrane after placement of cover soils is the performance of a leak location survey. The most appropriate method for a leak location survey over soil cover is dipole testing. This testing method involves charging the soil (sand) with 500 volts of electricity, as provided by a power source (i.e., generator) set outside the liner limits such that it is grounded to the semi-conductive soil layer beneath the geomembrane. The general concept of a dipole test is that the electrical current within the sand layer will look for a way to ground itself through the geomembrane to the underlying soil.

The critical component to the effective performance of dipole testing is the provision of an isolation barrier around the perimeter of the geomembrane to ensure the electrical current does not escape by grounding to the underlying soils. This isolation barrier is simply created by not extending the sand cover to the edges of the geomembrane (i.e., leaving a few feet of exposed liner) all the way around the perimeter. As well, the overlying sand material cannot be in contact with any protrusions through the geomembrane (in this case, the outlet structure) that would allow the electrical current to ground itself to the underlying soils via these protrusions.

If the geomembrane is properly isolated from the underlying soils (i.e., not in contact with overlying sand), then the only route for the electrical current applied to the sand to escape would be through a hole in the geomembrane. This replicates the potential water pathway through any holes in the geomembrane. If the electrical current does not escape, then it is presumed there are no holes in the geomembrane.

RACER retained the Liner Integrity Services division of TRI Environmental, Inc. to perform the dipole testing at the FFB-C basin. TRI mobilized to the site on September 28, 2017 and completed the dipole testing on that same day. TRI used a double dipole structure with two pairs of electrodes on either side of the structure that was manually carried around the bottom and side walls of the basin. Each pair of electrodes was 10 feet apart and the two pairs of electrodes were 10 feet apart (i.e., structure was 10-foot square). Each pair of

electrodes measures the current in the sand, with the values decreasing as the technician walked away from the plate where the electrical charge was introduced into the sand.

Prior to commencing the dipole survey, the TRI technician calibrated the dipole survey equipment by placing a 6 mm diameter artificial hole beneath the sand cover (on top of the liner) and performing a leak simulation test (in accordance with ASTM D7007) to determine that the dipole equipment could identify the artificial hole from an appropriate distance away. Upon completion of the leak simulation test, the field dipole survey was performed by walking in north-south lines across the basin and recording the voltage readings at each pair of electrodes. As previously mentioned, the voltage readings should decrease as the technician travels further from the charging plate, such that a comparison of the front to back electrode readings would be negative. However, if there is a hole in the liner the electrical current would ground out to the underlying soil beneath the liner. Therefore, the voltage readings would increase in close proximity to the hole and flip from negative to positive. It should be noted that when walking in the other direction (towards the plate), the opposite would occur and the values would flip from positive to negative if a hole was found in the liner.

At the end of the dipole survey, all of the voltage recordings were plotted and compiled into a 3-D color map, which is presented in the attached report received from TRI (Attachment C). But prior to leaving the site, the TRI technician produced a draft version of the 3-D color map and sent it to Abigail Gilson-Beck (Director of Liner Integrity Services for TRI) for internal review. Upon review of the map, one location of a suspected liner penetration was identified, therefore it was decided to go back and conduct a field inspection of that specific area. One small hole was identified and uncovered for confirmation, with the hole being patched and tested by the liner installer (Northern Seal).

In summary, the dipole survey was effective in locating a small hole in the installed liner, such that following repair of the identified hole, the FFB-C basin liner installation was verified to be complete and without any penetrations that could lead to groundwater infiltration through the liner.

5. Conclusion

The 60-mil HDPE geomembrane was appropriately installed over the entire bottom and side slopes of First Flush Basin-C with quality assurance testing showing that the geomembrane installation and all seams were properly completed. Following completion of the geomembrane installation, dipole testing was used to find one small hole in the installed geomembrane and the located hole was repaired. As such, GHD confirms that the installed geomembrane provides a complete barrier to groundwater infiltration.

Table 1

Summary of HDPE Liner Destructive Seam Test Results
Construction Certification Report
First Flush Basin C
Willow Run Powertrain Facility
Ypsilanti, Michigan

Sample ID	Location	Seam Number (Adjacent Panels)	Laboratory Test Date	Weld Type		Peel 1A	Peel 2A	Peel 3A	Peel 4A	Peel 5A	Peel 1B	Peel 2B	Peel 3B	Peel 4B	Peel 5B	GM 19 Values	Test Pass/Fail		Shear 1	Shear 2	Shear 3	Shear 4	Shear 5	GM 19 Values	Test Pass/Fail
DS 001	0+75	4/5	9/15/2017	Double Fusion	***Strength (ppi)***	120	121	119	134	122	125	122	125	120	124	*91*	Pass	***Strength (ppi)***	160	162	159	159	159	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 002	0+50	12/13	9/16/2017	Double Fusion	***Strength (ppi)***	131	129	125	126	122	137	134	125	127	129	*91*	Pass	***Strength (ppi)***	164	166	164	166	165	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 003	1+89	1/12	9/16/2017	Double Fusion	***Strength (ppi)***	127	123	122	126	128	125	133	129	127	127	*91*	Pass	***Strength (ppi)***	163	166	166	163	163	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 004	1+17	17/19	9/16/2017	Double Fusion	***Strength (ppi)***	130	132	131	131	128	133	123	123	129	125	*91*	Pass	***Strength (ppi)***	162	167	166	164	164	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 005	0+71	20/21	9/16/2017	Double Fusion	***Strength (ppi)***	130	124	134	122	136	131	131	130	135	127	*91*	Pass	***Strength (ppi)***	163	165	164	163	163	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 006	0+45	23/24	9/16/2017	Double Fusion	***Strength (ppi)***	127	118	130	124	127	138	131	140	134	138	*91*	Pass	***Strength (ppi)***	163	165	165	164	165	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 007	2+25	24/25	9/16/2017	Double Fusion	***Strength (ppi)***	130	119	125	125	120	127	118	124	121	121	*91*	Pass	***Strength (ppi)***	164	168	166	165	164	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 008	0+45	23/R-19	9/19/2017	Single Extrusion	***Strength (ppi)***	103	107	113	105	108	-	-	-	-	-	*78*	Pass	***Strength (ppi)***	158	158	153	156	152	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	-	-	-	-	-	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 009	2+25	25/R-20	9/19/2017	Single Extrusion	***Strength (ppi)***	**50**	97	**64**	110	89	-	-	-	-	-	*78*	**Fail**	***Strength (ppi)***	157	161	160	154	157	120	Pass
					Incursion (%)	**90**	<5	**90**	<5	40	-	-	-	-	-	*<50*	**Fail**	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 009A	1+50	1/R-21	9/26/2017	Single Extrusion	***Strength (ppi)***	106	120	112	110	114	-	-	-	-	-	*78*	Pass	***Strength (ppi)***	164	166	164	165	164	120	Pass
					Incursion (%)	30	<5	40	<5	<5	-	-	-	-	-	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 009B	1+53	1/R-23	9/26/2017	Single Extrusion	***Strength (ppi)***	87	97	**48**	104	86	-	-	-	-	-	*78*	**Fail**	***Strength (ppi)***	168	170	168	169	171	120	Pass
					Incursion (%)	**100**	**100**	**100**	**100**	**100**	-	-	-	-	-	*<50*	**Fail**	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 010	2+00	26/28	9/26/2017	Double Fusion	***Strength (ppi)***	112	112	113	116	118	111	109	105	110	113	*91*	Pass	***Strength (ppi)***	165	165	163	163	161	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 011	0+50	31/32	9/26/2017	Double Fusion	***Strength (ppi)***	108	125	110	132	115	133	139	132	132	124	*91*	Pass	***Strength (ppi)***	165	166	165	163	161	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 012	0+21	37/38	9/27/2017	Double Fusion	***Strength (ppi)***	125	126	126	129	126	122	136	131	143	124	*91*	Pass	***Strength (ppi)***	158	163	159	160	162	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 013	0+43	35/41	9/27/2017	Double Fusion	***Strength (ppi)***	132	122	133	128	116	136	128	137	147	146	*91*	Pass	***Strength (ppi)***	156	159	157	158	156	120	Pass
					Incursion (%)	**80**	30	<5	<5	**90**	<5	<5	<5	<5	<5	*<50*	**Fail**	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 013A	0+57	35/40	9/27/2017	Double Fusion	***Strength (ppi)***	105	124	121	103	120	132	103	120	121	135	*91*	Pass	***Strength (ppi)***	155	159	157	155	158	120	Pass
					Incursion (%)	**90**	<5	<5	**80**	<5	<5	**100**	<5	<5	<5	*<50*	**Fail**	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 013B	0+33	35/41	9/28/2017	Double Fusion	***Strength (ppi)***	116	134	113	136	133	115	129	128	122	145	*91*	Pass	***Strength (ppi)***	158	162	156	158	157	120	Pass
					Incursion (%)	**50**	10	<5	**90**	**70**	<5	<5	<5	<5	<5	*<50*	**Fail**	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS	0+00	35/44	9/29/2017	Double Fusion	***Strength (ppi)***	121	115	113	128	123	117	123	120	121	116	*91*	Pass	***Strength (ppi)***	154	156	139	152	153	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS	0+00	43/44	9/29/2017	Double Fusion	***Strength (ppi)***	126	129	117	119	109	126	132	118	131	127	*91*	Pass	***Strength (ppi)***	163	149	149	149	150	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass
DS 014	1+17	29/R-55	9/29/2017	Single Extrusion	***Strength (ppi)***	112	110	102	129	87	-	-	-	-	-	*78*	Pass	***Strength (ppi)***	156	158	155	156	158	120	Pass
					Incursion (%)	<5	<5	<5	<5	<5	-	-	-	-	-	*<50*	Pass	***Elongation (%)***	>50	>50	>50	>50	>50	>50	Pass

Attachments

Attachment A
Manufacturer's Data

GHD / RACER Project

GSE Environmental, LLC

ENVIRONMENTAL™

ROLL TEST DATA REPORT

GSE QC APPROVED

Report Date: May/15/2017

Sales Order No.	*Customer Name*	*Project Location*	*Product Name*	*BOL Number*
SO-081888	Northern Seal, Inc.	Kalkaska MI US	HST-060GE-BBB-B-W0-T	BL-0103519

Roll Number	Average Thickness ASTM D5994 (mils)	Minimum Thickness ASTM D5994 (mils)	Yield Strength ASTM D6693 (ppi) MD	Yield Strength ASTM D6693 (ppi) TD	Yield Elongation ASTM D6693 (%) MD	Yield Elongation ASTM D6693 (%) TD	Break Strength ASTM D6693 (ppi) MD	Break Strength ASTM D6693 (ppi) TD	Break Elongation ASTM D6693 (%) MD	Break Elongation ASTM D6693 (%) TD	Tear Resistance ASTM D1004 (lbs) MD	Tear Resistance ASTM D1004 (lbs) TD	Puncture Resistance ASTM D4833 (lbs)	Density ASTM D1505 (g/cc)	Carbon Black Content ASTM D4218 (%)	Carbon Black Dispersion ASTM D5596 (Views in Cat1~Cat2)	Asperity Height ASTM D7466 (mils) A Side
103210584	58	57	152	163	18	17	166	174	510	547	52	48	150	0.944	2.5	10	23
103210585	58	57	142	144	17	18	169	163	462	487	49	45	146	0.944	2.5	10	22
103210586	58	57	142	144	17	18	169	163	462	487	49	45	146	0.944	2.5	10	22
103210587	59	57	144	149	17	18	203	188	620	607	51	50	148	0.944	2.5	10	22
103210588	58	57	144	149	17	18	203	188	620	607	51	50	148	0.944	2.5	10	22
103210589	58	57	144	148	17	17	202	181	596	577	50	46	150	0.947	2.4	10	20
103210590	62	60	144	148	17	17	202	181	596	577	50	46	150	0.947	2.4	10	20
103210591	62	60	144	148	17	17	202	181	596	577	50	46	150	0.947	2.5	10	20

Laboratory Manager Mauricio Ossa

This test report shall not be reproduced, except in full, without written approval of the laboratory.

Attachment B
CTI Liner Report

28001 Cabot Drive ♦ Suite 250 ♦ Novi, MI 48377 ♦ 248.486.5100 Phone ♦ 248.486.5050 Fax

October 25, 2017

Ms. Heidi Flateau
Angelo Iafrate Construction Company
26300 Sherwood
Warren, MI 48091

Re: First Flush Basin C and Channel
Willow Run Powertrain
Ypsilanti, Michigan
CTI Project No. 1172040050

Dear Ms. Flateau:

CTI and Associates, Inc. (CTI) is submitting this letter report to document the installation of the geomembrane liner for the new Flush Basin and Low Flow Channel at the Willow Run Powertrain Facility in Ypsilanti, Michigan. This letter and its attachments detail the observations made by CTI during the construction.

Introduction

CTI was retained by Angelo Iafrate Construction Company (Iafrate) to perform construction quality control (CQC) during installation of the geomembrane and overlying sand layer of the Low Flow Channel and First Flush Basin. The base liner system constructed consisted of the following components, from top to bottom:

- Minimum 12-inches of topsoil;
- 8 ounce/square yard non-woven geotextile;
- Minimum 46-inches of MDOT 6AA aggregate;
- 12-inches of MDOT 2NS sand;
- 60-mil textured/smooth high-density polyethylene (HDPE) geomembrane; and
- Prepared Subgrade.

Iafrate performed earthworks construction, and sub-contracted Northern Seal, Inc. (NSI) to perform the geomembrane installation. Installation of the geomembrane occurred in three (3) phases, the first phase was performed on September 14th and 15th, while the second phase was performed from September 25th and 26th, with final repairs and acceptance of the geomembrane being conducted on October 2nd.

The letter provided and attachments detail the results of the CQC services by CTI during the installation of the geomembrane and overlying sand layer.

Earthworks

Iafrate performed the earthwork portion of the project to prepare the construction area for geomembrane. The earthworks included excavation of the native soils to general design grades, and preparation of the subgrade surface for receiving the geomembrane base liner. All this work was performed prior to CTI arriving onsite.

Subgrade surfaces were inspected by CTI and NSI prior to deployment of the geomembrane. Copies of the subgrade acceptance forms are included in Appendix B.2. The design firms for the project were GHD Limited (GHD) formerly CRA Engineering Inc. (CRA). GHD had onsite representation, which also inspected the subgrade conditions, copies of their subgrade acceptance forms are included in Appendix B.1

Geomembrane Installation

The 60-mil textured/smooth HDPE geomembrane was manufactured by GSE Environmental, LLC (GSE) and SOLMAX (Solmax). Quality control testing of the HDPE resin used to manufacture the geomembrane was performed by the resin supplier. Each resin batch was, at a minimum, tested for density and melt flow index. The reported test results were reviewed by CTI and verified that the materials provided comply with the current industry standards. The geomembrane manufacturer provided a certification report for the rolls of HDPE geomembrane supplied to the project. The material was tested for thickness, tensile properties, tear strength, carbon black dispersion and puncture. Material certifications were reviewed for completeness and conformance to the current industry standard for this material. The resin manufacturer test results, geomembrane manufacturer's certifications and inventory of the geomembrane are attached as Appendix A.1.

The geomembrane was installed directly over the approved subgrade. Prior to geomembrane installation, the subgrade surface was observed for dirt clods, metal, stones and any other protrusions that would impair the integrity of the geomembrane. A subgrade acceptance form was jointly completed by CTI and NSI prior to daily geomembrane deployment, stating that the subgrade surface was suitable for geosynthetics placement.

All geomembrane panels were installed by NSI. Geomembrane panels were deployed from rolls that were suspended from a trailer equipped with a spreader bar. The panels were deployed off the spreader bar either manually or with a John Deere all-terrain vehicle (ATV). No heavy equipment was permitted to operate directly on any geomembrane during the project. Once the panel was deployed, NSI manually positioned the panel to achieve the minimum 4-inch overlap with adjacent panels. As each panel was deployed, it was assigned a unique field identification number by CTI. Geomembrane panel placement information can be found in Appendix B.3.

Panels were continuously examined for damage and manufacturing imperfections. All geomembrane panels on the slopes were continuous from the top of the slope to a minimum

5-feet past the toe of the slope. A geomembrane as-built field sketch of the installed panels is included in Appendix B.11.

Prior to field seaming, trial weld samples were prepared and tested in the field using a calibrated field tensiometer to qualify welders for seaming activities. A copy of NSI's calibration data for the field tensiometer utilized during construction onsite is included in Appendix B.10.

Trial weld samples were made from the same geomembrane used in this project and prepared using the same procedures and under the environmental conditions anticipated during field welding. Three (3) 1-inch-wide samples were tested for peel and two (2) samples were tested for shear. CTI personnel observed the trial weld preparation and testing performed on the test strips. The minimum strength criteria required for peel testing of 60-mil HDPE is 91 pounds per inch (ppi) for fusion welds and 78 ppi for extrusion welds. For shear testing, the minimum strength criterion was 120 ppi for both fusion and extrusion welds. No seam separation was allowed on any specimens during trial weld testing.

Only if all trial weld samples passed the criteria mentioned above were NSI allowed to proceed with geomembrane installation. The process was performed at all startups of seaming, anytime the equipment required startup after a shutdown, every four hours of continuous seaming, and after each break in seaming of one hour or more. All trial welds performed by NSI welders meet the project requirements. Results of the trial weld testing are presented in Appendix B.4.

Production seaming was performed using dual hot wedge fusion welders. The dual hot wedge fusion welder created two fused seams separated by an air channel. The air channel was pressurized during the non-destructive testing to verify the integrity of the completed seam. Round shape patches made using the same geomembrane material that extended at least 3-inches beyond the edge of defect were extrusion welded to repair damages from the non-destructive tests.

The procedures associated with both fusion and extrusion seaming operations were observed by CTI. CTI's observations included the following items: seam preparation, weather conditions, general seaming procedures, overlap of geomembrane panels, and temporary bonding procedures. Seams were monitored throughout their length for quality and seam completion. Visually detected imperfections were marked by CTI and subsequently repaired by NSI. Geomembrane panel seaming, repairs, and weather logs are presented in Appendix B.5, B.8 and B.9, respectively.

Non-destructive testing of all geomembrane seams consisted of air channel pressure testing or vacuum box testing. Seams and repairs failing non-destructive testing were repaired and retested according to current industry standards.

Air channel testing consisted of pressurizing the channels between the double wedge seams with air to a minimum pressure of 30 pounds per square inch (psig). The channels were kept

pressurized for a minimum of 5 minutes. Passing tests for 60-mil HDPE were those with no more than a 3 psi drop over the 5-minute test duration period. If a double wedge seam did not meet the passing requirements, the seam was repaired by one of the following two methods: (1) tracking the failed seam back to the weld defect, repairing the defect, and then testing in both directions of the weld defect; or (2) capping the seam with a strip of geomembrane and extrusion welding the cap. All extrusion welds were then vacuum box tested.

Vacuum testing of extrusion welds uses a vacuum box consisting of a flexible plastic frame with a neoprene gasket around the bottom and a clear viewing window covering the top. The box is connected to a vacuum pump, which reduces the air pressure in the box. A soapy water solution is applied to the extrusion weld to be tested, the box is manually pressed against the seam, and a vacuum applied inside the box. If no air bubbles were observed coming from the seam, the test was considered to be passing. Bubbles drawn through the seam and viewed through the window on the box indicate a leak in the extrusion weld. Any flaws noted were recorded, repaired, and re-tested. Results of the non-destructive testing of the geomembrane seams are presented in Appendix B.6.

Destructive testing was completed on both fusion and extrusion welded seam completed during installation. It was determined in the geomembrane project kick off meeting that destructive testing frequencies would be increased from 1 per 1,000 linear feet (LF) to 1 per 500 LF. CTI collected samples at least one test per 500 LF of seam, and at least one test per day per seaming crew. Each sample was divided into four (4) equal sections. The first section was tested in the field. The second section was archived by CTI and given to Iafrate. The third section was sent to TRI/Environmental, Inc. (TRI) laboratory for peel and shear destructive testing. The fourth section was given to GHD for their internal archive. A total of fourteen (14) destructive samples were taken from the geomembrane. For fusion welds, a total of eleven (11) destructive samples were obtained from 4,842 linear feet welded, resulting in a frequency of one destructive sample per 440-feet. For extrusion welds, a total of three (3) destructive samples were obtained from extrusion welded repairs, which represented a sample per machine/technician combination for the project. Where samples were taken from the seams for destructive testing, oval shape geomembrane patches of a least 2-foot in width by 5-foot in length were extrusion welded on top of the void remaining from sample collection.

During the project if a destructive sample failed field or laboratory testing, additional samples were obtained from a minimum distance of 10-feet to each side of the failing sample, on the same or adjoining seams or repairs welded by the same machine/technician combination. The portion of the seam or repairs between passing bounding samples of a failed destructive test was covered with a cap strip.

Results of the geomembrane laboratory testing of destructive seam samples are included in Appendix B.7.

Sand/Stone Layer Installation

Directly overlying the geomembrane is a minimum 12-inch thick layer of MDOT 2NS sand (sand). One area in front of the plunge pool at the front of the inlet structure was not covered with sand. The sand was supplied and installed by Iafrate.

A sample of the sand was obtained by CTI at on-site stockpile. The material was tested by CTI's AASHTO accredited laboratory located in Farmington Hills, Michigan for grain size distribution and Unified Soil Classification System(USCS). The sample met the MDOT 2NS gradation requirements for granular materials. Table 1 summarizes the results of the grain size distribution performed.

Table 1. MDOT 2NS Grain Size Distribution Table

Sieve Size	MDOT 2NS Grading Requirement (% Passing by Weight)	Laboratory Percent Passing (By Weight)
3/8 in	100	100
No. 4	95-100	99
No.8	65-95	86
No.16	35-75	67
No.30	20-55	49
No.50	10-30	28
No.100	0-10	4
Loss by Washing % Passing No.200	0-3.0	1

Results of laboratory testing performed on the sand are included in Appendix C.1.

Sand was hauled to the site and stockpiled south of the construction area, or directly hauled and placed into the lined area by Michigan Gravel Trains. Stockpiled materials were hauled to the lined area with Caterpillar series off-road dump trucks. All haul trucks were only allowed to travel on areas covered with a minimum of 3-feet of sand cover. Materials were spread in a single 12-inch lift using a Caterpillar D6N low-ground-pressure (LGP) GPS bulldozer. CTI personnel continually monitored and observed the sand placement. Materials were spread in a manner that minimized wrinkle propagation.

The thickness of the sand was verified by CTI field staff probing the placed sand with a blunt-ended probe and measuring the distance the probe advanced into the sand layer. The measured thickness of the sand layer met or exceeded the required minimum 12-inch thickness.

Directly over the 12-inch sand layer is a minimum 46-inch thick layer of MDOT 6AA aggregate (gravel). The gravel layer directly overlies the sand layer everywhere except the area in front of the plunge pool at the front of the inlet structure, where the section of geomembrane did not receive any sand. This area had the gravel installed in direct contract with the geomembrane. The gravel was supplied and installed by Iafrate.

A sample of the gravel was obtained by CTI at the on-site stockpile. The material was tested by CTI's AASHTO accredited laboratory located in Farmington Hills, Michigan for grain size distribution and USCS. The sample met the project requirements of MDOT 6AA grading requirements for coarse aggregates. Table 2 summarizes the results of the grain size distribution performed.

Table 2. MDOT 6AA Grain Size Distribution Table

Sieve Size	MDOT 6AA Grading Requirement (% Passing by Weight)	Laboratory Percent Passing (By Weight)
1 ½ in	100	100
1 in	95-100	99
½ in	30-60	30
No. 4	0-8	2
Loss by Washing % Passing No.200	≤ 1	1

Results of laboratory testing performed on the gravel are included in Appendix C.2.

CTI was not onsite for the full duration of the gravel installation. The following details is what was observed during our short duration onsite during this phase. Gravel material was stockpiled south of the construction area, or directly hauled and placed into place by Michigan Gravel Trains. Stockpiled materials were hauled to the lined area with Caterpillar series off-road dump trucks. All haul trucks were only allowed to travel on areas covered with a minimum of 3-feet of material (gravel or sand) cover. Materials were spread in a single 46-inch lift using a Caterpillar D6N low-ground-pressure (LGP) GPS bulldozer. CTI personnel continually monitored and observed the sand placement. Materials were spread in a manner that minimized wrinkle propagation.

Summary

CTI personnel observed the geomembrane and sand layer installation and documented daily operation in Daily Field Reports. Copies of the Daily Field Reports are included in Appendix D. Select project photographs are included in Appendix D.

This document and all attachments were prepared under my direction or supervision in conformance with following documents provided by Iafrate:

- Drawings titled: “Proposed Storm Water Control Design, First Flush Basin C and Channel, Issued for Permit Approval, Willow Run Powertrain, Ypsilanti, Michigan”, prepared by CRA Engineering, Inc., dated July 11, 2017.
- Specifications titled: “Storm Water Control, First Flush Basin C and Channel, Willow Run Powertrain, Ypsilanti, Michigan; Geomembrane, Section 31 05 20 – 1 through 31 05 20 - 13”, prepared by unknown, dated June 16, 2017.

Based on our inquiries of the persons who were directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete.

Sincerely,

CTI and Associates, Inc.

Joshua R. Guy
Project Manager, Landfill Field Services

List of Appendices

APPENDIX A – Geosynthetics Inventory and Certifications
- Appendix A.1 – Geomembrane Inventory and Certifications

APPENDIX B – Geomembrane Installation Documentation
- Appendix B.1 – GHD Subgrade Acceptance
- Appendix B.2 – CTI Subgrade Acceptance
- Appendix B.3 – Geomembrane Panel Placement Data
- Appendix B.4 – Trial Weld Information
- Appendix B.5 – Geomembrane Panel Seaming Data
- Appendix B.6 – Geomembrane Nondestructive Test Data
- Appendix B.7 – Geomembrane Destructive Test Data
- Appendix B.8 – Geomembrane Repair Log
- Appendix B.9 – Weather Logs
- Appendix B.10 – NSI Field Tensiometer Calibration Certificate
- Appendix B.11 – Geomembrane Panel Layout Sketch

APPENDIX C - Cover Soils Test Data
- Appendix C.1 – MDOT 2NS Sand Laboratory Test Data
- Appendix C.2 – MDOT 6AA Aggregate Laboratory Test Data

APPENDIX D – Daily Field Reports
APPENDIX E – Select Project Photographs

APPENDIX A

GEOSYNTHETICS INVENTORY AND CERTIFICATIONS

Appendix A.1

Geomembrane Inventory and Certifications

GEOSYNTHETICS INVENTORY

Willow Run Powertrain

First Flush Basin C and Channel Construction

Ypsilanti, Michigan

Product Name: 60 mil. HDPE Smooth/Textured Geomembr

Manufacturer: GSE Environmental, LLC and SOLMAX

Roll Number	Lot Number	Length (ft)	Width (ft)	Area (sq ft)	QA ID	QC Certs	Comments
GSE Environmental, LLC.							
103210584	Not Provided	520	22.5	11,700	CRK	Yes	
103210585	Not Provided	520	22.5	11,700	CRK	Yes	
103210586	Not Provided	520	22.5	11,700	CRK	Yes	
103210587	Not Provided	520	22.5	11,700	CRK	Yes	
103210588	Not Provided	520	22.5	11,700	CRK	Yes	
103210589	Not Provided	520	22.5	11,700	CRK	Yes	
103210590	Not Provided	520	22.5	11,700	CRK	Yes	
103210591	Not Provided	520	22.5	11,700	CRK	Yes	
SOLMAX							
1-122740	15G1009	560	22.5	12,600	CRK	Yes	

TOTAL GEOMEMBRANE ROLLS INVENTORIED: 9

TOTAL SQUARE FOOTAGE: 106,200

GHD / RACER Project

GSE Environmental, LLC

ENVIRONMENTAL™

ROLL TEST DATA REPORT

GSE QC APPROVED

Report Date: May/15/2017

Sales Order No.	*Customer Name*	*Project Location*	*Product Name*	*BOL Number*
SO-081888	Northern Seal, Inc.	Kalkaska MI US	HST-060GE-BBB-B-W0-T	BL-0103519

Roll Number	Average Thickness ASTM D5994 (mils)	Minimum Thickness ASTM D5994 (mils)	Yield Strength ASTM D6693 (ppi) MD	Yield Strength ASTM D6693 (ppi) TD	Yield Elongation ASTM D6693 (%) MD	Yield Elongation ASTM D6693 (%) TD	Break Strength ASTM D6693 (ppi) MD	Break Strength ASTM D6693 (ppi) TD	Break Elongation ASTM D6693 (%) MD	Break Elongation ASTM D6693 (%) TD	Tear Resistance ASTM D1004 (lbs) MD	Tear Resistance ASTM D1004 (lbs) TD	Puncture Resistance ASTM D4833 (lbs)	Density ASTM D1505 (g/cc)	Carbon Black Content ASTM D4218 (%)	Carbon Black Dispersion ASTM D5596 (Views in Cat1~Cat2)	Asperity Height ASTM D7466 (mils) A Side
103210584	58	57	152	163	18	17	166	174	510	547	52	48	150	0.944	2.5	10	23
103210585	58	57	142	144	17	18	169	163	462	487	49	45	146	0.944	2.5	10	22
103210586	58	57	142	144	17	18	169	163	462	487	49	45	146	0.944	2.5	10	22
103210587	59	57	144	149	17	18	203	188	620	607	51	50	148	0.944	2.5	10	22
103210588	58	57	144	149	17	18	203	188	620	607	51	50	148	0.944	2.5	10	22
103210589	58	57	144	148	17	17	202	181	596	577	50	46	150	0.947	2.4	10	20
103210590	62	60	144	148	17	17	202	181	596	577	50	46	150	0.947	2.4	10	20
103210591	62	60	144	148	17	17	202	181	596	577	50	46	150	0.947	2.5	10	20

Laboratory Manager Mauricio Ossa

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QUALITY CONTROL REPORT

Roll Certification

SOLMAX

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7
Tél.: 1-450-929-1234 • Fax.: 1-450-929-2547 • www.solmax.com

ROLL IDENTIFICATION

Roll Number : 1-122740

Packing Slip Number : 218079

Product Code : Solmax 460ST-1000
HDPE 60 mil S-Textured - GRI - Grade A

Production Date 2015-10-31

Length (± 1%) :	560,0	ft
Width :	22,30	ft
Sheet Area :	12 488	sf
Weight :	3 899	lbs

RESIN INFORMATION

Resine Lot Numb 15G1009
Resine Type : HDPE / HL3812
Resine Supplier : Formosa

Property	Test Method	Results
Density (g/cc)	**ASTM D 1505**	0,937
Melt Index (g/10 min.)	**ASTM D 1238 (190/2.16)**	0,07
ESCR (hrs)	**ASTM D 5397**	>500
OIT (min.)	**ASTM D 3895**	120
HP-OIT (min.)	**ASTM D 5885**	

Physical Property		Test Method	Test Frequency	Technical Data	Test Results
Thickness (mil)	Average	ASTM D-5994	1/1 ro	57,0	57,1
	Minimum			51	54
Asperity (mil)	Average	ASTM D-7466	1/1 ro	16	17,9 /
Tensile properties		ASTM D-6693	1/2 ro		
Yield strength (ppi)	TD			132	156
	MD				150
Yield elongation (%)	TD			13	15,9
	MD				17,5
Break strength (ppi)	TD			132	219
	MD				231
Break elongation (%)	TD			150	626
	MD				620
Tear Resistance (Lbs)	TD	ASTM D-1004	1/6 ro	45	51,7
	MD				48,1
Puncture Resistance (Lbs)		ASTM D-4833	1/6 ro	120	147
Density (g/cc)		ASTM D-1505	1/2 ro	≥ 0.940	0,948
Carbon Black Content (%)		ASTM D-4218	1/2 ro	2.0 - 3.0	2,60
Carbon Black Dispersion		ASTM D-5596	1/6 ro	Cat. 1 & Cat. 2	10
Dimensional Stability (%)	TD	ASTM D-1204	Cert	± 2	
	MD				

GEOMEMBRANE CERTIFICATION

Physical Property	Test Method	Test Frequency	Test Results
Oven Aging - % retained after 90 days	ASTM D-5721	1/Form	
HP OIT (min. avg.)	ASTM D-5885		> 80
UV Resistance - % retained after 1600 hr	GRI-GM-11	1/Form	
HP-OIT (min. avg.)	ASTM D-5885		> 50

Solmax is not a design professional and has not performed any design services to determine if Solmax's goods comply with any project plans or specifications, or with the application or use of Solmax's goods to any particular system, project, purpose, installation or specification.

APPENDIX B

GEOMEMBRANE SYSTEM DOCUMENTATION

Appendix B.1

GHD Subgrade Acceptance

CRA ENGINEERING INC.

CERTIFICATE OF SOIL SURFACE ACCEPTANCE

GEOSYNTHETIC INSTALLER		PROJECT	
COMPANY:	**Northern Seal**	**OWNER:**	ACM
ADDRESS:		**PROJECT:**	FFB-C
		LOCATION:	Willow Run Powertrain, Ypsilanti, MI

We the Undersigned, duly authorized representatives of GHD and/or CRA Engineering **do hereby accept the area of soil surface bounded by** the excavated extent of FFB-C beginning from the north **as an acceptable surface on which to install geosynthetic materials.**

NAME	SIGNATURE	TITLE	DATE
Scott Adamowski		CRA Engineering	9/14/2017
Beth Landale	Beth Landale	GHD Project Manager	9/13/2017

Appendix B.2

CTI Subgrade Acceptance

CERTIFICATE OF SOIL SURFACE ACCEPTANCE

GEOSYNTHETIC INSTALLER

COMPANY: Northern Seal Inc.

ADDRESS: 312 E. Dresden St
Kalkaska, MI 49646

PROJECT

OWNER: _____

PROJECT: Willow Run Sediment Pond

LOCATION Ypsilanti, MI

I the Undersigned, a duly authorized representative of _____

do hereby accept the area of soil surface bounded by Panels #1 - #16.

as an acceptable surface on which to install geosynthetic materials, and shall be responsible for maintaining its integrity and suitability in accordance with the project specifications from this date to the completion of the installation.

CERTIFICATE OF ACCEPTANCE BY GEOSYNTHETIC INSTALLER

Dan Hill	Dan Hill	Foreman	9-14-17
NAME	SIGNATURE	TITLE	DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY CQA RESIDENT MANAGER

Cody Kurzer	Cody Kurzer	Lead CQA	9-14-17
NAME	SIGNATURE	TITLE	DATE

CERTIFICATE OF SOIL SURFACE ACCEPTANCE

GEOSYNTHETIC INSTALLER

COMPANY: Northern Seal Inc

ADDRESS: 312 E. Dresden St
Kalkaska, MI 49646

PROJECT

OWNER:

PROJECT: Willow Run 1st Flush Basin C

LOCATION Ypsilanti, MI

I the Undersigned, a duly authorized representative of

do hereby accept the area of soil surface bounded by

Panels # 17 - # 25

as an acceptable surface on which to install geosynthetic materials, and shall be responsible for maintaining its integrity and suitability in accordance with the project specifications from this date to the completion of the installation.

CERTIFICATE OF ACCEPTANCE BY GEOSYNTHETIC INSTALLER

NAME	SIGNATURE	TITLE	DATE
Dan Hill	Dan Hill	Foreman	9-15-17

CERTIFICATE OF ACCEPTANCE RECEIVED BY CQA RESIDENT MANAGER

NAME	SIGNATURE	TITLE	DATE
Cody Kurzer	Cody Kurzer	Lead CQA	9-15-17

CERTIFICATE OF SOIL SURFACE ACCEPTANCE

GEOSYNTHETIC INSTALLER

COMPANY: Northern Seal Inc

ADDRESS: 312 E. Dresden St.
Kalkaska

PROJECT

OWNER:

PROJECT: Willow Run 1st Flush Basin C

LOCATION Ypsilanti, MI

I the Undersigned, a duly authorized representative of

do hereby accept the area of soil surface bounded by P-26 to P-39

as an acceptable surface on which to install geosynthetic materials, and shall be responsible for maintaining its integrity and suitability in accordance with the project specifications from this date to the completion of the installation.

CERTIFICATE OF ACCEPTANCE BY GEOSYNTHETIC INSTALLER

Dan Hill	Dan Hill	Foreman	9-25-17
NAME	SIGNATURE	TITLE	DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY CQA RESIDENT MANAGER

Cody Kurzer	Cody Kurzer	Lead CQA	9-25-17
NAME	SIGNATURE	TITLE	DATE

CERTIFICATE OF SOIL SURFACE ACCEPTANCE

GEOSYNTHETIC INSTALLER

COMPANY: Northern Seal Inc.

ADDRESS: 312. E. Dresden St
Kalkaska, MI 49646

PROJECT

OWNER:

PROJECT: Willow Run 1st Flush Basin C

LOCATION Ypsilanti, MI

I the Undersigned, a duly authorized representative of

do hereby accept the area of soil surface bounded by P-40 to P-44

as an acceptable surface on which to install geosynthetic materials, and shall be responsible for maintaining its integrity and suitability in accordance with the project specifications from this date to the completion of the installation.

CERTIFICATE OF ACCEPTANCE BY GEOSYNTHETIC INSTALLER

Dan Hill	Dan Hill	Foreman	9-26-17
NAME	SIGNATURE	TITLE	DATE

CERTIFICATE OF ACCEPTANCE RECEIVED BY CQA RESIDENT MANAGER

Cody Kurzer	Cody Kurzer	Lead CQA	9-26-17
NAME	SIGNATURE	TITLE	DATE

Appendix B.3

Geomembrane Panel Placement Data

GEOMEMBRANE PANEL PLACEMENT LOG

WILLOW RUN POWERTAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

CTI Project No. : 1172040050

DATE	TIME	PANEL NUMBER	ROLL NUMBER	LOCATION	PANEL DIMENSIONS			QA ID	COMMENTS
					LENGTH	WIDTH	AREA		
60 mil. Smooth/Textured HDPE Geomembrane									
9/14/17	1050	1	103210586	East/West Slope and Floor	239	22.0	5258.0	CRK	
9/14/17	1100	2	103210586	East/West Slope and Floor	235	22.0	5170.0	CRK	
9/14/17	1124	3	103210586	North Slope	89	22.0	1958.0	CRK	
9/14/17	1317	4	103210589	North Slope	90	22.0	1980.0	CRK	
9/14/17	1330	5	103210589	North Slope	92	22.0	2024.0	CRK	
9/14/17	1340	6	103210589	North Slope	91	22.0	2002.0	CRK	
9/14/17	1407	7	103210589	North Slope	91	22.0	2002.0	CRK	
9/14/17	1435	8	103210589	North Slope	78	22.0	1716.0	CRK	
9/14/17	1516	9	103210589	North Slope	63	22.0	1386.0	CRK	
9/14/17	1530	10	103210589	North Slope	42	22.0	924.0	CRK	
9/14/17	1559	11	103210589	North Slope	16	9.0	72.0	CRK	Triangle
9/14/17	1656	12	103210587	West Slope and Floor	65	22.0	1430.0	CRK	
9/14/17	1712	13	103210587	West Slope and Floor	65	22.0	1430.0	CRK	
9/14/17	1745	14	103210587	North Slope	57	22.0	1254.0	CRK	
9/14/17	1756	15	103210587	East/West Slope	49	22.0	1078.0	CRK	
9/14/17	1830	16	103210587	North/West Slope	19	10.0	95.0	CRK	Triangle
				9/14/17 Total Deployment in Square Feet: =			**29779.0**		
9/15/17	920	17	103210587	East/West Slope and Floor	233	22.0	5126.0	SC	
9/15/17	930	18	103210587	East Slope and Floor	97	22.0	2134.0	SC	
9/15/17	1025	19	103210588	West Slope and Floor	145	22.0	3190.0	SC	
9/15/17	1100	20	103210588	East/West Slope and Floor	244	22.0	5368.0	SC	
9/15/17	1140	21	103210588	East Slope and Floor	176	22.0	3872.0	SC	
9/15/17	1320	22	103210590	West Slope and Floor	69	22.0	1518.0	CRK	
9/15/17	1354	23	103210590	East/West Slope and Floor	242	22.0	5324.0	CRK	
9/15/17	1448	24	103210590	East/West Slope and Floor	240	22.0	5280.0	CRK	
9/15/17	1551	25	103210585	East/West Slope and Floor	236	22.0	5192.0	CRK	
				9/15/17 Total Deployment in Square Feet: =			**37004.0**		
9/25/17	1100	26	103210585	East/West Slope and Floor	236	22.0	5192.0	CRK	
9/25/17	1130	27	103210585	East Slope and Floor	105	22.0	2310.0	CRK	
9/25/17	1156	28	103210584	West Slope and Floor	133	22.0	2926.0	CRK	
9/25/17	1405	29	103210584	East/West Slope and Floor	237	22.0	5214.0	CRK	
9/25/17	1430	30	103210584	South Slope and Floor	95	22.0	2090.0	CRK	
9/25/17	1445	31	103210584	South Slope and Floor	95	22.0	2090.0	CRK	
9/25/17	1515	32	103210591	South Slope and Floor	84	22.0	1848.0	CRK	

GEOMEMBRANE PANEL PLACEMENT LOG

WILLOW RUN POWERTAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

CTI Project No. : 1172040050

DATE	TIME	PANEL NUMBER	ROLL NUMBER	LOCATION	PANEL DIMENSIONS			QA ID	COMMENTS
					LENGTH	WIDTH	AREA		
60 mil. Smooth/Textured HDPE Geomembrane									
9/25/17	1524	33	103210591	South Slope and Floor	80	22.0	1760.0	CRK	
9/25/17	1545	34	103210591	South Slope and Floor	88	22.0	1936.0	CRK	
9/25/17	1556	35	103210591	South Slope and Floor	79	22.0	1738.0	CRK	
9/25/17	1730	36	103210591	West Slope	36	20.0	360.0	CRK	Triangle
9/25/17	1745	37	103210591	West Slope and Floor	69	22.0	759.0	CRK	Triangle
9/25/17	1815	38	103210591	West Slope	24	12.0	144.0	CRK	Triangle
9/25/17	1820	39	103210591	West Slope and Floor	57	22.0	1254.0	CRK	
				9/25/17 Total Deployment in Square Feet: =			**29621.0**		
9/26/17	820	40	103210591	East Slope and Floor	76	22.0	1672.0	SC	
9/26/17	1430	41	1-122740	East Slope	42	22.0	462.0	SC	
9/26/17	1435	42	103210591	East Slope	46	20.0	460.0	SC	Triangle
9/26/17	1445	43	103210591	East Slope	41	21.0	430.5	SC	Triangle
9/26/17	1450	44	103210590	East Slope	32	19.0	304.0	SC	Triangle
				9/26/17 Total Deployment in Square Feet: =			**3328.5**		
				Project Total Deployment in Square Feet: =			**99732.5**		

Appendix B.4

Trial Weld Information

GEOMEMBRANE TRIAL WELD LOG

WILLOW RUN POWERTRAIN

FIRST FLUSH BASIN C AND CHANNEL

YPSILANTI, MICHIGAN

CTI Project No. : 1172040050

DATE	TIME	AMB. TEMP	SAMPLE ID	SEAMER ID	MACH. ID	FUSION SPEED	FUSION TEMP EXTRUSION BARREL	FUSION TEMP EXTRUSION NOZZLE	PEEL (ppi) Inside Track	PEEL (ppi)	PEEL (ppi) Outside Track	SHEAR (ppi)		QA ID	PASS/ FAIL	COMMENTS
9/14/17	1145	67	1	DH	010	10	860		119	126	128	131	139	CRK	Pass	
									128	125	129					
9/14/17	1557	77	2	DH	010	12	860		103	100	111	133	131	CRK	Pass	
									100	107	112					
9/15/17	805	56	3	DH	010	10	860		48	--	--	--	--	SC	**Fail**	Due to high rate of speed.
									--	--	--					
9/15/17	835	56	4	DH	010	8	860		119	120	123	165	163	SC	Pass	Sample 3 Retest
									128	142	131					
9/15/17	1320	77	5	DH	010	11	860		120	120	119	131	127	CRK	Pass	
									122	126	122					
9/15/17	1715	79	6	JH	080	485	350		95	111	122	146	134	CRK	Pass	
9/16/17	830	57	7	DH	085	485	350		101	106	115	160	161	CRK	Pass	
9/16/17	855	57	8	JH	080	485	350		103	102	92	163	151	CRK	Pass	
9/16/17	1216	77	9	JH	080	485	350		106	100	106	146	126	CRK	Pass	
9/16/17	1245	77	10	DH	085	485	350		118	119	123	141	137	CRK	Pass	
9/25/17	900	70	11	JJ	080	485	475		100	117	115	138	150	CRK	Pass	
9/25/17	1015	76	12	DH	012	10	860		131	127	123	139	141	CRK	Pass	
									126	123	130					
9/25/17	1400	92	13	DH	012	12	860		122	123	114	132	127	CRK	Pass	
									122	103	123					
9/25/17	1810	86	14	DH	012	10	860		116	108	110	140	145	CRK	Pass	
									108	109	108					
9/26/17	825	65	15	DH	012	9	860		108	122	137	151	148	CRK	Pass	
									133	129	125					
9/26/17	950	69	16	JJ	080	485	475		99	90	88	148	153	CRK	Pass	

GEOMEMBRANE TRIAL WELD LOG

WILLOW RUN POWERTRAIN

FIRST FLUSH BASIN C AND CHANNEL

YPSILANTI, MICHIGAN

DATE	TIME	AMB. TEMP	SAMPLE ID	SEAMER ID	MACH. ID	FUSION SPEED	FUSION TEMP	PEEL (ppi) Inside Track			SHEAR (ppi)		QA ID	PASS/ FAIL	COMMENTS
						EXTRUSION BARREL	EXTRUSION NOZZLE	Outside Track							
9/26/17	1400	90	17	JJ	080	485	475	128	114	123	132	145	CRK	Pass	
9/26/17	1456	90	18	DH	012	12	860	114 123	129 127	123 122	143	148	CRK	Pass	
9/26/17	1610	90	19	JJ	085	485	475	118	120	122	144	144	CRK	Pass	
9/27/17	800	68	20	DH	085	485	475	111	122	121	168	161	CRK	Pass	
9/27/17	1045	70	21	DH	085	485	475	100	104	114	159	149	CRK	Pass	
9/27/17	1530	78	22	DH	085	485	475	138	136	112	145	142	CRK	Pass	
10/2/17	1430	75	23	JJ	080	475	485	98	99	106	137	127	CRK	Pass	

Appendix B.5

Geomembrane Panel Seaming Data

GEOMEMBRANE PANEL SEAMING LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL CONSTRUCTION
YPSILANTI, MICHIGAN

CTI Project No.: 1172040050

DATE	START TIME	SEAM ID	LOCATION	TECH ID	MACH ID	STATION		SEAM LENGTH	QA ID	COMMENTS
						BEG	END			
9/14/17	1210	1/2	Floor and E/W Slopes	DH	010	0+00	2+35	235	CRK	
9/14/17	1333	3/4	North Slope	DH	010	0+00	0+89	89	CRK	
9/14/17	1350	4/5	North Slope	DH	010	0+00	0+90	90	CRK	DS-1 @ 0+75
9/14/17	1405	5/6	North Slope	DH	010	0+00	0+92	92	CRK	
9/14/17	1423	6/7	North Slope	DH	010	0+00	0+91	91	CRK	
9/14/17	1626	7/8	North Slope	DH	010	0+00	0+78	78	CRK	
9/14/17	1640	8/10	North Slope	DH	010	0+00	0+42	42	CRK	
9/14/17	1652	10/11	North Slope	DH	010	0+00	0+16	16	CRK	
9/14/17	1709	9/11	North Slope	DH	010	0+00	0+09	9	CRK	
9/14/17	1710	9/10	North Slope	DH	010	0+09	0+31	22	CRK	
9/14/17	1714	8/9	North Slope	DH	010	0+31	0+62	31	CRK	
9/14/17	1728	12/13	West Slope	DH	010	0+00	0+65	65	CRK	DS-2 @ 0+50
9/14/17	1825	13/15	West Slope	DH	010	0+00	0+49	49	CRK	
9/14/17	1855	15/16	West Slope	DH	010	0+00	0+19	19	CRK	
9/14/17	1858	14/16	West Slope	DH	010	0+00	0+10	10	CRK	
9/14/17	1900	14/15	West Slope	DH	010	0+10	0+36	26	CRK	
9/14/17	1905	13/14	West Slope	DH	010	0+36	0+55	19	CRK	
9/14/17	1913	3/14	West Slope	DH	010	0+00	0+57	57	CRK	
9/14/17	1921	3/13	West Slope	DH	010	0+57	0+62	5	CRK	
9/14/17	1922	3/12	West Slope	DH	010	0+62	0+85	23	CRK	
9/15/17	901	1/9	East Slope and Floor	DH	010	0+00	0+63	63	SC	
9/15/17	915	1/7	Floor	DH	010	0+63	0+85	22	SC	
9/15/17	921	1/6	Floor	DH	010	0+85	1+07	22	SC	
9/15/17	925	1/5	Floor	DH	010	1+07	1+30	23	SC	
9/15/17	930	1/4	Floor	DH	010	1+30	1+52	22	SC	
9/15/17	934	1/3	Floor	DH	010	1+52	1+75	23	SC	

GEOMEMBRANE PANEL SEAMING LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL CONSTRUCTION
YPSILANTI, MICHIGAN

CTI Project No.: 1172040050

DATE	START TIME	SEAM ID	LOCATION	TECH ID	MACH ID	STATION		SEAM LENGTH	QA ID	COMMENTS
						BEG	END			
9/15/17	941	1/12	West Slope	DH	010	1+75	2+39	64	SC	DS-3 @ 1+89
9/15/17	1003	2/17	E/W Slopes and Floor	DH	010	0+00	2+33	233	SC	
9/15/17	1040	18/19	Floor	DH	010	0+00	0+22	22	SC	
9/15/17	1051	17/18	East Slope and Floor	DH	010	0+00	0+97	97	SC	
9/15/17	1103	17/19	West Slope and Floor	DH	010	0+97	2+32	135	SC	DS-4 @ 1+17
9/15/17	1131	18/20	East Slope and Floor	DH	010	0+00	0+97	97	CRK	
9/15/17	1144	19/20	West Slope and Floor	DH	010	0+97	2+42	145	CRK	
9/15/17	1346	21/22	Floor	DH	010	0+00	0+22	22	CRK	
9/15/17	1355	20/21	East Slope and Floor	DH	010	0+00	1+76	176	CRK	DS-5 @ 0+71
9/15/17	1416	20/22	West Slope and Floor	DH	010	1+76	2+44	68	CRK	
9/15/17	1436	21/23	East Slope and Floor	DH	010	0+00	1+73	173	CRK	
9/15/17	1456	22/23	West Slope and Floor	DH	010	1+73	2+42	69	CRK	
9/15/17	1530	23/24	E/W Slopes and Floor	DH	010	0+00	2+40	240	CRK	DS-6 @ 0+45
9/15/17	1604	24/25	E/W Slopes and Floor	DH	010	0+00	2+36	236	CRK	DS-7 @ 2+25
9/25/17	1130	25/26	E/W Slopes and Floor	DH	012	0+00	2+36	236	CRK	
9/25/17	1213	27/28	Floor	DH	012	0+22	0+00	22	CRK	
9/25/17	1222	26/27	East Slope and Floor	DH	012	0+00	1+05	105	CRK	
9/25/17	1230	26/28	West Slope and Floor	DH	012	1+05	2+36	131	CRK	DS-10 @ 2+00
9/25/17	1430	27/29	East Slope and Floor	DH	012	0+00	1+04	104	CRK	
9/25/17	1440	28/29	West Slope and Floor	DH	012	1+04	2+37	133	CRK	
9/25/17	1510	30/31	South Slope	DH	012	0+00	0+95	95	CRK	
9/25/17	1527	31/32	South Slope	DH	012	0+00	0+84	84	CRK	DS-11 @ 0+50
9/25/17	1552	32/33	South Slope	DH	012	0+00	0+80	80	CRK	
9/25/17	1606	30/34	South Slope	DH	012	0+88	0+00	88	CRK	
9/25/17	1718	34/35	South Slope	DH	012	0+79	0+00	79	CRK	
9/25/17	1746	36/37	West Slope	DH	012	0+00	0+20	20	CRK	

GEOMEMBRANE PANEL SEAMING LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL CONSTRUCTION
YPSILANTI, MICHIGAN

CTI Project No.: 1172040050

DATE	START TIME	SEAM ID	LOCATION	TECH ID	MACH ID	STATION		SEAM LENGTH	QA ID	COMMENTS
						BEG	END			
9/25/17	1752	33/37	S/W Slopes and Floor	DH	012	0+20	0+69	49	CRK	
9/25/17	1757	33/36	West Slope	DH	012	0+00	0+36	36	CRK	
9/25/17	1829	38/39	West Slope	DH	012	0+00	0+21	21	CRK	
9/25/17	1836	37/39	S/W Slopes and Floor	DH	012	0+64	0+24	40	CRK	
9/25/17	1841	37/38	West Slope	DH	012	0+24	0+00	24	CRK	DS-12 @ 0+21
9/25/17	1904	29/39	West Slope and Floor	DH	012	2+33	1+76	57	CRK	
9/25/17	1912	29/32	Floor	DH	012	1+76	1+55	21	CRK	
9/25/17	1915	29/31	Floor	DH	012	1+55	1+33	22	CRK	
9/25/17	1917	29/30	Floor	DH	012	1+33	1+11	22	CRK	
9/25/17	1920	29/34	Floor	DH	012	1+11	0+89	22	CRK	
9/26/17	920	29/35	Floor	DH	12	0+89	0+76	13	CRK	
9/26/17	925	29/40	East Slope and Floor	DH	012	0+76	0+00	76	CRK	
9/26/17	1511	41/42	East Slope	DH	012	0+42	0+00	42	CRK	
9/26/17	1520	40/41	East Slope	DH	012	0+58	0+46	12	CRK	
9/26/17	1522	40/42	East Slope	DH	012	0+46	0+00	46	CRK	
9/26/17	1530	41/43	East Slope	DH	012	0+41	0+00	41	CRK	
9/26/17	1545	43/44	East Slope	DH	012	0+29	0+00	29	CRK	
9/26/17	1602	35/44	East Slope	DH	012	0+00	0+32	32	CRK	
9/26/17	1605	35/41	East Slope	DH	012	0+32	0+53	21	CRK	DS-13 @ 0+43
9/26/17	1607	35/40	East Slope and Floor	DH	012	0+53	0+72	19	CRK	

Appendix B.6

Geomembrane Nondestructive Test Data

GEOMEMBRANE SEAM TESTING INFORMATION - NONDESTRUCTIVE

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

DATE	SEAM NUMBER	SEAM LOCATION	STATION		AIR TESTING					VACUUM BOX	TEST CREW	QA OBSVR.	COMMENTS
					PRESSURE		TIME		Pass/Fail				
			BEG.	END	BEG	END	BEG	END		Pass/Fail	ID	ID	
9/14/17	1/2	Floor	1+61	1+69	32	30	1330	1335	P	--	LK	CRK	See R-1 and R-2
9/14/17	1/2	East Slope and Floor	BOS	1+16	38	36	1436	1441	P	--	LK	CRK	See R-4
9/14/17	1/2	Floor	1+16	1+36	36	33	1449	1454	P	--	LK	CRK	See R-3 and R-4
9/14/17	1/2	Floor	1+36	1+61	0	0	--	--	**F**	--	--	CRK	Covered by R-21
9/14/17	1/2	West Slope and Floor	1+69	EOS	30	27	1657	1702	P	--	LK	CRK	See R-1
9/14/17	3/4	North Slope and Floor	BOS	EOS	32	31	1454	1459	P	--	LK	CRK	
9/14/17	4/5	North Slope and Floor	BOS	EOS	32	31	1511	1516	P	--	LK	CRK	
9/14/17	5/6	North Slope and Floor	BOS	0+48	34	32	1713	1718	P	--	LK	CRK	See R-6
9/14/17	5/6	North Slope and Floor	0+48	EOS	34	34	1732	1737	P	--	LK	CRK	See R-6
9/14/17	6/7	North Slope and Floor	BOS	EOS	34	33	1729	1734	P	--	LK	CRK	
9/14/17	7/8	North Slope and Floor	BOS	EOS	30	29	1748	1753	P	--	LK	CRK	
9/14/17	8/10	North Slope and Floor	BOS	EOS	34	33	1802	1807	P	--	LK	CRK	
9/14/17	8/9	Floor	BOS	EOS	32	31	1746	1751	P	--	LK	CRK	
9/14/17	9/10	Floor	BOS	EOS	34	33	1801	1806	P	--	LK	CRK	
9/14/17	12/13	West Slope and Floor	BOS	EOS	34	33	1828	1833	P	--	LK	CRK	
9/14/17	13/15	West Slope	BOS	EOS	32	32	1916	1921	P	--	LK	CRK	
9/14/17	10/11	North Slope and Floor	BOS	EOS	31	30	1907	1912	P	--	LK	CRK	
9/14/17	9/11	East Slope and Floor	BOS	EOS	30	29	1922	1927	P	--	LK	CRK	
9/15/17	15/16	West Slope	BOS	EOS	31	30	852	857	P	--	LK	SC	
9/15/17	14/16	N/W Slope and Floor	BOS	EOS	34	32	858	903	P	--	LK	SC	
9/15/17	14/15	N/W Slope and Floor	BOS	EOS	31	30	906	911	P	--	LK	SC	
9/15/17	13/14	N/W Slope and Floor	BOS	0+48	30	28	914	919	P	--	LK	SC	See R-22
9/15/17	13/14	N/W Slope and Floor	0+48	EOS	0	0	--	--	**F**	--	LK	SC	Covered by R-12
9/15/17	3/14	West Slope and Floor	BOS	EOS	32	31	923	928	P	--	LK	SC	
9/15/17	3/13	Floor	BOS	EOS	32	30	932	937	P	--	LK	SC	
9/15/17	3/12	Floor	BOS	EOS	0	0	--	--	**F**	--	--	SC	Covered by R-13
9/15/17	1/12	West Slope	BOS	2+32	32	30	1009	1014	P	--	LK	SC	See R-22
9/15/17	1/12	West Slope and Floor	2+32	EOS	32	29	1018	1023	P	--	LK	SC	See R-22
9/15/17	1/3	Floor	BOS	EOS	33	31	1029	1034	P	--	LK	SC	
9/15/17	1/4	Floor	BOS	EOS	30	28	1051	1056	P	--	LK	SC	
9/15/17	1/5	Floor	BOS	EOS	33	32	1058	1103	P	--	LK	SC	
9/15/17	1/6	Floor	BOS	EOS	34	32	1108	1113	P	--	LK	SC	
9/15/17	1/7	Floor	BOS	EOS	32	32	1118	1123	P	--	LK	SC	
9/15/17	1/9	East Slope	0+11	EOS	30	29	1129	1134	P	--	LK	SC	

GEOMEMBRANE SEAM TESTING INFORMATION - NONDESTRUCTIVE

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

DATE	SEAM NUMBER	SEAM LOCATION	STATION		AIR TESTING					VACUUM BOX	TEST CREW	QA OBSVR.	COMMENTS
					PRESSURE		TIME		Pass/Fail				
			BEG.	END	BEG	END	BEG	END		Pass/Fail	ID	ID	
9/15/17	1/9	East Slope and Floor	BOS	0+11	0	0	--	--	**F**	--	--	SC	Covered by R-27
9/15/17	2/17	East Slope	BOS	0+15	34	32	1141	1146	P	--	LK	SC	See R-28
9/15/17	2/17	E/W Slope and Floor	0+15	EOS	30	29	1151	1156	P	--	LK	SC	See R-28
9/15/17	17/18	East Slope and Floor	BOS	EOS	31	30	1210	1215	P	--	LK	SC	
9/15/17	17/19	West Slope and Floor	BOS	EOS	31	30	1209	1214	P	--	LK	SC	
9/15/17	18/19	Floor	BOS	EOS	32	30	1346	1351	P	--	LK	CRK	
9/15/17	18/20	Floor	0+75	EOS	32	31	1433	1438	P	--	LK	CRK	See R-31
9/15/17	19/20	West Slope and Floor	BOS	EOS	34	32	1407	1412	P	--	LK	CRK	
9/15/17	18/20	East Slope and Floor	BOS	0+59	32	30	1516	1521	P		LK	CRK	See R-33
9/15/17	18/20	Floor	0+59	0+64	34	32	1510	1515	P	--	LK	CRK	See R-32 and R-33
9/15/17	18/20	Floor	0+64	0+67	0	0	--	--	**F**	--	--	CRK	Covered by R-32
9/15/17	18/20	Floor	0+67	0+75	34	32	1442	1447	P	--	LK	CRK	See R-31 and R-32
9/15/17	20/21	East Slope and Floor	BOS	EOS	32	30	1532	1537	P	--	LK	CRK	
9/15/17	20/22	West Slope and Floor	BOS	EOS	32	29	1529	1534	P	--	LK	CRK	
9/15/17	21/22	Floor	BOS	EOS	0	0	--	--	**F**	--	--	CRK	Covered by R-34
9/15/17	21/23	East Slope and Floor	BOS	EOS	32	31	1603	1608	P	--	LK	CRK	
9/15/17	22/23	West Slope and Floor	BOS	EOS	32	30	1600	1605	P	--	LK	CRK	
9/15/17	23/24	E/W Slope and Floor	BOS	EOS	32	32	1620	1625	P	--	LK	CRK	
9/15/17	24/25	E/W Slope and Floor	BOS	EOS	32	32	1637	1642	P	--	LK	CRK	
9/25/17	25/26	E/W Slope and Floor	BOS	EOS	32	30	1406	1411	P		LK	CRK	
9/25/17	26/28	West Slope and Floor	BOS	EOS	32	30	1505	1510	P	--	LK	CRK	
9/25/17	26/27	East Slope and Floor	BOS	EOS	30	29	1509	1514	P	--	LK	CRK	
9/25/17	27/28	Floor	BOS	EOS	33	32	1521	1526	P	--	LK	CRK	
9/25/17	28/29	West Slope and Floor	BOS	EOS	31	30	1530	1535	P	--	LK	CRK	
9/25/17	27/29	East Slope and Floor	BOS	EOS	32	30	1532	1537	P	--	LK	CRK	
9/25/17	30/31	South Slope and Floor	BOS	EOS	31	30	1549	1554	P	--	LK	CRK	
9/25/17	31/32	South Slope and Floor	BOS	EOS	32	32	1553	1558	P	--	LK	CRK	
9/25/17	32/33	South Slope and Floor	BOS	EOS	32	30	1604	1609	P		LK	CRK	
9/25/17	33/37	West Slope	BOS	EOS	32	30	1844	1849	P	--	LK	CRK	
9/25/17	37/38	West Slope	BOS	EOS	33	32	1914	1919	P	--	LK	CRK	
9/25/17	38/39	West Slope	BOS	EOS	32	32	1920	1925	P	--	LK	CRK	
9/25/17	30/34	South Slope and Floor	BOS	EOS	32	31	1708	1713	P	--	LK	CRK	
9/25/17	34/35	South Slope and Floor	BOS	EOS	32	31	1732	1737	P	--	LK	CRK	

GEOMEMBRANE SEAM TESTING INFORMATION - NONDESTRUCTIVE

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

DATE	SEAM NUMBER	SEAM LOCATION	STATION		AIR TESTING					VACUUM BOX	TEST CREW ID	QA OBSVR. ID	COMMENTS
					PRESSURE		TIME		Pass/Fail				
			BEG.	END	BEG	END	BEG	END		Pass/Fail			
9/26/17	33/36	South Slope	BOS	EOS	32	30	816	821	P	--	LK	CRK	
9/26/17	36/37	West Slope	BOS	EOS	32	31	817	822	P	--	LK	CRK	
9/26/17	37/39	West Slope and Floor	BOS	EOS	33	32	852	857	P	--	LK	CRK	
9/26/17	29/39	West Slope and Floor	BOS	EOS	32	32	851	856	P	--	LK	CRK	
9/26/17	29/32	Floor	BOS	EOS	32	32	913	918	P	--	LK	CRK	
9/26/17	29/31	Floor	BOS	1+42	32	32	936	941	P	--	LK	CRK	See R-54
9/26/17	29/31	Floor	1+42	1+49	32	32	926	931	P	--	LK	CRK	See R-53 and R-54
9/26/17	29/31	Floor	1+49	EOS	32	30	921	926	P	--	LK	CRK	See R-53
9/26/17	29/30	Floor	BOS	EOS	0	0	--	--	**F**	--	--	CRK	Covered by R-55
9/26/17	29/35	Floor	BOS	EOS	32	31	1038	1043	P	--	LK	CRK	
9/26/17	29/34	Floor	BOS	EOS	32	30	1046	1051	P	--	LK	CRK	
9/26/17	29/40	Floor	BOS	EOS	32	31	1056	1101	P	--	LK	CRK	
9/26/17	40/41	East Slope and Floor	BOS	EOS	32	31	1715	1720	P	--	LK	CRK	
9/26/17	40/42	East Slope	BOS	EOS	32	32	1550	1555	P	--	LK	CRK	
9/26/17	41/42	East Slope	BOS	EOS	32	32	1550	1555	P	--	LK	CRK	
9/26/17	41/43	East Slope	BOS	EOS	32	32	1612	1617	P	--	LK	CRK	
9/26/17	43/44	East Slope	BOS	EOS	32	30	1612	1617	P	--	LK	CRK	
9/26/17	35/44	South Slope	0+23	EOS	32	31	1648	1653	P	--	LK	CRK	See R-64
9/26/17	35/44	South Slope	0+18	0+23	32	31	1700	1705	P	--	LK	CRK	See R-63 and R-64
9/26/17	35/44	South Slope	BOS	0+18	33	31	1705	1710	P	--	LK	CRK	See R-63
9/26/17	35/41	South Slope and Floor	BOS	EOS	31	30	1708	1713	P	--	LK	CRK	
9/26/17	35/40	Floor	BOS	EOS	32	32	1721	1726	P	--	LK	CRK	See R-67

Appendix B.7

Geomembrane Destructive Test Data

GEOMEMBRANE SEAM TESTING INFORMATION - DESTRUCTIVE

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

CTI Project No.: 1172040050

SAMPLE NUMBER	DATE WELDED	SEAM ID	LOCATION	SEAMER ID	MACHINE ID	WELD TYPE	TEST RESULTS Pass / Fail		REPAIR NUMBER	QA ID	COMMENTS
							FIELD	LAB			
DS-1	9/14/17	4/5	0+75	DH	010	Fusion	Pass	Pass	R-5	CRK	
DS-2	9/14/17	12/13	0+50	DH	010	Fusion	Pass	Pass	R-15	CRK	
DS-3	9/15/17	1/12	1+89	DH	010	Fusion	Pass	Pass	R-16	CRK	
DS-4	9/15/17	17/19	1+17	DH	010	Fusion	Pass	Pass	R-17	CRK	
DS-5	9/15/17	20/21	0+71	DH	010	Fusion	Pass	Pass	R-18	CRK	
DS-6	9/15/17	23/24	0+45	DH	010	Fusion	Pass	Pass	R-19	CRK	
DS-7	9/15/17	24/25	2+25	DH	010	Fusion	Pass	Pass	R-20	CRK	
DS-8	9/16/17	23/R-19	0+45	JH	080	Extrusion	Pass	Pass	R-39	CRK	
DS-9	9/16/17	25/R-20	2+25	DH	085	Extrusion	Pass	**FAIL**	R-40	CRK	- All welding performed by DH/085 on 9/16/17 were capped.
DS-9A	9/16/17	1/R-21	1+50	DH	085	Extrusion	Pass	**FAIL**	R-42	CRK	
DS-9B	9/16/17	1/R-23	1+53	DH	085	Extrusion	Pass	**FAIL**	R-43	CRK	
DS-10	9/25/17	26/28	2+00	DH	012	Fusion	Pass	Pass	R-46	CRK	
DS-11	9/25/17	31/32	0+50	DH	012	Fusion	Pass	Pass	R-47	CRK	
DS-12	9/25/17	37/38	0+21	DH	012	Fusion	Pass	Pass	R-48	CRK	
DS-13	9/26/17	35/41	0+43	DH	012	Fusion	Pass	**FAIL**	R-61	CRK	- All welding between DS-13B1 to the end of the project was capped.
DS-13A	9/26/17	35/40	0+57	DH	012	Fusion	Pass	**FAIL**	R-84	CRK	
DS-13B	9/26/17	35/41	0+33	DH	012	Fusion	Pass	**FAIL**	R-83	CRK	
DS-13B1	9/26/17	35/44	0+00	DH	012	Fusion	Pass	Pass	R-86	CRK	
DS-13B2	9/26/17	43/44	0+00	DH	012	Fusion	Pass	Pass	R-87	CRK	
DS-14	9/26/17	29/R-55	1+17	JJ	080	Extrusion	Pass	Pass	R-62	CRK	

Date: 2017-09-15

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GHD Services
6320 Rothway Suite 100
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Bill To:

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PO 081613.t12.17.4

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Dear Mr. Abdallah,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Former Willow Run Powertrain FFB-C Liner**
TRI Job Reference Number:	**32244**
Material(s) Tested:	(1) Heat Fusion Weld Seam(s)
Test(s) Requested:	SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.
Sincerely,

Patricia Zabaleta
Project Manager
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32244

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-81613 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	120	121	119	134	122	**123**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	125	122	125	120	124	**123**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	160	162	159	159	159	**160**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

Date: 2017-09-16

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Dear Mr. Abdallah,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Former Willow Run Powertrain FFB-C Liner**
TRI Job Reference Number:	**32263**
Material(s) Tested:	(7) Heat Fusion Weld Seam(s)
Test(s) Requested:	SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.
Sincerely,

Patricia Zabaleta
Project Manager
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32263

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-81613-002 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	131	129	125	126	122	**127**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	137	134	125	127	129	**130**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	164	166	164	166	165	**165**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-81613-003 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	127	123	122	126	128	**125**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	125	133	129	127	127	**128**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	163	166	166	163	163	**164**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32263

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-81613-004 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	130	132	131	131	128	**130**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	133	123	123	129	125	**127**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	162	167	166	164	164	**165**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-81613-005 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	130	124	134	122	136	**129**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	131	131	130	135	127	**131**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	163	165	164	163	163	**164**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32263

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-81613-006 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	127	118	130	124	127	**125**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	138	131	140	134	138	**136**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	163	165	165	164	165	**164**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-81613-007 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	130	119	125	125	120	**124**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	127	118	124	121	121	**122**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	164	168	166	165	164	**165**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2017-09-19

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PO 081613.t12.17.4

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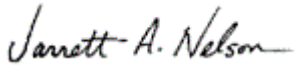
Dear Mr. Abdallah,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Former Willow Run Powertrain FFB-C Liner**
TRI Job Reference Number:	**32315**
Material(s) Tested:	(2) Single Extrusion Weld Seam(s)
Test(s) Requested:	SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.
Sincerely,



Jarret Nelson
Project Manager
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS - SINGLE TRACK
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32315

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-81613-008 | Weld: Single Extrusion						
Side: Peel						**Peel**
Peel Strength (ppi)	103	107	113	105	108	**107**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	158	158	153	156	152	**155**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-81613-009 | Weld: Single Extrusion						
Side: Peel						**Peel**
Peel Strength (ppi)	50	97	64	110	89	**82**
Peel Incursion (%)	90	<5	90	<5	40	
Peel Locus Of Failure Code	AD-BRK	SE	AD-BRK	SE	AD-BRK	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	157	161	160	154	157	**158**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2017-09-26

Mail To:
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Dear Mr. Abdallah,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Former Willow Run Powertrain FFB-C Liner**
TRI Job Reference Number:	**32506**
Material(s) Tested:	(2) Heat Fusion Weld Seam(s) (2) Single Extrusion Weld Seam(s)
Test(s) Requested:	SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

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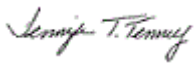
Sincerely,



Jennifer Tenney
Project Manager
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32506

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-81613-010 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	112	112	113	116	118	**114**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	111	109	105	110	113	**110**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	165	165	163	163	161	**163**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-81613-011 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	108	125	110	132	115	**118**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	133	139	132	123	124	**130**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	165	166	165	163	161	**164**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS - SINGLE TRACK
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32506

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-81613-009A | Weld: Single Extrusion						
Side: Peel						**Peel**
Peel Strength (ppi)	106	120	112	110	114	**112**
Peel Incursion (%)	30	<5	40	<5	<5	
Peel Locus Of Failure Code	AD-BRK	SE	AD-BRK	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	164	166	164	165	164	**165**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-81613-009B | Weld: Single Extrusion						
Side: Peel						**Peel**
Peel Strength (ppi)	87	97	48	104	86	**84**
Peel Incursion (%)	100	100	100	100	100	
Peel Locus Of Failure Code	AD	AD	AD	AD	AD	
Peel NSF Failure Code	NON-FTB	NON-FTB	NON-FTB	NON-FTB	NON-FTB	
Shear						**Shear**
Shear Strength (ppi)	168	170	168	169	171	**169**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2017-09-27

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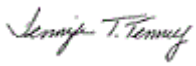
Dear Mr. Abdallah,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Former Willow Run Powertrain FFB-C Liner**
TRI Job Reference Number:	**32543**
Material(s) Tested:	(2) Heat Fusion Weld Seam(s) (1) Single Extrusion Weld Seam(s)
Test(s) Requested:	SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.
Sincerely,



Jennifer Tenney
Project Manager
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32543

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-8163-012 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	125	126	126	129	126	**126**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	122	136	131	143	124	**131**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	158	163	159	160	162	**160**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-8163-013 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	132	122	133	128	116	**126**
Peel Incursion (%)	80	30	<5	<5	90	
Peel Locus Of Failure Code	AD-BRK	AD-BRK	SE	SE	AD-BRK	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	136	128	137	147	146	**139**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	156	159	157	158	156	**157**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS - SINGLE TRACK
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32543

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-8163-014 | Weld: Single Extrusion						
Side: Peel						**Peel**
Peel Strength (ppi)	112	110	102	129	87	**108**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	156	158	155	156	158	**157**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2017-09-28

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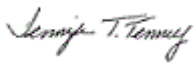
Dear Mr. Abdallah,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Former Willow Run Powertrain FFB-C Liner**
TRI Job Reference Number:	**32563**
Material(s) Tested:	(2) Heat Fusion Weld Seam(s)
Test(s) Requested:	SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
SE	Break in sheeting at edge of seam.
AD-BRK	Break in sheeting after some adhesion failure - partial peel.
SIP	Separation in the plane of the sheet (leaving the bond intact).
FTB	Film tearing bond (all non "AD" failures).
NON-FTB	100% peel.

If you have any questions or require any additional information, please call us at 1-800-880-8378.
Sincerely,



Jennifer Tenney
Project Manager
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32563

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-081613-13A | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	105	124	121	103	120	**115**
Peel Incursion (%)	90	<5	<5	80	<5	
Peel Locus Of Failure Code	AD-BRK	SE	SE	AD-BRK	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	132	103	120	121	135	**122**
Peel Incursion (%)	<5	100	<5	<5	<5	
Peel Locus Of Failure Code	SE	AD	SE	SE	SE	
Peel NSF Failure Code	FTB	NON-FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	155	159	157	155	158	**157**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-081613-13B | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	116	134	113	136	133	**126**
Peel Incursion (%)	50	10	<5	90	70	
Peel Locus Of Failure Code	AD-BRK	AD-BRK	SE	AD-BRK	AD-BRK	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	115	129	128	122	145	**128**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	158	162	156	158	157	**158**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2017-09-29

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Dear Mr. Abdallah,

Thank you for consulting with TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Former Willow Run Powertrain FFB-C Liner**
TRI Job Reference Number:	**32610**
Material(s) Tested:	(2) Heat Fusion Weld Seam(s)
Test(s) Requested:	SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)

Codes:	
AD	Adhesion Failure (100% Peel)
BRK	Break in sheeting away from Seam edge.
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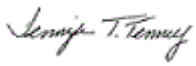
Sincerely,



Jennifer Tenney
Project Manager
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Former Willow Run Powertrain FFB-C Liner

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 32610

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DS-13B1 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	121	115	113	128	123	**120**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	117	123	120	121	116	**119**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	154	156	139	152	153	**151**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DS-13B2 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	126	129	117	119	109	**120**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side: B						**Peel B**
Peel Strength (ppi)	126	132	118	131	127	**127**
Peel Incursion (%)	<5	<5	<5	<5	<5	
Peel Locus Of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear						**Shear**
Shear Strength (ppi)	163	149	149	149	150	**152**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

Appendix B.8

Geomembrane Repair Log

GEOMEMBRANE REPAIR LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

DATE	TIME	REPAIR NUMBER	SEAM ID	PANEL(S)	LOCATION (STATION)	*REPAIR TYPE	REPAIR SIZE		REPAIR CREW		NON-DESTRUCTIVE VACUUM BOX TESTING				COMMENTS
							WIDTH	LENGTH	TECH ID	MACH ID	DATE	TECH ID	QA ID	P/F	
9/15/17	1801	1	1/2	--	1+69	PT	2	5	JH	080	9/16/17	JM	CRK	P	
9/15/17	1752	2	1/2	--	1+61	PT	2	5	JH	080	9/16/17	JM	CRK	P	
9/15/17	1743	3	1/2	--	1+36	PT	2	3	JH	080	9/16/17	JM	CRK	P	
9/15/17	1739	4	1/2	--	1+16	PT	2	3	JH	080	9/16/17	JM	CRK	P	
9/16/17	1020	5	4/5	--	0+75	DS-1	2	5	JH	080	9/16/17	JM	CRK	P	
9/16/17	1045	6	5/6	--	0+48	PT	2	2	JH	080	9/16/17	JM	CRK	P	
9/16/17	942	7	9/10/11	--	0+09	T-Int	2	2	DH	085	9/16/17	JM	CRK	P	Covered by R-78
9/16/17	949	8	8/9/10	--	0+31	T-Int	2	2	DH	085	9/16/17	JM	CRK	P	Covered by R-77
9/16/17	1100	9	1/7/8/9	--	0+62	T-Int	2	3	DH	085	9/16/17	JM	CRK	P	Covered by R-76
9/16/17	935	10	14/15/16	--	0+10	T-Int	2	3	JH	080	9/16/17	JM	CRK	P	
9/15/17	1842	11	13/14/15	--	0+36	T-Int	2	2	JH	080	9/16/17	JM	CRK	P	
9/15/17	1831	12	3/13/14	--	0+57	T-Int/Cap	2	9	JH	080	9/16/17	JM	CRK	P	Covers FS for P13/14 0+48 to EOS
9/15/17	1820	13	3/12	--	0+62 to 0+85	FS	2	23	JH	080	9/16/17	JM	CRK	P	
--	--	14	1/3/12	--	0+85	T-Int	Covered by R-13				--	--	--	--	
9/16/17	955	15	12/13	--	0+50	DS-2	2	6	JH	080	9/16/17	JM	CRK	P	
9/16/17	929	16	1/12	--	1+89	DS-3	2	5	JH	080	9/16/17	JM	CRK	P	
9/16/17	1215	17	17/19	--	1+17	DS-4	2	5	JH	080	9/16/17	AL	CRK	P	
9/16/17	1145	18	20/21	--	0+71	DS-5	3	5	JH	080	9/16/17	AL	CRK	P	
9/16/17	1200	19	23/24	--	0+45	DS-6	2	6	JH	080	9/16/17	JM	CRK	P	
9/16/17	1357	20	24/25	--	2+25	DS-7	2	6	DH	085	9/16/17	AL	CRK	P	Covered by R-41
9/16/17	1500	21	1/2	--	1+36 to 1+61	FS	2	25	DH	085	9/16/17	AL	CRK	P	Covered by R-42
9/16/17	1005	22	1/12	--	2+32	PT	2	3	JH	080	9/16/17	JM	CRK	P	
9/16/17	1206	23	1/3/4	--	1+52	T-Int	2	7	DH	085	9/16/17	JM	CRK	P	Covered by R-71
9/16/17	1150	24	1/4/5	--	1+30	T-Int	2	4	DH	085	9/16/17	JM	CRK	P	Covered by R-72
9/16/17	1140	25	1/5/6	--	1+07	T-Int	2	2	DH	085	9/16/17	JM	CRK	P	Covered by R-73
9/16/17	1113	26	1/6/7	--	0+85	T-Int	2	2	DH	085	9/16/17	JM	CRK	P	Covered by R-75
9/16/17	1030	27	1/9	--	0+00 to 0+11	FS	3	11	DH	085	9/16/17	JM	CRK	P	Covered by R-81
9/16/17	1240	28	2/17	--	0+15	FM	2	3	JH	080	9/16/17	AL	CRK	P	
9/16/17	1233	29	17/18/19	--	0+97	T-Int	2	3	JH	080	9/16/17	AL	CRK	P	
9/16/17	1055	30	18/19/20	--	0+97	T-Int	2	3	JH	080	9/16/17	AL	CRK	P	
9/16/17	1110	31	18/20	--	0+75	PT	2	3	JH	080	9/16/17	AL	CRK	P	
9/16/17	1135	32	18/20	--	0+64 to 0+67	FS	2	4	JH	080	9/16/17	AL	CRK	P	Cap

GEOMEMBRANE REPAIR LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

DATE	TIME	REPAIR NUMBER	SEAM ID	PANEL(S)	LOCATION (STATION)	*REPAIR TYPE	REPAIR SIZE		REPAIR CREW		NON-DESTRUCTIVE VACUUM BOX TESTING				COMMENTS
							WIDTH	LENGTH	TECH ID	MACH ID	DATE	TECH ID	QA ID	P/F	
9/16/17	1120	33	18/20	--	0+59	PT	2	3	JH	080	9/16/17	AL	CRK	P	
9/16/17	1340	34	20/21	--	0+00 to 0+23	FS	4	25	JH	080	9/16/17	AL	CRK	P	Cap
9/16/17	1125	35	--	6	0+83	Hole	2	2	DH	085	9/16/17	JM	CRK	P	1' West of P6/7 (Covered by R-74)
--	--	36	Repair number mistakenly skipped.			--	--	--	--	--	--	--	--	--	
9/16/17	1025	37	--	11	0+00	G&W	--	--	DH	085	9/16/17	JM	CRK	P	Covered by R-79
9/16/17	1038	38	10/11	--	0+16	PE	2	6	DH	085	9/16/17	JM	CRK	P	Extension into anchor trench (Covered by R-80)
9/16/17	1545	39	23/R-19	--	0+45	DS-8	2	5	JH	080	9/16/17	AL	CRK	P	
9/16/17	1530	40	25/R-20	--	2+25	DS-9	2	5	DH	085	9/16/17	AL	CRK	P	Covered by R-41
9/25/17	1000	41	24/25	--	2+24	Cap	4	6	JJ	080	9/26/17	DL	CRK	P	Covers R-20 and R-40
9/25/17	1045	42	1/R-21	--	1+50	DS-9A	5	26	JJ	080	9/26/17	JR	CRK	P	Covers R-21
9/25/17	1055	43	1/R-23	--	1+53	DS-9B	4	9	JJ	080	9/26/17	JR	CRK	P	Covered by R-70
9/26/17	1107	44	26/27/28	--	1+05	T-Int	2	2	JJ	080	9/26/17	DL	CRK	P	
9/26/17	1115	45	27/28/29	--	1+04	T-Int	2	2	JJ	080	9/26/17	DL	CRK	P	
9/26/17	1100	46	26/28	--	2+00	DS-10	2	5	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1525	47	31/32	--	0+50	DS-11	2	5	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1305	48	37/38	--	0+21	DS-12	2	5	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1130	49	29/32/33/37/39	--	1+76	5 T-Int	3	4	JJ	080	9/26/17	DL	CRK	P	
9/26/17	1135	50	29/31/32	--	1+55	T-Int	2	2	JJ	080	9/26/17	DL	CRK	P	
--	--	51	29/30/31	--	1+33	T-Int	Covered by R-55				--	--	--	--	
--	--	52	29/30/34	--	1+11	T-Int	Covered by R-55				--	--	--	--	
9/26/17	1142	53	29/31	--	1+49	PT	2	4	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1145	54	29/31	--	1+42	PT	2	3	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1215	55	29/30	--	1+11 to 1+33	FS	3	27	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1517	56	33/36/37	--	0+49	T-Int	3	6	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1455	57	37/38/39	--	0+24	T-Int	2	3	JJ	080	9/26/17	JR	CRK	P	
9/26/17	1122	58	--	28	1+35	Hole	2	2	JJ	080	9/26/17	DL	CRK	P	10' North of P28/29
9/26/17	1720	59	29/35/40	--	0+76	Batten Strip	12	11	JJ	085	9/27/17	AS	CRK	P	Batten connections to inlet structure
9/26/17	1745	60	29/40/R-59	--	0+74	PT	2	2	JJ	085	9/27/17	LK	CRK	P	
9/27/17	1116	61	35/41	--	0+43	DS-13	2	5	DH	085	9/27/17	AS	CRK	P	
9/27/17	1200	62	29/R-55	--	1+17	DS-14	2	6	DH	085	9/27/17	AS	CRK	P	
9/27/17	1142	63	35/44	--	0+18	PT	2	2	DH	085	9/27/17	AS	CRK	P	

GEOMEMBRANE REPAIR LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

DATE	TIME	REPAIR NUMBER	SEAM ID	PANEL(S)	LOCATION (STATION)	*REPAIR TYPE	REPAIR SIZE		REPAIR CREW		NON-DESTRUCTIVE VACUUM BOX TESTING				COMMENTS
							WIDTH	LENGTH	TECH ID	MACH ID	DATE	TECH ID	QA ID	P/F	
9/27/17	1147	64	35/44	--	0+23	PT	2	2	DH	085	9/27/17	AS	CRK	P	
9/27/17	1132	65	35/41/43/44	--	0+32	T-Int	2	7	DH	085	9/27/17	AS	CRK	P	
9/27/17	1106	66	35/40/41	--	0+53	T-Int	2	3	DH	085	9/27/17	LK	CRK	P	
9/27/17	1100	67	35/40	--	0+67	WHS	2	2	DH	085	9/27/17	AS	CRK	P	ATOK
9/26/17	1810	68	35/40/R-59	--	0+69	T-Int	5	3	JJ	085	9/27/17	AS	CRK	P	
9/27/17	1124	69	40/41/42	--	0+46	T-Int	2	4	DH	085	9/27/17	AS	CRK	P	
9/27/17	820	70	1/R-43	--	1+53	Cap	3	8	DH	085	9/27/17	LK	CRK	P	Covers failed R-43
9/27/17	825	71	1/3/4	--	1+52	Cap	3	6	DH	085	9/27/17	LK	CRK	P	Covers failed R-23
9/27/17	829	72	1/4/5	--	1+30	Cap	3	6	DH	085	9/27/17	LK	CRK	P	Covers failed R-24
9/27/17	836	73	1/5/6	--	1+07	Cap	3	4	DH	085	9/27/17	LK	CRK	P	Covers failed R-25
9/27/17	840	74	--	6	0+83	Cap	2	2	DH	085	9/27/17	LK	CRK	P	Covers failed R-35
9/27/17	845	75	1/6/7	--	0+85	Cap	3	3	DH	085	9/27/17	LK	CRK	P	Covers failed R-26
9/27/17	900	76	1/7/8/9	--	0+62	Cap	3	5	DH	085	9/27/17	LK	CRK	P	Covers failed R-9
9/27/17	908	77	8/9/10	--	0+31	Cap	3	3	DH	085	9/27/17	LK	CRK	P	Covers failed R-8
9/27/17	918	78	9/10/11	--	0+09	Cap	2	3	DH	085	9/27/17	LK	CRK	P	Covers failed R-7
9/27/17	926	79	--	11	0+00	Cap	2	3	DH	085	9/27/17	LK	CRK	P	Covers failed R-37
9/27/17	937	80	10/11	--	0+00	Cap	2	8	DH	085	9/27/17	LK	CRK	P	Covers failed R-38
9/27/17	945	81	1/9	--	0+00 to 0+12	Cap	4	12	DH	085	9/27/17	LK	CRK	P	Covers failed R-27
9/27/17	915	82	--	10	0+36	G&W	-	-	DH	085	9/27/17	LK	CRK	P	2' East of P8/10
9/27/17	1558	83	35/41	--	0+33	DS-13B	2	10	DH	085	9/27/17	AS	CRK	P	Cap covers 0+33 to 0+43
9/27/17	1606	84	35/40	--	0+57	DS-13A	2	7	DH	085	9/27/17	AS	CRK	P	Cap covers 0+53 to 0+60
9/27/17	1602	85	35/41	--	0+43 to 0+53	Cap	3	10	DH	085	9/27/17	AS	CRK	P	
10/2/17	1543	86	35/44	--	0+00	DS-13B1	2	18	JJ	080	10/2/17	DH	CRK	P	Cap covers 0+00 to 0+18
10/2/17	1550	87	43/44	--	0+00	DS-13B2	2	4	JJ	080	10/2/17	DH	CRK	P	
10/2/17	1505	88	35/40	--	0+60 to 0+72	Cap	2	12	JJ	080	10/2/17	DH	CRK	P	
10/2/17	1512	89	35/44	--	0+25 to 0+33	Cap	2	8	JJ	080	10/2/17	DH	CRK	P	
10/2/17	1516	90	35/44	--	0+18 to 0+25	Cap	2	7	JJ	080	10/2/17	DH	CRK	P	
10/2/17	1609	91	--	31	0+41	Hole	2	2	JJ	080	10/2/17	DH	CRK	P	7' West of P30/31 (hole found during dipole testing)

* Repair Type Descriptions:

ATOK	Air Pressure Test Ok (seam channel intact)	FM	Fishmouth	IO	Insufficient Overlap	VL	Vacuum Box Test Leak
BO	Fusion Seam Burn Out	FS	Failed Seam Length	MD	Manufacturing Defect	WR	Wrinkle
Cap	Capped Seam Length	G&W	Grind and Weld (no dimensions)	PT	Air Pressure Test Cut	WHS	Wheel Spin (Fusion Burn out with Air Channel intact)
DS/DP-##	Destructive Sample	Hole	From Unknown Source	PE	Panel Extension	WS	Fusion Welder Restart
ED	Earthwork Damage	ID	Installation Damage	T-Int	Panel Intersection	# T-Int	Numerous Panel Intersections (> 3 defined)

Appendix B.9

Weather Logs

WEATHER LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

Legend

CL	Clear (0-10% cloud cover)	MC	Mostly Cloudy (50-90% cover)
PC	Partly Cloudy (10-50% cover)	OC	Overcast (90-100% cover)

Date	Time	Temp (°F)	Sky	Comments
9/14/17	900	55	PC	
	1000	63	PC	
	1100	67	PC	
	1200	72	PC	
	1300	73	PC	
	1400	75	PC	
	1500	77	PC	
	1600	78	PC	
	1700	76	PC	
	1800	75	PC	
	1900	73	PC	
9/15/17	700	56	CL	
	800	56	CL	
	900	62	CL	
	1000	67	CL	
	1100	72	CL	
	1200	76	MC	
	1300	77	MC	
	1400	79	MC	
	1500	80	MC	
	1600	80	MC	
	1700	79	MC	
	1800	78	MC	
	1900	75	MC	
9/16/17	800	57	PC	
	900	64	PC	
	1000	68	PC	
	1100	75	PC	
	1200	77	PC	
	1300	80	PC	
	1400	82	PC	
	1500	83	PC	
	1600	83	PC	
	1700	81	PC	
9/25/17	800	64	MC	
	900	70	PC	
	1000	76	PC	
	1100	83	PC	
	1200	86	PC	
	1300	88	PC	
	1400	92	PC	

WEATHER LOG

WILLOW RUN POWERTRAIN
FIRST FLUSH BASIN C AND CHANNEL
YPSILANTI, MICHIGAN

Legend

CL	Clear (0-10% cloud cover)	MC	Mostly Cloudy (50-90% cover)
PC	Partly Cloudy (10-50% cover)	OC	Overcast (90-100% cover)

Date	Time	Temp (°F)	Sky	Comments
9/25/17	1500	94	PC	
	1600	92	PC	
	1700	89	PC	
	1800	86	PC	
	1900	81	PC	
9/26/17	730	65	PC	
	800	65	PC	
	900	69	PC	
	1000	75	PC	
	1100	81	PC	
	1200	85	PC	
	1300	88	PC	
	1400	90	PC	
	1500	91	PC	
	1600	90	PC	
	1700	88	PC	
	1800	88	PC	
9/27/17	700	66	MC	
	800	68	MC	
	900	69	MC	
	1000	70	MC	1048 to 1100 - Light sprinkles, no welding at this time.
	1100	72	MC	
	1200	74	PC	
	1300	77	PC	
	1400	79	PC	
	1500	78	PC	
	1600	77	PC	
	1700	75	MC	
10/2/17	800	41	PC	
	900	46	PC	
	1000	52	PC	
	1100	59	PC	
	1200	66	PC	
	1300	73	PC	
	1400	75	PC	
	1500	77	PC	
	1600	77	PC	
	1700	74	PC	

Appendix B.10

NSI Field Tensiometer Calibration Certificate

Demtech Services, Inc.

Placerville, California, USA

CALIBRATION CERTIFICATE

Tensiometer Model: Pro-Tester T-0100

Device Calibrated: S-Type load cell

Range: 0 - 750 lbs. Tension

Model No: M2405-750#

Serial No: **709514**

Calibration Apparatus:

Pro-Cal unit, model TC-0100/A

A/D Module Model No: T-029

A/D Module Serial No: 5013709514

Channel No: N/A

Dead Weight:	
W1	2
W2	152
W3	302

Reference Cell:	
R1	2
R2	152
R3	302

Indicator reading with no load: 0

Offset: **-3.580692** Scale: **3.162804**

Applied Force lbs.	Cell Response:	Deviation Error:
2	2	0.00
52	52	0.00
102	102	0.00
152	152	0.00
202	202	0.00
252	252	0.00
302	302	0.00

Total Deviation Error (%): 0.00%

Temperature at time of calibration: 73 degrees F

Exitation Voltage: 5 V DC

This calibration conforms to the standards set by ASTM E4 and is traceable to NIST standards

Note: A/D Module and load cell above have been systems calibrated and are considered a matched pair. In general, calibrated A/D Modules and load cells are not interchangeable.

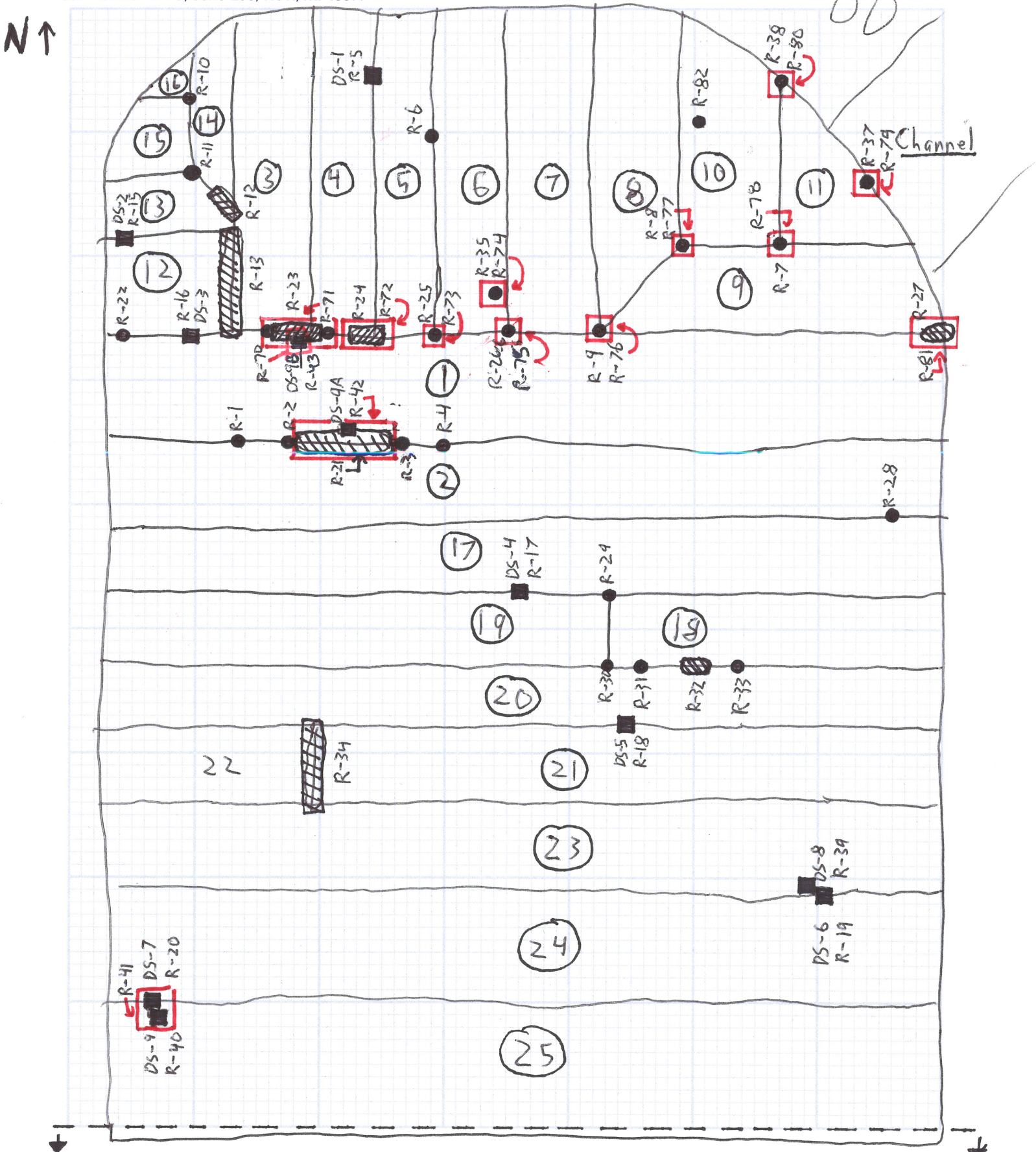
Ryan Beck Date: 07/21/17

Appendix B.11

Geomembrane Panel Layout Sketch

cti
Protecting, Enhancing, and Restoring Our Environment
www.cticompanies.com 800-CTI-TODAY
28001 Cabot Drive, Suite 250, Novi, MI 48377

PROJECT: Willow Run Basin C
TITLE: North portion of basin -NTS
PAGE: 1 OF: 2 DATE: 9-15-17
CALCULATED BY: CRK CHECKED BY:



SHEET 2
SHEET 2

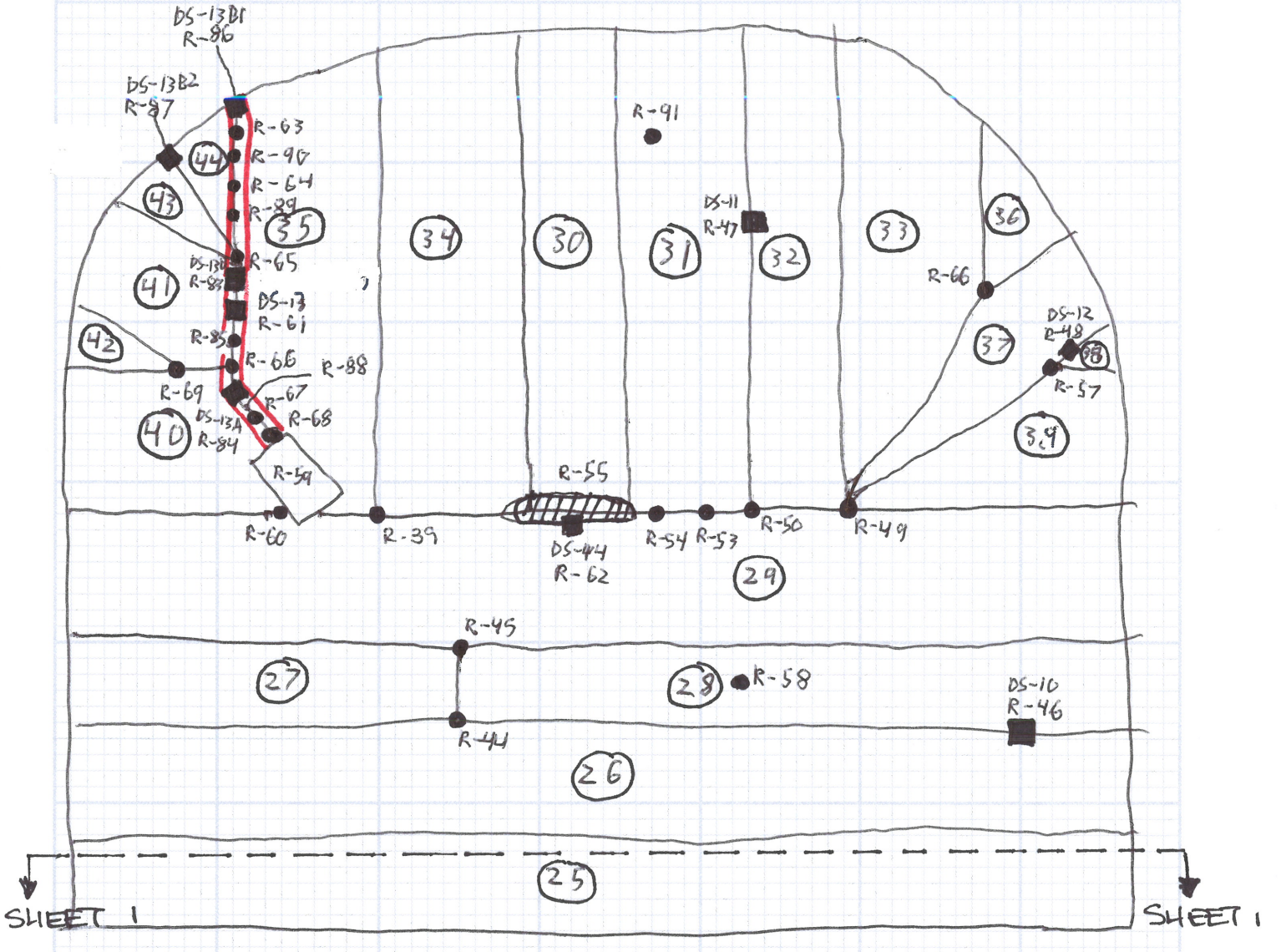
cti
Protecting, Enhancing, and Restoring Our Environment
www.cticompanies.com 800-CTI-TODAY
28001 Cabot Drive, Suite 250, Novi, MI 48377

PROJECT: Willow Run Basin C
TITLE: South portion of basin -NTS
PAGE: 2 OF: 2 DATE: 9-25-17
CALCULATED BY: CRK CHECKED BY:

N

LEGEND

- FUSION WELDED SEAM
- R-# ● REPAIRS
- DS-# / R-# ■ DESTRUCT LOCATION
- (1) PANEL ID
- SHEET 1 + 2 MATCHLINE
- CAP STRIP // COVER FOR FAILURE OF DS-9 + 13.
- LARGE REPAIR



APPENDIX C

COVER SOILS TEST DATA

Appendix C.1

MDOT 2NS Sand Laboratory Test Data

28001 Cabot Drive, Suite 250
Novi, MI 48377
Phone: (248) 486-5100
Fax: (248) 486-5050

Material Test Report

Project No.: 1172040050
ReportNo: MAT:FH17-W03297-S01

Client: Angelo Iafrate Construction Co. **CC:**

Project:

,

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AASHTO ACCREDITATION PROGRAM

Reviewed By: Elizabeth Taylor

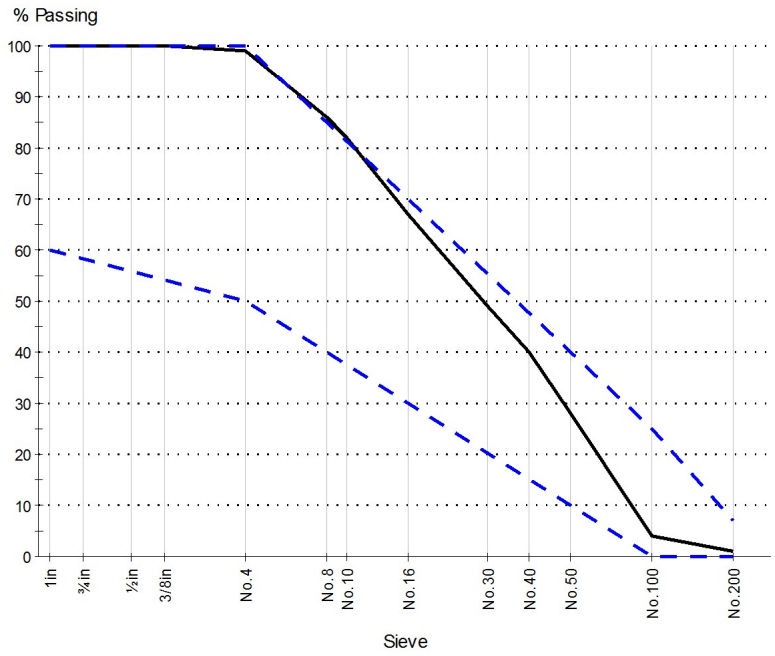
Sample Details

Sample ID	FH17-W03297-S01
Field Sample ID	WRA-PC-17.01
Date Sampled	10/2/2017
Source	Onsite Stockpile
Material	Granular (Class II)
Specification	MDOT Class II (c) & Class IIA (c) & Class IIAA
Sampling Method	Mini-Stockpile

Sample Description:

Brown Fine to Coarse Sand

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (1.0%)	
	Coarse	Fine	Coarse	Medium	Fine		
(0.0%)	(0.0%)	(1.0%)	(17.0%)	(42.0%)	(39.0%)	Silt	Clay

Grading: ASTM C 136, ASTM C 117

Drying by: Oven
Date Tested: 9/25/2017
Tested By: David Cook

Sieve Size	% Passing	Limits
1in	100	60 to 100
¾in	100	
½in	100	
3/8in	100	
No.4	99	50 to 100
No.8	86	
No.10	82	
No.16	67	
No.30	49	
No.40	40	
No.50	28	
No.100	4	0 to 25
No.200	1	0 to 7

D85: 2.2643 **D60:** 0.9071 **D50:** 0.6230
D30: 0.3179 **D15:** 0.2061 **D10:** 0.1784
Cu: 5.09 **Cc:** 0.62

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Appendix C.2

MDOT 6AA Aggregate Laboratory Test Data

28001 Cabot Drive, Suite 250
Novi, MI 48377
Phone: (248) 486-5100
Fax: (248) 486-5050

Material Test Report

Project No.: 1172040050
ReportNo: MAT:FH17-W03298-S01

Client: Angelo Iafrate Construction Co. **CC:**

Project:

,

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AASHTO ACCREDITATION PROGRAM

Reviewed By: Elizabeth Taylor

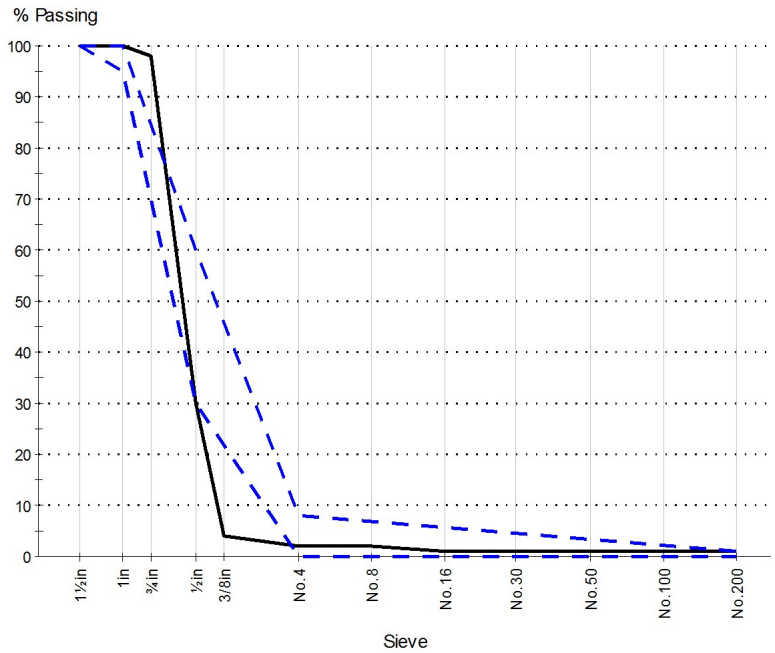
Sample Details

Sample ID	FH17-W03298-S01
Field Sample ID	WAR-6A-17.01
Date Sampled	10/2/2017
Source	Onsite Stockpile
Material	Coarse Aggregate (6A)
Specification	MDOT 6AA & 6A
Sampling Method	Mini-Stockpile

Sample Description:

Coarse Crushed Stone

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (1.0%)	
(0.0%)	Coarse (2.0%)	Fine (96.0%)	Coarse (0.2%)	Medium (0.8%)	Fine (0.0%)	Silt	Clay

Grading: ASTM C 136, ASTM C 117

Drying by: Oven
Date Tested:
Tested By:

Sieve Size	% Passing	Limits
1½in	100	100
1in	100	95 to 100
¾in	98	
½in	30	30 to 60
3/8in	4	
No.4	2	0 to 8
No.8	2	
No.16	1	
No.30	1	
No.50	1	
No.100	1	
No.200	1	0 to 1

D85: 17.5384 **D60:** 15.0361 **D50:** 14.1382
D30: 12.5000 **D15:** 10.6696 **D10:** 10.1211
Cu: 1.49 **Cc:** 1.03

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APPENDIX D

DAILY FIELD REPORTS

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
JOB NO.: 1172040050
PROJECT: Willow Run Airport CQA
TASK NO.: 0.02
LOCATION: ~~Belleville, MI.~~ Ypsilanti, MI
DATE: Sunday August 20, 2017
CONTRACTOR(S): ~~Hoffer~~ ~~NSI~~ Angelo Iafrate
REPORT NO.: 1
CONT. PERSONNEL: —
WEATHER: AM PC PM OC
TEMPERATURE: AM 69° PM 82
PRECIPITATION: —

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
N/A		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

12:00pm - Arrived at CTI (Novi) office to print construction drawings and setup the project folders and would begin to read the specifications concerning this project. Would notify for to attend a preconstruction mtg scheduled for tomorrow
17:00pm - Left office for the day.

Copies To:

Reginald W. Jackson
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Airport CQA
LOCATION: ~~Belleville, MI.~~ Ypsilati, MI
CONTRACTOR(S): ~~NSI~~ Angelo Iafrate
CONT. PERSONNEL:

JOB NO.: 1172040050
TASK NO.: 0.02
DATE: Monday August 21, 2017
REPORT NO.: 2

WEATHER: AM PC PM OC
TEMPERATURE: AM 69° PM ~~84°~~
PRECIPITATION: —

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
NA		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

8:30 AM - Would begin to review project drawings and would previews GM 13 & 19 which are referenced in the project specifications to verify.
10:00 AM - Left office to drive to site to visit the site and attend the preconstruction mtg.
12:10 pm - Preconstruction mtg has begun and would discuss issues concerning the subgrade which was discovered to not be ready or tested. Also there was an issue with perched water coming up through the subgrade which could be an issue. All parties agreed that Iafrate should consult with their "Geotechnical" representative to see if they have any suggestions to manage the perched water issue.
13:15 pm - Preconstruction mtg adjourned and I would speak with Iafrate to check on a tentative schedule of when we would resume work on site.
14:27 pm - Would have a brief discussion with the FML superintendent and QC to discuss some concerns we both had but wasn't addressed in the mtg.
15:07 pm - Left site and would talk with Josh (CTI PM) about the mtg and discuss my concerns.
16:00 pm - Stopped work on this project for the day.

Copies To:

Reginald W. Jackson
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: —
WEATHER: AM — PM —
TEMPERATURE: AM — PM —
PRECIPITATION: —

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-11-17
REPORT NO.: 3

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
NA		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

16:30 Talk to Josh Guy, then review roll data verse GSE GM13 specification. Compose email to Josh Guy and Kevin Foye.

17:00 Move onto different project.

Copies To:

Cody Kurzer ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: —
WEATHER: AM — PM —
TEMPERATURE: AM — PM —
PRECIPITATION: —

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-12-17
REPORT NO.: 4

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
N/A		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

12:45 Discuss results from previous days roll data comparison with Kevin Faye P.E. Phd.

13:20 Contact Heidi of Iafrate to inform her of geomembrane review findings and to get an idea of project schedule.

13:30 Move onto other project work.

Copies To:

Cody Kurz ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: —
WEATHER: AM — PM —
TEMPERATURE: AM — PM —
PRECIPITATION: —

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-13-17
REPORT NO.: 5

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
N/A		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

16:00 Review project specifications and develop list of important information.

16:45 Print out list for my use and to inform liner crew tomorrow.

Copies To:

Cody Kurzer ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM PC PM PC
TEMPERATURE: AM 55 PM 78
PRECIPITATION:

JOB NO.: 117040050
TASK NO.: 002
DATE: 9/14/17
REPORT NO.: 6

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
Trucks	3	3
Tool trailer	1	1
Deployment trailer	1	1
CAT D6 bulldozer	1	1
8 liner crew		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

7:30 Arrived on-site and went through safety training.
8:30 Met the liner crew, then observed the equipment be moved and setup.
9:00 Talked to GHD, Northern Seal, and Iafrate. Was informed that GHD performed an ~~investigation~~ investigation into the soils. GHD had Iafrate charge bad soil locations and haul out of pond. Those locations were back filled with approximately 48-inches of 1x3 aggragate, covered with geoturf H4800 and 12-inches of sand. All parties and Owner signed off on subgrade Both of GHD forwarded me a copy around 14:45.
10:00 Northern Seal began preparing to deploy liner, placing a roll of Seamembrane on the deployment trailer and stapling sand bags
10:15 A Iafrate laborer cleaned up around the chute at the NE pond corner
10:50 The first panael was deployed, and liner placement opperations began.
11:45 A trial weld meeting site specifications was made and tested. Iafrate used a CAT D6 bulldozer to knock down a high point.
12:00 Some guys took lunch while others worked through. Northern seal began welding geomembrane.
13:00 Geotextile was placed at the toe of the north slope for additional protection per GHD's request.
15:45 Northern Seal tried vaccumm testing the failing P-1/2 seam to find a leak. It was opted to Cap that section.
15:00 Scott arrived on-site
15:57 The second trial weld of the day was made and tested.
1700 Scott left for the day.
19:30 Northern seal wrapped up for the day. I made copies of field sheets for GHD
1945. I left the site for the day.
2030 I arrived home from the site.

Copies To:

Cody Kurzer
~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM Clear PM —
TEMPERATURE: AM 56° PM —
PRECIPITATION: Ø

JOB NO.: 1172040050
TASK NO.: 002
DATE: Friday 9-15-17
REPORT NO.: 17

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
3 Plu Trucks	3	0
1ool Trailer	1	0
Deployment Trailer	1	1
Liner Crew = 8		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

- 0630 - 0700 - Arrive on-site, prepare forms for the day.
- 0700 - 0720 - Attend Site Safety orientation.
- 0730 - 0830 - Liner crew arrived - Northern Seal - Set-up new roll on deployment bar / Perform trial Weld, 1st trial Weld failed 2nd passed after Slowing Speed down from 10' a minute to 8' a minute.
- 0830 - 1200 - Continue installation of 40mil panels following tie-in Seam along North toe of Slope Start Seaming panels installed.
- QC continues Air-testing procedures - all test documented + Witnessed by CTI rep.
- CTI perform all documentation of material being installed Seamed + tested.
- 1230 - 1330 - Continue Work observations.
- 1245 - Cody Kurzer arrived, Went over Work progress / paperwork.

*Scott Cosgrove

Copies To:

[redacted]
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Plateau
WEATHER: AM — PM PC
TEMPERATURE: AM — PM 80
PRECIPITATION: —

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-15-17
REPORT NO.: 7

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
Trucks	3	3
Tool trailer	1	1
Deployment trailer	1	1

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

12:00 Left house for site after doctors appointment
12:45 Arrived on-sight for the day and caught up with Scott on where every thing stood.
13:00 Northern Seal performed and tested a fusion trial weld. After receiving passing results seeming began for the afternoon.
13:30 Scott left the site for the day.
16:30 Northern Seal finished deploying geomembrane for this phase of deployment. Destructive samples were cut out and tested. They began heat tacking repairs down with a heat gun. I discussed sand placement with Lyke from Iafrate and concerns of liner moving not having anchor trench.
17:50 Northern Seal went ahead of the extrusion welder to roughen up the seaming edges. One extrusion welder passed trial weld and welded repairs.
18:45 Northern Seal finished repairs for the day and cleaned up around the site and trailer.
19:10 Signed out for the day, reiterated anchor trench concern and left the site for the day.
19:45 I arrived home and back checked data.
20:45 I finished checking data for the night.

Copies To:

Cody Kurzer
~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM PC PM PC
TEMPERATURE: AM 57 PM 83
PRECIPITATION: -

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-16-17
REPORT NO.: 8

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
Trucks	3	3
Tool trailer	1	1
Deployment trailer	1	0
8 liner crew		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

7:15 Left house
7:40 Arrived on-site and signed in. Northern Seal was preparing generators and extension cords
8:20 Northern Seal began heat gun tacking down repair patches
8:30 I made copies of paperwork for GHD. Extrusion welders made trial welds that met specifications. GHD and Northern Seal worked on battening geomembrane to the inlet channel.
9:00 Trial welds were successfully tested.
9:30 Northern seal began extrusion welding repairs with two extrusion guns. A laborer followed behind vacuuma testing repairs.
1300 Matt of GHD, Josh Guy and I discussed extrusion welding destructs and sand placement concerns.
1315 Stopped for lunch.
1345 Both extrusion guns had passing extrusion trial welds, and began welding repairs.
1400 Discussed sand placement with Matt (GHD) and Luke (Iafrate).
1620 Vacumme testing was completed and Northern Seal began packing up their trailers.
1700 Left the site for the day
1730 Arrived home

Copies To:

Cody Kurzer
~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM MC PM MC
TEMPERATURE: AM 69 PM 76
PRECIPITATION: —

JOB NO.: 117 2040 050
TASK NO.: 002
DATE: 9-18-17
REPORT NO.: 9

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
Water truck.	1	1

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

6:15 I left my house to head to the site.
6:50 I arrived on-site and signed in at the Iafrate trailer.
7:00 I attended Iafrate's morning safety briefing
7:20 Talked to Luke of Iafrate and was informed sand placement would begin once destructive sample results came back.
8:00 I talked with Heidi of Iafrate and was updated on the plan for today.
1030 I talked to Matt of GHD. He said he had not recieved destruct results yet. I told him to get paper work he was requesting from Heidi.
1145 I got paper work together and I made copies in the Iafrate trailer.
1245 I left the site for lunch.
1330 I arrived back onsite.
1400 I talked to Josh Guy and decided to find Luke to discuss sand placement plans for the day.
1415 Talked to Luke enroute to Iafrate trailer. Found out he had no operators to place sand today. He was going to talk to Heidi and report back to me.
1440 I talked to Luke and Heidi I will be on site tomorrow between 7:30 and 8.
1445 I left the site for the day.
1515 I arrived back at the office.

Copies To:

Cody Kurzej
~~Reginald W Jackson~~
CTI Representative Cody Kurzej

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM MC PM —
TEMPERATURE: AM 65 PM —
PRECIPITATION: —

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-19-17 Tues
REPORT NO.: 10

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
NA		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

7:15 I left on my way to the site.
7:50 I arrived on-site, and signed in at the Iafrate trailer.
8:15 I talked to Luke and learned there was an issue getting an opperator for the sand placement. He said to hold tight because they still plan on placing sand today.
10:20 I talked to Heidi and she contacted Luke it was determined we would not place sand today. Sand placement is expected to begin tomorrow.
10:45 I signed out and left the site for the day.
11:15 I arrived back at the office.

Copies To:

Cody Kurzer ~~Reginald Wadelson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM MC PM MC
TEMPERATURE: AM 68 PM 82
PRECIPITATION: —

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-20-17
REPORT NO.: 11

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
CAT D6N Dozer	1	1
CAT ORT	2	2
CAT Front Loader	2	2

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

7:00 I left my house and headed for the site.
7:50 I arrived on-site and signed in at the Iafrate trailer.
8:00 Talked with Matt (GHD) and Luke Clafrate and learned that DS-9 failed. We looked at what locations DH extrusion welded and determined an area Iafrate could place sand. Josh, Heidi, Matt ~~S~~, Mark (GHD) and I determined to hold off taking cup before and after samples until Northern Seal returns to the site and can cap/ repair the locations.
9:00 Iafrate began loading sand into two CAT off-road trucks using two CAT front end loaders. The off-road trucks dumped at the middle of the west slope and a CAT D6N low ground pressure GPS bulldozer pushed sand from there.
11:30 A gravel train brought a load of aggregate.
1315 The off-road trucks stopped hauling sand for the day. The D6N bulldozer continued pushing sand.
1330 I grabbed a composite bucket sample of sand for lab testing.
1445 Iafrate checked the sand grade with their surveyor. Luke opted to bump the grade to +.1' above required to ensure thickness is acheived.
16:15 Iafrate finished grading, and said they would call when to come back.
1645 I arrived home.

Copies To:

Cody Kurzer ~~Reginald W. Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM PC PM PC
TEMPERATURE: AM 64 PM 94
PRECIPITATION: —

JOB NO.: 117 2040 050
TASK NO.: 002
DATE: 9-25-17
REPORT NO.: 12

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
CAT 962H Front Loader	1	1
CAT D6 N Dozer	1	1
CAT 745 C ORT	1	1
CAT 365C Excavator	1	1
CAT 950M Front End loader	1	1

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

6:30 I left my house for the site
7:00 I arrived on-site and signed in at the Iafrate trailer.
7:15 Northern Seal Inc. arrived on-site.
7:45 Northern Seal setup their trailer and equipment. Some employees attended safety training. Iafrate used a CAT D6N bull dozer to push up a sand pile, then spread a soil pile.
9:00 A extrusion trial weld was made and tested with passing results. DS-9A/B was cut out tested and repaired.
9:30 GHD, Racer, Northern Seal, Iafrate and Northern Seal all discussed attachment of geomembrane to the concrete structure.
10:00 Iafrate smoothed out the east side of the concrete structure with the CAT 365C excavator. A CAT D6N bulldozer smoothed the grade more so.
10:15 A fusion trial weld was taken and passed. Iafrate began placing sand with a CAT 745C ORT being loaded with a CAT 962 H Front-end loader. The CAT D6N bull dozer pushed the sand.
11:00 Norther Seal began placing geomembrane.
11:30 Geomembrane Seaming began.
12:30 Concrete was placed in the concrete structure at the southern end of the pond.
12:45 Stoped work for lunch.
13:45 Iafrate finished placing sand. Northern Seal arrived back on-site.
14:00 Northern Seal performed a Fusion trial weld which passed. Air testing began.
16:15 Destructive samples were cut out and sampled.
19:30 Northern Seal began to wrap up for the day.
19:45 We left the site for the day.
20:15 I arrived at my house.

Copies To:

Cody Kurzer ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM PC PM PC
TEMPERATURE: AM 65 PM 91
PRECIPITATION: —

JOB NO.: 11720400SC
TASK NO.: 002
DATE: 9-26-17
REPORT NO.: 13

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
CAT D6N Dozer	1	1

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

6:30 I left home and headed to the site.
7:00 Arrived on-site and signed in at the Iafrate trailer.
7:30 Northern Seal arrived on-site. Jeff started tracking down the liner certs.
8:25 A fusion trial weld was made and passed.
9:20 Seam 29 to 40 was fusion welded.
9:50 An extrusion trial weld was made and tested to project specifications.
10:00 Northern Seal worked to setting up the battening around the concrete structure. The steel batten was cut to fit, neoprene gasket placed over bolts, and liner cut to fit. A boot will be extrusion welded around the bottom of the structure.
10:30 Repairs started to be extrusion welded.
11:45 Bentonite chips were placed around the bottom of the concrete structure
12:45 Stopped for lunch
13:30 Arrived back on-site. More bentonite was placed around the concrete structure. Liner continued to be shaped for the batten on the concrete structure. Vacuum tests were performed on repairs. GHD agreed to using the partial roll.
14:00 Extrusion tests welds were made and tested with passing results.
17:00 A fusion weld trial weld was taken and tested passing. Luke, Matt and I discussed destruct test results and DS-9B failings. (DH)
17:30 Told NSI about results and they opted to cap all of Dan's repairs before DS-9. Northern Seal welded repairs and the tie-in to the concrete inlet structure. Some repairs were vacuume tested the remaing will be tested tomorrow. The batten was tighted up and the excess geomembrane on top was trimmed off.
19:00 We left the site for the day.
19:30 I arrived home.

Copies To:

Cody Kurzer ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM MC PM PC
TEMPERATURE: AM 66 PM 79
PRECIPITATION: Light Sprinkle

JOB NO.: 117 2040 050
TASK NO.: 002
DATE: 9-27-17
REPORT NO.: 14

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
CAT D6N Bulldozer	1	1
CAT 950 M Front-end loader	1	1
CAT 745C ORT	1	1
Watertruck	1	1

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

6:15 I left my house and headed to the site for the day.
7:00 I arrived on-site and signed in at the Iafrate trailer.
7:30 I called into the conference call about scheduling.
800 Northern Seal (NSI) performed a extrusion trial weld which passed specification. They began grinding and extrusion welding cap repairs over all the repairs Dan did on the north end of the pond.
9:45 Iafrate began pushing sand on the northwest corner of the pond with a CAT D6N low ground pressure GPS bulldozer.
1030 NSI moved to the south end of the pond.
1045 An extrusion trial weld was made and tested with passing results.
1048 Light sprinkles came down GHD & NSI made a end cap out of liner.
11 Extrusion welding of pepairs began and sprinkles had cleared out. A disk grinder ground ahead of the extrusion gun. The remaining repairs were vaccuae tested.
1230 Sika construction sealant was placed around the top of the batten strip.
1245 NSI began packing up equipment and their trailer.
1400 Went over destruct results with Luke and Matt. Stated DS-13 failed peel incarsion.
1445 Talk to Mark GHD engineer he agreed that DS-13 failed.
1500 Informed NSI marked and cut out DS-13 A/B.
1530 An extrusion trial weld was made and tested with passing results. Repaired/capped repairs.
1545 Luke informed me that he was going to proceed with covering the geomembrane with sand, and we can dig up repairs if needed. A CAT 950M front-end loader loaded a CAT 745C ORT with sand. A new road was made at the south end of the pond. Gravel trains hauled sand and dumped between off-road trucks. The CAT D6N bulldozer continued to push sand.
1800 Iafrate utilized their watertruck to spray water onto the sand of the pond.
1815 I left the site for the day.
1845 I arrived home for the day.

Copies To:

Cody Kurzer ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM MC PM MC
TEMPERATURE: AM 48 PM 70
PRECIPITATION: ~

JOB NO.: 1172040050
TASK NO.: 002
DATE: 9-28-17
REPORT NO.: 15

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
CAT D6N Bulldozer	1	1
Water truck	1	1

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

6:30 I left my house enroute to the site.
7:10 I arrived on-site and signed in at the Iafrate trailer.
7:20 Iafrate began grading sand and driveways with a CAT D6N low ground pressure GPS bulldozer.
8:04 The first gravel train arrived and dumped it's load on the the northern end of the pond. More gravel trains followed suit.
8:30 Iafrate began applying water to the sand bedding with a hose from the water truck. Three tanks were applied in this method after water was applied out of the driver side sprayer. This was done to assist in the dipole test efficacy.
9:00 Talked to GHD was informed that the spec for sand is 6-inches and the client asked for 12-inches.
9:20 I called Heidi and discussed sand depth checks. She mentioned depth checks are not mentioned, and we agreed to an industry standard 1/100-foot grid.
9:45 I perforded depth checks on the northern ~3/4 of the pond all were greater than 12-inches.
10:15 The dipole testing technician arrived on-site looking for Cliff. Iafrate used the bulldozer and shovels to clean off the former eastern entry to the pond.
11:30 Discussed dipole testing procedure with the TRI representatives.
12:00 Destructive test results came in DS-13 A and B failed.
13:00 TRI began performing dipole testing.
13:45 Rick (GHD) and I talked we agreed to cap the remaing bffter portions to send two destructs DS-13 B1/2, and where to sample from. Samples were cut out and boxed for GHD to mail.
16:30 It was determined their was a small hole in the liner.
16:45 TRI, GHD, Iafrate, and I found the hole and documented it.
17:10 I grabed a sample of 6A aggregate for laboratory testing.
17:15 I signed out of the Iafrate trailer and left the site.
17:45 I arrived home from the site.

Copies To:

Cody Kurzet ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM PC PM PC
TEMPERATURE: AM 41 PM 77
PRECIPITATION: -

JOB NO.: 117204050
TASK NO.: 002
DATE: 10-2-17
REPORT NO.: 16

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
CAT D6N bulldozer	2	2
Water truck	1	1
CAT 315C excavator	1	1

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

7:15 I left my house there was 2+ accidents along the way.
8:10 I arrived on-site and signed in at the Iafrate trailer. I talked to Luke and learned northern Seal Inc (NSI) would be on-site this afternoon. I went to the Iafrate trailer checked and entered data into my computer.
12:15 Lunch
12:30 Continued data checking and entry
13:45 NSI arrived on-site, I showed them what needed to be capped or repaired. 2 D6N low ground pressure GPS bulldozers pushed 6A aggregate. Gravel trains were hauling 6A and dumping it on the bedding sand on the west slope. A CAT 315C excavator was used to excavate sand off of the geomembrane. A water truck was used to keep dust down.
14:30 A extrusion trial weld was made and tested with passing results.
15:00 Repairs and caps were heat tacked down with a heat gun. A disk grinder ground the edges ahead of the extrusion gun. Everything from DS-13B1 to the end of day/job fusion welding is now capped and DS-13B2 and the hole found during dipole testing was repaired.
16:00 All of todays repairs were vacuum tested with passing results.
16:30 NSI began packing up all there equipment.
17:30 I left the site
18:00 I arrived home.

Copies To:

Cody Kurzec ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM MC PM MC
TEMPERATURE: AM 60 PM 82
PRECIPITATION:

JOB NO.: 172040050
TASK NO.: 002
DATE: 10-3-17
REPORT NO.: 17

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
NA		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

8:45 Arrived at the office began data entry and checking over data.
12:00 Took a break for lunch.
12:45 Went back to checking data and working on the report.
5:15 I left the office for the day.

Copies To:

Cody Kurzer ~~Reginald Wilkinson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM OC PM MC
TEMPERATURE: AM 70 PM 73
PRECIPITATION: NA

JOB NO.: 1172040050
TASK NO.: 002
DATE: 10-4-17
REPORT NO.: 18

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
NA		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

8:15 Arrived at the office and worked on backchecking data, and the photo log.
12:00 Stopped for lunch
12:30 Continued working on the photo log and other report components.
5:15 I left the office for the day

Copies To:

Cody Kurzer ~~Reginald W Jackson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flateau
WEATHER: AM PC PM PC
TEMPERATURE: AM 49 PM 74
PRECIPITATION: —

JOB NO.: 1172640050
TASK NO.: 002
DATE: 10-5-17
REPORT NO.: 19

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
NA		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

8:15 I arrived at the office and worked on the report and different components.
12:00 Stopped working for lunch.
12:30 I went back to working on the report and its different components.
18:00 I left the office for the day

Copies To:

Cody Kurzer ~~Reginald Wilkerson~~
CTI Representative

Daily Field Report Summary

CLIENT: Angelo Iafrate Construction Company
PROJECT: Willow Run Powertrain / 1st. Flush Basin C & Chan
LOCATION: Ypsilanti, Michigan
CONTRACTOR(S): Iafrate Construction
CONT. PERSONNEL: Heidi Flatley
WEATHER: AM OC PM OC
TEMPERATURE: AM 58 PM 60
PRECIPITATION: Drizzle

JOB NO.: 1172040050
TASK NO.: 002
DATE: 10-6-17
REPORT NO.: 20

EQUIPMENT		
MAKE / MODEL	TOTAL	IN USE
N/A		

Description of field activities (including labor, equipment, site conditions, sampling, ect.)

12:00 Worked on wraping up report and corresponding components for review.
16:00 I left the office for the day.

Copies To:

Cody Kurzer [redacted]
CTI Representative

APPENDIX E

SELECT PROJECT PHOTOGRAPHS

Soil subgrade conditions before geomembrane deployment.

NSI manually deploying geomembrane panels over the accepted subgrade.

NSI loading a roll of geomembrane onto the trailer equipped with a spreader bar.

NSI fusion welding geomembrane panels, while another technician pulls a rub sheet under the geomembrane ahead of the welder.

NSI deploying geomembrane panels utilizing a John Deere ATV when subgrade conditions allowed.

NSI fusion welding geomembrane panels, while another NSI technician is ahead of the welder cleaning the seam.

NSI air pressure testing a completed fusion welded seam.

A NSI technician heat tacking down a repair to be extrusion welded.

NSI technician grinding the edge of a geomembrane repair with a grinder ahead of the extrusion gun.

NSI and GHD working on batten bar on concrete inlet channel to fasten the geomembrane to the structure.

Finished product of battened geomembrane liner to concrete inlet channel.

NSI extrusion welding a geomembrane repair.

NSI technician vacuum box testing an extrusion welded repair.

Iafrate using a Caterpillar D6N LGP GPS bulldozer to place the sand layer. The Caterpillar off-road truck hauls sand to the placement location atop on a minimum of 3-feet of sand.

NSI installing batten bar to the concrete inlet structure to secure the geomembrane to the structure.

NSI securing geomembrane to the batten bar located on concrete inlet structure.

Finished batten bar securing the geomembrane to the concrete inlet structure below the inlet pipe.

NSI applying construction grade sealant to the top of the batten bar.

Iafrate building a 3-foot thick access road over the southern end of the basin. The gravel train is unloading onto the sand layer already placed. Unloading directly onto the geomembrane was not permitted.

Iafrate applying water to the sand layer over the geomembrane to assist with the dipole leak detection test.

TRI/Environmental performing the geomembrane dipole leak detection test.

Iafrate fine grade the sand layer.

Hole found by the dipole leak detection testing. The area was subsequently repaired by NSI.

Iafrate placing the 6AA aggregate layer with two Caterpillar D6N LGP bulldozers. Both bulldozers were equipped with GPS to assist in grade control.

Attachment C
TRI Dipole Report

September 29, 2017

Grant Trigger
Racer Trust
500 Woodward Avenue, Suite 2650
Detroit, MI 48226
gtrigger@racertrust.org
Tel: 734-879-9524

Subject: Final Report for Electrical Leak Location Survey of Willow Run Stormwater Pond

Dear Mr. Trigger,

This report documents the electrical leak location survey conducted by TRI Environmental (TRI) on the installed sand-covered geomembrane of the Willow Run Stormwater pond located in Ypsilanti, Michigan.

The liner system consisted, from top to bottom, of ~1' sand cover material and HDPE geomembrane on prepared subgrade.

The dipole method was performed on September 28, 2017. The weather was warm and cloudy.

This report describes the methods, procedures, and results of the survey.

DIPOLE METHOD

Method / Procedure

The method used to perform the geoelectric leak detection surveys on the installed geomembrane was the dipole method. Testing was performed in accordance with ASTM D7007. A DC voltage was applied to the material covering the geomembrane and the power source was grounded to the surrounding soil. A roving dipole operated by Andrew Lange was used to measure voltage potential.

The operator observed and recorded voltage potential measurements every approximately ten feet in a grid pattern throughout the survey area. At the beginning and termination of the survey, the dipole operator verified that the survey equipment and survey circuit was functioning properly.

Voltage data collected during the survey was organized into a voltage contour map in order to locate the potential areas of concern in the geomembrane.

RESULTS

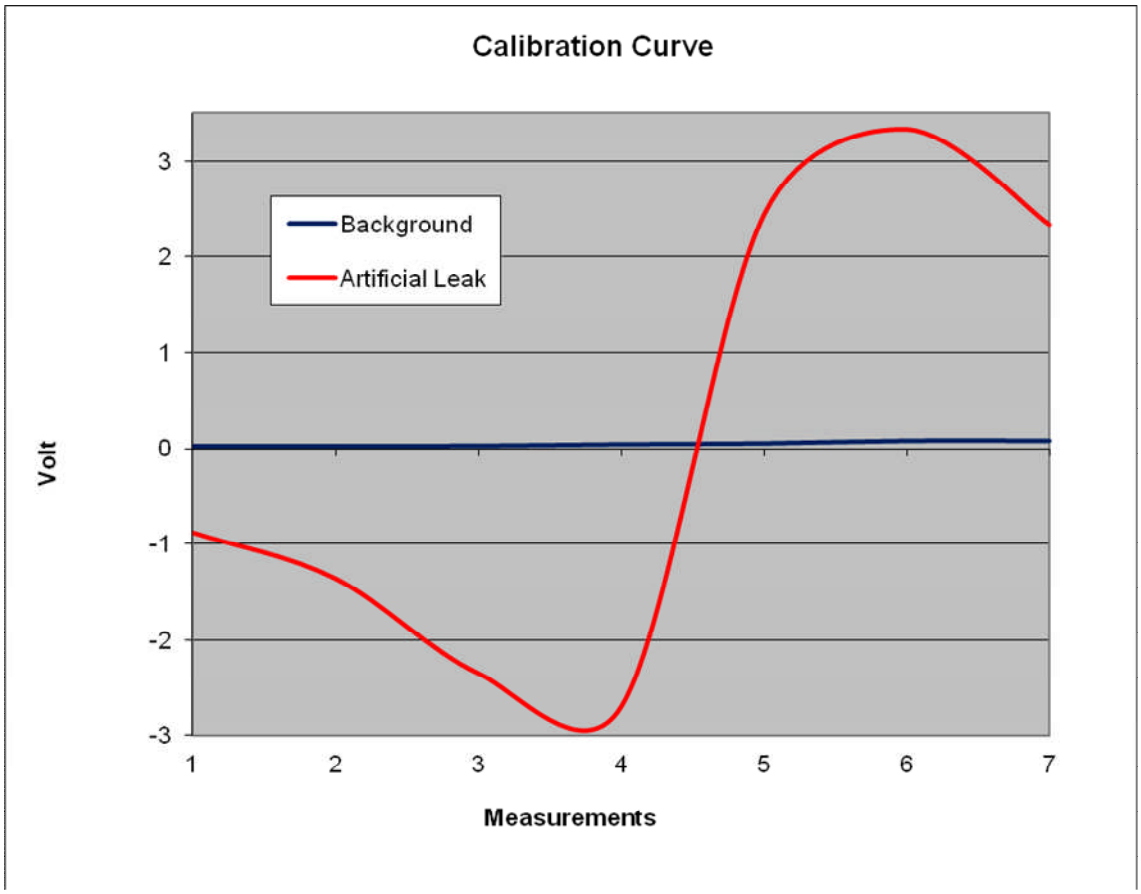
Leak Detection Distance Testing

Prior to the survey, a leak detection distance test was performed to verify the proposed grid spacing and the maximum distance from the current injector electrode. The calibration hole

consisted of a 6.4 mm (1/4") diameter artificial leak fabricated and placed in accordance with ASTM D7007.

The leak detection distance test showed that the artificial leak could easily be detected at an offset distance of 6 feet 8 inches from the location of the artificial leak. ASTM procedures require that the artificial leak produce a signal to noise ratio of at least 3.0 from the leak detection distance. A signal to noise ratio of 88.6 was created by the artificial leak. The "signal" to "signal+noise" ratio calibration curve is shown on Graph 1.

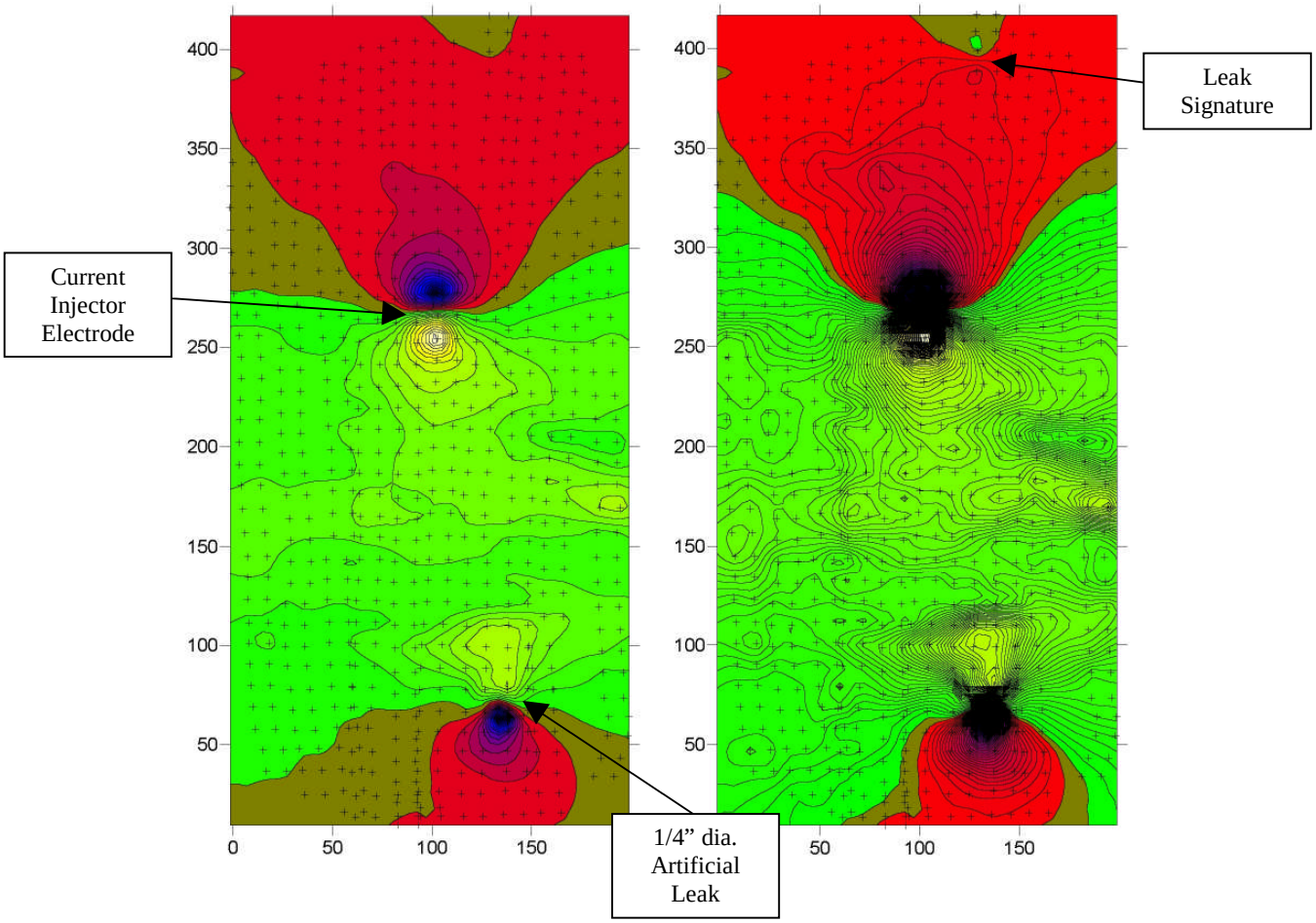
Graph 1: Leak Detection Distance Testing at 6'8" Offset from Artificial Leak



The electrical response of the survey area is shown in Figure 1. The 1/4" diameter artificial leak was left plugged in during the survey in order to document the method's capabilities of locating a leak. The colors on the voltage maps represent voltage values in order to easily recognize a shift from positive to negative values. Negative values are represented by red changing to blue with increasing magnitude and positive values are represented by green changing to yellow with increasing magnitude. The tick marks are voltage measurement locations and show the general shape of the survey area.

The negative on top (red to blue to black), positive on the bottom (green to yellow to white) polarity of the area is created by the current injector electrode. Leak locations are recognized as a positive peak directly on top of a negative peak (opposite of the current injector electrode). The peaks stacked on top of each other typically resemble a butterfly, with closely spaced contours separating the two round peaks. The voltage map is typically analyzed at several contour intervals in order to view all magnitudes of anomalies. Figure 1 shows two different contour intervals. The map on the left is plotted at a contour interval of 0.5 volts where it is easy to see the artificial leak and the current injector. The map on the right is plotted at a contour interval of 0.1 volts, which reveals the smallest magnitude anomalies.

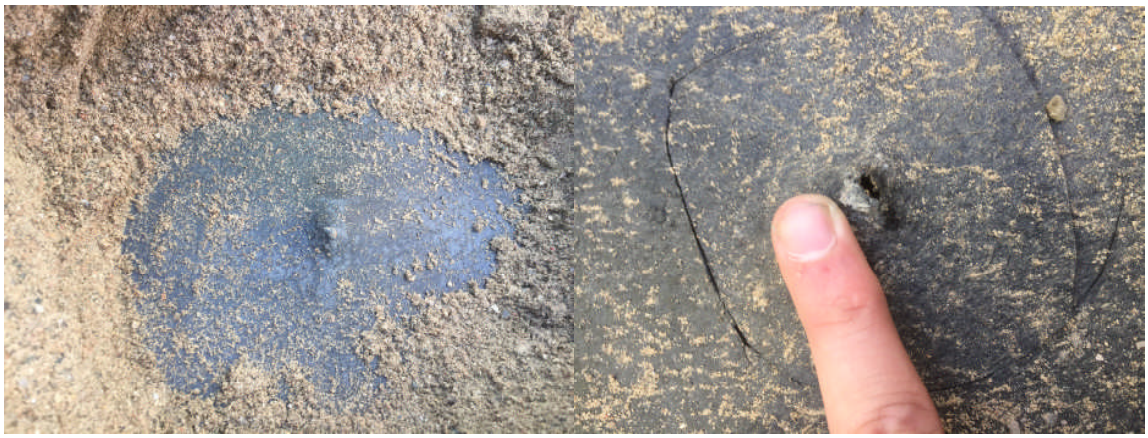
Figure 1: Voltage Map of Survey Area at Two Contour Intervals



The current draw of the survey area with the 1/4" artificial leak plugged in was 8 mA at a voltage setting of 350 volts. With no artificial leak plugged in, the current draw of the survey area was 1 mA.

The small leak signature shown in Figure 1 on the voltage map on the right was investigated and pinpointed. The current leakage originated from a puncture measuring approximately 2 mm caused by a small rock puncturing the geomembrane. A photo of the damage both before and after it was cut out for investigation is shown in Photo 1.

Photo 1: Leak Located During Survey – Before and After Cut out for Investigation



The areas around the current injector and artificial leak were also checked for leak signatures when the current injector was moved and the artificial leak was unplugged. No further leak signatures were observed.

If you have any questions regarding the information provided, please feel free to contact me at your convenience. It was a pleasure to work with you on this project.

Abigail Gilson, P.E.
Director of Liner
Integrity Services,
TRI Environmental, Inc.

Attachment C
Elevation Verification Evaluation

Memorandum

July 3, 2018

To:	Beth Landale	Ref. No.:	081613A
	AJB		
From:	Andrew Betts/aj/8	Tel:	519-340-4101

Subject: **As-Constructed Elevation Verification – First Flush Basin C Powertrain Willow Run, Ypsilanti, MI**

1. Background

The following memorandum provides a summary of the verification as-constructed elevations for First Flush Basin-C (FFB-C). In particular, the outlet structure, subgrade elevation and the top of ballast elevations are reviewed and compared to design elevations. The purpose of this review is to:

- Ensure outlet elevations match design elevations
- Ensure there is sufficient ballast on top of the liner to counter act the buoyance forces from the high water table
- Verify basin active stormwater runoff volume holding capacity
- Verify outlet elevations

Acceptable tolerance of as-constructed grades was +/- 0.2 feet.

Three surveys are used is this verification assessment:

- Subgrade (basin excavation) elevation: There were several surveys completed of the basin's subgrade prior to the placement of sand and gravel. The surveying was done in two phases. The first phases measured the elevations in the northern two-thirds of the basin and the second measured the southern one-third. Previous verification of these surveys concluded that on average, the surveyed points were within the acceptable tolerance. However, there were some areas that required further excavation or filling. Prior to placement of the geomembrane liner, basin elevations were corrected to the satisfaction of GHD. The following provides the date and source of the subgrade surveys:
  - September 8, 2017 completed by Iafrate.
  - September 13, 2017 completed by Monument Engineering and witnessed by GHD.
  - September 13, 2017 additional verification survey points from by Stantec
  - September 21, 2017, GHD survey of energy dissipater
  - September 25,2017 by Iafrate

GHD
455 Phillip Street Waterloo Ontario N2L 3X2 Canada
T 519 884 0510 **F** 519 884 0525 **W** www.ghd.com

REGISTERED COMPANY FOR ISO 9001 ENGINEERING DESIGN

- Top of ballast elevation. On April 5, 2018, Iafrate completed a survey of the top of ballast within Basin-C. Details on the results of this survey are presented in the following section.

2. Outlet Structure Elevations

GHD collected survey information on the outlet structure of FFB-C on September 23, 2017. The survey information collected was focused on the elevation of the orifice opening inverts in the concrete outlet structure. There are three openings in the outlet structure: low flow six (6) inch pipe; twelve (12) inch at grade orifice; and a twenty four (24) inch high flow orifice. Table 1 provides a summary of the design verse as-constructed elevations. It was previously determined that all of the elevations were within acceptable tolerance.

Table 1 FFB-C outlet elevation verification

Opening Size	Design Elevation	As-Constructed Elevation
(in)	(ft)	(ft)
24	710.00	710.13
12	709.00	709.26
6	704.18	704.04

3. Top of Ballast As-Constructed Elevation Verification

In total 39 elevation points were collected. For an area as large as Basin-C this number of points is not sufficient to complete a thorough verification of as-constructed elevations. All of the surveyed elevations were located in the bottom of the basin, and therefore, no verification of the side slopes or top of basin could be complete. In addition, no survey points were collected in the low flow channel, and therefore, no verification of the final low flow channel elevations could be completed. Only three elevation points were collected in the plunge pool, two on the southwest side of the outlet structure and one on the northwest side of the plunge pool. This does not provide sufficient density of elevation points to complete an as-constructed verification.

On average, the survey points collected are within the acceptable tolerance. Overall, it appears that there is sufficient ballast placed in the basin to counter act the buoyancy forces. GHD is satisfied with the overall depth of ballast within the basin with the exception of the following:

- The top of plunge pool elevation at the outlet structure appears to be one-foot lower than design elevation. This will need to be further verified with additional elevation points within the plunge pool and corrected to design elevation of 709 ft.
- There are seven (7) spots throughout the basin that are half a foot or greater higher than the design elevation. These areas have been circled in red on the attached figure. Additional elevation points should be surveyed in these areas to determine how localized the high points area are and regrading should be completed.

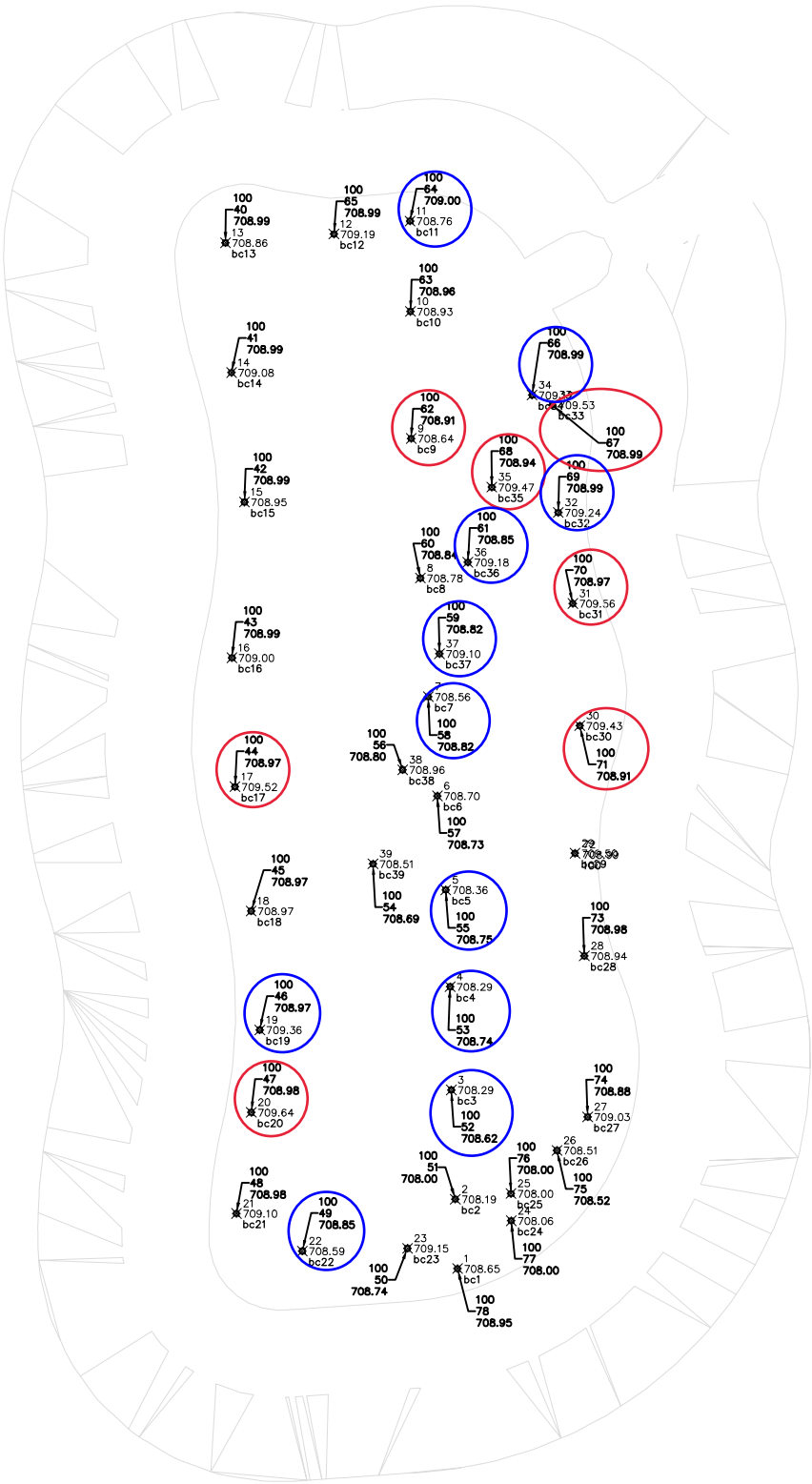
- There are eleven (11) spots that are above the +/- 0.2 ft tolerance limits but less than half a foot. These areas have been circled in blue on the attached figure. Additional elevation points should be collected in these areas to determine how localized these high/low spots are and then the best course of action can be determine.

4. Conclusion

In conclusion, the survey data provides sufficient information to perform a qualitative evaluation only of the as-constructed elevations of FFB-C. Additional survey information would be required to perform a quantitative assessment of the as-constructed basin elevations to ensure it meets design storage volume.

Qualitatively the basin is adequate as constructed due to the smaller drainage area and grassed swales constructed that should offset the area where there is additional ballast than designed.

To quantitatively determine the storage volume, additional details on drainage area and additional survey of FFB-C would be required to create a final surface to calculate volume and definitively determine if the changes made to the site and the extra ballast offset each other.


100 40 708.99 13 708.86 bc13
100 65 708.99 12 709.19 bc12
100 64 709.00 11 708.76 bc11
100 63 708.96 10 708.93 bc10
100 41 708.99 14 709.08 bc14
100 66 708.99 34 709.53 bc33
100 67 708.99
100 62 708.91 9 708.64 bc9
100 68 708.94 35 709.47 bc35
100 69 708.99 32 709.24 bc32
100 42 708.99 15 708.95 bc15
100 61 708.85 36 709.18 bc36
100 60 708.84 8 708.78 bc8
100 70 708.97 31 709.56 bc31
100 43 708.99 16 709.00 bc16
100 59 708.82 37 709.10 bc37
7 708.56 bc7
100 58 708.82
30 709.43 bc30
100 71 708.91
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4 708.29 bc4
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100 52 708.62
100 74 708.88 27 709.03 bc27
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26 708.51 bc26
100 75 708.52
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100 77 708.00
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23 709.15 bc23
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1 708.65 bc1
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