GAI-LAP
Initial: CVZ #:0.13
DATE: 05/01/2014

May 1, 2014

Allan Brantley
***Brantley Engineering, LLC***
13933 Tree Loft Road
Milton, GA, 30004

**Re:** FINAL LABORATORY TEST REPORT

Dear Mr. Brantley:

Thank you for consulting TRI California for your material testing needs.

Enclosed is the ***final*** laboratory report for the seam testing of seven (7) HDPE seam samples.

**PROJECT NAME:** JED Cell 10 DATE REPORTED: **May 1, 2014**

**REFERENCE TRI JOB NO.:** G140377

**DATE RECEIVED:** May 1, 2014

**SAMPLES SENT BY:** Brantley Engineering

**SAMPLE IDENTIFICATIONS:**

| | ***SAMPLE ID*** | ***TRI-CA CONTROL NUMBER*** |
|---|---|---|
| 1. | DSP1 1/2 | 97568 |
| 2. | DSP2 2/3 | 97569 |
| 3. | DSP3 3/5 | 97570 |
| 4. | DSP4 10/12 | 97571 |
| 5. | DSP5 12/13 | 97572 |
| 6. | DSP6 13/15 | 97573 |
| 7. | DSP9 21/22 | 97574 |

**TESTS REQUIRED / PERFORMED:**

| | ***TEST METHOD*** | ***DESCRIPTION*** |
|---|---|---|
| 1. | ASTM D6392 | Shear Bond Strength |
| 2. | ASTM D6392 | Peel Bond Adhesion |

**TEST RESULTS:** The test results are summarized in the attached Tables 1 to 4.

Respectfully,

**TRI Environmental, Inc. - California**

Maria Espitia
Quality Assurance

Carmelo V. Zantua
Technical Director

*Signatures are on file*

It shall be noted that the samples tested are believed to be true representatives of the material produced under the designation herein stated. In addition, the attached laboratory tests results are considered indicative only of the quality of samples/specimens that were actually tested. The appropriate test methods hereby employed are based on the current and accepted industry practices. TRI neither accepts responsibility for nor makes claims to the intended final use and purpose of the material. The test data and all associated project information shall be held confidential and not to be reproduced and/or disclosed to other parties except in full and with prior written approval from pertinent entity duly authorized by the respective client or from the client itself. It is our policy to keep physical records of each job for two (2) years commencing from the date of receipt of the samples and keep its corresponding electronic file for seven (7) years. ***Failed seam samples are kept for two (2) years and good seam samples are disposed of after two (2) weeks.*** On the other hand, should you need us to keep them at a longer period, please advise us in writing.

**5 Pages Total**

GAI-LAP

# TABLE 1.
## SEAM PEEL AND SHEAR TEST RESULTS

CLIENT: **Brantley Engineering, LLC**
PROJECT: **JED Cell 10**
DATE REC'D: **1-May-14**

MATERIAL: **HDPE SEAM**
SEAM TYPE: **Fusion Weld**
TRI JOB #: **G140377**

QC'd By: Maria Espitia
TEST METHOD: ASTM D6392
DATE REPORT: 1-May-14

| Crosshead Speed: 2 in/min | | SHEAR EVALUATION | | | | Crosshead Speed: 2 in/min | PEEL EVALUATION | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | TRI CONTROL # | MAXIMUM STRENGTH (lb/in width) | % Elongation | Locus of Break | PROJECT SPEC. (lb/in width) | SPECIMEN NUMBER | MAXIMUM STRENGTH (lb/in width) | % INCURSION (%) | LOCUS OF BREAK | PROJECT SPEC. (lb/in width) |
| **DSP1** | **97568** | 155 | > 50% | BRK | | 1 Outside | 116 | 0 | SE1 | |
| **1/2** | | 155 | > 50% | BRK | | 2 Outside | 111 | 0 | SE1 | |
| | | 155 | > 50% | BRK | | 3 Outside | 111 | 0 | SE1 | |
| | | 161 | > 50% | BRK | | 4 Outside | 119 | 0 | SE1 | |
| | | 159 | > 50% | BRK | | 5 Outside | 121 | 0 | SE1 | |
| | | | | | | **AVG:** | **116** | | | 91 |
| | | | | | | STD. DEV. | **5** | | | |
| | | | | | | 1 Inside | 130 | 0 | SE1 | |
| | | | | | | 2 Inside | 127 | 0 | SE1 | |
| | | | | | | 3 Inside | 136 | 0 | SE1 | |
| | | | | | | 4 Inside | 142 | 0 | SE1 | |
| | | | | | | 5 Inside | 121 | 0 | SE1 | |
| | **AVG.** | **157** | | | 120 | **AVG:** | **131** | | | 91 |
| | STD. DEV. | **3** | | | | STD. DEV. | **8** | | | |
| **DSP2** | **97569** | 149 | > 50% | BRK | | 1 Outside | 115 | 0 | SE1 | |
| **2/3** | | 153 | > 50% | BRK | | 2 Outside | 116 | 0 | SE1 | |
| | | 150 | > 50% | BRK | | 3 Outside | 117 | 0 | SE1 | |
| | | 153 | > 50% | BRK | | 4 Outside | 113 | 0 | SE1 | |
| | | 161 | > 50% | BRK | | 5 Outside | 114 | 0 | SE1 | |
| | | | | | | **AVG:** | **115** | | | 91 |
| | | | | | | STD. DEV. | **2** | | | |
| | | | | | | 1 Inside | 116 | 0 | SE1 | |
| | | | | | | 2 Inside | 109 | 0 | SE1 | |
| | | | | | | 3 Inside | 114 | 0 | SE1 | |
| | | | | | | 4 Inside | 109 | 0 | SE1 | |
| | | | | | | 5 Inside | 121 | 0 | SE1 | |
| | **AVG:** | **153** | | | 120 | **AVG:** | **114** | | | 91 |
| | STD. DEV. | **5** | | | | STD. DEV. | **5** | | | |

**BREAK DESCRIPTION (ASTM D6392 FUSION):**

| | |
|---|---|
| AD | ADHESION FAILURE. |
| BRK | BREAK IN SHEETING. |
| SE1 | BREAK AT OUTER EDGE OF SEAM. |
| SE2 | BREAK AT INNER EDGE OF SEAM. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

**EXTRUSION:**

| | |
|---|---|
| AD1 | ADHESION FAILURE. SPECIMENS DELAMINATED UNDER THE BEAD. |
| AD2 | ADHESION FAILURE. |
| AD-WLD | BREAK THROUGH THE FILLET. |
| SE1 | BREAK AT BOTTOM EDGE OF SEAM. |
| SE2 | BREAK AT TOP EDGE OF SEAM. |
| SE3 | BREAK AT BOTTOM EDGE OF SEAM (for PEEL only) |
| BRK1 | BREAK IN BOTTOM SHEETING. |
| BRK2 | BREAK IN TOP SHEETING. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| HT | BREAK AT EDGE OF HOT TACK |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

(End of Table 1)

GAI-LAP

# TABLE 2.
## SEAM PEEL AND SHEAR TEST RESULTS

CLIENT: ***Brantley Engineering, LLC***
PROJECT: ***JED Cell 10***
DATE REC'D: ***1-May-14***

MATERIAL: ***HDPE SEAM***
SEAM TYPE: ***Fusion Weld***
TRI JOB #: ***G140377***

QC'd By: Maria Espitia
TEST METHOD: ASTM D6392
DATE REPORT: 1-May-14

| Crosshead Speed: 2 in/min | | SHEAR EVALUATION | | | | Crosshead Speed: 2 in/min | PEEL EVALUATION | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | TRI CONTROL # | MAXIMUM STRENGTH (lb/in width) | % Elongation | Locus of Break | PROJECT SPEC. (lb/in width) | SPECIMEN NUMBER | MAXIMUM STRENGTH (lb/in width) | % INCURSION (%) | LOCUS OF BREAK | PROJECT SPEC. (lb/in width) |
| **DSP3** | **97570** | 148 | > 50% | BRK | | 1 Outside | 127 | 0 | SE1 | |
| **3/5** | | 153 | > 50% | BRK | | 2 Outside | 110 | 0 | SE1 | |
| | | 155 | > 50% | BRK | | 3 Outside | 108 | 0 | SE1 | |
| | | 163 | > 50% | BRK | | 4 Outside | 111 | 0 | SE1 | |
| | | 162 | > 50% | BRK | | 5 Outside | 115 | 0 | SE1 | |
| | | | | | | **AVG:** | **114** | | | 91 |
| | | | | | | STD. DEV. | **8** | | | |
| | | | | | | 1 Inside | 111 | 0 | SE1 | |
| | | | | | | 2 Inside | 112 | 0 | SE1 | |
| | | | | | | 3 Inside | 105 | 0 | SE1 | |
| | | | | | | 4 Inside | 110 | 0 | SE1 | |
| | | | | | | 5 Inside | 107 | 0 | SE1 | |
| | **AVG.** | **156** | | | 120 | **AVG:** | **109** | | | 91 |
| | STD. DEV. | **6** | | | | STD. DEV. | **3** | | | |
| **DSP4** | **97571** | 156 | > 50% | BRK | | 1 Outside | 130 | 0 | SE1 | |
| **10/12** | | 158 | > 50% | BRK | | 2 Outside | 126 | 0 | SE1 | |
| | | 160 | > 50% | BRK | | 3 Outside | 122 | 0 | SE1 | |
| | | 166 | > 50% | BRK | | 4 Outside | 120 | 0 | SE1 | |
| | | 158 | > 50% | BRK | | 5 Outside | 116 | 0 | SE1 | |
| | | | | | | **AVG:** | **123** | | | 91 |
| | | | | | | STD. DEV. | **5** | | | |
| | | | | | | 1 Inside | 135 | 0 | SE1 | |
| | | | | | | 2 Inside | 129 | 0 | SE1 | |
| | | | | | | 3 Inside | 127 | 0 | SE1 | |
| | | | | | | 4 Inside | 128 | 0 | SE1 | |
| | | | | | | 5 Inside | 116 | 0 | SE1 | |
| | **AVG:** | **160** | | | 120 | **AVG:** | **127** | | | 91 |
| | STD. DEV. | **4** | | | | STD. DEV. | **7** | | | |

**BREAK DESCRIPTION (ASTM D6392 FUSION):**

| | |
|---|---|
| AD | ADHESION FAILURE. |
| BRK | BREAK IN SHEETING. |
| SE1 | BREAK AT OUTER EDGE OF SEAM. |
| SE2 | BREAK AT INNER EDGE OF SEAM. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

**EXTRUSION:**

| | |
|---|---|
| AD1 | ADHESION FAILURE. SPECIMENS DELAMINATED UNDER THE BEAD. |
| AD2 | ADHESION FAILURE. |
| AD-WLD | BREAK THROUGH THE FILLET. |
| SE1 | BREAK AT BOTTOM EDGE OF SEAM. |
| SE2 | BREAK AT TOP EDGE OF SEAM. |
| SE3 | BREAK AT BOTTOM EDGE OF SEAM (for PEEL only) |
| BRK1 | BREAK IN BOTTOM SHEETING. |
| BRK2 | BREAK IN TOP SHEETING. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| HT | BREAK AT EDGE OF HOT TACK |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

(End of Table 2)

GAI-LAP

# TABLE 3.
## SEAM PEEL AND SHEAR TEST RESULTS

CLIENT: ***Brantley Engineering, LLC***
PROJECT: ***JED Cell 10***
DATE REC'D: ***1-May-14***

MATERIAL: ***HDPE SEAM***
SEAM TYPE: ***Fusion Weld***
TRI JOB #: ***G140377***

QC'd By: Maria Espitia
TEST METHOD: ASTM D6392
DATE REPORT: 1-May-14

| Crosshead Speed: 2 in/min | | SHEAR EVALUATION | | | | Crosshead Speed: 2 in/min | PEEL EVALUATION | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | TRI CONTROL # | MAXIMUM STRENGTH (lb/in width) | % Elongation | Locus of Break | PROJECT SPEC. (lb/in width) | SPECIMEN NUMBER | MAXIMUM STRENGTH (lb/in width) | % INCURSION (%) | LOCUS OF BREAK | PROJECT SPEC. (lb/in width) |
| **DSP5** | **97572** | 154 | > 50% | BRK | | 1 Outside | 122 | 0 | SE1 | |
| **12/13** | | 159 | > 50% | BRK | | 2 Outside | 127 | 0 | SE1 | |
| | | 158 | > 50% | BRK | | 3 Outside | 124 | 0 | SE1 | |
| | | 162 | > 50% | BRK | | 4 Outside | 122 | 0 | SE1 | |
| | | 162 | > 50% | BRK | | 5 Outside | 123 | 0 | SE1 | |
| | | | | | | **AVG:** | **124** | | | 91 |
| | | | | | | STD. DEV. | **2** | | | |
| | | | | | | 1 Inside | 143 | 0 | SE1 | |
| | | | | | | 2 Inside | 138 | 0 | SE1 | |
| | | | | | | 3 Inside | 130 | 0 | SE1 | |
| | | | | | | 4 Inside | 105 | 0 | SE1 | |
| | | | | | | 5 Inside | 119 | 0 | SE1 | |
| | **AVG.** | **159** | | | 120 | **AVG:** | **127** | | | 91 |
| | STD. DEV. | **3** | | | | STD. DEV. | **15** | | | |
| **DSP6** | **97573** | 166 | > 50% | BRK | | 1 Outside | 121 | 0 | SE1 | |
| **13/15** | | 165 | > 50% | BRK | | 2 Outside | 103 | 0 | SE1 | |
| | | 161 | > 50% | BRK | | 3 Outside | 98 | 0 | SE1 | |
| | | 170 | > 50% | BRK | | 4 Outside | 114 | 0 | SE1 | |
| | | 170 | > 50% | BRK | | 5 Outside | 101 | 0 | SE1 | |
| | | | | | | **AVG:** | **107** | | | 91 |
| | | | | | | STD. DEV. | **10** | | | |
| | | | | | | 1 Inside | 135 | 0 | SE1 | |
| | | | | | | 2 Inside | 111 | 0 | SE1 | |
| | | | | | | 3 Inside | 105 | 0 | SE1 | |
| | | | | | | 4 Inside | 106 | 0 | SE1 | |
| | | | | | | 5 Inside | 105 | 0 | SE1 | |
| | **AVG:** | **166** | | | 120 | **AVG:** | **112** | | | 91 |
| | STD. DEV. | **4** | | | | STD. DEV. | **13** | | | |

**BREAK DESCRIPTION (ASTM D6392 FUSION):**

| | |
|---|---|
| AD | ADHESION FAILURE. |
| BRK | BREAK IN SHEETING. |
| SE1 | BREAK AT OUTER EDGE OF SEAM. |
| SE2 | BREAK AT INNER EDGE OF SEAM. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

**EXTRUSION:**

| | |
|---|---|
| AD1 | ADHESION FAILURE. SPECIMENS DELAMINATED UNDER THE BEAD. |
| AD2 | ADHESION FAILURE. |
| AD-WLD | BREAK THROUGH THE FILLET. |
| SE1 | BREAK AT BOTTOM EDGE OF SEAM. |
| SE2 | BREAK AT TOP EDGE OF SEAM. |
| SE3 | BREAK AT BOTTOM EDGE OF SEAM (for PEEL only) |
| BRK1 | BREAK IN BOTTOM SHEETING. |
| BRK2 | BREAK IN TOP SHEETING. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| HT | BREAK AT EDGE OF HOT TACK |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

(End of Table 3)

GAI-LAP

## TABLE 4.
## SEAM PEEL AND SHEAR TEST RESULTS

CLIENT: **Brantley Engineering, LLC**
PROJECT: **JED Cell 10**
DATE REC'D: **1-May-14**

MATERIAL: **HDPE SEAM**
SEAM TYPE: **Fusion Weld**
TRI JOB #: **G140377**

QC'd By: Maria Espitia
TEST METHOD: ASTM D6392
DATE REPORT: 1-May-14

| Crosshead Speed: 2 in/min | | SHEAR EVALUATION | | | | Crosshead Speed: 2 in/min | PEEL EVALUATION | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SAMPLE ID | TRI CONTROL # | MAXIMUM STRENGTH (lb/in width) | % Elongation | Locus of Break | PROJECT SPEC. (lb/in width) | SPECIMEN NUMBER | MAXIMUM STRENGTH (lb/in width) | % INCURSION (%) | LOCUS OF BREAK | PROJECT SPEC. (lb/in width) |
| **DSP9** | **97574** | 153 | > 50% | BRK | | 1 Outside | 126 | 0 | SE1 | |
| **21/22** | | 156 | > 50% | BRK | | 2 Outside | 121 | 0 | SE1 | |
| | | 161 | > 50% | BRK | | 3 Outside | 128 | 0 | SE1 | |
| | | 160 | > 50% | BRK | | 4 Outside | 109 | 0 | SE1 | |
| | | 159 | > 50% | BRK | | 5 Outside | 114 | 0 | SE1 | |
| | | | | | | **AVG:** | **120** | | | 91 |
| | | | | | | STD. DEV. | **8** | | | |
| | | | | | | 1 Inside | 130 | 0 | SE1 | |
| | | | | | | 2 Inside | 130 | 0 | SE1 | |
| | | | | | | 3 Inside | 118 | 0 | SE1 | |
| | | | | | | 4 Inside | 122 | 0 | SE1 | |
| | | | | | | 5 Inside | 116 | 0 | SE1 | |
| | **AVG.** | **158** | | | 120 | **AVG:** | **123** | | | 91 |
| | STD. DEV. | **3** | | | | STD. DEV. | **7** | | | |

**BREAK DESCRIPTION (ASTM D6392 FUSION):**

| | |
|---|---|
| AD | ADHESION FAILURE. |
| BRK | BREAK IN SHEETING. |
| SE1 | BREAK AT OUTER EDGE OF SEAM. |
| SE2 | BREAK AT INNER EDGE OF SEAM. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

**EXTRUSION:**

| | |
|---|---|
| AD1 | ADHESION FAILURE. SPECIMENS DELAMINATED UNDER THE BEAD. |
| AD2 | ADHESION FAILURE. |
| AD-WLD | BREAK THROUGH THE FILLET. |
| SE1 | BREAK AT BOTTOM EDGE OF SEAM. |
| SE2 | BREAK AT TOP EDGE OF SEAM. |
| SE3 | BREAK AT BOTTOM EDGE OF SEAM (for PEEL only) |
| BRK1 | BREAK IN BOTTOM SHEETING. |
| BRK2 | BREAK IN TOP SHEETING. |
| AD-BRK | BREAK IN FIRST SEAM AFTER SOME ADHESION FAILURE. |
| HT | BREAK AT EDGE OF HOT TACK |
| SIP | SEPARATION IN THE PLANE OF THE SHEET. |

(End of Table 4)