Appendices

Appendix A

Record Drawings

UPLAND EXCAVATING LTD.
CAMPBELL RIVER, B.C.

NEW LANDFILL (NORTHWIN LANDFILL)
AS-BUILT RECORD DRAWINGS
OCTOBER 2021

LOCATION MAP

DRAWING LIST

DWG. No.	DRAWING TITLE
GN-0001	COVER
CI-0002	BASE OF LINER (TOP OF SAND)
CI-0003	TOP OF DRAINAGE LAYER
CI-0004	DETAILS - LINER DETAILS
CI-0005	DETAILS - LEACHATE COLLECTION SUMP
CI-0006	DETAILS - LEACHATE LEAK DETECTION SUMP
CI-0007	DETAILS - LEACHATE COLLECTION SYSTEM
CI-0008	DETAILS - PERIMETER TIE-IN DETAILS
CI-0009	DETAILS - LEACHATE TREATMENT AND EFFLUENT STORAGE PONDS DETAILS

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0 250 500 750m

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Project
AS-BUILT
RECORD DRAWINGS

No.	Issue	Drawn	Approved	Date
1	ISSUED FOR RECORD	T.W.	R.H.	10-19-2021

Drawn	T.WAGSTAFF	Designer	S.KEMP
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Project Manager	D. LIDDY	Date	Oct 19, 2021
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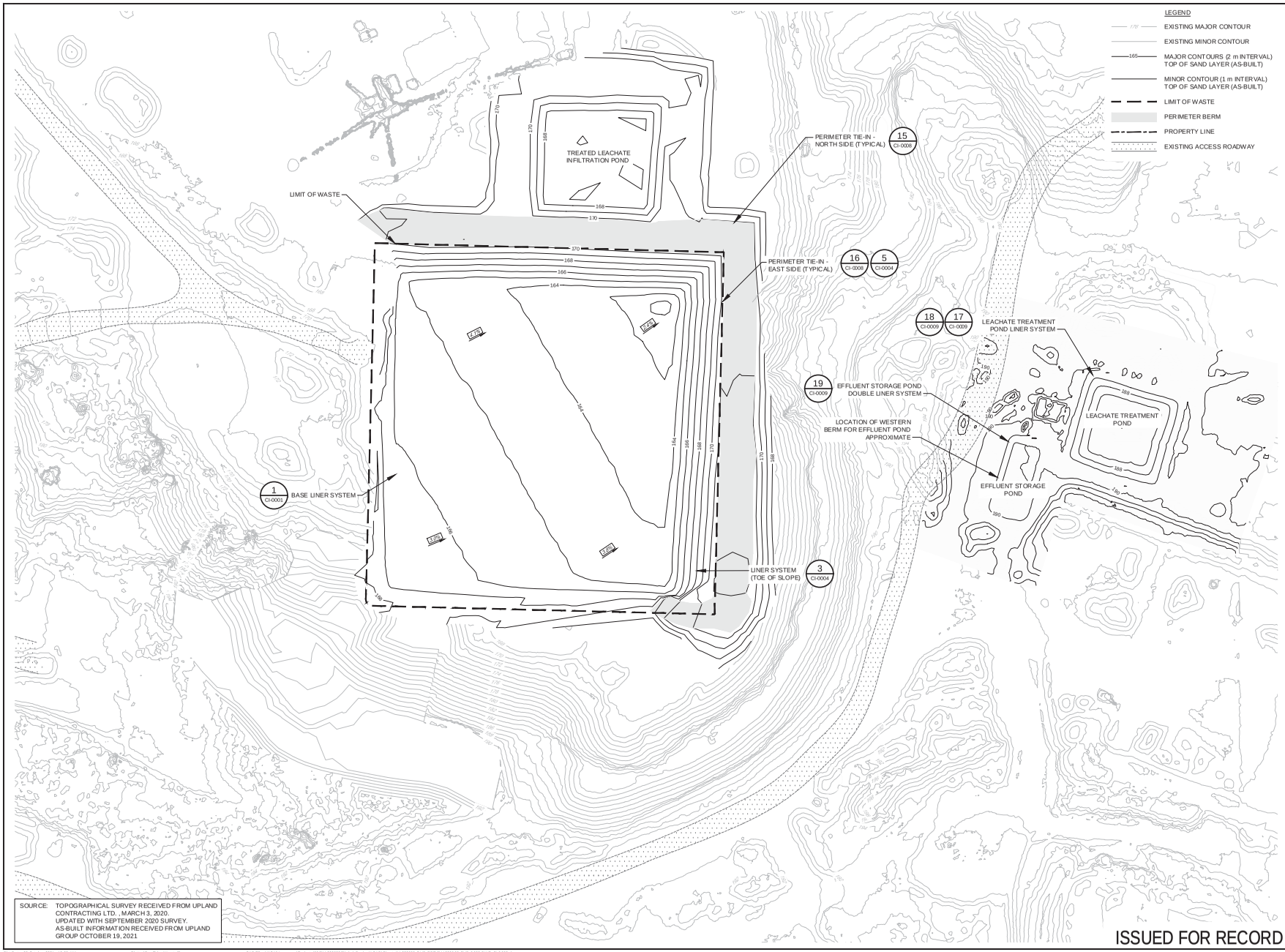
Project No. 11222680

Title
COVER

Sheet No.
GN-0001

Sheet 1 of 9

Plot Date: 19 October 2021 - 10:16 PM Plotted By: Tyler Wagstaff CAD File: N:\CA\Vancouver\Projects\66\11222680\Digital_Design\CAD\Sheets\11222680-GHD-RPT-2\11222680-GHD-0000-DWG-GN-0001.dwg



SOURCE: TOPOGRAPHICAL SURVEY RECEIVED FROM UPLAND CONTRACTING LTD. , MARCH 3, 2020.
UPDATED WITH SEPTEMBER 2020 SURVEY.
AS-BUILT INFORMATION RECEIVED FROM UPLAND GROUP OCTOBER 19, 2021

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Project Manager	D. LIDDY	Date	October 20, 2021
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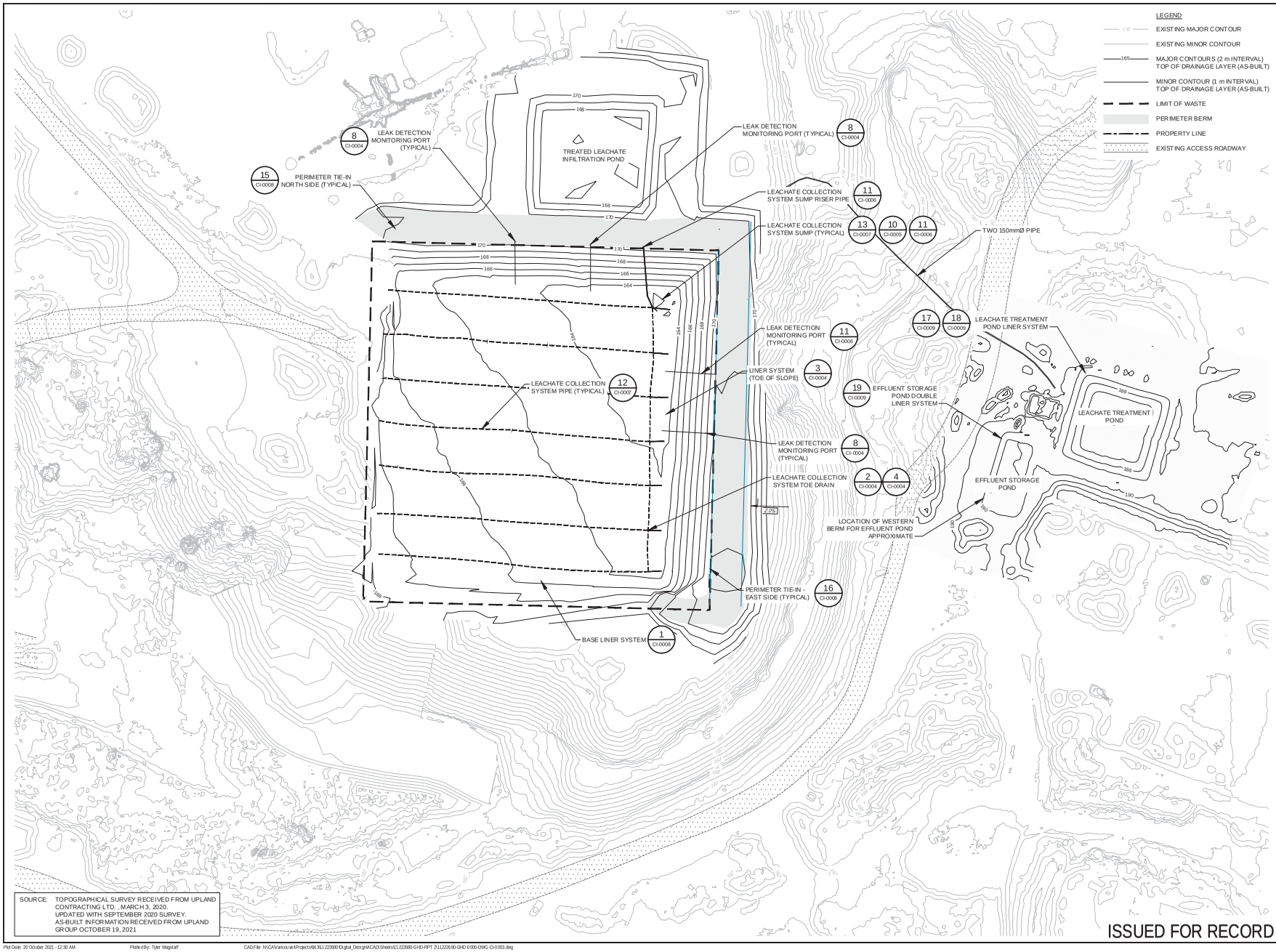
Project No. 11222680

Title
BASE OF LINER
(TOP OF SAND)

Sheet No.
CI-0002

Sheet 2 of 9



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Project Manager D. LIDDY	Date October 20, 2021
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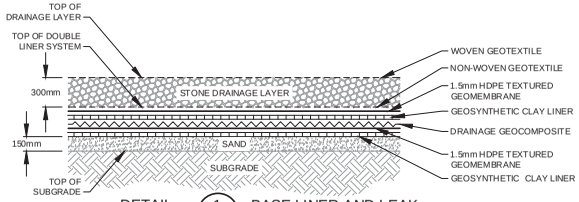
Title
TOP OF DRAINAGE LAYER

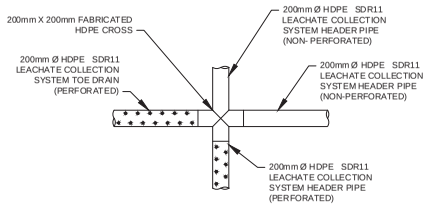
Sheet No.
CI-0003

Sheet 3 of 9

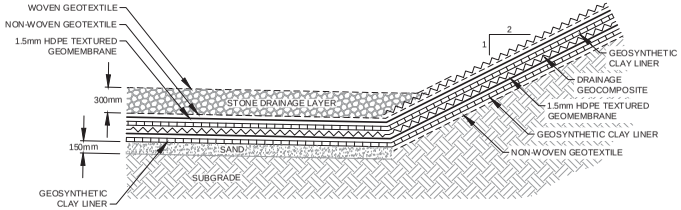
Plot Date: 20 October 2021 - 12:30 AM Plotted By: Tyler Wagstaff CAD File: N:\CAN\Vancouver\Projects\66\11222680\Digital_Design\CAD\Sheets\11222680-GHD-RPT 2\11222680-GHD-0000-DWG-CI-0003.dwg



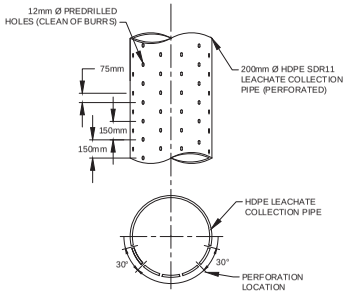
DETAIL 1 (CI-0001) 1:25 — BASE LINER AND LEAK DETECTION SYSTEM



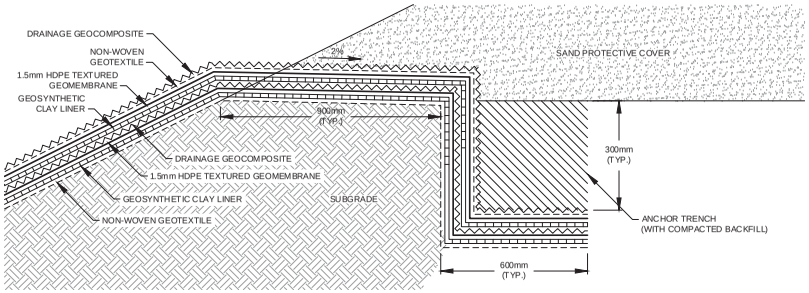
DETAIL 2 (CI-0002) 1:30 — LEACHATE COLLECTION SYSTEM TOE DRAIN / LEACHATE COLLECTION SYSTEM PIPE CONNECTION



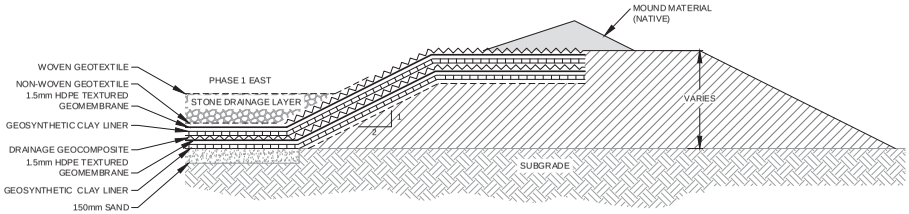
DETAIL 3 (CI-0002) 1:30 — LINER SYSTEM (TOE OF SLOPE) NORTH AND EAST (TYP.)



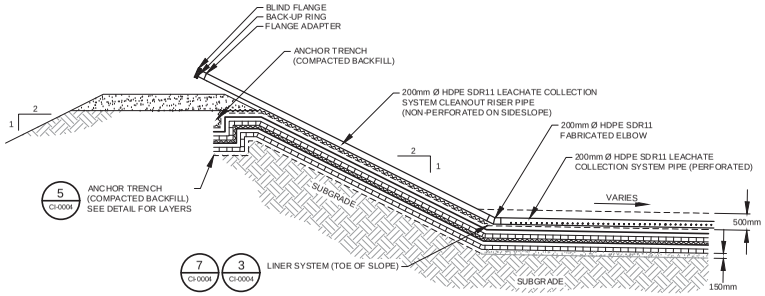
DETAIL 4 (CI-0002) N.T.S. — LEACHATE COLLECTION SYSTEM TOE DRAIN / LEACHATE COLLECTION SYSTEM PIPE PERFORATIONS



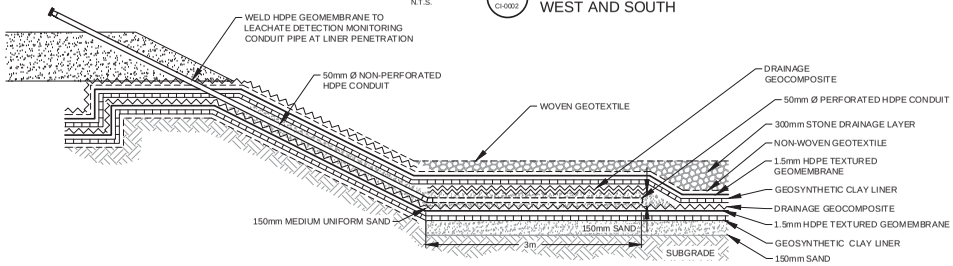
DETAIL 5 (CI-0002) 1:10 — ANCHOR TRENCH (TYPICAL) NORTH AND EAST



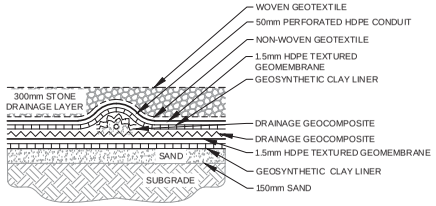
DETAIL 6 (CI-0002) N.T.S. — TRANSITION BERM WEST AND SOUTH



DETAIL 7 (CI-0002) 1:75 — LEACHATE COLLECTION SYSTEM CLEANOUT RISER PIPE (TYPICAL)



DETAIL 8 (CI-0003) N.T.S. — LEAK DETECTION DETECTION PORT (TYP.) PROFILE



DETAIL 9 (CI-0003) 1:25 — LEAK DETECTION MONITORING PORT (TYP.) CROSS-SECTION

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No.	Issue	Drawn	Approved	Date
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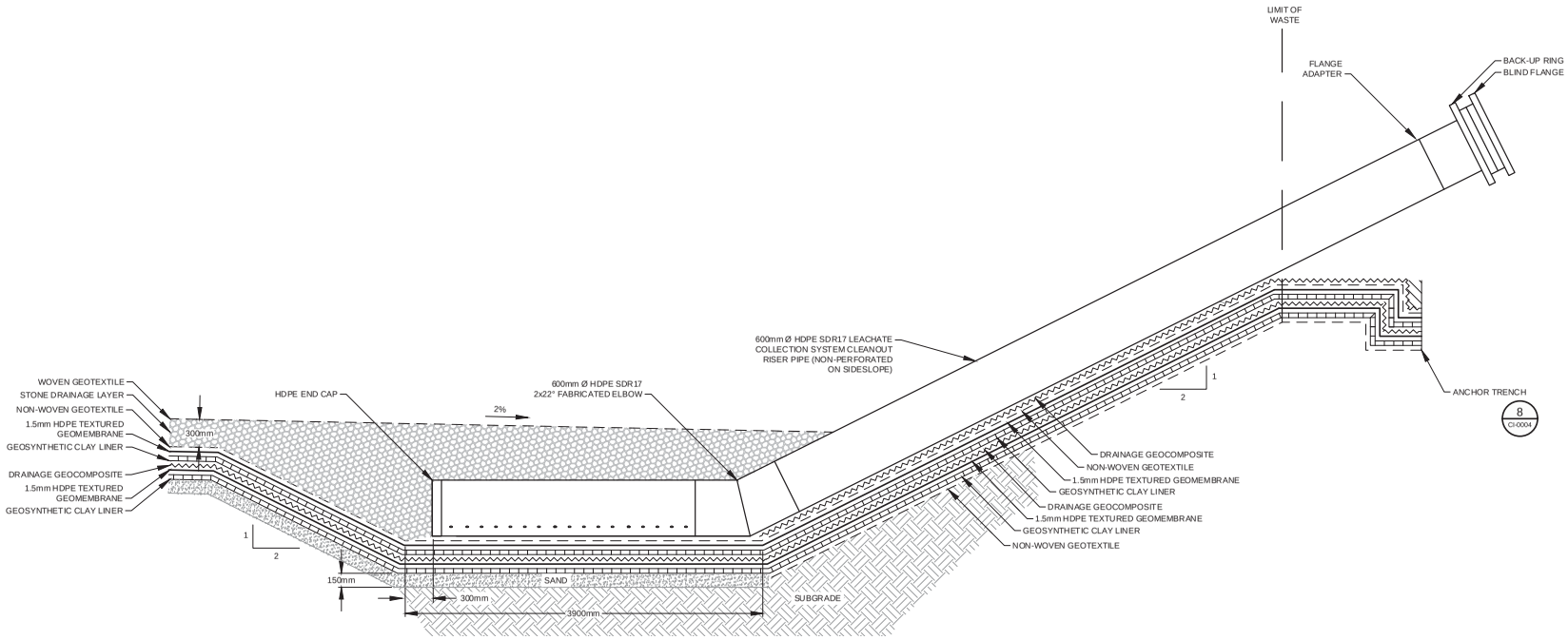
Project No. 11222680

Title
DETAILS
LINER DETAILS

Sheet No.
CI-0004

Plot Date: 19 October 2021 - 11:11 PM Plotted By: Tyler Wagstaff CAD File: N:\CAV\Vancouver\Projects\66\11222680\Digital_Design\CAD\Sheets\11222680-GHD-RPT-2\11222680-GHD-0000-DWG-CI-0004.dwg



DETAIL 10 / CI-0003 LEACHATE COLLECTION SYSTEM SUMP, SUMP RISER PIPE, AND LEACHATE LEVEL MONITORING PIPE

N.T.S.

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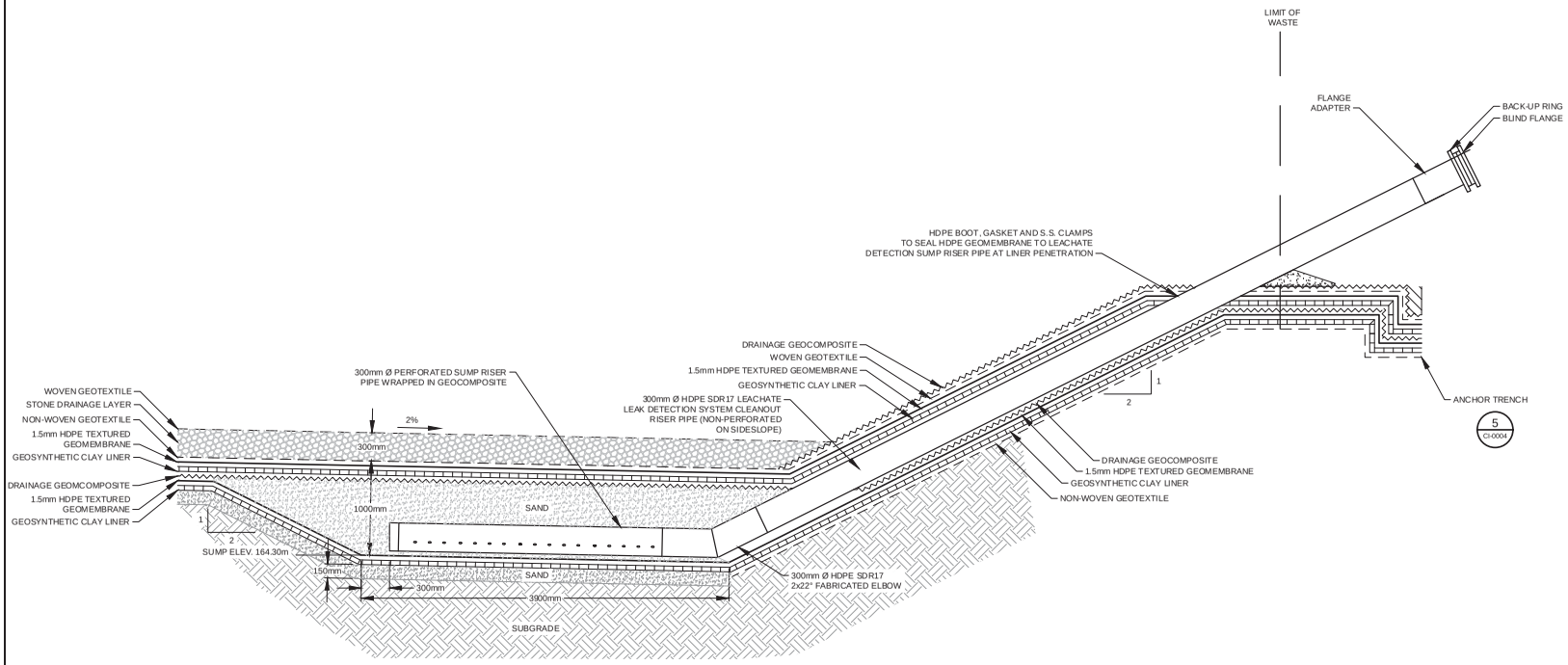
Project No. 11222680

Title
DETAILS
LEACHATE
COLLECTION SUMP

Sheet No.
CI-0005

Sheet 5 of 9



DETAIL 11 (CI-0003) LEACHATE LEAK DETECTION SUMP, SUMP RISER PIPE

N.T.S.

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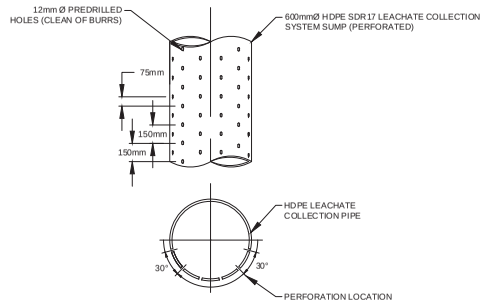
Title
DETAILS
LEACHATE LEAK
DETECTION SUMP

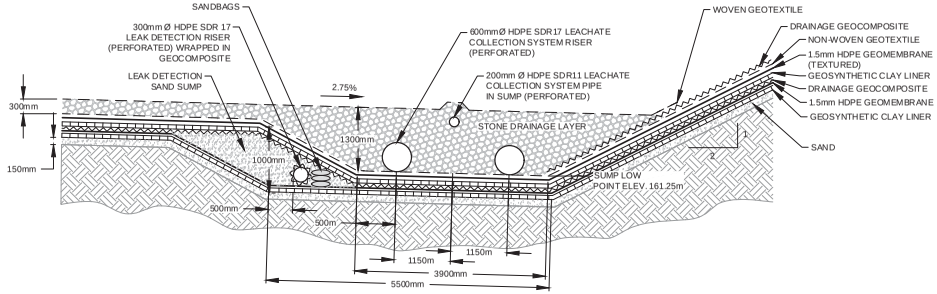
Sheet No.
CI-0006

Sheet 6 of 9

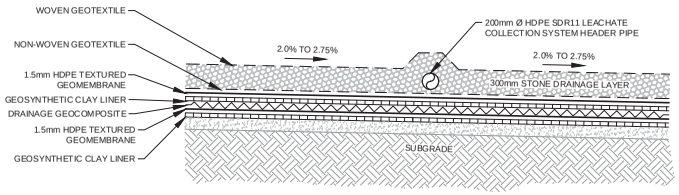
Plot Date: 20 October 2021 - 12:27 AM Plotted By: Tyler Wagstaff CAD File: N:\CAV\Vancouver\Projects\66\11222680\Digital_Design\CAD\Sheets\11222680-GHD-RPT-2\11222680-GHD-0000-DWG-CI-0005.dwg



DETAIL 12 (CI-0003) 600mmØ LEACHATE COLLECTION SYSTEM SUMP PIPE PERFORATIONS
NTS



DETAIL 13 (CI-0003) LEACHATE COLLECTION SYSTEM SUMP
1:50



DETAIL 14 (CI-0003) LEACHATE COLLECTION SYSTEM TOE DRAIN/ LEACHATE COLLECTION SYSTEM PIPE
1:30

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Project
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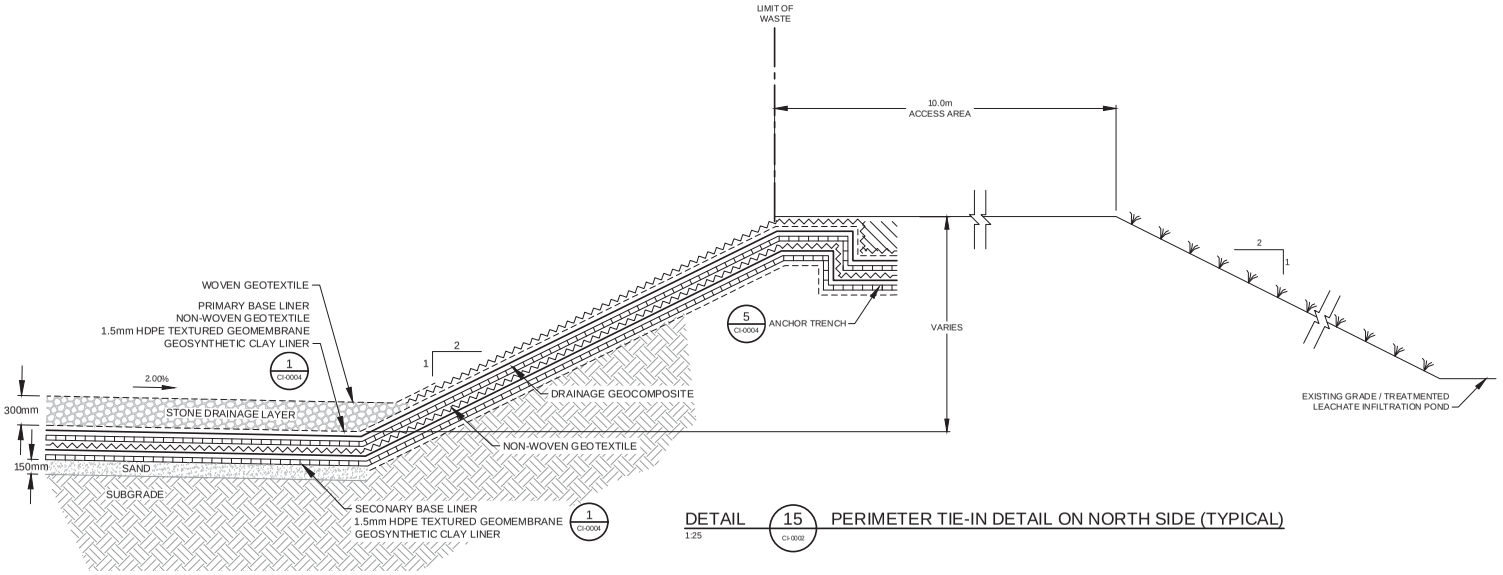
Project No. 11222680

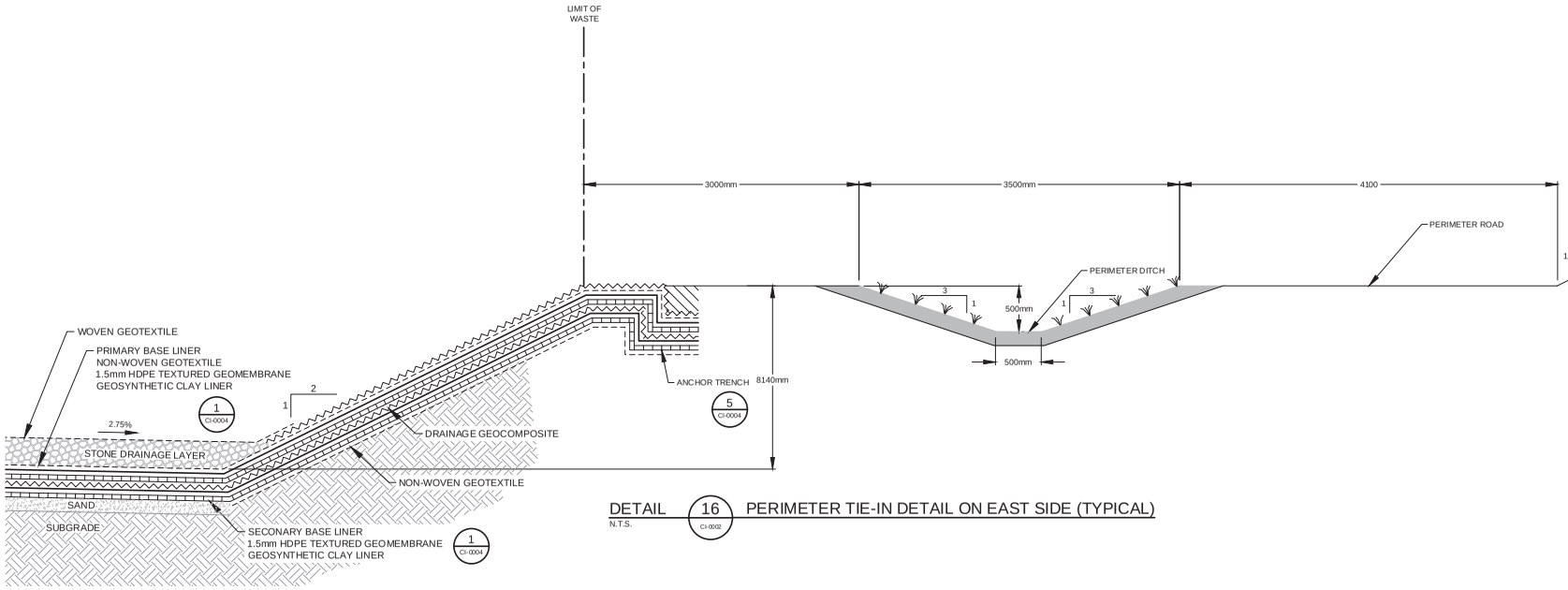
Title
DETAILS
LEACHATE COLLECTION
SYSTEM

Sheet No.
CI-0007

Sheet 7 of 9



DETAIL 15 CI-0002 PERIMETER TIE-IN DETAIL ON NORTH SIDE (TYPICAL)
1:25



DETAIL 16 CI-0002 PERIMETER TIE-IN DETAIL ON EAST SIDE (TYPICAL)
N.T.S.

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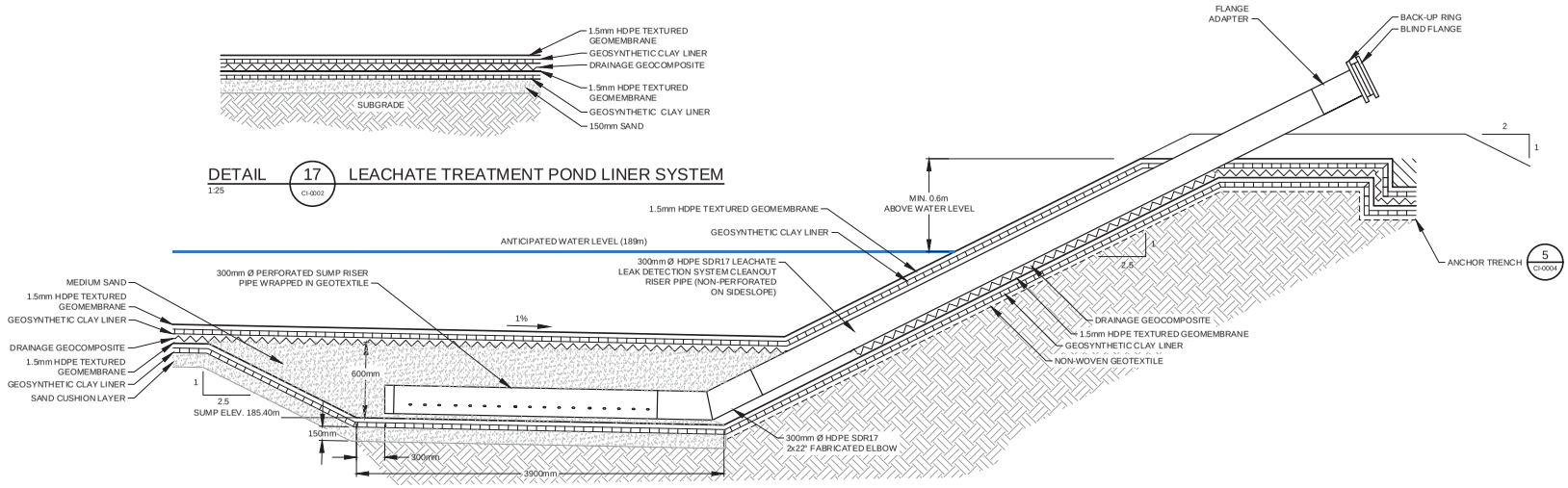
Project No. 11222680

Title
DETAILS
PERIMETER TIE-IN DETAILS

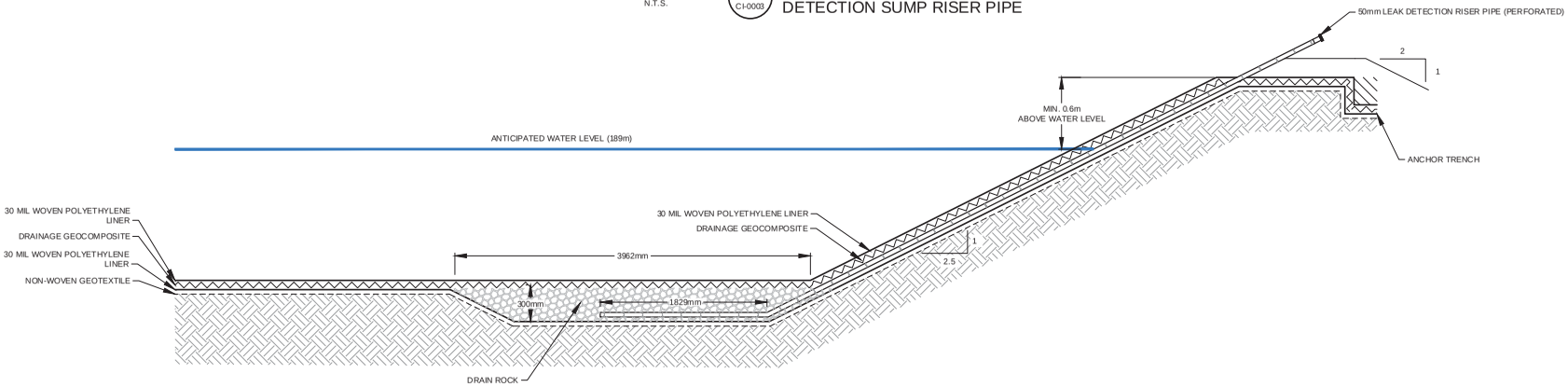
Sheet No.
CI-0008

Sheet 8 of 9

DETAIL 17 (CI-0002) LEACHATE TREATMENT POND LINER SYSTEM
1:25



DETAIL 18 (CI-0003) LEACHATE TREATMENT POND LEAK DETECTION SUMP RISER PIPE
N.T.S.



DETAIL 19 (CI-0003) EFFLUENT STORAGE POND DOUBLE LINER & LEAK DETECTION
N.T.S.

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Project No. 11222680

Title
LEACHATE TREATMENT AND EFFLUENT STORAGE PONDS, TREATED LEACHATE INFILTRATION POND AND LYSIMETER DETAILS

Sheet No.
CI-0009

Sheet 9 of 9

Appendix B

Photograph Log

Site Photographs

Photo 1 Leachate Treatment Pond Excavation

Photo 2 Leachate Treatment Pond Excavation Complete

Photo 3 Leachate Treatment Pond GCL Installation

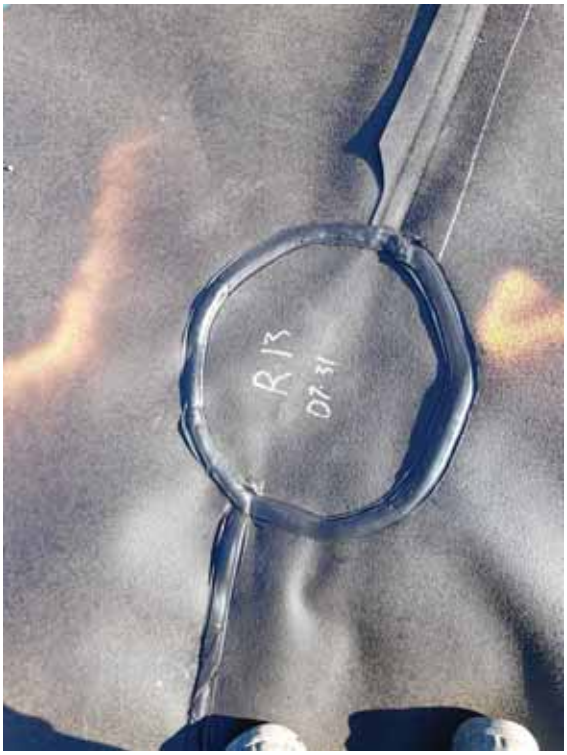

Photo 4 Leachate Treatment Pond Typical Repair

Photo 5 HDPE Fusion Machine

Photo 6 Leachate Treatment Pond GCL Placement

Photo 7 Leachate Treatment Pond Geomembrane Deployment

Photo 8 Leachate Treatment Pond Geomembrane Installation Complete

Photo 9 Treated Effluent Holding Pond Geotextile

Photo 10 Treated Effluent Holding Pond Leak Detection

Site Photographs

Photo 1 Constructing East and West Berm

Photo 2 Constructing West Berm

Photo 3 Placing Bedding Sand

Photo 4 Field Tensiometer

Photo 5 Field Tensiometer

Photo 6 Sub-base Before GCL Installation

Photo 7 GCL Installation

Photo 8 Typical Geomembrane Tag

Photo 9 Primary Geomembrane Installation

Photo 10 Typical Destructive Samples of Geomembrane Seams for Lab Testing

Photo 11 Primary Geomembrane

Photo 12 Drainage Geocomposite on top of Primary Geomembrane

Photo 13 Typical Drainage Geocomposite Cable Ties

Photo 14 Installing Geomembrane on North Berm

Photo 15 Installing GCL on top of Geocomposite

Photo 16 Leachate Sump with Primary Geomembrane

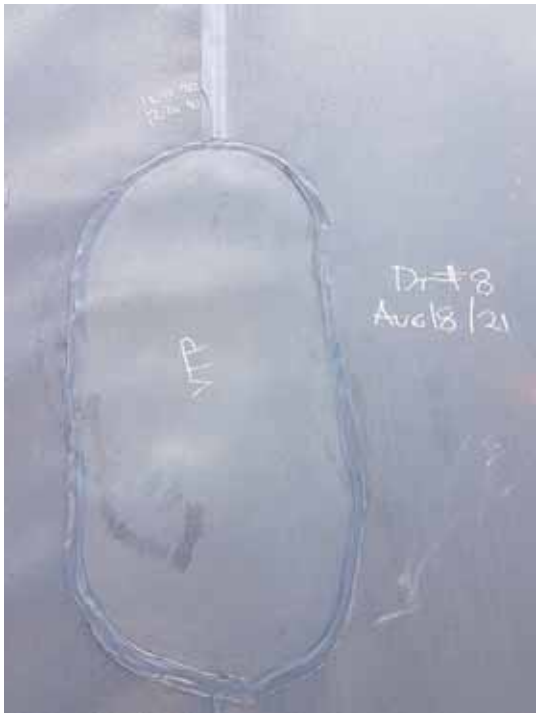

Photo 17 Typical Geomembrane Repair

Photo 18 Geomembrane Seam Pressure Test

Photo 19 HDPE Pipe Fusion Machine

Photo 20 Deploying Geomembrane on North Berm

Photo 21 Leachate Sump with Leak Detection Riser

Photo 22 Seaming Geocomposite above Sump

Photo 23 Complete Installation of Geosynthetics

Photo 24 Initial Placement of Drainage Layer in 900 mm Lifts

Photo 25 Completing Third 900 mm Drainage Layer Lift

Photo 26 Infiltration Pond

Photo 27 Spreading 300 mm of Drainrock

Photo 28 Typical Geomembrane Penetration Boot

Appendix C

Material Test Results

McElhanney

McElhanney Ltd.
1196 Dogwood Street
Campbell River, BC
Tel: (250) 287-7799

Report of:

Field Density Report
Nuclear Densometer

ASTM Ref: *D6938*

Project: Upland Pit Berm
Client: Upland Contracting Ltd.

Project Number: 2221-49292-00
Report Date: March 22, 2021
Report Number: 1

Test Date: March 22, 2021

Material Description: Proctor #5 - 75mm Pitrun

Project Specific Location: Landfill Berm in Pit #1

Tested By: JDC
Specification: 95%
ASTM: D698 *(D698 Standard, D1557 Modified)*

Test No.	Test Location	Elevation (m)	Test Depth (mm)	Proctor No.	Field Dry Density (kg/m^3)	Percent Moisture (%)	Max. Proctor Dry Density (kg/m^3)	Optimum Moisture (%)	Percent Compact. (%)	Spec. (%)
	South end of berm Multiple passes									
1	SEE MAP OF BERM	Subbase	300	1	2234	4.7	2260	8.0	99%	95%
2	SEE MAP OF BERM	Subbase	300	1	2350	4.1	2260	8.0	104%	95%
3	SEE MAP OF BERM	Subbase	300	1	2269	4.7	2260	8.0	100%	95%
4	SEE MAP OF BERM	Subbase	300	1	2223	5.1	2260	8.0	98%	95%
	North end of berm after 6 passes									
5	SEE MAP OF BERM	Subbase	300	1	2280	5.3	2260	8.0	101%	95%
6	SEE MAP OF BERM	Subbase	300	1	2270	5.3	2260	8.0	100%	95%
	North end of berm after another 4 passes									
7	SEE MAP OF BERM	Subbase	300	1	2221	5.0	2260	8.0	98%	95%
8	SEE MAP OF BERM	Subbase	300	1	2248	5.3	2260	8.0	99%	95%
9	SEE MAP OF BERM	Subbase	300	1	2345	3.5	2260	8.0	104%	95%
	North end of berm after another 4 passes									
10	SEE MAP OF BERM	Subbase	300	1	2323	4.8	2230	8.0	104%	95%
11	SEE MAP OF BERM	Subbase	300	1	2192	5.4	2230	8.0	98%	95%

Comments:

Reviewed by:

McElhanney

McElhanney Ltd.
1196 Dogwood Street
Campbell River, BC
Tel: (250) 287-7799

Report of:

Field Density Report
Nuclear Densometer

ASTM Ref: *D6938*

Project: Upland Pit Berm
Client: Upland Contracting

Project Number: 2221-49292-00
Report Date: March 22, 2021
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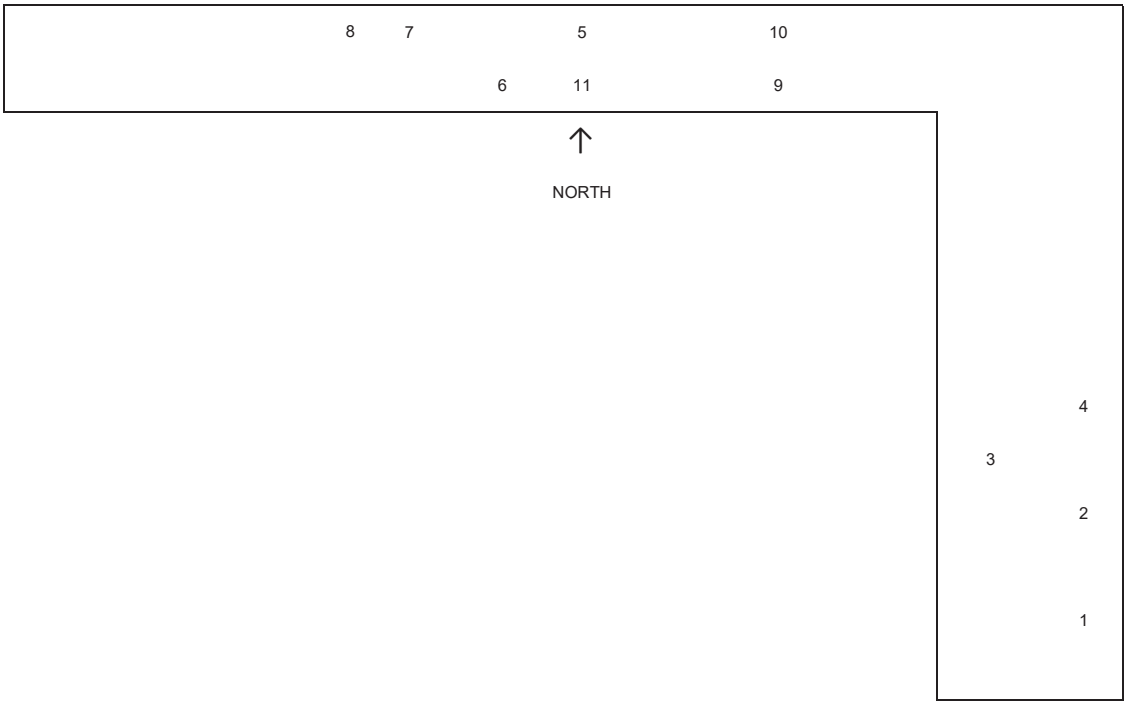
Material Description: Proctor #5 - 75mm Pitrun

Project Specific Location: Landfill Berm in Pit #1

Tested By: JDC
Specification: 95%
ASTM: D698 *(D698 Standard, D1557 Modified)*



Comments:

Reviewed by:

McElhanney Ltd.
1211 Ryan Road
Courtenay, BC

MOISTURE - DENSITY RELATIONSHIP REPORT

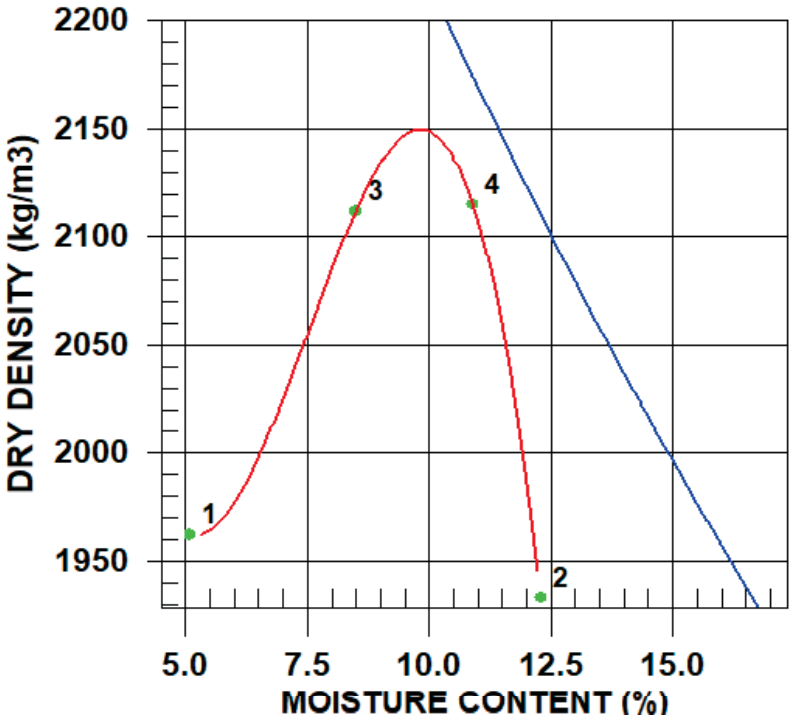
PROJECT NO. 2221-49292-08
CLIENT Upland Contracting Ltd.
C.C.

TO
Upland Contracting Ltd.
7295 Gold River Hwy.
Campbell River, BC
V9H 1P1

PROJECT Upland Misc 2020 — Campbell River
CONTRACTOR Campbell River

PROCTOR NO. 5 DATE TESTED 24-Mar-2021 DATE RECEIVED 24-Mar-2021 DATE SAMPLED 22-Mar-2021

INSITU MOISTURE	7.0 %	COMPACTION STANDARD	Standard Proctor, ASTM D698
SAMPLED BY	JC	COMPACTION PROCEDURE	C: 152.4mm Mold, Passing 19mm
TESTED BY	TI	RAMMER TYPE	Automatic
SUPPLIER	Upland Contracting Ltd.	PREPARATION	Moist
SOURCE	Upland Pit #1	OVERSIZE CORRECTION METHOD	ASTM 4718
MATERIAL IDENTIFICATION		RETAINED 19mm SCREEN	20.0 %
MAJOR COMPONENT	PIT RUN	OVERSIZE SPECIFIC GRAVITY	2.85
SIZE	75MM	TOTAL NUMBER OF TRIALS	4
DESCRIPTION			
ROCK TYPE			



TRIAL NUMBER	WET DENSITY (kg/m3)	DRY DENSITY (kg/m3)	MOISTURE CONTENT (%)
1	2062	1962	5.1
2	2171	1933	12.3
3	2291	2112	8.5
4	2346	2115	10.9

ZERO AIR VOIDS CURVE FOR ESTIMATED SPECIFIC GRAVITY OF 2.85	MAXIMUM DRY DENSITY (kg/m3)	OPTIMUM MOISTURE CONTENT (%)
CALCULATED	2150	10.0
OVERSIZE CORRECTED	2260	8.0

COMMENTS
Lab ID: 21-086
Corresponds With: Sieve #26

 29-Mar-2021 McElhanney Ltd.

Reviewed By:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

McElhanney Ltd.
1211 Ryan Road
Courtenay, BC

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

PROJECT NO. 2221-49292-08
CLIENT Upland Contracting Ltd.
C.C.

TO
Upland Contracting Ltd.
7295 Gold River Hwy.
Campbell River, BC
V9H 1P1

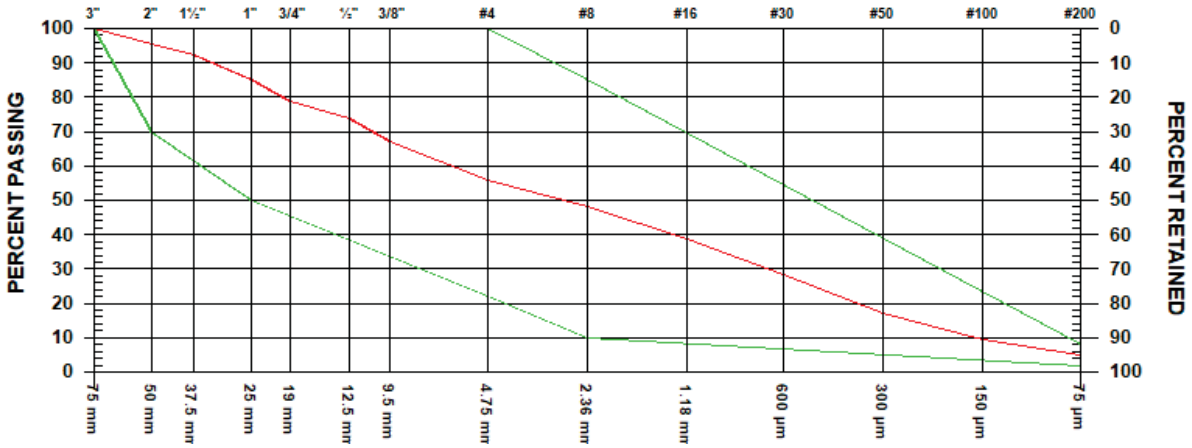
PROJECT Upland Misc 2020 — Campbell River

CONTRACTOR Campbell River

SIEVE TEST NO. 26 DATE RECEIVED 24-Mar-2021 DATE TESTED 24-Mar-2021 DATE SAMPLED 22-Mar-2021

SUPPLIER Upland Contracting Ltd.
SOURCE Upland Pit #1
SPECIFICATION MMCD 2.3.1 Pit Run Gravel
MATERIAL TYPE Pit Run

SAMPLED BY JC
TESTED BY TI
TEST METHOD WASHED



GRAVEL SIZES			PERCENT PASSING	GRADATION LIMITS
3"	75	mm	100.0	100.0-100.0
2"	50	mm	95.7	70.0-100.0
1 1/2"	37.5	mm	92.3	
1"	25	mm	85.2	50.0-100.0
3/4"	19	mm	78.9	
1/2"	12.5	mm	73.7	
3/8"	9.5	mm	67.3	

SAND SIZES AND FINES			PERCENT PASSING	GRADATION LIMITS
No. 4	4.75	mm	56.1	22.0-100.0
No. 8	2.36	mm	48.0	10.0-85.0
No. 16	1.18	mm	38.7	
No. 30	600	µm	28.5	
No. 50	300	µm	17.2	
No. 100	150	µm	9.3	
No. 200	75	µm	5.0	2.0-8.0

MOISTURE CONTENT 7.0%

COMMENTS
Lab ID: 21-086
Corresponds With: Proctor #5

 29-Mar-2021 McElhanney Ltd. Reviewed By:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

McElhanney Ltd.
1211 Ryan Road
Courtenay, BC

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

PROJECT NO. 2221-49292-08
CLIENT Upland Contracting Ltd.
C.C.

TO
Upland Contracting Ltd.
7295 Gold River Hwy.
Campbell River, BC
V9H 1P1

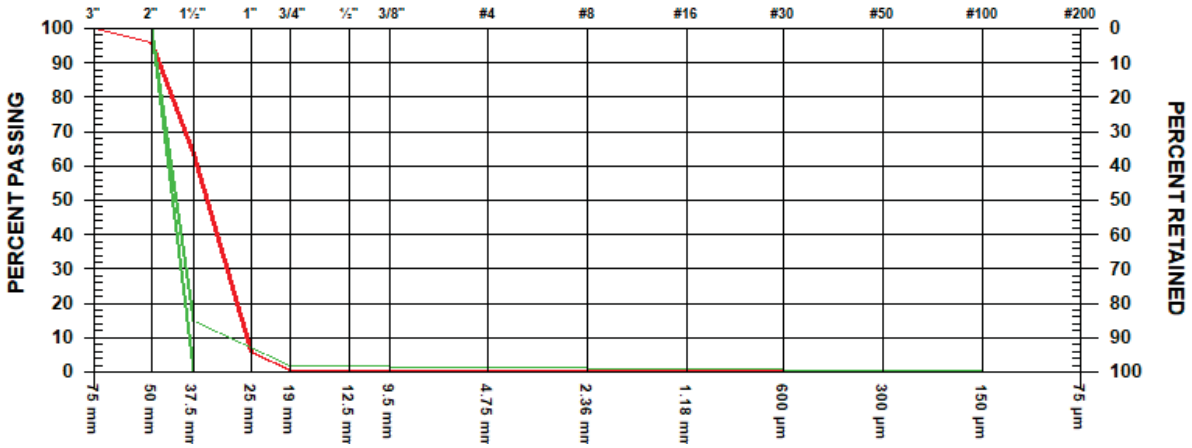
PROJECT Upland Misc 2020 — Campbell River

CONTRACTOR Campbell River

SIEVE TEST NO. 31 DATE RECEIVED 24-Sep-2021 DATE TESTED 27-Sep-2021 DATE SAMPLED 09-Sep-2021

SUPPLIER Upland Contracting Ltd.
SOURCE Upland Pit #1
SPECIFICATION Stone Drainage Layer
MATERIAL TYPE 1-2" Drain Rock

SAMPLED BY Client
TESTED BY JY
TEST METHOD WASHED



GRAVEL SIZES			PERCENT PASSING	GRADATION LIMITS
3"	75	mm	100.0	
2"	50	mm	96.0	100.0-100.0
1 1/2"	37.5	mm	63.6	0.0-15.0
1"	25	mm	5.8	
3/4"	19	mm	0.4	0.0-2.0
1/2"	12.5	mm	0.4	
3/8"	9.5	mm	0.4	

SAND SIZES AND FINES			PERCENT PASSING	GRADATION LIMITS
No. 4	4.75	mm	0.4	
No. 8	2.36	mm	0.4	
No. 16	1.18	mm	0.4	
No. 30	600	µm	0.4	
No. 50	300	µm	0.3	
No. 100	150	µm	0.2	
No. 200	75	µm	0.1	

MOISTURE CONTENT 4.3%

COMMENTS
Sample ID: #21-420A

 29-Sep-2021 McElhanney Ltd. Reviewed By:

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McElhanney Ltd.
1211 Ryan Road
Courtenay, BC

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

PROJECT NO. 2221-49292-08
CLIENT Upland Contracting Ltd.
C.C.

TO
Upland Contracting Ltd.
7295 Gold River Hwy.
Campbell River, BC
V9H 1P1

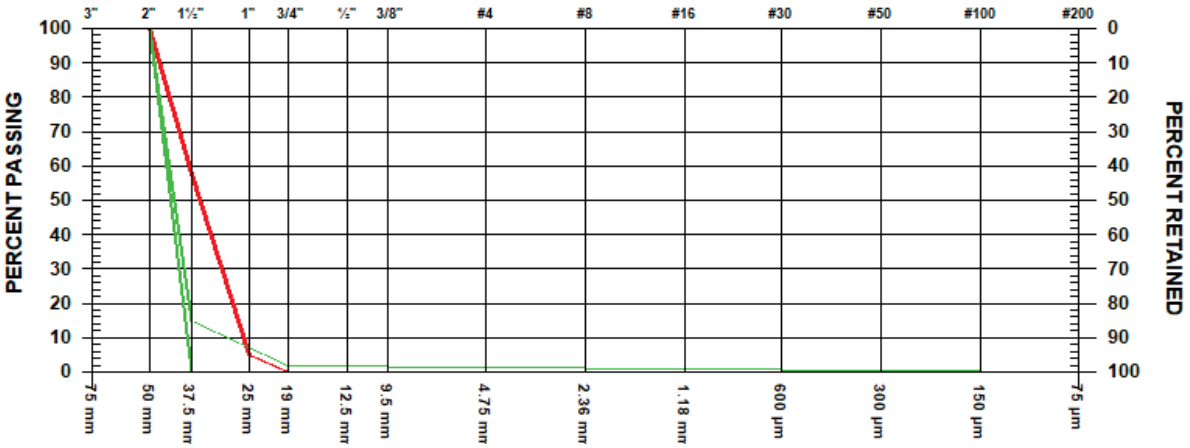
PROJECT Upland Misc 2020 — Campbell River

CONTRACTOR Campbell River

SIEVE TEST NO. 32 DATE RECEIVED 24-Sep-2021 DATE TESTED 27-Sep-2021 DATE SAMPLED 07-Sep-2021

SUPPLIER Upland Contracting Ltd.
SOURCE Upland Pit #1
SPECIFICATION Stone Drainage Layer
MATERIAL TYPE 1-2" Drain Rock

SAMPLED BY Client
TESTED BY JY
TEST METHOD WASHED



GRAVEL SIZES			PERCENT PASSING	GRADATION LIMITS
3"	75	mm	100.0	
2"	50	mm	100.0	100.0-100.0
1 1/2"	37.5	mm	57.5	0.0-15.0
1"	25	mm	4.8	
3/4"	19	mm	0.1	0.0-2.0
1/2"	12.5	mm	0.1	
3/8"	9.5	mm	0.1	

SAND SIZES AND FINES			PERCENT PASSING	GRADATION LIMITS
No. 4	4.75	mm	0.1	
No. 8	2.36	mm	0.1	
No. 16	1.18	mm	0.1	
No. 30	600	µm	0.1	
No. 50	300	µm	0.1	
No. 100	150	µm	0.1	
No. 200	75	µm	0.1	

MOISTURE CONTENT 1.7%

COMMENTS
Sample ID: #21-420B

 29-Sep-2021 McElhanney Ltd. Reviewed By:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.
Report System Software Registered to: McElhanney Consulting Services, Courtenay

McElhanney Ltd.
1211 Ryan Road
Courtenay, BC

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

PROJECT NO. 2221-49292-08
CLIENT Upland Contracting Ltd.
C.C.

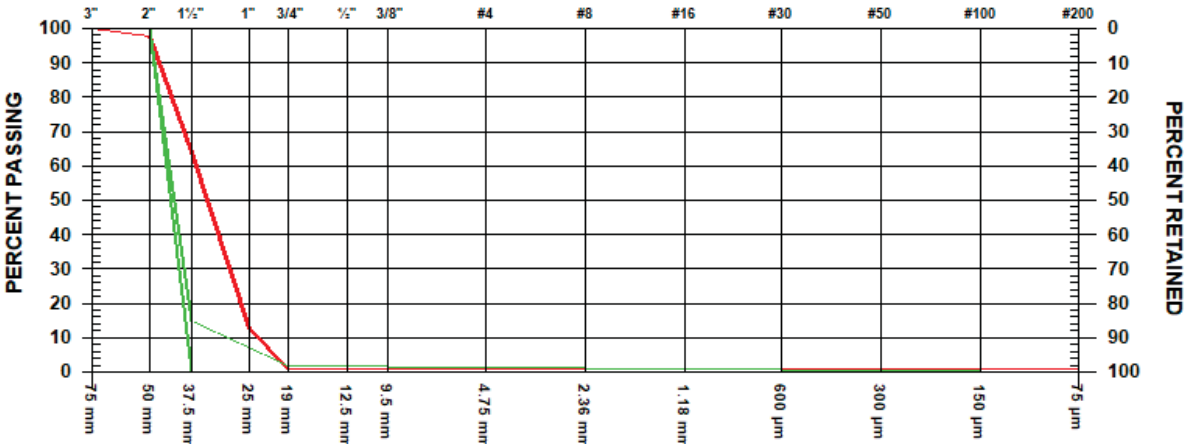
TO
Upland Contracting Ltd.
7295 Gold River Hwy.
Campbell River, BC
V9H 1P1

PROJECT Upland Misc 2020 — Campbell River
CONTRACTOR — Campbell River

SIEVE TEST NO. 33 DATE RECEIVED 24-Sep-2021 DATE TESTED 27-Sep-2021 DATE SAMPLED 07-Sep-2021

SUPPLIER Upland Contracting Ltd.
SOURCE Upland Pit #1
SPECIFICATION Stone Drainage Layer
MATERIAL TYPE 1-2" Drain Rock

SAMPLED BY Client
TESTED BY JY
TEST METHOD WASHED



GRAVEL SIZES			PERCENT PASSING	GRADATION LIMITS
3"	75	mm	100.0	
2"	50	mm	97.7	100.0-100.0
1 1/2"	37.5	mm	64.1	0.0-15.0
1"	25	mm	12.4	
3/4"	19	mm	1.0	0.0-2.0
1/2"	12.5	mm	1.0	
3/8"	9.5	mm	1.0	

SAND SIZES AND FINES			PERCENT PASSING	GRADATION LIMITS
No. 4	4.75	mm	1.0	
No. 8	2.36	mm	1.0	
No. 16	1.18	mm	0.9	
No. 30	600	µm	0.9	
No. 50	300	µm	0.9	
No. 100	150	µm	0.9	
No. 200	75	µm	0.9	

MOISTURE CONTENT 3.1%

COMMENTS
Sample ID: #21-420C

 29-Sep-2021 McElhanney Ltd. Reviewed By:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.
Report System Software Registered to: McElhanney Consulting Services, Courtenay

Appendix D

Product Data

Submittal Transmittal Form

DATE: May 3, 2021 GHD PROJECT NO.: 088877

PROJECT NAME: Northwin Landfill Phase 1 East CONTRACT NO.:

CONTRACTOR: Upland Contracting Ltd.

Certification By Contractor:

I hereby represent that I have satisfied CONTRACTOR's obligations under the Contract Documents including but not limited to review and approval, verification of products required, field dimensions, adjacent construction work, and coordination of information with respect to CONTRACTOR's review and approval of that submittal.

Contractor's Signature or Stamp

Contractor Submittal No.: 001 -1

GHD Submittal No.: 001 -1

Spec Section No./Drawing No.:

Page No.	Item No.	Description
		Bentomat DN (Geosythetic clay liner) SKAPS W13 (Woven Geotextile) SKAPS GE200 (Non-woven Geotextile) Interdrain GM (Drainage Geocomposite) Alvatech (Geomembrane)

Submittal Type:

- ☐ A - Test Results and/or Certificates
- ☒ B - Manufacturer's Literature or Data
- ☐ C - Shop Drawings
- ☐ D - Operation & Maintenance Instructions
- ☐ E - Samples
- ☐ F - Alternative Product Supporting Data
- ☐ G - Administrative (Schedules, etc.)

Notes: **Bolded** text show updates from Submittal 001.

Review Comments:

- Bentomat DN
  - Peel strength Spec: 2100 N/m, Sumbittal: 610 N/m
  - **Based on manufacture provided information and supported by GRI-GCL3-Spec SI (attached) Bentomat DN is accepted**
- Skaps W315
  - Puncture strength: Spec ASTM D4833, Submittal ASTM 6241
  - **ASTM 6241 acceptable for testing puncture strength of geotextile**
- Skaps GE200
  - Puncture strength Spec: 2420 N , Submittal 1.99 kN
  - **Puncture strength was reviewed and found to be acceptable**
  - Puncture strength Spec: ASTM D4833, Submittal ASTM 6241
  - **ASTM D6241 is acceptable for testing puncture strength of geotextile**
- Alvatech
  - Tensile and elongation strength Spec test method: ASTM D638, Submittal ASTM D 6693 **Acceptable test method supported by GRI-HDPE-Spec (attached)**
  - Carbon black content: Spec test method: ASTM D1603, Submittal ASTM 4218 **Acceptable test method supported by GRI-HDPE-Spec (attached)**
  - Asperity height: GRI test method GM12, Submittal ASTM D7466 **Acceptable test method supported by GRI-HDPE-Spec (attached)**

REVIEWED BY:

REVIEWED BY: David Barbour

SUBMITTAL REVIEW

GHD Submittal No. **001-1**

Contractor Submittal No.

Contract No.

ENGINEER's review is for the sole purpose of ascertaining conformance with general design concepts expressed in the Contract Documents and in no way constitutes approval of the detail design inherent in CONTRACTOR's Submittal responsibility for which remains solely with CONTRACTOR submitting same. Review does not authorize changes to Contract Documents.

- [x] Reviewed
- [ ] Reviewed as Noted
- [ ] Revise and Resubmit
- [ ] Not Subject to Review
- [ ] Other

Name: **David Barbour**

Signed: D Barbour

Date: **May 3, 2021**

BENTOMAT® DN CERTIFIED PROPERTIES

CETCO® Bentomat® DN is a reinforced geosynthetic clay liner (GCL) consisting of a layer of sodium bentonite between two polypropylene nonwoven geotextiles, which are needle-punched together.

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY	CERTIFIED VALUES
Nonwoven Base Geotextile Mass/Area[1]	ASTM D5261	200,000 ft^2 (20,000 m^2)	6.0 oz/yd^2 (203 g/m^2) min.
Nonwoven Cap Geotextile Mass/Area[1]	ASTM D5261	200,000 ft^2 (20,000 m^2)	6.0 oz/yd^2 (203 g/m^2) min.
Bentonite Moisture Content[2]	ASTM D2216	1 per 50 tonnes	12% max.
Bentonite Swell Index[2]	ASTM D5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss[2]	ASTM D5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area[3]	ASTM D5993	40,000 ft^2 (4,000 m^2)	0.75 lb/ft^2 (3.7 kg/m^2) min.
Total Mass/Area[3]	ASTM D5993	40,000 ft^2 (4,000 m^2)	0.83 lb/ft^2 (4.1 kg/m^2) min.
GCL Moisture Content	ASTM D5993	40,000 ft^2 (4,000 m^2)	35% max.
GCL Grab Strength[4]	ASTM D6768	200,000 ft^2 (20,000 m^2)	50 lbs/in (8.8 kN/m) min.
GCL Peel Strength	ASTM D6496	40,000 ft^2 (4,000 m^2)	3.5 lbs/in (610 N/m) min.
GCL Hydraulic Conductivity[5]	ASTM D5887	250,000 ft^2 (25,000 m^2)	5×10^{-11} m/s max.
GCL Index Flux[5]	ASTM D5887	250,000 ft^2 (25,000 m^2)	1×10^{-8} $m^3/m^2/s$ max.
GCL Hydrated Internal Shear Strength[6]	ASTM D6243	1,000,000 ft^2 (100,000 m^2)	500 psf (24 kPa) typ.@ 200 psf (9.6 kPa)

Notes:

[1] Geotextile property tests performed on the geotextile components before they are incorporated into the finished GCL product.

[2] Bentonite property tests performed before the bentonite is incorporated into the finished GCL product.

[3] Reported at 0% moisture content.

[4] All tensile strength testing is performed in the machine direction using ASTM D6768.

[5] Index flux and hydraulic conductivity testing with deaired distilled/deionized water at 80 psi (550 kPa) cell pressure, 77 psi (530 kPa) headwater pressure and 75 psi (515 kPa) tailwater pressure.

[6] Peak values measured at 200 psf (9.6 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

TR-401-BDN-3.5lb/in-D5889/GRI-GCL3
05/2018

www.CETCO.com | contact@cetco.com

IMPORTANT: The information contained herein supersedes all previous printed versions, and is believed to be accurate and reliable. For the most up-to-date information, please contact CETCO sales team. CETCO accepts no responsibility for the results obtained through application of this product. CETCO reserves the right to update information without notice.

MINERALS TECHNOLOGIES CETCO®

Table 1(a) – Specification for Geosynthetic Clay Liners (GCLs)

Property	ASTM Test Method	Reinforced GCL			Non-Reinforced GCL			Testing Frequency
		GT-Related	GT Polymer Coated	GM-GF Related	GT-Related	GT Polymer Coated	GM-GF Related	
Clay (as received)								
swell index (ml/2g)	D5890	24	24	24	24	24	24	50 tonnes
fluid loss (ml)(1)	D5891	18	18	18	18	18	18	50 tonnes
Geotextiles (as received)								
cap fabric (nonwoven) - mass/unit area (g/m^2)(2)	D5261	200	200	200	100	100	n/a/100	20,000 m^2
cap fabric -(woven) - mass/unit area (g/m^2)	D5261	100	100	100	100	100	100	20,000 m^2
carrier fabric (nonwoven composite) - mass/(g/m^2)(2)	D5261	200	200	200	100	100	n/a/100	20,000 m^2
carrier fabric (woven) - mass/unit area (g/m^2)	D5261	100	100	100	-	-	-	20,000 m^2
coating - mass/unit area (g/m^2)(3)	D5261	n/a	200	n/a	n/a	200	n/a	4,000 m^2
Geomembrane/Geofilm (as received)								
thickness(4) (mm)	D5199/D5994	n/a	n/a	0.40/0.50/0.10	n/a	n/a	0.40/0.75/0.10	20,000 m^2
density (g/cc)	D1505/D792	n/a	n/a	0.92	n/a	n/a	0.92	20,000 m^2
break tensile strength, MD&XMD (kN/m)	D6693	n/a	n/a	n/a	n/a	n/a	6.0	20,000 m^2
break tensile strength, MD (kN/m)	D882	n/a	n/a	2.5	n/a	n/a	2.5	20,000 m^2
GCL (as manufactured)								
mass of GCL (g/m^2)(5)	D5993	4000	4050	4100	4000	4050	4100	4,000 m^2
mass of bentonite (g/m^2)(5)	D5993	3700	3700	3700	3700	3700	3700	4,000 m^2
moisture content(1) (%)	D5993	35	35	35	35	35	35	4,000 m^2
tensile str., MD (kN/m)	D6768	4.0	4.0	4.0	4.0	4.0	4.0	20,000 m^2
peel strength (N/m)	D6496	360	360	360	n/a	n/a	n/a	4,000 m^2
permeability(1) (m/sec), "or"	D5887	5×10^{-11}	n/a	n/a	5×10^{-11}	n/a	n/a	25,000 m^2
flux(1) (m^3/sec-m^2),	D5887	1×10^{-8}	n/a	n/a	1×10^{-8}	n/a	n/a	25,000 m^2
GCL permeability(1),(6),(7),(8) ($m^3/m^2/s$) (max. at 35 kPa)	D6766	1×10^{-7}	n/a	n/a	1×10^{-7}	n/a	n/a	yearly
Component Durability								
geotextile and reinforcing yarns (9) (% strength retained)	See § 5.6.2	65	65	n/a	65	65	n/a	yearly
geomembrane	See § 5.6.3	n/a	n/a	GM Spec(10)	n/a	n/a	GM Spec(10)	yearly
geofilm/polymer treated(9) (% strength retained)	See § 5.6.4	n/a	85	80	n/a	85	80	yearly

n/a = not applicable with respect to this property

(1) These values are maximum (all others are minimum).

(2) For both cap and carrier fabrics for nonwoven reinforced GCLs; one, or the other, must contain a scrim component of mass ≥ 100 g/m^2 for dimensional stability. This only applies to GM/GCL composites which are exposed to the atmosphere for several months or longer so as to mitigate panel separation.

(3) Calculated value obtained from difference of coated fabric to as-received fabric.

(4) First value is for smooth geomembrane; second for textured geomembrane; third for geofilm.

(5) Mass of the GCL and bentonite is measured after oven drying per the stated test method.

(6) Value represents GCL permeability after permeation with a 0.05 M calcium chloride solution; for termination criterion see § 5.6.1.

(7) The specimen is saturated with DI water until steady flow is obtained. $CaCL_2$ saturation at 0.05 M added after, minimum flow conditions exist as per the standard requirement.

(8) Test should be run on the pure bentonite only. Not on polymer modified bentonites.

(9) Value represents the minimum percent strength retained from the as-manufactured value after oven aging at 60°C for 50 days tested per ASTM D5035.

(10) Durability criteria should follow the appropriate specification for the geomembrane type used; i.e., GRI GM-13 for HDPE, GRI GM-17 for LLDPE or GRI GM-18 for fPP.

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Geotextile Product Description Sheet

SKAPS W315

SKAPS woven geotextile fabrics are woven polypropylene materials offering optimum performance when used in stabilization applications. Produced from first quality raw materials, they provide the perfect balance of strength and separation in styles capable of functioning exceptionally well in a wide range of performance requirements. Unless indicated below, all listed properties are Minimum Average Roll Values:

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight	ASTM D 5261	oz/sy (g/m^2)	6.3 (214)
Grab Tensile	ASTM D 4632	lbs (kN)	315 (1.40)
Grab Elongation	ASTM D 4632	%	15
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	120 (.533)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	1000 (4.45)
Permittivity*	ASTM D 4491	sec^{-1}	0.05
Water Flow*	ASTM D 4491	gpm/sf (l/min/m^2)	4 (163)
AOS*	ASTM D 4751	US Sieve (mm)	40 (.425)
UV Resistance	ASTM D 4355	%/hrs	70/500

* At the time of manufacturing. Handling, storage, and shipping may change these properties.

PACKAGING	
Roll Dimensions (W x L) – ft	12.5 x 360 / 17.5 x 258
Square Yards Per Roll	500
Estimated Roll Weight - lbs	210

This information is provided for reference purposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information.

SKAPS Industries,
316 S. Holland Dr., Pendergrass, GA 30567,
Phone: (706)-693-3440, Fax (706)-693-3450,
www.skaps.com

Made in U.S.A.

SKAPS GE-200 is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. SKAPS GE-200 resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13.

DOWNLOAD DATA SHEET

SKAPS GE-200 conforms to the physical property values listed below:

Property	Method	English (MARV^2)	Metric (MARV^2)
Weight	ASTM D 5261	20 oz/yd^2	675 g/m^2
Grab Tensile Strength	ASTM D 4632	450 lbs	1.99 kN
Grab Elongation	ASTM D 4632	50%	50%
Trapezoid Tear Strength	ASTM D 4533	125 lbs	0.55 kN
CBR Puncture Resistance	ASTM D 6241	1437 lbs	1.67 kN
UV Resistance	ASTM D 4355	70%/500 hrs.	70%/500 hrs.

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INTERDRAIN GM & GMG 30.8

Drainage Geocomposite

High-density polyethylene (HDPE) geonet with one or two polypropylene (PP) geotextiles heat laminated, respectively. The geonet is made with 2 overcrossed strands, whose geometry creates channels with a high flow capacity, also under high pressures and at very low gradients.

FUNCTIONS:
DRAINAGE, FILTRATION, SEPARATION and PROTECTION.

MAIN USES:
Landfill cappings, new landfills, water reservoirs, horizontal drainage in embankments and platforms of roads, railways, trams and other trafficked areas, retaining structures, bridges, foundations, basements, canals, cut-and-cover tunnels, tunnels and other underground structures, gardens and sport fields.

Properties	Values	Units	Qualifiers	Standards
Geonet [1]				
Polymer		High-density polyethylene (HDPE)		
Carbon black	2	%	Min	ASTM D4218
Density	0,94	g / cm³	Min	ASTM D1505
Thickness	300 (7,6)	mil (mm)	MAV	ASTM D5199
Transmissivity, MD	8×10^{-3}	m² / s [2]	MARV	ASTM D4716 [3]
Tensile strength, MD	75 (13,1)	lb / in (kN / m)	Min	ASTM D7179
Geotextile [1]				
Polymer		Polypropylene (PP)		
Mass per unit area	8 (270)	oz / yd² (g / m²)	MARV	ASTM D5261
CBR Puncture	600 (2.670)	lb (N)	MARV	ASTM D6241
AOS	80 (180)	US Sieve (µm)	MaxARV	ASTM D4751
Grab strength	225 (1.000)	lb (N)	MARV	ASTM D4632
Grab elongation	50	%	MARV	ASTM D4632
Tear strength	90 (400)	lb (N)	MARV	ASTM D4533
Permeability	100 (4.074)	gal / ft²·min (l / m²·min)	MARV	ASTM D4491
Permittivity	1,26	s^{-1}	MARV	ASTM D4491
UV resistance	70	% ret. 500h	MARV	ASTM D4355
Drainage geocomposite				
Ply adhesion, MD	1 (178)	lb / in (g / cm)	Min	ASTM D7005
Transmissivity, MD (SS)	3×10^{-3}	m² / s [2]	MARV	ASTM D4716 [3]
Transmissivity, MD (DS)	9×10^{-4}	m² / s [2]	MARV	ASTM D4716 [3]
Remarks				
- Standard roll format is 12,5 feet (3,8 meters) wide.				
- Has a geotextile overlap at one side, which eases the installation and prevents soil intrusion.				
- Has to be covered within 14 days after installation.				

[1] Geonet and geotextile listed properties are prior to lamination
[2] 10^{-3} m² / s = l / m·s
[3] Transmissivity measured under an hydraulic gradient of 0.1, normal load of 10,000 psf (480 kPa), water at 70 °F (21 °C) between HDPE plates (H/H) for 15 minutes

MD : Machine Direction (longitudinal)
SS : Single-Sided Geocomposite
DS : Double-Sided Geocomposite
MARV : Minimum Average Roll Value
MAV : Minimum Average Value
Min : Minimum Value
MAX : Maximum Value
MaxARV : Maximum Average Roll Value

CE Certificate of conformity
0099/CPR/A42/0124
0099/CPR/A42/0127

AENOR Gestión Ambiental
GA-1998/0007

AENOR Empresa Registrada
ER-0061/1994

January 2020

These specifications are based on our present state of knowledge.
INTERMAS declines any responsibility due to their use in projects or civil works and hands them for informative purposes only.

ALVATECH FIX
High-Density Polyethylene Waterproofing Geomembrane

ALVATECH FIX is manufactured by SOTRAFA (Almería – Spain), a company of the Armando Alvarez Group.

ALVATECH FIX is a High-Density Polyethylene liner, structured on one (FIX 1F) or both sides (FIX 2F), available in 7.5 m and manufactured with the latest cast system technology.

SOTRAFA certifies that HDPE Geomembrane Alvatech FIX, satisfactorily meets Standard GRI GM-13.

PROPERTIES	UNIT	GEOMEMBRANE ALVATECH FIX 1F – 2F			Test Method
		Geo. 1.5	Geo. 2.0	Geo. 2.5	
Thickness (minimum average)	mm	**1.50** (±5%)	**2.00** (±5%)	**2.50** (±5%)	ASTM D 5994
• Lowest individual for 8 out of 10 values		-10%	-10%	-10%	
• Lowest individual for any of the 10 values		-15%	-15%	-15%	
Asperity Height (2)	mm	**≥ 0.80** (≥ 0,40)			ASTM D7466
Density with Carbon Black	g/cm^3	**≥ 0.940**			ASTM D 1505
Yield Strength (1)	kN/m	**24** (≥ 22)	**32** (≥ 29)	**40** (≥ 37)	ASTM D 6693 Type IV
Break Strength (1)	kN/m	**19** (≥ 16)	**26** (≥ 21)	**32** (≥ 26)	
Yield Elongation (1)	%	**13** (≥ 12)	**13** (≥ 12)	**13** (≥12)	
Break Elongation (1)	%	**150** (≥ 100)	**200** (≥ 100)	**200** (≥ 100)	
Tear Resistance (1)	N	**200** (≥ 187)	**270** (≥ 249)	**335** (≥ 311)	ASTM D 1004
Puncture Resistance (2)	N	**450** (≥400)	**600** (≥534)	**750** (≥667)	ASTM D 4833
Stress Crack Resistance (SP-NCTL) (3)	h	**≥ 500**			ASTM D 5397
Carbon Black					
Carbon Black Content	%	**2 - 3**			ASTM D 4218
Carbon Black Dispersion	Category	**1 - 2**			ASTM D 5596
Oxidative Induction Time (4)					
Standard OIT	min	**≥ 100**			ASTM D 3895
--- or ---					
HPOIT		**≥ 400**			ASTM D 5885
OVEN AGEING AT 85 º C (4)					ASTM D 5721
Standard OIT - % Retained after 90 days	% retained	**≥ 55**			ASTM D 3895
--- or ---					
HPOIT - % Retained after 90 days		**≥ 80**			ASTN D 5885
U.V. RESISTANCE	% retained				ASTM D7238
High Pressure OIT - % Retained after 1600hours		**≥ 50**			ASTM D5885

(1) Both directions (machine direction and cross machine direction) (2) Both sides. (3) SP-NTCL must be evaluated in the smooth area.

(4) Sotrafa reserves the right to evaluate the antioxidant content with one or any other oxidation induction method.

All the values are nominal. Those values between parentheses are the minimum ones required by the norm GM-13.

This Information is provided for reference purposes only. The values are not guaranteed. SOTRAFA is not responsible for improper use of this information or for the final use of the product if that use is not the normal application of the geomembrane. This information is subject to change without prior notice. Please contact Sotrafa for any updated information.

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ENGLISH UNITS

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) - mils	D 5994	nom. -5%	nom. -5%	nom. -5%	nom. -5%	nom. -5%	nom. -5%	nom. -5%	per roll
• lowest individual for 8 out of 10 values - %		-10	-10	-10	-10	-10	-10	-10	
• lowest individual for any of the 10 values - %		-15	-15	-15	-15	-15	-15	-15	
Asperity Height mils (min. ave.) - mils	D 7466	16	16	16	16	16	16	16	every 2nd roll *(1)*
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb
Tensile Properties (min. ave.) *(2)*	D 6693 Type IV								20,000 lb
• yield strength - lb/in.		63	84	105	126	168	210	252	
• break strength - lb/in.		45	60	75	90	120	150	180	
• yield elongation - %		12	12	12	12	12	12	12	
• break elongation - %		100	100	100	100	100	100	100	
Tear Resistance (min. ave.) - lb	D 1004	21	28	35	42	56	70	84	45,000 lb
Puncture Resistance (min. ave.) - lb	D 4833	45	60	75	90	120	150	180	45,000 lb
Stress Crack Resistance *(3)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM10
Carbon Black Content (range) - %	D 4218 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 lb
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(6)*									200,000 lb
(a) Standard OIT - min.	D 8117	100	100	100	100	100	100	100	
— or —									
(b) High Pressure OIT - min.	D 5885	400	400	400	400	400	400	400	
Oven Aging at 85°C *(6), (7)*	D 5721								
(a) Standard OIT (min. ave.) - % retained after 90 days	D 8117	55	55	55	55	55	55	55	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	80	80	80	80	80	80	80	
UV Resistance *(8)*	D 7238								
(a) Standard OIT (min. ave.)	D 8117	N.R. *(9)*	N.R. *(9)*	N.R. *(9)*	N.R. *(9)*	N.R. *(9)*	N.R. *(9)*	N.R. *(9)*	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	D 5885	50	50	50	50	50	50	50	

(1) Alternate the measurement side for double sided textured sheet

(2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches

(3) SP-NCTL per ASTM D5397 Appendix, is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

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Revision 16: March 17, 2021
Revision schedule on pg. 11

GRI - GM13 Standard Specification*

Standard Specification for

"Test Methods, Test Properties and Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes" SM

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers high density polyethylene (HDPE) geomembranes with a formulated sheet density of 0.940 g/ml, or higher, in the thickness range of 0.75 mm (30 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good quality and performance of HDPE geomembranes in general applications, but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive

*This GRI standard specification is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version and it is kept current on the Institute's Website <<geosynthetic-institute.org>>.

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values for test indicated, may be necessary under conditions of a particular application.

Note 2: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

2. Referenced Documents

2.1 ASTM Standards

D 792 Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004 Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505 Test Method for Density of Plastics by the Density-Gradient Technique
D 1603 Test Method for Carbon Black in Olefin Plastics
D 4218 Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5397 Procedure to Perform a Single Point Notched Constant Tensile Load – (SP-NCTL) Test: Appendix
D 5596 Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5721 Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5885 Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
D 5994 Test Method for Measuring the Core Thickness of Textured Geomembranes
D 6370 Standard Test Method for Rubber-Compositional Analysis by Thermogravimetry (TGA)
D 6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
D 7238 Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
D 7466 Test Method for Measuring the Asperity Height of Textured Geomembranes
D 8117 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by Differential Scanning Calorimetry

2.2 GRI Standards

GM10 Specification for the Stress Crack Resistance of Geomembrane Sheet

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications.
ref. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For HDPE polyethylene geomembranes, a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

Nominal - Representative value of a measurable property determined under a set of conditions, by which a product may be described. Abbreviated as nom. in Tables 1 and 2.

4. Material Classification and Formulation

4.1 This specification covers high density polyethylene geomembranes with a formulated sheet density of 0.940 g/ml, or higher. Density can be measured by ASTM D1505 or ASTM D792. If the latter, Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.932 g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar HDPE as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth HDPE geomembranes and Table 2 is for single and double sided textured HDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

Note 3: The tensile strength properties in this specification were originally based on ASTM D 638 which uses a laboratory testing temperature of 23°C ± 2°C. Since ASTM Committee D35 on Geosynthetics adopted ASTM D 6693 (in place of D 638), this GRI Specification followed accordingly. The difference is that D 6693 uses a testing temperature of 21°C ± 2°C. The numeric values of strength and elongation were not changed in this specification. If a dispute arises in this regard, the original temperature of 23°C ± 2°C should be utilized for testing purposes.

Note 4: There are several tests often included in other HDPE specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693)
- Wide Width Tensile
- Water Vapor Transmission
- Water Absorption
- Ozone Resistance
- Modulus of Elasticity
- Hydrostatic Resistance
- Tensile Impact
- Field Seam Strength
- Multi-Axial Burst
- Various Toxicity Tests

Note 5: There are several tests which are included in this standard (that are not customarily required in other HDPE specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet (see Note 6)

Note 6: The minimum average value of asperity height does not represent an expected value of interface shear strength. Shear strength associated with geomembranes is both site-specific and product-specific and should be determined by direct shear testing using ASTM D5321/ASTM D6243 as prescribed. This testing should be included in the particular site's CQA conformance testing protocol for the geosynthetic materials involved, or formally waived by the Design Engineer, with concurrence from the Owner prior to the deployment of the geosynthetic materials.

Note 7: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Puncture Resistance
- Stress Crack Resistance
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The properties of the HDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

Note 8: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

ENGLISH UNITS

Table 1(a) – High Density Polyethylene (HDPE) Geomembrane -Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness (min. ave.) - mils • lowest individual of 10 values - %	D5199	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	per roll
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb
Tensile Properties *(1)* (min. ave.) • yield strength - lb/in. • break strength - lb/in. • yield elongation - % • break elongation - %	D 6693 Type IV	 63 114 12 700	 84 152 12 700	 105 190 12 700	 126 228 12 700	 168 304 12 700	 210 380 12 700	 252 456 12 700	20,000 lb
Tear Resistance (min. ave.) - lb	D 1004	21	28	35	42	56	70	84	45,000 lb
Puncture Resistance (min. ave.) - lb	D 4833	54	72	90	108	144	180	216	45,000 lb
Stress Crack Resistance *(2)* - hr.	D5397 (App.)	500	500	500	500	500	500	500	per GRI-GM10
Carbon Black Content (range) - %	D 4218 *(3)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 lb
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	200,000 lb
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 7238 D 8117 D 5885	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 in.

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC) UNITS

Table 1(b) – High Density Polyethylene (HPDE) Geomembrane - Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness - (min. ave.) - mm • lowest individual of 10 values - %	D5199	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	per roll
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	90,000 kg
Tensile Properties *(1)* (min. ave.) • yield strength - kN/m • break strength - kN/m • yield elongation - % • break elongation - %	D 6693 Type IV	 11 20 12 700	 15 27 12 700	 18 33 12 700	 22 40 12 700	 29 53 12 700	 37 67 12 700	 44 80 12 700	9,000 kg
Tear Resistance (min. ave.) - N	D 1004	93	125	156	187	249	311	374	20,000 kg
Puncture Resistance (min. ave.) - N	D 4833	240	320	400	480	640	800	960	20,000 kg
Stress Crack Resistance *(2)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM-10
Carbon Black Content (range) - %	D 4218 *(3)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	9,000 kg
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	90,000 kg
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 7238 D 8117 D 5885	 N. R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm
(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

ENGLISH UNITS

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) - mils • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	per roll
Asperity Height mils (min. ave.) - mils	D 7466	16	16	16	16	16	16	16	every 2nd roll *(1)*
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb
Tensile Properties (min. ave.) *(2)* • yield strength - lb/in. • break strength - lb/in. • yield elongation - % • break elongation - %	D 6693 Type IV	 63 45 12 100	 84 60 12 100	 105 75 12 100	 126 90 12 100	 168 120 12 100	 210 150 12 100	 252 180 12 100	20,000 lb
Tear Resistance (min. ave.) - lb	D 1004	21	28	35	42	56	70	84	45,000 lb
Puncture Resistance (min. ave.) - lb	D 4833	45	60	75	90	120	150	180	45,000 lb
Stress Crack Resistance *(3)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM10
Carbon Black Content (range) - %	D 4218 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 lb
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	200,000 lb
Oven Aging at 85°C *(6), (7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	D 7238 D 8117 D 5885	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	per each formulation

(1) Alternate the measurement side for double sided textured sheet

(2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches

(3) SP-NCTL per ASTM D5397 Appendix, is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 2(b) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness (min. ave.) - mm • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	per roll
Asperity Height mils (min. ave.) - mm	D 7466	0.40	0.40	0.40	0.40	0.40	0.40	0.40	every 2nd roll *(1)*
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	90,000 kg
Tensile Properties (min. ave.) *(2)* • yield strength - kN/m • break strength - kN/m • yield elongation - % • break elongation - %	D 6693 Type IV	 11 8 12 100	 15 10 12 100	 18 13 12 100	 22 16 12 100	 29 21 12 100	 37 26 12 100	 44 32 12 100	9,000 kg
Tear Resistance (min. ave.) - N	D 1004	93	125	156	187	249	311	374	20,000 kg
Puncture Resistance (min. ave.) - N	D 4833	200	267	333	400	534	667	800	20,000 kg
Stress Crack Resistance *(3)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM10
Carbon Black Content (range) - %	D 4218 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	9,000 kg
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	90,000 kg
Oven Aging at 85°C *(6), (7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	D 7238 D 8117 D 5885	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	per each formulation

(1) Alternate the measurement side for double sided textured sheet

(2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(3) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Adoption and Revision Schedule
for
HDPE Specification per GRI-GM13

"Test Methods, Test Properties, Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes"

Adopted:	June 17, 1997
Revision 1:	November 20, 1998; changed CB dispersion from allowing 2 views to be in Category 3 to requiring all 10 views to be in Category 1 or 2. Also reduced UV percent retained from 60% to 50%.
Revision 2:	April 29, 1999: added to Note 5 after the listing of Carbon Black Dispersion the following: "(In the viewing and subsequent quantitative interpretation of ASTM D5596 only near spherical agglomerates shall be included in the assessment)" and to Note (4) in the property tables.
Revision 3:	June 28, 2000: added a new Section 5.2 that the numeric table values are neither MARV or MaxARV. They are to be interpreted per the the designated test method.
Revision 4:	December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to "strength" and "elongation".
Revision 5:	May 15, 2003: Increased minimum acceptable stress crack resistance time from 200 hrs to 300 hrs.
Revision 6:	June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 2.
Revision 7:	February 20, 2006: Added Note 6 on Asperity Height clarification with respect to shear strength.
Revision 8:	Removed recommended warranty from specification.
Revision 9:	June 1, 2009: Replaced GRI-GM12 test for asperity height of textured geomembranes with ASTM D 7466.
Revision 10	April 11, 2011: Added alternative carbon black content test methods
Revision 11	December 13, 2012: Replaced GRI-GM11 with the equivalent ASTM D 7238.
Revision 12	November 14, 2014: Increased minimum acceptable stress crack resistance time from 300 to 500 hours. Also, increased asperity height of textured sheet from 10 to 16 mils (0.25 to 0.40 mm).
Revision 13	November 4, 2015: Removed Footnote (1) on asperity height from tables.
Revision 14	January 6, 2016: Removed Trouser Tear from Note 5.
Revision 15:	September 9, 2019: Editorial update to harmonize tables.
Revision 16:	March 17, 2021: Updated Standard OIT Test from ASTM D3895 to D8117

Submittal Transmittal Form

DATE: May 3, 2021

GHD PROJECT NO.: 088877

PROJECT NAME: Northwin Landfill Phase 1 East

CONTRACT NO.:

CONTRACTOR: Upland Contracting Ltd.

Certification By Contractor:

I hereby represent that I have satisfied CONTRACTOR's obligations under the Contract Documents including but not limited to review and approval, verification of products required, field dimensions, adjacent construction work, and coordination of information with respect to CONTRACTOR's review and approval of that submittal.

Contractor's Signature or Stamp

Contractor Submittal No.: 002

GHD Submittal No.: 002

Spec Section No./Drawing No.:

Page No.	Item No.	Description
		Perforated HDPE Pipe

Submittal Type:

- ☐ A - Test Results and/or Certificates
- ☒ B - Manufacturer's Literature or Data
- ☐ C - Shop Drawings
- ☐ D - Operation & Maintenance Instructions
- ☐ E - Samples
- ☐ F - Alternative Product Supporting Data
- ☐ G - Administrative (Schedules, etc.)

Notes:

Review Comments:

SUBMITTAL REVIEW

GHD Submittal No. **002**

Contractor Submittal No.

Contract No.

ENGINEER's review is for the sole purpose of ascertaining conformance with general design concepts expressed in the Contract Documents and in no way constitutes approval of the detail design inherent in CONTRACTOR's Submittal responsibility for which remains solely with CONTRACTOR submitting same. Review does not authorize changes to Contract Documents.

- [x] Reviewed
- [ ] Reviewed as Noted
- [ ] Revise and Resubmit
- [ ] Not Subject to Review
- [ ] Other

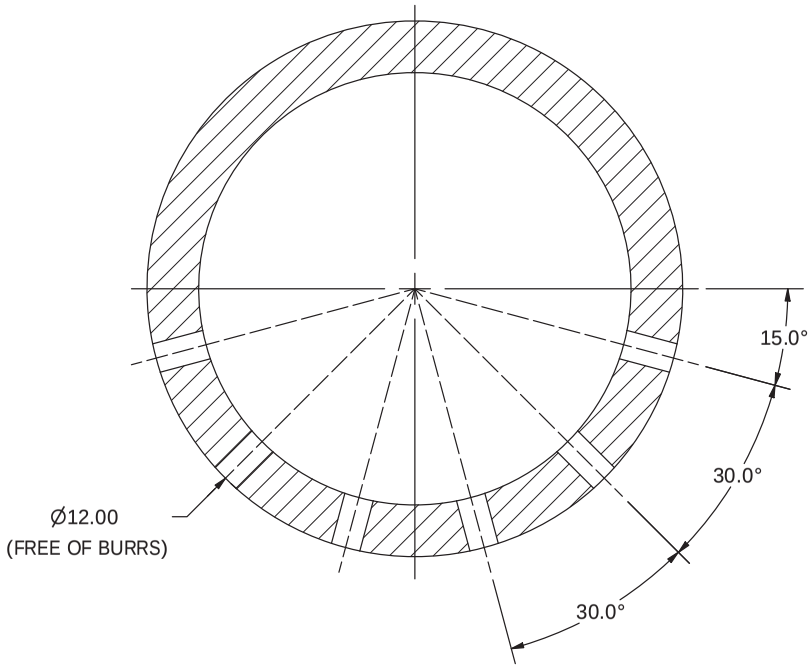
Name: **David Barbour**

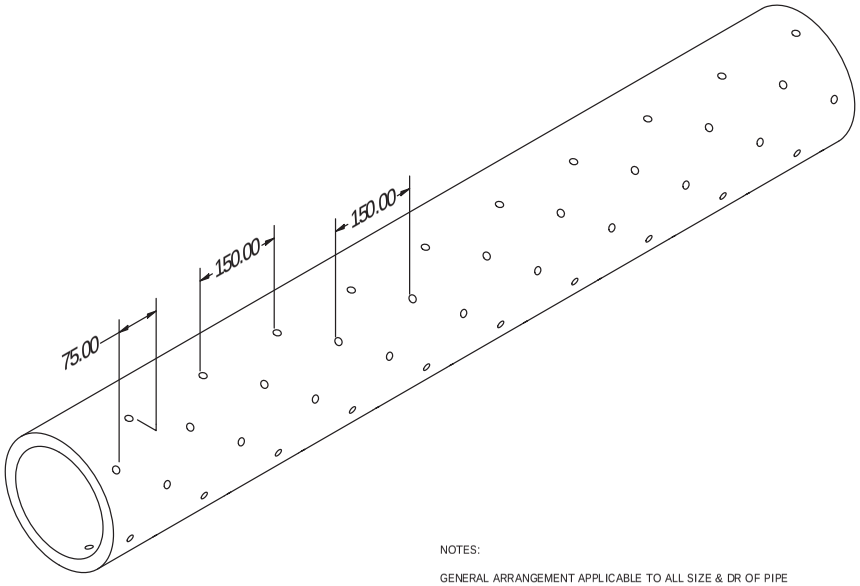
Signed: D Barbour

Date: **May 3, 2021**

REVIEWED BY:

REVIEWED BY: David Barbour





NOTES:

GENERAL ARRANGEMENT APPLICABLE TO ALL SIZE & DR OF PIPE

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED

SHIPPING:
PARTIALLY ASSEMBLED BEFORE SHIPMENT TO SITE. INSTALLATION ON SITE BY OTHERS

DISCLAIMER:
ALL DIMENSIONS APPROXIMATE, SUBJECT TO CHANGE WITHOUT NOTICE
ANGLE TOLERANCE IS ±2° @ 23°C
ALL OTHER DIMENSIONS TO ±25mm" @ 23°C
THIS DRAWING IS ONLY APPLICABLE IF A SIGNED COPY IS REFERENCED AT TIME OF ORDER
SUBJECT TO ICONIX WATERWORKS STANDARD TERMS AND CONDITION

ICONIX waterworks

		DESCRIPTION: Peferated HDPE Pipe General Arrangment
QUOTE#:	SO#:	PROJECT: Campbell River Land Fill
SCALE:NTS	SHEET 1 OF 1	
DRAWING NO:		REV: 0

THIS DRAWING IS THE PROPERTY OF ICONIX WATERWORKS, AND CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN EXPRESSLY AUTHORIZED BY ICONIX.

Submittal Transmittal Form

DATE: May 6, 2021

GHD PROJECT NO.: 088877

PROJECT NAME: Northwin Landfill Phase 1 East

CONTRACT NO.:

CONTRACTOR: Upland Contracting Ltd.

Certification By Contractor:

I hereby represent that I have satisfied CONTRACTOR's obligations under the Contract Documents including but not limited to review and approval, verification of products required, field dimensions, adjacent construction work, and coordination of information with respect to CONTRACTOR's review and approval of that submittal.

Contractor's Signature or Stamp

Contractor Submittal No.: 003

GHD Submittal No.: 003

Spec Section No./Drawing No.:

Page No.	Item No.	Description
		WovenSpec

Submittal Type:

- ☐ A - Test Results and/or Certificates
- ☒ B - Manufacturer's Literature or Data
- ☐ C - Shop Drawings
- ☐ D - Operation & Maintenance Instructions
- ☐ E - Samples
- ☐ F - Alternative Product Supporting Data
- ☐ G - Administrative (Schedules, etc.)

Notes:

Review Comments:

SUBMITTAL REVIEW

GHD Submittal No. **003**

Contractor Submittal No.

Contract No.

ENGINEER's review is for the sole purpose of ascertaining conformance with general design concepts expressed in the Contract Documents and in no way constitutes approval of the detail design inherent in CONTRACTOR's Submittal responsibility for which remains solely with CONTRACTOR submitting same. Review does not authorize changes to Contract Documents.

- [x] Reviewed
- [ ] Reviewed as Noted
- [ ] Revise and Resubmit
- [ ] Not Subject to Review
- [ ] Other

Name: **David Barbour**

Signed: D Barbour

Date: **May 6, 2021**

REVIEWED BY:

REVIEWED BY: David Barbour

US 800-277-8298
CAN 866-567-7112

Woven Geotextiles

1. Product Description
Standard woven slit-film polypropylene geotextiles, usually called "wovens" are an economical range of geotextiles that combine high strength with low cost. These materials are made by weaving pre-stressed polypropylene tapes in a simple weave pattern. The resulting fabric has a high strength to weight ratio. Slit-film wovens are primarily used in roadbuilding and embankment construction but can be used in most applications requiring the separation of one type of soil from another. Slit-film wovens help to speed construction with short term reinforcement of the base. Slit film wovens can also be used in sediment control products such as floating silt curtains and silt fence.

2. Technical Data
Materials information is on page 2.

3. Installation
General Installation: Place the roll of woven geotextile at the top of the slope/grade and roll down grade, over lap successive and adjacent rolls by 450mm minimum. Do not allow vehicles to drive directly on the geotextile. Geotextile should be stored such that it is protected from rain and direct sunlight. Geotexile Separation: Ensure subgrade is rolled flat and compacted to engineer's specifications with no sharp objects or protrusions. Install geotextile as per General Installation above.

4. Availability and Cost
Available from Layfield or distributors. Call
425-254-1075 Pacific time
780-453-6731 Mountain time, or
905-761-9123 Eastern time

5. Manufactured For
Layfield USA Corp.
Layfield Canada Ltd.

6. Warranty
Products sold will meet Layfield's published specifications at time of sale. Full warranty details are available from Layfield.

7. Maintenance
Once geotextiles and geogrids are installed and carefully backfilled they do not require ongoing maintenance.

8. Filing Systems
https://www.layfieldgroup.com/Geosynthetics/Geotext-Products/Woven-Geotextiles.aspx

9.

25 Oct. 2011	Woven Geotextiles - US Values[1]			
	ASTM	**LP 200**	**LP 250**	**LP 315**
Grab Tensile (lbs)	D4632	200	250	315
Elongation (%)	D4632	15	15	15
Trapezoid Tear (lbs)	D4533	75	90	120
CBR Puncture Strength (lbs)	D6241	700	900	1000
AOS (sieve size)	D4751	40	40	40
Permittivity (sec^{-1})	D4491	0.05	0.05	0.05
Weight (oz/yd^2) (Typical)	D5261	4.0	5.0	6.3
UV Resistance (500 hrs)	D4355	70	70	70
Roll Size (ft) Typical)		15 x 360 17.5 x 309	15 x 360 17.5 x 309	15 x 300 17.5 x 258
Roll Weight (lbs) (Typical)		205	215	220
Note[1] - The physical properties presented in the table above are Minimum Average Roll Values or otherwise indicated.				

10.

25 Oct 2011	Woven Geotextiles - Metric Values[1]			
	ASTM	**LP 200**	**LP 250**	**LP 315**
Grab Tensile (N)	D4632	889	1110	1400
Elongation (%)	D4632	15	15	15
Trapezoid Tear (N)	D4533	333	400	533
CBR Puncture Strength (N)	D6241	3120	4005	4450
AOS (Microns)	D4751	425	425	425
Permittivity (sec^{-1})	D4491	0.05	0.05	0.05
Weight (g/m^2) (Typical)	D5261	136	170	214
UV Resistance (500 hrs)	D4355	70	70	70
Roll Size (m) (Typical)		4.6 x 110 5.3 x 94	4.6 x 110 5.3 x 94	4.6 x 91 5.3 x 79
Roll Weight (kg) (Typical)		92	97.5	100
Note[1] - The physical properties provided in the table above are Minimum Average Roll Values or otherwise indicated.				

WE PROTECT
www.LayfieldConstructionProducts.com
customerservice@layfieldconstructionproducts.com

Appendix E

Geosynthetics QA/QC Information

Date: 2021-08-06

Mail To:
Roxy Hasior
GHD Services
138 East 7th Ave Suite 100
Vancouver , BC , V9T 1M6

Bill To:

GHD Services
11222680-7-1

e-mail:
roxanne.hasior@ghd.com david.barbour@ghd.com rosemarie.rocca@ghd.com

Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66011**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66011

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-1 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	143	138	149	146	148	**145**
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)	135	146	145	139	155	**144**
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)	194	197	188	189	189	**191**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2021-08-09

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138 East 7th Ave Suite 100
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11222680-7-1

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roxanne.hasior@ghd.com david.barbour@ghd.com rosemarie.rocca@ghd.com

Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66061**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66061

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-2 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	145	159	136	142	151	**147**
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	140	136	142	146	**140**
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)	194	194	197	202	199	**197**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Date: 2021-08-11

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Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66141**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66141

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-1 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	135	144	139	153	137	**142**
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	131	134	134	**132**
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)	200	194	191	191	197	**195**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DT-2 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	141	140	133	137	155	**141**
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)	161	137	158	147	150	**151**
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)	193	194	190	195	191	**193**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Date: 2021-08-12

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Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66171**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66171

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-3 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	136	142	141	136	129	**137**
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)	145	147	149	153	162	**151**
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)	190	192	183	183	184	**186**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DT-4 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	135	142	158	137	117	**138**
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)	130	133	126	120	126	**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)	185	185	181	179	181	**182**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2021-08-17

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Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66271**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66271

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-5 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	151	158	131	133	132	**141**
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)	152	146	140	143	142	**145**
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)	196	199	186	194	190	**193**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DT-6 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	140	148	127	127	114	**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	
Side: B						**Peel B**
Peel Strength (ppi)	148	135	144	149	153	**146**
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)	194	186	191	189	187	**189**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2021-08-18

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Bill To:

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11222680-7-1

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Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66309**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66309

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-7 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	140	140	147	162	140	**146**
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)	128	122	120	126	155	**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)	191	184	185	184	183	**185**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
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Date: 2021-08-23

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Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66389**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66389

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-8 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	129	131	135	127	133	**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	
Side: B						**Peel B**
Peel Strength (ppi)	154	147	152	154	156	**153**
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)	198	190	196	192	194	**194**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
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Date: 2021-08-26

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Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66469**
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,

Jarrett A. Nelson

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

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66469

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-12 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	142	138	148	137	119	**137**
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)	154	153	153	154	150	**153**
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)	176	169	167	167	166	**169**
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.

TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Date: 2021-08-27

Mail To:
Roxy Hasior
GHD Services
138 East 7th Ave Suite 100
Vancouver , BC , V9T 1M6

Bill To:

GHD Services
11222680-7-1

e-mail:
roxanne.hasior@ghd.com david.barbour@ghd.com rosemarie.rocca@ghd.com deacon.liddy@ghd.com

Dear Ms. Hasior,

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:	**Upland LF - Northwin LF Phase 1 East**
TRI Job Reference Number:	**66509**
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,

Jarrett A. Nelson

Jarret Nelson
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: Upland LF - Northwin LF Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 66509

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-13 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	159	133	154	158	158	**152**
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	145	122	143	150	**137**
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)	193	186	186	187	193	**189**
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.

TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

C.J. Cassidy
Consulting Inc.

NORTHWIN LANDFILL
CAMPBELL RIVER, B.C. – 2021
EFFLUENT POND AND LANDFILL CELL#1

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4. Landfill Cell #1 – Primary Liner
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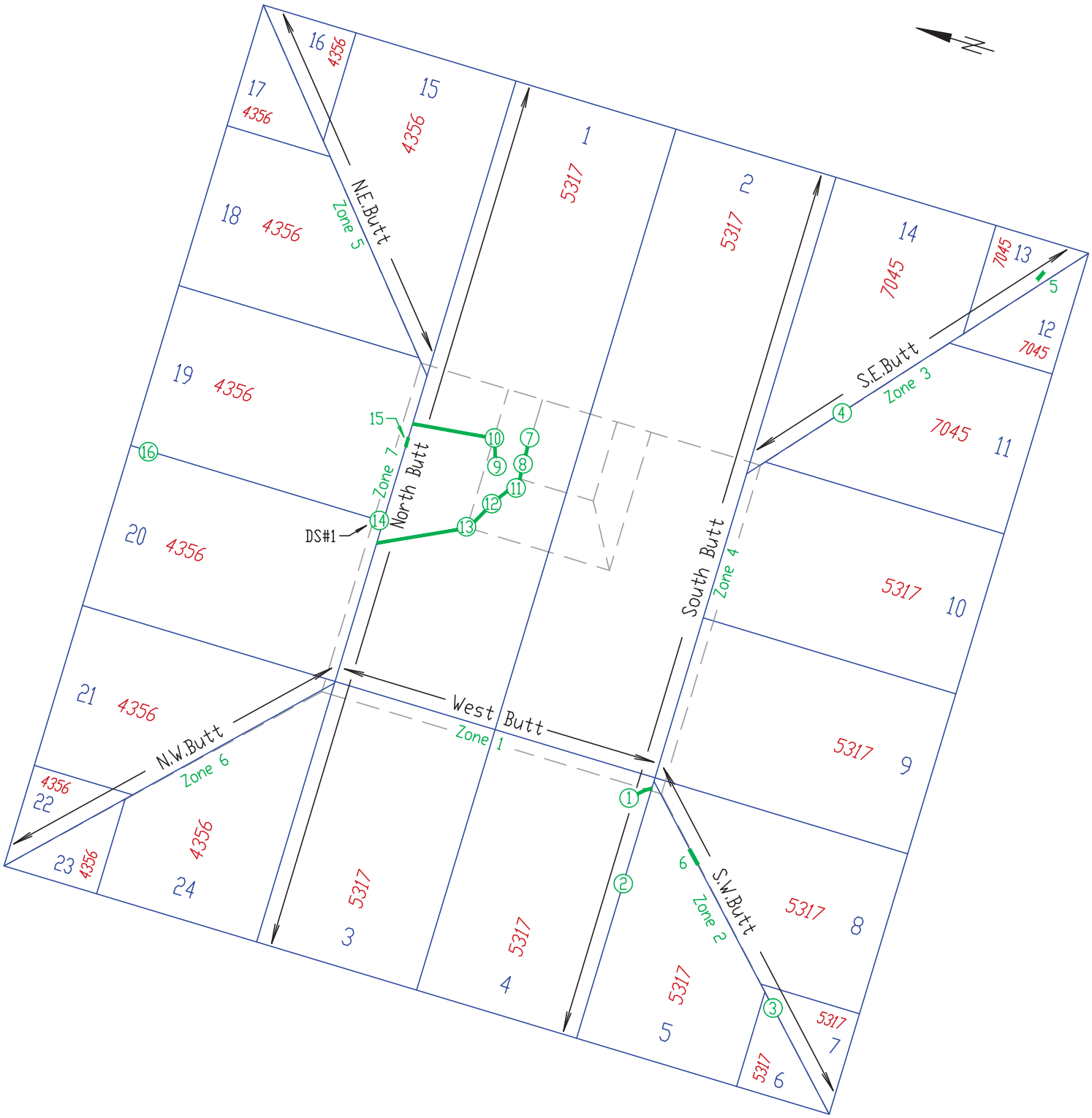
    b. Welder Qualifications
    c. Panel Placement Logs
    d. Non-Destructive Testing – Seamlogs
    e. Extrusion Weld Report
    f. Destructive Testing Report

EFFLUENT STORAGE POND

SECONDARY LINER



DATE: August 30 2021	Cassidy Consulting Inc.	NORTHWIN LANDFILL CAMPBELL RIVER, B.C. - 2021
SCALE: NTS		EFFLUENT STORAGE POND
FILE NAME: EffluentStoragePond-Secondary		Secondary Liner Representative Drawing
DRAWN BY: SSC		
CHECKED BY: CJC		

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, August 03, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:30	9	JC			860ºF		430	1	115	1	134	1	196	CC	
6:30	9	JC			860ºF		430	2	100	2	146	2	198	CC	
6:30	9	JC			860ºF		430	3	124	3	151	3	198	CC	
6:30	9	JC			860ºF		430	4	112	4	139	4	197	CC	
6:30	9	JC			860ºF		430	5	113	5	146	5	198	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, August 04, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:33	9	JC			860ºF		430ºF	1	118	1	123	1	187	CC	
6:33	9	JC			860ºF		430ºF	2	114	2	118	2	184	CC	
6:33	9	JC			860ºF		430ºF	3	135	3	132	3	184	CC	
6:33	9	JC			860ºF		430ºF	4	135	4	122	4	185	CC	
6:33	9	JC			860ºF		430ºF	5	110	5	128	5	186	CC	
8:00	X2	JC	500ºC	500ºC				1	96	1		1	154	CC	
8:00	X2	JC	500ºC	500ºC				2	92	2		2	154	CC	
8:00	X2	JC	500ºC	500ºC				3	87	3		3	159	CC	
8:00	X2	JC	500ºC	500ºC				4	87	4		4	166	CC	
8:00	X2	JC	500ºC	500ºC				5	111	5		5	167	CC	
12:30	9	JC			860ºF		600ºF	1	123	1	129	1	154	CC	
12:30	9	JC			860ºF		600ºF	2	121	2	134	2	143	CC	
12:30	9	JC			860ºF		600ºF	3	111	3	139	3	158	CC	
12:30	9	JC			860ºF		600ºF	4	117	4	147	4	159	CC	
12:30	9	JC			860ºF		600ºF	5	127	5	142	5	158	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, August 05, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
7:42	9	JC			860ºF		430ºF	1	128	1	150	1	189	CC	
7:42	9	JC			860ºF		430ºF	2	150	2	138	2	188	CC	
7:42	9	JC			860ºF		430ºF	3	128	3	136	3	193	CC	
7:42	9	JC			860ºF		430ºF	4	148	4	142	4	186	CC	
7:42	9	JC			860ºF		430ºF	5	136	5	152	5	181	CC	
1:37	X2	MC	500ºC	500ºC				1	109	1		1	162	CC	
1:37	X2	MC	500ºC	500ºC				2	137	2		2	164	CC	
1:37	X2	MC	500ºC	500ºC				3	129	3		3	161	CC	
1:37	X2	MC	500ºC	500ºC				4	124	4		4	162	CC	
1:37	X2	MC	500ºC	500ºC				5	133	5		5	162	CC	
8:18	9	JC			860ºF		430ºF	1	113	1	131	1	174	CC	
8:18	9	JC			860ºF		430ºF	2	120	2	132	2	168	CC	
8:18	9	JC			860ºF		430ºF	3	127	3	144	3	170	CC	
8:18	9	JC			860ºF		430ºF	4	133	4	134	4	171	CC	
8:18	9	JC			860ºF		430ºF	5	128	5	133	5	158	CC	

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE August 3 to August 5, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021

MATERIAL 60mil HDPE DTEX - Secondary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
1	5317	E.Slope & Floor	29.00	7.30	211.70	Layout - August 3
2	5317	E.Slope & Floor	29.00	7.30	211.70	Layout - August 3
3	5317	West Slope	15.00	7.30	109.50	Layout - August 3
4	5317	West Slope	15.00	7.30	109.50	Layout - August 3
5	5317	S.W.Corner	15.00	7.30	109.50	Layout - August 4
6	5317	S.W.Corner	3.00	3.00	9.00	Layout - August 4
7	5317	S.W.Corner	4.00	4.00	16.00	Layout - August 4
8	5317	S.W.Corner	12.00	7.30	87.60	Layout - August 4
9	5317	South Slope	12.00	7.30	87.60	Layout - August 4
10	5317	South Slope	13.00	7.30	94.90	Layout - August 4
11	7045	S.E.Corner	13.00	7.30	94.90	Layout - August 4
12	7045	S.E.Corner	3.00	4.00	12.00	Layout - August 4
13	7054	S.E.Corner	4.00	3.00	12.00	Layout - August 4
14	7045	S.E.Corner	15.00	7.30	109.50	Layout - August 4
15	4356	N.E.Corner	15.00	7.30	109.50	Layout - August 5
16	4356	N.E.Corner	5.60	3.00	16.80	Layout - August 5
17	4356	N.E.Corner	4.00	4.00	16.00	Layout - August 5
18	4356	N.E.Corner	14.00	7.30	102.20	Layout - August 5
19	4356	North Slope	14.00	7.30	102.20	Layout - August 5
20	4356	North Slope	14.00	7.30	102.20	Layout - August 5
21	4356	N.W.Corner	14.00	7.30	102.20	Layout - August 5
22	4356	N.W.Corner	6.00	4.00	24.00	Layout - August 5
23	4356	N.W.Corner	6.00	3.00	18.00	Layout - August 5
24	4356	N.W.Corner	15.00	7.30	109.50	Layout - August 5

1978.00 **sq m**

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: August 3 to August 5, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021

MATERIAL: 60mil HDPE DTEX - Secondary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
Welded August 3rd													
1/2	29.0	9:17	JC	9	1:53	1:58	32	31	Pass	Pass	N/A	CC	
3/4	15.0	10:15	JC	9	12:10	12:15	30	30	Pass	Pass	N/A	CC	
West Butt	14.5	11:10	JC	9	2:25	2:30	30	29	Pass	Pass	N/A	CC	Panels 1,2 to 3,4.
Welded August 4th													
5/6	3.0	10:30	JC	9	12:18	12:23	30	30	Pass	Pass	N/A	CC	
7/8	4.0	11:07	JC	9	12:21	12:26	40	39	Pass	Pass	N/A	CC	
8/9	12.0	11:15	JC	9	12:29	12:34	32	32	Pass	Pass	N/A	CC	
9/10	12.0	11:45	JC	9	12:43	12:48	43	41	Pass	Pass	N/A	CC	
10/11	13.0	12:00	JC	9	12:48	12:53	41	40	Pass	Pass	N/A	CC	
11/12	3.0	12:10	JC	9	1:15	1:21	39	38	Pass	Pass	N/A	CC	
13/14	4.0	12:25	JC	9	1:32	1:37	41	40	Pass	Pass	N/A	CC	
S.W.Butt	16.0	12:40	JC	9	1:25	1:30	30	30	Pass	Pass	N/A	CC	Panels 5 - 8.
S.E.Butt	16.0	12:09	JC	9	1:35	1:40	31	31	Pass	Pass	N/A	CC	Panels 11 - 14.
South Butt	44.5	1:15	JC	9	1:41	1:46	42	41	Pass	Pass	N/A	CC	Panels 2, 4 to 5, 9, 10, 14.
Welded August 5th													
15/16	5.6	8:07	JC	9	1:59	2:04	36	36	Pass	Pass	N/A	CC	
17/18	4.0	8:15	JC	9	9:36	9:40	30	30	Pass	Pass	N/A	CC	
18/19	14.0	8:25	JC	9	9:37	9:42	30	30	Pass	Pass	N/A	CC	
19/20	14.0	8:47	JC	9	1:51	1:56	38	38	Pass	Pass	N/A	CC	
20/21	14.0	9:03	JC	9	2:10	2:15	30	29	Pass	Pass	N/A	CC	
21/22	6.0	9:15	JC	9	2:18	2:23	31	31	Pass	Pass	N/A	CC	
23/24	6	9:22	JC	9	9:44	9:49	30	30	Pass	Pass	N/A	CC	
N.E.Butt	16	9:57	JC	9	2:30	2:35	30	30	Pass	Pass	N/A	CC	Panels 15 - 18.
N.W..Butt	16	10:44	JC	9	2:45	2:50	30	30	Pass	Pass	N/A	CC	Panels 21 - 24.
North Butt	44.5	11:32	JC	9	2:57	3:02	31	29	Pass	Pass	N/A	CC	Panels 1, 3 to 15, 19, 20, 24.

Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE: August 4th and 5th, 2021

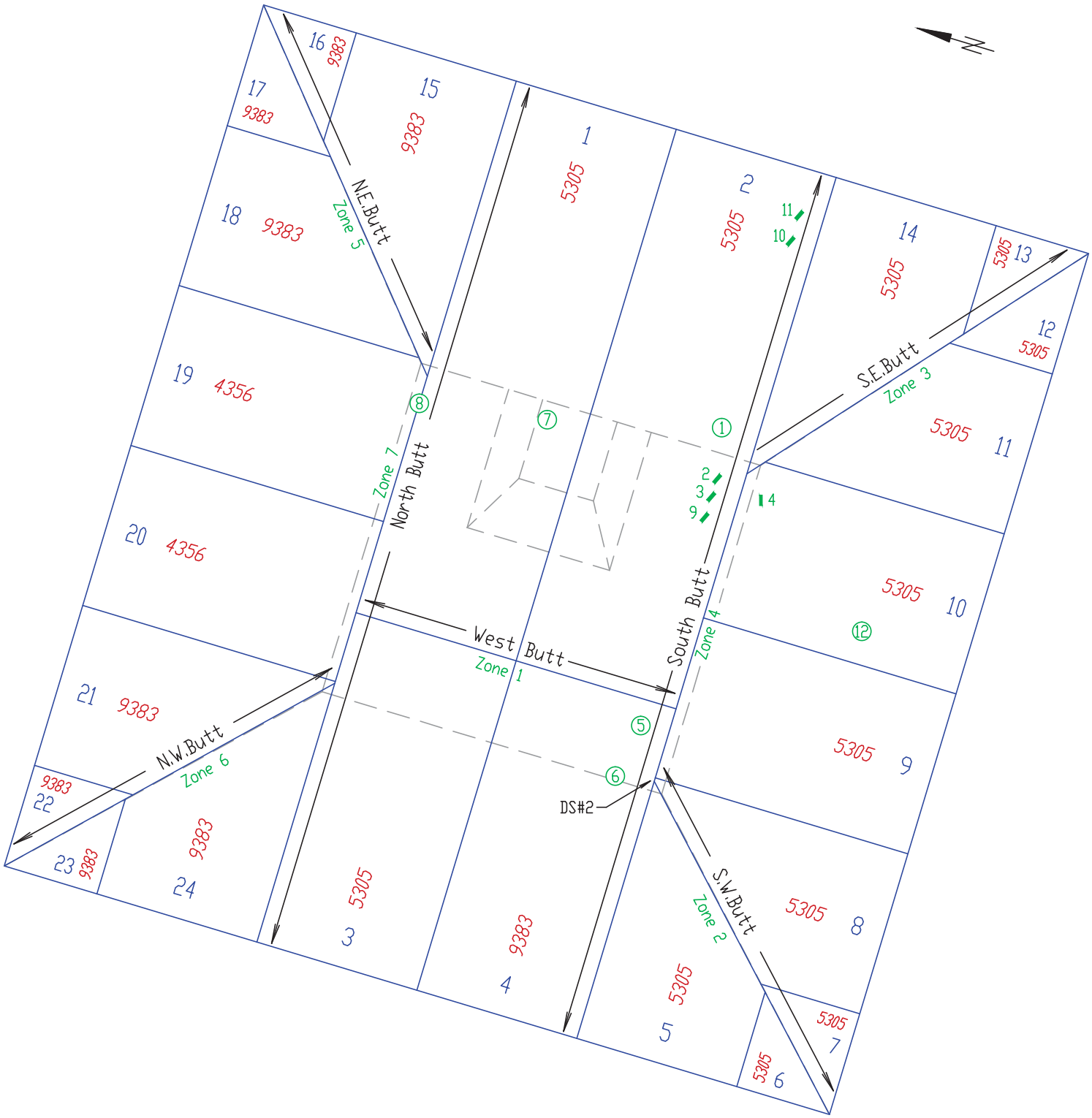
PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021

MATERIAL: 60mil HDPE DTEX - Secondary Liner

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
	Extruded August 4th							
1	Patch/Bead	4	Aug 4, 2021	JC	X2	CC	Pass	Near S.W.Toe.
2	Patch	South Butt	Aug 4, 2021	JC	X2	CC	Pass	On West Slope.
3	Patch	S.W.Butt	Aug 4, 2021	JC	X2	CC	Pass	Near top of Slope.
4	Patch	S.E.Butt	Aug 4, 2021	JC	X2	CC	Pass	On Corner Slope.
5	Bead	13	Aug 4, 2021	JC	X2	CC	Pass	Roll damage near top of slope.
6	Bead	S.W.Butt	Aug 4, 2021	JC	X2	CC	Pass	Near top of slope.
7	Patch/Bead	1	Aug 4, 2021	JC	X2	CC	Pass	Patch and Bead in Sump to remove Slack.
8	Patch/Bead	1	Aug 4, 2021	JC	X2	CC	Pass	Patch and Bead in Sump to remove Slack.
9	Patch/Bead	1	Aug 4, 2021	JC	X2	CC	Pass	Patch and Bead in Sump to remove Slack.
10	Patch/Bead	1	Aug 4, 2021	JC	X2	CC	Pass	Bead in Sump to remove Slack.
11	Patch/Bead	1	Aug 4, 2021	JC	X2	CC	Pass	Patch and Bead in Sump to remove Slack.
12	Patch/Bead	1	Aug 4, 2021	JC	X2	CC	Pass	Patch and Bead in Sump to remove Slack.
13	Patch/Bead	1	Aug 4, 2021	JC	X2	CC	Pass	Patch and Bead in Sump to remove Slack.
Zone 1	Beads	West Butt	Aug 4, 2021	JC	X2	CC	Pass	All "T" Intersections along West Butt Seam.
Zone 2	Beads	S.W.Butt	Aug 4, 2021	JC	X2	CC	Pass	All "T" Intersections along South West Butt Seam.
Zone 3	Beads	S.E.Butt	Aug 4, 2021	JC	X2	CC	Pass	All "T" Intersections along South East Butt Seam.
Zone 4	Beads	South Butt	Aug 4, 2021	JC	X2	CC	Pass	All "T" Intersections along South Butt Seam.
	Extruded August 5th							
14	Patch	North Butt	Aug 5, 2021	MC	X2	CC	Pass	Patch over Destruct #1.
15	Bead	North Butt	Aug 5, 2021	MC	X2	CC	Pass	At panel 19.
16	Patch	19/20	Aug 5, 2021	MC	X2	CC	Pass	At top of slope.
Zone 5	Beads	N.E.Butt	Aug 5, 2021	MC	X2	CC	Pass	All "T" Intersections along North East Butt Seam.
Zone 6	Beads	N.W.Butt	Aug 5, 2021	MC	X2	CC	Pass	All "T" Intersections along North West Butt Seam.
Zone 7	Beads	North Butt	Aug 5, 2021	MC	X2	CC	Pass	All "T" Intersections along North Butt Seam.

EFFLUENT STORAGE POND

PRIMARY LINER



DATE: August 30 2021	Cassidy Consulting Inc.	NORTHWIN LANDFILL CAMPBELL RIVER, B.C. - 2021
SCALE: NTS		EFFLUENT STORAGE POND
FILE NAME: EffluentStoragePond-Primary		Primary Liner Representative Drawing
DRAWN BY: SSC		
CHECKED BY: CJC		

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, August 05, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
7:42	9	JC			860ºF		430ºF	1	128	1	150	1	189	CC	
7:42	9	JC			860ºF		430ºF	2	150	2	138	2	188	CC	
7:42	9	JC			860ºF		430ºF	3	128	3	136	3	193	CC	
7:42	9	JC			860ºF		430ºF	4	148	4	142	4	186	CC	
7:42	9	JC			860ºF		430ºF	5	136	5	152	5	181	CC	
1:37	X2	MC	500ºC	500ºC				1	109	1		1	162	CC	
1:37	X2	MC	500ºC	500ºC				2	137	2		2	164	CC	
1:37	X2	MC	500ºC	500ºC				3	129	3		3	161	CC	
1:37	X2	MC	500ºC	500ºC				4	124	4		4	162	CC	
1:37	X2	MC	500ºC	500ºC				5	133	5		5	162	CC	
8:18	9	JC			860ºF		430ºF	1	113	1	131	1	174	CC	
8:18	9	JC			860ºF		430ºF	2	120	2	132	2	168	CC	
8:18	9	JC			860ºF		430ºF	3	127	3	144	3	170	CC	
8:18	9	JC			860ºF		430ºF	4	133	4	134	4	171	CC	
8:18	9	JC			860ºF		430ºF	5	128	5	133	5	158	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Friday, August 06, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:30	9	JC			860ºF		430	1	122	1	148	1	206	CC	
6:30	9	JC			860ºF		430	2	137	2	120	2	200	CC	
6:30	9	JC			860ºF		430	3	142	3	111	3	203	CC	
6:30	9	JC			860ºF		430	4	135	4	138	4	203	CC	
6:30	9	JC			860ºF		430	5	128	5	154	5	199	CC	
8:45	X2	MC	500ºC	500ºC				1	92	1		1	178	CC	
8:45	X2	MC	500ºC	500ºC				2	99	2		2	184	CC	
8:45	X2	MC	500ºC	500ºC				3	91	3		3	177	CC	
8:45	X2	MC	500ºC	500ºC				4	101	4		4	178	CC	
8:45	X2	MC	500ºC	500ºC				5	112	5		5	190	CC	

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE August 5 to August 6, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
1	5305	E.Slope & Floor	24.00	7.30	175.20	Layout - August 5
2	5305	E.Slope & Floor	24.00	7.30	175.20	Layout - August 5
3	5305	E.Slope & Floor	20.00	7.30	146.00	Layout - August 5
4	9383	E.Slope & Floor	20.00	7.30	146.00	Layout - August 5
5	5305	S.W.Corner	15.00	7.30	109.50	Layout - August 6
6	5305	S.W.Corner	5.00	3.00	15.00	Layout - August 6
7	5305	S.W.Corner	7.00	4.00	28.00	Layout - August 6
8	5305	S.W.Corner	12.00	7.30	87.60	Layout - August 6
9	5305	South Slope	12.00	7.30	87.60	Layout - August 6
10	5305	South Slope	12.00	7.30	87.60	Layout - August 6
11	5305	S.E.Corner	12.00	7.30	87.60	Layout - August 6
12	5305	S.E.Corner	4.00	4.00	16.00	Layout - August 6
13	5305	S.E.Corner	4.00	3.00	12.00	Layout - August 6
14	5305	S.E.Corner	15.00	7.30	109.50	Layout - August 6
15	9383	N.E.Corner	15.00	7.30	109.50	Layout - August 6
16	9383	N.E.Corner	4.00	4.00	16.00	Layout - August 6
17	9383	N.E.Corner	4.00	4.00	16.00	Layout - August 6
18	9383	N.E.Corner	15.00	7.30	109.50	Layout - August 6
19	4356	North Slope	15.00	7.30	109.50	Layout - August 6
20	4356	North Slope	15.00	7.30	109.50	Layout - August 6
21	9383	N.W.Corner	15.00	7.30	109.50	Layout - August 6
22	9383	N.W.Corner	4.00	4.00	16.00	Layout - August 6
23	9383	N.W.Corner	4.00	4.00	16.00	Layout - August 6
24	9383	N.W.Corner	12.00	7.30	87.60	Layout - August 6

1981.90 **sq m**

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: August 5 to August 6, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
Welded August 5th													
1/2	24.0	8:55	JC	9	2:13	2:18	40	40	Pass	Pass	N/A	CC	
3/4	20.0	9:35	JC	9	2:46	2:51	30	30	Pass	Pass	N/A	CC	
West Butt	14.5	10:22	JC	9	2:19	2:26	30	29	Pass	Pass	N/A	CC	Panels 1,2 to 3,4.
Welded August 6th													
5/6	5.0	9:47	JC	9	10:09	10:14	30	30	Pass	Pass	N/A	CC	
7/8	7.0	9:02	JC	9	11:21	11:17	40	40	Pass	Pass	N/A	CC	
8/9	12.0	9:14	JC	9	11:41	11:46	40	39	Pass	Pass	N/A	CC	
9/10	12.0	9:33	JC	9	12:31	12:37	31	31	Pass	Pass	N/A	CC	
10/11	12.0	11:21	JC	9	6:50	6:55	40	40	Pass	Pass	N/A	CC	
11/12	4.0	11:30	JC	9	1:28	1:37	40	40	Pass	Pass	N/A	CC	
13/14	4.0	11:39	JC	9	1:41	1:46	30	30	Pass	Pass	N/A	CC	
S.E.Butt	17.0	11:49	JC	9	1:31	1:36	40	40	Pass	Pass	N/A	CC	Panels 11 - 14.
S.W.Butt	17.0	10:28	JC	9	10:00	10:15	30	29	Pass	Pass	N/A	CC	Panels 5 - 8.
South Butt	44.0	1:36	JC	9	2:05	2:10	38	37	Pass	Pass	N/A	CC	Panels 2, 4 to 5, 9, 10, 14.
16/15	4.0	11:58	JC	9	6:35	6:40	40	40	Pass	Pass	N/A	CC	
17/18	4.0	12:36	JC	9	6:30	6:35	40	40	Pass	Pass	N/A	CC	
18/19	15.0	1:05	JC	9	6:30	6:35	40	40	Pass	Pass	N/A	CC	
19/20	15.0	12:29	JC	9	13:05	13:10	35	35	Pass	Pass	N/A	CC	
20/21	15.0	11:05	JC	9	11:15	11:20	30	29	Pass	Pass	N/A	CC	
21/22	4.0	10:50	JC	9	2:39	2:44	31	31	Pass	Pass	N/A	CC	
24/23	4.0	10:36	JC	9	2:24	2:29	31	30	Pass	Pass	N/A	CC	
N.E.Butt	16.5	12:45	JC	9	6:35	6:40	40	40	Pass	Pass	N/A	CC	Panels 15 - 18.
N.W..Butt	17.0	10:47	JC	9	2:31	2:36	40	38	Pass	Pass	N/A	CC	Panels 21 - 24.
North Butt	44.0	1:55	JC	9	2:47	2:52	30	30	Pass	Pass	N/A	CC	Panels 1, 3 to 15, 19, 20, 24.

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Consulting Inc.

EXTRUSION WELD REPORT

DATE: Friday, August 06, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
1	Patch	2	Aug 6, 2021	MC	X2	CC	Pass	Near bottom of slope.
2	Bead	2	Aug 6, 2021	MC	X2	CC	Pass	On floor.
3	Bead	2	Aug 6, 2021	MC	X2	CC	Pass	On floor.
4	Bead	10	Aug 6, 2021	MC	X2	CC	Pass	At Toe.
5	Patch	4	Aug 6, 2021	MC	X2	CC	Pass	On floor.
6	Patch	4	Aug 6, 2021	MC	X2	CC	Pass	At Toe.
7	Patch	1	Aug 6, 2021	MC	X2	CC	Pass	In The Sump.
8	Patch	North Butt	Aug 6, 2021	MC	X2	CC	Pass	At panel 19.
9	Bead	2	Aug 6, 2021	MC	X2	CC	Pass	On floor.
10	Bead	2	Aug 6, 2021	MC	X2	CC	Pass	Upper slope.
11	Bead	2	Aug 6, 2021	MC	X2	CC	Pass	Upper slope.
12	Patch	10	Aug 6, 2021	MC	X2	CC	Pass	On Slope.
Zone 1	Beads	West Butt	Aug 6, 2021	MC	X2	CC	Pass	All "T" Intersections along West Butt Seam.
Zone 2	Beads	S.W.Butt	Aug 6, 2021	MC	X2	CC	Pass	All "T" Intersections along South West Butt Seam.
Zone 3	Beads	S.E.Butt	Aug 6, 2021	MC	X2	CC	Pass	All "T" Intersections along South East Butt Seam.
Zone 4	Beads	South Butt	Aug 6, 2021	MC	X2	CC	Pass	All "T" Intersections along South Butt Seam.
Zone 5	Beads	N.E. Butt	Aug 6, 2021	MC	X2	CC	Pass	All "T" Intersections along North East Butt Seam.
Zone 6	Beads	N.W.Butt	Aug 6, 2021	MC	X2	CC	Pass	All "T" Intersections along North West Butt Seam.
Zone 7	Beads	North Butt	Aug 6, 2021	MC	X2	CC	Pass	All "T" Intersections along North West Butt Seam.

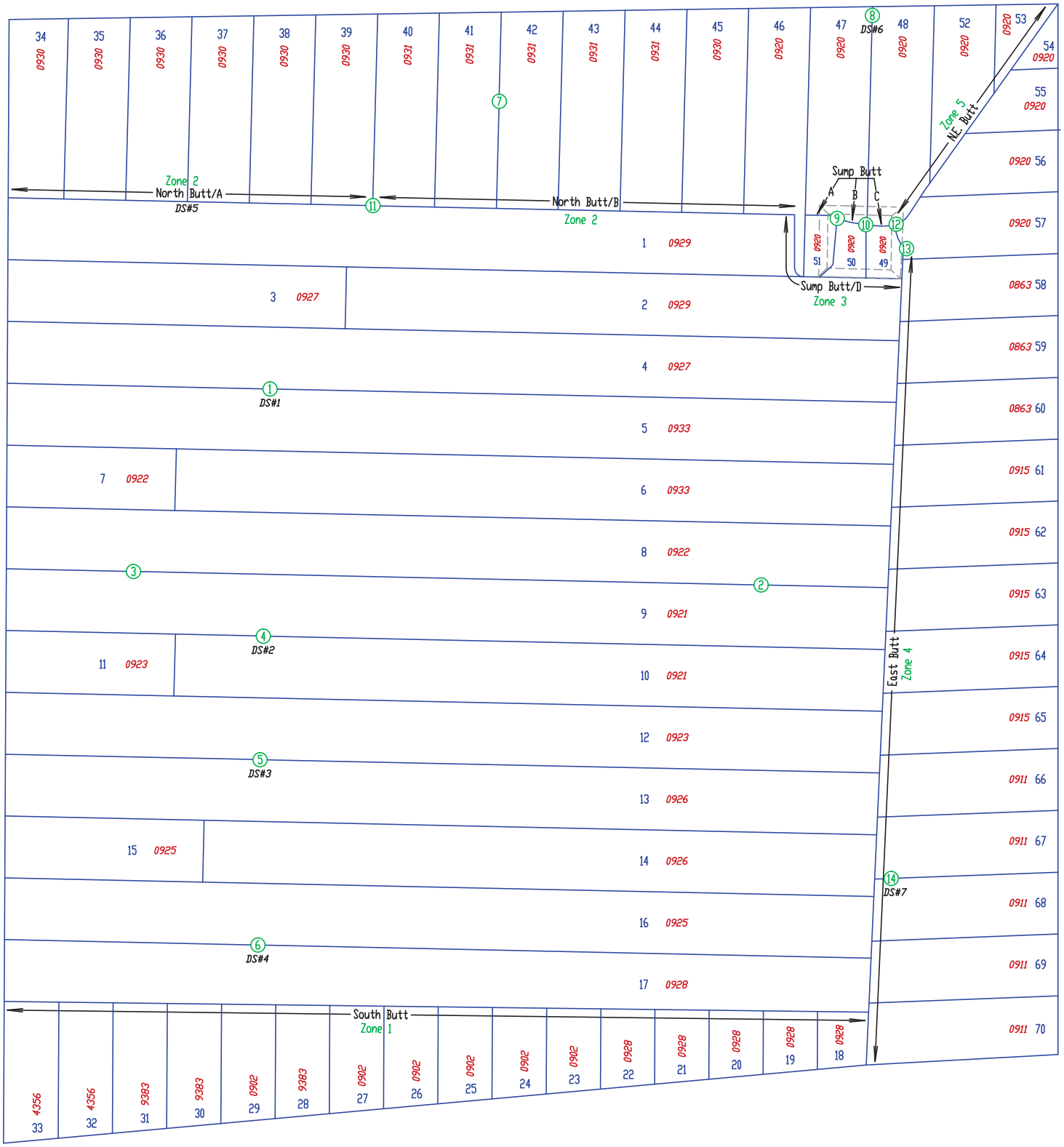
Cassidy
Consulting Inc.

DESTRUCTIVE TESTING REPORT

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - EFFLUENT POND - 2021** MATERIAL 60mil HDPE DTEX - Secondary & Primary Liners

WELD DATE	D.S. #	SEAM #	TECH INITIAL	WELDER NUMBER	PEEL 1		SHEAR	PEEL 2		SHEAR	PEEL 3		SHEAR	PEEL 4		SHEAR	PEEL 5		SHEAR	QC INITIAL	COMMENTS / LOCATION
					IN	OUT		IN	OUT		IN	OUT		IN	OUT		IN	OUT			
Aug 5/21	1	19/20	JC	9	129	135	186	136	114	183	132	115	187	121	124	180	121	111	185	CC	Seam 19/20 at Toe - Secondary.
Aug 6/21	2	8/9	JC	9	124	124	208	142	118	210	135	119	208	121	119	208	150	133	201	CC	Seam 8/9 at Toe - Primary.

NORTHWIN LANDFILL CELL 1
SECONDARY LINER



DATE: September 7, 2021	Cassidy Consulting Inc.	NORTHWIN LANDFILL - CELL 1 - 2021
SCALE: NTS		CAMPBELL RIVER, B.C.
FILE NAME: CampbellRiverCell-Secondary		60mil Dtex Secondary Liner Representative Drawing
DRAWN BY: SSC		
CHECKED BY: CJC		

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, August 09, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:54	9	RC			860ºF		600	1	137	1	140	1	175	CC	
8:54	9	RC			860ºF		600	2	131	2	134	2	182	CC	
8:54	9	RC			860ºF		600	3	104	3	140	3	172	CC	
8:54	9	RC			860ºF		600	4	127	4	141	4	165	CC	
8:54	9	RC			860ºF		600	5	130	5	143	5	170	CC	
11:28	9	RC			860ºF		430	1	124	1	125	1	173	CC	
11:28	9	RC			860ºF		430	2	128	2	133	2	168	CC	
11:28	9	RC			860ºF		430	3	130	3	135	3	168	CC	
11:28	9	RC			860ºF		430	4	130	4	129	4	173	CC	
11:28	9	RC			860ºF		430	5	131	5	137	5	169	CC	
12:19	X2	JC	520ºF	530ºF				1	96	1		1	158	CC	
12:19	X2	JC	520ºF	530ºF				2	99	2		2	158	CC	
12:19	X2	JC	520ºF	530ºF				3	92	3		3	152	CC	
12:19	X2	JC	520ºF	530ºF				4	103	4		4	154	CC	
12:19	X2	JC	520ºF	530ºF				5	108	5		5	154	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, August 10, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
7:13	9	RC			860ºF		600ºF	1	141	1	137	1	188	CC	
7:13	9	RC			860ºF		600ºF	2	148	2	147	2	186	CC	
7:13	9	RC			860ºF		600ºF	3	143	3	147	3	188	CC	
7:13	9	RC			860ºF		600ºF	4	142	4	143	4	188	CC	
7:13	9	RC			860ºF		600ºF	5	144	5	141	5	185	CC	
9:28	X2	JC	520ºF	530ºF				1	115	1		1	146	CC	
9:28	X2	JC	520ºF	530ºF				2	107	2		2	141	CC	
9:28	X2	JC	520ºF	530ºF				3	109	3		3	146	CC	
9:28	X2	JC	520ºF	530ºF				4	106	4		4	164	CC	
9:28	X2	JC	520ºF	530ºF				5	105	5		5	156	CC	
11:22	9	RC			860ºF		600ºF	1	134	1	129	1	178	CC	
11:22	9	RC			860ºF		600ºF	2	136	2	133	2	178	CC	
11:22	9	RC			860ºF		600ºF	3	141	3	146	3	181	CC	
11:22	9	RC			860ºF		600ºF	4	143	4	156	4	184	CC	
11:22	9	RC			860ºF		600ºF	5	149	5	159	5	177	CC	
12:21	9	RC			860ºF		750ºF	1	123	1	119	1	154	CC	
12:21	9	RC			860ºF		750ºF	2	135	2	121	2	155	CC	
12:21	9	RC			860ºF		750ºF	3	127	3	122	3	155	CC	
12:21	9	RC			860ºF		750ºF	4	140	4	134	4	160	CC	
12:21	9	RC			860ºF		750ºF	5	141	5	137	5	161	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, August 11, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:13	9	RC			860ºF		600ºF	1	143	1	144	1	186	CC	
6:13	9	RC			860ºF		600ºF	2	120	2	141	2	183	CC	
6:13	9	RC			860ºF		600ºF	3	140	3	144	3	183	CC	
6:13	9	RC			860ºF		600ºF	4	135	4	151	4	180	CC	
6:13	9	RC			860ºF		600ºF	5	135	5	137	5	183	CC	
8:48	X2	JC	520ºF	530ºF				1	91	1		1	153	CC	
8:48	X2	JC	520ºF	530ºF				2	92	2		2	156	CC	
8:48	X2	JC	520ºF	530ºF				3	97	3		3	150	CC	
8:48	X2	JC	520ºF	530ºF				4	98	4		4	153	CC	
8:48	X2	JC	520ºF	530ºF				5	94	5		5	150	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, August 14, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH								
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:23	9	RC			860ºF		600ºF	1	137	1	1125	1	172	CC	
6:23	9	RC			860ºF		600ºF	2	129	2	123	2	168	CC	
6:23	9	RC			860ºF		600ºF	3	99	3	126	3	168	CC	
6:23	9	RC			860ºF		600ºF	4	94	4	126	4	167	CC	
6:23	9	RC			860ºF		600ºF	5	142	5	125	5	170	CC	
8:40	17	RC			860ºF		620ºF	1	142	1	138	1	173	CC	
8:40	17	RC			860ºF		620ºF	2	129	2	137	2	174	CC	
8:40	17	RC			860ºF		620ºF	3	123	3	125	3	169	CC	
8:40	17	RC			860ºF		620ºF	4	131	4	138	4	166	CC	
8:40	17	RC			860ºF		620ºF	5	136	5	131	5	164	CC	
11:19	X2	MC	520ºF	530ºF				1	109	1		1	147	CC	
11:19	X2	MC	520ºF	530ºF				2	106	2		2	146	CC	
11:19	X2	MC	520ºF	530ºF				3	112	3		3	145	CC	
11:19	X2	MC	520ºF	530ºF				4	113	4		4	146	CC	
11:19	X2	MC	520ºF	530ºF				5	121	5		5	148	CC	

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Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, August 16, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Secondary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
7:31	9	RC			860ºF		600ºF	1	123	1	145	1	193	CC	
7:31	9	RC			860ºF		600ºF	2	116	2	141	2	194	CC	
7:31	9	RC			860ºF		600ºF	3	130	3	138	3	193	CC	
7:31	9	RC			860ºF		600ºF	4	122	4	130	4	190	CC	
7:31	9	RC			860ºF		600ºF	5	120	5	139	5	194	CC	
11:01	17	JC			860ºF		620ºF	1	116	1	122	1	166	CC	
11:01	17	JC			860ºF		620ºF	2	118	2	115	2	163	CC	
11:01	17	JC			860ºF		620ºF	3	117	3	121	3	169	CC	
11:01	17	JC			860ºF		620ºF	4	120	4	125	4	164	CC	
11:01	17	JC			860ºF		620ºF	5	139	5	121	5	165	CC	
11:06	X2	MC	520ºF	530ºF				1	124	1		1	182	CC	
11:06	X2	MC	520ºF	530ºF				2	128	2		2	181	CC	
11:06	X2	MC	520ºF	530ºF				3	112	3		3	179	CC	
11:06	X2	MC	520ºF	530ºF				4	109	4		4	176	CC	
11:06	X2	MC	520ºF	530ºF				5	130	5		5	178	CC	

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Monday, August 09, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Secondary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
1	0929	Floor	90.00	7.30	657.00	
2	0929	Floor	60.00	7.30	438.00	
3	0927	Floor	40.00	7.30	292.00	
4	0927	Floor	100.00	7.30	730.00	
5	0933	Floor	100.00	7.30	730.00	
6	0933	Floor	80.00	7.30	584.00	
7	0922	Floor	20.00	7.30	146.00	
8	0922	Floor	102.00	7.30	744.60	

4321.60 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Tuesday, August 10, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Secondary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
9	0921	Floor	100.00	7.30	730.00	
10	0921	Floor	80.00	7.30	584.00	
11	0923	Floor	20.00	7.30	146.00	
12	0923	Floor	99.00	7.30	722.70	
13	0926	Floor	97.00	7.30	708.10	
14	0926	Floor	80.00	7.30	584.00	
15	0925	Floor	20.00	7.30	146.00	
16	0925	Floor	94.00	7.30	686.20	
17	0928	Floor	92.00	7.30	671.60	

4978.60 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Wednesday, August 11, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Secondary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
18	0928	South Slope	5.00	7.30	36.50	
19	0928	South Slope	5.00	7.30	36.50	
20	0928	South Slope	6.00	7.30	43.80	
21	0928	South Slope	7.00	7.30	51.10	
22	0928	South Slope	7.00	7.30	51.10	
23	0902	South Slope	8.00	7.30	58.40	
24	0902	South Slope	9.00	7.30	65.70	
25	0902	South Slope	11.00	7.30	80.30	
26	0902	South Slope	12.00	7.30	87.60	
27	0902	South Slope	13.00	7.30	94.90	
28	9383	South Slope	13.00	7.30	94.90	
29	0902	South Slope	14.00	7.30	102.20	
30	9383	South Slope	16.00	7.30	116.80	
31	9383	South Slope	17.00	7.30	124.10	
32	4356	South Slope	18.00	7.30	131.40	
33	4356	South Slope	18.00	7.30	131.40	

1306.70 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Saturday, August 14, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Secondary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
34	0930	North Slope	17.00	7.30	124.10	
35	0930	North Slope	19.00	7.30	138.70	
36	0930	North Slope	20.00	7.30	146.00	
37	0930	North Slope	20.00	7.30	146.00	
38	0930	North Slope	21.00	7.30	153.30	
39	0930	North Slope	21.00	7.30	153.30	
40	0931	North Slope	23.00	7.30	167.90	
41	0931	North Slope	23.00	7.30	167.90	
42	0931	North Slope	23.00	7.30	167.90	
43	0931	North Slope	23.00	7.30	167.90	
44	0931	North Slope	24.00	7.30	175.20	
45	0930	North Slope	25.00	7.30	182.50	
46	0920	North Slope	34.00	7.30	248.20	
47	0920	North Slope	28.00	7.30	204.40	
48	0920	North Slope	26.00	7.30	189.80	
49	0920	North Slope	8.00	3.60	28.80	
50	0920	North Slope	8.00	3.60	28.80	
51	0920	North Slope	6.00	3.60	21.60	

2612.30 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Monday, August 16, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Secondary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
52	0920	NE Corner	18.00	7.30	131.40	
53	0920	NE Corner	12.00	7.30	87.60	
54	0920	NE Corner	4.00	7.30	29.20	
55	0920	NE Corner	8.00	7.30	58.40	
56	0920	East Slope	12.00	7.30	87.60	
57	0920	East Slope	18.00	7.30	131.40	
58	0863	East Slope	22.00	7.30	160.60	
59	0863	East Slope	23.00	7.30	167.90	
60	0863	East Slope	23.00	7.30	167.90	
61	0915	East Slope	23.00	7.30	167.90	
62	0915	East Slope	23.00	7.30	167.90	
63	0915	East Slope	24.00	7.30	175.20	
64	0915	East Slope	24.00	7.30	175.20	
65	0915	East Slope	24.00	7.30	175.20	
66	0911	East Slope	24.00	7.30	175.20	
67	0911	East Slope	24.00	7.30	175.20	
68	0911	East Slope	24.00	7.30	175.20	
69	0911	East Slope	24.00	7.30	175.20	
70	0911	East Slope	25.00	7.30	182.50	

2766.70 **sq m**

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Monday, August 09, 2021

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL: 60mil HDPE DTEX - Secondary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
2/3	7.3	9:03	RC	9	12:36	12:41	35	35	Pass	Pass	N/A	CC	Cross Seam
1/2/3	90.0	9:10	RC	9	10:09	10:14	30	30	Pass	Pass	N/A	CC	
2/3/4	100.0	10:30	RC	9	11:17	11:23	35	35	Pass	Pass	N/A	CC	
4/5	100.0	11:26	RC	9	1:18	1:23	30	29	Pass	Pass	N/A	CC	
6/7	7.3	12:32	RC	9	2:01	2:06	30	30	Pass	Pass	N/A	CC	Cross Seam
5/6/7	100.0	12:43	RC	9	1:33	1:38	40	39	Pass	Pass	N/A	CC	
6/7/8	100.0	1:37	RC	9	2:45	2:50	30	30	Pass	Pass	N/A	CC	

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Tuesday, August 10, 2021

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL: 60mil HDPE DTEX - Secondary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
8/9/A	15.0	7:36	RC	9	10:24	10:29	30	30	Pass	Pass	N/A	CC	
8/9/B	75.0	7;36	RC	9	10:25	10:30	30	30	Pass	Pass	N/A	CC	
8/9/C	15.0	7:36	RC	9	10:36	10:41	30	30	Pass	Pass	N/A	CC	
10/11	7.3	8:31	RC	9	10:27	10:32	30	29	Pass	Pass	N/A	CC	Cross Seam
9/10/11	100.0	9:23	RC	9	11:00	11:05	30	30	Pass	Pass	N/A	CC	
10/11/12	99.0	9:40	RC	9	11:12	11:17	30	28	Pass	Pass	N/A	CC	
12/13	97.0	10:22	RC	9	12:15	12:20	32	31	Pass	Pass	N/A	CC	
14/15	7.3	11:47	RC	9	12:23	12:28	40	39	Pass	Pass	N/A	CC	Cross Seam
13/14/15	97.0	11:55	RC	9	12:30	12:35	32	30	Pass	Pass	N/A	CC	
14/15/16	94.0	12:37	RC	9	1:58	2:03	30	29	Pass	Pass	N/A	CC	
16/17	92.0	2:28	RC	9	3:00	3:05	30	30	Pass	Pass	N/A	CC	

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NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Wednesday, August 11, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Secondary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
18/19	5.0	8:06	RC	9	9:14	9:19	38	38	Pass	Pass	N/A	CC	
19/20	5.0	8:12	RC	9	9:18	9:23	30	30	Pass	Pass	N/A	CC	
20/21	5.0	8:17	RC	9	9:20	9:25	30	30	Pass	Pass	N/A	CC	
21/22	7.0	8:31	RC	9	9:26	9:31	40	40	Pass	Pass	N/A	CC	
22/23	7.0	8:37	RC	9	9:27	9:32	30	29	Pass	Pass	N/A	CC	
23/24	8.0	9:15	RC	9	10:50	10:55	32	31	Pass	Pass	N/A	CC	
24/25	9.0	9:22	RC	9	11:30	11:35	40	39	Pass	Pass	N/A	CC	
25/26	11.0	9:30	RC	9	11:35	11:40	32	30	Pass	Pass	N/A	CC	
26/27	12.0	9:38	RC	9	11:40	11:45	30	29	Pass	Pass	N/A	CC	
27/28	13.0	9:52	RC	9	11:45	11:50	30	30	Pass	Pass	N/A	CC	
28/29	13.0	9:57	RC	9	11:50	11:55	30	30	Pass	Pass	N/A	CC	
29/30	14.0	10:05	RC	9	11:55	12:00	30	30	Pass	Pass	N/A	CC	
30/31	16.0	10:15	RC	9	12:00	12:05	30	30	Pass	Pass	N/A	CC	
31/32	17.0	10:24	RC	9	12:04	12:09	30	30	Pass	Pass	N/A	CC	
32/33	18.0	10:32	RC	9	12:09	12:13	30	29	Pass	Pass	N/A	CC	
S.Butt	92.0	11:02	RC	9	12:15	12:20	36	35	Pass	Pass	N/A	CC	Panels 18 - 33.

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Saturday, August 14, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Secondary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
34/35	17.0	6:49	RC	9	11:36	11:41	30	30	Pass	Pass	N/A	CC	
35/36	19.0	7:00	RC	9	12:34	12:39	40	40	Pass	Pass	N/A	CC	
36/37	20.0	7:11	RC	9	11:45	11:50	30	30	Pass	Pass	N/A	CC	
37/38	20.0	7:23	RC	9	11:37	11:42	30	30	Pass	Pass	N/A	CC	
38/39	21.0	7:36	RC	9	11:29	11:34	30	30	Pass	Pass	N/A	CC	
39/40	21.0	7:48	RC	9	11:20	11:25	30	30	Pass	Pass	N/A	CC	
40/41	23.0	8:03	RC	9	11:14	11:19	30	29	Pass	Pass	N/A	CC	
41/42A	13.0	8:15	RC	9	11:55	12:00	32	30	Pass	Pass	N/A	CC	
41/42B	10.0	8:22	RC	9	11:54	12:00	30	30	Pass	Pass	N/A	CC	
42/43	23.0	8:58	RC	9	12:55	1:00	30	30	Pass	Pass	N/A	CC	
43/44	23.0	9:10	RC	9	1:01	1:06	30	30	Pass	Pass	N/A	CC	
44/45	24.0	9:21	RC	9	10:12	10:17	30	30	Pass	Pass	N/A	CC	
45/46	25.0	10:07	RC	9	10:20	10:25	31	30	Pass	Pass	N/A	CC	
46/47	28.0	9;37	RC	9	10:45	10:50	30	30	Pass	Pass	N/A	CC	
47/48	26.0	10:21	RC	9	10:53	10:58	31	31	Pass	Pass	N/A	CC	
49/50	8.0	10:03	RC	9	11:00	11:05	30	29	Pass	Pass	N/A	CC	
50/51	8.0	10:33	RC	9	11:06	11:11	30	30	Pass	Pass	N/A	CC	
N.Butt/A	43.0	11:35	RC	9	12:20	12:25	31	28	Pass	Pass	N/A	CC	Panels 34 - 39.
N.Butt/B	50.0	11:35	RC	9	12:33	12:38	30	29	Pass	Pass	N/A	CC	Panels 40 - 46.
Sump/A	3.5	12:10	RC	9	1:13	1:18	30	30	Pass	Pass	N/A	CC	North side of Sump, Panels 47/51.
Sump/B	3.5	12:10	RC	9	1:20	1:25	30	30	Pass	Pass	N/A	CC	North side of Sump, Panels 47/50.
Sump/C	3.5	12:10	RC	9	1:29	1:34	30	30	Pass	Pass	N/A	CC	North side of Sump, Panels 48/49.
Sump/D	20.0	12:35	RC	9	1:45	1:50	30	28	Pass	Pass	N/A	CC	South side of Sump, Panels 49 - 51.

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Monday, August 16, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Secondary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
48/52	18.0	8:17	RC	9	9:58	10:03	30	30	Pass	Pass	N/A	CC	
52/53	12.0	8:31	RC	9	9:50	9:55	32	32	Pass	Pass	N/A	CC	
54/55	4.0	9:27	RC	9	10:22	10:27	30	30	Pass	Pass	N/A	CC	
55/56	8.0	9:00	RC	9	10:35	10:40	30	30	Pass	Pass	N/A	CC	
56/57	12.0	9:12	RC	9	10:50	10:55	30	30	Pass	Pass	N/A	CC	
57/58	18.0	9:47	RC	9	11:11	11:16	33	33	Pass	Pass	N/A	CC	
58/59	22.0	10:03	RC	9	11:20	11:25	30	30	Pass	Pass	N/A	CC	
59/60	23.0	10:15	RC	9	11:29	11:34	30	30	Pass	Pass	N/A	CC	
60/61	23.0	10:45	RC	9	11:43	11:48	30	30	Pass	Pass	N/A	CC	
61/62	23.0	10:59	RC	9	11:55	12:00	30	30	Pass	Pass	N/A	CC	
62/63	23.0	11:43	RC	9	12:20	12:25	30	30	Pass	Pass	N/A	CC	
63/64	24.0	11:26	RC	9	12:33	12:38	31	30	Pass	Pass	N/A	CC	
64/65	24.0	11:34	RC	9	12:41	12:46	30	30	Pass	Pass	N/A	CC	
65/66	24.0	12:50	RC	9	1:47	1:51	30	30	Pass	Pass	N/A	CC	
66/67	24.0	1:02	RC	9	1:57	2:02	30	30	Pass	Pass	N/A	CC	
67/68	24.0	1:19	RC	9	2:06	2:11	30	30	Pass	Pass	N/A	CC	
68/69	24.0	1:41	RC	9	2:22	2:27	32	31	Pass	Pass	N/A	CC	
69/70	24.0	2:03	RC	9	2:26	2:31	40	38	Pass	Pass	N/A	CC	
East Butt	93.0	3:22	RC	9	7:06	7:11	34	33	Pass	Pass	N/A	CC	Panels 70 - 57.
N.E.Butt	35.0	12:11	JC	17	2:45	2:50	30	29	Pass	Pass	N/A	CC	Panels 57 - 52.

Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE: August 9 to 16, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Secondary Liner

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
	Extruded August 9th							
1	Patch	4/5	Aug 9, 2021	JC	X2	RC	Pass	Destruct #1.
	Extruded August 10th							
2	Patch	8/9	Aug 10, 2021	JC	X2	RC	Pass	GCL caught in welder.
3	Patch	8/9	Aug 10, 2021	JC	X2	RC	Pass	GCL caught in welder.
4	Patch	9/10	Aug 10, 2021	JC	X2	RC	Pass	Destruct #2.
5	Patch	12/13	Aug 10, 2021	JC	X2	RC	Pass	Destruct #3.
6	Patch	16/17	Aug 10, 2021	JC	X2	RC	Pass	Destruct #4.
	Extruded August 11th							
Zone 1	Beads	S.Butt	Aug 11, 2021	JC	X2	MC	Pass	All "T" Intersections along South Butt.
	Extruded August 14th							
7	Patch	41/42	Aug 14, 2021	MC	X2	CC	Pass	Welder stalled midway up slope.
8	Patch	47/48	Aug 14, 2021	MC	X2	CC	Pass	Destruct #6.
9	Patch	50/51	Aug 14, 2021	MC	X2	CC	Pass	In Sump.
10	Patch	49/50	Aug 14, 2021	MC	X2	CC	Pass	In Sump.
11	Patch	N.Butt	Aug 14, 2021	MC	X2	CC	Pass	At Seam 39/40.
Zone 2	Beads	N.Butt	Aug 14, 2021	MC	X2	CC	Pass	All "T" Intersections along South Butt/A and B.
Zone 3	Beads	Sump Butt	Aug 14, 2021	MC	X2	CC	Pass	All "T" Intersections along Sump Butt/D.
	Extruded August 16th							
12	Patch	49/57	Aug 16, 2021	MC	X2	CC	Pass	At Sump.
13	Patch	E.Butt	Aug 16, 2021	MC	X2	CC	Pass	End of East Butt at Panel 57.
14	Patch	67/68	Aug 16, 2021	MC	X2	CC	Pass	Destruct #7.
Zone 4	Beads	E.Butt	Aug 16, 2021	MC	X2	CC	Pass	All "T" Intersections along East Butt.
Zone 5	Beads	N.E.Butt	Aug 16, 2021	MC	X2	CC	Pass	All "T" Intersections along North East Butt.

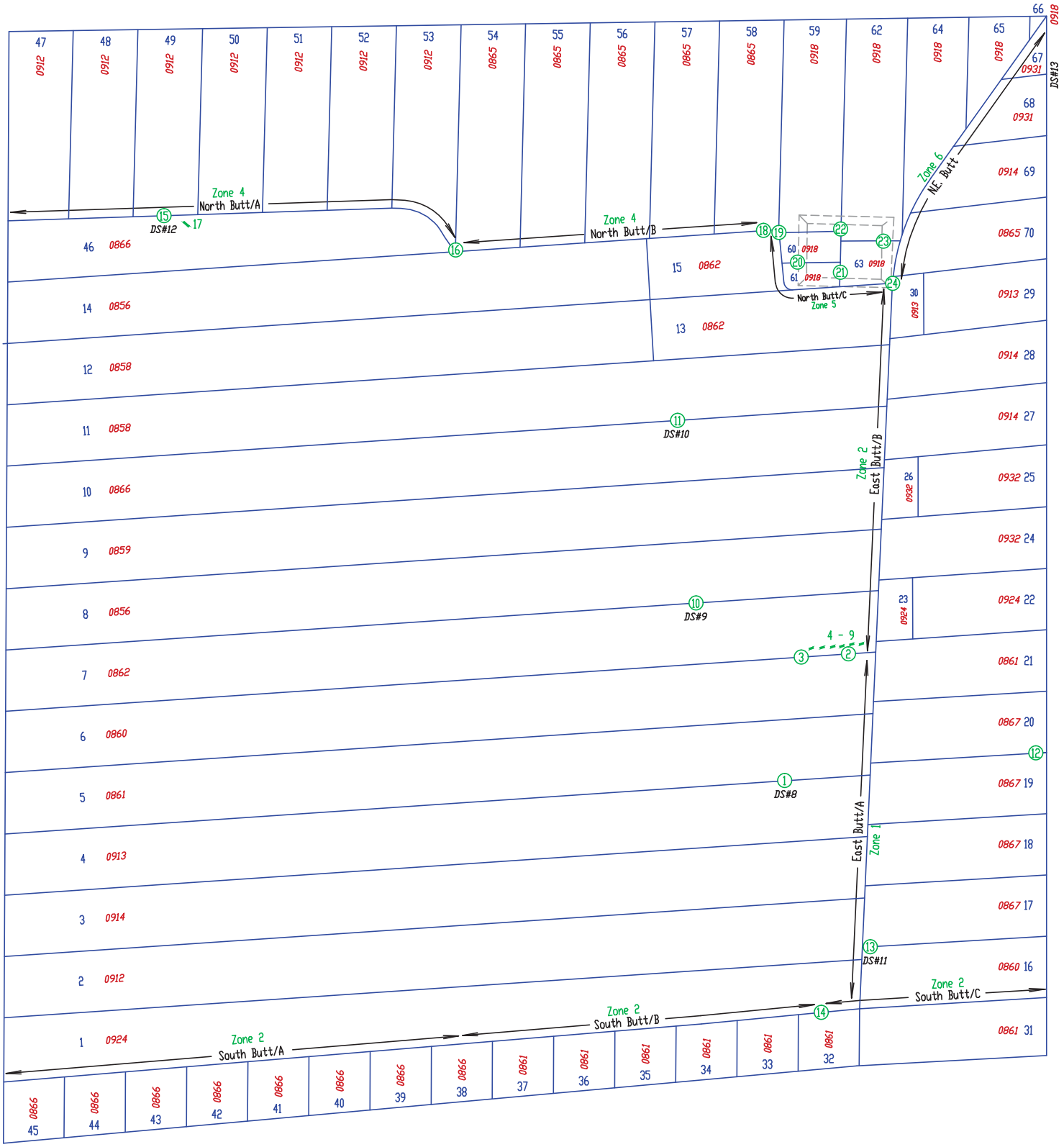
Cassidy
Consulting Inc.

DESTRUCTIVE TESTING REPORT

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021** MATERIAL 60mil HDPE DTEX - Secondary Liner

WELD DATE	D.S. #	SEAM #	TECH INITIAL	WELDER NUMBER	PEEL 1		SHEAR	PEEL 2		SHEAR	PEEL 3		SHEAR	PEEL 4		SHEAR	PEEL 5		SHEAR	QC INITIAL	COMMENTS / LOCATION
					IN	OUT		IN	OUT		IN	OUT		IN	OUT		IN	OUT			
8-09-21	1	4/5	RC	9	121	128	193	117	138	194	128	113	194	108	143	192	133	143	190	CC	On Floor.
8-10-21	2	9/10	RC	9	130	150	190	121	142	189	124	148	193	119	145	191	122	141	190	CC	On Floor.
8-10-21	3	12/13	RC	9	105	121	151	113	118	155	106	116	158	118	121	156	138	129	159	CC	On Floor.
8-10-21	4	16/17	RC	9	112	123	151	110	120	151	114	109	152	115	117	150	112	107	158	CC	On Floor.
8-14-21	5	36/37	RC	9	105	116	181	113	126	182	115	127	184	137	131	179	119	120	180	CC	Run out on floor.
8-14-21	6	47/48	RC	9	134	244	187	130	125	192	136	132	191	127	133	192	129	136	189	CC	Crest of slope.
8-16-21	7	67/68	RC	9	130	120	180	118	116	179	134	129	178	128	132	177	149	128	177	CC	Toe of slope.

NORTHWIN LANDFILL CELL 1
PRIMARY LINER



DATE: September 13, 2021	Cassidy Consulting Inc.	NORTHWIN LANDFILL - CELL 1 - 2021
SCALE: NTS		CAMPBELL RIVER, B.C.
FILE NAME: CampbellRiverCell-Primary		60mil Dtex Primary Liner Representative Drawing
DRAWN BY: SSC		
CHECKED BY: CJC		

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, August 18, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:31	9	RC			860ºF		600	1	140	1	128	1	190	CC	
8:31	9	RC			860ºF		600	2	131	2	124	2	193	CC	
8:31	9	RC			860ºF		600	3	132	3	143	3	191	CC	
8:31	9	RC			860ºF		600	4	131	4	140	4	191	CC	
8:31	9	RC			860ºF		600	5	136	5	137	5	188	CC	
11:01	9	RC			860ºF		620	1	125	1	145	1	182	CC	
11:01	9	RC			860ºF		620	2	130	2	134	2	183	CC	
11:01	9	RC			860ºF		620	3	133	3	142	3	177	CC	
11:01	9	RC			860ºF		620	4	137	4	139	4	182	CC	
11:01	9	RC			860ºF		620	5	132		139	5	179	CC	
1:30	X2	MC	520ºF	530ºF				1	125	1		1	176	CC	
1:30	X2	MC	520ºF	530ºF				2	128	2		2	178	CC	
1:30	X2	MC	520ºF	530ºF				3	136	3		3	171	CC	
1:30	X2	MC	520ºF	530ºF				4	137	4		4	176	CC	
1:30	X2	MC	520ºF	530ºF				5	133	5		5	174	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, August 19, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
7:22	9	RC			860ºF		600	1	135	1	147	1	195	CC	
7:22	9	RC			860ºF		600	2	138	2	132	2	193	CC	
7:22	9	RC			860ºF		600	3	145	3	137	3	194	CC	
7:22	9	RC			860ºF		600	4	127	4	120	4	191	CC	
7:22	9	RC			860ºF		600	5	115	5	131	5	193	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Friday, August 20, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:44	9	RC			860ºF		600	1	113	1	112	1	176	CC	
6:44	9	RC			860ºF		600	2	109	2	116	2	177	CC	
6:44	9	RC			860ºF		600	3	114	3	113	3	174	CC	
6:44	9	RC			860ºF		600	4	116	4	119	4	174	CC	
6:44	9	RC			860ºF		600	5	127		123	5	176	CC	
9:35	X2	MC	520ºF	530ºF				1	139	1		1	170	CC	
9:35	X2	MC	520ºF	530ºF				2	126	2		2	172	CC	
9:35	X2	MC	520ºF	530ºF				3	133	3		3	169	CC	
9:35	X2	MC	520ºF	530ºF				4	130	4		4	164	CC	
9:35	X2	MC	520ºF	530ºF				5	135	5		5	167	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, August 21, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:24	9	RC			860ºF		600	1	132	1	126	1	200	CC	
6:24	9	RC			860ºF		600	2	134	2	132	2	199	CC	
6:24	9	RC			860ºF		600	3	137	3	129	3	199	CC	
6:24	9	RC			860ºF		600	4	136	4	134	4	197	CC	
6:24	9	RC			860ºF		600	5	135		138	5	195	CC	
2:15	X2	JC	520ºF	530ºF				1	131	1		1	178	CC	
2:15	X2	JC	520ºF	530ºF				2	141	2		2	174	CC	
2:15	X2	JC	520ºF	530ºF				3	143	3		3	171	CC	
2:15	X2	JC	520ºF	530ºF				4	132	4		4	174	CC	
2:15	X2	JC	520ºF	530ºF				5	117			5	178	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, August 23, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
12:00	9	RC			860ºF		600	1	115	1	134	1	168	CC	
12:00	9	RC			860ºF		600	2	116	2	129	2	169	CC	
12:00	9	RC			860ºF		600	3	139	3	133	3	164	CC	
12:00	9	RC			860ºF		600	4	122	4	129	4	173	CC	
12:00	9	RC			860ºF		600	5	119		128	5	172	CC	
2:00	X2	JC	520ºF	530ºF				1	121	1		1	171	CC	
2:00	X2	JC	520ºF	530ºF				2	132	2		2	173	CC	
2:00	X2	JC	520ºF	530ºF				3	135	3		3	169	CC	
2:00	X2	JC	520ºF	530ºF				4	112	4		4	169	CC	
2:00	X2	JC	520ºF	530ºF				5	113			5	166	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, August 24, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
12:00	9	RC			860ºF		600	1	134	1	133	1	168	CC	
12:00	9	RC			860ºF		600	2	123	2	146	2	167	CC	
12:00	9	RC			860ºF		600	3	124	3	145	3	169	CC	
12:00	9	RC			860ºF		600	4	111	4	145	4	168	CC	
12:00	9	RC			860ºF		600	5	124		136	5	170	CC	
2:00	X2	JC	520ºF	530ºF				1	111	1		1	155	CC	
2:00	X2	JC	520ºF	530ºF				2	109	2		2	156	CC	
2:00	X2	JC	520ºF	530ºF				3	108	3		3	164	CC	
2:00	X2	JC	520ºF	530ºF				4	121	4		4	164	CC	
2:00	X2	JC	520ºF	530ºF				5	107			5	159	CC	

Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, August 25, 2021

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL 60mil HDPE DTEX - Primary Liner

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºC/ºF	PREHEAT TEMP ºC/ºF	SET TEMP ºC/ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
7:08	9	RC			860ºF		600	1	135	1	112	1	169	CC	
7:08	9	RC			860ºF		600	2	114	2	117	2	172	CC	
7:08	9	RC			860ºF		600	3	133	3	107	3	168	CC	
7:08	9	RC			860ºF		600	4	142	4	106	4	169	CC	
7:08	9	RC			860ºF		600	5	133		115	5	160	CC	
11:00	9	RC			860ºF		680	1	107	1	112	1	167	CC	
11:00	9	RC			860ºF		680	2	113	2	112	2	165	CC	
11:00	9	RC			860ºF		680	3	109	3	112	3	166	CC	
11:00	9	RC			860ºF		680	4	110	4	111	4	170	CC	
11:00	9	RC			860ºF		680	5	118	5	113	5	178	CC	
11:54	X2	JC	520ºF	530ºF				1	111	1		1	155	CC	
11:54	X2	JC	520ºF	530ºF				2	109	2		2	156	CC	
11:54	X2	JC	520ºF	530ºF				3	109	3		3	160	CC	
11:54	X2	JC	520ºF	530ºF				4	105	4		4	161	CC	
11:54	X2	JC	520ºF	530ºF				5	106			5	160	CC	

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Wednesday, August 18, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
1	0924	Floor	84.00	7.30	613.20	South side laying North - West to East.
2	0912	Floor	84.00	7.30	613.20	
3	0914	Floor	87.00	7.30	635.10	
4	0913	Floor	90.00	7.30	657.00	
5	0861	Floor	90.00	7.30	657.00	
6	0860	Floor	90.00	7.30	657.00	
7	0862	Floor	90.00	7.30	657.00	
8	0856	Floor	90.00	7.30	657.00	

5146.50 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Thursday, August 19, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
9	0859	Floor	90.00	7.30	657.00	
10	0866	Floor	90.00	7.30	657.00	
11	0858	Floor	87.00	7.30	635.10	
12	0858	Floor	60.00	7.30	438.00	
13	0862	Floor	30.00	7.30	219.00	
14	0856	Floor	60.00	7.30	438.00	
15	0862	Floor	20.00	7.30	146.00	

3190.10 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Friday, August 20, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
16	0860	East Slope	34.00	7.30	248.20	
17	0867	East Slope	35.00	7.30	255.50	
18	0867	East Slope	35.00	7.30	255.50	
19	0867	East Slope	35.00	7.30	255.50	
20	0867	East Slope	34.00	7.30	248.20	
21	0861	East Slope	32.00	7.30	233.60	

1496.50 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Saturday, August 21, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
22	0924	East Slope	30.00	7.30	219.00	
23	0924	Floor	3.00	7.30	21.90	
24	0932	East Slope	34.00	7.30	248.20	
25	0932	East Slope	28.00	7.30	204.40	
26	0932	Floor	4.00	7.30	29.20	
27	0914	East Slope	32.00	7.30	233.60	
28	0914	East Slope	32.00	7.30	233.60	
29	0913	East Slope	29.00	7.30	211.70	
30	0913	Floor	3.00	7.30	21.90	

1423.50 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Monday, August 23, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
31	0861	S.E.Corner	33.00	7.30	240.90	
32	0861	South Slope	5.00	7.30	36.50	
33	0861	South Slope	5.00	7.30	36.50	
34	0861	South Slope	6.00	7.30	43.80	
35	0861	South Slope	7.00	7.30	51.10	
36	0861	South Slope	7.00	7.30	51.10	
37	0861	South Slope	7.00	7.30	51.10	
38	0866	South Slope	8.00	7.30	58.40	
39	0866	South Slope	8.00	7.30	58.40	
40	0866	South Slope	9.00	7.30	65.70	
41	0866	South Slope	9.00	7.30	65.70	
42	0866	South Slope	9.00	7.30	65.70	
43	0866	South Slope	8.00	7.30	58.40	
44	0866	South Slope	7.00	7.30	51.10	
45	0866	S.W.Corner	7.00	7.30	51.10	

985.50 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Tuesday, August 24, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
46	0866	Floor	50.00	7.30	365.00	
47	0912	N.W.Corner	23.00	7.30	167.90	
48	0912	North Slope	24.00	7.30	175.20	
49	0912	North Slope	24.00	7.30	175.20	
50	0912	North Slope	24.00	7.30	175.20	
51	0912	North Slope	24.00	7.30	175.20	
52	0912	North Slope	24.00	7.30	175.20	
53	0912	North Slope	31.00	7.30	226.30	
54	0865	North Slope	31.00	7.30	226.30	
55	0865	North Slope	31.00	7.30	226.30	
56	0865	North Slope	31.00	7.30	226.30	
57	0865	North Slope	31.00	7.30	226.30	
58	0865	North Slope	31.00	7.30	226.30	

2766.70 **sq m**

PANEL PLACEMENT LOG

Cassidy
Consulting Inc.

DATE Wednesday, August 25, 2021

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL 60mil HDPE DTEX - Primary Liner

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
59	0918	North Slope	32.00	7.30	233.60	
60	0918	Sump	4.00	7.30	29.20	
61	0918	Sump	3.00	7.30	21.90	
62	0918	North Slope	33.00	7.30	240.90	
63	0918	Sump	7.00	7.30	51.10	
64	0918	N.E.Corner	25.00	7.30	182.50	
65	0918	N.E.Corner	9.00	7.30	65.70	
66	0918	N.E.Corner	3.00	7.30	21.90	
67	0931	N.E.Corner	7.00	7.30	51.10	
68	0931	N.E.Corner	18.00	7.30	131.40	
69	0914	N.E.Corner	26.00	7.30	189.80	
70	0865	East Slope	29.00	7.30	211.70	

1430.80 **sq m**

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Wednesday, August 18, 2021

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
1/2	84.0	9:06	RC	9	9:45	9:50	35	35	Pass	Pass	N/A	CC	
2/3	84.0	9:45	RC	9	10:30	10:35	30	30	Pass	Pass	N/A	CC	
3/4	87.0	10:57	RC	9	12:02	12:07	40	39	Pass	Pass	N/A	CC	
4/5	90.0	11:27	RC	9	12:11	12:16	30	30	Pass	Pass	N/A	CC	
5/6	90.0	12:58	RC	9	1:33	1:38	30	30	Pass	Pass	N/A	CC	
6/7/A	75.0	1:47	RC	9	3:06	3:11	30	30	Pass	Pass	N/A	CC	
6/7/B	15.0	1:47	RC	9	3:01	3:06	30	30	Pass	Pass	N/A	CC	
7/8	90.0	2:55	RC	9	3:40	3:45	30	30	Pass	Pass	N/A	CC	

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Thursday, August 19, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
8/9	90.0	8:06	RC	9	8:46	8:51	30	30	Pass	Pass	N/A	CC	
9/10	90.0	8:45	RC	9	9:25	9:30	30	30	Pass	Pass	N/A	CC	
10/11	87.0	7:18	RC	9	8:06	8:11	40	39	Pass	Pass	N/A	CC	
12/13	7.3	8:08	RC	9	9:15	9:20	30	30	Pass	Pass	N/A	CC	Cross Seam
11/12/13	87.0	8:12	RC	9	9:30	9:35	30	30	Pass	Pass	N/A	CC	
14/15	7.3	8:45	RC	9	8:40	8:45	30	30	Pass	Pass	N/A	CC	Cross Seam
12/13/14/15	80.0	8:52	RC	9	9:36	9:41	30	30	Pass	Pass	N/A	CC	

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Friday, August 20, 2021

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
16/17	34.0	12:06	RC	9	12:38	12:43	30	30	Pass	Pass	N/A	CC	
17/18	35.0	12:32	RC	9	12::42	12:47	30	30	Pass	Pass	N/A	CC	
18/19	35.0	12:37	RC	9	1:25	1:30	30	30	Pass	Pass	N/A	CC	
19/20	34.0	12:54	RC	9	1:20	1:25	30	30	Pass	Pass	N/A	CC	
20/21	32.0	1:08	RC	9	1:30	1:35	30	30	Pass	Pass	N/A	CC	
E.Butt/A	42.0	1:53	RC	9	3:11	3:16	30	30	Pass	Pass	N/A	CC	Panels 16 - 21.

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Saturday, August 21, 2021

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021**

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
22/23	7.3	6:54	RC	9	9:06	9:11	30	30	Pass	Pass	N/A	CC	Cross Seam
21/22/23	32.0	8:54	RC	9	10:35	10:40	30	30	Pass	Pass	N/A	CC	
22/23/24	33.0	6:59	RC	9	10:18	10:23	40	39	Pass	Pass	N/A	CC	
25/26	7.3	7:29	RC	9	9:10	9:15	30	30	Pass	Pass	N/A	CC	Cross Seam
24/25/26	32.0	7:46	RC	9	10:13	10:18	30	30	Pass	Pass	N/A	CC	
25/26/27	32.0	8:05	RC	9	10:43	10:48	30	30	Pass	Pass	N/A	CC	
27/28	32.0	8:26	RC	9	10:52	10:57	33	31	Pass	Pass	N/A	CC	
29/30	7.3	9:09	RC	9	9:30	9:40	30	30	Pass	Pass	N/A	CC	Cross Seam
28/29/30	32.0	9:27	RC	9	9:22	9:27	30	30	Pass	Pass	N/A	CC	
E.Butt/B	42.0	9:46	RC	9	11:25	11:30	30	30	Pass	Pass	N/A	CC	Panels 21 - 30.

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Monday, August 23, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
31/32	5.0	12:01	RC	9	12:10	12:15	30	30	Pass	Pass	N/A	CC	
32/33	5.0	12:10	RC	9	12:15	12:20	30	30	Pass	Pass	N/A	CC	
33/34	5.0	12:14	RC	9	12:20	12:25	40	39	Pass	Pass	N/A	CC	
34/35	6.0	12:18	RC	9	12:30	12:35	30	30	Pass	Pass	N/A	CC	
35/36	7.0	12:20	RC	9	12:37	12:42	30	30	Pass	Pass	N/A	CC	
36/37	7.0	12:25	RC	9	12:45	12:50	30	30	Pass	Pass	N/A	CC	
37/38	7.0	12:29	RC	9	12:50	12:55	30	30	Pass	Pass	N/A	CC	
38/39	8.0	12:34	RC	9	12:55	1:00	33	31	Pass	Pass	N/A	CC	
39/40	8.0	12:41	RC	9	1:01	1:06	30	30	Pass	Pass	N/A	CC	
40/41	9.0	12:45	RC	9	1:07	1:12	30	30	Pass	Pass	N/A	CC	
41/42	9.0	12:50	RC	9	1:15	1:20	30	30	Pass	Pass	N/A	CC	
42/43	8.0	1:01	RC	9	1:20	1:25	30	30	Pass	Pass	N/A	CC	
43/44	8.0	1:07	RC	9	1:30	1:35	30	30	Pass	Pass	N/A	CC	
44/45	7.0	1:11	RC	9	1:36	1:41	31	30	Pass	Pass	N/A	CC	
S.Butt/A	47.0	1:33	RC	9	2.57	3:02	35	33	Pass	Pass	N/A	CC	Panels 45 - 39.
S.Butt/B	47.0	1:33	RC	9	3:11	3:16	30	28	Pass	Pass	N/A	CC	Panels 39 - 32.
S.Butt/C	38.0	1:33	RC	9	3:25	3:30	30	29	Pass	Pass	N/A	CC	Panels 32 - 31.

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Tuesday, August 24, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
47/48	23.0	9:04	RC	9	11:10	11:15	30	30	Pass	Pass	N/A	CC	
48/49	24.0	9:14	RC	9	11:15	11:20	30	30	Pass	Pass	N/A	CC	
49/50	24.0	9:43	RC	9	11:21	11:26	40	39	Pass	Pass	N/A	CC	
50/51	24.0	9:54	RC	9	11:27	11:32	30	30	Pass	Pass	N/A	CC	
51/52	24.0	10:03	RC	9	11:38	11:43	30	30	Pass	Pass	N/A	CC	
52/53	24.0	11:39	RC	9	12:06	12:11	30	30	Pass	Pass	N/A	CC	
53/54	31.0	11:51	RC	9	12:12	12:17	30	30	Pass	Pass	N/A	CC	
54/55	31.0	12:50	RC	9	1:05	1:10	33	31	Pass	Pass	N/A	CC	
55/56	31.0	12:07	RC	9	12:18	12:23	30	30	Pass	Pass	N/A	CC	
56/57	31.0	12:21	RC	9	12:24	12:29	30	30	Pass	Pass	N/A	CC	
57/58	31.0	12:32	RC	9	12:40	12:45	30	30	Pass	Pass	N/A	CC	
14/46	50.0	1:15	RC	9	2:46	2:51	30	30	Pass	Pass	N/A	CC	
N.Butt/A	50.0	10:28	RC	9	11:47	11:52	35	33	Pass	Pass	N/A	CC	Panels 46 - 53.
N.Butt/B	35.0	1:15	RC	9	2:46	2:51	32	30	Pass	Pass	N/A	CC	Panels 54 - 58

Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Wednesday, August 25, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
58/59	31.0	11:41	RC	9	12:26	12:31	30	30	Pass	Pass	N/A	CC	
59/60	7.3	10:25	RC	9	10:45	10:50	30	30	Pass	Pass	N/A	CC	Cross Seam
60/61	7.3	10:38	RC	9	11:10	11:15	40	39	Pass	Pass	N/A	CC	Cross Seam
62/63	7.3	10:34	RC	9	11:01	11:06	30	30	Pass	Pass	N/A	CC	Cross Seam
59-62/60-63	39.0	11:10	RC	9	11:56	12:01	30	30	Pass	Pass	N/A	CC	Slope to Sump Panels 59/60/61/62/63.
62/64	25.0	9:56	RC	9	10:44	10:49	30	30	Pass	Pass	N/A	CC	
64/65	9.0	9:46	RC	9	10:31	10:36	30	30	Pass	Pass	N/A	CC	
65/66	3.0	10:07	RC	9	10:36	10:41	33	31	Pass	Pass	N/A	CC	
67/68	7.0	11:27	RC	9	12:11	12:16	30	30	Pass	Pass	N/A	CC	
68/69	18.0	9:29	RC	9	9:40	9:45	30	30	Pass	Pass	N/A	CC	
69/70	26.0	9:20	RC	9	9:10	9:15	30	30	Pass	Pass	N/A	CC	
70/29	29.0	8:44	RC	9	8:50	8:55	32	31	Pass	Pass	N/A	CC	
N.Butt/C	20.0	12:09	RC	9	12:47	12:52	30	28	Pass	Pass	N/A	CC	Sump Panels 60 - 63.
N.E.Butt	51.0	1:27	RC	9	2:11	2:16	40	38	Pass	Pass	N/A	CC	Panels 63 - 70.

Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE: August 18 to 23, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
	Extruded August 18th							
1	Patch	4/5	Aug 18, 2021	MC	X2	CC	Pass	Destruct #8.
2	Patch	6/7	Aug 18, 2021	MC	X2	CC	Pass	Burn Out.
3	Patch	6/7	Aug 18, 2021	MC	X2	CC	Pass	Burn Out.
4	Bead	7	Aug 18, 2021	MC	X2	CC	Pass	Roll Damage.
5	Bead	7	Aug 18, 2021	MC	X2	CC	Pass	Roll Damage.
6	Bead	7	Aug 18, 2021	MC	X2	CC	Pass	Roll Damage.
7	Bead	7	Aug 18, 2021	MC	X2	CC	Pass	Roll Damage.
8	Bead	7	Aug 18, 2021	MC	X2	CC	Pass	Roll Damage.
9	Bead	7	Aug 18, 2021	MC	X2	CC	Pass	Roll Damage.
	Extruded August 20th							
10	Patch	7/8	Aug 20, 2021	MC	X2	CC	Pass	Destruct #9.
11	Patch	10/11	Aug 20, 2021	MC	X2	CC	Pass	Destruct #10.
12	Patch	19/20	Aug 20, 2021	MC	X2	CC	Pass	Burn out Crest of slope.
Zone 1	Beads	E.Butt/A	Aug 20, 2021	MC	X2	CC	Pass	All "T" Intersections along E.Butt/A.
	Extruded August 21st							
13	Patch	16/17	Aug 21, 2021	JC	X2	RC	Pass	Destruct #11.
Zone 2	Beads	E.Butt/B	Aug 21, 2021	JC	X2	RC	Pass	All "T" Intersections along E.Butt/B.
	Extruded August 23rd							
14	Patch	32/1	Aug 23, 2021	JC	X2	RC	Pass	Start/Stop at Panel 32.

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EXTRUSION WELD REPORT

DATE: August 24 to 25, 2021

PROJECT: NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021

MATERIAL: 60mil HDPE DTEX - Primary Liner

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
	Extruded August 24th							
15	Patch	46/49	Aug 24, 2021	JC	X2	RC	Pass	Destruct #12.
16	Patch	N.Butt	Aug 24, 2021	JC	X2	RC	Pass	Start/Stop at Seam 53/54.
17	Bead	46	Aug 24, 2021	JC	X2	RC	Pass	Near Panel 49.
Zone 4	Beads	N.Butt/A&B	Aug 24, 2021	JC	X2	RC	Pass	All "T" Intersections along N.Butt/A and B.
	Extruded August 25th							
18	Patch	N.Butt/B	Aug 25, 2021	JC	X2	RC	Pass	Start/Stop at Panel 58.
19	Patch	58/59	Aug 25, 2021	JC	X2	RC	Pass	At N.W. Corner of Sump.
20	Patch	60/61	Aug 25, 2021	JC	X2	RC	Pass	Fit Liner in Sump area.
21	Patch	61/63	Aug 25, 2021	JC	X2	RC	Pass	Fit Liner in Sump area.
22	Patch	59/62	Aug 25, 2021	JC	X2	RC	Pass	Fit Liner in Sump area.
23	Patch	62/63	Aug 25, 2021	JC	X2	RC	Pass	Fit Liner in Sump area.
24	Patch	E.Butt/B	Aug 25, 2021	JC	X2	RC	Pass	Start/Stop between E.Butt/B and N.E.Butt.
Zone 5	Beads	N.Butt/C	Aug 25, 2021	JC	X2	RC	Pass	All "T" Intersections along N.Butt/C.
Zone 6	Beads	N.E.Butt	Aug 25, 2021	JC	X2	RC	Pass	All "T" Intersections along N.E.Butt.

Cassidy
Consulting Inc.

DESTRUCTIVE TESTING REPORT

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - CELL1 - 2021** MATERIAL 60mil HDPE DTEX - Primary Liner

WELD DATE	D.S. #	SEAM #	TECH INITIAL	WELDER NUMBER	PEEL 1 IN	PEEL 1 OUT	SHEAR	PEEL 2 IN	PEEL 2 OUT	SHEAR	PEEL 3 IN	PEEL 3 OUT	SHEAR	PEEL 4 IN	PEEL 4 OUT	SHEAR	PEEL 5 IN	PEEL 5 OUT	SHEAR	QC INITIAL	COMMENTS / LOCATION
8-18-21	8	4/5	RC	9	107	122	183	129	128	183	127	113	181	127	111	182	117	122	182	CC	First Destruct on Primary liner - Floor.
8-19-21	9	7/8	RC	9	119	117	156	102	104	158	119	106	159	120	116	160	113	115	169	CC	On Floor.
8-19-21	10	10/11	RC	9	124	120	170	122	108	168	123	111	164	127	112	167	129	140	165	CC	On Floor.
8-20-21	11	16/17	RC	9	132	119	172	119	107	173	121	106	171	118	122	170	120	120	165	CC	At Toe of Slope.
8-24-21	12	46/49	RC	9	135	145	151	131	135	153	112	134	152	113	135	150	131	122	150	CC	On Floor.
8-25-21	13	67/68	RC	9	143	130	175	117	120	174	118	128	174	119	134	180	136	121	175	CC	In Anchor Trench.

Appendix F

Field Inspections

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	3/19/2021 13:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil, Brad Maxwell		
WEATHER CONDITIONS:	Raining 7 ^{o}C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe sub-base conditions of pit particularly where East Berm construction will begin next week

SITE NOTES / PROGRESS:
-Fill stakes have been placed by surveyor
-No excavation required before filling activities begin for East Berm
-Floor of pit generally compact and free of debris
-Small amounts of ponding scattered around pit floor due to recent rain
-Observed proof roll, soil compaction appeared adequate
-One large rock observed near toe of east slope (photo attached). Instructed Joe to remove before placing fill

Next Steps
-Begin fill activities on Monday, March 22
-Compaction testing tentatively set for 13:00 on March 22

OUTSTANDING INFORMATION / NEW ISSUES:
-Brad has question regarding centre line of East Berm on drawing. Email sent to Roxy.

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	3/22/2021 13:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil, Brad Maxwell Johnny Csondes (McElhanney)		
WEATHER CONDITIONS:	Mixed sun, cloud, rain 10 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe fill activites and compaction testing

SITE NOTES / PROGRESS:
-One lift had been placed on North and East Berm
-Trucks were hauling material being excavated from slope South of Landfill routing over East Berm to North Berm to increase compaction
-McElhanney tested compaction on several places on East Berm. It was unknown how many passes were made with the vibrator packer.
-No packing had yet taken place on the North Berm. Material had been placed in approximiately 0.3 m lift.
-Vibrator packer made 6 passes, compaction was tested, 4 more passes, compaction tested, 4 more passes, compaction tested on North Berm.
-Compaction test results averaged 93.5% based on Proctor on file. Did not improve noticable with subsequent passes of packer
McElhanney grabbed a sample of material from where it was being excavated to send to lab
-Confirmed with Brad that Proctor results that were given to GHD did not represent the material that was being placed
Next Steps
-Lab results expected tomorrow (March 23) evening
-McElhanney to confirm compaction based on lab results
-GHD to determine appropriate inspection schedule for remainder of berm construction

OUTSTANDING INFORMATION / NEW ISSUES:
-Proctor test given to GHD from Upland not representative of material being placed

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	3/23/2021 14:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil		
WEATHER CONDITIONS:	Overcast 9 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe fill activites on North and East Berms

SITE NOTES / PROGRESS:
-Three lifts placed on North and East Berms, begining to work on 4th lift on south end of East Berm
-Trucks continuing one way haul, dumping and then driving the length of the two berms to increase compaction
-D8 pushing material and vibrator packer working continously
-Height of 3 compacted lifts approximately 1m
-Height of 4th lift approximately 0.3m
-Material being hauled from same location as yesterday from slope south of landfill footpring

OUTSTANDING INFORMATION / NEW ISSUES:
-Results Proctor test given to GHD from Upland not representative of material being placed
-Results of Proctor of material being placed expected by end of day today

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	3/29/2021 12:10	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Doug Wynd		
WEATHER CONDITIONS:	Sunny 8 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe fill activites on North and East Berms

SITE NOTES / PROGRESS:
-North Berm and majority of East Berm filled to design grade.
-Small fill remaining on south end of East Berm
-crushing plant being removed from landfill footprint
-lock blocks placed at west end of North Berm
-trucks hauling material to remaining fill by driving over North Berm full and dumping on East Berm
-vibratory compactor working continously, when operator takes break different operator fills in
-location of infiltration pond berms marked out with paint, some aggregate currently in way of fill

Next Steps

-complete fill on East Berm
-cut back berms slopes to design
-complete moving crushing plant
-move pile of aggregate that is in base of infiltration pond
-cut base of landfill to grade

OUTSTANDING INFORMATION / NEW ISSUES:
-Results of Proctor still not available from lab - Brad followed up again today

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	3/31/2021 9:10	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Brad Maxwell Tyler(surveyor)		
WEATHER CONDITIONS:	Mixed Sun and Cloud 8 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe fill activites and base of infiltration pond

SITE NOTES / PROGRESS:
-Fill on North and East Berm almost complete. Small fill required on south end of East Berm
-Shaping of inside slopes of North Berm beginig
-Base of lock-block wall on north-east corner of Infiltration Pond being prepped
-Crew moving stockpiled material out of way that is currently setting in of infiltration pond
-Observed loaded trucks travelling over base of berms. Sub-base is competent with no deflection observed..
-Varying depth of round-rock, from previous stockpiled material up to 30 mm depth sitting where in footprint of Infiltraion Pond including where berms will be constructed.
-Instructed Tyler and followed up with Brad, to make sure round-rock is removed before berms are placed

Next Steps

-Remove round-rock from base of infiltration pond berms before constructing berms
-Complete removing stock-pile of material that is in infiltration pond footprint
-Cut base of landfill to design contours (up to 2m cut close to North Berm) This will take most of next week.

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	4/7/2021 14:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil		
WEATHER CONDITIONS:	Mixed Sun and Cloud 7 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe / excavation activites

SITE NOTES / PROGRESS:
-Excavation of base of landfill underway
-Gravel removed from base of infiltration pond
-Infiltration pond berms nearly complete
-Grubbing activities have begun for leachate treatment pond

Next Steps

-Remove round-rock from base of infiltration pond berms before constructing berms
-Complete removing stock-pile of material that is in infiltration pond footprint
-Cut base of landfill to design contours (up to 2m cut close to North Berm) This will take most of next week.

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	4/16/2021 14:30 AM	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil		
WEATHER CONDITIONS:	Mixed Sun and Cloud 7 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe / excavation activites

SITE NOTES / PROGRESS:
-Excavation of base of landfill underway
-Gravel removed from base of infiltration pond
-Infiltration pond berms nearly complete
-Grubbing activities have begun for leachate treatment pond

Next Steps

-Remove round-rock from base of infiltration pond berms before constructing berms
-Complete removing stock-pile of material that is in infiltration pond footprint
-Cut base of landfill to design contours (up to 2m cut close to North Berm) This will take most of next week.

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	4/30/2021 8:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil, Brad Maxwell		
WEATHER CONDITIONS:	Mixed Sun and Cloud 7 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe sand to be used for GCL protection layers

SITE NOTES / PROGRESS:
-Excavation to new contours rearly complete
-Material in base of pit was sandy Joe Vandereil asked if it would be acceptable for GCL protection layer. Sand was observed to be clean free of fines but contained oversized up to approximately 25 mm. (see attached photolog)
-Disccussed with Brad and Joe if protection layer would be required on slopes given that rocks are on side slope.

Next Steps

-Complete excavation to new contours

OUTSTANDING INFORMATION / NEW ISSUES:
-sand present in landfill excavation not acceptable for placement as GCL protection Layer

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	5/7/2021 11:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil,		
WEATHER CONDITIONS:	Mixed Sun and Cloud 9 °C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe subbase excavation and potential sand to be placed for GCL protection layer

SITE NOTES / PROGRESS:
-Excavation to base contours complete. Floor of pit is clean and free of lumps and debris, slopes visually appear to match design.
-some triming of berms still required
-observed potential sand source to be used for GCL protection layer. Material was clean but conatined signifant rocks greater than max spec (4.75mm). Reviewed sand specification with Joe and conclued that that sand would have to be screened

Next Steps

-Complete shaping of berms where required
-Perform as-built survey of pit
-Screen and place sand

OUTSTANDING INFORMATION / NEW ISSUES:
-GHD to determine if GCL protection layer required on landfill slopes

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	5/12/2021 10:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Vanderweil,		
WEATHER CONDITIONS:	Sunny 12 ^{o}C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Inspect sand and observe sand placement on floor of Landfill

SITE NOTES / PROGRESS:
-observed stockpiled sand being used for GCL protection layer. Sand washed, screened and acceptable for use as the GCL protection layer
-Sand was being place to depth of 150 mm starting on south end of landfill.
-Dozer placing sand is equipped with laser level to ensure correct depth of is placed
-Vibrator packer will be used to compact sand layer

Next Steps

-Complete placing sand
- minimal futher activities unitl lining

OUTSTANDING INFORMATION / NEW ISSUES:
-GHD to determine if GCL protection layer required on landfill slopes
-GHD to complete review of moisture sensor

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/3/2021 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Sunny, 16 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Witness test seams
- Obersrve panel placement and welds
- Observe Geosynthetic deployement

SITE NOTES / PROGRESS:
-Geomembrane placed on Leachate Pond except North Slope.
-1 roll of geomembrane used, second roll started
-Witnessed sheer and peel of test weld
-Oberved liner welds and panel placement
-Liner placement and welds appeared acceptable. No wrinkles observed in geomembrane
-Observed HDPE pipe for leachate leak detection being fused on site

Next Steps

- Continue placing geosythetics
- Place geotextile protection layer leak detection pipe
- Pressure test seams
- Vaccuum test repairs
- Backfill leack detection sump with sand

OUTSTANDING INFORMATION / NEW ISSUES:
-Vaccuum box is not working, New device is expected to arrive tomorrow. Cannot place sand in Leachate pond sump until repairs are tested

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/4/2021 6:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Sunny, 20 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Witness test seams
- Obersrve panel placement and welds
- Observe Geosynthetic deployement

SITE NOTES / PROGRESS:
-1st layer of geomembrane placement complete. Panels 17-24 placed yesterday
-Geocomposite installation began yesterday two panels placed on south and two placed on west slope
-Leak detection pipe placed with geotextile covering perforated section
-Witnessed test weld and destructive tests.
-Observed extrusiion test weld and destructive test
-Cut first destructive test sample
-Observed geocomposite connections
-Observed vaccum test of repairs

Next Steps

-Continue placing geosythetics
-Place sand in leak detection sump
-Pressure test seams
-Backfill leack detection sump with sand

OUTSTANDING INFORMATION / NEW ISSUES:
-Temperature got too high in the afternoon so geomembrane installation shut down early

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/5/2021 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Scattered cloud 18 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Witness test seams
- Obersrve geo-synthetic installation

SITE NOTES / PROGRESS:
-Geocomposite installation complete
-Second GCL layer installation complete except corners
-Two panels of Geomembrane placed
-Witnessed test weld destructive tests, all results acceptable
-Observed GCL placement and checked overlap
-Observed geomembrane placement
-Leak detection sump backfilled with sand

Next Steps

- Complete placement of final layer of Geomembrane on Leachate pond
- Perform pressure tests on seams
- Backfill anchor trench

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/6/2021 7:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Terry Stuart, Liner crew		
WEATHER CONDITIONS:	Scattered cloud 18 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe Leachate pond geomembrane installation

SITE NOTES / PROGRESS:
-All geomembrane installed fused and repairs / patches made
-Observed all welds and repairs, all repairs marked after vaccuum test
-Walked each panel with Joe Cassidy, and Terry Stuart inspecting for defects. No issues observed
-Observed field sheer and peel test on destructive test 2 (DT-2), sent sample to lab

Next Steps

- Complete sealing geomembrane to HDPE leak detection pipe.
- Backfill anchor trench
- Begin geosythetic installation on landfill cell

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/9/2021 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Sun and cloud, 14 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Witness lining activities in Landfill area
- Observe conditions after Saturday's rain

SITE NOTES / PROGRESS:
-First day of geosythetic installation in landfill area.
-Rolls of Geotextile placed around landfill perimeter
-Bedding sand placed and compacted where it was previously missing on sub-base on north-west corner
-All sub-base now acceptable, some trimming still required on toe of slopes
-Sump dimensions are acceptable but edges need to be trimmed before liner placed
-Observed deployement of geotextile and geomembrane
-No ponding of water after rainfall in area where GCL rolls placed. No GCL was deployed before rainfall on Saturday

Next Steps

- Continue placing first layer of GCL and geomembrane on base of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):
-See attached photolog

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/10/2021 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Mostly sunny, 18 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Witness lining activities in Landfill area

SITE NOTES / PROGRESS:
- Eight Geomembrane panels laid yesterday
- Observed field peel and sheer test for first destructive test, DT - 1, Seam 4/5, Welder # 9, field results acceptable
- Obersvered peel and sheer on test seem, results acceptable
- Marked out location of DT-2, Seam 8/9, Welder # 9, observed field peel and sheer tests, field results acceptable
- Sent DT-1 and DT-2 to lab
- Observed GCL and Geomembrane placement and seam welding

Next Steps

- Continue placing first layer of GCL and geomembrane on base of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/11/2021 14:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:			
WEATHER CONDITIONS:	Sunny, 30 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Witness lining activities in Landfill area

SITE NOTES / PROGRESS:
-Geosythetic placement had stopped for the day due to the heat and high winds
- Panels 9 - 17 placed and seamed yesterday completing floor of landfill to south toe
- Panels 18-33 placed and seamed today on south slope
- Sent DT-3, Panel 12/13 and and DT-4, panel 16/17 to lab
- Crew attempted to place geocomposite with skid steer, weather was too hot and windy so shut down for the day
- Inspected new panels placed, no deficiencies found

Next Steps

- Place geo-composite on geomembrane
- Place geotextile on slopes

OUTSTANDING INFORMATION / NEW ISSUES:
-Need to review procedure for operating equipment on liner to ensure damage is avoided

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/12/2021 8:45	**SITE:**	Upland landfill
PERSONNEL ON SITE:			
WEATHER CONDITIONS:	Sunny, 18 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Witness lining activities in Landfill area

SITE NOTES / PROGRESS:

-Spoke to Terry Stuart and Joe Cassidy about leak detection pipe locations and requirements. Confirmed that PVC is not acceptable for pipe material.
-Observed placement of Geomembrane, no damage was be observed from skid-steer on liner
-Practices being followed were acceptable including: leaf blower used to remove sand and gravel before placing material, equipment entering liner at 90 degree angle to edge and not turning on geombrane, crew members observing geomembrane as liner is placed, placing in morning when there are fewer wrinkles in the liner.

Next Steps

- Continue placing geo-composite on geomembrane
- Place geotextile on slopes
- Shape area for leak detection ports.

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/13/2021 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Terry Stuart, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Sunny, 17 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

-Anchor trench on North and East Slopes excavated, excavation dimensions acceptable
-Observed Geotextile installed on North Slope
-Observed location marking for Leak Detection Ports, locations acceptable
-Observed crew was continuing to place geomembrane on west side of base of landfill

Next Steps

- Continue placing geocomposite on base of landfill
- Place geotextile on East Slope
- Place first layer of GCL and Geomembrane on North and East Slopes
- Hand dig leak detection port depression

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/14/2021 7:20	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy,, Brian Fagan, Liner Crew, Terry Stuart		
WEATHER CONDITIONS:	Sunny, 18 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

-Geotextile placement on East Slope complete
-Observed Geomebrane being placed on North Slope, Panels 34-44 placed from West to edge of sump
-Marked location of destructive test (DT-5), witnessed field sheer and peel tests
-Witnessed sheer and peel tests on trail seem, welder # 17
-Spoke to Brian and Terry about need for depression below gemembrane for leak detection Ports
- Observed placement of GCL in sump

Next Steps

- Finish placing and seaming geomembrane on North Slope and sump
- Place GCL and Geomembrane on East Slope
- Establish depression for leak detection ports

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/16/2021 6:45	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew, Terry Stuart		
WEATHER CONDITIONS:	Overcast, 15 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

-Geomembrane installed on North Slope, up to and including Sump.
-All GCL placed was covered with geomembrane before Sunday's rain.
-Water drained to sump after rain yesterday, no pooling observed on geomembrane on base of landfill.
-Observed crew placing GCL and Geomembrane in North-East corner.
-Observed test weld peel and sheer test.
-Marked location of destructive test DT-6, Panel 47/48, observed field peer and sheer test.
-Sent DT-5 and DT-6 to lab.

Next Steps

- Place GCL and Geomembrane on East Slope.

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/17/2021 5:55	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Clear sky, 14 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

- First layer geomembrane installation complete
- Checked yesterday's geomembrane installation for defects
- Collected destructive test DT-7 seam, 67/68 and sent to lab

Next Steps

-Install leak detetion ports
-Install leachate leak detection sump riser pipe
-Complete installing geocomposite on geomembrane

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/18/2021 7:15	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Overcast, 16 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

- Geocomposite installation complete except for North Slope and area around sump
- Checked yesterday's geocomposite installation for defects
- Observed crew placing GCL and Geomembrane working from South end to North
- 50 mm HDPE pipe for leak detection port on site and perforations drilled

Next Steps

- Continue placing GCL and Geomembrane
- Install leak detection ports
- Install leachate leak detection sump riser pipe

OUTSTANDING INFORMATION / NEW ISSUES:

-No depression established for leak detection ports. Installation will require a field fit.

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/19/2021 7:15	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Sunny, 17 C, strong wind from North-West		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

- 8 geomembrane panels installed and welded yesterday along with underlying GCL
- Observed crew placing GCL and geomembrane panels 9 & 10
- Inspected yesterday's geomembrane installation
- Collected destructive test DT-8, Panel 4/5 and sent to lab

Next Steps

- Continue placing GCL and Geomembrane to toe of North slope
- Install leak detection ports
- Install leachate leak detection sump riser pipe

OUTSTANDING INFORMATION / NEW ISSUES:

- HDPE pipe fusion machine under repair, leachate leak detection pipe installation delayed until tomorrow or Monday

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/20/2021 7:15	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	mixed sun and cloud, 14 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

- Operation shut down early yesterday due to high winds
- 2 geomembrane panels (9&10) installed and welded yesterday along with underlying GCL
- Observed crew placinng geomembrane panels 11 - 14 up to close to toe of North slope
- Observed crew placing geomembrane on South end of East slope
- Inspected yesterday's geomembrane installation
- Marked location for destructive test DT-10, witnessed field sheer and peel test, sent DT-9 and DT-10 to lab

Next Steps

- Continue placing GCL and Geomembrane on East Slope
- Install leak detection ports
- Install leachate leak detection sump riser pipe

OUTSTANDING INFORMATION / NEW ISSUES:

- HDPE pipe fusion machine still under repair

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/21/2021 7:15	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Sunny, 14 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

- Geomembrane panels 12 -21 and underlying GCL installed on East slope yesterday
- Obersrved crew placing geomembrane panels 22 - 29, completeing East slope
- HDPE pipe fusion welder onsite welding 300 mm leachate leak detection pipe
-Two leak detection ports were installed on East slope yesterday and GCL placed on top.

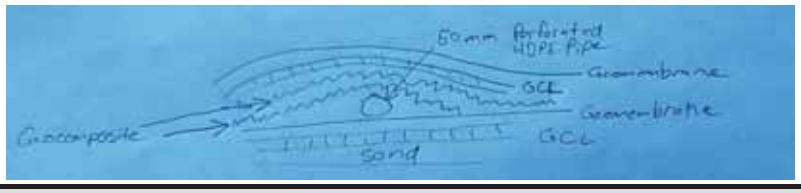
Construction notes on leak detection ports
-Leak detection monitoring ports were field fit by the Contractor (without the presence of the Engineer)
-3 m section of perforated pipe was placed on top of geomembrane, two layers of geocomposite were placed on top of pipe, see sketch below
-The two layers of gemeombrane on top of perforated pipe will prevent the upper GCL from deforming around the perforated pipe and ensure hydraulic connectivity in the inter-membrane will be acceptable.
-Without depression below leak detection port, small volumes flowing past the detection port will be difficult to detect
-Port will function acceptably for detecting larger flow volumes and leachate pooled on the geomembrane in the area of the ports

Next Steps

-Place geocomposite on North slope
-Install two leak detection ports on North slope
- Install Leachate leak detection pipe
- Install GCL and geomembrane on South Transition Berm

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):



NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/23/2021 6:45	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Sunny, 12 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

-Observed crew placing geocomposite on North Slope and North-East Corner
-Witnessed destructive test, DT-11, field sheer and peel and sent sample to lab
-Observed Field fit of leak detection port on North Slope nearest to the sump

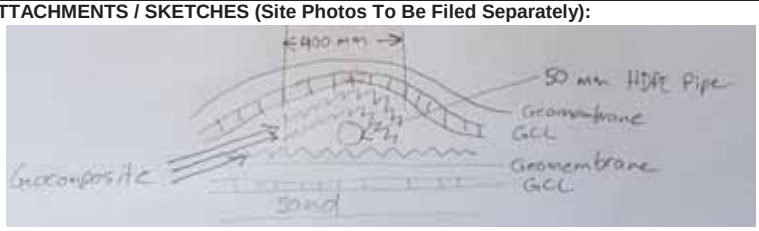
Construction notes on leak detection port:
-Leak detection port was field fit with Engineer present
-50 mm HDPE pipe was run along geomembrane, 3 m perforated section was placed on Geocomposite (see sketch below)
- Two 40 cm wide strips of geocomposite were placed on top of perforated section and heat seamed to layer below
- Installation achieves hydraulic connectivity with the inter-membrane space and will prevent the upper GCL from deforming around perforated pipe
- Lack of depression where perforated pipe sits will make it difficult to detect small volumes of leachate flowing past leak detection port
-Port will function acceptably for detecting large volumes or leachate pooled on the geomembrane in the area

Next Steps

-Complete installation of geocomposite on North slope
-Install second leak detection port on North Slope
-Insalll leachate leak detection pipe in sump
-Place GCL and Geomembrane on South Transition Berm
-Weld 600 mm leachate collection pipe, fusion machine expected to arrive today

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):



NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/24/2021 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Sunny, 12 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

-Geomembrane installation on South Transition Berm completed yesterday, panels 31 - 45
-Second leak detection port on North Berm installed yesterday, see Aug 23 Field Inspection notes for installation details
-Observed crew placing geotextile on west side of landfill
-Observed crew placing leak detection pipe in sump
-Observed crew placing geomembrane by toe of west slope
-Spoke to Briand and Joe about need for additional geocomposite at transition to sump
-Witnessed test seem field peel and sheer tests

Next Steps

-Complete installation of GCL and geomeombrane on North Slope
-Place sand in sump
-Place additional geocomposite where needed to ensure hydraulic connectivity between geocomposite layer and leak detection pipe in sump

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/25/2021 6:15	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Clear sky, 10 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

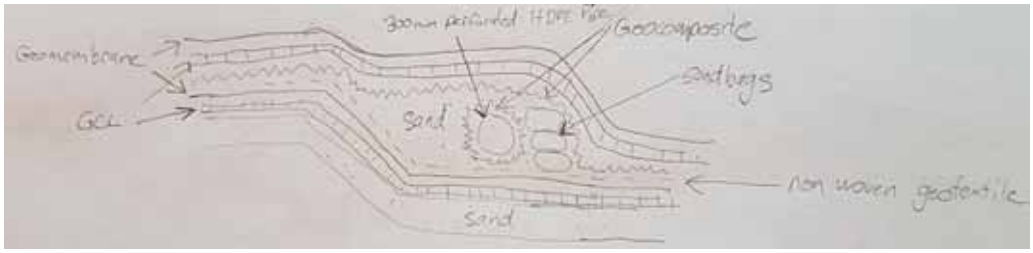
SITE NOTES / PROGRESS:
-Geomembrane panels 46 - 58 and underlying GCL installed on North Berm yesterday
-Observed crew installing geomembrane on North-East corner
-Witnessed test weld peel and sheer test
-Collected destructive test DT-12 and sent to lab
-Observed 600mm HDPE pipe welding
-Observed placement of 300 mm leak detection pipe
-Observed crew backfilling leak detection pipe

Leak detection pipe details:
-The following modifications from design were observed and approved in the field by the Engineer:
-Sandbags were placed on east side of perforated pipe to secure pipe in place
-300mm perforated HDPE pipe was wrapped in geocomposite to maintain hydraulic connectivity between pipe and sandbags
-Non-woven geotextile was installed above lower geomembrane layer
-See sketch of installation below

Next Steps
-Complete installation of GCL and geomeombrane on North-East Corner
-Install Geocomposite on slopes
-Install non-woven geotextiile on remainder of landfill floor

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):



NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/26/2021 6:45	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Overcast, light rain 16 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

-Geomembrane panels 59 - 70 installed yesterday, geomembrane installation is now complete
-600 mm leachate collection pipe section welded yesterday and ready to be installed in sump
-Observed crew placing geocomposite on north slope
-Collected destructive test DT-13, panel 67/68, and sent to lab

Next Steps

- Complete installation of geocomposite on landfill slopes
- Install 600 mm HDPE leachate pipe in sump
- Install non-woven geotextile on remainder of landfill floor (East side)

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/27/2021 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner Crew		
WEATHER CONDITIONS:	Sunny, 14 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Witness geosythetic installation activities in Landfill area

SITE NOTES / PROGRESS:

-Geocomposite installation complete on slopes
-Observed crew placing non-woven geotextile on floor of landfill

Next Steps

- Complete installation of geotextile on landfill floor
- Weld / place 200 mm HDPE leachate collection system
- Place stone drainage layer on landfill floor

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	8/28/2021 7:45	**SITE:**	Upland landfill
PERSONNEL ON SITE:			
WEATHER CONDITIONS:	Sunny, 12 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Inspect geotextile and geocomposite installation

SITE NOTES / PROGRESS:

-Geotextile installation on landfill complete
-Installation of geotextile and geocomposite is acceptable for placement of leachate collection pipe and stone drainage layer

Next Steps

- Seal geomembrane penetrations Landfill: 4 x 50 mm HDPE leak detection conduit, 1 x 300 mm HDPE leachate leak detection pipe
- Seal geomembrane penetration Leachate Treatment Pond: 1 x 300 mm leak detection pipe
- Weld / place 200 mm HDPE leachate collection pipe
- Place stone drainage layer on landfill floor

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	Dave Engstrom	**PROJECT NUMBER:**	11222680
DATE/TIME:	8/30/2021 9:00	**SITE:**	Upland Landfill
PERSONNEL ON SITE:	Brian Fagain; Liner Installation Contractor; Terry Stuart		
WEATHER CONDITIONS:	Sunny; 13-15 deg C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

Observe cell preparation for placement of drain rock and install of pipe boots for the cell and leachate pond underliners.

SITE NOTES / PROGRESS:
Discussed with Brian Fagan regarding schedule for producing drain rock. Tentative plan is to begin producing tomorrow when Brad Maxwell is on-site (8/31 follow-up - Brad provided an update that drain rock production would begin on Wednesday, 9/1).

Observed pipe boots with extrusion seams vacuum box tested at the leachate pond and the cell. Geocomposite was to be placed over the pipe boot at the cell.

Walked the cell for any new damage or concerns prior to drain rock install. No concerns or issues observed.

Next Steps
Coordinate with Brad Maxwell regarding schedule for production and placement of drain rock in the cell for next site visit.

OUTSTANDING INFORMATION / NEW ISSUES:
No issues observed during site visit.

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	Dave Engstrom	**PROJECT NUMBER:**	11222680
DATE/TIME:	9/1/2021 7:30	**SITE:**	Upland Landfill
PERSONNEL ON SITE:	Brad Maxwell; Kris Goodridge		
WEATHER CONDITIONS:	Sunny; 10-15 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

Observe cell preparation for placement of drain rock.

SITE NOTES / PROGRESS:

Met Brad Maxwell and Kris Goodridge on-site to discuss approach installing drain rock. Upland plans to mark locations of leachate pipes (to avoid placing drain rock until pipe is in place), construct a 1 m high road at the center of the cell for dumping with drain rock, placing the drain rock using a low-ground pressure excavator (CAT 315F) and placing the drain rock close to the surface (not dropping from high up). General approach will be to construct three roads from the west side future tie-in, place along the east toe and work back to the west tie in to push out any wrinkles.

Drain rock visually appeared to be in substantial conformance with the project specifications.

Leachate collection piping was inspected and found to be in conformance with the specifications. Confirmed with pipe fitter that thermal butt fusion of piping was in accordance with manufacturer's recommendations. Inspected fusion welds and found no issues.

Observed placement of drain rock at west end of cell by large mining rock truck (outside of cell). Excavator operator excavated from pile and placed in cell to start 1 m high road. Discussed with Kris and Upland plans to continue this approach until 1 m high road is started and CAT 370 rock truck will place on the road for placement by the excavator.

Next Steps

Coordinate with Upland for progress and visit site for progress check-in of the 1 m high drain rock road.

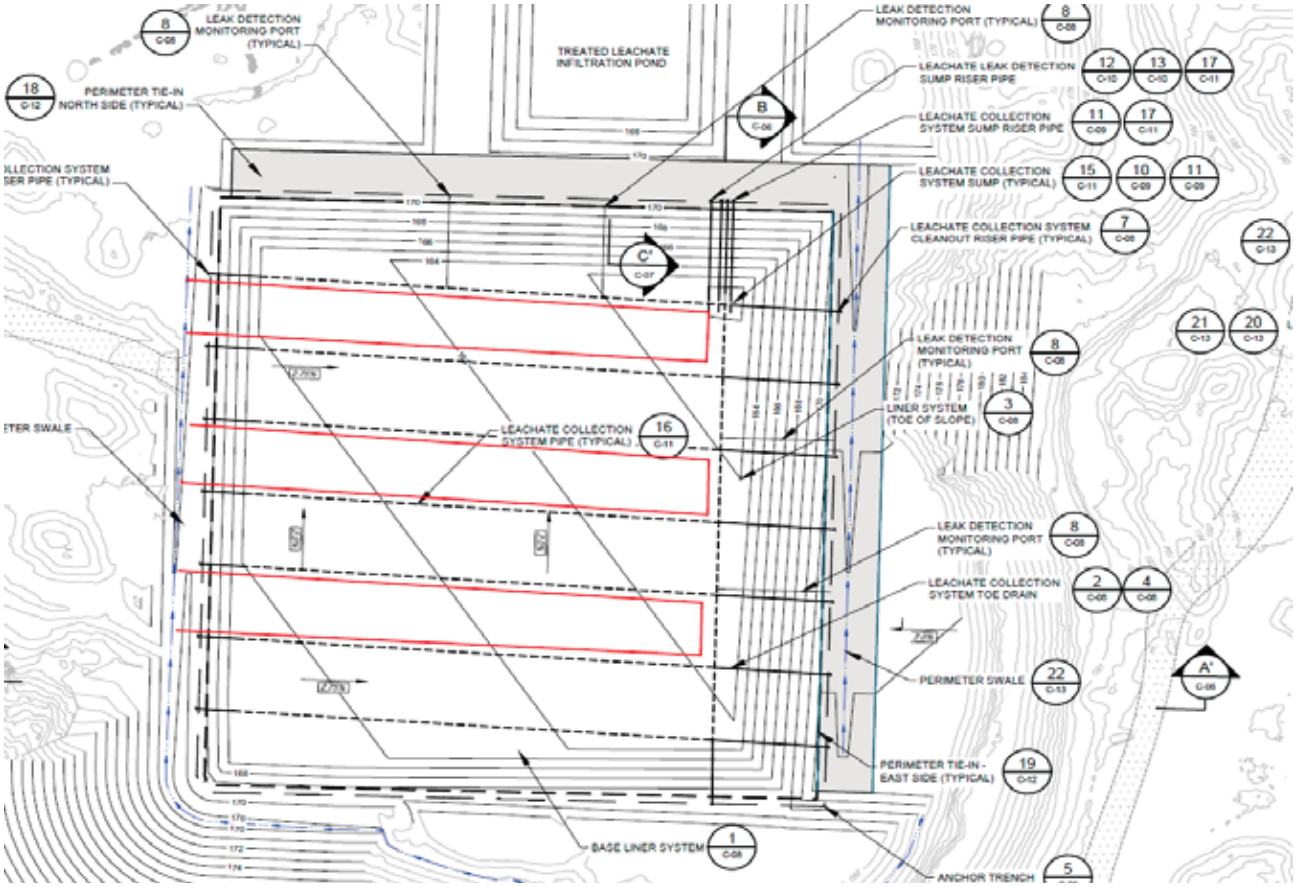
OUTSTANDING INFORMATION / NEW ISSUES:

No issues observed during site visit.

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

See attached sketch for haul road locations.

NOTE: All site photos to be filed in the Project Folder on the Project Portal.



Planned location of three 1 m high drain rock roads.

Field Notes

NAME:	Dave Engstrom	**PROJECT NUMBER:**	11222680
DATE/TIME:	9/2/2021 11:30	**SITE:**	Upland Landfill
PERSONNEL ON SITE:	Kris Goodridge		
WEATHER CONDITIONS:	Sunny; 15-17 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

Observe cell preparation for placement of drain rock.

SITE NOTES / PROGRESS:

Met Kris Goodridge on-site to discuss progress of drain rock and planned date for leachate collection piping installation (ETA Weds. 9/8).

Observed hauling, stockpiling and placement of drain rock on center minimum 1 m high drain rock road by the CAT 370 rock truck and CAT 315 low ground pressure dozer. Haul truck dumped drain rock on the 1 m high access road as a temporary stockpile. Excavator placed material in the cell by dropping from approximately less than 1 m from geosynthetics. Upland plans to continue this approach tomorrow and next Tuesday.

Collected a 5 gallon bucket sample of drain rock placed in the cell for quality assurance testing (sieve analysis).

Next Steps

Coordinate with Upland for progress and visit site for progress check-in of the 1 m high drain rock roads, placement of the leachate collection piping, and backfill over the leachate collection piping.

OUTSTANDING INFORMATION / NEW ISSUES:

No issues observed during site visit.

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	9/9/2021 14:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Kris Goodrich		
WEATHER CONDITIONS:	21 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Inspect drainage layer installation

SITE NOTES / PROGRESS:

-2 900 mm high roadway of drainrock installed from west to east toe
-3rd drainrock roadway being installed, rock trucks hauling and placing on top of lift and excavator being used to push material
-traffic cones being used to mark elevation of lift
-Two leachate riser pipes installed in sump,braced to temporary lock block
-4 perforated lengths of leachate collection pipe welded and ready to be placed in drainage layer.

Next Steps

- Finish placing 3rd 900 mm high drainrock road
- place perforated leachate collection pipes
- place 300 mm lift of drainrock on base of landfill

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	9/14/2021 7:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Kris Goodrich, HDPE Welding Crew, Equipment Operators		
WEATHER CONDITIONS:	13 C raining		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Inspect drainage layer installation

SITE NOTES / PROGRESS:

-3 900 mm high roadway of drainrock installed from west to east toe complete. Traffic pilons with ribbons being used to indicate required heigh of lift
-Observed HDPE welding crew setting up to weld non- perforated leachate riser pipes. Party tent being used to shield welding area from rain
-Perforated leachate pipes placed on landfill floor ready for backfill

Next Steps

- Finish welding leachate riser pipes
- place 300 mm of drain rock on floor of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	9/22/2021 14:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	HDPE Welding Crew, Equipment Operators		
WEATHER CONDITIONS:	14 C Sunny		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:

- Inspect drainage layer installation

SITE NOTES / PROGRESS:

-HDPE Leachate collection pipe installation complete on base of landfill
-Obseved crew placing placing 300 mm lift of drain rock with Caterpillar D5 dozer, using traffic pilons to indicate required depth. Dozer was pushing material from 900m lift onto geotextile to required depth

Next Steps

- Fuse solid HDPE leachate collection risers and install on east berm
- Continue placing drain rock on remainder of landfill footprint
- Install HDPE leachate risers

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

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The Power of Commitment

Cell 1 West Construction Report

Cell 1 West Construction Report

Northwin Landfill

Upland Excavating Ltd.

19 March 2024

DRAFT

The Power of Commitment

DRAFT

GHD Limited 735
138 East 7th Avenue, Suite 100
Vancouver, BC V5T 1M6, Canada

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	00	David Barbour	Roxy Hasior		Rose Marie Rocca		March 19, 2024
[Status code]							

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Appendices

Appendix A Record Drawings
Appendix B Photograph Log
Appendix C Material Test Results
Appendix D Product Data
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1. Introduction

The Northwin Landfill (Landfill or Site) is owned by Upland Excavating Ltd. (Upland) and operated by Northwin Environmental (Northwin). The Site has an area of approximately 48 hectares (ha) and is located at civic address 7295 and 7311 Gold River Highway, Campbell River, BC, approximately 7 kilometres (km) southwest of Campbell River city centre. The Site operates as a sand, gravel and rock quarry and a waste management facility.

This Construction Report (Report) documents the construction of Cell 1 West carried out by Upland Contracting Ltd. (Contractor), Northwin and other contractors hired by Upland.

The Report has been prepared by GHD for Upland for submission to the Ministry of Environment and Climate Change Strategy (ENV) as required by Section 2.11 of the Landfill's OC and also satisfies the requirements of Section 10.2 of the Landfill Criteria for Municipal Solid Waste (Second Edition), BC Ministry of Environment, June 2016 (the Criteria).

Upland, as the OC holder retained GHD to act as the Qualified Professional (QP) for this project scope. In this capacity, GHD designed the civil work for Cell 1 West, carried out inspections during construction, and completed this construction report.

1.1 Project Scope

Cell 1 West is the second cell constructed in the Landfill. In accordance with the 2022 Design Operations and Closure Plan (DOCP) for the Landfill and the detailed design, the Cell 1 West base consists of a double liner system and includes a leak detection layer. Leachate generated from the Landfill will be collected within the cell and conveyed to the existing Cell 1 East sump, and then to the leachate treatment system. The leachate treatment system is a batch treatment system and includes the leachate collection system, aerated equalization pond, a treated leachate holding pond and an infiltration pond, which were initially designed and constructed in 2021.

The composite double liner system for Cell 1 West is comprised of a primary and secondary base liner. The primary base liner refers to the composite liner system that consists of an HDPE geomembrane liner and geosynthetic clay liner (GCL) which underlies the leachate collection system, and the secondary base liner refers to the composite liner system comprised from of an HDPE geomembrane liner and GCL which underlies the leak detection system.

The leachate collection system includes perforated leachate collection pipes within a stone drainage blanket sloped towards the leachate sump, with the following components:

- 300 mm thick, 50 mm diameter, clear, round stone drainage blanket, with minimal fines
- Perforated leachate collection pipes (LCP) with minimum diameter of 200 mm
- Maximum 15 m lateral spacing between leachate collection pipes (LCP) running south to north
- Maximum 50 m drainage path for leachate to travel before it is intercepted by the LCPs
- Clean-outs at each end of the LCPs
- Leachate collection header pipe at the east end of the Landfill running towards the leachate collection sump at a minimum slope of 2 percent
- Leachate sump at elevation 164 m AMSL with two leachate sump riser pipes with diameters of 450 mm
- Leak detection system with four 50 mm leak detection monitoring riser pipes

2. Construction Narrative

The following sections provide the construction narrative for Cell 1 West. Record drawings are provided in Appendix A.

Construction activities began on October 12, 2022, and were completed on September 22, 2023

In general, construction generally progressed as follows:

- Site preparation and excavation

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– Cell 1 West double liner installation
– Cell 1 West leachate collection and leak detection system installation

2.1 Site Preparation & Excavation

Site preparation activities including excavation of the Cell 1 West base, preparation of subgrade contours, and construction of berms around the Cell 1 West perimeter began in September 2022 and continued through October 12, 2022. Site preparation works were completed prior to GHD arriving on site.

2.2 Cell 1 West - Composite Double Liner

Joe Cassidy (Liner Installer) was hired as an independent contractor to oversee the geosynthetic installation. Mr. Cassidy is an experienced liner installer with over thirty years of experience in the industry. Several experienced liner technicians were also hired for the installation and worked alongside Upland (the Contractor) employees with Mr. Cassidy overseeing the work. The geosynthetic installation crew mobilized to site on October 12, 2022 and the installers met with GHD to confirm QA/QC requirements.

Installation of geosynthetics in the Cell 1 West began on October 14, 2022. The QA/QC program for the construction of the base liner systems included non-destructive testing of each seam. Details of the QA/QC program are described in Section 3.

The geosynthetic deployment began with the placement of a non-woven geotextile on the slopes and floor of the landfill cell, starting at the Cell 1 East tie in berm. Geosynthetic rolls were deployed using a telehandler forklift. An excavator was used to deploy geosynthetics for the rest of the Landfill cell.

GCL was placed over top of the non-woven geotextile. Rolls in the east section of the cell were installed in a north-south direction working from the east end of the landfill to the west. For the west section of the cell, rolls were installed in a west-east direction working from the north end of the landfill to the south. The seams of the GCL were overlapped, with the crew using factory provided indicating lines that marked the minimum overlap. The seams were heat seamed shortly after the GCL deployment. In general, the geomembrane was installed on top of the GCL as soon as the width of GCL panels would allow. This process continued until the primary GCL and geomembrane layer was installed across the landfill floor.

Geocomposite installation began after the primary geomembrane installation on the landfill floor. The geocomposite was installed with panels in the same direction starting near the north toe working south. A skid-steer with smooth rubber tracks was used to deploy the geocomposite on the liner while an excavator held the rolls. GHD observed the procedures being followed by the operators and determined they were acceptable to avoid damage to the liner. The deployment procedure involved using a leaf blower to remove any debris from the area being driven on, having a spotter observe the geomembrane between the skid-steer tracks and the geo-composite, and skid steer operator never turning the equipment on the exposed geomembrane. Nylon cable ties were applied at 1.5 m intervals at the edge netting and the overlapping geotextile was heat seamed.

As the geocomposite was being placed on the base of the landfill, the crew began deploying non-woven geotextile on the slopes of the landfill. The geotextile rolls were held with an excavator while the crew placed the material manually on the slopes. The geotextile was heat seamed shortly after deployment.

The GCL was placed on the slopes after the geotextile using the same method. GCL was heat seamed shortly after it was placed and covered with the second layer of Geomembrane. The primary layer of GCL and geomembrane was completed and tied into the geosynthetics on the floor of the landfill before the secondary containment layers were installed. The same procedures were followed to install the secondary geomembrane. The smooth tracked skid steer was used to pull the geosynthetics on the base of the landfill and while the excavator held the rolls and materials were pulled by hand down the slopes. Installation of geosynthetics was completed on November 20, 2022, with the final placement of non-woven geotextile on the floor of the landfill.

Some damage to the liner was observed and repaired on November 18, 2022. Photos of the repairs are provided in the Appendix B (photo log).

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2.3 Leachate Collection System

The Contractor began installing the leachate collection pipes and the stone drainage layer in November of 2022 after completion of the geosynthetics work, however construction was postponed for the winter and resumed on June 7, 2023.

The leachate collection system was installed per the drawings with one 300 mm HDPE leachate collection header pipe running south to north, and seven 300 mm HDPE leachate collection pipes running west to east. To facilitate installation of the leachate collection system over the liner, the Contractor initially placed the stone drainage layer in 3 rows of 900 mm high lifts to form roadways from the south to the north side of the landfill cell. The material was hauled with rock trucks and placed with an excavator. Traffic cones were used for visual aids to ensure the minimum 900 mm depth of material was placed. After the drain rock roads were built the Contractor fused and placed perforated leachate collection pipe on the base of the landfill. A Caterpillar mini excavator was then used to spread the drain rock in 300 mm lifts across the floor of the landfill. The Contractor placed woven geotextile on top of the drain rock, completing the leachate collection system installation.

2.4 Close-Out

GHD performed an inspection of the Cell 1 West Works on July 7, 2023, and created a deficiency list which was provided to the Contractor. All deficiencies were addressed to the satisfaction of GHD and Upland by September 22, 2023.

3. Construction Quality Assurance & Quality Control

GHD carried out regular inspections throughout the duration of the construction to assure construction quality and quality control (QA/QC). The QA/QC program included product data review and geosynthetics installation QA/QC according to the design specifications.

A photo log with select photographs from throughout the construction is provided in Appendix B. Appendix C provides the material test results. Product data sheets and reviewed submittals are provided in Appendix D. Appendix E provides geosynthetics QA/QC information including the results of destructive and non-destructive quality testing. GHD's inspection notes from select field inspections during liner installation are included in Appendix F.

3.1 Earthworks

Site preparation and excavation activities were completed by the contractor prior to GHD's first inspection. Based on GHD's earthworks inspection was conducted prior to geosynthetics placement, the materials installed were in conformance with design specifications and drawings (refer to Section 4.1).

3.2 Leachate Collection System & Leak Detection Piping

QA/QC activities carried out during leachate collection system installation include the following:

- Inspection to witness placement of materials
- Review of submittals for pipe materials
- Review of results of sieve analysis performed on a sample of drain rock material collected by Contractor. A total of 1 sample was collected and analysed (results are presented in Appendix C).

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3.3 Geosynthetics QA/QC

The Liner Installer performed QA/QC according to the design specifications on all geomembrane installed. QC included performing field sheer and peel on a test weld before welding began and whenever conditions changed, pressure testing each welded seam, recording roll number and location of each panel placed, location of each repair. After each repair was made the weld was tested with a vacuum box.

GHD collected samples of welds at intervals less than 300 m of seams. The samples were sent to TRI Environmental Inc. for peel and sheer testing and the results were reviewed by GHD. Laboratory results are presented in Appendix E.

Geotextile material met the specifications and was installed both on the side slopes per the design and the landfill base. The geotextile on the landfill based was installed in place of the bedding sand in the design and was approved by GHD.

Geocomposite material met the specifications and was installed both on the side slopes per the design, and on a portion of the west berm of the cell base, a design change that was approved by GHD. The affected area is shown on the record drawings and notes are provided in the June 13 inspection report.

4. Conformance with Design

In general, the construction of the Cell 1 West landfill cell was carried out according to the design and specifications prepared by GHD. The below documents conformance with the original design.

4.1 Earthworks

A berm was constructed on the north end of Cell 1 West, along the road from approximately the middle of Cell 1 West to the western edge. This berm was not included in the design or inspected by GHD.

Material was left on a portion of the cell base along the western edge of Cell 1 West to cover a bedrock outcrop. This was completed to protect the liner and achieve minimum depth to groundwater. The remainder of the earthworks were carried out in accordance with the design.

4.2 Leachate Collection System & Leak Detection Piping

The 300 mm HDPE leak detection system riser was constructed as shown on Detail 15 of Drawing CI-0104.The perforated portion of the pipe was wrapped in geo-composite and sandbags were placed on the east side of the pipe to secure the pipe in place. Wrapping the pipe in geo-composite ensured there was hydraulic connectivity around the pipe.

A sample of the drain rock was collected to carry out sieve analysis and confirm whether gradation met design specifications. The results of the sieve analysis showed gravel larger than 50 mm and fines content above the design specification. The fines content was less than or equal to 1% and the material was accepted by GHD.

The stone drainage layer was placed on the non-woven geotextile layer. The Contractor exposed the top of leachate pipe by hand to confirm pipe location prior to mounding drainage rock overtop to a depth of greater than 300 mm. The area was visually inspected and large rocks were identified and removed from the cell.

During an inspection, GHD noted that 20% of loads placed within a 20 x 30 m area on the southeast section of the cell had silty sand mixed into the drainage rock. Upland discussed with the loading operator to avoid material sitting directly on the pit floor, which resulted in the material meeting specifications and resolving the material issue.

The remaining components of the leachate collection system and leak detection piping were installed in conformance with the design drawings and specifications.

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4.3 Geosynthetics

Non-woven geotextile was placed on the subgrade in place of bedding sand, on the landfill base as well as the side slopes. The geotextile placed on the landfill base was a deviation from design, which was approved by GHD.

Geocomposite material was placed on an area of the west side of the cell where a grade break was present due to the bedrock outcropping mentioned in Section 4.1. =

All other geosynthetics were installed in conformance with the design.

5. Certification

This construction report dated MONTH X, 2024, demonstrates that the Cell 1 West has been constructed in accordance with OC and the most recent DOCP, with the changes noted below and approved by the undersigned during construction. Qualified Professionals completed inspections before and during construction of Cell 1 West.

This construction report includes the information described in Section 10.2 Construction Report(s) of the Landfill Criteria and Section 2.11 of the OC, specifically:

- Changes from the original design that were approved during construction
- As-built record drawings of Cell 1 West
- All inspection and testing reports
- Quality control and quality testing results
- Soil test data including field and laboratory testing

All of Which is Respectfully Certified and Submitted by:

GHD

Deacon Liddy

David Barbour

Roxy Hasior

DRAFT

Appendices

Appendix A

Record Drawings

UPLAND EXCAVATING LTD.
CAMPBELL RIVER, B.C.

NEW LANDFILL (NORTHWIN LANDFILL)
STAGE 1 WEST - ISSUED FOR RECORD
NOVEMBER 2023

SOURCE:
JANUARY 01, 2007. GOVERNMENT OF CANADA, NATURAL RESOURCES CANADA.

AREA MAP

SOURCE:
BING IMAGERY: MICROSOFT PRODUCT SCREEN SHOT(S) REPRINTED WITH PERMISSION FROM MICROSOFT CORPORATION

LOCATION MAP

DRAWING LIST	
DWG NO	DRAWING TITLE
GN-0001	COVER AND INDEX
CI-0101	EXISTING CONDITIONS
CI-0102	FINAL CONDITIONS
CI-0103	TOP OF SUBGRADE
CI-0104	TOP OF DOUBLE LINER SYSTEM
CI-0105	TOP OF DRAINAGE LAYER
CI-0301	STAGE 1 WEST CROSS-SECTIONS
CI-0501	LINER SYSTEM DETAILS
CI-0502	PERIMETER TIE-IN DETAILS
CI-0503	LEACHATE COLLECTION SUMP DETAILS
CI-0504	LEACHATE LEAK DETECTION SUMP DETAILS
CI-0505	LEACHATE COLLECTION SYSTEM DETAILS

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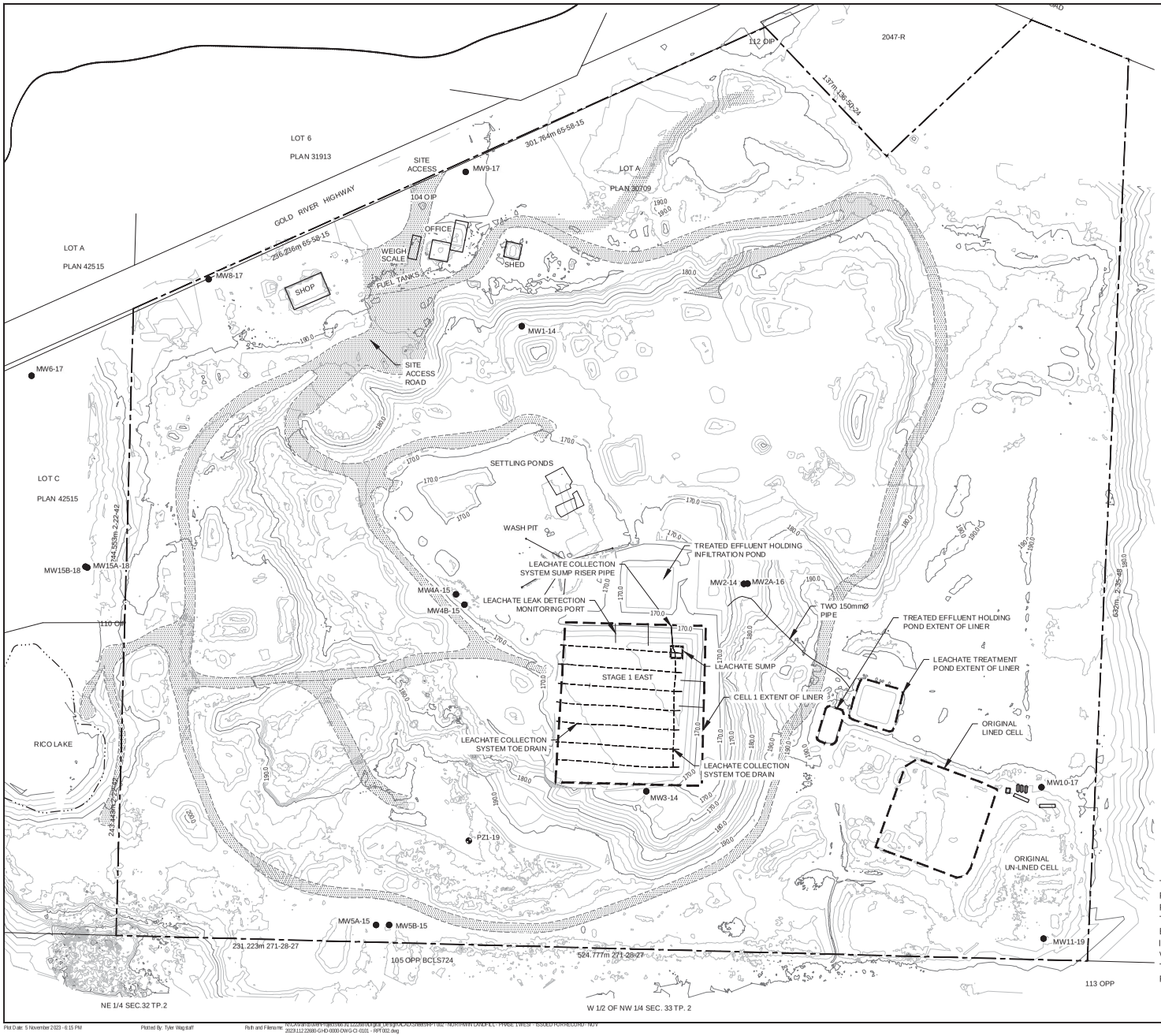
No.	Issue	Checked	Approved	Date
-	-	-	-	-

Author T.WAGSTAFF Designer
Drafting Check Design Check
Project Manager Project Director

Client
UPLAND EXAVATING LTD.
CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale N.T.S.
Project No. 11222680
Title COVER AND INDEX
Size ANSI D
Status Code
Sheet No. GN-0001
Sheet 1 of 10



LEGEND

160.0	EXISTING CONTOUR (MAJOR) - 10m
	EXISTING CONTOUR (MINOR) - 2m
	PROPERTY BOUNDARY
	EXISTING LAKE SHORELINE
	EXISTING ROADWAY
MW1-14	EXISTING MONITORING WELL

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-	-	-	-	-

Author T.WAGSTAFF
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Drafting Check
Design Check
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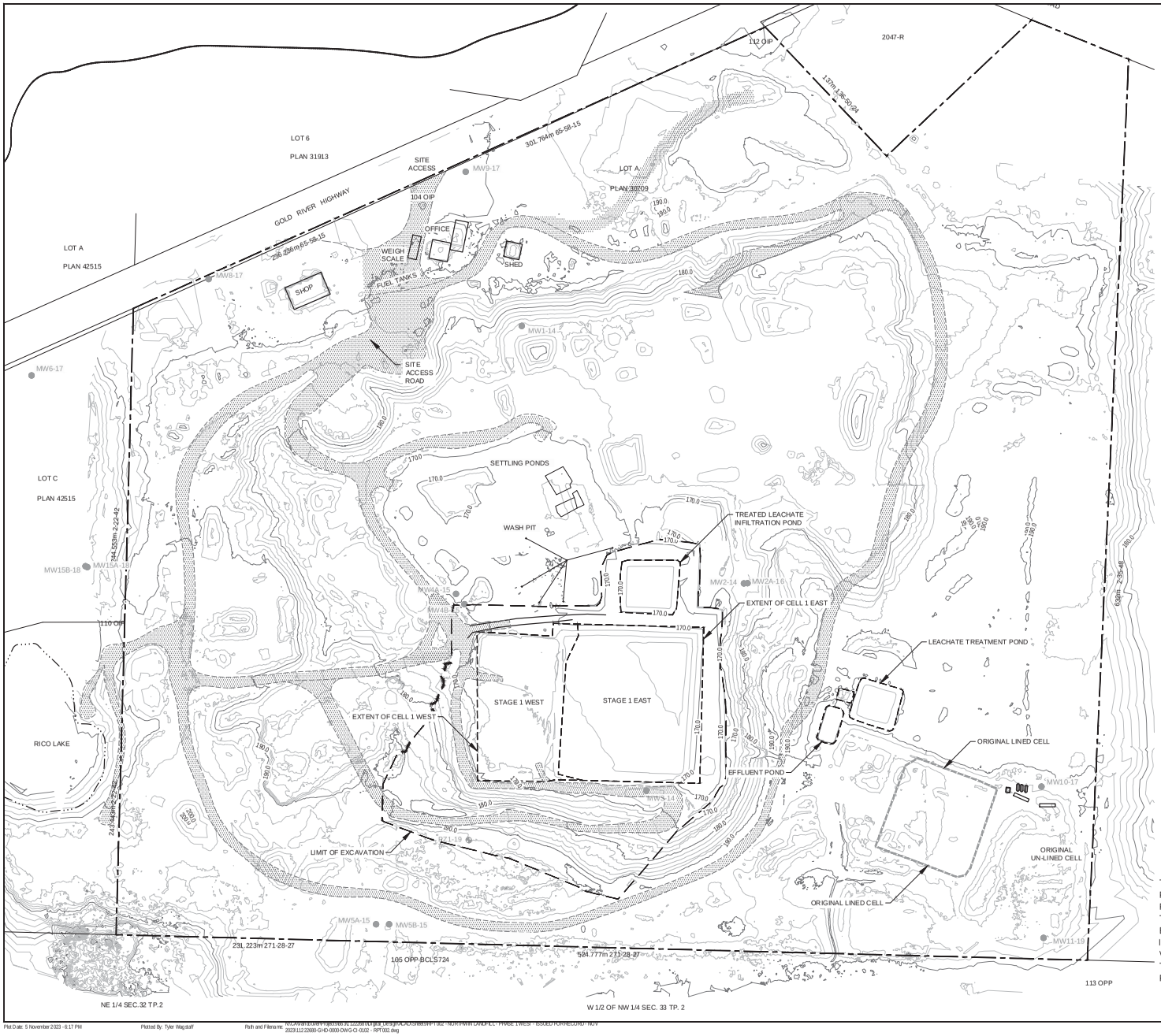
Project Director

Client
UPLAND EXAVATING LTD.
CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale 1:1500
Project No. 11222680
Title EXISTING CONDITIONS
Size ANSI D
Status Code
Sheet No. CI-0101
Sheet 1 of 10



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Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale 1:1500
Project No. 11222680
Title FINAL CONDITIONS
Size ANSI D
Status Code
Sheet No. CI-0102
Sheet 1 of 10

Plot Date: 5 November 2023 - 6:17 PM
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N

0 5 10 15m

LEGEND

168.0	EXISTING CONTOUR (MAJOR) - 4m
	EXISTING CONTOUR (MINOR) - 1m
172.0	TOP OF SUBGRADE CONTOUR (MAJOR) - 4m
	TOP OF SUBGRADE CONTOUR (MINOR) - 1m
	PROPERTY BOUNDARY
	EXISTING ROADWAY
	LIMIT OF WASTE
	EXTENT OF CELL 1 WEST AND EXCAVATION
	SWALE

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Author T.WAGSTAFF
Designer
Drafting Check
Design Check
Project Manager
Project Director

Client
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CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale 1:500
Project No. 11222680
Title TOP OF SUBGRADE
Size ANSI D
Status Code
Sheet No. CI-0103
Sheet 1 of 10

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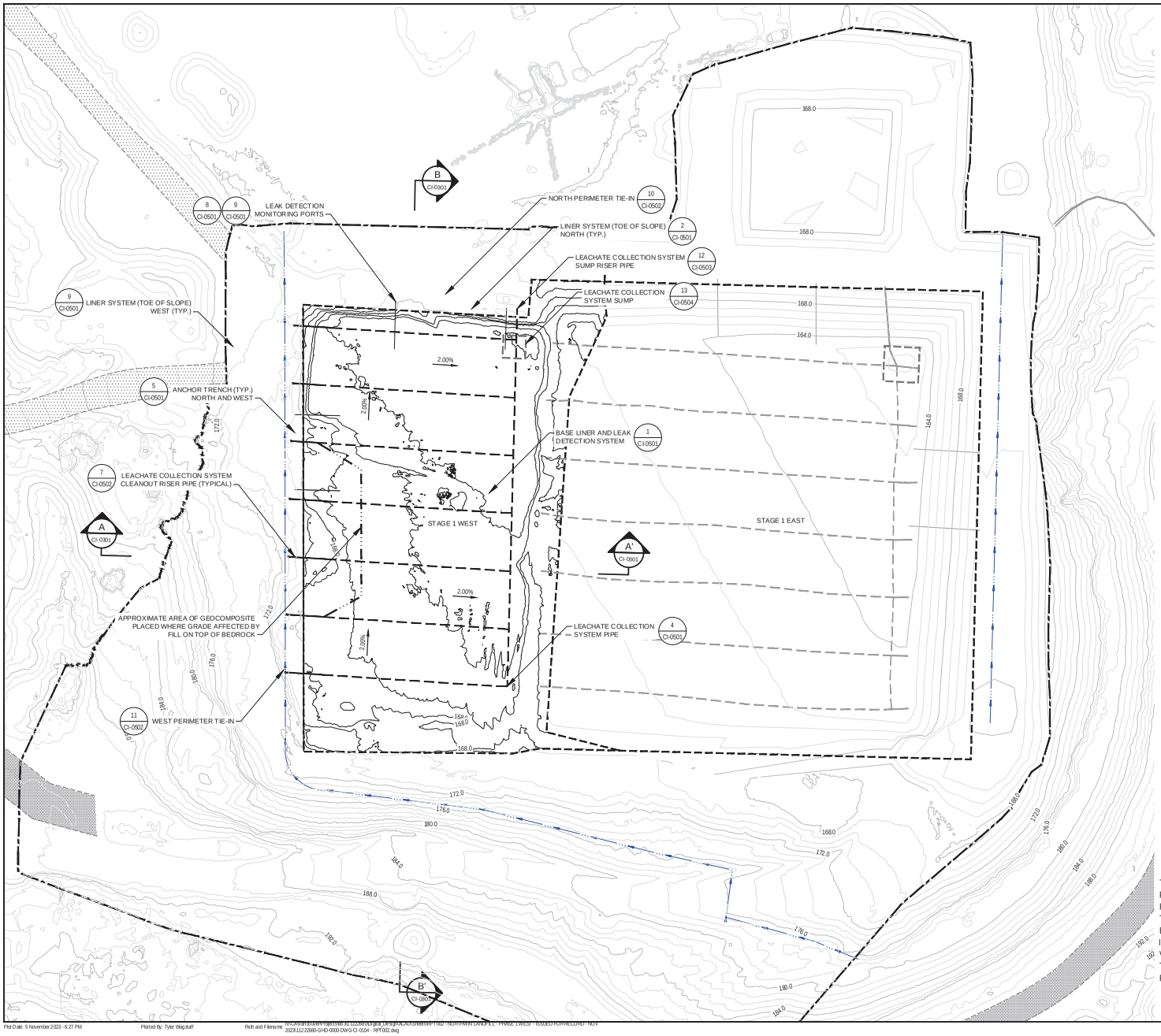

N

0 5 10 15m

LEGEND

- 172.0 — EXISTING CONTOUR (MAJOR) - 4m
- EXISTING CONTOUR (MINOR) - 1m
- 168.0 — BOTTOM OF LINER CONTOUR (MAJOR) - 4m
- BOTTOM OF LINER CONTOUR (MINOR) - 1m
- PROPERTY BOUNDARY
- LEACHATE COLLECTION SYSTEM PIPE (PERFORATED)
- LEACHATE COLLECTION SYSTEM PIPE (NON-PERFORATED)
- EXISTING ROADWAY
- LIMIT OF WASTE
- EXTENT OF CELL 1 WEST AND EXCAVATION
- SWALE
- AREA OF GEOCOMPOSITE

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Author T.WAGSTAFF
Designer
Drafting Check
Design Check
Project Manager
Project Director

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UPLAND EXAVATING LTD.
CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale 1:500
Project No. 11222680
Title TOP OF DOUBLE LINER SYSTEM
Size ANSI D
Status Code
Sheet No. CI-0104
Sheet 1 of 10

Plot Date: 5 November 2023 - 6:27 PM
Plotted By: Tyler Wagstaff
Path and Filename: 10.CAD\01\0001\Project\0000\00.ac\122680.00\Grid_Design\ACAD\SHEETS\CI-1 - NORTHWIN LANDFILL - PHASE 1 WEST - ISSUED FOR RECORD - NOV 2023\122 22680-GHD-0000-DWG-CI-0104 - RPT002.dwg

N

0 5 10 15m

LEGEND

- 172.0 — EXISTING CONTOUR (MAJOR) - 4m
- EXISTING CONTOUR (MINOR) - 1m
- 168.0 — TOP OF DRAINAGE LAYER CONTOUR (MAJOR) - 4m
- TOP OF DRAINAGE LAYER CONTOUR (MINOR) - 1m
- PROPERTY BOUNDARY
- EXISTING ROADWAY
- LIMIT OF WASTE
- EXTENT OF CELL 1 WEST AND EXCAVATION
- SWALE

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No.	Issue	Checked	Approved	Date

Author T.WAGSTAFF Designer

Drafting Check Design Check

Project Manager Project Director

Client
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CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06 Scale 1:500

Project No. 11222680

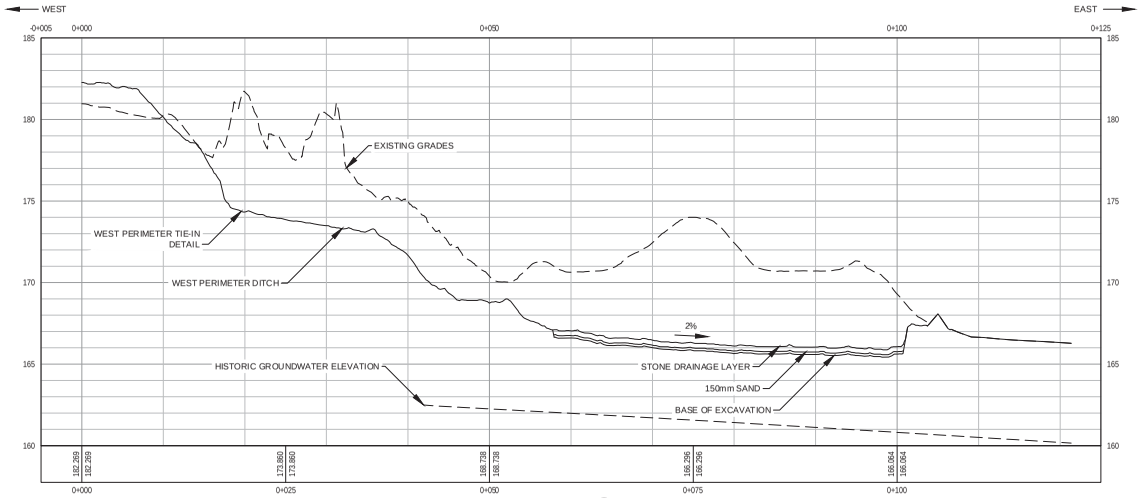
Title
TOP OF DRAINAGE LAYER

Size ANSI D

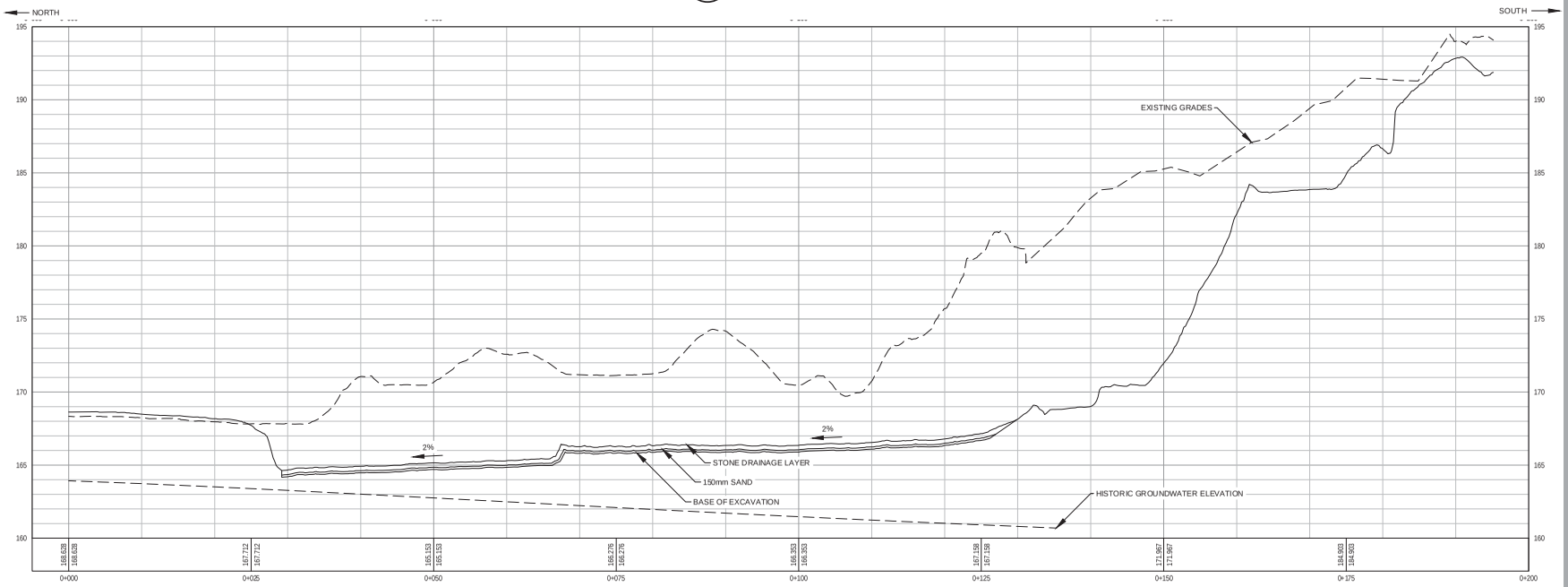
Status Code

Sheet No. CI-0105 Sheet 1 of 10

Plot Date: 5 November 2023 - 6:32 PM Plotted By: Tyler Wagstaff Path and Filename: 10.CAD\01\0001\11222680.dwg\11222680-0001\Plot_Dwg\ACAD\SHEETS\CI-1 - NORTHWIN LANDFILL - PHASE 1 WEST - ISSUED FOR RECORD - NOV 2023\11222680-GHD-0000-DWG-CI-0105 - RPT002.dwg



SECTION A-A' (CI-0103)
HORZ: 1:300
VERT: 1:150



SECTION B-B' (CI-0103)
HORZ: 1:300
VERT: 1:150

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Author T.WAGSTAFF
Designer
Drafting Check
Design Check
Project Manager
Project Director

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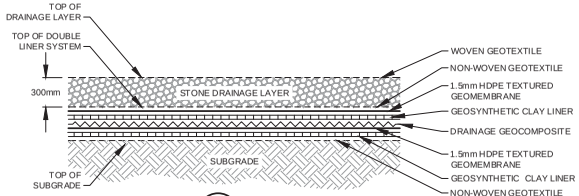
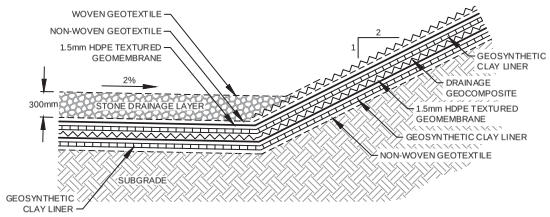
CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

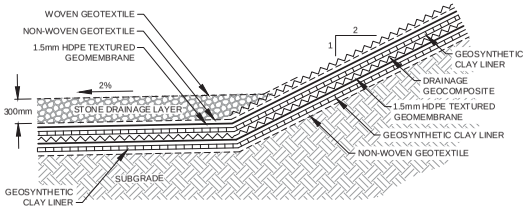
Date 2023-11-06
Scale AS SHOWN
Project No. 11222680
Title STAGE 1 WEST CROSS-SECTIONS
Size ANSI D
Status Code
Sheet No. CI-0301
Sheet 1 of 10



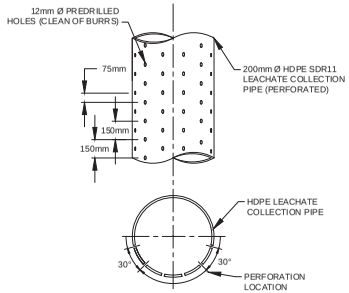
DETAIL 1 (CI-0103) 1:25 — BASE LINER AND LEAK DETECTION SYSTEM



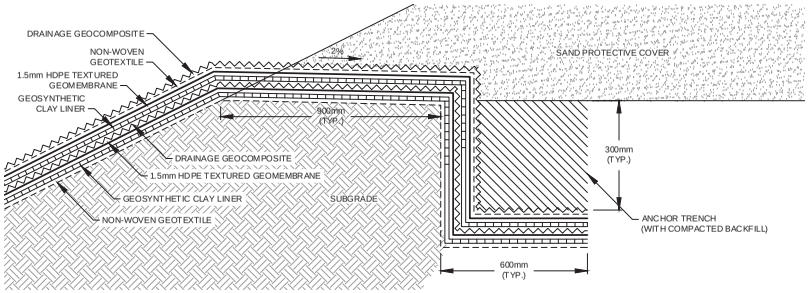
DETAIL 2 (CI-0103) 1:30 — LINER SYSTEM (TOE OF SLOPE) NORTH (TYP.)



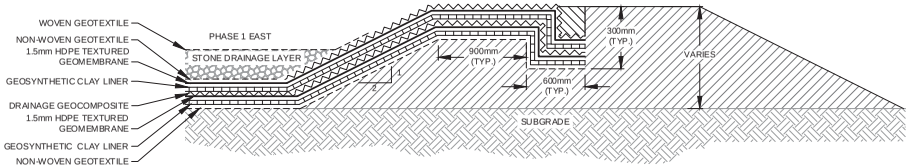
DETAIL 3 (CI-0103) 1:30 — LINER SYSTEM (TOE OF SLOPE) WEST (TYP.)



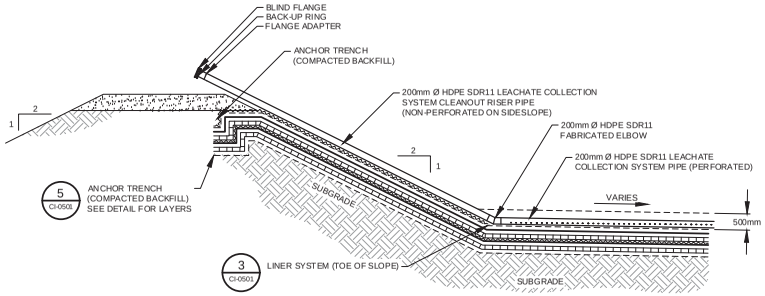
DETAIL 4 (CI-0104) N.T.S. — LEACHATE COLLECTION SYSTEM TOE DRAIN / LEACHATE COLLECTION SYSTEM PIPE PERFORATIONS



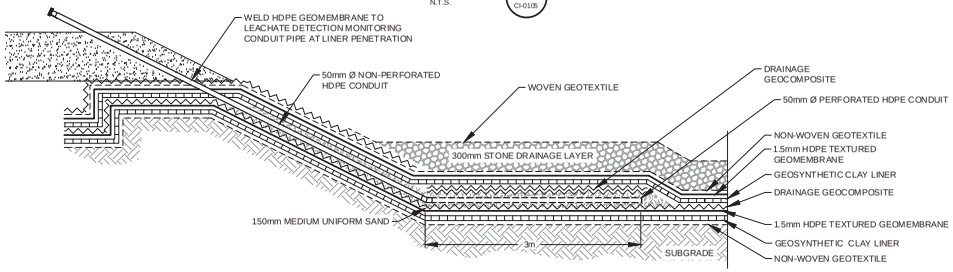
DETAIL 5 (CI-0103) 1:10 — ANCHOR TRENCH (TYPICAL) NORTH AND WEST



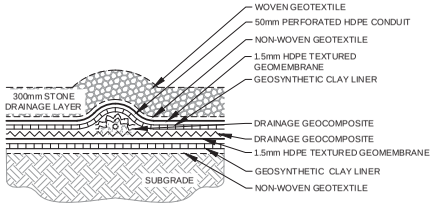
DETAIL 6 (CI-0105) N.T.S. — SOUTHERN TRANSITION BERM



DETAIL 7 (CI-0104) 1:75 — LEACHATE COLLECTION SYSTEM CLEANOUT RISER PIPE (TYPICAL)



DETAIL 8 (CI-0105) N.T.S. — LEAK DETECTION DETECTION PORT (TYP.) PROFILE



DETAIL 9 (CI-0103) 1:25 — LEAK DETECTION MONITORING PORT (TYP.) CROSS-SECTION

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No.	Issue	Checked	Approved	Date

Author T.WAGSTAFF — Designer
Drafting Check — Design Check
Project Manager — Project Director

Client
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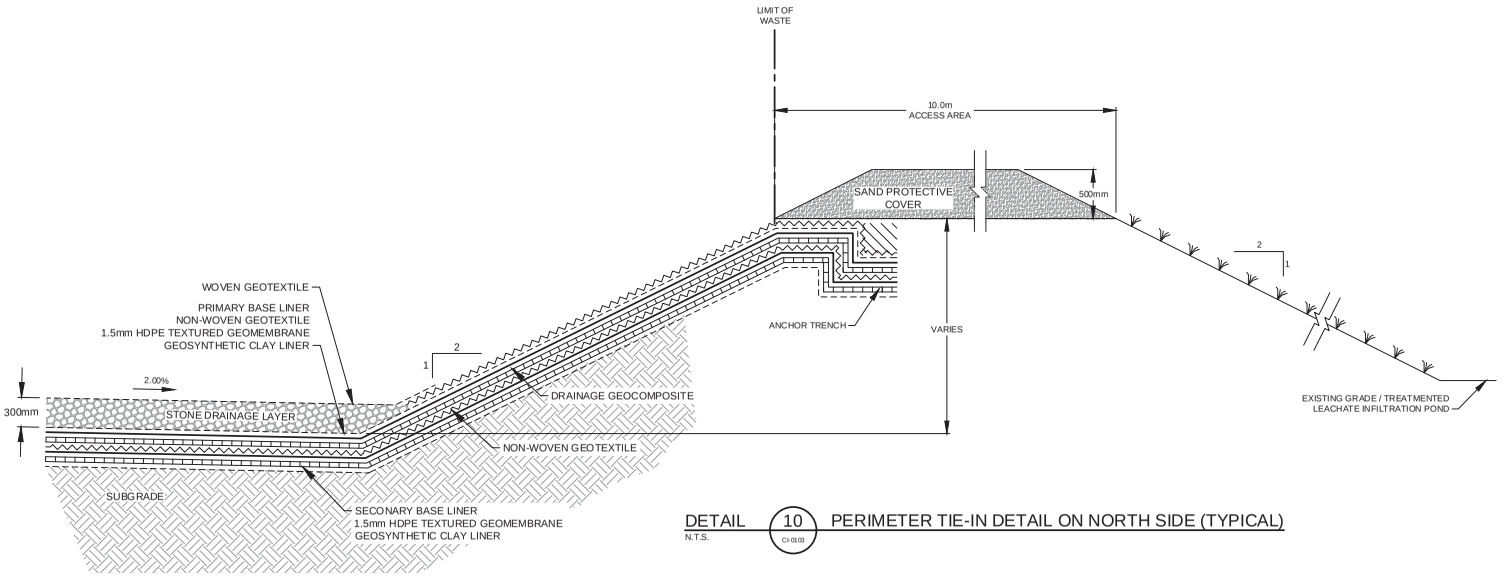
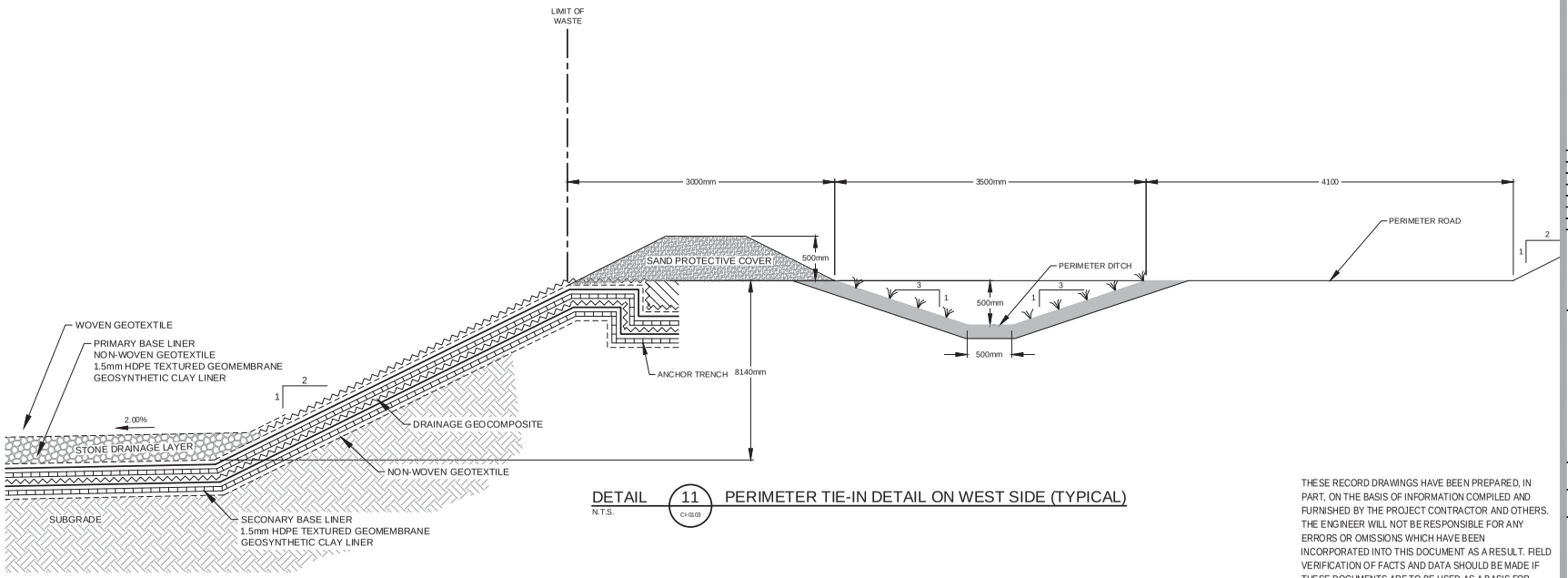
CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale AS SHOWN
Project No. 11222680
Title LINER SYSTEM DETAILS
Size ANSI D
Status Code
Sheet No. CI-0501
Sheet 1 of 10



DETAIL 10 (CI-0101) PERIMETER TIE-IN DETAIL ON NORTH SIDE (TYPICAL)
N.T.S.



DETAIL 11 (CI-0101) PERIMETER TIE-IN DETAIL ON WEST SIDE (TYPICAL)
N.T.S.

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Project Manager Project Director

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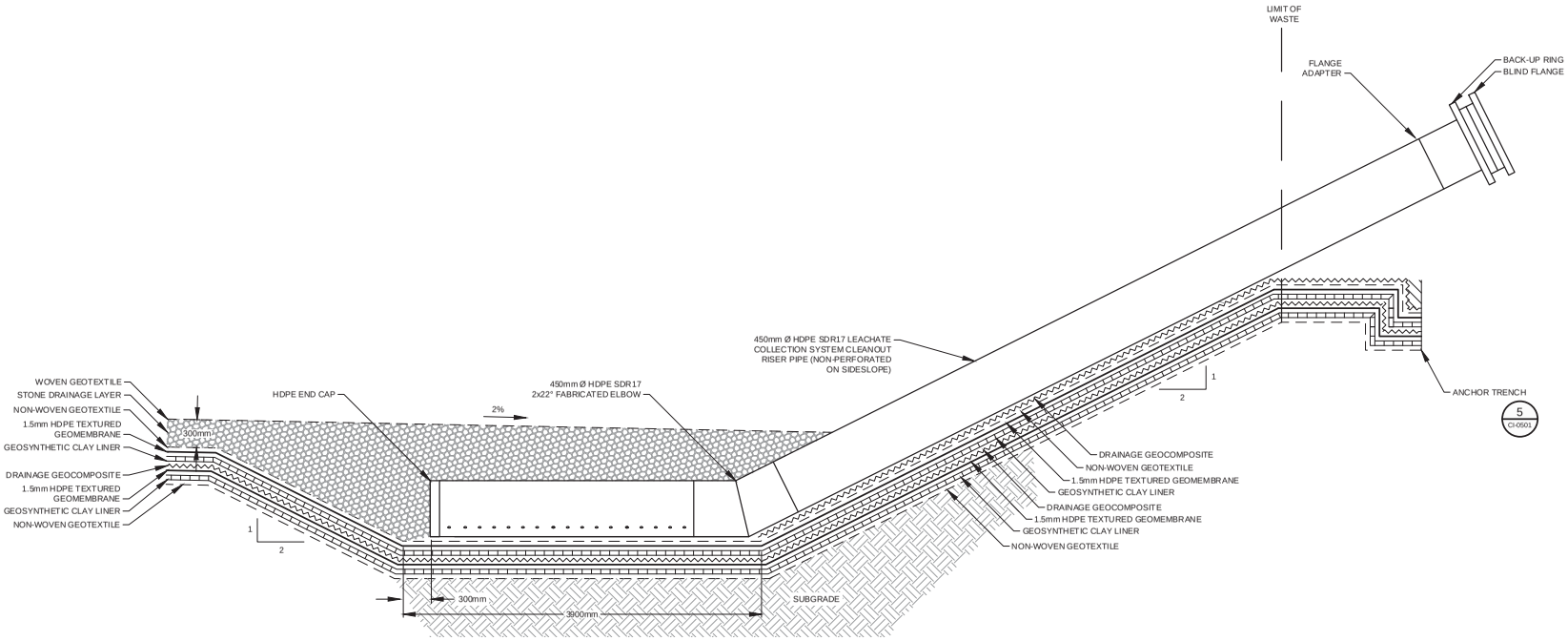
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale N.T.S.
Project No. 11222680
Title PERIMETER TIE-IN DETAILS
Size ANSI D
Status Code
Sheet No. CI-0502
Sheet 1 of 10



DETAIL 12 (CI-0104) LEACHATE COLLECTION SYSTEM SUMP, SUMP RISER PIPE, AND LEACHATE LEVEL MONITORING PIPE

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Drafting Check Design Check

Project Manager Project Director

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Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06 Scale N.T.S.

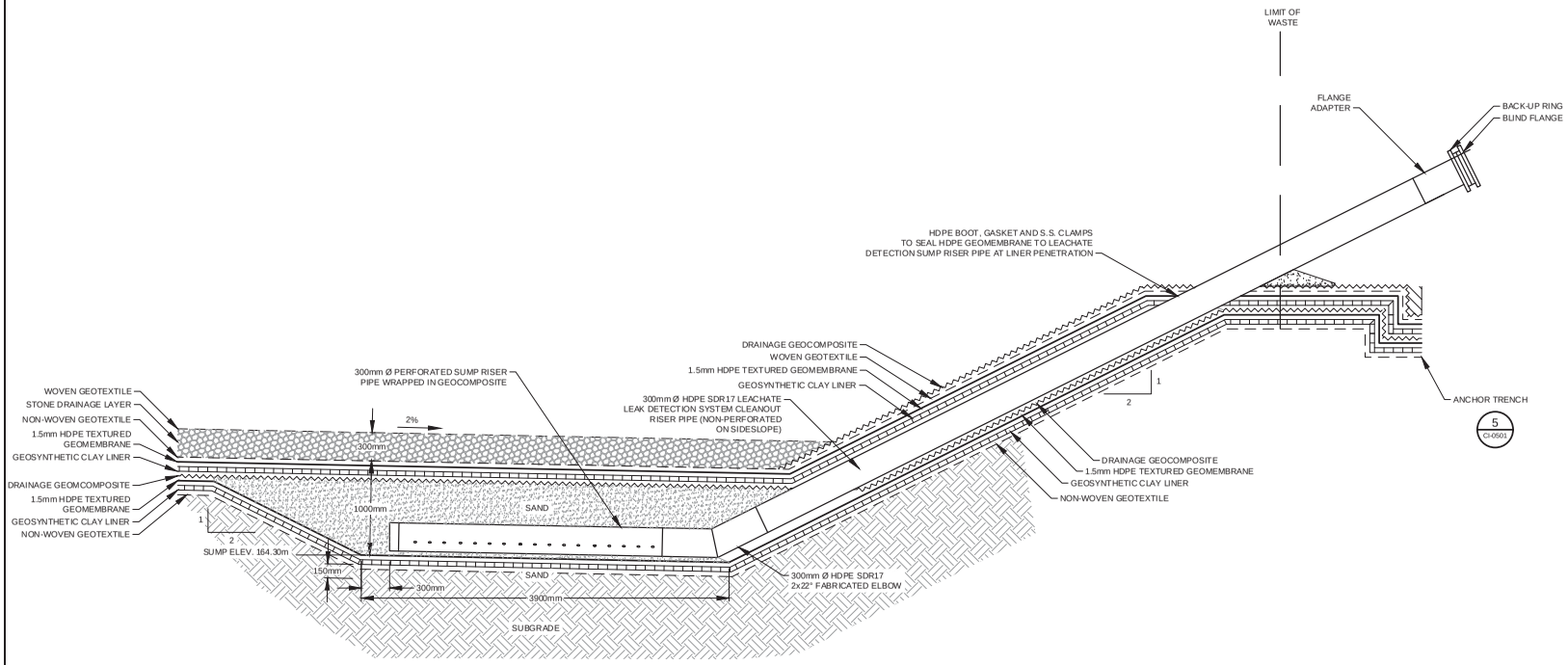
Project No. 11222680

Title
LEACHATE COLLECTION SUMP DETAILS

Size ANSI D

Status Code

Sheet No. CI-0503 Sheet 1 of 10



DETAIL 13 (CI-0104) LEACHATE LEAK DETECTION SUMP, SUMP RISER PIPE

N.T.S.

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Project Manager Project Director

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Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06 Scale N.T.S.

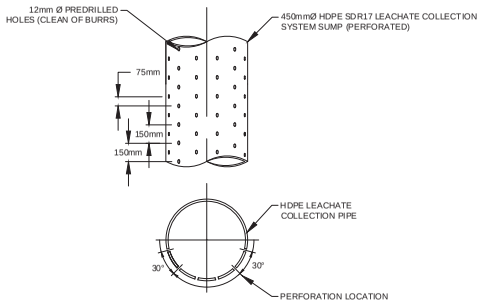
Project No. 11222680

Title
LEACHATE LEAK DETECTION SUMP DETAILS

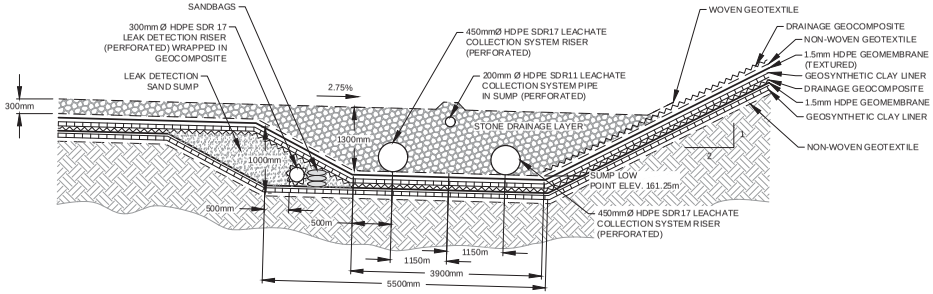
Size ANSI D

Status Code

Sheet No. CI-0504 Sheet 1 of 10



DETAIL 14 (CI-0501) 450mmØ LEACHATE COLLECTION SYSTEM SUMP PIPE PERFORATIONS
NTS



DETAIL 15 (CI-0504) LEACHATE COLLECTION SYSTEM SUMP
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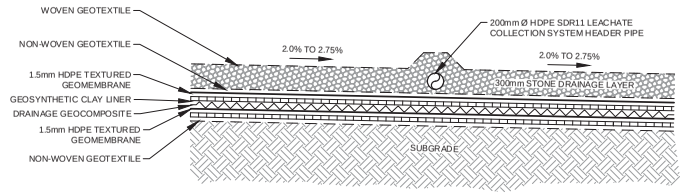

DETAIL 16 (CI-0104) LEACHATE COLLECTION SYSTEM TOE DRAIN/ LEACHATE COLLECTION SYSTEM PIPE
N.T.S.

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Drafting Check Design Check
Project Manager Project Director

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CAMPBELL RIVER, B.C.

Project
STAGE 1 WEST
ISSUED FOR RECORD

Date 2023-11-06
Scale N.T.S.
Project No. 11222680
Title LEACHATE COLLECTION SYSTEM DETAILS
Size ANSI D
Status Code
Sheet No. CI-0505
Sheet 1 of 10

Appendix B

Photograph Log

Photo 1 Installing Non-Woven Geotextile

Photo 2 Typical Destructive Sample of Geomembrane Seam for Lab Testing

Photo 3 HDPE Liner Welding Cell 1 West to Cell 1 East Tie in

Photo 4 Field Tensiometer

Photo 5 Primary Geomembrane Installation

Photo 6 Seaming GCL and Primary Geomembrane Installation

Photo 7 Typical Geomembrane Repair

Photo 8 Seaming Geomembrane

Photo 9 Typical Drainage Geocomposite Cable Ties

Photo 10 Installing GCL on top of Geocomposite

Phot 11 Test Weld

Photo 12 Leachate Sump with Primary Geomembrane

Photo 13 Deploying Non-Woven Geotextile

Photo 14 Geomembrane Welding in Liner Anchor Trench

Photo 15 Seaming the Geomembrane

Photo 16 Seaming the Geomembrane

Photo 17 Seaming Geocomposite on the North Berm

Photo 18 HDPE Pipe Fusion Machine

Photo 19 50 mm Leak Detection Riser Pipe

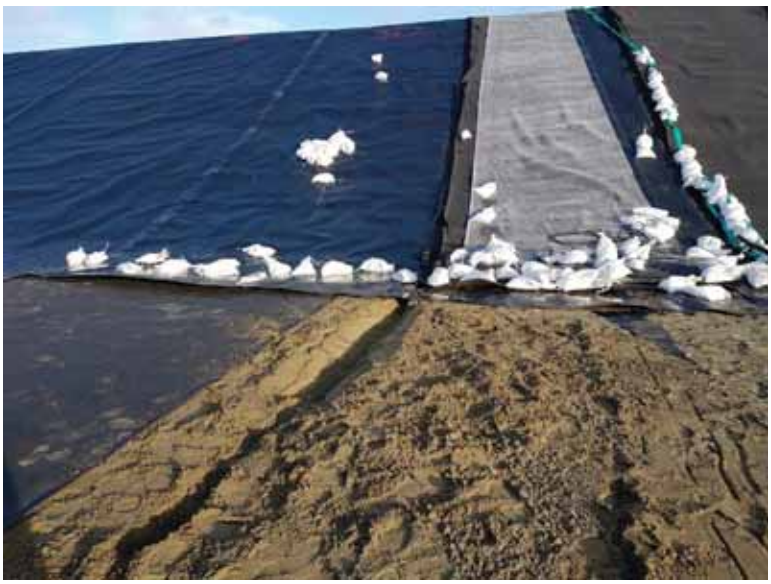


Photo 20 Deploying the secondary GCL on the North Berm

Photo 21 Placing Leachate Collection Pipes

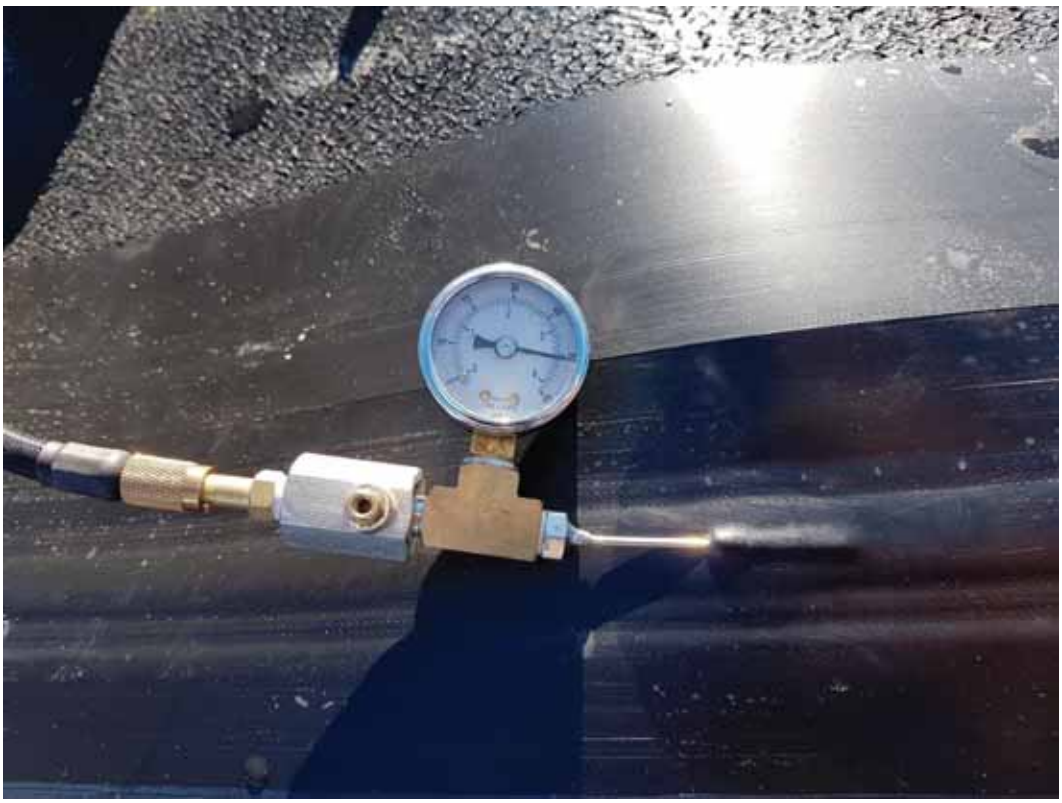


Photo 22 Geomembrane Seam Pressure Test

Photo 23 *Deploying Primary GCL on top of* Geotextile

Photo 24 *Geomembrane Seaming*

Photo 25 Completed repair to damaged liner area (November 18, 2022)

Photo 24 Cell 1 West viewed from northwest corner (September 22, 2023)

Photo 25 Leachate and leak detection risers / concrete poured for pump station (September 22, 2023)

Photo 26 Leachate and leak detection risers / concrete poured for pump station (September 22, 2023)

Photo 27 Pipe directing leachate to Cell 1 East (September 22, 2023)

Photo 28 Cell 1 West from northeast corner (September 22, 2023)

Photo 29 West perimeter road. Berm to prevent surface water run-on visible on right side of photo (September 22, 2023)

Photo 30 South end of Cell 2 (September 22, 2023)

Appendix C

Material Test Results

METRO TESTING + ENGINEERING

CCIL CAR OQM
401-6741 Cariboo Rd., Burnaby, BC V3N 4A3
t: 604.436.9111 tf: 1.844.732.2638
e: info@metrotesting.ca

To: GHD Limited - 735 (Ontario)
455 Phillip Street
Waterloo, ON
N2L 3X2

Date: 28-Nov-22
Project No.: MB41159

Attn: Roxy Hasior, P.Eng.

Materials Finer than 75-µm (No. 200) Sieve
in Mineral Aggregates by Washing
ASTM C117

This test method covers the determination of the amount of material finer than a 75-um sieve in aggregates by washing.

Product	Date Sampled	Sample Source	Proceedure Used	Percentage of Material Finer than a 75-um (0.1%)
75mm Minus	2022-11-18		A	0.5%
			Contract Requirements:	n/a
			MoT Specified Limit:	n/a

Comment:
Percentage of material finer than 75-um sieve is 0.5

Conducted by:

Peregrina Israel
Senior Laboratory Technician
CCIL Certified

Reviewed by:

Andy Bernardino, AScT
Quality Supervisor/Technical Lead
for Asphalt and Aggregate
CCIL Certified

Metro Testing + Engineering
401 - 6741 Cariboo Rd, Burnaby, BC V3N 4A3
Tel: (604) 436-9111 Fax: (604) 436-9050

CCIL CERTIFIED TESTING LABORATORY

SIEVE ANALYSIS REPORT
Series 8 16 30 50

PROJECT NO. MB41159
CLIENT GHD Limited - 735 (Ontario)
CC David Barbour
Airesse MacPhee
David Barbour

TO
GHD Limited - 735 (Ontario)
455 Phillip Street
Waterloo, ON
N2L 3X2

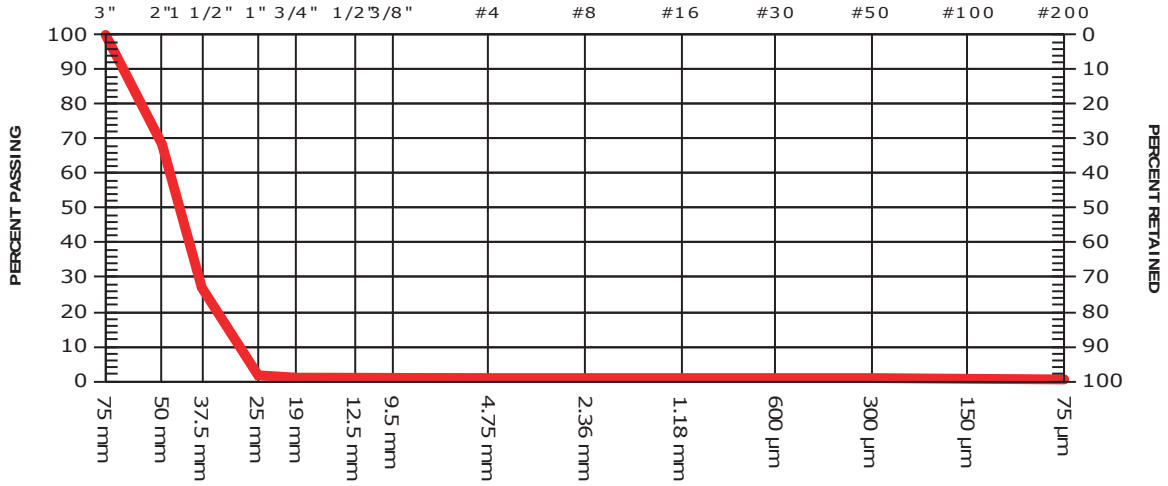
ATTN : Roxy Hasior, P.Eng

PROJECT Upland Landfill
Materials Testing
7295 Gold River Highway
Campbell River
CONTRACTOR GHD Ltd.

SIEVE TEST NO. 1 DATE RECIEVED 2022.Nov.22 DATE TESTED 2022.Nov.28 DATE SAMPLED 2022.Nov.18

SUPPPLIER N/A
SOURCE N/A
SPECIFICATION
MATERIAL TYPE 75MM MINUS

SAMPLED BY CLIENT
TESTED BY PI
TEST METHOD WASHED



GRAVEL SIZES		PERCENT PASSING	GRADATION LIMITS
3"	75 mm	100.0	
2"	50 mm	68.5	
1 1/2"	37.5 mm	27.0	
1"	25 mm	1.7	
3/4"	19 mm	1.0	
1/2"	12.5 mm		
3/8"	9.5 mm		

SAND SIZES AND FINES		PERCENT PASSING	GRADATION LIMITS
No. 4	4.75 mm	0.9	
No. 8	2.36 mm	0.9	
No. 16	1.18 mm	0.9	
No. 30	600 µm	0.9	
No. 50	300 µm	0.9	
No. 100	150 µm	0.7	
No. 200	75 µm	0.5	

COMMENTS

Page 1 2022.Nov.28

PER.

Reporting of the these test result constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

Metro Testing + Engineering
401 - 6741 Cariboo Rd, Burnaby, BC V3N 4A3
Tel: (604) 436-9111 Fax: (604) 436-9050

CCIL CERTIFIED TESTING LABORATORY

SIEVE ANALYSIS REPORT
Series 8 16 30 50

PROJECT NO. MB41159
CLIENT GHD Limited - 735 (Ontario)
CC David Barbour
Airesse MacPhee
David Barbour

TO
GHD Limited - 735 (Ontario)
455 Phillip Street
Waterloo, ON
N2L 3X2

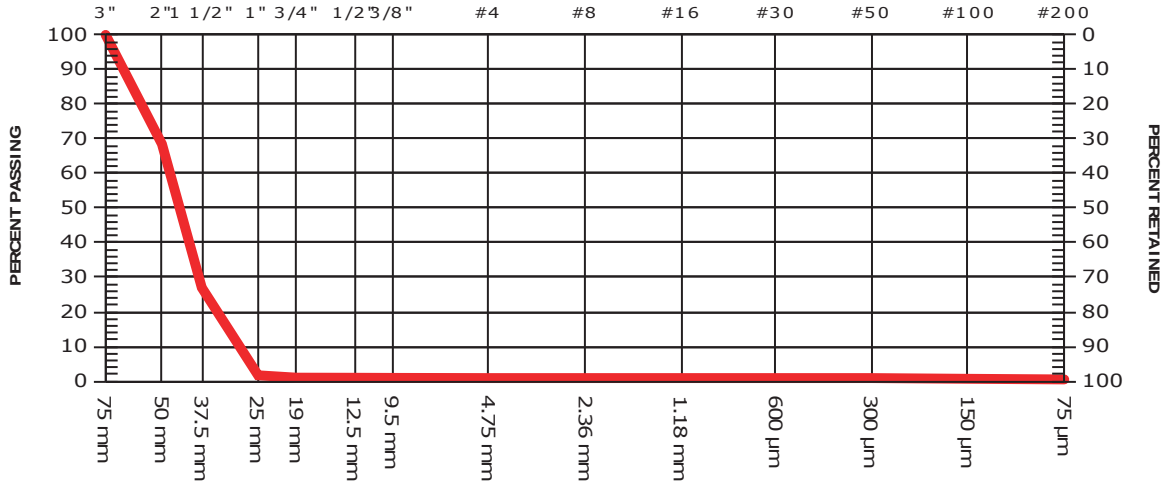
ATTN : David Barbour

PROJECT Upland Landfill
Materials Testing
7295 Gold River Highway
Campbell River
CONTRACTOR GHD Ltd.

SIEVE TEST NO. 1 DATE RECIEVED 2022.Nov.22 DATE TESTED 2022.Nov.28 DATE SAMPLED 2022.Nov.18

SUPPPLIER N/A
SOURCE N/A
SPECIFICATION
MATERIAL TYPE 75MM MINUS

SAMPLED BY CLIENT
TESTED BY PI
TEST METHOD WASHED



GRAVEL SIZES		PERCENT PASSING	GRADATION LIMITS
3"	75 mm	100.0	
2"	50 mm	68.5	
1 1/2"	37.5 mm	27.0	
1"	25 mm	1.7	
3/4"	19 mm	1.0	
1/2"	12.5 mm		
3/8"	9.5 mm		

SAND SIZES AND FINES		PERCENT PASSING	GRADATION LIMITS
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COMMENTS

Page 2 2022.Nov.28

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Waterloo, ON
N2L 3X2

ATTN : Airesse MacPhee

PROJECT Upland Landfill
Materials Testing
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Campbell River
CONTRACTOR GHD Ltd.

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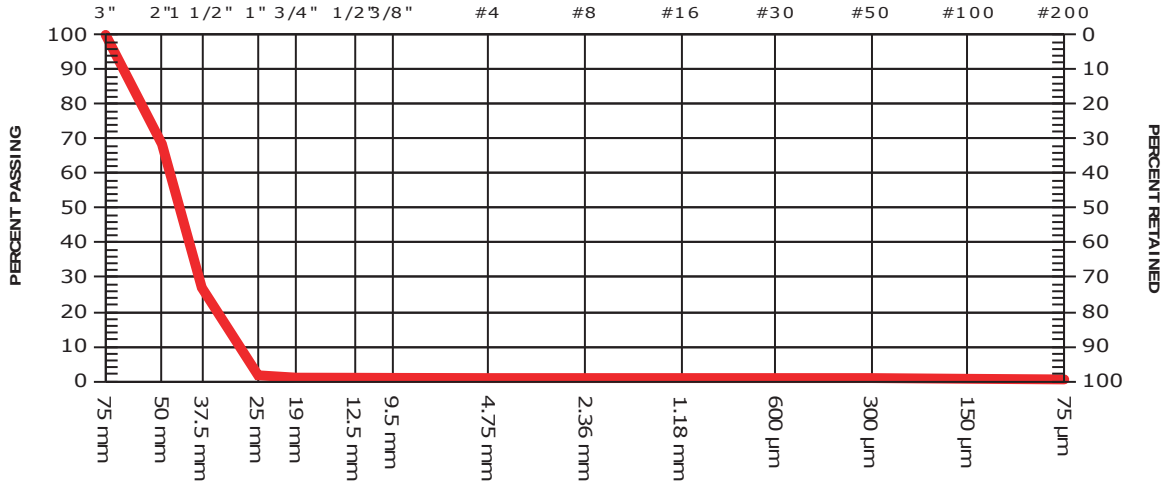
SAMPLED BY CLIENT
TESTED BY PI
TEST METHOD WASHED



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COMMENTS

Page 3 2022.Nov.28

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CCIL CERTIFIED TESTING LABORATORY

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Materials Testing
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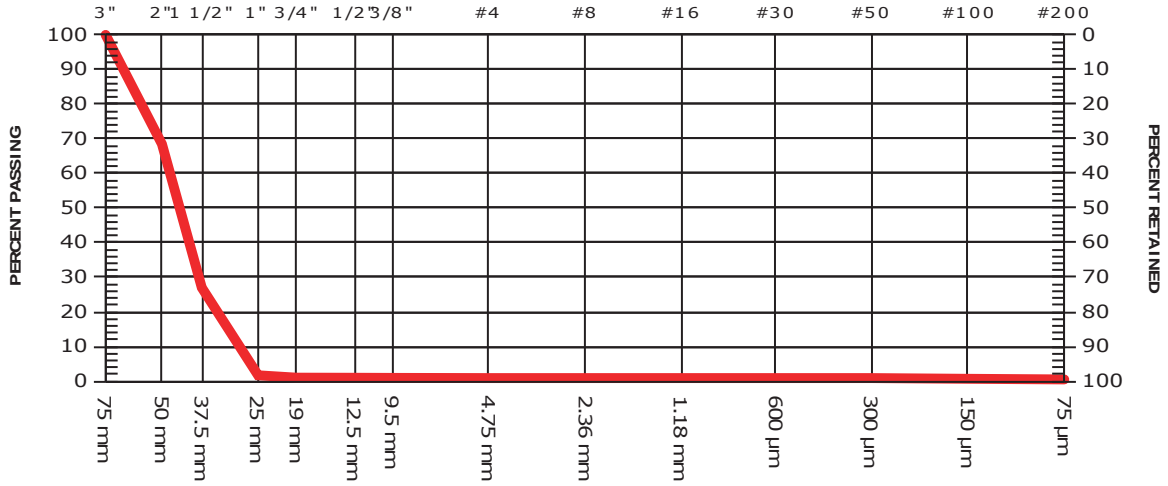
SUPPPLIER N/A
SOURCE N/A
SPECIFICATION
MATERIAL TYPE 75MM MINUS

SAMPLED BY CLIENT
TESTED BY PI
TEST METHOD WASHED



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COMMENTS

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Appendix D

Product Data

Submittal Transmittal

Project Description:	Northwin Landfill Phase 1 West	**Contract No.:**	Click or tap here to enter text.
		Project No.:	11222680
Submitted by:	Upland Contracting Ltd.	**Submittal #:**	**001**

Submitted to Consultant by the General Contractor on Date: [Publish Date]

Verification by General Contractor:

The document attached with this shop drawing transmittal was/were reviewed against following specifications and it complies with following specifications with listed exceptions:

Spec No.	Meets following specifications	with Following exceptions
ASTM D4716	Transmissivity	
ASTM D7005	Ply Adhesion	
ASTM D5199	Thickness	
ASTM D1505	Density	
ASTM D7179		Tensile Strength
ASTM D4218	Carbon Black	
ASTM D5261	Mass per Unit Area	
ASTM D4632	Grab Tensile Strength, Grab Elongation	
ASTM D6241	Puncture Strength	
ASTM D4533	Trapezoidal Tear Strength	
ASTM D4751	Apparent Opening Size	
ASTM D4491	Permittivity	
ASTM D4491		Water Flow Rate

Submittal Information: ***(Describe the submittal)***

Notes: SKAPS TN 330-2-8 (GeoNet)	Contractor's Signature or Stamp

Email Submittals to: Susan.McPhee@ghd.com; Sandi.Mullins@ghd.com; Kira.Turner@ghd.com and cc:

For Consultant Use Only

Notes/Comments:

Tensile Strength spec: 13.3N/mm, Submittal: 13.12kN/m
Minimal difference in tensile strength

Water Flow Rate spec: 3865 lpm/m2, Submittal: 4075 lpm/m2
Proposed material exceeds the minimum required spec

REVIEWED BY: Toby Wong

Shop Drawing Review

Submission No. **001**

Contractor's Reference

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- [ ] Reviewed
- [x] Reviewed as Noted
- [ ] Revise and Resubmit
- [ ] Not Subject to Review
- [ ] Other

By: **GHD Limited**

Signed: **Roxy Hasior**

Date: **June 10, 2022**

SKAPS TRANSNET™ HDPE GEOCOMPOSITE TN 330-2-8

SKAPS TRANSNET™ geocomposite consists of SKAPS GeoNet made from HDPE resin with nonwoven polypropylene geotextile fabric heat bonded on both sides of geonet.

Property	Test Method	Unit	Value	Qualifier
Geonet				
Thickness	ASTM D 5199	mil (mm)	300 (7.62)	MAV(3)
Carbon Black	ASTM D 4218	%	2.0	MAV
Tensile Strength	ASTM D 7179	lb/in (kN/m)	75 (13.12)	MAV
Melt Flow	ASTM D 1238(2)	g/10 min	1.0	Maximum
Density	ASTM D 1505	g/cm^3	0.94	MAV
Transmissivity(1)	ASTM D 4716	gal/min/ft (m^2/sec)	38.67 (8.0×10^{-3})	MAV
Composite				
Ply Adhesion	ASTM D 7005	lb/in (g/cm)	1.0 (178)	MAV
Transmissivity(1)	ASTM D 4716	gal/min/ft (m^2/sec)	4.35 (9.0×10^{-4})	MAV
Geotextile				
Fabric Weight	ASTM D 5261	oz/yd^2 (gm/m^2)	8 (271)	MARV(4)
Grab Tensile	ASTM D 4632	lb (N)	225 (1001)	MARV
Grab Elongation	ASTM D 4632	%	50	MARV
Trapezoid Tear	ASTM D 4533	lb (N)	90 (400)	MARV
CBR Puncture	ASTM D 6241	lb (N)	600 (2670)	MARV
Water Flow(5)	ASTM D 4491	gpm/ft^2 ($l/min/m^2$)	100 (4075)	MARV
Permittivity(5)	ASTM D 4491	sec^{-1}	1.26	MARV
Permeability(5)	ASTM D 4491	cm/sec	0.30	MARV
AOS	ASTM D 4751	US Sieve (mm)	80 (0.180)	MaxARV

Notes:

(1) Transmissivity measured using water at 21 ± 2 °C (70 ± 4 °F) with a gradient of 0.1 and a confining pressure of 10,000 psf (479 kPa) between steel plates after 15 minutes. Values may vary with individual labs.

(2) Condition 190/2.16

(3) Minimum average value.

(4) MARV is statistically defined as mean minus two standard deviations and it is the value which is exceeded by 97.5% of all the test data.

(5) At the time of manufacturing. Handling may change these properties.

This information is provided for reference purposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information. Geotextile and Geonet properties are prior to lamination.

SKAPS Industries, 571 Industrial Pkwy., Commerce, GA 30529, **Ph:** (706) 336-7000, **Fax:** (706) 336-7007, **E-mail:** contact@skaps.com

Submittal Transmittal

Project Description:	Northwin Landfill Phase 1 West	**Contract No.:**	Click or tap here to enter text.
		Project No.:	11222680
Submitted by:	Upland Contracting Ltd.	**Submittal #:**	**002**

Submitted to Consultant by the General Contractor on Date: [Publish Date]

Verification by General Contractor:

The document attached with this shop drawing transmittal was/were reviewed against following specifications and it complies with following specifications with listed exceptions:

Spec No.	Meets following specifications	with Following exceptions
ASTM D5261	Mass per Unit Area	
ASTM D4632	Grab Tensile Strength, Grab Elongation	
ASTM D4833		Puncture Strength
ASTM D4533	Trapezoidal Tear Strength	
ASTM D4355	UV Resistance	

Submittal Information: ***(Describe the submittal)***

Notes: SKAPS GE280 (Non-woven Geotextile)	Contractor's Signature or Stamp

Email Submittals to: Susan.McPhee@ghd.com; Sandi.Mullins@ghd.com; Kira.Turner@ghd.com and cc:

For Consultant Use Only

Notes/Comments:

Puncture strength spec: ASTM D4833, Submittal: ASTM D6241

ASTM has recently replaced the standard pin puncture strength test, D4833, with the CBR puncture strength test, D6241.

Based on GRI -GT12(a)∗ - ASTM Version Standard Specification Standard Specification for “Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials”, the CBR exceeds the required strength for 949 g/m2 material at 8.914 kN

S.I. (Metric) Units

Table 1(b) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property[1]	Test Method ASTM	Unit	Mass/Unit Area (g/m^2)					
Mass per unit area	D5261	g/m^2	340	406	542	812	1080	2000
Grab tensile strength	D4632	kN	1.02	1.33	1.64	2.00	2.25	2.80
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	kN	0.42	0.51	0.64	0.89	0.96	1.27
Puncture (CBR) strength	D6241	kN	3.11	3.56	4.00	4.90	7.56	10.60
UV resistance[2]	D7238	%	70	70	70	70	70	70

Notes:
(1) All values are MARV except UV resistance; it is a minimum value.
(2) Evaluation to be on 50 mm strip tensile specimens per ASTM D5035 after 500 lt. hrs. exposure.

REVIEWED BY: Toby Wong

Shop Drawing Review

Submission No. **002**

Contractor’s Reference

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- [ ] Reviewed
- [x] Reviewed as Noted
- [ ] Revise and Resubmit
- [ ] Not Subject to Review
- [ ] Other

By: **GHD Limited**

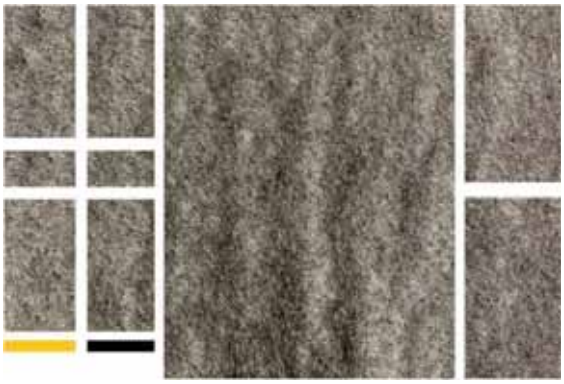
Signed: **Roxy Hasior**

Date: **June 10, 2022**

HEAVY WEIGHT NON-WOVEN GEOTEXTILE

GE - 280

SKAPS GE-280 is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. SKAPS GE-280 resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids.



Polypropylene is stable within a pH range of 2 to 13. SKAPS GE-280 conforms to the physical property values listed below:

Property	Method	English (MARV^2)	Metric (MARV^2)
Weight	ASTM D 5261	28 oz/yd^2	949 g/m^2
Grab Tensile Strength	ASTM D 4632	550 lbs	2.45 kN
Grab Elongation	ASTM D 4632	50%	50%
Trapezoid Tear Strength	ASTM D 4533	250 lbs	1.11 kN
CBR Puncture Resistance	ASTM D 6241	2004 lbs	8.914 kN
UV Resistance	ASTM D 4355	70%/500 hrs.	70%/500 hrs.

At time of manufacturing. Handling may change these properties.

This information is provided for reference purposes only and is not intended as a warranty or guarantee. SKAPS assumes no liability in connection with the use of this information.

335 Athena Drive, Athens, GA 30601
Ph: (706)-354-3700, Fax: (706)-354-3737, Email: contact@skaps.com
www.skaps.com

Submittal Transmittal

Project Description:	Northwin Landfill Phase 1 West	**Contract No.:**	Click or tap here to enter text.
		Project No.:	11222680
Submitted by:	Upland Contracting Ltd.	**Submittal #:**	**003**

Submitted to Consultant by the General Contractor on Date: [Publish Date]

Verification by General Contractor:

The document attached with this shop drawing transmittal was/were reviewed against following specifications and it complies with following specifications with listed exceptions:

Spec No.	Meets following specifications	with Following exceptions
ASTM D4632	Grab Tensile Strength, Grab Elongation	
ASTM D4833		Puncture Strength
ASTM D4533	Trapezoidal Tear Strength	
ASTM D4751	Apparent Opening Size	
ASTM D4491	Permittivity	
ASTM D4491	Water Flow Rate	
ASTM 4355	UV Resistance	

Submittal Information: ***(Describe the submittal)***

Notes: SKAPS SW-315 (Woven Geotextile)	Contractor's Signature or Stamp

Email Submittals to:

For Consultant Use Only

Notes/Comments:

Puncture Strength spec: ASTM D4833, Submittal: ASTM D6241

GRI GT13(a) – ASTM Version Standard Specification∗ Standard Specification for "Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate"

ASTM D6241 is acceptable as an alternative to ASTM D4833.

Product meets GRI standard specification for CBR puncture strength for a high survivability geotextile.

SI Metric Units

Table 2(a) – Geotextile Properties Class 1 (High Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	1400	900
Trapezoid Tear Strength	D 4533	N	500	350
CBR Puncture Strength	D 6241	N	2800	2000
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability[2]	D 7238	% Str. Ret. @ 500 lt. hrs.	80	80

REVIEWED BY: Roxy Hasior

Shop Drawing Review

Submission No. **003**

Contractor's Reference

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- [ ] Not Subject to Review
- [ ] Other

By: **GHD Limited**

Signed: **Roxy Hasior**

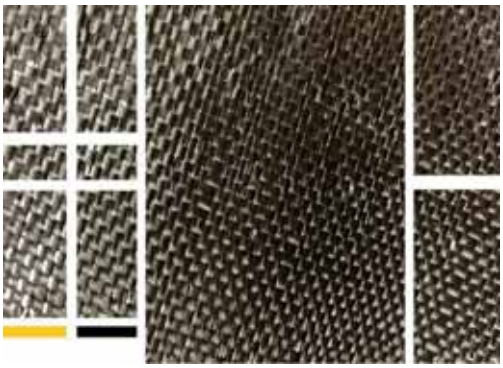
Date: **June 10, 2022**

WOVEN GEOTEXTILE

SW - 315

SKAPS

SKAPS woven geotextile fabrics are woven polypropylene materials offering optimum performance when used in stabilization applications. Produced from first quality raw materials, they provide the perfect balance of strength and separation in styles capable of functioning exceptionally well in a wide range of performance requirements.



Unless indicated below, all listed properties are Minimum Average Roll Values

Property	Method	English (MARV[2])	Metric (MARV[2])
Grab Tensile	ASTM D 4632	315 lbs.	1.4 kN
Grab Elongation	ASTM D 4632	15%	15%
Trapezoid Tear	ASTM D 4533	120 lbs.	0.533 kN
CBR Puncture Resistance	ASTM D 6241	1000 lbs	4.45 kN
Water Flow[3]	ASTM D 4491	4 gpm/sf	163 l/min/m^2
Permittivity[3]	ASTM D 4491	0.05 sec^{-1}	0.05 sec^{-1}
AOS[3]	ASTM D 4751	40 U.S. Sieve	0.425 mm
UV Resistance	ASTM D 4355	70%/500 hrs.	70%/500 hrs.

Packaging

Roll Dimensions (W x L)	12.5 x 360 ft. 17.5 x 258 ft.	3.81 m x 110 m 5.33 m x 79 m
Area Per Roll	500 sq. yards	420 sq. meters

Note

1. The property values listed above are subject to change without notice.
2. Minimum Average Roll Values (MARV) is calculated as the average minus two standard deviations. Statistically, it yields approximately 97.5% degree of confidence that any samples taken from quality assurance testing will meet or exceed the values described above.
3. At time of manufacturing. Handling may change these properties.

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335 Athena Drive, Athens, GA 30601
Ph: (706)-354-3700, Fax: (706)-354-3737, Email: contact@skaps.com
www.skaps.com

Submittal Transmittal

Project Description:	Northwin Landfill Phase 1 West	**Contract No.:**	Click or tap here to enter text.
		Project No.:	11222680
Submitted by:	Upland Contracting Ltd.	**Submittal #:**	**004**

Submitted to Consultant by the General Contractor on Date: [Publish Date]

Verification by General Contractor:

The document attached with this shop drawing transmittal was/were reviewed against following specifications and it complies with following specifications with listed exceptions:

Spec No.	Meets following specifications	with Following exceptions
ASTM D5261	Cap Nonwoven, Mass/Unit Area	
ASTM D4643		Moisture Content
ASTM D5890	Free Swell	
ASTM D5891	Fluid Loss	
ASTM D5993	Bentonite Mass (Dry)	
ASTM D6768	Grab Tensile Strength	
ASTM D6496 ASTM D4632		Peel Strength
ASTM D6243	Internal Shear Strength	

Submittal Information: ***(Describe the submittal)***

Notes: Bentomat DN TR-401 (Geosynthetic Clay Liner)	Contractor's Signature or Stamp

Email Submittals to: Susan.McPhee@ghd.com; Sandi.Mullins@ghd.com; Kira.Turner@ghd.com and cc:

For Consultant Use Only

Notes/Comments:

Moisture Content spec: ASTM D4643, Submittal: ASTM D2216

ASTM D4643 test method can be used as a substitute for test method D2216 when more rapid results are desired to expedite other phases of testing. Test methods are considered equivalent.

Peel Strength spec: 2100 N/m, Submittal: 1401 N/m

CETCO's manufacturing process does not include thermal bonding of needle-punched fibers.

REVIEWED BY:

Shop Drawing Review

Submission No. **004**

Contractor's Reference

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- [ ] Reviewed
- [x] Reviewed as Noted
- [ ] Revise and Resubmit
- [ ] Not Subject to Review
- [ ] Other

By: **GHD Limited**

Signed:

Date:

CETCO 2870 Forbs Avenue Hoffman Estates, IL 60192
847.851.1800 800.527.9948 Fax 847.851.1339 www.cetco.com

May 12, 2022

RE: Northwin Landfill ('22)
Geosynthetic Clay Liner

To whom it may concern:

CETCO® was provided with Section 02 56 13.16 - Geosynthetic Clay Liner, pages 02 56 13.15 – 1 through 8, dated August, 2020 of the Technical Specification for the Northwin Landfill Phase 1 East. Based upon our review of this information, CETCO® proposes to supply Bentomat® DN as the geosynthetic clay liner (GCL) for this project. A Technical Data Sheet (TDS) for Bentomat® DN is enclosed, and Bentomat® DN will meet or exceed the project requirements as indicated by the aforementioned document with the exceptions and clarifications identified below.

- Peel Strength: The Technical Specification requires a GCL peel strength of 12 lb/in (2100 N/m). This is an index test that can be manipulated by processes such as "thermal bonding." CETCO®'s manufacturing process does not include thermal bonding of needle-punched fibers. Independent research by Bareither et al, 2018 has demonstrated that non heat-treated GCLs exhibit greater shear strength than heat-treated GCLs (of similar peel strengths). This is perhaps due to brittleness caused by the heat-treating process. Accordingly, we are proposing Bentomat® DN with an 8 lb/in peel manufactured using CETCO®'s propriety high-density needle-punching technology. A GCL with a 12 lb/in peel strength can be offered at additional cost.

- Bentonite Montmorillonite Content: The Specification requires that the bentonite consist of at least 90 percent sodium montmorillonite. Unfortunately, there are no reliable test methods available for determining sodium montmorillonite content. The available methods can only give a qualitative indication of montmorillonite content. For this reason, the industry uses free swell (ASTM D5890) and fluid loss (ASTM D5891) tests to evaluate sodium bentonite quality. Only bentonite whose primary constituent is the clay mineral sodium montmorillonite will meet the free swell, fluid loss, and hydraulic conductivity values required for Bentomat GCLs. CETCO® certifies that the Bentomat GCL supplied to this project will be manufactured using the finest grade native Wyoming sodium bentonite, whose primary constituent is the mineral sodium montmorillonite, and that the bentonite will meet the minimum fluid loss, free swell, and moisture values required in the Specification.

- Minimum Average Roll Value: The GCL Properties table requires that the Bentonite Mass and Peel Strength meet the Minimum Average Roll Value (MARV). However, neither of the governing industry standard specifications: ASTM D5889, *Standard Practice for Quality Control of Geosynthetic Clay Liners*, or GRI-GCL3, *Standard Specification for Test Methods, Required Properties, and Testing Frequencies of Geosynthetic Clay Liners* require manufacturing quality control testing to be reported in MARV. As such, CETCO® testing and reporting conforms to these industry specifications, and reports minimum or maximum average values, as applicable, for our GCLs. Accordingly, CETCO® recommends that the manufacturing quality control testing conform to the current industry standard for this project.

In addition to our Bentomat® DN TDS and the Technical References, please find enclosed our quotation based upon the above-indicated exceptions. Placement of an order in connection with the above-referenced project acknowledges receipt of this letter and acceptance of the proposed product and exceptions and clarifications made herein. We appreciate your interest in CETCO® Environmental Products. Please call Rob Stafford at (970) 749-6118 if you have any further questions.

Best Regards,

Rob Stafford
Technical Sales Manager
CETCO® Environmental Products

Enclosures (4)

BENTOMAT® DN CERTIFIED PROPERTIES

CETCO® Bentomat® DN is a reinforced geosynthetic clay liner (GCL) consisting of a layer of sodium bentonite between two polypropylene nonwoven geotextiles, which are needle-punched together.

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY	CERTIFIED VALUES
Nonwoven Base Geotextile Mass/Area[1]	ASTM D5261	200,000 ft^2 (20,000 m^2)	6.0 oz/yd^2 (203 g/m^2) min.
Nonwoven Cap Geotextile Mass/Area[1]	ASTM D5261	200,000 ft^2 (20,000 m^2)	6.0 oz/yd^2 (203 g/m^2) min.
Bentonite Moisture Content[2]	ASTM D2216	1 per 50 tonnes	12% max.
Bentonite Swell Index[2]	ASTM D5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss[2]	ASTM D5891	1 per 50 tonnes	18 mL max.
Bentonite Mass/Area[3]	ASTM D5993	40,000 ft^2 (4,000 m^2)	0.75 lb/ft^2 (3.6 kg/m^2) min.
Total Mass/Area[3]	ASTM D5993	40,000 ft^2 (4,000 m^2)	0.83 lb/ft^2 (4.1 kg/m^2) min.
GCL Moisture Content	ASTM D5993	40,000 ft^2 (4,000 m^2)	35% max.
GCL Grab Strength[4]	ASTM D6768	200,000 ft^2 (20,000 m^2)	50 lbs/in (8.8 kN/m) min.
GCL Peel Strength	ASTM D6496	40,000 ft^2 (4,000 m^2)	8.0 lbs/in (1401 N/m) min.
GCL Hydraulic Conductivity[5]	ASTM D5887	250,000 ft^2 (25,000 m^2)	5×10^{-11} m/s max.
GCL Index Flux[5]	ASTM D5887	250,000 ft^2 (25,000 m^2)	1×10^{-8} $m^3/m^2/s$ max.
GCL Hydrated Internal Shear Strength[6]	ASTM D6243	1,000,000 ft^2 (100,000 m^2)	500 psf (24 kPa) typ.@ 200 psf (9.6 kPa)

Notes:

[1] Geotextile property tests performed on the geotextile components before they are incorporated into the finished GCL product.

[2] Bentonite property tests performed before the bentonite is incorporated into the finished GCL product.

[3] Reported at 0% moisture content.

[4] All tensile strength testing is performed in the machine direction using ASTM D6768.

[5] Index flux and hydraulic conductivity testing with deaired distilled/deionized water at 80 psi (550 kPa) cell pressure, 77 psi (530 kPa) headwater pressure and 75 psi (515 kPa) tailwater pressure.

[6] Peak values measured at 200 psf (9.6 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

TR 401-BDN-8.0lb/in-D5889/GRI-GCL3
05/2018

www.CETCO.com | contact@cetco.com

IMPORTANT: The information contained herein supersedes all previous printed versions, and is believed to be accurate and reliable. For the most up-to-date information, please contact CETCO sales team. CETCO accepts no responsibility for the results obtained through application of this product. CETCO reserves the right to update information without notice.

MINERALS TECHNOLOGIES CETCO®

Submittal Transmittal

Project Description:	Northwin Landfill Phase 1 West	**Contract No.:**	Click or tap here to enter text.
		Project No.:	11222680
Submitted by:	Upland Contracting Ltd.	**Submittal #:**	**005**

Submitted to Consultant by the General Contractor on Date: [Publish Date]

Verification by General Contractor:

The document attached with this shop drawing transmittal was/were reviewed against following specifications and it complies with following specifications with listed exceptions:

Spec No.	Meets following specifications	with Following exceptions
ASTM D5199		Thickness
ASTM D1505/D792	Density	
ASTM D638 Type IV, 2 pm		Tensile Strength at Yield Tensile Strength at Break Elongation at Yield Elongation at Break
ASTM D5397		Stress Crack Resistance
ASTM D1603	Carbon Black Content	
ASTM D5596	Carbon Black Dispersion	
ASTM D4833	Puncturing Resistance	
ASTM D1004	Tear Resistance	
GRI Test Method GM12		Asperity Height

Submittal Information: ***(Describe the submittal)***

Notes: SKAPS HD-60T2 AVG HDPE Geomembrane	Contractor's Signature or Stamp

Email Submittals to: Susan.McPhee@ghd.com; Sandi.Mullins@ghd.com; Kira.Turner@ghd.com and cc:

For Consultant Use Only

Notes/Comments:

Thickness spec: ASTM D5199, Submittal: ASTM D5994
Tensile Strength at Yield spec: ASTM D638, Submittal: ASTM D6693
Tensile Strength at Break spec: ASTM D638, Submittal: ASTM D6693
Elongation at Yield spec: ASTM D638, Submittal: ASTM D6693
Elongation at Break spec: ASTM D638, Submittal: ASTM D6693
Stress Crack Resistance spec: 200 hour, Submittal: 500 hour
Asperity Height spec: GRI Test Method GM12, Submittal: ASTM D7466

Submittal compared to GRI - GM13 Standard Specification* Standard Specification for "Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes" (attached)

Submittal meets the requirement of GRI Standard Specification for all except the ASTM method for testing geomembrane thickness.

ASTM D5199
Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes (04.08)

ASTM D5994
Test Method for Measuring the Core Thickness of Textured Geomembranes, (04.08)

The two methods can be taken as substantially equivalent.

REVIEWED BY: Toby Wong

Shop Drawing Review

Submission No. **005**

Contractor's Reference

ENGINEER's review is for the sole purpose of ascertaining conformance with general design concepts expressed in the contract Documents, and in no way constitutes approval of the detail design inherent in CONTRACTOR's Shop Drawings, responsibility for which remains solely with CONTRACTOR submitting same. Review does not authorize changes to Contract Documents.

- [ ] Reviewed
- [x] Reviewed as Noted
- [ ] Revise and Resubmit
- [ ] Not Subject to Review
- [ ] Other

By: **GHD Limited**

Signed: **Roxy Hasior**

Date: **June 10, 2022**

ENGLISH UNITS

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) - mils • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	per roll
Asperity Height mils (min. ave.) - mils	D 7466	16	16	16	16	16	16	16	every 2nd roll *(1)*
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb
Tensile Properties (min. ave.) *(2)* • yield strength - lb/in. • break strength - lb/in. • yield elongation - % • break elongation - %	D 6693 Type IV	 63 45 12 100	 84 60 12 100	 105 75 12 100	 126 90 12 100	 168 120 12 100	 210 150 12 100	 252 180 12 100	20,000 lb
Tear Resistance (min. ave.) - lb	D 1004	21	28	35	42	56	70	84	45,000 lb
Puncture Resistance (min. ave.) - lb	D 4833	45	60	75	90	120	150	180	45,000 lb
Stress Crack Resistance *(3)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM10
Carbon Black Content (range) - %	D 4218 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 lb
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	200,000 lb
Oven Aging at 85°C *(6), (7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	D 7238 D 8117 D 5885	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	per each formulation

(1) Alternate the measurement side for double sided textured sheet
(2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches
(3) SP-NCTL per ASTM D5397 Appendix, is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC UNITS)

Table 2(b) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness (min. ave.) - mm • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	per roll
Asperity Height mils (min. ave.) - mm	D 7466	0.40	0.40	0.40	0.40	0.40	0.40	0.40	every 2nd roll *(1)*
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	90,000 kg
Tensile Properties (min. ave.) *(2)* • yield strength - kN/m • break strength - kN/m • yield elongation - % • break elongation - %	D 6693 Type IV	 11 8 12 100	 15 10 12 100	 18 13 12 100	 22 16 12 100	 29 21 12 100	 37 26 12 100	 44 32 12 100	9,000 kg
Tear Resistance (min. ave.) - N	D 1004	93	125	156	187	249	311	374	20,000 kg
Puncture Resistance (min. ave.) - N	D 4833	200	267	333	400	534	667	800	20,000 kg
Stress Crack Resistance *(3)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM10
Carbon Black Content (range) - %	D 4218 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	9,000 kg
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	90,000 kg
Oven Aging at 85°C *(6), (7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	D 7238 D 8117 D 5885	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	per each formulation

(1) Alternate the measurement side for double sided textured sheet
(2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm
(3) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.
(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SKAPS HD-60T2 AVG
HDPE GEOMEMBRANE
Textured Double Sided

SKAPS INDUSTRIES
571 Industrial Pkwy
Commerce, GA 30529
Phone: (706) 336-7000
Fax: (706) 336-7007
E-Mail: contact@skaps.com

SKAPS HD-60T2 AVG Geomembrane is manufactured utilizing the highest quality standards to provide the greatest durability in geomembrane applications. The geomembrane is formulated to meet the requirements of GRI GM13 specifications.

PROPERTY	TEST METHOD	FREQUENCY	VALUE	QUALIFIER
Thickness (minimum avg), mils	ASTM D 5994	Per Roll	60	MAV(1)
Thickness (minimum), mils			54	MIN
Asperity Height, mils	ASTM D 7466	2nd Roll	16	MAV
Density, g/cc	ASTM D 1505	200,000 lb	0.940	MIN
Tensile Properties (both directions)	ASTM D 6693 Type IV Specimen, 2 in/min	20,000 lb		
Strength at Yield, lb/in width			126	MAV
Elongation at Yield, % (1.3 in. GL)			12	MAV
Strength at Break, lb/in width			90	MAV
Elongation at Break, % (2 in. GL)			100	MAV
Tear Resistance, lb	ASTM D 1004	45,000 lb	42	MAV
Puncture Resistance, lb	ASTM D 4833	45,000 lb	90	MAV
Carbon Black Content, %	ASTM D 4218	20,000 lb	2-3	Range
Carbon Black Dispersion (Category)	ASTM D 5596	45,000 lb	Note (2)	Category
Stress Crack Resistance, hr.	ASTM D 5397, Appendix	200,000 lb	500	MIN
Oxidative Induction Time, minutes	ASTM D 3895 200°C, 1 atm O_2	200,000 lb	100	MIN
ROLL DIMENSIONS				
Roll Length, ft			490	NOM
Roll Width, ft			23.5	
Roll Area, sf			11,515	

Notes:
(1) Minimum average value
(2) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3

This information is provided for reference purposes only and is not intended as a warranty or guarantee.
SKAPS assumes no liability in connection with the use of this information.

1/6/2021

Appendix E

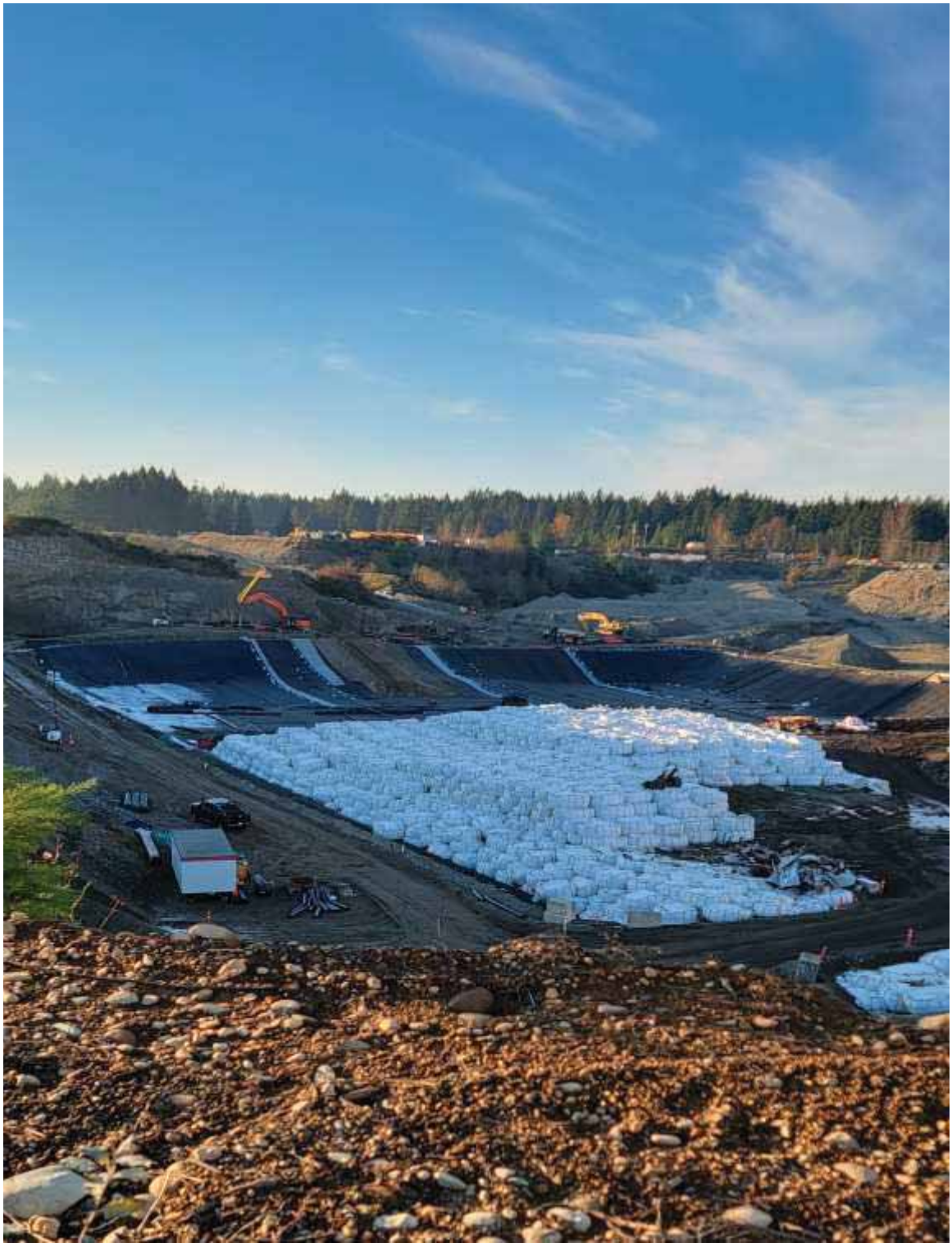
Geosynthetics QA/QC Information

C.J. Cassidy

Consulting Inc.

NORTHWIN LANDFILL - WEST CELL - 2022

CAMPBELL RIVER, B.C.



C.J. Cassidy

Consulting Inc.

NORTHWIN LANDFILL - WEST CELL - 2022

CAMPBELL RIVER, B.C.

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Primary Liner	
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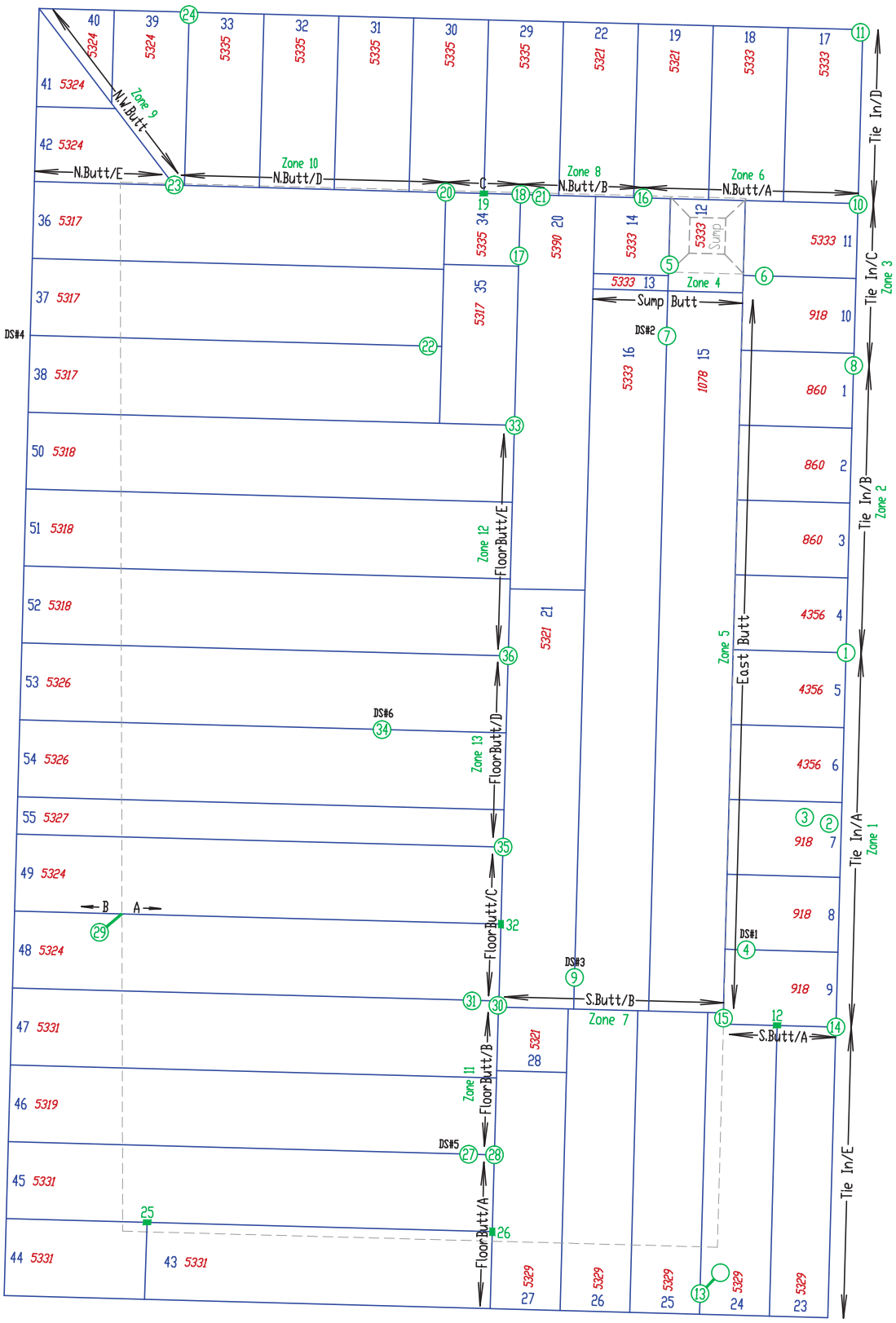
NORTHWIN LANDFILL WEST CELL
SECONDARY LINER



Blue = Liner Red = Roll Numbers Green = Extrusion Welds

DATE: December 19, 2022	C.J. Cassidy Consulting Inc.	NORTHWIN LANDFILL - 2022
SCALE: NTS		CAMPBELL RIVER, B.C.
FILE NAME: SecondaryRep-2022		West Cell Secondary Liner Representative Drawing
DRAWN BY: SSC		
CHECKED BY: CJC		

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Friday, October 14, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
10:10	1	CJC				860	350	1	152	1	149	1	200	CC	
10:10	1	CJC				860	350	2	148	2	150	2	191	CC	
10:10	1	CJC				860	350	3	130	3	162	3	194	CC	
10:10	1	CJC				860	350	4	154	4	161	4	190	CC	
10:10	1	CJC				860	350	5	143	5	170	5	200	CC	
2:45	X1	MC	485	485				1	142	1		1	184	CC	
2:45	X1	MC	485	485				2	129	2		2	181	CC	
2:45	X1	MC	485	485				3	99	3		3	184	CC	
2:45	X1	MC	485	485				4	102	4		4	180	CC	
2:45	X1	MC	485	485				5	126	5		5	177	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, October 18, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:15	1	JC			860		250	1	125	1	130	1	205	CC	
9:15	1	JC			860		250	2	125	2	129	2	195	CC	
9:15	1	JC			860		250	3	136	3	140	3	202	CC	
9:15	1	JC			860		250	4	133	4	122	4	202	CC	
9:15	1	JC			860		250	5	118	5	132	5	194	CC	
10:00	X1	RC	500	500				1	118	1		1	190	CC	
10:00	X1	RC	500	500				2	124	2		2	195	CC	
10:00	X1	RC	500	500				3	135	3		3	183	CC	
10:00	X1	RC	500	500				4	115	4		4	180	CC	
10:00	X1	RC	500	500				5	119	5		5	186	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, October 19, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
10:30	1	JC			860		250	1	143	1	137	1	194	CC	
10:30	1	JC			860		250	2	134	2	149	2	190	CC	
10:30	1	JC			860		250	3	147	3	158	3	192	CC	
10:30	1	JC			860		250	4	158	4	147	4	193	CC	
10:30	1	JC			860		250	5	146	5	149	5	194	CC	
12:03	X1	RC	500	500				1	117	1		1	173	CC	
12:03	X1	RC	500	500				2	117	2		2	175	CC	
12:03	X1	RC	500	500				3	111	3		3	178	CC	
12:03	X1	RC	500	500				4	121	4		4	176	CC	
12:03	X1	RC	500	500				5	110	5		5	180	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, October 22, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
10:24	1	RC			860		300	1	147	1	132	1	199	CC	
10:24	1	RC			860		300	2	142	2	132	2	204	CC	
10:24	1	RC			860		300	3	132	3	126	3	208	CC	
10:24	1	RC			860		300	4	148	4	136	4	206	CC	
10:24	1	RC			860		300	5	126	5	143	5	205	CC	
12:05	X1	RC	500	500				1	99	1		1	184	CC	
12:05	X1	RC	500	500				2	97	2		2	167	CC	
12:05	X1	RC	500	500				3	102	3		3	167	CC	
12:05	X1	RC	500	500				4	118	4		4	159	CC	
12:05	X1	RC	500	500				5	113	5		5	172	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, October 25, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:10	1	JC			860		300	1	125	1	128	1	210	CC	
8:10	1	JC			860		300	2	126	2	146	2	210	CC	
8:10	1	JC			860		300	3	141	3	135	3	209	CC	
8:10	1	JC			860		300	4	142	4	143	4	212	CC	
8:10	1	JC			860		300	5	128	5	135	5	212	CC	
12:00	X1	MC	500	500				1	109	1		1	196	CC	
12:00	X1	MC	500	500				2	112	2		2	196	CC	
12:00	X1	MC	500	500				3	100	3		3	203	CC	
12:00	X1	MC	500	500				4	109	4		4	200	CC	
12:00	X1	MC	500	500				5	95	5		5	201	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, October 26, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:39	1	JC			860		300	1	162	1	166	1	206	CC	
8:39	1	JC			860		300	2	175	2	154	2	218	CC	
8:39	1	JC			860		300	3	155	3	155	3	205	CC	
8:39	1	JC			860		300	4	158	4	158	4	204	CC	
8:39	1	JC			860		300	5	161	5	155	5	211	CC	
8:09	X1	MC	500	500				1	119	1		1	212	CC	
8:09	X1	MC	500	500				2	88	2		2	207	CC	
8:09	X1	MC	500	500				3	119	3		3	210	CC	
8:09	X1	MC	500	500				4	131	4		4	213	CC	
8:09	X1	MC	500	500				5	119	5		5	206	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Friday, October 28, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:14	1	JC			860		300	1	162	1	166	1	206	CC	
8:14	1	JC			860		300	2	132	2	133	2	201	CC	
8:14	1	JC			860		300	3	155	3	155	3	205	CC	
8:14	1	JC			860		300	4	141	4	149	4	204	CC	
8:14	1	JC			860		300	5	161	5	155	5	204	CC	
8:40	X1	RC	500	500				1	119	1		1	211	CC	
8:40	X1	RC	500	500				2	98	2		2	207	CC	
8:40	X1	RC	500	500				3	120	3		3	210	CC	
8:40	X1	RC	500	500				4	130	4		4	213	CC	
8:40	X1	RC	500	500				5	120	5		5	211	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, November 01, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
12:15	1	JC			860		300	1	130	1	133	1	198	CC	
12:15	1	JC			860		300	2	141	2	140	2	198	CC	
12:15	1	JC			860		300	3	151	3	145	3	193	CC	
12:15	1	JC			860		300	4	146	4	148	4	199	CC	
12:15	1	JC			860		300	5	132	5	137	5	195	CC	
11:35	X1	RC	500	500				1	91	1		1	186	CC	Warm sample, rain coming.
11:35	X1	RC	500	500				2	98	2		2	193	CC	
11:35	X1	RC	500	500				3	93	3		3	192	CC	
11:35	X1	RC	500	500				4	88	4		4	196	CC	
11:35	X1	RC	500	500				5	87	5		5	189	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, November 03, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:10	1	JC			860		300	1	140	1	123	1	191	CC	
9:10	1	JC			860		300	2	134	2	129	2	190	CC	
9:10	1	JC			860		300	3	132	3	132	3	193	CC	
9:10	1	JC			860		300	4	126	4	141	4	192	CC	
9:10	1	JC			860		300	5	127	5	137	5	195	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, November 08, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
10:07	1	JC			860		300	1	138	1	130	1	204	CC	
10:07	1	JC			860		300	2	146	2	150	2	203	CC	
10:07	1	JC			860		300	3	135	3	148	3	199	CC	
10:07	1	JC			860		300	4	136	4	145	4	204	CC	
10:07	1	JC			860		300	5	149	5	138	5	196	CC	
10:45	X1	MC	500	500				1	116	1		1	203	CC	
10:45	X1	MC	500	500				2	99	2		2	204	CC	
10:45	X1	MC	500	500				3	101	3		3	201	CC	
10:45	X1	MC	500	500				4	102	4		4	200	CC	
10:45	X1	MC	500	500				5	113	5		5	199	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, November 09, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:50	1	JC			860		300	1	140	1	130	1	204	CC	
9:50	1	JC			860		300	2	146	2	150	2	197	CC	
9:50	1	JC			860		300	3	141	3	132	3	199	CC	
9:50	1	JC			860		300	4	138	4	149	4	204	CC	
9:50	1	JC			860		300	5	144	5	139	5	196	CC	
10:10	X1	RC	500	500				1	100	1		1	204	CC	
10:10	X1	RC	500	500				2	111	2		2	204	CC	
10:10	X1	RC	500	500				3	100	3		3	200	CC	
10:10	X1	RC	500	500				4	102	4		4	200	CC	
10:10	X1	RC	500	500				5	97	5		5	201	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, November 10, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
1:27	1	JC			860		300	1	140	1	141	1	189	CC	
1:27	1	JC			860		300	2	167	2	143	2	193	CC	
1:27	1	JC			860		300	3	154	3	169	3	200	CC	
1:27	1	JC			860		300	4	145	4	144	4	199	CC	
1:27	1	JC			860		300	5	161	5	155	5	197	CC	
7:23	X1	RC	500	500				1	99	1		1	189	CC	
7:23	X1	RC	500	500				2	101	2		2	199	CC	
7:23	X1	RC	500	500				3	97	3		3	196	CC	
7:23	X1	RC	500	500				4	98	4		4	196	CC	
7:23	X1	RC	500	500				5	102	5		5	197	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, November 12, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
11:30	1	JC			860		300	1	169	1	155	1	189	CC	
11:30	1	JC			860		300	2	151	2	126	2	196	CC	
11:30	1	JC			860		300	3	122	3	140	3	200	CC	
11:30	1	JC			860		300	4	134	4	145	4	203	CC	
11:30	1	JC			860		300	5	167	5	129	5	204	CC	
7:20	X1	RC	500	500				1	100	1		1	190	CC	
7:20	X1	RC	500	500				2	88	2		2	200	CC	
7:20	X1	RC	500	500				3	98	3		3	204	CC	
7:20	X1	RC	500	500				4	98	4		4	204	CC	
7:20	X1	RC	500	500				5	101	5		5	188	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, November 14, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
11:25	1	JC			860		300	1	131	1	143	1	216	CC	
11:25	1	JC			860		300	2	135	2	145	2	198	CC	
11:25	1	JC			860		300	3	127	3	145	3	211	CC	
11:25	1	JC			860		300	4	136	4	153	4	211	CC	
11:25	1	JC			860		300	5	116	5	147	5	209	CC	
10:13	X1	RC	500	500				1	114	1		1	188	CC	
10:13	X1	RC	500	500				2	113	2		2	189	CC	
10:13	X1	RC	500	500				3	109	3		3	180	CC	
10:13	X1	RC	500	500				4	122	4		4	181	CC	
10:13	X1	RC	500	500				5	125	5		5	176	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, November 15, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:33	1	JC			860		300	1	128	1	141	1	187	CC	
9:33	1	JC			860		300	2	134	2	138	2	192	CC	
9:33	1	JC			860		300	3	136	3	132	3	198	CC	
9:33	1	JC			860		300	4	122	4	149	4	188	CC	
9:33	1	JC			860		300	5	120	5	144	5	206	CC	
9:51	X1	RC	500	500				1	119	1		1	199	CC	
9:51	X1	RC	500	500				2	116	2		2	191	CC	
9:51	X1	RC	500	500				3	122	3		3	195	CC	
9:51	X1	RC	500	500				4	108	4		4	207	CC	
9:51	X1	RC	500	500				5	124	5		5	184	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, November 16, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:45	1	JC			860		300	1	125	1	134	1	184	CC	
9:45	1	JC			860		300	2	123	2	148	2	182	CC	
9:45	1	JC			860		300	3	136	3	140	3	191	CC	
9:45	1	JC			860		300	4	140	4	149	4	201	CC	
9:45	1	JC			860		300	5	138	5	153	5	189	CC	
10:26	X1	RC	500	500				1	120	1		1	187	CC	
10:26	X1	RC	500	500				2	119	2		2	196	CC	
10:26	X1	RC	500	500				3	126	3		3	192	CC	
10:26	X1	RC	500	500				4	121	4		4	203	CC	
10:26	X1	RC	500	500				5	118	5		5	199	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, November 17, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
1:20	1	JC			860		300	1	139	1	136	1	206	CC	
1:20	1	JC			860		300	2	134	2	142	2	192	CC	
1:20	1	JC			860		300	3	140	3	153	3	189	CC	
1:20	1	JC			860		300	4	138	4	149	4	197	CC	
1:20	1	JC			860		300	5	145	5	150	5	189	CC	
1:28	X1	MC	500	500				1	120	1		1	181	CC	
1:28	X1	MC	500	500				2	117	2		2	183	CC	
1:28	X1	MC	500	500				3	118	3		3	171	CC	
1:28	X1	MC	500	500				4	119	4		4	178	CC	
1:28	X1	MC	500	500				5	120	5		5	186	CC	

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Friday, October 14, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
1	860	East Slope	11.00	7.30	80.30	
2	860	East Slope	11.00	7.30	80.30	
3	860	East Slope	11.00	7.30	80.30	
4	4356	East Slope	11.00	7.30	80.30	
5	4356	East Slope	11.00	7.30	80.30	
6	4356	East Slope	11.00	7.30	80.30	
7	918	East Slope	11.00	7.30	80.30	
8	918	East Slope	11.00	7.30	80.30	
9	918	East Slope	11.00	7.30	80.30	

722.70 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Tuesday, October 18, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
10	918	East Slope	11.50	7.30	83.95	
11	5333	East Slope	11.50	7.30	83.95	
12	5333	Sump	9.00	7.30	65.70	
13	5333	Sump	1.50	7.30	10.95	
14	5333	Sump	8.00	7.30	58.40	

302.95 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Wednesday, October 19, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
15	1078	East Floor	70.00	7.30	511.00	
16	5333	East Floor	70.00	7.30	511.00	
17	5333	North Slope	23.00	7.30	167.90	
18	5333	North Slope	23.00	7.30	167.90	
19	5321	North Slope	23.00	7.30	167.90	

1525.70 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Saturday, October 22, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
20	5390	Floor	40.00	7.30	292.00	
21	5321	Floor	40.00	7.30	292.00	

584.00 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Tuesday, October 25, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
22	5321	North Slope	23.00	7.30	167.90	

167.90 sq m

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Wednesday, October 26, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
23	5329	S.Slope/Floor	30.00	7.30	219.00	
24	5329	S.Slope/Floor	30.00	7.30	219.00	
25	5329	S.Slope/Floor	30.00	7.30	219.00	

657.00 sq m

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Friday, October 28, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
26	5329	S.Slope/Floor	30.00	7.30	219.00	
27	5329	S.Slope/Floor	23.50	7.30	171.55	
28	5321	S.Slope/Floor	7.00	7.30	51.10	

441.65 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Tuesday, November 01, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
29	5335	North Slope	22.00	7.30	160.60	
30	5335	North Slope	21.00	7.30	153.30	

313.90 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Thursday, November 03, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
31	5335	North Slope	19.00	7.30	138.70	
32	5335	North Slope	19.00	7.30	138.70	
33	5335	North Slope	19.00	7.30	138.70	

416.10 sq m

PANEL PLACEMENT LOG

C.J. Cassidy
Consulting Inc.

DATE Tuesday, November 08, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022 MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
34	5335	North Floor	7.00	7.30	51.10	

51.10 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Wednesday, November 09, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
35	5317	North Floor	14.50	7.30	105.85	
36	5317	W.Slope/Floor	40.00	7.30	292.00	
37	5317	W.Slope/Floor	40.00	7.30	292.00	
38	5317	W.Slope/Floor	40.00	7.30	292.00	
39	5324	N.W.Corner	18.00	7.30	131.40	
40	5324	N.W.Corner	9.00	7.30	65.70	
41	5324	N.W.Corner	8.00	7.30	58.40	
42	5324	N.W.Corner	15.00	7.30	109.50	

1346.85 **sq m**

PANEL PLACEMENT LOG

C.J. Cassidy Consulting Inc.

DATE Saturday, November 12, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
43	5331	S.W.Slope/Floor	33.00	7.30	240.90	
44	5331	S.W.Slope/Floor	15.00	7.30	109.50	
45	5331	W.Slope/Floor	47.00	7.30	343.10	

693.50 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Monday, November 14, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
46	5319	W.Slope/Floor	47.00	7.30	343.10	
47	5331	W.Slope/Floor	47.00	7.30	343.10	

686.20 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Tuesday, November 15, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
48	5324	W.Slope/Floor	47.00	7.30	343.10	
49	5324	W.Slope/Floor	47.00	7.30	343.10	

686.20 sq m

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Wednesday, November 16, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
50	5318	W.Slope/Floor	47.00	7.30	343.10	
51	5318	W.Slope/Floor	47.00	7.30	343.10	
52	5318	W.Slope/Floor	47.00	7.30	343.10	

1029.30 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Thursday, November 17, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - SECONDARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
53	5326	W.Slope/Floor	47.00	7.30	343.10	
54	5326	W.Slope/Floor	47.00	7.30	343.10	
55	5327	W.Slope/Floor	47.00	3.50	164.50	

850.70 **sq m**

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Friday, October 14, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
1/2	11.0	10:25	CJC	1	10:40	10:45	40	40	FTB	FTB	N/A	CC	
2/3	11.0	10:33	CJC	1	10:44	10:49	40	40	FTB	FTB	N/A	CC	
3/4	11.0	10:39	CJC	1	11:00	11:05	40	40	FTB	FTB	N/A	CC	
4/5	11.0	11:05	CJC	1	11:20	11:25	40	40	FTB	FTB	N/A	CC	
5/6	11.0	11:10	CJC	1	11:25	11:30	40	40	FTB	FTB	N/A	CC	
6/7	11.0	11:18	CJC	1	11:35	11:40	40	40	FTB	FTB	N/A	CC	
7/8	11.0	12:00	CJC	1	12:15	12:20	40	40	FTB	FTB	N/A	CC	
8/9	11.0	12:12	CJC	1	12:25	12:30	40	40	FTB	FTB	N/A	CC	
TieIn/A	36.5	12:45	CJC	1	2:20	2:25	40	39	FTB	FTB	N/A	CC	Panels 5 to 9, Tie In to existing cell.
TieIn/B	29.0	12:45	CJC	1	2:10	2:15	41	39	FTB	FTB	N/A	CC	Panels 1 to 4, Tie In to existing cell.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Tuesday, October 18, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
1/10	11.0	9:25	JC	1	9:50	9:55	40	40	FTB	FTB	N/A	CC	
10/11	11.5	10:15	JC	1	11:16	11:21	40	39	FTB	FTB	N/A	CC	
10/11/12	9.0	10:36	JC	1	10:55	11:00	40	39	FTB	FTB	N/A	CC	
13/14	7.3	10:42	JC	1	10:50	10:55	40	40	FTB	FTB	N/A	CC	
12/13/14	9.0	10:51	JC	1	11:05	11:10	40	40	FTB	FTB	N/A	CC	
TieIn/C	14.5	11:55	JC	1	12:55	1:00	40	38	FTB	FTB	N/A	CC	Panels 10 & 11, Tie In to existing cell.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Wednesday, October 19, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
15/16	70.0	10:50	JC	1	11:35	11:40	40	40	FTB	FTB	N/A	CC	Floor Panels.
17/18	23.0	1:36	JC	1	1:36	1:41	40	40	FTB	FTB	N/A	CC	North Slope.
18/19	23.0	1:51	JC	1	2:01	2:06	40	39	FTB	FTB	N/A	CC	North Slope.
E.Butt	72.0	11:20	JC	1	12:10	12:15	40	38	FTB	FTB	N/A	CC	Panels 1 - 10 to Panel 15.
SumpButt	14.5	2:22	JC	1	2:43	2:48	40	40	FTB	FTB	N/A	CC	Panels 12 & 13 to 15 & 16.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Saturday, October 22, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
20/21	7.3	9:25	RC	1	11:20	11:25	40	40	FTB	FTB	N/A	CC	Cross Seam.
20/21/13/14/16	79.0	10:50	RC	1	12:03	12:08	40	40	FTB	FTB	N/A	CC	Floor Panels.
N.Butt/A	21.0	11:35	RC	1	12:24	12:29	40	40	FTB	FTB	N/A	CC	Panels 17 - 19.
TieIn/D	23.0	2:40	RC	1	3:00	3:05	40	38	FTB	FTB	N/A	CC	Panel 17, Tie In to existing cell.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Tuesday, October 25, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
19/22	23.0	8:30	JC	1	9:02	9:07	40	38	FTB	FTB	N/A	CC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Wednesday, October 26, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
23/24	30.0	12:37	JC	1	2:00	2:05	40	38	FTB	FTB	N/A	CC	
24/25	30.0	1:02	JC	1	2:10	2:15	40	40	FTB	FTB	N/A	CC	
S.Butt/A	20.0	1:25	JC	1	2:14	2:19	40	40	FTB	FTB	N/A	CC	Panels 22 & 23 to Panel 9.
TieIn/E	30.0	1:40	JC	1	2:20	2:25	40	40	FTB	FTB	N/A	CC	Panel 23, Tie In to existing cell.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Friday, October 28, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
25/26	30.0	8:45	JC	1	9:38	9:43	40	38	FTB	FTB	N/A	CC	
27/28	7.3	9:05	JC	1	9:46	9:51	40	40	FTB	FTB	N/A	CC	Cross Seam.
26/27/28	30.0	9:12	JC	1	9:48	9:53	40	40	FTB	FTB	N/A	CC	
S.Butt/B	21.5	9:26	JC	1	10:09	10:15	40	40	FTB	FTB	N/A	CC	Panels 25,26,28 to Panels 15,16,21.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Tuesday, November 01, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
22/29	22.0	8:19	JC	1	8:45	8:50	40	40	FTB	FTB	N/A	CC	
20/30	21.0	9:00	JC	1	9:05	9:10	40	38	FTB	FTB	N/A	CC	
N.Butt/B	11.0	9:25	JC	1	9:50	9:55	40	40	FTB	FTB	N/A	CC	Panels 22 & 29.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Thursday, November 03, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
30/31	19.0	9:34	JC	1	10:05	10:10	40	40	FTB	FTB	N/A	CC	
31/32	19.0	10:03	JC	1	10:15	10:20	40	40	FTB	FTB	N/A	CC	
32/33	19.0	10:15	JC	1	10:34	10:40	40	40	FTB	FTB	N/A	CC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Tuesday, November 08, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
34/20	7.0	9:29	JC	1	10:05	10:10	40	40	FTB	FTB	N/A	CC	
N.Butt/C	7.3	9:45	JC	1	10:21	10:26	40	40	FTB	FTB	N/A	CC	Panels 29 & 30 to Panel 34.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Wednesday, November 09, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
34/35	7.3	1:11	JC	1	1:17	1:23	40	40	FTB	FTB	N/A	CC	
36/37	40.0	1:15	JC	1	1:29	1:34	40	39	FTB	FTB	N/A	CC	
37/38	40.0	12:10	JC	1	12:22	12:27	40	39	FTB	FTB	N/A	CC	
33/39	18.0	2:26	JC	1	2:38	2:43	40	40	FTB	FTB	N/A	CC	
39/40	9.0	2:11	JC	1	2:40	2:45	40	40	FTB	FTB	N/A	CC	
41/42	8.0	2:59	JC	1	3:25	3:30	40	40	FTB	FTB	N/A	CC	
34/36	7.0	12:57	JC	1	1:21	1:26	40	40	FTB	FTB	N/A	CC	
35/37/38	14.0	12:43	JC	1	1:10	1:15	40	40	FTB	FTB	N/A	CC	
35/20	21.0	1:35	JC	1	1:51	1:56	40	38	FTB	FTB	N/A	CC	
N.W.Butt	21.0	3:22	JC	1	3:55	4:00	40	40	FTB	FTB	N/A	CC	Panels 39 - 41.
N.Butt/D	25.0	3:39	JC	1	4:11	4:16	40	39	FTB	FTB	N/A	CC	Panels 30 - 33.
N.Butt/E	15.0	3:39	JC	1	4:15	4:20	40	40	FTB	FTB	N/A	CC	Panels 36/42.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Saturday, November 12, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
43/44	7.3	11:20	JC	1	12:06	12:11	40	40	FTB	FTB	N/A	CC	Cross Seam.
43/44/45	47.0	11:40	JC	1	12:13	12:18	40	40	FTB	FTB	N/A	CC	
FloorButt/A	14.5	12:05	JC	1	12:40	12:45	40	40	FTB	FTB	N/A	CC	Panels 43, 45 to Panel 27.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Monday, November 14, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
45/46	47.0	9:37	JC	1	11:01	11:06	40	40	FTB	FTB	N/A	CC	
46/47	47.0	10:10	JC	1	11:12	11:17	40	40	FTB	FTB	N/A	CC	
FloorButt/B	14.5	10:40	JC	1	11:20	11:25	40	40	FTB	FTB	N/A	CC	Panels 45, 46, 47 to Panels 27 & 28.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Tuesday, November 15, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
47/48	47.0	10:36	JC	1	11:17	11:22	40	40	FTB	FTB	N/A	CC	
48/49/A	36.5	10:15	JC	1	11:25	11:30	40	40	FTB	FTB	N/A	CC	
48/49/B	10.5	10:15	JC	1	11:37	11:42	40	40	FTB	FTB	N/A	CC	
FloorButt/C	14.5	11:11	JC	1	11:56	12:01	40	40	FTB	FTB	N/A	CC	Panels 48, 49 to Panel 21.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Wednesday, November 16, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
38/50	47.0	10:45	JC	1	12:15	12:20	40	40	FTB	FTB	N/A	CC	
50/51	47.0	10:11	JC	1	12:13	12:18	40	40	FTB	FTB	N/A	CC	
51/52	47.0	11:07	JC	1	12:28	12:33	40	40	FTB	FTB	N/A	CC	
FloorButt/E	22.5	11:40	JC	1	12:40	12:45	40	40	FTB	FTB	N/A	CC	Panels 50 - 52 to Panels 20 & 21.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Thursday, November 17, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
52/53	47.0	1:44	JC	1	2:53	2:58	40	40	FTB	FTB	N/A	CC	
53/54	47.0	9:44	JC	1	12:10	12:15	40	40	FTB	FTB	N/A	CC	
54/55	47.0	10:25	JC	1	12:30	12:35	40	40	FTB	FTB	N/A	CC	
55/49	47.0	11:06	JC	1	12:35	12:40	40	40	FTB	FTB	N/A	CC	
FloorButt/D	18.0	2:15	JC	1	3:05	3:10	40	40	FTB	FTB	N/A	CC	Panels 53 - 55 to Panel 21.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Friday, October 14, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
1	Patch	4/5	Oct 14	MC	X1	CG	Pass	At Intersection of TieIn/A & TieIn/B, Tie In to Existing Liner.
2	Patch	P7	Oct 14	MC	X1	CG	Pass	
3	Patch	P7	Oct 14	MC	X1	CG	Pass	
4	Patch	8/9	Oct 14	MC	X1	CG	Pass	Destruct #1.
Zone 1	Beads	TieIn/A	Oct 14	MC	X1	CG	Pass	All "T" Intersections along Tie In A.
Zone 2	Beads	TieIn/B	Oct 14	MC	X1	CG	Pass	All "T" Intersections along Tie In B.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Tuesday, October 18, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
5	Patch	12/14	Oct 18	RC	X1	CG	Pass	
6	Patch	10/11	Oct 18	RC	X1	CG	Pass	
Zone 3	Beads	TieIn/C	Oct 18	RC	X1	CG	Pass	All "T" Intersections along Tie In C.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE: Wednesday, October 19, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
7	Patch	15/16	Oct 19	RC	X1	CG	Pass	Destruct #2.
8	Patch	P1/TieIn	Oct 19	RC	X1	CG	Pass	At Intersection of TieIn/B & TieIn/C, Tie In to Existing Liner.
Zone 4	Beads	Sump	Oct 19	RC	X1	CG	Pass	All "T" Intersections in Sump Area.
Zone 5	Beads	East Butt	Oct 19	RC	X1	CG	Pass	All "T" Intersections along East Butt Seam.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Saturday, October 22, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
9	Patch	16/21	Oct 22	RC	X1	CG	Pass	Destruct #3.
10	Patch	P11/TieIn/C	Oct 22	RC	X1	CG	Pass	At Intersection of TieIn/C & TieIn/D, Tie In to Existing Liner.
11	Patch	P17/TieIn/D	Oct 22	RC	X1	CG	Pass	At Intersection of TieIn/D at North Slope of Existing Liner.
Zone 6	Beads	N.Butt/A	Oct 22	RC	X1	CG	Pass	All "T" Intersections along North Butt/A.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Wednesday, October 26, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
12	Bead	S.Butt/A	Oct 26	MC	X1	CG	Pass	"T" Intersection along South Butt/A.
13	Patch/Bead	24/25	Oct 26	MC	X1	CG	Pass	South Slope, fish mouth repair.
14	Patch	9/23	Oct 26	MC	X1	CG	Pass	At Intersection of TieIn/A & TieIn/E, Tie In to Existing Liner.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Friday, October 28, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
15	Patch	9/24	Oct 28	RC	X1	CG	Pass	At Intersection of South Butt/A and South Butt/B.
Zone 7	Beads	S.Butt/B	Oct 28	RC	X1	CG	Pass	All "T" Intersections along South Butt/B and Seam 27/28.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Tuesday, November 01, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
16	Patch	N.Butt	Nov 1	RC	X1	CG	Pass	At Intersection of N.Butt/A and N.Butt/B.
Zone 8	Beads	N.Butt/B	Nov 1	RC	X1	CG	Pass	All "T" Intersections along North Butt/B.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Tuesday, November 08, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
17	Patch	20/34	Nov 8	MC	X1	RC	PASS	
18	Patch	N.Butt	Nov 8	MC	X1	RC	PASS	At Intersection of N.Butt/B and N.Butt/C.
19	Bead	N.Butt	Nov 8	MC	X1	RC	PASS	"T" Intersection along N.Butt/C.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Wednesday, November 09, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
20	Patch	N.Butt	Nov 9	RC	X1	MC	PASS	At Intersection of N.Butt/C and N.Butt/D.
21	Patch	N.Butt	Nov 9	RC	X1	MC	PASS	At Panel 20/29.
22	Patch	37/38	Nov 9	RC	X1	MC	PASS	Destruct #4.
Zone 9	Beads	N.W.Butt	Nov 9	RC	X1	MC	PASS	All "T" Intersections along N.W.Butt.
Zone 10	Beads	N.Butt/D	Nov 9	RC	X1	MC	PASS	All "T" Intersections along N.Butt/D and 35/36/37.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Thursday, November 10, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
23	Patch	N.Butt	Nov 10	RC	X1	MC	PASS	At Intersection of N.W.Butt.
24	Patch	33/39	Nov 10	RC	X1	MC	PASS	At Anchor Trench.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Saturday, November 12, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
25	Bead	43/44/45	Nov 12	RC	X1	CC	PASS	"T" Intersection on Seam 43/44/45.
26	Bead	F.Butt/A	Nov 12	RC	X1	CC	PASS	"T" Intersection on Floor Butt/A.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Monday, November 14, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
27	Patch	45/46	Nov 14	RC	X1	CC	PASS	Destruct #5.
28	Patch	Floor Butt	Nov 14	RC	X1	CC	PASS	At Intersection of Floor Butt/A and Floor Butt/B.
Zone 11	Beads	F.Butt/B	Nov 14	RC	X1	CC	PASS	All "T" Intersections along Floor Butt/B.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Tuesday, November 15, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
29	Patch/Bead	48/49	Nov 15	RC	X1	CC	PASS	Fishmouth at Toe of Slope.
30	Patch	Floor Butt	Nov 15	RC	X1	CC	PASS	At Intersection of Floor Butt/B and Floor Butt/C.
31	Patch	47/48	Nov 15	RC	X1	CC	PASS	Near Floor Butt Seam.
32	Bead	Floor Butt	Nov 15	RC	X1	CC	PASS	"T" Intersection on Floor Butt/C.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Wednesday, November 16, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
33	Patch	Floor Butt	Nov 16	RC	X1	MC	PASS	At North End of Floor Butt/E.
Zone 12	Beads	F.Butt/E	Nov 16	RC	X1	MC	PASS	All "T" Intersections along Floor Butt/E.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Thursday, November 17, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - SECONDARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
34	Patch	53/54	Nov 17	MC	X1	RC	PASS	Destruct #6.
35	Patch	Floor Butt	Nov 17	MC	X1	RC	PASS	At Intersection of Floor Butt/C and Floor Butt/D.
36	Patch	Floor Butt	Nov 17	MC	X1	RC	PASS	At Intersection of Floor Butt/D and Floor Butt/E.
Zone 13	Beads	F.Butt/D	Nov 17	MC	X1	RC	PASS	All "T" Intersections along Floor Butt/D.

C.J. Cassidy
Consulting Inc.

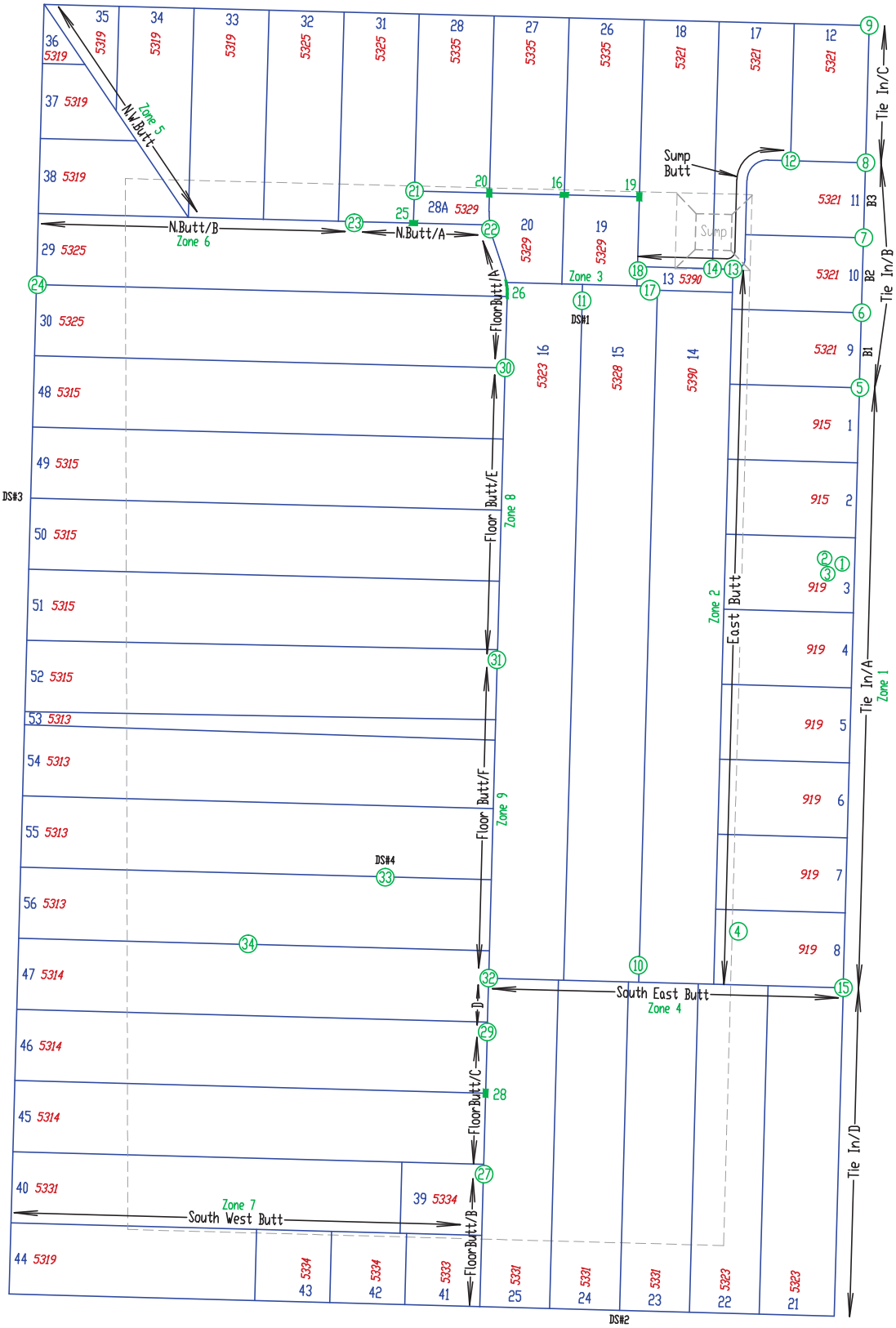
DESTRUCTIVE TESTING REPORT

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022** MATERIAL 60mil HDPE - SECONDARY LINER

WELD DATE	D.S. #	SEAM #	TECH INITIAL	WELDER NUMBER	PEEL 1 IN	PEEL 1 OUT	SHEAR	PEEL 2 IN	PEEL 2 OUT	SHEAR	PEEL 3 IN	PEEL 3 OUT	SHEAR	PEEL 4 IN	PEEL 4 OUT	SHEAR	PEEL 5 IN	PEEL 5 OUT	SHEAR	QC INITIAL	COMMENTS / LOCATION
10-14-22	1	8/9	JC	1	116	123	182	124	124	180	124	110	183	120	112	184	134	133	180	CC	Near Toe.
10-19-22	2	15/16	JC	1	145	123	198	139	134	200	121	129	195	133	128	197	121	140	190	CC	3m from the North End.
10-22-22	3	16/21	JC	1	149	144	195	124	129	198	103	110	199	124	114	201	132	118	204	CC	7m from the South End.
11-09-22	4	37/38	JC	1	147	165	202	144	144	199	156	162	206	160	123	208	121	167	210	CC	Run out at Anchor Trench.
11-14-22	5	45/46	JC	1	135	136	207	131	110	208	145	135	200	107	139	207	124	111	200	CC	On Floor.
11-17-22	6	53/54	JC	2	118	129	204	133	139	211	126	138	195	124	118	191	127	122	203	CC	On Floor.

NORTHWIN LANDFILL WEST CELL

PRIMARY LINER



Blue = Liner Red = Roll Numbers Green = Extrusion Welds

DATE: December 19, 2022	C.J. Cassidy Consulting Inc.	NORTHWIN LANDFILL - 2022
SCALE: NTS		CAMPBELL RIVER, B.C.
FILE NAME: WestCellRep-2022		West Cell Primary Liner Representative Drawing
DRAWN BY: SSC		
CHECKED BY: CJC		

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, October 15, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
11:42	1	JC			860		600	1	123	1	142	1	178	CC	
11:42	1	JC			860		600	2	121	2	152	2	181	CC	
11:42	1	JC			860		600	3	117	3	150	3	176	CC	
11:42	1	JC			860		600	4	132	4	141	4	182	CC	
11:42	1	JC			860		600	5	146	5	124	5	179	CC	
9:45	X1	RC	500	500				1	118	1		1	190	CC	
9:45	X1	RC	500	500				2	124	2		2	195	CC	
9:45	X1	RC	500	500				3	135	3		3	183	CC	
9:45	X1	RC	500	500				4	115	4		4	180	CC	
9:45	X1	RC	500	500				5	119	5		5	186	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, October 17, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
7:46	1	JC			860		250	1	145	1	156	1	197	CC	
7:46	1	JC			860		250	2	151	2	171	2	197	CC	
7:46	1	JC			860		250	3	143	3	138	3	197	CC	
7:46	1	JC			860		250	4	151	4	135	4	192	CC	
7:46	1	JC			860		250	5	157	5	139	5	196	CC	
9:55	X1	RC	500	500				1	91	1		1	187	CC	
9:55	X1	RC	500	500				2	92	2		2	186	CC	
9:55	X1	RC	500	500				3	106	3		3	188	CC	
9:55	X1	RC	500	500				4	97	4		4	189	CC	
9:55	X1	RC	500	500				5	102	5		5	189	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Friday, October 21, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
10:20	1	JC			860		250	1	121	1	143	1	204	CC	
10:20	1	JC			860		250	2	112	2	140	2	206	CC	
10:20	1	JC			860		250	3	120	3	120	3	204	CC	
10:20	1	JC			860		250	4	119	4	119	4	204	CC	
10:20	1	JC			860		250	5	125	5	125	5	204	CC	
11:50	X1	RC	500	500				1	111	1		1	199	CC	
11:50	X1	RC	500	500				2	112	2		2	200	CC	
11:50	X1	RC	500	500				3	122	3		3	202	CC	
11:50	X1	RC	500	500				4	123	4		4	198	CC	
11:50	X1	RC	500	500				5	140	5		5	202	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, October 24, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
11:46	1	JC			860		300	1	138	1	125	1	199	CC	
11:46	1	JC			860		300	2	130	2	133	2	199	CC	
11:46	1	JC			860		300	3	125	3	128	3	203	CC	
11:46	1	JC			860		300	4	129	4	122	4	201	CC	
11:46	1	JC			860		300	5	119	5	130	5	203	CC	
12:15	X1	MC	500	500				1	120	1		1	187	CC	
12:15	X1	MC	500	500				2	119	2		2	188	CC	
12:15	X1	MC	500	500				3	105	3		3	188	CC	
12:15	X1	MC	500	500				4	111	4		4	189	CC	
12:15	X1	MC	500	500				5	118	5		5	181	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, October 25, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:10	1	JC			860		300	1	125	1	128	1	210	CC	
8:10	1	JC			860		300	2	126	2	146	2	210	CC	
8:10	1	JC			860		300	3	141	3	135	3	209	CC	
8:10	1	JC			860		300	4	142	4	143	4	212	CC	
8:10	1	JC			860		300	5	128	5	135	5	212	CC	
12:00	X1	MC	500	500				1	109	1		1	196	CC	
12:00	X1	MC	500	500				2	112	2		2	196	CC	
12:00	X1	MC	500	500				3	100	3		3	203	CC	
12:00	X1	MC	500	500				4	109	4		4	200	CC	
12:00	X1	MC	500	500				5	95	5		5	201	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, October 26, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:39	1	JC			860		300	1	162	1	166	1	206	CC	
8:39	1	JC			860		300	2	175	2	154	2	218	CC	
8:39	1	JC			860		300	3	155	3	155	3	205	CC	
8:39	1	JC			860		300	4	158	4	158	4	204	CC	
8:39	1	JC			860		300	5	161	5	155	5	211	CC	
8:09	X1	MC	500	500				1	119	1		1	212	CC	
8:09	X1	MC	500	500				2	88	2		2	207	CC	
8:09	X1	MC	500	500				3	119	3		3	210	CC	
8:09	X1	MC	500	500				4	131	4		4	213	CC	
8:09	X1	MC	500	500				5	119	5		5	206	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Friday, October 28, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:14	1	JC			860		300	1	162	1	166	1	206	CC	
8:14	1	JC			860		300	2	132	2	133	2	201	CC	
8:14	1	JC			860		300	3	155	3	155	3	205	CC	
8:14	1	JC			860		300	4	141	4	149	4	204	CC	
8:14	1	JC			860		300	5	161	5	155	5	204	CC	
8:40	X1	RC	500	500				1	119	1		1	211	CC	
8:40	X1	RC	500	500				2	98	2		2	207	CC	
8:40	X1	RC	500	500				3	120	3		3	210	CC	
8:40	X1	RC	500	500				4	130	4		4	213	CC	
8:40	X1	RC	500	500				5	120	5		5	211	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, October 29, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:01	1	JC			860		300	1	162	1	166	1	204	CC	
9:01	1	JC			860		300	2	165	2	178	2	204	CC	
9:01	1	JC			860		300	3	155	3	155	3	205	CC	
9:01	1	JC			860		300	4	139	4	144	4	204	CC	
9:01	1	JC			860		300	5	166	5	150	5	204	CC	
10:30	X1	RC	500	500				1	121	1		1	201	CC	
10:30	X1	RC	500	500				2	100	2		2	201	CC	
10:30	X1	RC	500	500				3	100	3		3	203	CC	
10:30	X1	RC	500	500				4	125	4		4	200	CC	
10:30	X1	RC	500	500				5	119	5		5	198	CC	

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, October 31, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:55	1	JC			860		300	1	131	1	234	1	201	CC	
8:55	1	JC			860		300	2	116	2	162	2	203	CC	
8:55	1	JC			860		300	3	134	3	146	3	192	CC	
8:55	1	JC			860		300	4	134	4	148	4	199	CC	
8:55	1	JC			860		300	5	144	5	114	5	198	CC	
10:10	X1	RC	500	500				1	121	1		1	201	CC	
10:10	X1	RC	500	500				2	127	2		2	202	CC	
10:10	X1	RC	500	500				3	124	3		3	194	CC	
10:10	X1	RC	500	500				4	116	4		4	205	CC	
10:10	X1	RC	500	500				5	123	5		5	195	CC	
								5		5		5		CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, November 01, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
12:15	1	JC			860		300	1	130	1	133	1	198	CC	
12:15	1	JC			860		300	2	141	2	140	2	198	CC	
12:15	1	JC			860		300	3	151	3	145	3	193	CC	
12:15	1	JC			860		300	4	146	4	148	4	199	CC	
12:15	1	JC			860		300	5	132	5	137	5	195	CC	
11:35	X1	RC	500	500				1	91	1		1	186	CC	Warm sample rain coming
11:35	X1	RC	500	500				2	98	2		2	193	CC	
11:35	X1	RC	500	500				3	93	3		3	192	CC	
11:35	X1	RC	500	500				4	88	4		4	196	CC	
11:35	X1	RC	500	500				5	87	5		5	189	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, November 02, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
6:34	1	JC			860		300	1	129	1	146	1	216	CC	
6:34	1	JC			860		300	2	153	2	143	2	218	CC	
6:34	1	JC			860		300	3	145	3	143	3	218	CC	
6:34	1	JC			860		300	4	143	4	150	4	223	CC	
6:34	1	JC			860		300	5	156	5	144	5	213	CC	
6:49	X1	RC	500	500				1	115	1		1	207	CC	
6:49	X1	RC	500	500				2	113	2		2	200	CC	
6:49	X1	RC	500	500				3	133	3		3	210	CC	
6:49	X1	RC	500	500				4	99	4		4	206	CC	
6:49	X1	RC	500	500				5	98	5		5	202	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, November 05, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
1:58	1	JC			860		300	1	131	1	124	1	199	CC	
1:58	1	JC			860		300	2	116	2	143	2	203	CC	
1:58	1	JC			860		300	3	134	3	146	3	192	CC	
1:58	1	JC			860		300	4	134	4	148	4	199	CC	
1:58	1	JC			860		300	5	144	5	129	5	198	CC	
2:15	X1	RC	500	500				1	125	1		1	206	CC	
2:15	X1	RC	500	500				2	131	2		2	198	CC	
2:15	X1	RC	500	500				3	119	3		3	197	CC	
2:15	X1	RC	500	500				4	121	4		4	200	CC	
2:15	X1	RC	500	500				5	136	5		5	188	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, November 10, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
1:27	1	JC			860		300	1	140	1	141	1	189	CC	
1:27	1	JC			860		300	2	167	2	143	2	193	CC	
1:27	1	JC			860		300	3	154	3	169	3	200	CC	
1:27	1	JC			860		300	4	145	4	144	4	199	CC	
1:27	1	JC			860		300	5	161	5	155	5	197	CC	
7:23	X1	MC	500	500				1	99	1		1	189	CC	
7:23	X1	MC	500	500				2	101	2		2	199	CC	
7:23	X1	MC	500	500				3	97	3		3	196	CC	
7:23	X1	MC	500	500				4	98	4		4	196	CC	
7:23	X1	MC	500	500				5	102	5		5	197	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, November 12, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
1:40	1	JC			860		300	1	142	1	137	1	155	CC	
1:40	1	JC			860		300	2	132	2	130	2	154	CC	
1:40	1	JC			860		300	3	152	3	142	3	157	CC	
1:40	1	JC			860		300	4	133	4	129	4	151	CC	
1:40	1	JC			860		300	5	143	5	143	5	155	CC	
1:53	X1	MC	500	500				1	114	1		1	158	CC	
1:53	X1	MC	500	500				2	120	2		2	156	CC	
1:53	X1	MC	500	500				3	112	3		3	156	CC	
1:53	X1	MC	500	500				4	114	4		4	157	CC	
1:53	X1	MC	500	500				5	115	5		5	157	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Monday, November 14, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
1:27	1	JC			860		300	1	131	1	131	1	151	CC	
1:27	1	JC			860		300	2	130	2	132	2	148	CC	
1:27	1	JC			860		300	3	132	3	126	3	154	CC	
1:27	1	JC			860		300	4	131	4	122	4	153	CC	
1:27	1	JC			860		300	5	127	5	137	5	148	CC	
1:45	X1	RC	500	500				1	116	1		1	129	CC	
1:45	X1	RC	500	500				2	125	2		2	120	CC	
1:45	X1	RC	500	500				3	121	3		3	120	CC	
1:45	X1	RC	500	500				4	123	4		4	105	CC	
1:45	X1	RC	500	500				5	129	5		5	129	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Tuesday, November 15, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
11:20	1	JC			860		300	1	146	1	129	1	183	CC	
11:20	1	JC			860		300	2	134	2	134	2	156	CC	
11:20	1	JC			860		300	3	140	3	139	3	161	CC	
11:20	1	JC			860		300	4	155	4	137	4	165	CC	
11:20	1	JC			860		300	5	145	5	152	5	159	CC	
11:38	X1	RC	500	500				1	119	1		1	167	CC	
11:38	X1	RC	500	500				2	104	2		2	199	CC	
11:38	X1	RC	500	500				3	116	3		3	160	CC	
11:38	X1	RC	500	500				4	113	4		4	174	CC	
11:38	X1	RC	500	500				5	120	5		5	155	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, November 16, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:32	1	JC			860		300	1	144	1	137	1	199	CC	
9:32	1	JC			860		300	2	140	2	142	2	200	CC	
9:32	1	JC			860		300	3	152	3	150	3	187	CC	
9:32	1	JC			860		300	4	149	4	150	4	192	CC	
9:32	1	JC			860		300	5	153	5	148	5	193	CC	
10:16	X1	RC	500	500				1	138	1		1	188	CC	
10:16	X1	RC	500	500				2	142	2		2	190	CC	
10:16	X1	RC	500	500				3	135	3		3	191	CC	
10:16	X1	RC	500	500				4	137	4		4	199	CC	
10:16	X1	RC	500	500				5	141	5		5	194	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, November 17, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
9:49	1	JC			860		300	1	178	1	163	1	202	CC	
9:49	1	JC			860		300	2	141	2	158	2	209	CC	
9:49	1	JC			860		300	3	153	3	162	3	214	CC	
9:49	1	JC			860		300	4	174	4	151	4	216	CC	
9:49	1	JC			860		300	5	145	5	153	5	211	CC	
10:05	X1	RC	500	500				1	126	1		1	189	CC	
10:05	X1	RC	500	500				2	120	2		2	205	CC	
10:05	X1	RC	500	500				3	124	3		3	196	CC	
10:05	X1	RC	500	500				4	119	4		4	191	CC	
10:05	X1	RC	500	500				5	125	5		5	187	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Friday, November 18, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
10:33	1	JC			860		300	1	146	1	134	1	210	CC	
10:33	1	JC			860		300	2	152	2	136	2	207	CC	
10:33	1	JC			860		300	3	141	3	142	3	208	CC	
10:33	1	JC			860		300	4	136	4	147	4	213	CC	
10:33	1	JC			860		300	5	140	5	152	5	210	CC	
10:40	X1	RC	500	500				1	123	1		1	201	CC	
10:40	X1	RC	500	500				2	116	2		2	187	CC	
10:40	X1	RC	500	500				3	132	3		3	191	CC	
10:40	X1	RC	500	500				4	128	4		4	200	CC	
10:40	X1	RC	500	500				5	130	5		5	195	CC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Saturday, November 19, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
8:47	1	JC			860		300	1	144	1	142	1	201	CC	
8:47	1	JC			860		300	2	124	2	129	2	194	CC	
8:47	1	JC			860		300	3	152	3	126	3	195	CC	
8:47	1	JC			860		300	4	130	4	131	4	196	CC	
8:47	1	JC			860		300	5	129	5	144	5	192	CC	
9:05	X1	MC	500	500				1	122	1		1	199	CC	
9:05	X1	MC	500	500				2	117	2		2	200	CC	
9:05	X1	MC	500	500				3	119	3		3	196	CC	
9:05	X1	MC	500	500				4	118	4		4	185	CC	
9:05	X1	MC	500	500				5	129	5		5	188	CC	

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Saturday, October 15, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
1	915	East Slope	11.50	7.30	83.95	
2	915	East Slope	11.50	7.30	83.95	
3	919	East Slope	11.50	7.30	83.95	
4	919	East Slope	11.50	7.30	83.95	
5	919	East Slope	11.50	7.30	83.95	
6	919	East Slope	11.50	7.30	83.95	
7	919	East Slope	11.50	7.30	83.95	
8	919	East Slope	11.50	7.30	83.95	

671.60 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Friday, October 21, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
9	5321	East Slope	11.50	7.30	83.95	
10	5321	East Slope	11.50	7.30	83.95	
11	5321	East Slope	10.00	7.30	73.00	
12	5321	North Slope	17.00	7.30	124.10	
13	5390	Sump	3.00	7.30	21.90	
14	5390	Floor	67.50	7.30	492.75	

879.65 **sq m**

PANEL PLACEMENT LOG

C.J.Cassidy
Consulting Inc.

DATE Monday, October 24, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
15	5328	Floor	68.00	7.30	496.40	
16	5323	Floor	68.00	7.30	496.40	

992.80 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Tuesday, October 25, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
17	5321	North Slope	27.00	7.30	197.10	
18	5321	North Slope	27.00	7.30	197.10	

394.20 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Wednesday, October 26, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
19	5329	Floor	9.00	7.30	65.70	Floor West of Sump
20	5329	Floor	9.00	7.30	65.70	Floor West of Sump

131.40 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Friday, October 28, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
21	5323	S.E.Slope	30.00	7.30	219.00	

219.00 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Saturday, October 29, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
22	5323	S.Slope/Floor	30.00	7.30	219.00	

219.00 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Monday, October 31, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
23	5331	S.Slope/Floor	30.00	7.30	219.00	
24	5331	S.Slope/Floor	30.00	7.30	219.00	
25	5331	S.Slope/Floor	30.00	7.30	219.00	

657.00 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Tuesday, November 01, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
26	5335	North Slope	19.00	7.30	138.70	
27	5335	North Slope	19.00	7.30	138.70	

277.40 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Saturday, November 05, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
28	5335	North Slope	19.00	7.30	138.70	
28A	5329	North Slope	1.50	7.30	10.95	

149.65 **sq m**

PANEL PLACEMENT LOG

C.J. Cassidy Consulting Inc.

DATE Thursday, November 10, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
29	5325	W.Slope/Floor	46.00	7.30	335.80	
30	5325	W.Slope/Floor	46.00	7.30	335.80	
31	5325	North Slope	20.00	7.30	146.00	
32	5325	North Slope	20.00	7.30	146.00	

963.60 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Saturday, November 12, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
33	5319	W.Slope/Floor	20.00	7.30	146.00	
34	5319	N.W.Corner	19.00	7.30	138.70	
35	5319	N.W.Corner	11.00	7.30	80.30	
36	5319	N.W.Corner	5.00	7.30	36.50	
37	5319	N.W.Corner	10.00	7.30	73.00	
38	5319	N.W.Corner	15.00	7.30	109.50	

584.00 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Monday, November 14, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
39	5334	South Floor	8.00	7.30	58.40	
40	5331	S.Slope/Floor	40.50	7.30	295.65	
41	5333	South Slope	7.00	7.30	51.10	
42	5334	South Slope	7.00	7.30	51.10	
43	5334	South Slope	7.00	7.30	51.10	
44	5319	South Slope	26.00	7.30	189.80	

697.15 sq m

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Tuesday, November 15, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
45	5314	W.Slope/Floor	47.00	7.30	343.10	
46	5314	W.Slope/Floor	47.00	7.30	343.10	

686.20 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Wednesday, November 16, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
47	5314	W.Slope/Floor	47.00	7.30	343.10	

343.10 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Thursday, November 17, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
48	5315	W.Slope/Floor	46.00	7.30	335.80	
49	5315	W.Slope/Floor	46.00	7.30	335.80	
50	5315	W.Slope/Floor	46.00	7.30	335.80	

1007.40 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Friday, November 18, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
51	5315	W.Slope/Floor	46.00	7.30	335.80	
52	5315	W.Slope/Floor	47.00	7.30	343.10	

678.90 **sq m**

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Saturday, November 19, 2022

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022

MATERIAL 60mil HDPE - PRIMARY LINER

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
53	5313	W.Slope/Floor	47.00	2.00	94.00	
54	5313	W.Slope/Floor	47.00	7.30	343.10	
55	5313	W.Slope/Floor	47.00	7.30	343.10	
56	5313	W.Slope/Floor	47.00	7.30	343.10	

1123.30 **sq m**

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Saturday, October 15, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
1/2	11.5	11:58	JC	1	12:15	12:20	40	40	FTB	FTB	N/A	CC	
2/3	11.5	12:23	JC	1	12:30	12:35	40	40	FTB	FTB	N/A	CC	
3/4	11.5	12:30	JC	1	12:40	12:45	40	40	FTB	FTB	N/A	CC	
4/5	11.5	12:39	JC	1	12:50	12:55	40	40	FTB	FTB	N/A	CC	
5/6	11.5	12:47	JC	1	1:00	1:05	40	40	FTB	FTB	N/A	CC	
6/7	11.5	1:05	JC	1	2:00	2:05	40	40	FTB	FTB	N/A	CC	
7/8	11.5	1:46	JC	1	2:15	2:20	40	40	FTB	FTB	N/A	CC	
TieIn/A	68.0	8:03	JC	1	11:20	11:25	40	39	FTB	FTB	N/A	CC	Panels 1 to 10, Tie In to existing cell.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Friday, October 21, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
1/9	11.5	10:45	JC	1	10:59	11:04	40	40	FTB	FTB	N/A	CC	
9/10	11.5	10:52	JC	1	11:05	11:10	40	40	FTB	FTB	N/A	CC	
10/11	10.0	10:59	JC	1	11:30	11:35	40	40	FTB	FTB	N/A	CC	
11/12	7.3	11:06	JC	1	11:11	11:16	40	39	FTB	FTB	N/A	CC	
13/14	7.3	12:54	JC	1	1:21	1:26	40	40	FTB	FTB	N/A	CC	
E.Butt	68.5	1:31	JC	1	2:12	2:17	40	38	FTB	FTB	N/A	CC	Panels 1 - 10, E. Floor Butt Seam.
TieIn/B1	7.2	1:11	JC	1	2:04	2:09	40	40	FTB	FTB	N/A	CC	Panels 9, Tie In to existing cell.
TieIn/B2	7.2	1:11	JC	1	2:06	2:11	40	40	FTB	FTB	N/A	CC	Panel 10, Tie In to existing cell.
TieIn/B3	7.2	1:11	JC	1	2:10	2:15	40	40	FTB	FTB	N/A	CC	Panel 11, Tie In to existing cell.
TieIn/C	17.0	1:47	JC	1	2:54	2:59	40	40	FTB	FTB	N/A	CC	Panel 12, Tie In to existing cell.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Monday, October 24, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
14/15	67.5	12:30	JC	1	1:30	1:35	40	39	FTB	FTB	N/A	CC	Floor Panels
15/16	68.0	12:00	JC	1	12:41	12:46	40	40	FTB	FTB	N/A	CC	Floor Panels

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Tuesday, October 25, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
12/17	17.0	8:30	JC	1	9:02	9:07	40	38	FTB	FTB	N/A	CC	
17/18	27.0	10:31	JC	1	10:43	10:48	40	40	FTB	FTB	N/A	CC	
Sump Butt	25.0	10:07	JC	1	10:34	10:39	41	40	FTB	FTB	N/A	CC	Panels 10, 11, 13, 17 & 18 in Sump.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Wednesday, October 26, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
19/20	9.0	9:40	JC	1	10:05	10:10	40	38	FTB	FTB	N/A	CC	
15/16/19/20	14.0	9:55	JC	1	10:16	10:21	40	40	FTB	FTB	N/A	CC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Friday, October 28, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
TieIn/D	30.0	4:09	JC	1	4:21	4:26	40	38	FTB	FTB	N/A	CC	Panel 21, Tie In to existing cell.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Saturday, October 29, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
21/22	30.0	10:10	JC	1	11:35	11:40	40	40	FTB	FTB	N/A	CC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Monday, October 31, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
22/23	30.0	9:45	JC	1	10:05	10:10	40	40	FTB	FTB	N/A	CC	
23/24	30.0	10:13	JC	1	10:25	10:30	40	38	FTB	FTB	N/A	CC	
24/25	30.0	10:31	JC	1	10:45	10:50	40	40	FTB	FTB	N/A	CC	
S.E.Butt	36.0	10:52	JC	1	12:01	12:06	40	40	FTB	FTB	N/A	CC	Panels 21 - 25.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Tuesday, November 01, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
26/27	19.0	12:52	JC	1	1:05	1:10	40	38	FTB	FTB	N/A	CC	
19/20/26/27	14.5	1:15	JC	1	1:31	1:36	40	40	FTB	FTB	N/A	CC	
18/19/26	29.0	4:07	JC	1	4:31	4:36	40	40	FTB	FTB	N/A	CC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Saturday, November 05, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
28/28A	7.3	8:55	JC	1	12:20	12:25	40	40	FTB	FTB	N/A	CC	Cross Seam
27/28	20.0	9:12	JC	1	12:35	12:40	40	39	FTB	FTB	N/A	CC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Thursday, November 10, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
29/30	46.0	1:45	JC	1	2:01	2:06	40	40	FTB	FTB	N/A	CC	
28/31	20.0	2:32	JC	1	2:45	2:50	40	40	FTB	FTB	N/A	CC	
31/32	20.0	3:10	JC	1	3:26	3:31	40	40	FTB	FTB	N/A	CC	
N.Butt/A	11.0	2:40	JC	1	3:05	3:10	40	38	FTB	FTB	N/A	CC	Panel 31, 28 & 20.
FloorButt/A	12.0	2:46	JC	1	3:15	3:20	40	40	FTB	FTB	N/A	CC	Panels 29 & 30 to Panel16 & 20.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Saturday, November 12, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
32/33	20.0	2:10	JC	1	3:09	3:14	40	40	FTB	FTB	N/A	CC	
33/34	19.0	2:26	JC	1	3:04	3:09	40	40	FTB	FTB	N/A	CC	
34/35	11.0	2:36	JC	1	2:50	2:55	40	40	FTB	FTB	N/A	CC	
36/37	5.0	2:40	JC	1	2:56	3:01	40	40	FTB	FTB	N/A	CC	
37/38	10.0	2:43	JC	1	3:01	3:06	40	40	FTB	FTB	N/A	CC	
N.W.Butt	26.0	2:59	JC	1	3:28	3:33	40	38	FTB	FTB	N/A	CC	Panels 34 - 38.
N.Butt/B	31.0	3:16	JC	1	3:36	3:41	40	39	FTB	FTB	N/A	CC	Panel 29 to Panels 31 - 33 & 38..

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Monday, November 14, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
39/40	7.3	1:45	JC	1	2:01	2:06	40	40	FTB	FTB	N/A	CC	
41/42	7.0	2:32	JC	1	2:45	2:50	40	40	FTB	FTB	N/A	CC	
42/43	7.0	3:10	JC	1	3:26	3:31	40	40	FTB	FTB	N/A	CC	
43/44	7.0	2:40	JC	1	3:05	3:10	40	40	FTB	FTB	N/A	CC	
S.W.Butt	47.0	3:22	JC	1	1:24	1:29	40	38	FTB	FTB	N/A	CC	Panels39 - 44.
FloorButt/B	14.5	3:41	JC	1	1:12	1:17	40	40	FTB	FTB	N/A	CC	Panels 39 & 41 to Panel 25.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Tuesday, November 15, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
39/40/45	47.0	12:15	JC	1	1:11	1:16	40	40	FTB	FTB	N/A	CC	
45/46	47.0	2:30	JC	1	1:28	1:33	40	40	FTB	FTB	N/A	CC	
FloorButt/C	14.5	3:01	JC	1	1:40	1:45	40	40	FTB	FTB	N/A	CC	Panels 45 & 46 to Panel 25.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Wednesday, November 16, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
46/47	47.0	11:58	JC	1	1:30	1:35	40	40	FTB	FTB	N/A	CC	
FloorButt/D	5.0	12:24	JC	1	1:56	2:01	40	40	FTB	FTB	N/A	CC	Panell 47 to Panel 25.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Thursday, November 17, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
30/48	46.0	10:44	JC	1	11:16	11:21	40	40	FTB	FTB	N/A	CC	
48/49	46.0	10:17	JC	1	11:23	11:23	40	40	FTB	FTB	N/A	CC	
49/50	46.0	11:49	JC	1	12:35	12:40	40	40	FTB	FTB	N/A	CC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Friday, November 18, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
50/51	46.0	12:02	JC	1	1:32	1:37	40	40	FTB	FTB	N/A	CC	
51/52	46.0	12:36	JC	1	1:40	1:45	40	39	FTB	FTB	N/A	CC	
FloorButt/E	30.0	1:22	JC	1	1:51	1:56	40	40	FTB	FTB	N/A	CC	Panels 48 - 51 to Panel16.

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING
SEAM LOG

DATE: Saturday, November 19, 2022

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL: 60mil HDPE - PRIMARY LINER

					AIR PRESSURE TESTING				PEELS				
Seam NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
52/53	47.0	11:25	JC	1	1:25	1:30	40	40	FTB	FTB	N/A	CC	
53/54	47.0	10:15	JC	1	1:15	1:20	40	39	FTB	FTB	N/A	CC	
54/55	47.0	10:36	JC	1	1:12	1:17	40	40	FTB	FTB	N/A	CC	
55/56	47.0	11:03	JC	1	1:00	1:05	40	40	FTB	FTB	N/A	CC	
56/47	47.0	12:04	JC	1	2:02	2:07	40	40	FTB	FTB	N/A	CC	
FloorButt/F	31.0	12:47	JC	1	2:39	2:44	40	39	FTB	FTB	N/A	CC	Panels 47 & 52 - 56 to Panel16.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Saturday, October 15, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
Zone 1	Beads	Tie In/A	Oct 15	RC	X1	CG	Pass	All "T" Intersections along Tie In/A to existing cell..

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Monday, October 17, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
1	Patch	P3	Oct 17	RC	X1	CG	Pass	Upper Slope.
2	Patch	P3	Oct 17	RC	X1	CG	Pass	Upper Slope.
3	Patch	P3	Oct 17	RC	X1	CG	Pass	Upper Slope.
4	Patch	P8	Oct 17	RC	X1	CG	Pass	Toe of Slope.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Friday, October 21, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
5	Patch	1/9	Oct 21	RC	X1	CG	Pass	At Intersection of TieIn/A and TieIn/B1.
6	Patch	9/10	Oct 21	RC	X1	CG	Pass	At Intersection of TieIn/B1 and TieIn/B2.
7	Patch	10/11	Oct 21	RC	X1	CG	Pass	At Intersection of TieIn/B2 and TieIn/B3.
8	Patch	11/12	Oct 21	RC	X1	CG	Pass	At Intersection of TieIn/B3 and TieIn/C.
9	Patch	TieIn/C	Oct 21	RC	X1	CG	Pass	At Achor Trench of Panel 12 and TieIn/C.
Zone 2	Beads	East Butt	Oct 21	RC	X1	CG	Pass	All "T" Intersections along East Butt Seam.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Monday, October 24, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
10	Patch	14/15	Oct 24	MC	X1	CG	Pass	Near South Butt Seam.
11	Patch	15/16	Oct 24	MC	X1	CG	Pass	Destruct #4.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Tuesday, October 25, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
12	Patch	Sump Butt	Oct 25	MC	X1	CG	Pass	At Intersection of 11/12/17.
13	Patch	Sump Butt	Oct 25	MC	X1	CG	Pass	At Intersection of 10/13/17.
14	Patch	Sump Butt	Oct 25	MC	X1	CG	Pass	At Intersection of 13/17/18.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Wednesday, October 26, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
Zone 3	Beads	15/16/19/20	Oct 26	MC	X1	CG	Pass	"T" Intersections.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Monday, October 31, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
15	Patch	8/21	Oct 31 2022	RC	X1	CG	Pass	At Intersection of TieIn/A and TieIn/D.
Zone 4	Beads	S.E.Butt	Oct 31 2022	RC	X1	CG	Pass	All "T" Intersections along South East Butt Seam.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Tuesday, November 01, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
16	Beads	19/20/26/27	Nov 1	RC	X1	CG	Pass	"T" Intersection.
17	Patch	13/14/15	Nov 1	RC	X1	CG	Pass	At Intersection of 13/14/15.
18	Patch	13/18/19	Nov 1	RC	X1	CG	Pass	At Intersection of 13/18/19.
19	Bead	18/19/26	Nov 1	RC	X1	CG	Pass	"T" Intersection.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Saturday, November 05, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
20	Bead	27/28	Nov 5	RC	X1	RC	Pass	"T" Intersection.
21	Patch	28/31	Nov 5	RC	X1	RC	Pass	At Intersection of 28/28A.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Thursday, November 10, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
22	Patch	20/28A	Nov 10	MC	X1	RC	Pass	At Intersection of North Butt/A and Floor Butt/A.
23	Patch	North Butt	Nov 10	MC	X1	RC	Pass	At Intersection of North Butt/A and North Butt/B.
24	Patch	29/30	Nov 10	MC	X1	RC	Pass	At Anchor Trench.
25	Bead	28A/31	Nov 10	MC	X1	RC	Pass	"T" Intersection on North Butt/A.
26	Bead	29/30	Nov 10	MC	X1	RC	Pass	"T" Intersection on Floor Butt/A.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Saturday, November 12, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
Zone 5	Beads	N.W.Butt	Nov 12	MC	X1	CG	Pass	All "T" Intersections along North West Butt.
Zone 6	Beads	N.Butt/B	Nov 12	MC	X1	CG	Pass	All "T" Intersections along North Butt/B.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Monday, November 14, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
Zone 7	Beads	S.W.Butt	Nov 14	RC	X1	CG	Pass	All "T" Intersections along 39/40, S.W.Butt and Floor Butt/B.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Tuesday, November 15, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
27	Patch	Floor Butt	Nov 15	RC	X1	CG	Pass	At Intersection of Floor Butt/B and Floor Butt/C.
28	Bead	Floor Butt	Nov 15	RC	X1	CG	Pass	"T" Intersections on Floor Butt/C.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Wednesday, November 16, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
29	Patch	Floor Butt	Nov 16	RC	X1	CG	Pass	At Intersection of Floor Butt/C and Floor Butt/D.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Friday, November 18, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
30	Patch	Floor Butt	Nov 18	RC	X1	CG	Pass	At Intersections of Floor Butt/A and Floor Butt/E.
Zone 8	Beads	Foor Butt/E	Nov 18	RC	X1	CG	Pass	All "T" Intersections along Floor Butt/E.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Saturday, November 19, 2022

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022**

MATERIAL 60mil HDPE - PRIMARY LINER

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
31	Patch	Floor Butt	Nov 19	MC	X1	CG	Pass	At Intersections of Floor Butt/E and Floor Butt/F.
32	Patch	Foor Butt	Nov 19	MC	X1	CG	Pass	At Intersections of Floor Butt/D and Floor Butt/F.
33	Patch	55/56	Nov 19	MC	X1	CG	Pass	Destruct #4.
34	Patch	47/56	Nov 19	MC	X1	CG	Pass	On Floor.
Zone 9	Beads	Foor Butt/F	Nov 19	MC	X1	CG	Pass	All "T" Intersections along Floor Butt/F.

C.J. Cassidy
Consulting Inc.

DESTRUCTIVE TESTING REPORT

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WEST CELL - 2022** MATERIAL 60mil HDPE - PRIMARY LINER

WELD DATE	D.S. #	SEAM #	TECH INITIAL	WELDER NUMBER	PEEL 1		SHEAR	PEEL 2		SHEAR	PEEL 3		SHEAR	PEEL 4		SHEAR	PEEL 5		SHEAR	QC INITIAL	COMMENTS / LOCATION
					IN	OUT		IN	OUT		IN	OUT		IN	OUT		IN	OUT			
10-24-22	1	15/16	JC	1	124	146	194	142	139	190	126	136	191	130	139	193	128	134	195	CC	North end of seam 15/16.
10-31-22	2	23/24	JC	1	122	132	204	129	145	205	131	119	202	144	154	199	132	154	201	CC	Run out in Anchor Trench.
11-17-22	3	49/50	JC	1	134	141	189	137	127	181	137	137	187	131	128	188	124	127	186	CC	Run out in Anchor Trench.
11-19-22	4	55/56	JC	1	123	123	182	119	135	190	121	138	197	122	128	200	121	126	191	CC	10m from Floor Butt/F.

C.J. Cassidy Consulting Inc.

WELDER QUALIFICATIONS

DATE Wednesday, July 05, 2023

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WATER TREATMENT POND - 2023**

MATERIAL 60mil HDPE

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
5:29	1	JC			860		450	1	108	1	113	1	181	MC	
5:29	1	JC			860		450	2	132	2	120	2	179	MC	
5:29	1	JC			860		450	3	138	3	120	3	182	MC	
5:29	1	JC			860		450	4	131	4	125	4	182	MC	
5:29	1	JC			860		450	5	119	5	131	5	181	MC	

C.J. Cassidy
Consulting Inc.

WELDER QUALIFICATIONS

DATE Thursday, July 06, 2023

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WATER TREATMENT POND - 2023**

MATERIAL 60mil HDPE

			EXTRUDER		FUSION WELDER			TENSIONMETER VALUES LBs/INCH							
QUALIFY TIME	WELDER NUMBER	TECH INITIALS	BARREL TEMP ºF	PREHEAT TEMP ºF	SET TEMP ºF	MEASURED SPEED	SPEED SETTINGS		PEEL INSIDE		PEEL OUTSIDE		SHEAR VALUE	QC INITIAL	WEATHER / COMMENTS:
5:15	1	JC			860		450	1	134	1	132	1	176	MC	
5:15	1	JC			860		450	2	118	2	132	2	171	MC	
5:15	1	JC			860		450	3	131	3	121	3	182	MC	
5:15	1	JC			860		450	4	136	4	119	4	179	MC	
5:15	1	JC			860		450	5	137	5	127	5	180	MC	
6:47	Ex1	JC	500	505				1	143	1		1	200	MC	
6:47	Ex1	JC	500	505				2	143	2		2	204	MC	
6:47	Ex1	JC	500	505				3	144	3		3	208	MC	
6:47	Ex1	JC	500	505				4	139	4		4	200	MC	
6:47	Ex1	JC	500	505				5	124	5		5	203	MC	

C.J. Cassidy
Consulting Inc.

PANEL PLACEMENT LOG

DATE Wednesday, July 05, 2023

PROJECT NORTHWIN ENVIRONMENTAL LANDFILL - WATER TREATMENT POND - 2023 MATERIAL 60mil HDPE

PANEL NUMBER	ROLL NUMBER	WORK AREA	PANEL LENGTH	PANEL WIDTH	PANEL AREA	COMMENTS:
1	15330	N.Slope/Floor	26.00	7.30	189.80	
2	15330	N.Slope/Floor	26.00	7.30	189.80	
3	15330	South Slope	12.00	7.30	87.60	
4	15330	South Slope	12.00	7.30	87.60	
5	15330	S.W.Corner	10.00	7.30	73.00	
6	15330	S.W.Corner	13.00	7.30	94.90	
7	15330	West Side	12.00	7.30	87.60	
8	15330	West Side	12.00	7.30	87.60	
9	15330	N.W.Corner	11.00	7.30	80.30	
10	15330	N.W.Corner	10.20	7.30	74.46	
11	15320	N.E.Corner	12.00	7.30	87.60	
12	15320	N.E.Corner	14.00	7.30	102.20	
13	15320	East Side	14.00	7.30	102.20	
14	15320	East Side	14.00	7.30	102.20	
15	15320	S.E.Corner	13.00	7.30	94.90	
16	15320	S.E.Corner	12.00	7.30	87.60	

1629.36 **sq m**

C.J. Cassidy Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Wednesday, July 05, 2023

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WATER TREATMENT POND - 2023**

MATERIAL: 60mil HDPE

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
1/2	26.0	6:02	JC	1	9:11	9:16	40	40	FTB	FTB	N/A	MC	
3/4	12.0	7:12	JC	1	9:10	9:15	40	40	FTB	FTB	N/A	MC	
5/6/7	10.0	9:20	JC	1	9:57	10:02	40	40	FTB	FTB	N/A	MC	
6/7	12.0	9:10	JC	1	9:56	10:01	40	40	FTB	FTB	N/A	MC	
7/8	12.0	7:30	JC	1	9:48	9:53	40	40	FTB	FTB	N/A	MC	
8/9	11.0	8:00	JC	1	9:27	9:32	40	40	FTB	FTB	N/A	MC	
9/10	10.2	8:30	JC	1	9:25	9:30	40	40	FTB	FTB	N/A	MC	
11/12	12.0	10:50	JC	1	9:00	9:05	40	40	FTB	FTB	N/A	MC	
12/13	14.0	10:30	JC	1	8:55	9:00	40	40	FTB	FTB	N/A	MC	
13/14	14.0	10:15	JC	1	8:55	9:00	40	40	FTB	FTB	N/A	MC	
14/15	13.0	12:30	JC	1	10:45	10:50	40	40	FTB	FTB	N/A	MC	
15/16	12.0	1:05	JC	1	10:30	10:35	40	40	FTB	FTB	N/A	MC	

C.J. Cassidy
Consulting Inc.

NON-DESTRUCTIVE TESTING SEAM LOG

DATE: Thursday, July 06, 2023

PROJECT: **NORTHWIN ENVIRONMENTAL LANDFILL - WATER TREATMENT POND - 2023**

MATERIAL: 60mil HDPE

					AIR PRESSURE TESTING				PEELS				
SEAM NUMBER	SEAM LENGTH	WELD TIME	TECH INITIAL	WELDER NUMBER	TIME START	TIME FINISH	PSI START	PSI FINISH	PEEL INSIDE	PEEL OUTSIDE	VAC-TEST Pass/FAIL	QC INITIAL	COMMENTS:
South Butt	14.6	7:50	JC	1	8:15	8:20	40	40	FTB	FTB	N/A	MC	Panels 1 & 2 to Panels 3 & 4.
E.Butt/A	10.0	8:14	JC	1	9:10	9"15	40	40	FTB	FTB	N/A	MC	Panels 11 & 12 to Panel 2.
E.Butt/B	15.0	8:14	JC	1	9:28	9:33	40	40	FTB	FTB	N/A	MC	Panels 12 - 14 to Panel 2.
E.Butt/C	7.3	8:14	JC	1	10:07	10:12	40	40	FTB	FTB	N/A	MC	Panel 15 to Panel 3.
E.Butt/D	4.5	8:14	JC	1	10:07	10:12	40	40	FTB	FTB	N/A	MC	Panel 16 to Panel 3.
W.Butt/A	16.0	8:42	JC	1	9:19	9:24	40	40	FTB	FTB	N/A	MC	Panels 8 - 10 to Panel 1.
W.Butt/B	9.0	8:42	JC	1	9:25	9:30	40	40	FTB	FTB	N/A	MC	Panels 7 & 8 to Panels 1 & 2.
W.Butt/C	12.0	8:42	JC	1	10:02	10:07	40	40	FTB	FTB	N/A	MC	Panel 4 to 5.

C.J. Cassidy
Consulting Inc.

EXTRUSION WELD REPORT

DATE Thursday, July 06, 2023

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WATER TREATMENT POND - 2023**

MATERIAL 60mil HDPE

EXTRUSION NUMBER	EXTRUSION TYPE	PANEL/SEAM NUMBER	TEST DATE	TECH INITIAL	MACHINE NUMBER	QC INITIAL	PASS/ FAIL	COMMENTS:
1	Patch	1/2	July 6	JC	Ex1	MC	Pass	On Floor.
2	Patch	E.Butt	July 6	JC	Ex1	MC	Pass	At Seam 15/16.
3	Patch	E.Butt	July 6	JC	Ex1	MC	Pass	At Intersection of South Butt.
4	Patch	E.Butt	July 6	JC	Ex1	MC	Pass	At Panel 12.
5	Patch	W.Butt	July 6	JC	Ex1	MC	Pass	At Panel 8.
6	Patch	W.Butt	July 6	JC	Ex1	MC	Pass	At Intersection of South Butt.
Zone 1	Beads	S.Butt	July 6	JC	Ex1	MC	Pass	All "T" Intersections along South Butt.
Zone 2	Beads	E.Butt	July 6	JC	Ex1	MC	Pass	All "T" Intersections along East Butt.
Zone 3	Beads	EW.Butt	July 6	JC	Ex1	MC	Pass	All "T" Intersections along West Butt.

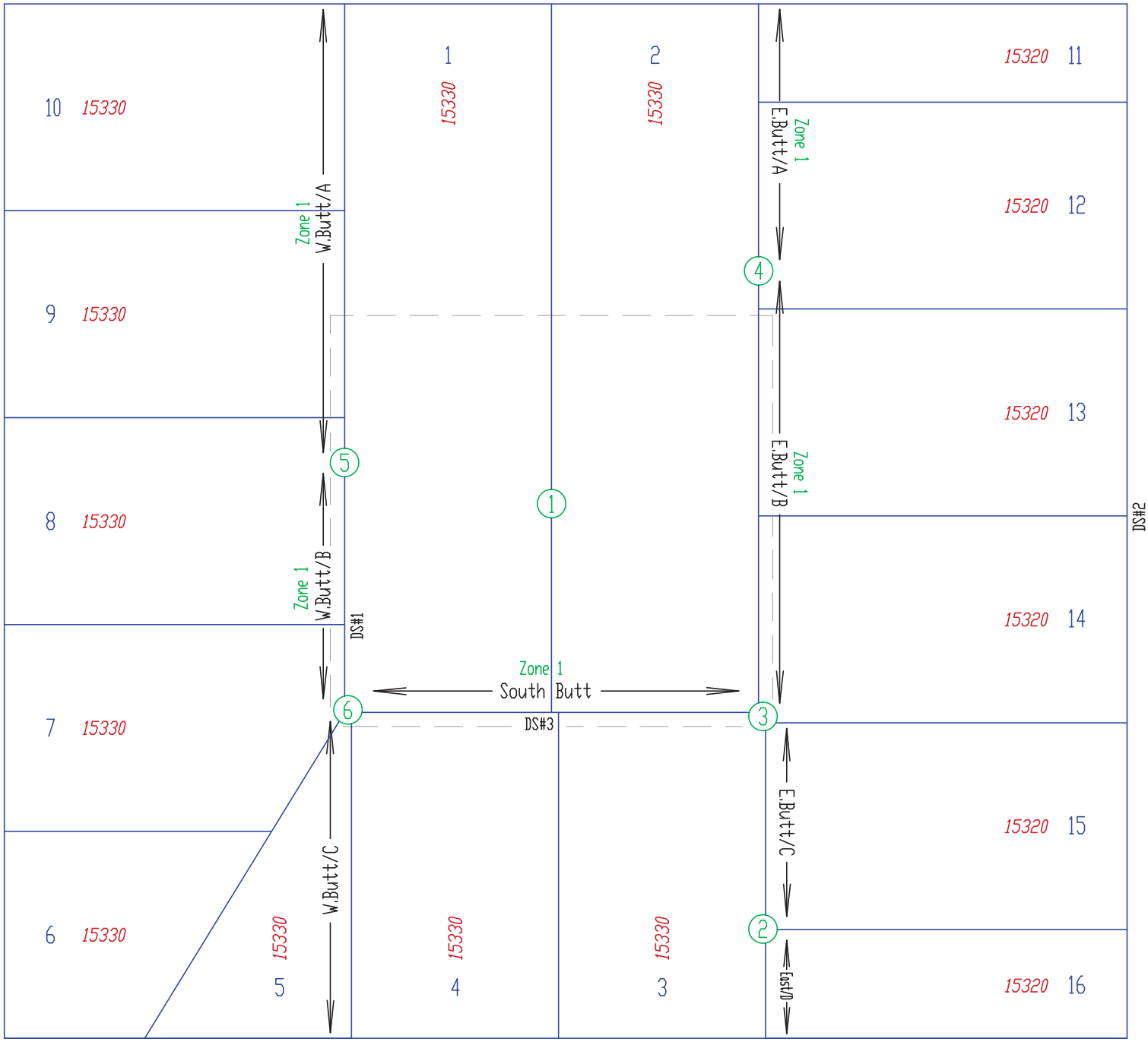
C.J. Cassidy
Consulting Inc.

DESTRUCTIVE TESTING REPORT

PROJECT **NORTHWIN ENVIRONMENTAL LANDFILL - WATER TREATMENT POND - 2023** MATERIAL 60mil HDPE

WELD DATE	D.S. #	SEAM #	TECH INITIAL	WELDER NUMBER	PEEL 1		SHEAR	PEEL 2		SHEAR	PEEL 3		SHEAR	PEEL 4		SHEAR	PEEL 5		SHEAR	QC INITIAL	COMMENTS / LOCATION
					IN	OUT		IN	OUT		IN	OUT		IN	OUT		IN	OUT			
7-05-23	1	7/8	JC	1	137	111	216	127	135	216	121	114	209	138	119	210	181	138	207	MC	At Start of Seam.
7-05-23	2	13/14	JC	1	142	124	201	141	127	203	123	146	203	140	121	208	128	141	202	MC	In Anchor Trench.
7-06-23	3	S.Butt	JC	1	128	129	208	131	136	222	167	133	199	129	132	205	131	127	210	MC	On South Butt Seam.

NORTHWIN LANDFILL - WATER TREATMENT POND



Blue = Liner Red = Roll Numbers Green = Extrusion Welds

DATE: July 10, 2023	C.J. Cassidy Consulting Inc.	NORTHWIN LANDFILL - 2023
SCALE: NTS		CAMPBELL RIVER, B.C.
FILE NAME: CampbellRiverPond-2023		Water Treatment Pond Liner Representative Drawing
DRAWN BY: SSC		
CHECKED BY: CJC		

Date: 2022-10-24

Mail To:
David Barbour
GHD Services

, ,

e-mail:
david.barbour@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Services
11222680

Dear Barbour,

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:	**Upland LF Northwin LF Phase 1 West**
TRI Job Reference Number:	**76033**
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,

Nicole Saucedo

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: Upland LF Northwin LF Phase 1 West

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76033

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-2 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	131	127	122	124	142	**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)	138	147	169	145	158	**151**
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)	199	196	190	188	186	**192**
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: 2022-10-27

Mail To:
David Barbour
GHD Limited

, ,

e-mail:
david.barbou@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited
11222680

Dear Mr. Barbour,

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:	**Upland Landfill - Northwin Landfill Phase 1 East**
TRI Job Reference Number:	**76142**
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 T. Tenney

Jennifer Tenney
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 Limited
Project: Upland Landfill - Northwin Landfill Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76142

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-3 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	132	133	130	137	138	**134**
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)	142	142	145	149	154	**146**
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)	191	192	192	198	203	**195**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DT-4 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	148	149	145	153	154	**150**
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)	146	140	146	151	145	**146**
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)	192	195	190	203	200	**196**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Date: 2024-03-19

Mail To:
David Barbour
GHD Limited

, ,

e-mail:
david.barbour@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited

Dear Mr. Barbour,

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:	**Upland LF Northwin Landfill Phase 1 West**
TRI Job Reference Number:	**76142**
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,
sigfile
geolab

Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Limited
Project: Upland LF Northwin Landfill Phase 1 West

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76142

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-3 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	132	133	130	137	138	**134**
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)	142	142	145	149	154	**146**
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)	191	192	192	198	203	**195**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DT-4 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	148	149	145	153	154	**150**
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)	146	140	146	151	145	**146**
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)	192	195	190	203	200	**196**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2022-11-02

Mail To:
David Barbour
GHD Limited

, ,

e-mail:
david.barbou@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited
11222680

Dear Mr. Barbour,

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:	**Upland Landfill - Northwin Landfill Phase 1 East**
TRI Job Reference Number:	**76309**
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,

Mansukh Patel
Sr. Laboratory Coordinator
Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Limited
Project: Upland Landfill - Northwin Landfill Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76309

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-5 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	135	145	136	136	144	**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	
Side: B						**Peel B**
Peel Strength (ppi)	149	151	137	146	151	**147**
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)	198	160	192	194	199	**189**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Date: 2024-03-19

Mail To:
David Barbour
GHD Limited

, ,

e-mail:
david.barbour@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited

Dear Mr. Barbour,

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:	**Upland LF Northwin Landfill Phase 1 West**
TRI Job Reference Number:	**76309**
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,
sigfile
geolab

Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Limited
Project: Upland LF Northwin Landfill Phase 1 West

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76309

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-5 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	135	145	136	136	144	**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	
Side: B						**Peel B**
Peel Strength (ppi)	149	151	137	146	151	**147**
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)	198	160	192	194	199	**189**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2022-11-11

Mail To:
David Barbour
GHD Limited

, ,

Bill To:

GHD Limited
11222680

e-mail:
david.barbou@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Dear Mr. Barbour,

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:	**Upland Landfill - Northwin Landfill Phase 1 East**
TRI Job Reference Number:	**76556**
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,
sigfile
geolab

Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Limited
Project: Upland Landfill - Northwin Landfill Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76556

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-6 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	158	152	161	161	162	**159**
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)	154	154	169	151	148	**155**
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)	197	194	187	192	196	**193**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Date: 2024-03-19

Mail To:
David Barbour
GHD Limited

, ,

e-mail:
david.barbour@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited

Dear Mr. Barbour,

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:	**Upland LF Northwin Landfill Phase 1 West**
TRI Job Reference Number:	**76556**
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,
sigfile
geolab

Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Limited
Project: Upland LF Northwin Landfill Phase 1 West

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76556

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-6 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	158	152	161	161	162	**159**
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)	154	154	169	151	148	**155**
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)	197	194	187	192	196	**193**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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TRI ENVIRONMENTAL, INC.
9063 BEE CAVES RD. – AUSTIN, TX 78733 – USA | PH: 800.880.TEST OR 512.263.2101

Date: 2022-11-17

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GHD Limited

, ,

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david.barbou@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited
11222680

Dear Mr. Barbour,

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:	**Upland Landfill - Northwin Landfill Phase 1 East**
TRI Job Reference Number:	**76686**
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,
sigfile
a-login

Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DE4TSURTC E 4EVM AUVLCTQ V44USVNRE TE4T SE4ULT4
TSCRlient: GHD Limited
Project: Upland Landfill - Northwin Landfill Phase 1 East

Material: 60 milYHDPE
4VME DVQ Peel and 4hear .V4TM D 6(329GSCGM139D / / (79N4F 5/ 9882 modY)
TSCLog#: 76686

	TE4T SEPLCRVTE NUMBES					
PARAMETER	1	2	3	4	5	MEAN
4ample CD: DT-7 | Weld: Heat Fusion						
4ide: V						**Peel V**
Peel Strength (ppi)	145	145	152	141	171	**151**
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	
4ide: B						**Peel B**
Peel Strength (ppi)	144	138	149	151	144	**1/ 5**
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	
4hear						**4hear**
Shear Strength (ppi)	201	202	193	195	195	**137**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2024-03-19

Mail To:
David Barbour
GHD Limited

, ,

e-mail:
david.barbour@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited

Dear Mr. Barbour,

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:	**Upland LF Northwin Landfill Phase 1 West**
TRI Job Reference Number:	**76686**
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,
sigfile
geolab

Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Limited
Project: Upland LF Northwin Landfill Phase 1 West

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76686

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-7 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	145	145	152	141	171	**151**
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)	144	138	149	151	144	**145**
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)	201	202	193	195	195	**197**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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Date: 2022-11-21

Mail To:
David Barbour
GHD Limited

Bill To:

GHD Limited
11222680

, ,

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Deab s bvMab. r obB

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Project:	**Upland Landfill - Northwin Landfill Phase 1 East**
, wRpr . weyebexhe J o7 . eb:	**76740**
s atebnaiEn(,entel :	E2(Neat Hbnmx F eil Wea7 En(
,entEn(weSoentel :	Wqs / DqA Yeei axl Wgeab EqW, s D P632I9 wR9 s 13ID GG64IJ WH 5GI882 7 r l v(

Cr l en:	
qD	ql genmx Hanobe E100% Yeei(
MwK	MbeaT mx ngeetmx@af ak ybr 7 Wea7 el @ev
W	MbeaT mx ngeetmx@at el @e r ynea7 v
qD-MwK	MbeaT mx ngeetmx@ayteb nr 7 e al genmx yanobe -) abtmai) eeiv
WRY	We) abatmx mx tge) iaxe r ytge ngeet Eieadmx@tge . r xl mtaht(v
H, M	Hm7 teabmx@. r xl Eaii xr x "qD" yanoben(v
J OJ -H, M	100%) eeiv

Ryk r o gade axk Soentmxn r b beSonbe axk al l rmmxai mxyr b7 atmxB) ieane haii on at 1-800-880-8648v
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pexxmyeb , exxek
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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 Limited
Project: Upland Landfill - Northwin Landfill Phase 1 East

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D FF37/NS5 4F/882 mod.)
TRI Log#: 76740

	TEST REPLICATE NUMBER					
Yqwqs / , / w	1	2	6	G	5	s / qJ
Sample ID: DT-8 | Weld: Heat 5usion						
Side: A						**Peel A**
Yeei Wtbex@tg E)) m(	155	156	155	1P6	158	**147**
Yeei Rxhobnmx E%(	<5	<5	<5	<5	<5	
Yeei Lr hon Oy Hanobe Cr l e	W	W	W	W	W	
Yeei J WH Hanobe Cr l e	H, M	H, M	H, M	H, M	H, M	
Side: B						**Peel B**
Yeei Wtbex@tg E)) m(	1P4	1P1	1P8	1G1	145	**162**
Yeei Rxhobnmx E%(	<5	<5	<5	<5	<5	
Yeei Lr hon Oy Hanobe Cr l e	W	W	W	W	W	
Yeei J WH Hanobe Cr l e	H, M	H, M	H, M	H, M	H, M	
Shear						**Shear**
Wgeab Wtbex@tg E)) m(	201	208	200	13G	135	**200**
Wgeab / ir x@atmx u MbeaT E%(	>50	>50	>50	>50	>50	
Sample ID: DT-9 | Weld: Heat 5usion						
Side: A						**Peel A**
Yeei Wtbex@tg E)) m(	1P0	165	1G5	142	14G	**147**
Yeei Rxhobnmx E%(	<5	<5	<5	<5	<5	
Yeei Lr hon Oy Hanobe Cr l e	W	W	W	W	W	
Yeei J WH Hanobe Cr l e	H, M	H, M	H, M	H, M	H, M	
Side: B						**Peel B**
Yeei Wtbex@tg E)) m(	1P1	1P4	1PP	141	1PP	**166**
Yeei Rxhobnmx E%(	<5	<5	<5	<5	<5	
Yeei Lr hon Oy Hanobe Cr l e	W	W	W	W	W	
Yeei J WH Hanobe Cr l e	H, M	H, M	H, M	H, M	H, M	
Shear						**Shear**
Wgeab Wtbex@tg E)) m(	136	130	131	131	138	**193**
Wgeab / ir x@atmx u MbeaT E%(	>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: 2024-03-19

Mail To:
David Barbour
GHD Limited

, ,

e-mail:
david.barbour@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Limited

Dear Mr. Barbour,

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:	**Upland LF Northwin Landfill Phase 1 West**
TRI Job Reference Number:	**76750**
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,
sigfile
geolab

Geosynthetic Services Division
http://www.geosyntheticstestinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Limited
Project: Upland LF Northwin Landfill Phase 1 West

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76750

	TEST REPLICATE NUMBER					
PARAMETER	1	2	3	4	5	MEAN
Sample ID: DT-8 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	155	153	155	163	158	**157**
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)	167	161	168	141	175	**162**
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)	201	208	200	194	195	**200**
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID: DT-9 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength (ppi)	160	135	145	172	174	**157**
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)	161	167	166	171	166	**166**
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)	193	190	191	191	198	**193**
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: 2022-11-27

Mail To:
David Barbour
GHD Services

, ,

e-mail:
david.barbour@ghd.com roxanne.hasior@ghd.com rosemarie.rocca@ghd.com

Bill To:

GHD Services
11222680

Dear MarbourB

, hanT kou yor consulting f ith , wR/ nvironmentalBRnc. E, wR(yor kour geosknthetics testing needs. , wRis) leased to submit this yinal re) ort yor laboratork testing.

Project:	**Upland LF Northwin LF Phase 1 West**
, wRpob weyerence J umber:	**76826**
NaterialEs(, ested:	E1(Heat Fusion Weld SeamEs(
, estEs(wequested:	SAN/ DAY Peel and Shear EAS, N D 6732I9 wR9 N 13ID GG74IJ SF 5GI882 mod.(

Codes:	
AD	Adhesion Failure E100% Peel(
MwK	MreaT in sheeting af ak yrom Seam edge.
S/	MreaT in sheeting at edge oyseam.
AD-MwK	MreaT in sheeting ayter some adhesion yailure -) artial) eel.
SRP	Se) aration in the) lane oy the sheet Eleaving the bond intact(.
F, M	Film tearing bond Eall non "AD" yailures(.
J OJ -F, M	100%) eel.

Ry kou have ank questions or require ank additional inyormationB) lease call us at 1-800-880-8748.
SincerelkB

penniyer , ennek
Project Nanager
9 eosknthetic Services Division
htt) :IIf f f .geosknthetics testinc.com

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DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS
TRI Client: GHD Services
Project: Upland LF Northwin LF Phase 1 West

Material: 60 mil. HDPE
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54/882 mod.)
TRI Log#: 76826

	TEST REPLICATE NUMBER					
PAwAN/ , / w	1	2	7	G	5	N/ AJ
Sample ID: DT-10 | Weld: Heat Fusion						
Side: A						**Peel A**
Peel Strength E)) i(	173	150	1G5	163	1G4	**150**
Peel Rncursion E%(	<5	<5	<5	<5	<5	
Peel Locus Oy Failure Code	S/	S/	S/	S/	S/	
Peel J SF Failure Code	F, M	F, M	F, M	F, M	F, M	
Side: B						**Peel B**
Peel Strength E)) i(	158	150	156	154	160	**156**
Peel Rncursion E%(	<5	<5	<5	<5	<5	
Peel Locus Oy Failure Code	S/	S/	S/	S/	S/	
Peel J SF Failure Code	F, M	F, M	F, M	F, M	F, M	
Shear						**Shear**
Shear Strength E)) i(	207	202	137	135	135	**198**
Shear / longation @ MreaT E%(	>50	>50	>50	>50	>50	

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Appendix F

Field Inspection Notes

Matthew Senior

From: Roxy Hasior
Sent: Friday, October 27, 2023 10:34 AM
To: Matthew Senior
Subject: FW: Upland Landfill Drainrock Placement June 6th

CompleteRepository: 088877
Description: Upland Landfill
JobNo: 8877
OperatingCentre: 08
RepoEmail: 088877@ghd.com
RepoType: Project

From: David Barbour <David.Barbour@ghd.com>
Sent: Wednesday, June 7, 2023 8:56 AM
To: Roxy Hasior <Roxanne.Hasior@ghd.com>; Rose Marie Rocca <RoseMarie.Rocca@ghd.com>
Subject: Upland Landfill Drainrock Placement June 6th

Hi Rose and Roxy,

I received a text from Terry Stuart yesterday that they were placing drain rock in the new cell at the Upland Landfill and that I should come do an inspection. I went to site at 3 pm to take a look.

Crew had begun placing drain rock on the cell floor. Terry informed me the material is from the Upland pit and GHD had received sieve analysis results last year.

Activities had stopped for the day when I arrived.

Generally it looked like they were following proper procedures for filling. A roadway higher than1 m high was being used to haul material into the cell before it was spread.

The drain rock contained some large stones some as big as 8”. It was mostly clean, but not washed, but it looked like the operators had scoped up some material from the pit floor (4th photo below).

The old landfill has been completely excavated (5th photo) an material moved to the new cell.

Let me know if you have any questions,

David Barbour
P. Eng.
Construction Engineering Inspector & Waste Management Engineer

GHD
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138 East 7th Avenue Suite 100 Vancouver British Columbia V5T 1M6 Canada
T 778 347-1339 **E** david.barbour@ghd.com

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David Barbour
P. Eng.
Construction Engineering Inspector & Waste Management Engineer

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Matthew Senior

From: Roxy Hasior
Sent: Friday, October 27, 2023 10:33 AM
To: Matthew Senior
Subject: FW: Upland Landfill June 13

CompleteRepository: 088877
Description: Upland Landfill
JobNo: 8877
OperatingCentre: 08
RepoEmail: 088877@ghd.com
RepoType: Project

From: David Barbour <David.Barbour@ghd.com>
Sent: Friday, June 16, 2023 11:01 AM
To: Roxy Hasior <Roxanne.Hasior@ghd.com>; Rose Marie Rocca <RoseMarie.Rocca@ghd.com>
Subject: Upland Landfill June 13

Hi Rose and Roxy,

I inspected the Upland landfill on June 13.

I provided direction to excavator operators to have geocomposite installed to the grade break and tied into the drainrock at the cell floor where slopes have been adjusted due to the fill on top of the bedrock on the west side of the cell. (First two photos below)

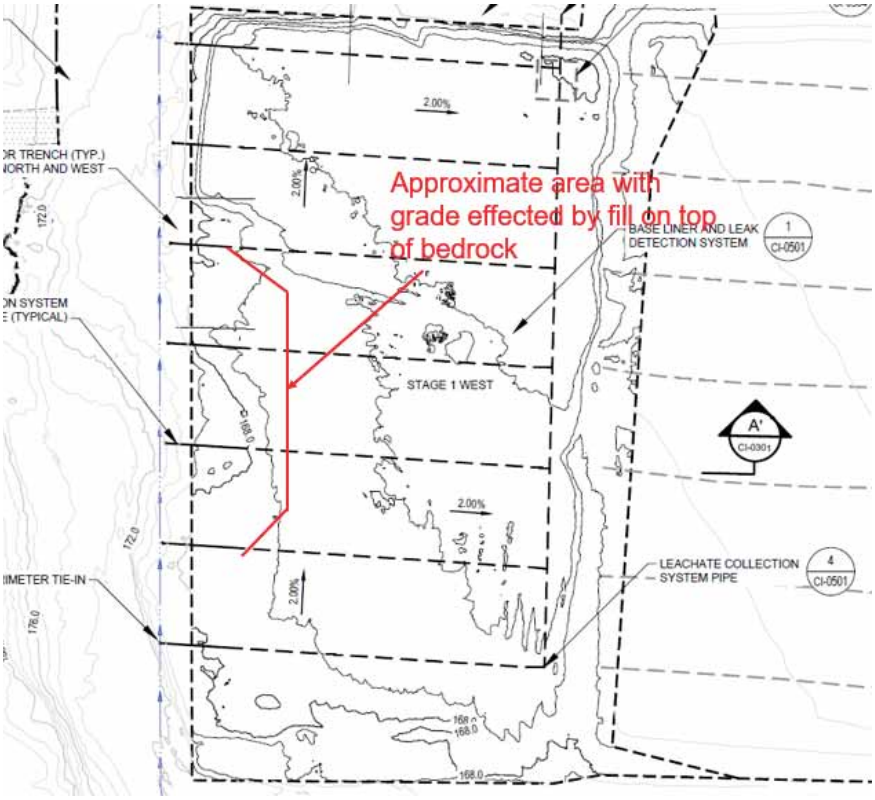
The operators were mounding drain rock on top of the leachate pipes in the bottom of the cell after exposing top of pipe by hand to confirm exact location. Depth of coverage was acceptable >300 mm .

I estimate an area about 20 x 30 m on the south east part of the cell has some silty sand mixed with the drainrock. Approximately 20% of the loads hauled into this area appear to be affected. Northwin has spoken to the operators loading the material and asked them to avoid loading material that is sitting directly on the pit floor..

Most of the oversized rock had been removed from the cell.

The final two photos are of the old landfill. Most of the waste has been remove although some cleanup is required.

Let me know if you have any questions,


Approximate area with grade effected by fill on top of bedrock
BASE LINER AND LEAK DETECTION SYSTEM
1
CI-0501
STAGE 1 WEST
A'
CI-0301
LEACHATE COLLECTION SYSTEM PIPE
4
CI-0501
2.00%
172.0
176.0
168.0

CAT

David Barbour
P. Eng.
Construction Engineering Inspector & Waste Management Engineer

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Matthew Senior

From: Roxy Hasior
Sent: Wednesday, November 1, 2023 2:11 PM
To: Matthew Senior
Cc: David Barbour
Subject: FW: Uplands Landfill Update week of July 3-7

CompleteRepository: 088877
Description: Upland Landfill
JobNo: 8877
OperatingCentre: 08
RepoEmail: 088877@ghd.com
RepoType: Project

From: David Barbour <David.Barbour@ghd.com>
Sent: Sunday, July 9, 2023 5:16 PM
To: Roxy Hasior <Roxanne.Hasior@ghd.com>; Rose Marie Rocca <RoseMarie.Rocca@ghd.com>; Riley Kieser <Riley.Kieser@ghd.com>
Subject: Uplands Landfill Update week of July 3-7

Hello all,

Uplands is near completion of Cell1 West.

Remaining work is to:

- install drainrock in the sump
- complete woven geotextile installation (95% complete to date)
- Install leachate pump and related infrastructure

Work completed last week included:

- Regraded a portion of the top of effluent holding pond and installed geotextile and HDPE liner on top of existing liner.
- Completed geo-composite installation on west slope of Cell 1 West and tie in to drain rock
- Installed 2 leachate pump out riser pipes

There are a few things we should discuss when I am back after July 18th.

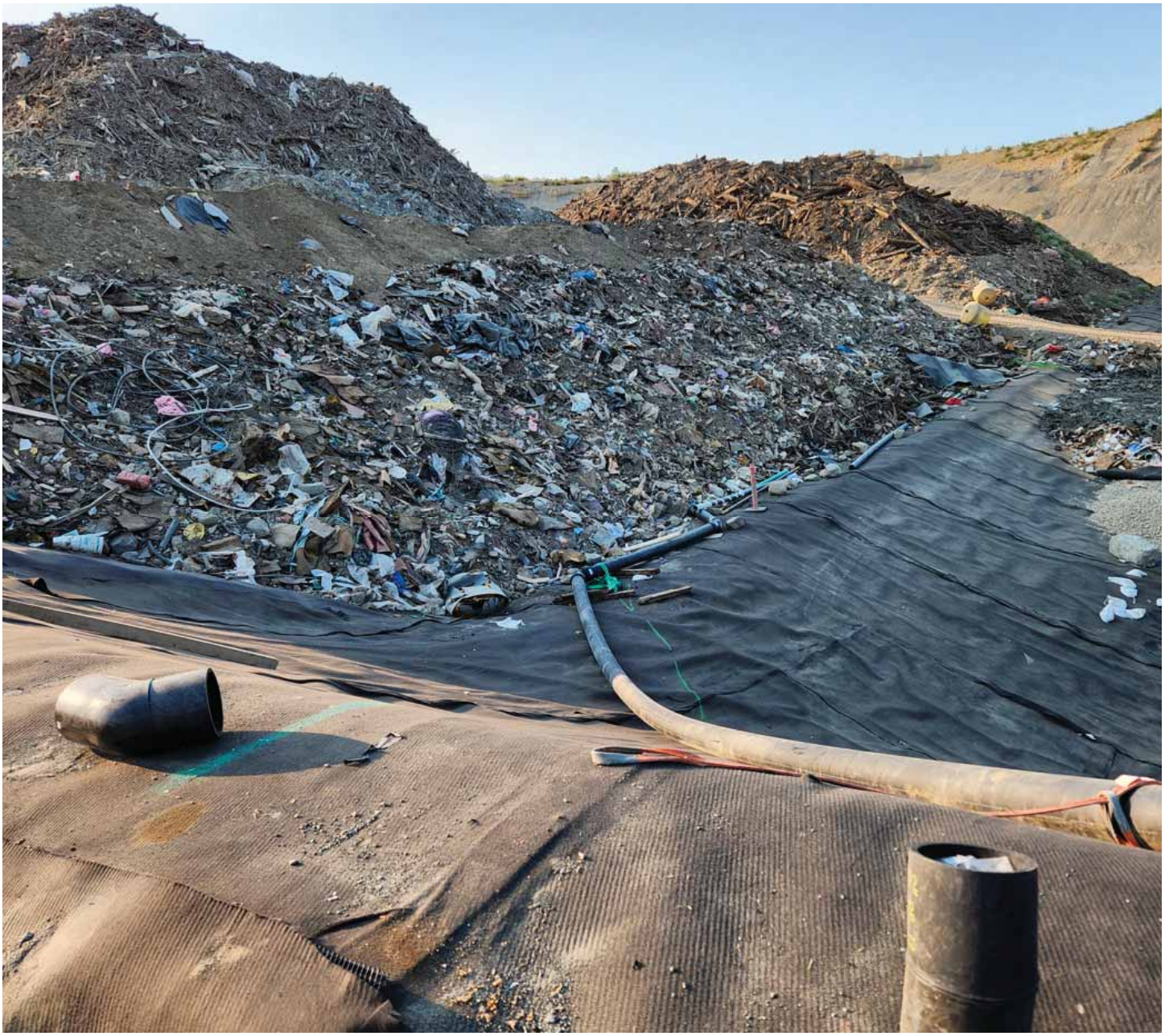
- Uplands has installed a pipe connecting to one of the leachate collection pipes that ties into Cell 1 East sump with the intention of pumping from Cell 1 West sump into the pipe.
- We are waiting for the final QA data from Joe Cassidy which includes the recent work on the effluent pond
- I am not sure what information is outstanding from Uplands such as material submittals and as built surveys

Geotextile on effluent pond before HDPE

HDPE liner with previously installed liner visible

Effluent pond after HDPE installation

Cell 1 West Sump ready for drainrock installation



HDPE pipe connected to leachate collection pipe in Cell 1 East

David Barbour
P. Eng.
Construction Engineering Inspector & Waste Management Engineer

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T 778 347-1339 **E** david.barbour@ghd.com

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Matthew Senior

From: David Barbour
Sent: Tuesday, September 26, 2023 4:50 PM
To: Matthew Senior; Rose Marie Rocca; Roxy Hasior
Cc: Deacon Liddy
Subject: Upland Landfill Site Inspection Sept 22

CompleteRepository: 088877
Description: Upland Landfill
JobNo: 8877
OperatingCentre: 08
RepoEmail: 088877@ghd.com
RepoType: Project

Hello all,

Here are my notes and photos with descriptions regarding Friday's site inspection.

Work completed

- The sump area was filled with drain rock and the geotextile installed before waste was placed.
- One lift of waste has been place over entire floor of landfill.
- A second lift has been started on the north west area
- Concrete slab poured for pump station enclosure
- A berm has been built along the top west and south edge of landfill to divert surface water from flowing onto the lined area

Next steps

- Construct pump station enclosure
- Install pump, wiring, ect.

Let me know if you have any questions. I am available tomorrow but away from Sept 28 – Oct 10th. You can reach my by call or text during that time.

Cell 1 West viewed from northwest corner

Leachate and leak detection risers / concrete poured for pump station

Leachate and leak detection risers / concrete poured for pump station

Pipe directing leachate to Cell 1 East

Cell 1 West from north east corner

West perimeter road. Berm to prevent surface water run-on visible on right side of photo

Z
South end of Cell 2

David Barbour
P. Eng.
Construction Engineering Inspector & Waste Management Engineer

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T 778 347-1339 **E** david.barbour@ghd.com

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Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/8/2022 8:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Mixed sun and cloud, -2 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew cleared snow from geotextiled area west of sump yesterday. No geosythetics installed yesterday due to snow
-Crew placing GCL and HDPE panels # 34 and 35 on small area where primary liner was placed west of sump. Slope above this area has both layers of HDPE installed. Area being lined to prevent run-off from lined slope flowing into leak detection layer in sump. Area approximately 7m x 10m.
-Slow progress due to snow and frozen conditions

Next Steps

- resume geosynthetic installation when weather permits

OUTSTANDING INFORMATION / NEW ISSUES:
-Snow and frozen conditions making geosythetic installation inpracticle

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/8/2022 8:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Mixed sun and cloud, -2 C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew cleared snow from geotextiled area west of sump yesterday. No geosythetics installed yesterday due to snow
-Crew placing GCL and HDPE panels # 34 and 35 on small area where primary liner was placed west of sump. Slope above this area has both layers of HDPE installed. Area being lined to prevent run-off from lined slope flowing into leak detection layer in sump. Area approximately 7m x 10m.
-Slow progress due to snow and frozen conditions

Next Steps

- resume geosynthetic installation when weather permits

OUTSTANDING INFORMATION / NEW ISSUES:
-Snow and frozen conditions making geosythetic installation inpracticle

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/10/2022 12:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Liner crew		
WEATHER CONDITIONS:	Cloudy 1C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Geotextile, GCL and HDPE liner on north-west area of landfill yesterday
- Geocomposite being placed on north end of west slope

Next Steps

- continue placing geosythetics on north west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/10/2022 12:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Liner crew		
WEATHER CONDITIONS:	Cloudy 1C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Geotextile, GCL and HDPE liner on north-west area of landfill yesterday
- Geocomposite being placed on north end of west slope

Next Steps

- continue placing geosythetics on north west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/11/2022 12:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Snowing 1C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Liner Crew cleaning up noth west area of landfill floor
-Installing second 50 mm leachate detection port on north slope
-Shut down operation due to snow

Next Steps

- resume geosythetic installation when weather permits

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/11/2022 12:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Snowing 1C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Liner Crew cleaning up noth west area of landfill floor
-Installing second 50 mm leachate detection port on north slope
-Shut down operation due to snow

Next Steps

- resume geosythetic installation when weather permits

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/12/2022 8:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Overcast 1C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Liner crew installing geotextile, GCL and HDPE on south west area of landfill
-tieing liner into anchor trench on slope between top of west berm and south transition berm

Next Steps

- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/12/2022 8:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Overcast 1C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Liner crew installing geotextile, GCL and HDPE on south west area of landfill
-tieing liner into anchor trench on slope between top of west berm and south transition berm

Next Steps

- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/14/2022 9:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Foggy 0C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew installed 3 HDPE pannels 43-45 in south west area of landfill on Saturday Nov 12.
-Crew installed HDPE panels 29-32 on norrth west corner of landfill on Saturday Nov 12
-Geotextile and GCL installed in south west area up edge of fill around ramp
- Installing first HDPE layer on south west area
-Cut DT-7 on panels 45/46 (Smooth / Texture) and sent to lab

Next Steps

- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
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PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Foggy 0C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew installed 3 HDPE pannels 43-45 in south west area of landfill on Saturday Nov 12.
-Crew installed HDPE panels 29-32 on norrth west corner of landfill on Saturday Nov 12
-Geotextile and GCL installed in south west area up edge of fill around ramp
- Installing first HDPE layer on south west area
-Cut DT-7 on panels 45/46 (Smooth / Texture) and sent to lab

Next Steps

- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/15/2022 7:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Sunny 0C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Grew installing GCL and HDPE on South west area up to edge of ramp

Next Steps

- place fill in ramp area to blend grades and allow for anchor trench tie in
- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/15/2022 7:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Sunny 0C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Grew installing GCL and HDPE on South west area up to edge of ramp

Next Steps

- place fill in ramp area to blend grades and allow for anchor trench tie in
- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/16/2022 9:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Sunny 0C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Ramp area filled and remainder of anchor trench dug on top of west slope
-Grew installing GCL and HDPE on South west area were ramp was filled over
-Inspected proposed drainrock material in Upland pit wil Terry

Next Steps

- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/16/2022 9:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Sunny 0C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Ramp area filled and remainder of anchor trench dug on top of west slope
-Grew installing GCL and HDPE on South west area were ramp was filled over
-Inspected proposed drainrock material in Upland pit wil Terry

Next Steps

- complete installation of geosythetics on south west area of landfill

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/17/2022 13:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Liner crew, Brian Fagan		
WEATHER CONDITIONS:	Sunny 3C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe cnstruction activities

SITE NOTES / PROGRESS:
-Installing first layer of Geotextile, GCL and HDPE on former ramp area on west slope

Next Steps

-Install remaining geosythetic layers in middle on former ramp area

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/17/2022 13:30	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Liner crew, Brian Fagan		
WEATHER CONDITIONS:	Sunny 3C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe cnstruction activities

SITE NOTES / PROGRESS:
-Installing first layer of Geotextile, GCL and HDPE on former ramp area on west slope

Next Steps

-Install remaining geosythetic layers in middle on former ramp area

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/18/2022 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Clear Sky -2C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew installing first layer of GCL and HDPE in middle of west slope and panels number 53, 54 and 55 completing first layer of HDPE
--Grabbed destructive tests 8 - panels 49/50 of upper HDPE layer and 9 Panel 53/54 of lowerr HDPE layer

Next Steps

- Install GCL, Geocomposite, and HDPE in middle area of west slope

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/18/2022 7:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Brian Fagan, Liner crew		
WEATHER CONDITIONS:	Clear Sky -2C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew installing first layer of GCL and HDPE in middle of west slope and panels number 53, 54 and 55 completing first layer of HDPE
--Grabbed destructive tests 8 - panels 49/50 of upper HDPE layer and 9 Panel 53/54 of lowerr HDPE layer

Next Steps

- Install GCL, Geocomposite, and HDPE in middle area of west slope

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/19/2022 8:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Liner crew		
WEATHER CONDITIONS:	Sunny -3C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew placing final GCL on middle of west slope
-Installed second 50 mm HDPE port on west slope
-Installed final 3.5 HDPE panels numbers 53-56 on middle of west slope
-Cut destructive test 10 from panels 55/56

Next Steps

- Prep west side of base of landfill for geotextile installation
- Install geocomposite on west slope
- Install remainder of 200 mm perforated leachate collection pipe

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

Field Notes

NAME:	David Barbour	**PROJECT NUMBER:**	88877
DATE/TIME:	11/19/2022 8:00	**SITE:**	Upland landfill
PERSONNEL ON SITE:	Joe Cassidy, Liner crew		
WEATHER CONDITIONS:	Sunny -3C		

HASP for this project can be found on project portal

SITE VISIT OBJECTIVE:
- Observe construction activities

SITE NOTES / PROGRESS:
-Crew placing final GCL on middle of west slope
-Installed second 50 mm HDPE port on west slope
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-Cut destructive test 10 from panels 55/56

Next Steps

- Prep west side of base of landfill for geotextile installation
- Install geocomposite on west slope
- Install remainder of 200 mm perforated leachate collection pipe

OUTSTANDING INFORMATION / NEW ISSUES:

ATTACHMENTS / SKETCHES (Site Photos To Be Filed Separately):

NOTE: All site photos to be filed in the Project Folder on the Project Portal.

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The Power of Commitment

Cell 1 East, Cell 1 West & Ponds
Commissioning Report

Cell 1 East, Cell 1 West & Ponds Commissioning Report

Northwin Landfill

Northwin Environmental

22 March 2024

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The Power of Commitment

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Document title	Cell 1 East, Cell 1 West & Ponds Commissioning Report | Northwin Landfill						
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Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S3	00	Toby Wong	Deacon Liddy		Deacon Liddy		January 20, 2023
S3	01	Deacon Liddy	Deacon Liddy		Rose Marie Rocca		February 22, 2024
S3	02	Deacon Liddy	Deacon Liddy		Rose Marie Rocca		March 22, 2024

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The Power of Commitment

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Table 5.2 Summary of Treated Leachate Samples During Commissioning Period 4

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Appendix B Photograph Log
Appendix C Laboratory Analytical Reports

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1. Introduction

1.1 Purpose of this Report

The Northwin Landfill (landfill) is owned by Upland Excavating Ltd. (Upland) and operated by Northwin Environmental (Northwin). The landfill is located on the Upland property at civic address 7295 and 7311 Gold River Highway, Campbell River, British Columbia (Site), approximately 7 kilometers (km) southwest of Campbell River city centre. The Site operates as a sand, gravel and rock quarry, and a waste management facility.

This Commissioning Report (Report) documents the initial leachate characterization and confirmation of treatment process capabilities during the commissioning period of Cell 1 East and Cell 1 West, carried out by Upland Contracting Ltd. (Contractor), Northwin, and other contractors hired by Upland. The Leachate Treatment Facility (LTF) Commissioning Plan is provided in Appendix F of the 2021 Design, Operation, and Closure Plan (DOCP).

The Report has been prepared by GHD for Upland for submission to the Ministry of Environment and Climate Change Strategy (ENV) fulfilling the requirements of Section 2.6(b) of the Landfill's Operational Certificate 107689 (OC).

Upland, as the OC holder retained GHD to act as the Qualified Professional (QP) for this project scope. In this capacity, GHD reviewed and summarized the sampling results taken during the commissioning period to determine the performance of LTF.

2. Leachate Treatment Concept

The leachate treatment system is designed to treat the landfill leachate to meet the BC Contaminated Sites Regulation (CSR) Schedule 3.2 Drinking Water Criteria (discharge criteria) prior to discharge to the infiltration pond.

A series of perforated pipes installed at the base of the landfill cell convey leachate to the existing Cell 1 East sump and the Cell 1 West sump. Pumps in perforated pipes within the Cell 1 East sump and Cell 1 West sump, pump leachate to the LTF. The pumps are controlled by level transducers.

The LTS is a batch treatment system, generating a batch of effluent for infiltration. To target operation of a weekly batch at the peak daily leachate generation rate, an average batch size is considered to be 625 m^3, with the maximum batch size to be 1,400 m^3. A batch size may vary, requiring operational adjustments to the treatment system.

The process begins with aerated equalization, where the aerated equalization pond is filled, and undergoes aeration during filling. The leachate is pumped through a shipping container where chemicals for oxidization, pH adjustment and/or coagulation/flocculation can be added inline through injection ports. After chemical addition, leachate can be recirculated to the equalization pond or a clarifier for settling/precipitation of solids. The water is then pumped through a series of sand filters before entering the effluent holding pond and/or pumped through Granular Activated Carbon (GAC) filters. The effluent batch will be held in the effluent holding pond and sampled and sent for laboratory analysis. Following receipt of sample results, the batch will then be pumped to the infiltration pond or recirculated through the treatment steps as required to meet discharge criteria. During operations the batches will be tested periodically to confirm discharge criteria are being met.

The leachate treatment system will reduce the concentration of leachate constituents by the processes described below:

– Aeration oxidizes dissolved metals such as iron and manganese to less soluble forms and produces flocs that will be filtered. Concentrations of other metals present in the leachate that are not readily oxidized in an aeration lagoon will also be reduced when the suspended (not dissolved) components of these metals are filtered in the sand filters. Oxidization can also be enhanced by adding oxidization chemicals.

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– Hydrocarbons and volatile organic compounds will be readily volatized in an aeration lagoon thereby reducing the concentration. If concentrations of organic compounds are required to be further reduced, the effluent will be filtered through a GAC filter.
– The dissolved metals will be removed, if required by chemical precipitation, by adding a volume of chemicals (i.e., mild acids or bases) that will cause an increase or decrease of pH of the leachate to facilitate the formation of an insoluble salt.

Should leachate quality change over time and additional leachate constituents require treatment, the process can include a polishing step to continue to meet the CSR Schedule 3.2 Drinking Water Criteria.

3. Summary of Construction

Construction of the LTF was completed with the liner installation on the effluent holding pond on October 19, 2021. The effluent pond was expanded in November with construction completed on November 12, 2021. All components of the LTF were tested by Northwin. GHD observed the functioning of pumps through each stage of the treatment process on December 2, 2021. A drawing of the leachate treatment works layout is provided in Appendix A.

The leachate treatment process is depicted in Figure 3.1 below.

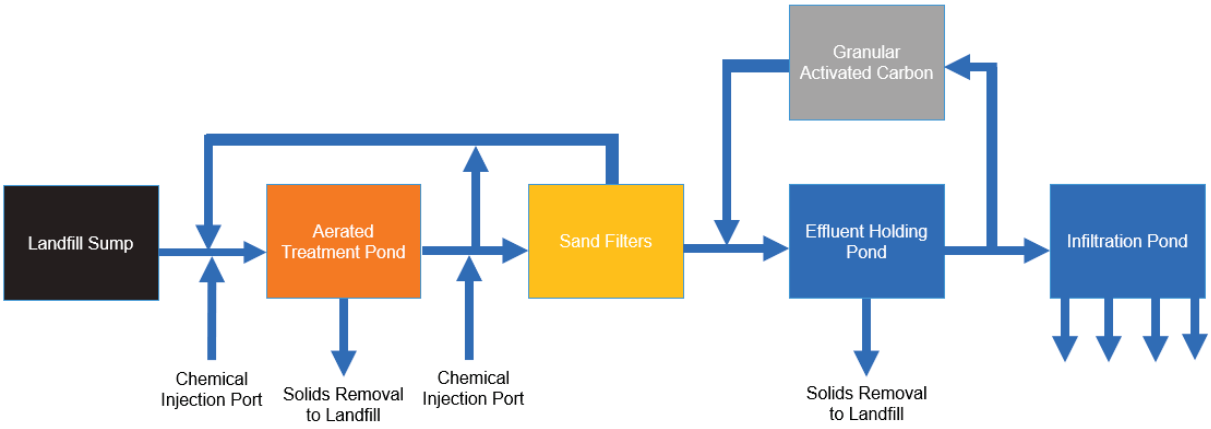

Figure 3.1 Leachate Treatment Process

3.1 Observed Deficiencies and Corrective Actions

The effluent holding pond constructed in October 2021 was undersized. A larger effluent holding pond of appropriate size was constructed in November 2021.

4. Commissioning Activities

The commissioning activities support initial leachate quality characterization and confirm treatment process capabilities. the commissioning activities summarized below.

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Clean Water Testing and Equipment Commissioning

Clean water testing was the initial step in the LTF commissioning in the fall of 2021. The hydraulic integrity of all major process ponds, tanks, pumps, piping, and appurtenance was verified via clean water testing prior to the commencement of start-up and commissioning activities. Process equipment (blowers, pumps, and aeration system) was also commissioned by manufacturer representatives prior to start-up activities. All necessary process chemicals were delivered to Site prior to commissioning and all control systems were tested to verify automatic control functions prior to initiation of start-up activities.

Sampling Activities

During the commissioning period, untreated leachate samples were collected from the effluent holding pond prior to discharge to the infiltration pond. This will aid in leachate characterization and establish a baseline for determining the effectiveness of the leachate treatment process.

Samples were analyzed for the comprehensive set of parameters presented in the attached Tables 1 through 4 to confirm the parameters of concern within the leachate.

5. Analytical Results

Influent and treated leachate samples were collected and submitted to ALS Environmental (ALS) in Burnaby, BC. Samples were analysed for one or more of the treatment parameters listed in the LTF Commissioning Plan (refer to Appendix F of the DOCP) which include dissolved metals, hardness, chemical oxygen demand (COD), alkalinity, sulphate, sulphide, sodium, pH, total dissolved solids (TDS), total suspended solids (TSS), and polycyclic aromatic hydrocarbons (PAH). Parameter concentrations were compared to the CSR Schedule 3.2 Drinking Water Criteria. If treated leachate concentrations met the discharge criteria, then the treated leachate was discharged to the infiltration pond. If the discharge criteria were not met, leachate continued treatment.

During the commissioning period between December 2021 to December 2023, 24 sampling events were completed. Influent samples were collected by GHD and are summarized in Table 5.1. Treated leachate samples were collected by Northwin and are summarized in Table 5.2. Laboratory reports are provided in Appendix C.

Table 5.1 Summary of Influent Leachate Samples During Commissioning Period

Sample Date	Lab Report No.
June 03, 2021	C138327
November 16, 2021	C188804
April 01, 2022	C221453
June 22, 2022	C244592
September 8, 2022	C268908
November 17, 2022	C268889

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Table 5.2 Summary of Treated Leachate Samples During Commissioning Period

Sample Date	Lab Report No.	Discharge Criteria Results	Treatment Continued or Discharged
December 8, 2021 December 15, 2021 January 7, 2022 January 12, 2022	VA21C7462 VA21C7962 VA22A0431 VA22A0612	– 001: Quinoline – 001: Quinoline – 001: No exceedances – 001: No exceedances	Treatment continued Treatment continued Treatment continued Discharged
February 23, 2022	VA22A3490	– 001: Sulphate, lithium, manganese, benzo(b)pyridine (Quinoline) – 002: Sulphate	Treatment continued
March 29, 2022	VA22A6872	– 001: Sulfate, manganese, quinoline	Treatment continued
April 11, 2022	VA22A7623	– 001: Sulfate, manganese, quinoline	Treatment continued
June 07, 2022 July 01, 2022 July 29, 2022	VA22B2754 VA22B5020 VA22B7883	– 001: Sulfate – 001: Quinoline, cobalt – 001: No exceedances	Treatment continued Treatment continued Discharged
July 29, 2022	VA22B7886	– 001: Boron, cobalt, sodium	Treatment continued
November 2, 2022	VA22C6839	– 001: Sulfate, boron, sodium	Treatment continued
February 2, 2023	VA23A2628	– 001: No exceedances	Discharged
February 13, 2023	VA23A3351	– 001: Boron, quinoline	Treatment continued
March 6, 2023	VA23A4848	– 001: Arsenic, boron, quinoline	Treatment continued
March 30, 2023	VA23A6860	– 001: No exceedances – 002: No exceedances	Discharged
April 14, 2023	VA23A8082	– 001: Boron, sodium	Treatment continued
October 23, 2023	VA23C5387	– 001: Sulfate, boron, benzo(a)pyrene, quinoline	Treatment continued
November 21, 2023	VA23C7975	– 001: No exceedances – 002: No exceedances	Discharged
December 11, 2023	VA23C0976	– 001: No exceedances	Discharged
December 18, 2023	VA23D0378	– 001: Benzo(a)pyrene, quinoline – 002: No exceedances	Treatment continued Discharged

6. Maintenance and Performance Monitoring Plan

To assist in the operation and maintenance of the LTF, a Maintenance and Performance Monitoring Plan has been developed to monitor the performance of the LTF and to identify modifications where necessary.

Influent and Chemical Jar Testing

To optimize chemical dosing to suit the influent leachate characteristics, on-site jar testing will be conducted at the same time as clean water testing. Influent samples will be collected to create an initial leachate profile. LTF operators will conduct jar tests with various chemicals and dosages to evaluate the effectiveness and appropriate dose conditions for removal of target parameters. The jar tests will be used to set initial batch volume chemical dosage rates.

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Future Sampling Activities

To meet discharge quality objectives, treated leachate will be sampled regularly to develop a relationship between the parameters of concern within the leachate and the batch treatment sampling program, as well as to monitor the performance of the LTF and chemical dosage.

Each batch of effluent will be sampled from the effluent holding pond and analyzed for a comprehensive set of parameters to determine if a batch can be discharged to the infiltration pond. The effluent will only be discharged to the infiltration pond if the effluent meets the CSR Schedule 3.2 DW criteria. Dependent on the analytical sampling results, leachate will either be recirculated back through the treatment process for additional treatment or, if the effluent meets CSR Schedule 3.2 Drinking Water Criteria, discharged into the infiltration pond.

The effluent sampling results will be used to establish the parameter list for compliance sampling throughout the operation of LTF. Based on leachate quality forecasting discussed in the DOCP, the key leachate parameters will be chemical constituents commonly found in construction and demolition waste, and contaminated soil leachate which may include:

- Chloride
- Sulphate
- Boron
- Iron
- Manganese
- Sulphide
- Arsenic
- Sodium
- PAHs

In addition to sampling to meet discharge quality objectives, leachate will also be sampled to monitor the performance of the treatment process and to observe changes to leachate quality over time as additional waste is added to the landfill. The following parameters may be used to develop an understanding of the system performance and to assist in the operation and maintenance of the LTF:

- Chemical Oxygen Demand (COD)
- Alkalinity
- CSR Metals including hardness
- pH
- TDS
- TSS

Northwin and GHD will continue to monitor parameters and observe changes to the leachate quality, if any.

7. Certification

This commissioning report demonstrates that Cell 1 East, Cell 1 West and Ponds have been commissioned in accordance with the OC and the 2021 DOCP. QPs completed inspections before and during commissioning of Cell 1 East, Cell 1 West and the Ponds.

This commissioning report includes the information described in Section 2.6(b) of the OC, and LTF Commissioning Plan presented in the 2021 DOCP, specifically:

- Summary of commission activities including sampling activities
- Summary of analytical results of influent leachate and effluent sampling
- Copy of all calibration reports and laboratory analytical reports
- Comments on any observed deficiencies in the LTF design or performance, and a plan for addressing any such deficiencies
- Maintenance and performance monitoring plan

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All of Which is Respectfully Certified and Submitted by:

GHD

Deacon Liddy

Rose Marie Rocca

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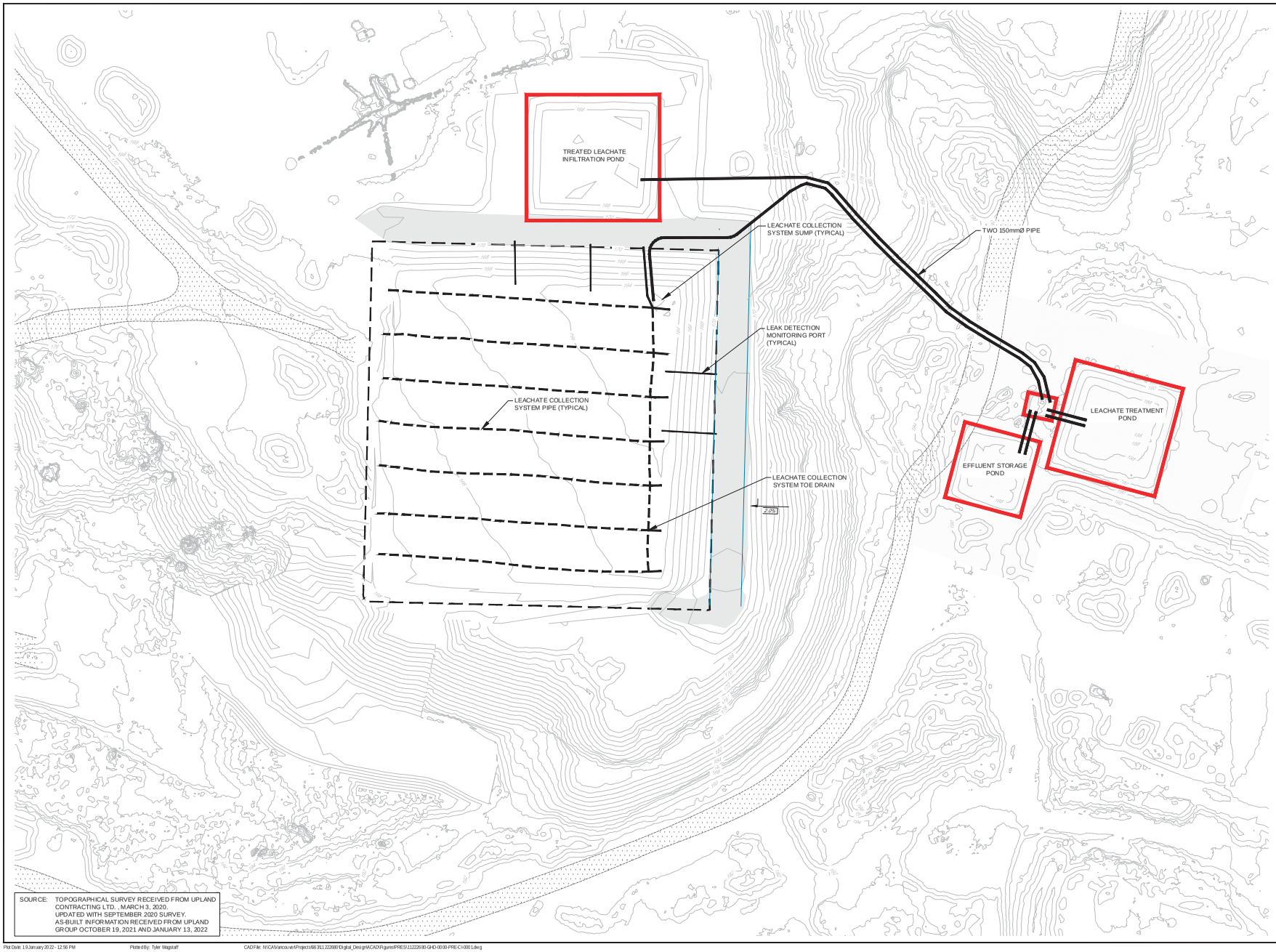
Appendices

Appendix A

Leachate Treatment Works Layout



SOURCE: TOPOGRAPHICAL SURVEY RECEIVED FROM UPLAND CONTRACTING LTD. , MARCH 3, 2020.
UPDATED WITH SEPTEMBER 2020 SURVEY.
AS-BUILT INFORMATION RECEIVED FROM UPLAND GROUP OCTOBER 19, 2021 AND JANUARY 13, 2022

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UPLAND EXCAVATING LTD.
CAMPBELL RIVER, B.C.

Project
LEACHATE TREATMENT WORKS

No.	Issue	Drawn	Approved	Date

Drawn T.WAGSTAFF	Designer
Drafting Check	Design Check
Project Manager	Date January 19, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale 1:600
Original Size ANSI D	Bar is 20mm on original size drawing 0 20mm

Project No. 11222680

Title
LEACHATE TREATMENT WORKS LAYOUT

Sheet No.
CI-0001

Sheet 1 of 1

Plot Date: 19 January 2022 - 12:56 PM Plotted By: Tyler Wagstaff CAD File: N:\CAV\Vancouver\Projects\66.3911.222680 Digital_Design\CAD\Figures\PRES\11222680-GHD-0000-PRE-CI-0001.dwg

Appendix B

Photo Log

Site Photographs

Photo 1 Aerated Treatment Pond

Photo 2 Infiltration Pond

Photo 3 Submersible landfill leachate pump

Photo 4 Effluent pond after reconstruction

Photo 5 Leachate inlet / effluent out lines

Photo 6 Recirculation control valves

Photo 7 Leachate and effluent lines inside treatment container

Photo 8 Typical chemical injection port

Photo 9 Aeration Pond inlet / suction lines

Photo 10 Effluent Pond inlet lines

Appendix C

Laboratory Analytical Reports

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA21C7462**	Page	: 1 of 7
Client	: **Northwin Environmental Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Mr Brian Fagan	Account Manager	: Sneha Sansare
Address	: 315 - 1434 Ironwood Street Campbell River BC Canada V9W 5T5	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 09-Dec-2021 13:15
PO	: ----	Date Analysis Commenced	: 09-Dec-2021
C-O-C number	: ----	Issue Date	: 11-Dec-2021 17:01
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Angelo Salandanan	Lab Assistant	Metals, Burnaby, British Columbia
Dee Lee	Analyst	Metals, Burnaby, British Columbia
Harsha Attanayake	Laboratory Analyst	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLCI	*Detection Limit Raised: Chromatographic interference due to co-elution.*
DLQ	*Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.*

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	08-Dec-2021 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	22.8	----	----	----	----
Anions and Nutrients									
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	2.84	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0244	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00025	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00537	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0000050	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	6.93	----	----	----	----
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	----	----	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	<0.00050	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00010	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00409	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.017	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000061	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	1.34	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.0414	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000220	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	----	----	----	----
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	0.060	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.287	----	----	----	----
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	<0.00020	----	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000095	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	08-Dec-2021 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.11	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	17341-25-2	E421	0.050	mg/L	5.47	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0186	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	0.89	----	----	----	----
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	----	----	----	----
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	0.00018	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	0.00096	----	----	----	----
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000013	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00055	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0018	----	----	----	----
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	<0.00020	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	----	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	----	----	----	----
Volatile Organic Compounds									
chlorobenzene	108-90-7	E611C	0.50	µg/L	<0.50	----	----	----	----
chloromethane	74-87-3	E611C	5.0	µg/L	<5.0	----	----	----	----
dichlorobenzene, 1,2-	95-50-1	E611C	0.50	µg/L	<0.50	----	----	----	----
dichlorobenzene, 1,3-	541-73-1	E611C	0.50	µg/L	<0.50	----	----	----	----
dichlorobenzene, 1,4-	106-46-7	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloropropane, 1,2-	78-87-5	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloropropylene, cis+trans-1,3-	542-75-6	E611C	0.75	µg/L	<0.75	----	----	----	----
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.50	µg/L	<0.50	----	----	----	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.50	µg/L	<0.50	----	----	----	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.20	µg/L	<0.20	----	----	----	----
trichloroethane, 1,1,2-	79-00-5	E611C	0.50	µg/L	<0.50	----	----	----	----
trichlorofluoromethane	75-69-4	E611C	0.50	µg/L	<0.50	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	08-Dec-2021 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					Result	----	----	----	----
Volatile Organic Compounds [Drycleaning]									
carbon tetrachloride	56-23-5	E611C	0.50	µg/L	<0.50	----	----	----	----
chloroethane	75-00-3	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethane, 1,1-	75-34-3	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethane, 1,2-	107-06-2	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethylene, 1,1-	75-35-4	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethylene, cis-1,2-	156-59-2	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethylene, trans-1,2-	156-60-5	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloromethane	75-09-2	E611C	1.0	µg/L	<1.0	----	----	----	----
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.50	µg/L	<0.50	----	----	----	----
tetrachloroethylene	127-18-4	E611C	0.50	µg/L	<0.50	----	----	----	----
trichloroethane, 1,1,1-	71-55-6	E611C	0.50	µg/L	<0.50	----	----	----	----
trichloroethylene	79-01-6	E611C	0.50	µg/L	<0.50	----	----	----	----
vinyl chloride	75-01-4	E611C	0.40	µg/L	<0.40	----	----	----	----
Volatile Organic Compounds [Fuels]									
benzene	71-43-2	E611C	0.50	µg/L	<0.50	----	----	----	----
ethylbenzene	100-41-4	E611C	0.50	µg/L	<0.50	----	----	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.50	µg/L	<0.50	----	----	----	----
styrene	100-42-5	E611C	0.50	µg/L	<0.50	----	----	----	----
toluene	108-88-3	E611C	0.40	µg/L	<0.40	----	----	----	----
xylene, m+p-	179601-23-1	E611C	0.40	µg/L	<0.40	----	----	----	----
xylene, o-	95-47-6	E611C	0.30	µg/L	<0.30	----	----	----	----
xylenes, total	1330-20-7	E611C	0.50	µg/L	<0.50	----	----	----	----
Volatile Organic Compounds [THMs]									
bromodichloromethane	75-27-4	E611C	0.50	µg/L	<0.50	----	----	----	----
bromoform	75-25-2	E611C	0.50	µg/L	<0.50	----	----	----	----
chloroform	67-66-3	E611C	0.50	µg/L	<0.50	----	----	----	----
dibromochloromethane	124-48-1	E611C	0.50	µg/L	<0.50	----	----	----	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611C	1.0	%	84.2	----	----	----	----
difluorobenzene, 1,4-	540-36-3	E611C	1.0	%	101	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	08-Dec-2021 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					Result	----	----	----	----
Hydrocarbons									
EPH (C10-C19)	----	E601A	250	µg/L	<250	----	----	----	----
EPH (C19-C32)	----	E601A	250	µg/L	<250	----	----	----	----
HEPHw	----	EC600A	250	µg/L	<250	----	----	----	----
LEPHw	----	EC600A	250	µg/L	<250	----	----	----	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (EPH surr)	392-83-6	E601A	1.0	%	90.7	----	----	----	----
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.010	µg/L	0.399	----	----	----	----
acenaphthylene	208-96-8	E641A	0.010	µg/L	0.012	----	----	----	----
acridine	260-94-6	E641A	0.010	µg/L	<0.021 DLQ	----	----	----	----
anthracene	120-12-7	E641A	0.010	µg/L	<0.022 DLCI	----	----	----	----
benz(a)anthracene	56-55-3	E641A	0.010	µg/L	<0.011 DLQ	----	----	----	----
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L	<0.0050	----	----	----	----
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L	0.010	----	----	----	----
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L	<0.015	----	----	----	----
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L	<0.010	----	----	----	----
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L	<0.010	----	----	----	----
chrysene	218-01-9	E641A	0.010	µg/L	<0.010	----	----	----	----
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L	<0.0050	----	----	----	----
fluoranthene	206-44-0	E641A	0.010	µg/L	0.112	----	----	----	----
fluorene	86-73-7	E641A	0.010	µg/L	0.176	----	----	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L	<0.010	----	----	----	----
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L	<0.064 DLQ	----	----	----	----
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L	0.032	----	----	----	----
naphthalene	91-20-3	E641A	0.050	µg/L	0.098	----	----	----	----
phenanthrene	85-01-8	E641A	0.020	µg/L	0.104	----	----	----	----
pyrene	129-00-0	E641A	0.010	µg/L	0.055	----	----	----	----
quinoline	91-22-5	E641A	0.050	µg/L	0.554	----	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates									
chrysene-d12	1719-03-5	E641A	0.1	%	101	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
					Client sampling date / time	08-Dec-2021 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA21C7462-001	--------	--------	--------	--------
						Result	----	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates										
naphthalene-d8	1146-65-2	E641A	0.1	%		97.1	----	----	----	----
phenanthrene-d10	1517-22-2	E641A	0.1	%		111	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA21C7462**	ePgs	: 1 of L
CirsVt	: **Northwin Environmental Ltd.**	bPr oaPtoay	: c PVuol vsa - EVvraoVrmsVtPi
CoVtPut	: MaBarPV SPgPV	3uuol Vt MPVPgsa	: h VsAP h PVdPas
355asdd	: 417 - 1I 4I wroVp oo5 h tasst CPmRr sii 9 rvsa BC CPVP5P c WT 7F7	355asdd	: 8081 bol gAss5 HrgAp Py BI aVPr y BC CPVP5P c 73 1T W
FsisRAoVs	: ----	FsisRAoVs	: +1 60I 274 I 188
eaojsut	: ----	DPts h PmRisd 9 susrvs5	: 17-Dsu-2021 20:47
eO	: ----	DPts 3 VPiydrd CommsVus5	: 16-Dsu-2021
C-O-C VI mr sa	: ----	wddl s DPts	: 1WDsu-2021 24:0L
h PmRisa	: ----		
h rts	: ----		
QI ots VI mr sa	: ----		
No. of dPmRisd asusrvs5	: 1		
No. of dPmRisd PVPiyds5	: 1		

FArd asRoat dI Rsads5sd PVy Rasvrol d asRoat(d) p rtA tArd as fs as Vus. 9 sdI itd PRRiy to tAs dPmRis(d) Pd dI r mrtts5. FArd 5oul msVt dAPii Vot r s asRao5I us5, sxusRt rV fI ii.

FArd CsatrinuPts of 3 VPiydrd uoVtPrVd tAs foiiop rVg rVfoamPtroV:

- GsVsaPi CommsVtd
- 3 VPiytruPi 9 sdI itd
- h I aaogPts CoVtaoi brmrtd

355rtroVPi rVfoamPtroV RsatrVsVt to tArd asRoat p rii r s fol V5 rV tAs foiiop rVg dsRPaPts PttPuAmsVtd: QI Pirty CoVtaoi 9 sRoat, QC wVtsaRastrvs asRoat to Pddrdt p rtA QI Pirty 9 svrsp PV5 h PmRis 9 susrRt NotrinuPtroV (h 9 N).

Signatories

FArd 5oul msVt APd r ssV sisutaoVruPiiy drgVs5 r y tAs PI tAoarzs5 drgVPtoarsd r siop . EisutaoVru drgVrVg rd uoV5I uts5 rV Puuoa5PVus p rtA Uh SD3 21 CS9 ePat 11.

Signatories	*Position*	*Laboratory Department*
CrV5y FPVg	FsPm bsP5sa - wVoagPVrud	wVoagPVrud, BI aVPr y, BarrdA Coil mr rP
Dss bss	3 VPiydt	MstPid, BI aVPr y, BarrdA Coil mr rP
wVPz BP5r szPVuAn	FsPm bsP5sa - MstPid RasRPaPtroV	MstPid, BI aVPr y, BarrdA Coil mr rP
ORAsinP CArl	DsRPatmsVt MPVPgsa - OagPVrud	OagPVrud, BI aVPr y, BarrdA Coil mr rP
9 or rV T sskd	FsPm bsP5sa - MstPid	MstPid, BI aVPr y, BarrdA Coil mr rP

General Comments

FAs PVPiytruPi mstAo5d lds5 ry 3bh Pas 5svsioRs5 ldnVg nVtsaVPtroVPiiy asuogVrzs5 asfsasVus mstAo5d (pAsas PvPriPris), dl uA Pd tAods Rl rirdAs5 ry Uh Ee3, 3eH3 htPV5Pa5 MstAo5d, 3hFM, vnO, EVvraoVmsVt CPVP5P, BC MOE, PV5 OVtParo MOE. 9sfsa to tAs 3bh Ql Pirty CoVtaoi wvtsaRastrvs asRoat (QCvy foa PRRinuPris asfsasVusd PV5 mstAo5oiogy dl mmPansd. 9sfsasVus mstAo5d mPy nVuoaRoaPts mo5rinuPtroVd to mmRaovs RsafoamPVus.

T Asas P asRoats5 isdd tAPV (K) asdl it rd ArgAs at APV tAs bO9, tArd mPy r s 5l s to RamPay dPmRis sxtaPut<5rgsdtPts 5nil troV PV5<oanVdl ffnurs Vt dPmRis foaPVPiydrd.

T Asas tAs bO9 of P asRoats5 asdl it 5rifsad faom dtPV5Pa5 bO9, tArd mPy r s 5l s to ArgA mordtl as uoVtsVt, nVdl ffnurs Vt dPmRis (as5l us5 psrgAt smRioys5) oamPtarx nVtsafsasVus.

eisPds asfsato Ql Pirty CoVtaoi wvtsaRastrvs asRoat (QCvy foanVfoamPtroV asgPa5nVg Hoi5nVg Frrms uomRinPVus.

/ sy : C3h Nl mr sa CAsmruPi 3r dtaPutd h sa/rusd Vl mr sard P l Vrql s r5sVtrfrsaPddrgVs5 to 5rduasts dl r dtPVusd bO9 : brrmrt of 9sRoatnVg (5stsutroV irrmrt).

Unit	Description
-	No UVrt
µg<b	mruaogaPrmd Rsairtas
mg<b	mriirgaPrmd Rsairtas

K: isdd tAPV.

>: gasPtsat APV.

hl aaogPts: 3V PVPiyts tAPt rd drrmriPanV r sAPvroato tPagst PVPiyts(d), r l t tAPt 5osd Vot ouul aVPtl aPiiy nV sVvraoVmsVtPi dPmRisd. SoaPRRinuPris tsdtd, dl aaogPtsd Pas P55s5 to dPmRisd Raroato PVPiydrd Pd P uAsuk oV asuovsay.

Fsdt asdl itd asRoats5 asiPts oViy to tAs dPmRisd Pd asusrvs5 r y tAs iPr oaPtoay.

UNbEh h OFHE9T vnE h F3FED oV h9N oaQCw9sRoat, 3bb h3MebEh T E9E 9ECEwc ED vN 3CCEeF3BbE CONDvFvON.

Qualifiers

Qualifier	Description
DLCI	*Detection Limit Raised: Chromatographic interference due to co-elution.*
DLQ	*Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.*

Analytical Results

hl r -MPtax: Water (MPtax: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	17-Dsu-2021 0I :40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					9 sdl it	----	----	----	----
Physical Tests									
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	2W6	----	----	----	----
Anions and Nutrients									
sulfate (as SO4)	1I 808-LW8	E247.h OI	0.40	mg/L	11.L	----	----	----	----
Missolved b etals									
aluminum, dissolved	LI 2WW0-7	EI 21	0.0010	mg/L	0.02WI	----	----	----	----
antimony, dissolved	LI I 0-46-0	EI 21	0.00010	mg/L	K0.00010	----	----	----	----
arsenic, dissolved	LI I 0-48-2	EI 21	0.00010	mg/L	0.00047	----	----	----	----
parium, dissolved	LI I 0-4W4	EI 21	0.00010	mg/L	0.00I 78	----	----	----	----
peryllium, dissolved	LI I 0-I 1-L	EI 21	0.000100	mg/L	K0.000100	----	----	----	----
pismuth, dissolved	LI I 0-6WW	EI 21	0.000070	mg/L	K0.000070	----	----	----	----
poron, dissolved	LI I 0-I 2-8	EI 21	0.010	mg/L	0.021	----	----	----	----
cadmium, dissolved	LI I 0-I 4-W	EI 21	0.0000070	mg/L	0.000014I	----	----	----	----
calcium, dissolved	LI I 0-L0-2	EI 21	0.070	mg/L	W0I	----	----	----	----
cesium, dissolved	LI I 0-I 6-2	EI 21	0.000010	mg/L	K0.000010	----	----	----	----
chromium, dissolved	LI I 0-I L-4	EI 21	0.00070	mg/L	K0.00070	----	----	----	----
copalt, dissolved	LI I 0-I 8-I	EI 21	0.00010	mg/L	0.00016	----	----	----	----
cozzer, dissolved	LI I 0-70-8	EI 21	0.00020	mg/L	0.00LLW	----	----	----	----
iron, dissolved	LI 4W8W6	EI 21	0.010	mg/L	0.018	----	----	----	----
lead, dissolved	LI 4WW2-1	EI 21	0.000070	mg/L	0.000112	----	----	----	----
lithium, dissolved	LI 4WW4-2	EI 21	0.0010	mg/L	K0.0010	----	----	----	----
magnesium, dissolved	LI 4WW7-I	EI 21	0.0070	mg/L	1.L1	----	----	----	----
manganese, dissolved	LI 4WW6-7	EI 21	0.00010	mg/L	0.066I	----	----	----	----
mercury, dissolved	LI 4WWL-6	E70W	0.0000070	mg/L	K0.0000070	----	----	----	----
molypdenum, dissolved	LI 4WW8-L	EI 21	0.000070	mg/L	0.0007I W	----	----	----	----
nickel, dissolved	LI I 0-02-0	EI 21	0.00070	mg/L	K0.00070	----	----	----	----
zhoszhorus, dissolved	LL24-1I -0	EI 21	0.070	mg/L	0.106	----	----	----	----
zotassium, dissolved	LI I 0-0WL	EI 21	0.070	mg/L	0.484	----	----	----	----
rupidium, dissolved	LI I 0-1L-L	EI 21	0.00020	mg/L	0.00027	----	----	----	----
selenium, dissolved	LL82-I W2	EI 21	0.000070	mg/L	0.0000WL	----	----	----	----

Analytical Results

hl r -MPtax: Water (MPtax: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	17-Dsu-2021 0I :40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					9 sdl it	----	----	----	----
Missolved b etals									
silicon, dissolved	LI I 0-21-4	EI 21	0.070	mg-b	1.06	----	----	----	----
silver, dissolved	LI I 0-22-I	EI 21	0.000010	mg-b	K0.000010	----	----	----	----
sodium, dissolved	LI I 0-24-7	EI 21	0.070	mg-b	8.6W	----	----	----	----
strontium, dissolved	LI I 0-2I -6	EI 21	0.00020	mg-b	0.0411	----	----	----	----
sulfur, dissolved	LL0I -4I -W	EI 21	0.70	mg-b	4.L8	----	----	----	----
tellurium, dissolved	14I W -80-W	EI 21	0.00020	mg-b	K0.00020	----	----	----	----
thallium, dissolved	LI I 0-28-0	EI 21	0.000010	mg-b	K0.000010	----	----	----	----
thorium, dissolved	LI I 0-2W1	EI 21	0.00010	mg-b	K0.00010	----	----	----	----
tin, dissolved	LI I 0-41-7	EI 21	0.00010	mg-b	K0.00010	----	----	----	----
titanium, dissolved	LI I 0-42-6	EI 21	0.00040	mg-b	0.00106	----	----	----	----
tungsten, dissolved	LI I 0-44-L	EI 21	0.00010	mg-b	K0.00010	----	----	----	----
uranium, dissolved	LI I 0-61-1	EI 21	0.000010	mg-b	0.000016	----	----	----	----
vanadium, dissolved	LI I 0-62-2	EI 21	0.00070	mg-b	0.00076	----	----	----	----
+inc, dissolved	LI I 0-66-6	EI 21	0.0010	mg-b	0.00I 4	----	----	----	----
+irconium, dissolved	LI I 0-6L-L	EI 21	0.00020	mg-b	K0.00020	----	----	----	----
dissolved mercury filtration location	----	Ee 70W	-	-	Srsi5	----	----	----	----
dissolved metals filtration location	----	Ee I 21	-	-	Srsi5	----	----	----	----
Volatile Organic Comz ounds									
chloropen+ene	108-W0-L	E611C	0.70	µg-b	K0.70	----	----	----	----
chloromethane	LI -8L-4	E611C	7.0	µg-b	K7.0	----	----	----	----
dichloropen+ene, 1,2-	W7-70-1	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloropen+ene, 1,3-	7I 1-L4-1	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloropen+ene, 1,D-	106-I 6-L	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloroz roz ane, 1,2-	L8-8L-7	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloroz roz ylene, cis[trans-1,3-	7I 2-L7-6	E611C	0.L7	µg-b	K0.L7	----	----	----	----
dichloroz roz ylene, cis-1,3-	10061-01-7	E611C	0.70	µg-b	K0.70	----	----	----	----
tetrachloroethane, 1,1,1,2-	640-20-6	E611C	0.70	µg-b	K0.70	----	----	----	----
tetrachloroethane, 1,1,2,2-	LW4I -7	E611C	0.20	µg-b	K0.20	----	----	----	----
trichloroethane, 1,1,2-	LW00-7	E611C	0.70	µg-b	K0.70	----	----	----	----
trichlorofluoromethane	L7-6W-I	E611C	0.70	µg-b	K0.70	----	----	----	----

Analytical Results

h l r -MPtax: Water (MPtax: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	17-Dsu-2021 0I :40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					9sdl it	----	----	----	----
Volatile Organic Comzounds]MrycleaningB									
carpon tetrachloride	76-24-7	E611C	0.70	µg-b	K0.70	----	----	----	----
chloroethane	L7-00-4	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloroethane, 1,1-	L7-4I -4	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloroethane, 1,2-	10L-06-2	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloroethylene, 1,1-	L7-47-I	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloroethylene, cis-1,2-	176-7W2	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloroethylene, trans-1,2-	176-60-7	E611C	0.70	µg-b	K0.70	----	----	----	----
dichloromethane	L7-0W2	E611C	1.0	µg-b	K1.0	----	----	----	----
dichlorozrozylene, trans-1,3-	10061-02-6	E611C	0.70	µg-b	K0.70	----	----	----	----
tetrachloroethylene	12L-18-I	E611C	0.70	µg-b	K0.70	----	----	----	----
trichloroethane, 1,1,1-	L1-77-6	E611C	0.70	µg-b	K0.70	----	----	----	----
trichloroethylene	LW01-6	E611C	0.70	µg-b	K0.70	----	----	----	----
vinyl chloride	L7-01-I	E611C	0.I 0	µg-b	K0.I 0	----	----	----	----
Volatile Organic Comzounds]FuelsB									
pen+ene	L1-I 4-2	E611C	0.70	µg-b	K0.70	----	----	----	----
ethylpen+ene	100-I 1-I	E611C	0.70	µg-b	K0.70	----	----	----	----
methyl-tert-putyl ether]b TxEB	164I -0I -I	E611C	0.70	µg-b	K0.70	----	----	----	----
styrene	100-I 2-7	E611C	0.70	µg-b	K0.70	----	----	----	----
toluene	108-88-4	E611C	0.I 0	µg-b	K0.I 0	----	----	----	----
9ylene, m[z-	1LW601-24-1	E611C	0.I 0	µg-b	K0.I 0	----	----	----	----
9ylene, o-	W7-I L-6	E611C	0.40	µg-b	K0.40	----	----	----	----
9ylenes, total	1440-20-L	E611C	0.70	µg-b	K0.70	----	----	----	----
Volatile Organic Comzounds]THb sB									
promodichloromethane	L7-2L-I	E611C	0.70	µg-b	K0.70	----	----	----	----
promoform	L7-27-2	E611C	0.70	µg-b	K0.70	----	----	----	----
chloroform	6L-66-4	E611C	0.70	µg-b	K0.70	----	----	----	----
dipromochloromethane	12I -I 8-1	E611C	0.70	µg-b	K0.70	----	----	----	----
Volatile Organic Comzounds Surrogates									
promofluoropen+ene, D-	I 60-00-I	E611C	1.0	%	102	----	----	----	----
difluoropen+ene, 1,D-	7I 0-46-4	E611C	1.0	%	WW8	----	----	----	----

Analytical Results

hl r -MPtax: Water (MPtax: Water)				Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
				Client sampling date / time	17-Dsu-2021 0I :40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA21C7462-001	--------	--------	--------	--------
					9 sdl it	----	----	----	----
Hydrocarpons									
EPH (C10-C14)	----	E6013	270	µg/L	K270	----	----	----	----
EPH (C14-C32)	----	E6013	270	µg/L	K270	----	----	----	----
HEPHw	----	EC6003	270	µg/L	K270	----	----	----	----
LEPHw	----	EC6003	270	µg/L	K270	----	----	----	----
Hydrocarpons Surrogates									
promopen+otrifluoride, 2- (EPH surr)	4W2-84-6	E6013	1.0	%	8W2	----	----	----	----
Polycyclic Aromatic Hydrocarpons									
acenazhthene	84-42-W	E6I 13	0.010	µg/L	0.210	----	----	----	----
acenazhthylene	208-W6-8	E6I 13	0.010	µg/L	K0.010	----	----	----	----
acridine	260-WI -6	E6I 13	0.010	µg/L	0.021	----	----	----	----
anthracene	120-12-L	E6I 13	0.010	µg/L	K0.020 DbCw	----	----	----	----
pen+(a)anthracene	76-77-4	E6I 13	0.010	µg/L	K0.010	----	----	----	----
pen+o(a)zyrene	70-42-8	E6I 13	0.0070	µg/L	K0.0070	----	----	----	----
pen+o(p[j)fluoranthene	V+P	E6I 13	0.010	µg/L	K0.010	----	----	----	----
pen+o(p[j[k)fluoranthene	V+P	E6I 13	0.017	µg/L	K0.017	----	----	----	----
pen+o(g,h,i)zerylene	1WI-2I -2	E6I 13	0.010	µg/L	K0.010	----	----	----	----
pen+o(k)fluoranthene	20L-08-W	E6I 13	0.010	µg/L	K0.010	----	----	----	----
chrysene	218-01-W	E6I 13	0.010	µg/L	K0.010	----	----	----	----
dipen+(a,h)anthracene	74-L0-4	E6I 13	0.0070	µg/L	K0.0070	----	----	----	----
fluoranthene	206-I I -0	E6I 13	0.010	µg/L	0.0LI	----	----	----	----
fluorene	86-L4-L	E6I 13	0.010	µg/L	0.086	----	----	----	----
indeno(1,2,3-c,d)zyrene	1WI-4W7	E6I 13	0.010	µg/L	K0.010	----	----	----	----
methylnazhthalene, 1-	W0-12-0	E6I 13	0.010	µg/L	K0.070 DbQ	----	----	----	----
methylnazhthalene, 2-	WI-7L-6	E6I 13	0.010	µg/L	0.01I	----	----	----	----
nazhthalene	WI-20-4	E6I 13	0.070	µg/L	K0.070	----	----	----	----
zhenanthrene	87-01-8	E6I 13	0.020	µg/L	0.044	----	----	----	----
zyrene	12W00-0	E6I 13	0.010	µg/L	0.04W	----	----	----	----
quinoline	WI-22-7	E6I 13	0.070	µg/L	0.712	----	----	----	----
Polycyclic Aromatic Hydrocarpons Surrogates									
chrysene-d12	1L1W04-7	E6I 13	0.1	%	W8.2	----	----	----	----

Analytical Results

hl r -MPtax: Water (MPtax: Water)					Client sample ID	New Landfill Holding Pond 08/12/21	----	----	----	----
					Client sampling date / time	17-Dsu-2021 0l :40	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA21C7462-001	--------	--------	--------	--------
						9sdl it	----	----	----	----
Polycyclic Aromatic Hydrocarpons Surrogates										
nazhthalene-d8	11l 6-67-2	E6l 13	0.1	%		87.6	----	----	----	----
zhenanthrene-d10	171L-22-2	E6l 13	0.1	%		107	----	----	----	----

eisPds asfsato tAs GsVsaPi CommsVtd dsutroV foaPV sxRlPVPtroV of PVy ql Pirfrsad 5stsuts5.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22A0431**	Page	: 1 of 5
Amendment	: **(Partial Results)**		
Client	: **Northwin Environmental Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Mr Brian Fagan	Account Manager	: Sneha Sansare
Address	: 315 - 1434 Ironwood Street Campbell River BC Canada V9W 5T5	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 12-Jan-2022 07:30
PO	: ----	Date Analysis Commenced	: 12-Jan-2022
C-O-C number	: ----	Issue Date	: 12-Jan-2022 16:32
Sampler	: B F		
Site	: ----		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Christopher Li	Lab Assistant	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Inorganics, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	*Comment*
VA22A0431-001	Holding Pond	Sample(s) XXX: Water sample(s) for dissolved mercury analysis was not submitted in glass or PTFE container with HCl preservative. Results may be biased low.

Qualifiers

Qualifier	*Description*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	Holding Pond	----	----	----	----
				Client sampling date / time	07-Jan-2022	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A0431-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	165	----	----	----	----
Anions and Nutrients									
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	166	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0112	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00202	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00186	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0228	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.857	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.000151	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	55.1	----	----	----	----
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	0.000010	----	----	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	0.00192	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00188	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.0553	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.020	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000431	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0025	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	6.68	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.344	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00186	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00364	----	----	----	----
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	0.074	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	6.65	----	----	----	----
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00348	----	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000286	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.72	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	35.3	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	Holding Pond	----	----	----	----
				Client sampling date / time	07-Jan-2022	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A0431-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.240	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	54.3	----	----	----	----
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000014	----	----	----	----
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	0.00020	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00060 DLM	----	----	----	----
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000272	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00065	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0207	----	----	----	----
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	<0.00020	----	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	----	----	----	----
Volatile Organic Compounds [Fuels]									
benzene	71-43-2	E611A	0.50	µg/L	Not Authorised	----	----	----	----
ethylbenzene	100-41-4	E611A	0.50	µg/L	Not Authorised	----	----	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.50	µg/L	Not Authorised	----	----	----	----
styrene	100-42-5	E611A	0.50	µg/L	Not Authorised	----	----	----	----
toluene	108-88-3	E611A	0.50	µg/L	Not Authorised	----	----	----	----
xylene, m+p-	179601-23-1	E611A	0.40	µg/L	Not Authorised	----	----	----	----
xylene, o-	95-47-6	E611A	0.30	µg/L	Not Authorised	----	----	----	----
xylenes, total	1330-20-7	E611A	0.50	µg/L	Not Authorised	----	----	----	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611A	1.0	%	Not Authorised	----	----	----	----
difluorobenzene, 1,4-	540-36-3	E611A	1.0	%	Not Authorised	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	Holding Pond	----	----	----	----
					Client sampling date / time	07-Jan-2022	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22A0431-001	--------	--------	--------	--------
						Result	----	----	----	----
Hydrocarbons										
EPH (C10-C19)	----	E601A	250	µg/L		Not Authorised	----	----	----	----
EPH (C19-C32)	----	E601A	250	µg/L		Not Authorised	----	----	----	----
VHw (C6-C10)	----	E581.VH+F1	100	µg/L		Not Authorised	----	----	----	----
VPHw	----	EC580A	100	µg/L		Not Authorised	----	----	----	----
Hydrocarbons Surrogates										
bromobenzotrifluoride, 2- (EPH surr)	392-83-6	E601A	1.0	%		Not Authorised	----	----	----	----
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%		Not Authorised	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22A0612**	Page	: 1 of 6
Client	: **Northwin Environmental Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Mr Brian Fagan	Account Manager	: Sneha Sansare
Address	: 315 - 1434 Ironwood Street Campbell River BC Canada V9W 5T5	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: ----	Date Samples Received	: 13-Jan-2022 17:50
PO	: ----	Date Analysis Commenced	: 13-Jan-2022
C-O-C number	: ----	Issue Date	: 14-Jan-2022 20:23
Sampler	: ----		
Site	: ----		
Quote number	: ----		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Ophelia Chiu	Department Manager - Organics	Organics, Burnaby, British Columbia
Ruby Pham	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
µg/L	micrograms per litre
mg/L	milligrams per litre

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLQ	*Detection Limit raised due to co-eluting interference. GCMS qualifier ion ratio did not meet acceptance criteria.*

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	New Landfill Recirc 13/01/22	----	----	----	----
				Client sampling date / time	12-Jan-2022 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A0612-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	85.1	----	----	----	----
Anions and Nutrients									
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	87.3	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0079	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00096	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00090	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00764	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.000020	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.317	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000541	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	27.5	----	----	----	----
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	0.000032	----	----	----	----
chromium, dissolved	7440-47-3	E421	0.00050	mg/L	0.00079	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.00069	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.0218	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.024	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000785	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0013	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	4.00	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.140	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000956	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00167	----	----	----	----
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	0.113	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	3.76	----	----	----	----
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00263	----	----	----	----
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000140	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.10	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)					Client sample ID	New Landfill Recirc 13/01/22	----	----	----	----
					Client sampling date / time	12-Jan-2022 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit		VA22A0612-001	--------	--------	--------	--------
						Result	----	----	----	----
Dissolved Metals										
sodium, dissolved	7440-23-5	E421	0.050	mg/L		20.6	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L		0.127	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L		30.8	----	----	----	----
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L		<0.00020	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L		<0.000010	----	----	----	----
thorium, dissolved	7440-29-1	E421	0.00010	mg/L		<0.00010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L		0.00014	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L		<0.00030	----	----	----	----
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L		<0.00010	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L		0.000092	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L		<0.00050	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L		0.0157	----	----	----	----
zirconium, dissolved	7440-67-7	E421	0.00030	mg/L		<0.00030	----	----	----	----
dissolved metals filtration location	----	EP421	-	-		Field	----	----	----	----
Volatile Organic Compounds										
chlorobenzene	108-90-7	E611C	0.50	µg/L		<0.50	----	----	----	----
chloromethane	74-87-3	E611C	5.0	µg/L		<5.0	----	----	----	----
dichlorobenzene, 1,2-	95-50-1	E611C	0.50	µg/L		<0.50	----	----	----	----
dichlorobenzene, 1,3-	541-73-1	E611C	0.50	µg/L		<0.50	----	----	----	----
dichlorobenzene, 1,4-	106-46-7	E611C	0.50	µg/L		<0.50	----	----	----	----
dichloropropane, 1,2-	78-87-5	E611C	0.50	µg/L		<0.50	----	----	----	----
dichloropropylene, cis+trans-1,3-	542-75-6	E611C	0.75	µg/L		<0.75	----	----	----	----
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.50	µg/L		<0.50	----	----	----	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.50	µg/L		<0.50	----	----	----	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.20	µg/L		<0.20	----	----	----	----
trichloroethane, 1,1,2-	79-00-5	E611C	0.50	µg/L		<0.50	----	----	----	----
trichlorofluoromethane	75-69-4	E611C	0.50	µg/L		<0.50	----	----	----	----
Volatile Organic Compounds [Drycleaning]										
carbon tetrachloride	56-23-5	E611C	0.50	µg/L		<0.50	----	----	----	----
chloroethane	75-00-3	E611C	0.50	µg/L		<0.50	----	----	----	----
dichloroethane, 1,1-	75-34-3	E611C	0.50	µg/L		<0.50	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	New Landfill Recirc 13/01/22	----	----	----	----
				Client sampling date / time	12-Jan-2022 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A0612-001	--------	--------	--------	--------
					Result	----	----	----	----
Volatile Organic Compounds [Drycleaning]									
dichloroethane, 1,2-	107-06-2	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethylene, 1,1-	75-35-4	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethylene, cis-1,2-	156-59-2	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloroethylene, trans-1,2-	156-60-5	E611C	0.50	µg/L	<0.50	----	----	----	----
dichloromethane	75-09-2	E611C	1.0	µg/L	<1.0	----	----	----	----
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.50	µg/L	<0.50	----	----	----	----
tetrachloroethylene	127-18-4	E611C	0.50	µg/L	<0.50	----	----	----	----
trichloroethane, 1,1,1-	71-55-6	E611C	0.50	µg/L	<0.50	----	----	----	----
trichloroethylene	79-01-6	E611C	0.50	µg/L	<0.50	----	----	----	----
vinyl chloride	75-01-4	E611C	0.40	µg/L	<0.40	----	----	----	----
Volatile Organic Compounds [Fuels]									
benzene	71-43-2	E611C	0.50	µg/L	<0.50	----	----	----	----
ethylbenzene	100-41-4	E611C	0.50	µg/L	<0.50	----	----	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.50	µg/L	<0.50	----	----	----	----
styrene	100-42-5	E611C	0.50	µg/L	<0.50	----	----	----	----
toluene	108-88-3	E611C	0.40	µg/L	0.69	----	----	----	----
xylene, m+p-	179601-23-1	E611C	0.40	µg/L	<0.40	----	----	----	----
xylene, o-	95-47-6	E611C	0.30	µg/L	<0.30	----	----	----	----
xylenes, total	1330-20-7	E611C	0.50	µg/L	<0.50	----	----	----	----
Volatile Organic Compounds [THMs]									
bromodichloromethane	75-27-4	E611C	0.50	µg/L	<0.50	----	----	----	----
bromoform	75-25-2	E611C	0.50	µg/L	<0.50	----	----	----	----
chloroform	67-66-3	E611C	0.50	µg/L	3.28	----	----	----	----
dibromochloromethane	124-48-1	E611C	0.50	µg/L	<0.50	----	----	----	----
Hydrocarbons									
EPH (C10-C19)	----	E601A	250	µg/L	<250	----	----	----	----
EPH (C19-C32)	----	E601A	250	µg/L	<250	----	----	----	----
HEPHw	----	EC600A	250	µg/L	<250	----	----	----	----
LEPHw	----	EC600A	250	µg/L	<250	----	----	----	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (EPH surr)	392-83-6	E601A	1.0	%	64.2	----	----	----	----

Analytical Results

Sub-Matrix: Water (Matrix: Water)				Client sample ID	New Landfill Recirc 13/01/22	----	----	----	----
				Client sampling date / time	12-Jan-2022 04:30	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22A0612-001	--------	--------	--------	--------
					Result	----	----	----	----
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.010	µg/L	<0.035 DLQ	----	----	----	----
acenaphthylene	208-96-8	E641A	0.010	µg/L	<0.010	----	----	----	----
acridine	260-94-6	E641A	0.010	µg/L	<0.010	----	----	----	----
anthracene	120-12-7	E641A	0.010	µg/L	<0.010	----	----	----	----
benz(a)anthracene	56-55-3	E641A	0.010	µg/L	<0.010	----	----	----	----
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L	<0.0050	----	----	----	----
benzo(b+j)fluoranthene	n/a	E641A	0.010	µg/L	<0.010	----	----	----	----
benzo(b+j+k)fluoranthene	n/a	E641A	0.015	µg/L	<0.015	----	----	----	----
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L	<0.010	----	----	----	----
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L	<0.010	----	----	----	----
chrysene	218-01-9	E641A	0.010	µg/L	<0.010	----	----	----	----
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L	<0.0050	----	----	----	----
fluoranthene	206-44-0	E641A	0.010	µg/L	<0.010	----	----	----	----
fluorene	86-73-7	E641A	0.010	µg/L	<0.010	----	----	----	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L	<0.010	----	----	----	----
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L	0.108	----	----	----	----
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L	0.277	----	----	----	----
naphthalene	91-20-3	E641A	0.050	µg/L	0.233	----	----	----	----
phenanthrene	85-01-8	E641A	0.020	µg/L	<0.020	----	----	----	----
pyrene	129-00-0	E641A	0.010	µg/L	<0.010	----	----	----	----
quinoline	91-22-5	E641A	0.050	µg/L	<0.050	----	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates									
chrysene-d12	1719-03-5	E641A	0.1	%	108	----	----	----	----
naphthalene-d8	1146-65-2	E641A	0.1	%	98.9	----	----	----	----
phenanthrene-d10	1517-22-2	E641A	0.1	%	106	----	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

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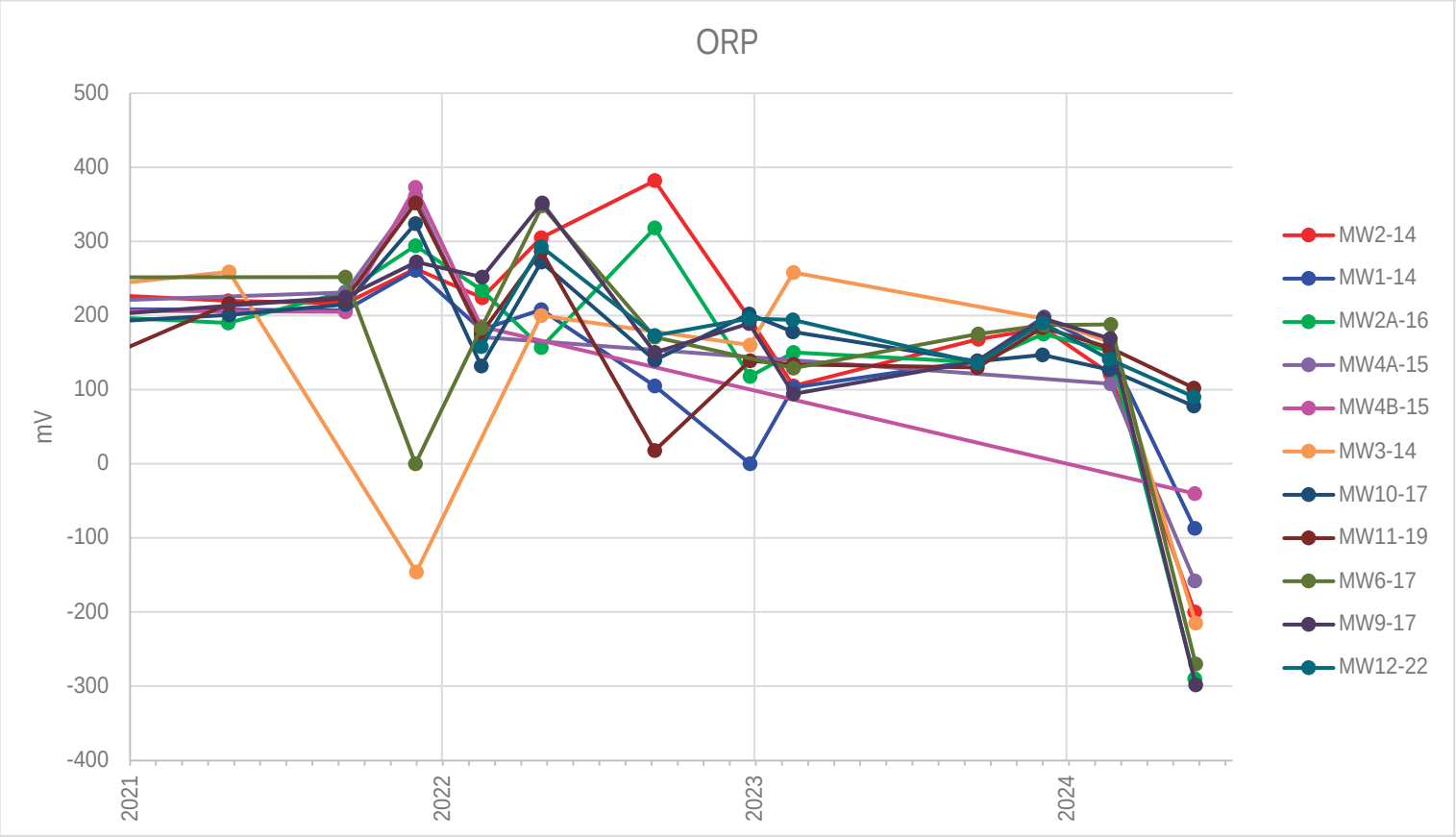
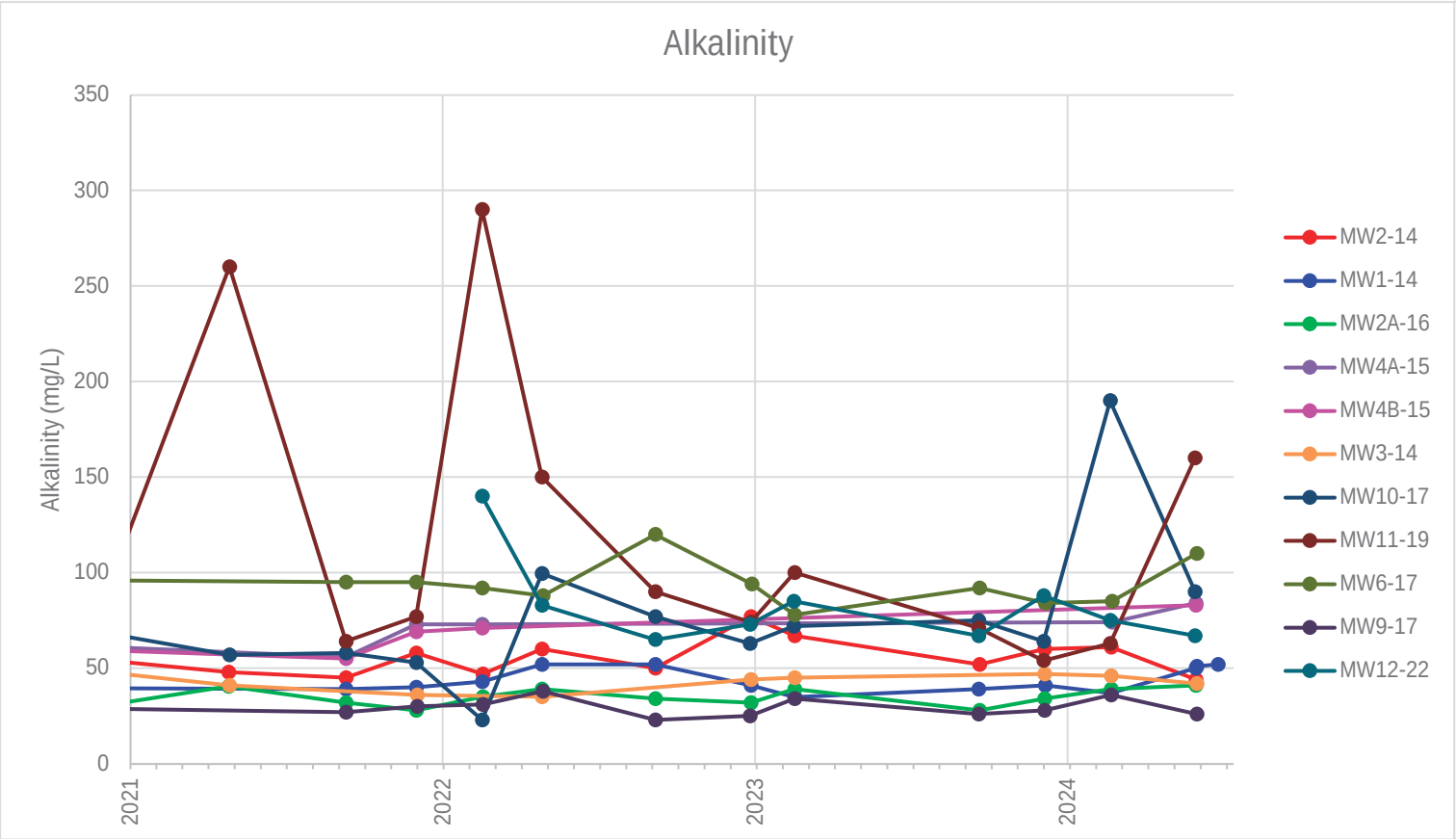
The Power of Commitment

APPENDIX D

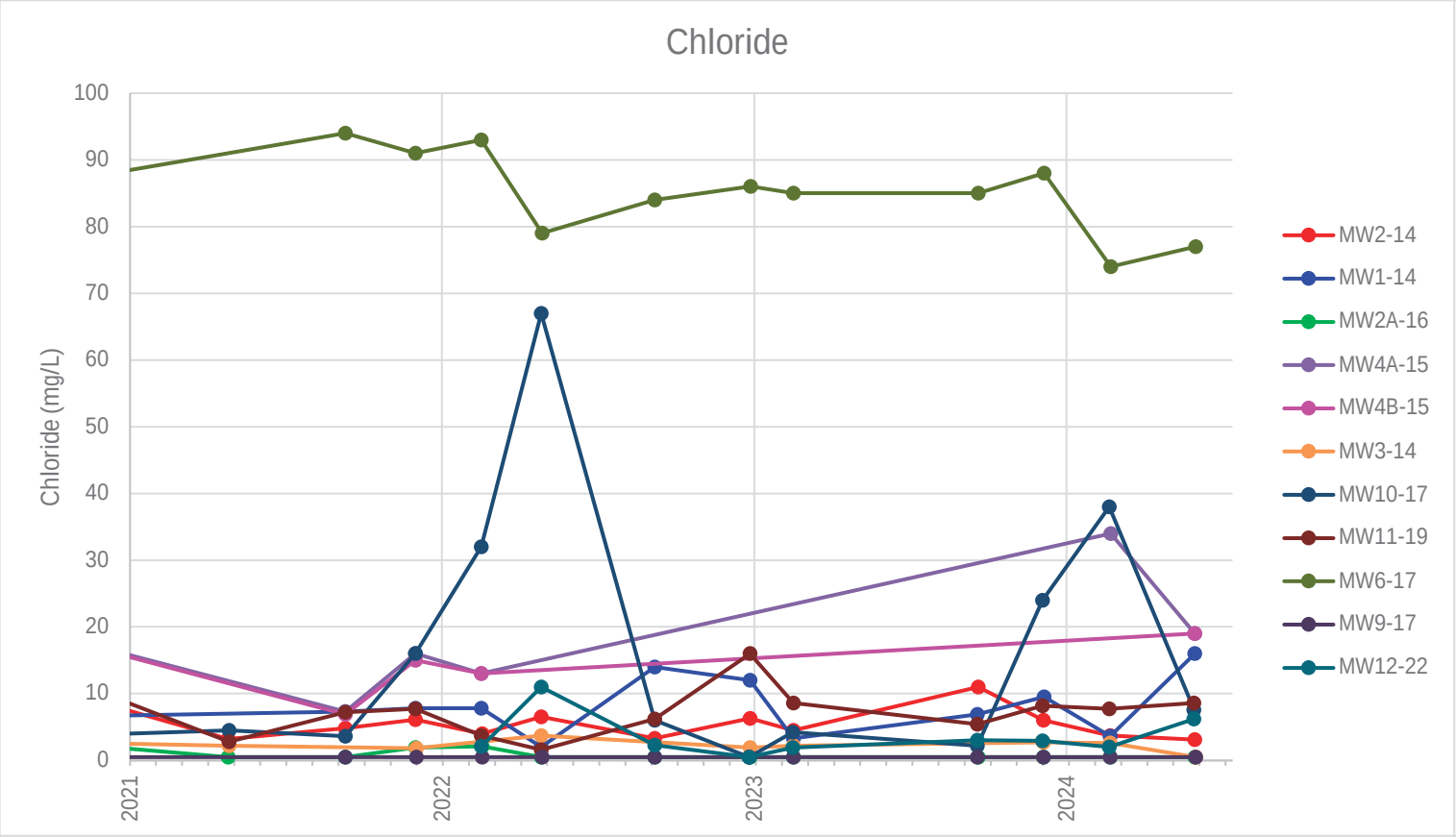
Concentration Versus Time Plots

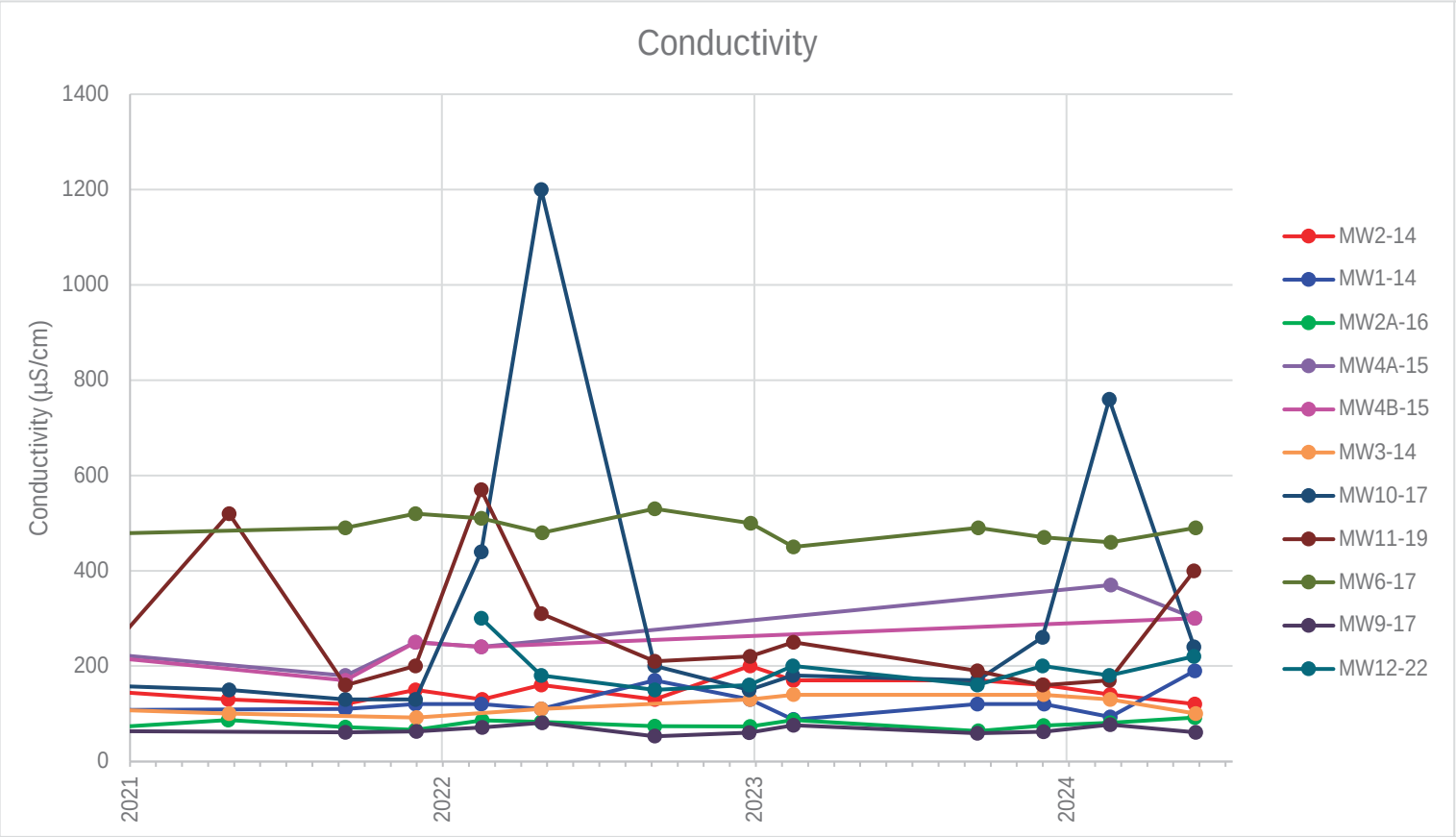
APPENDIX D1 (2021-2024)



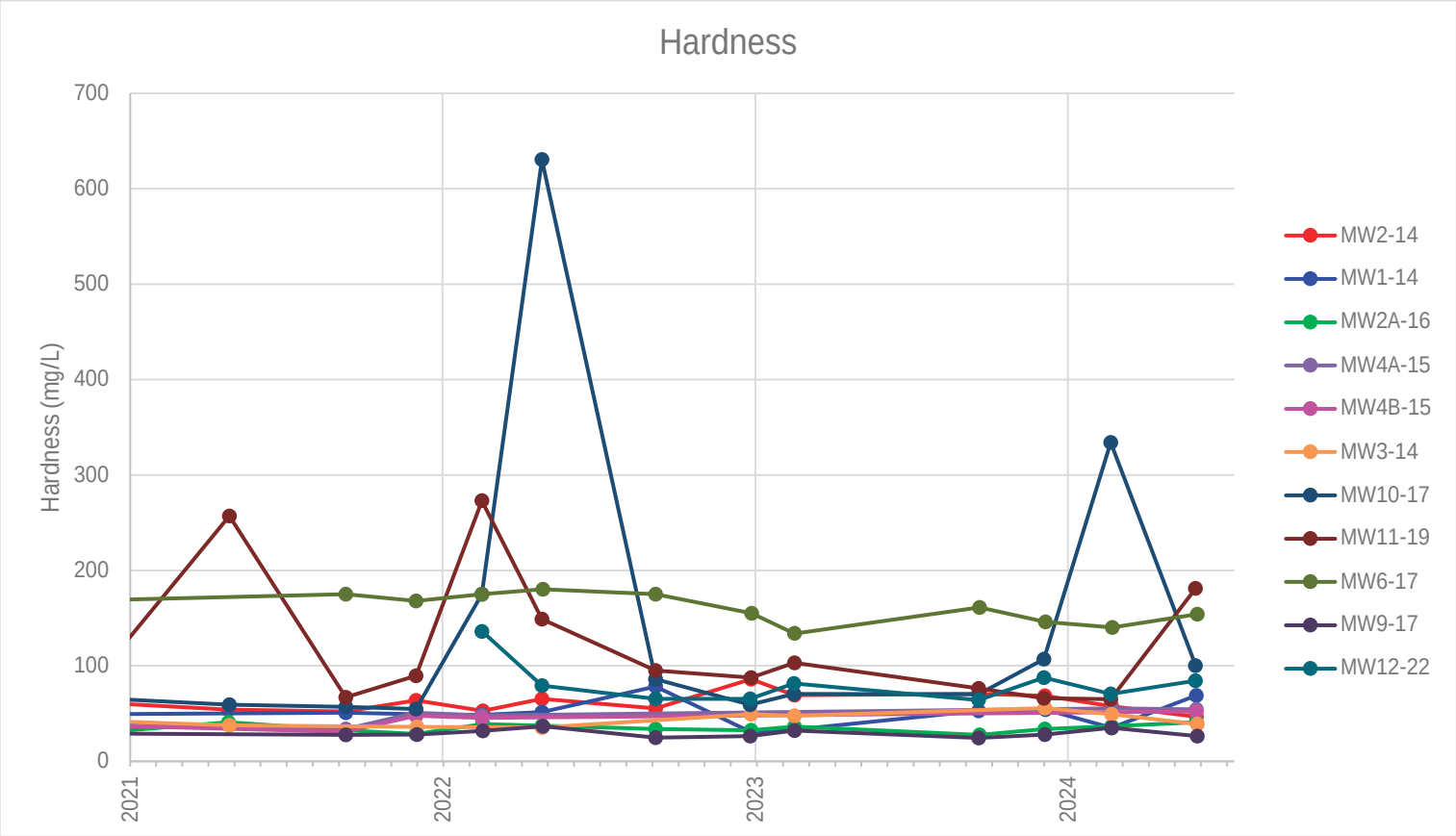


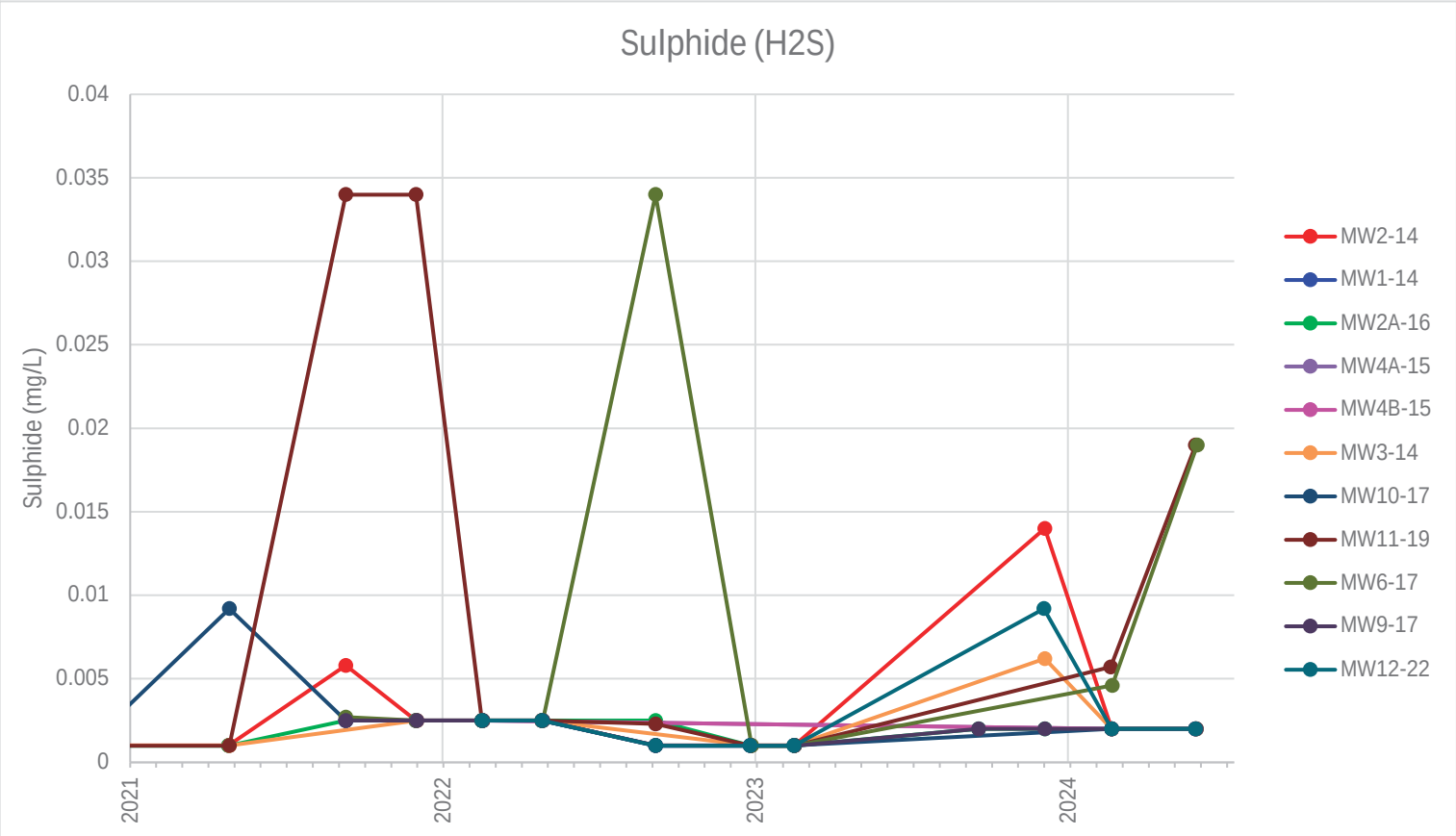
APPENDIX D1 (2021-2024)



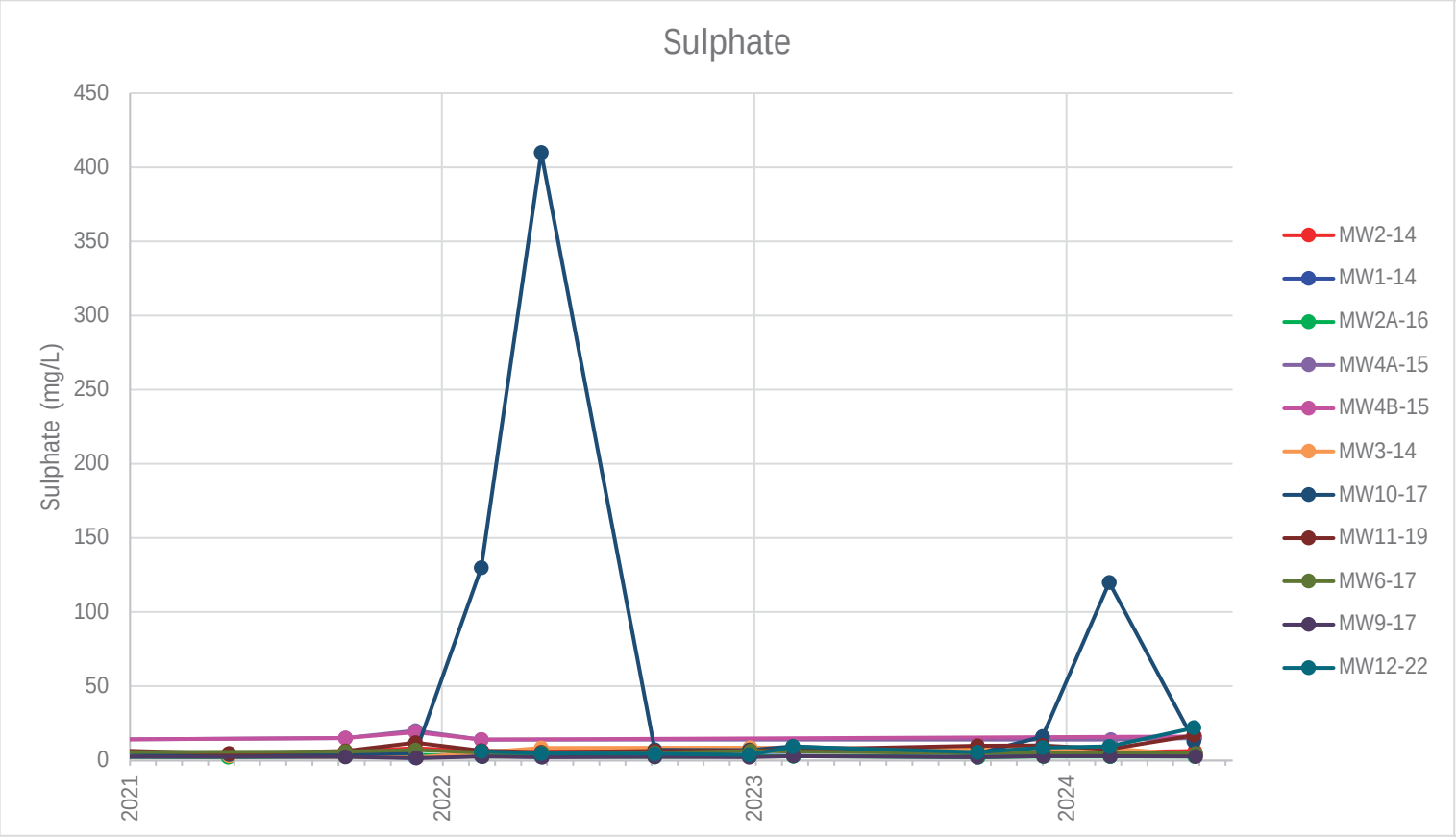


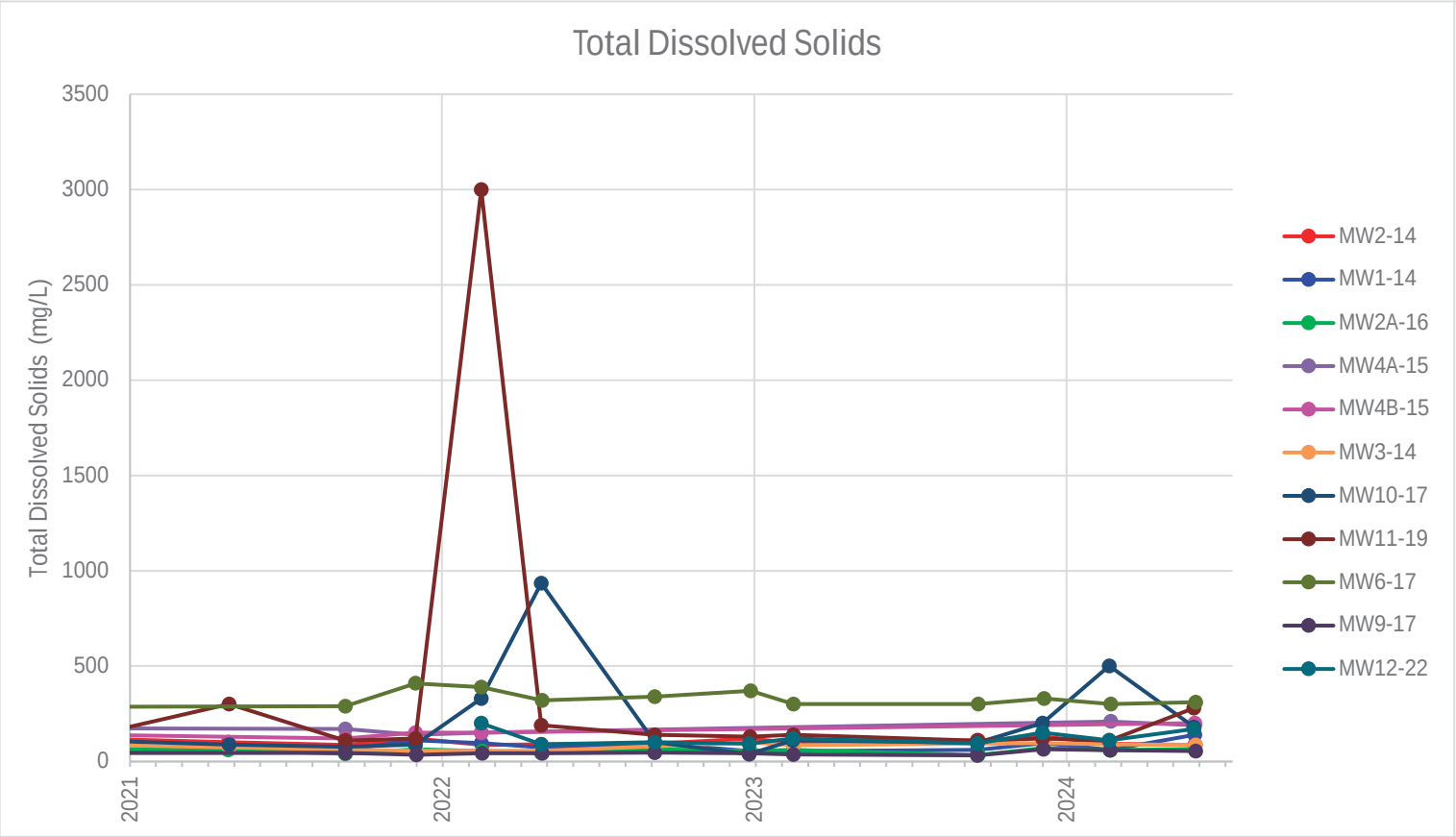
APPENDIX D1 (2021-2024)



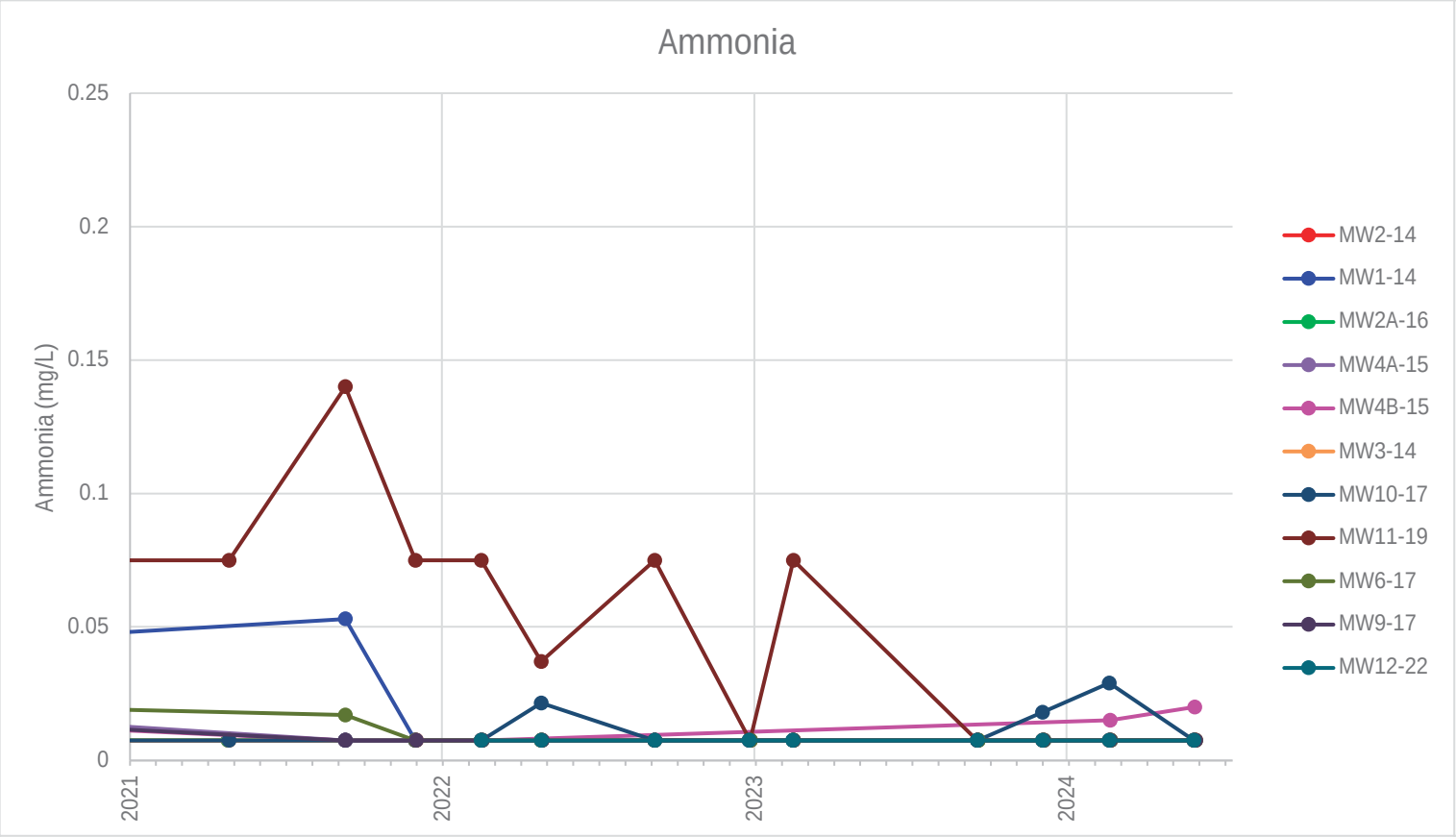


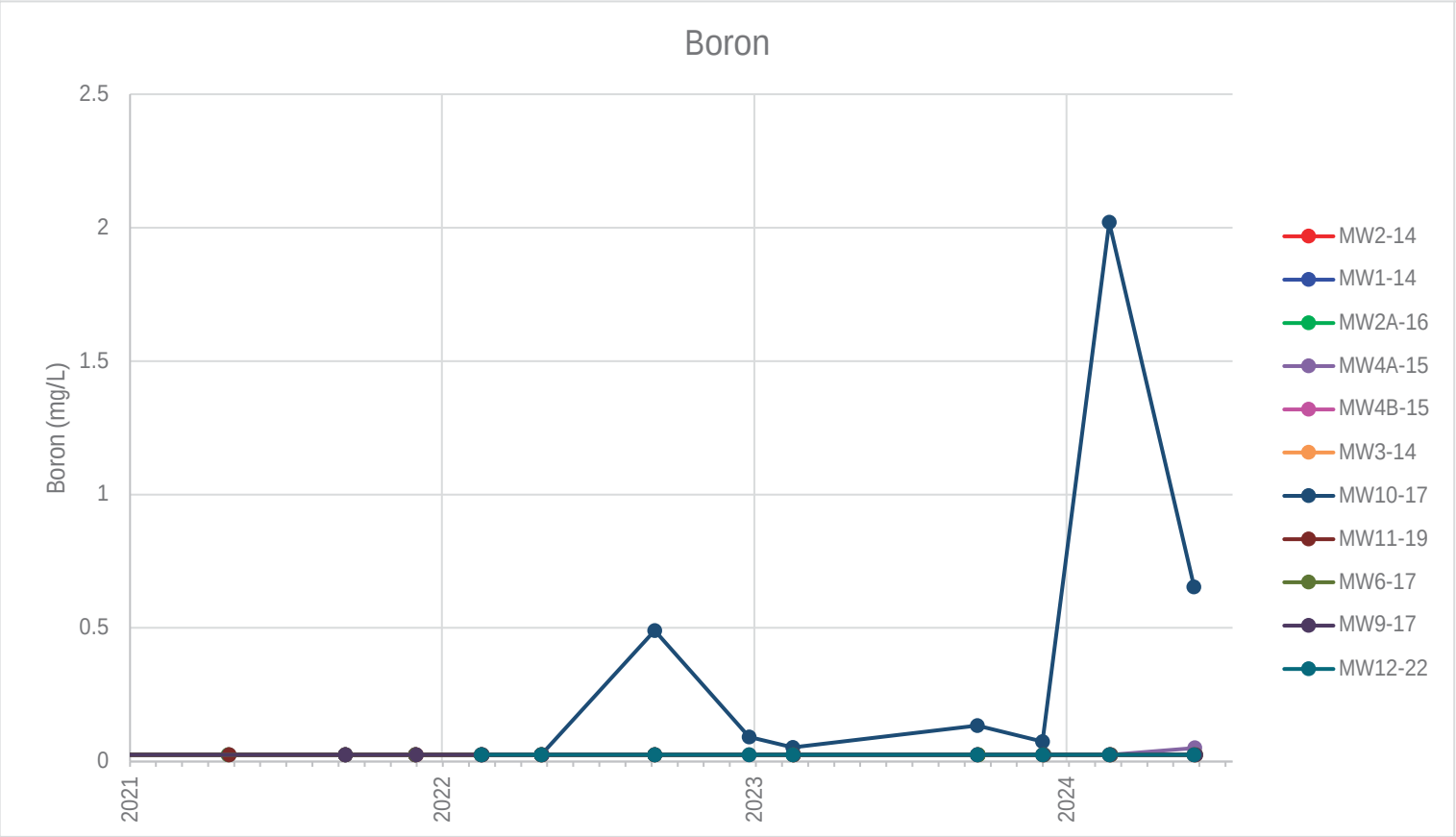
APPENDIX D1 (2021-2024)





APPENDIX D1 (2021-2024)





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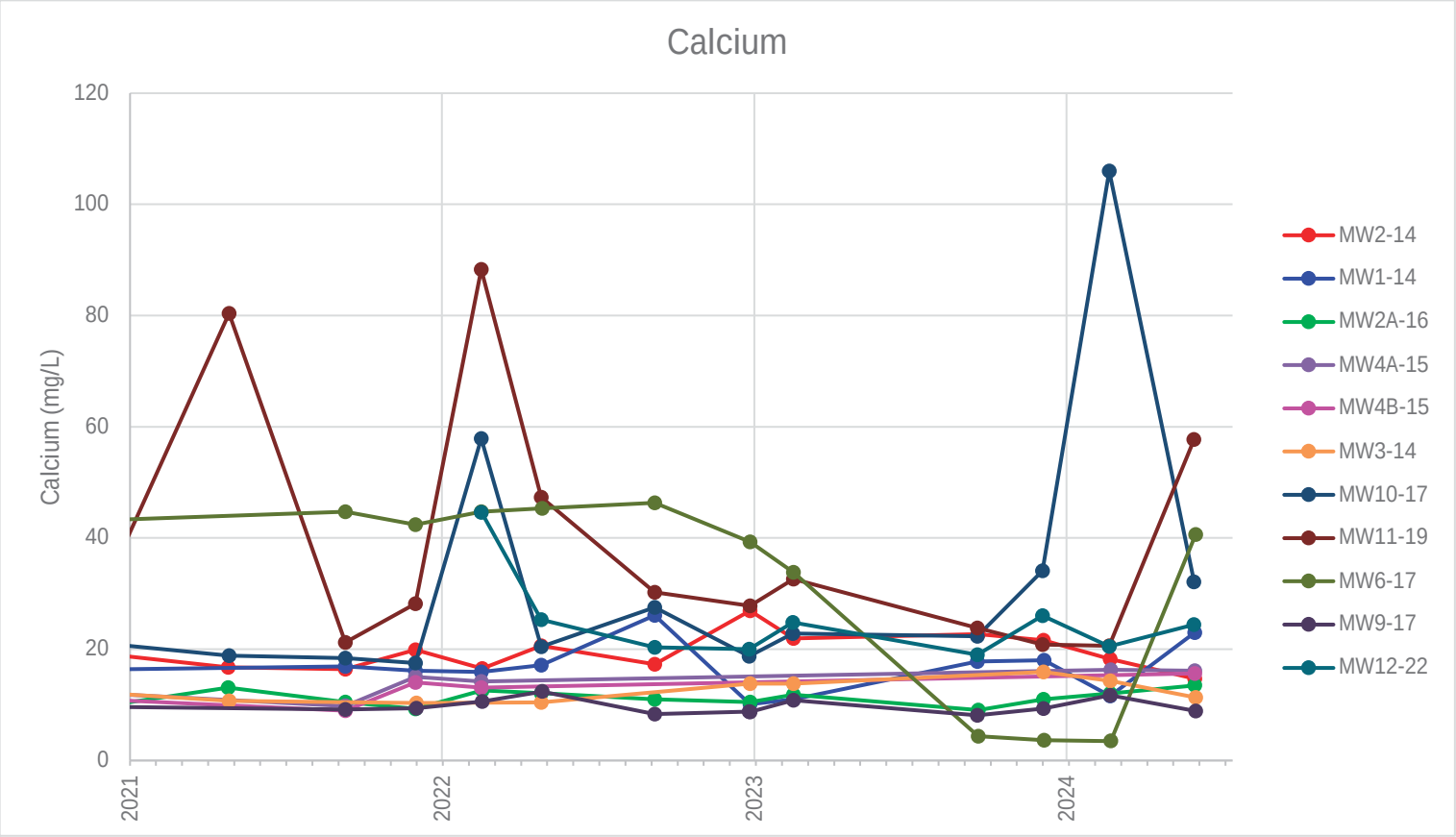

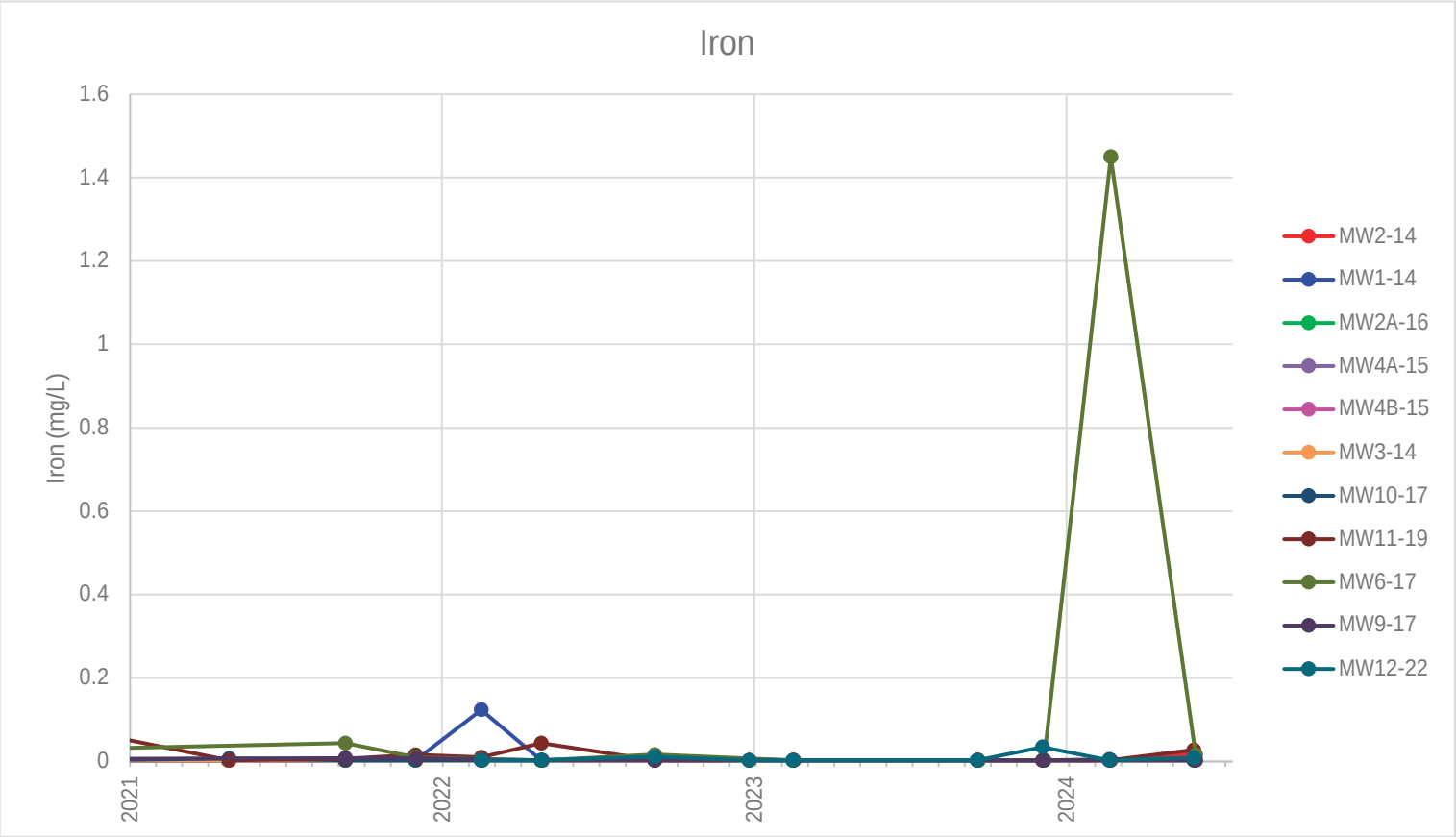

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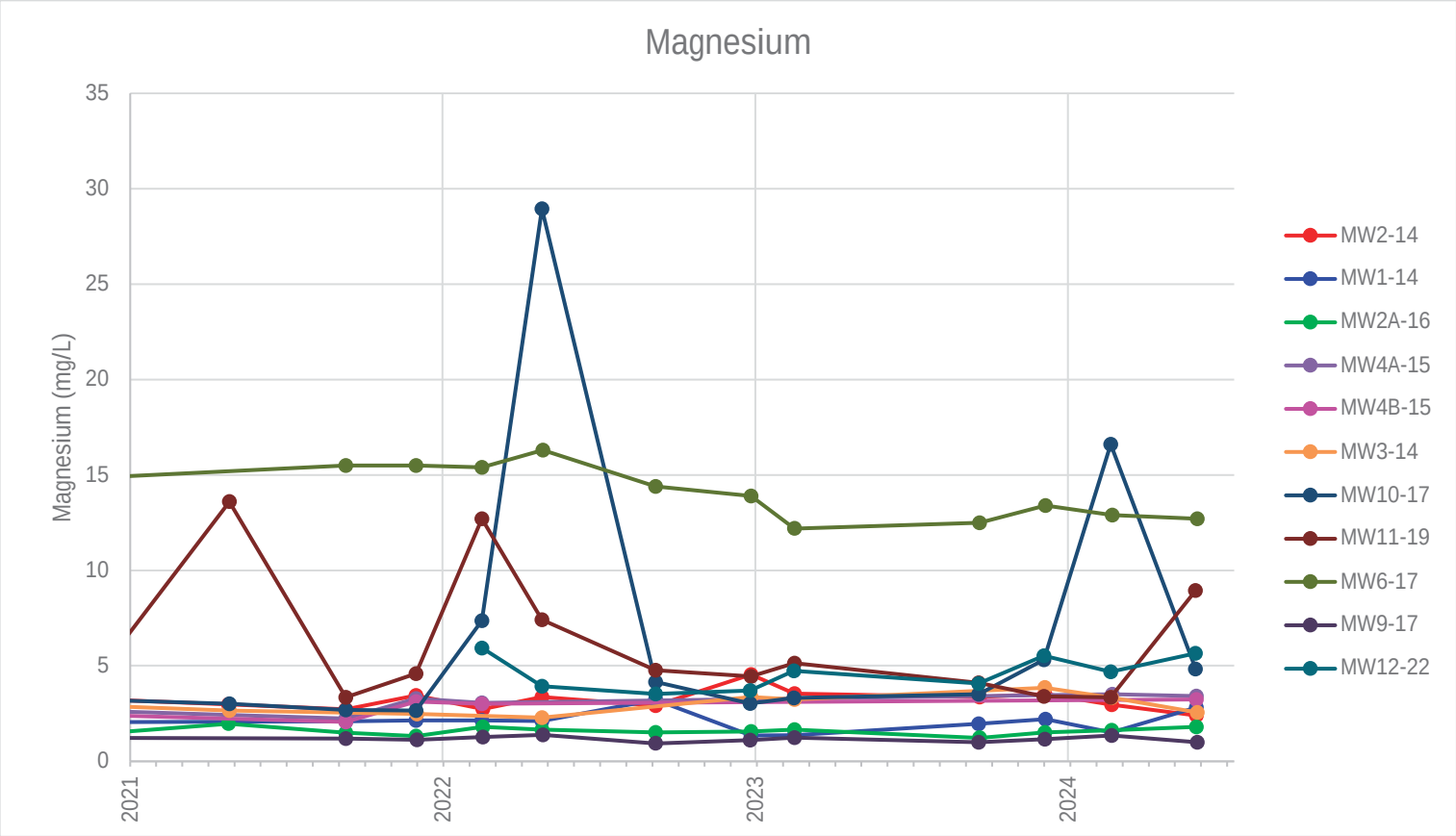

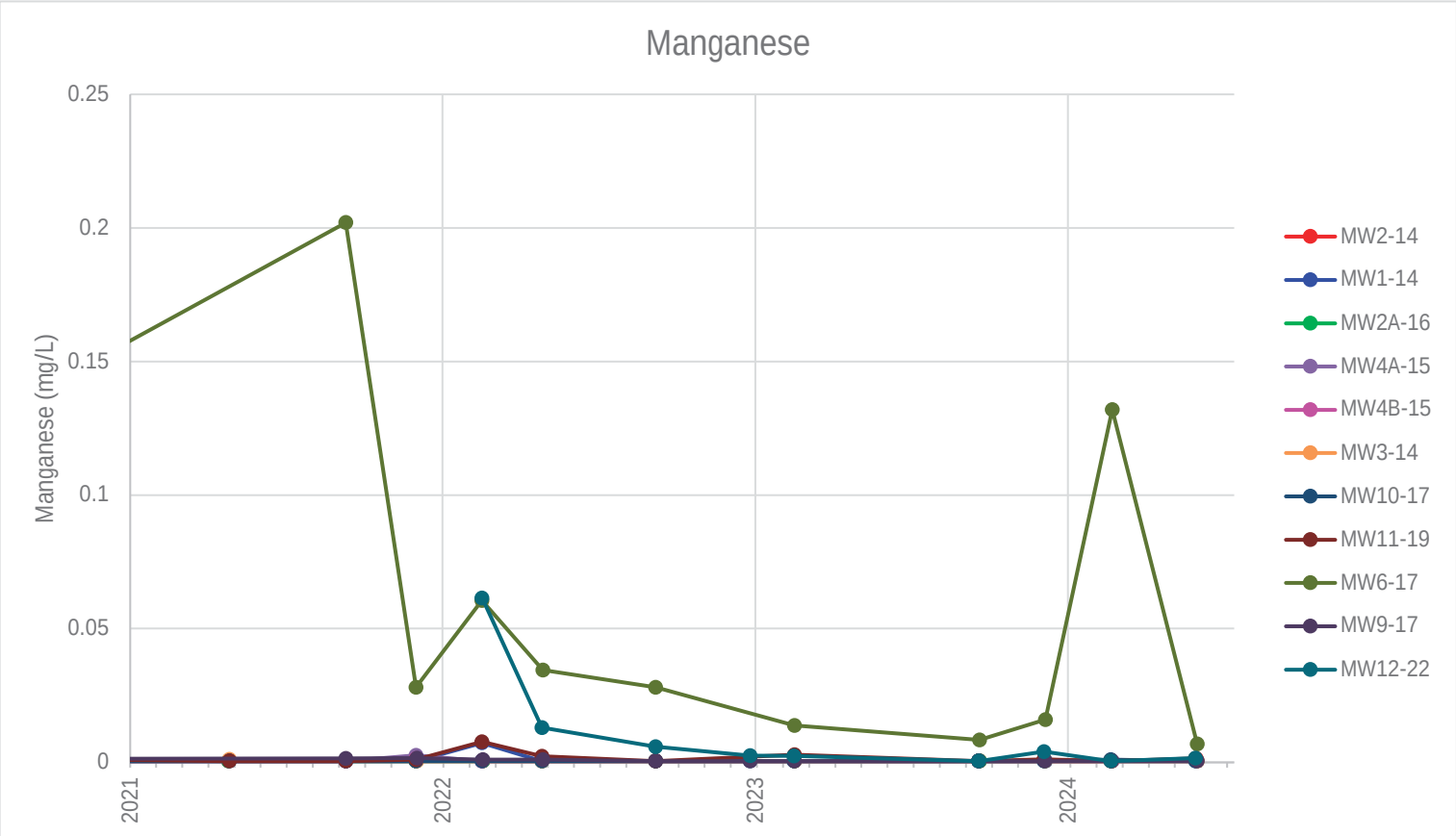

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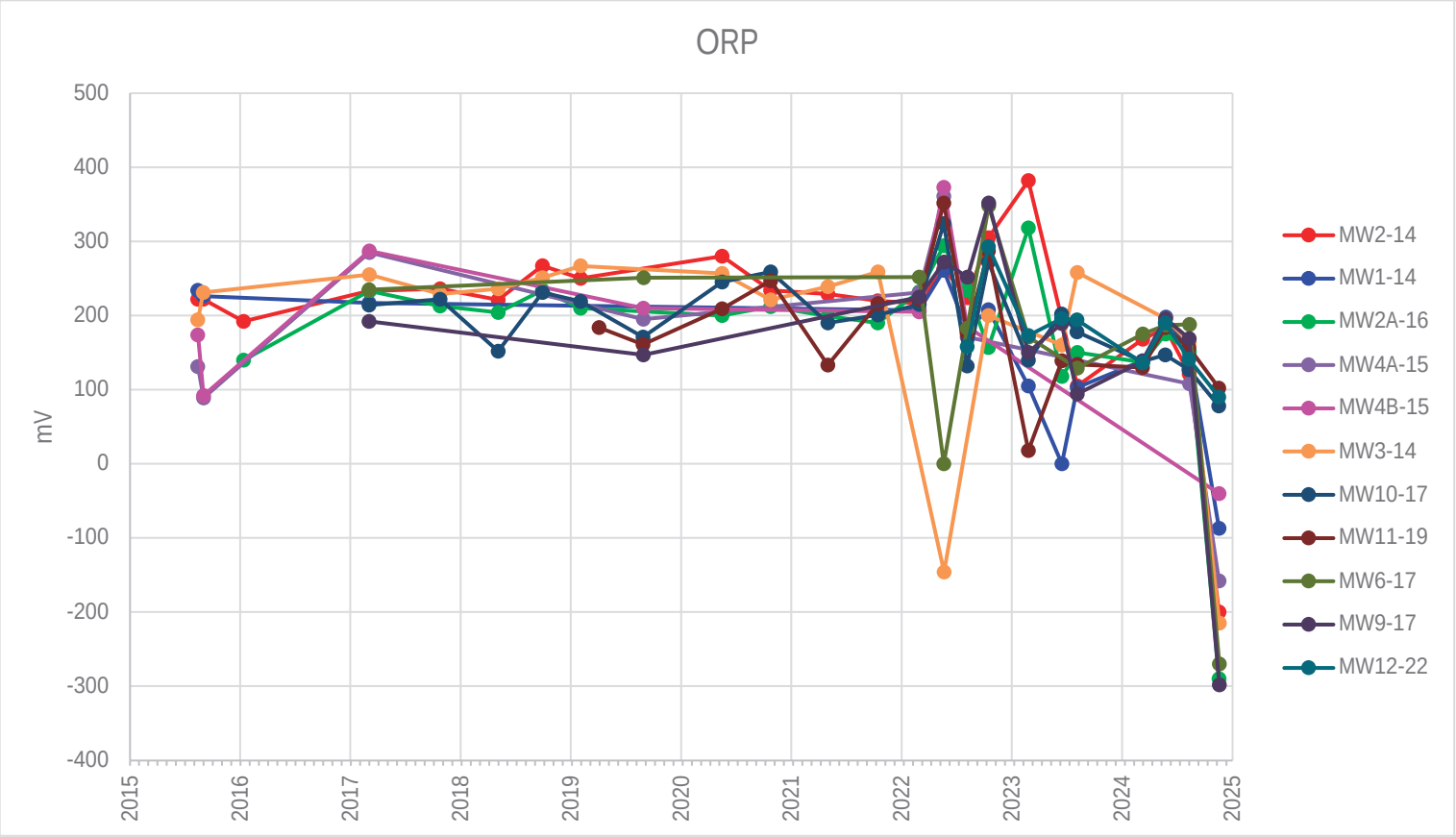

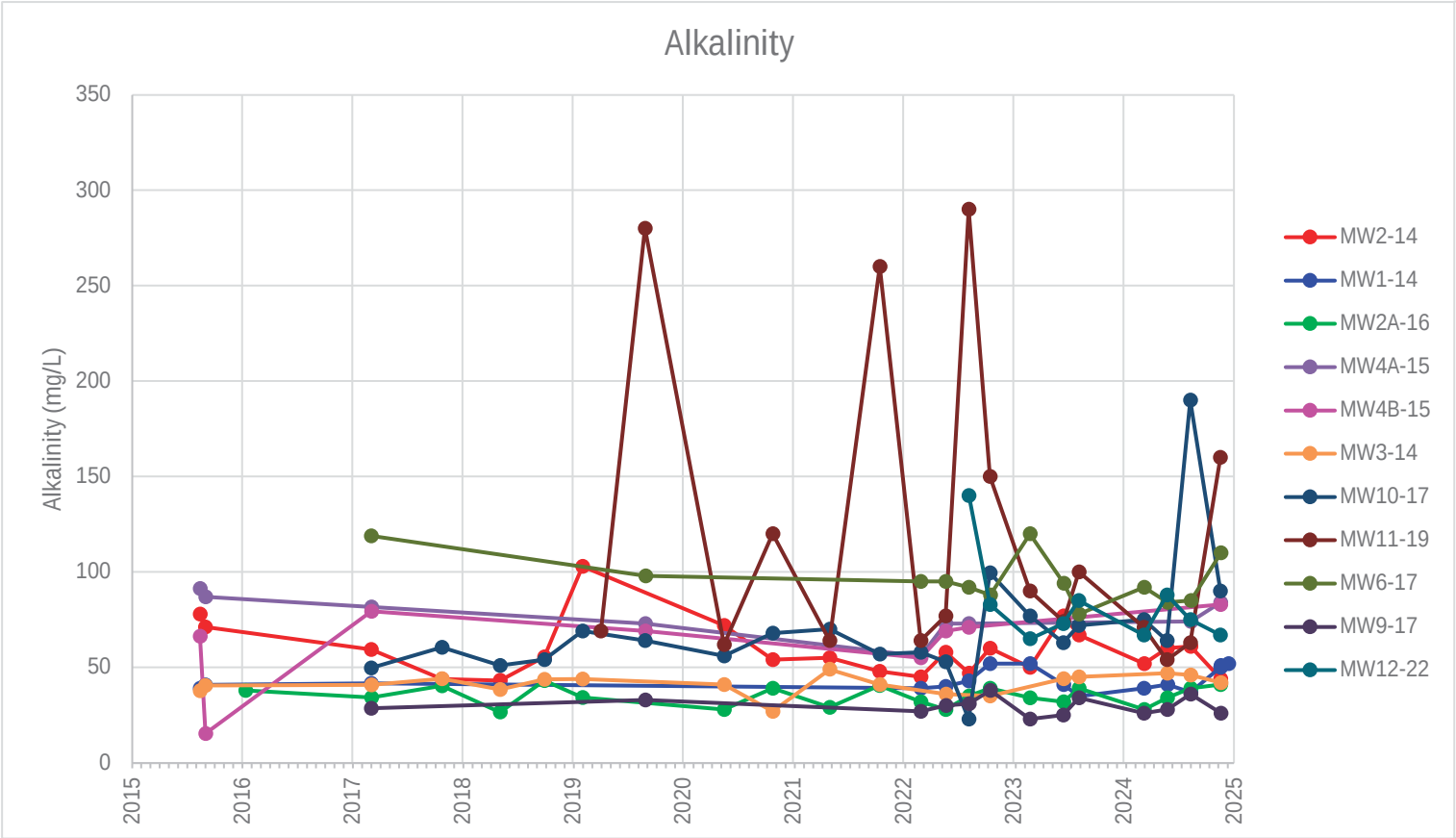

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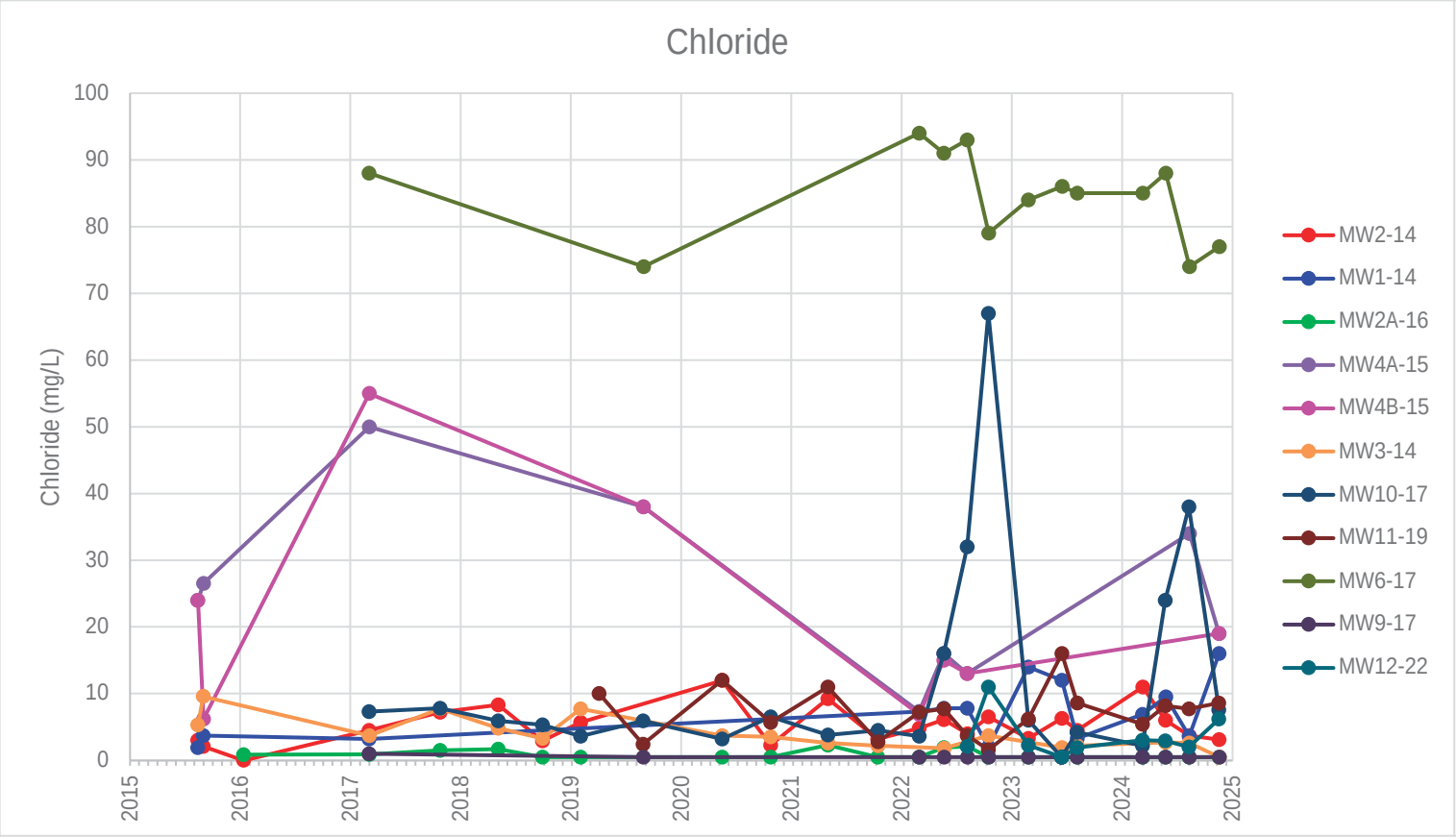

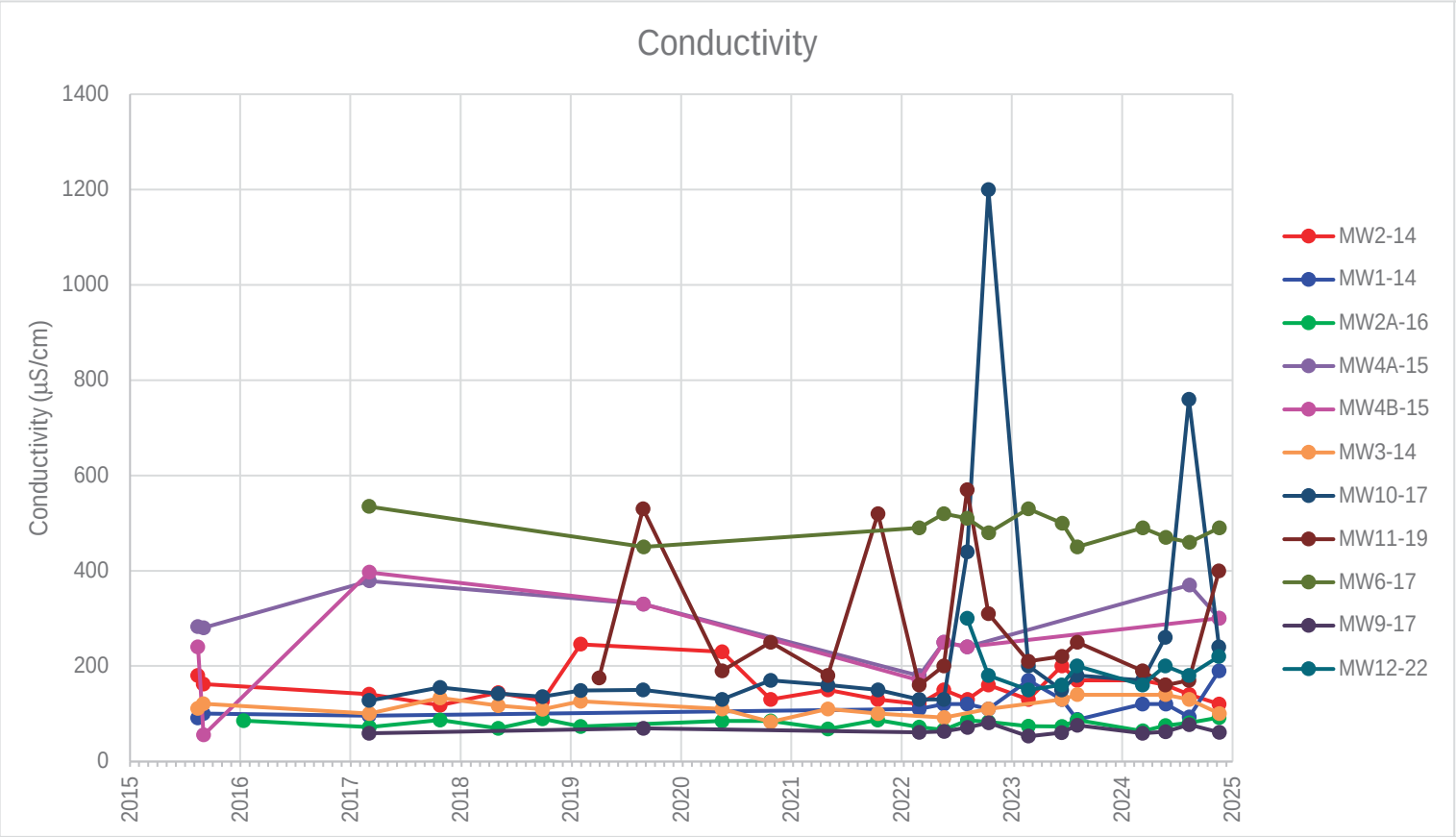

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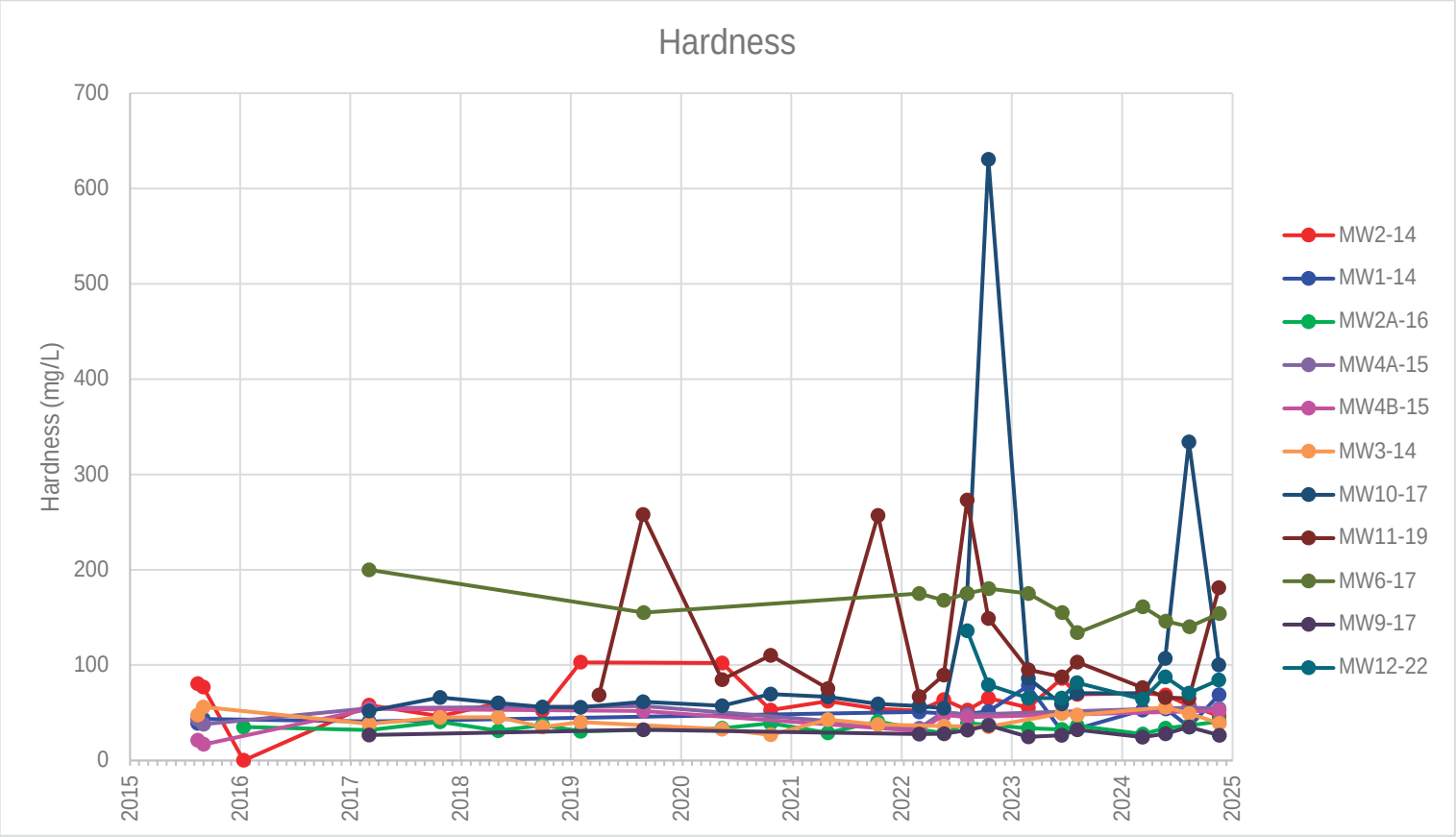

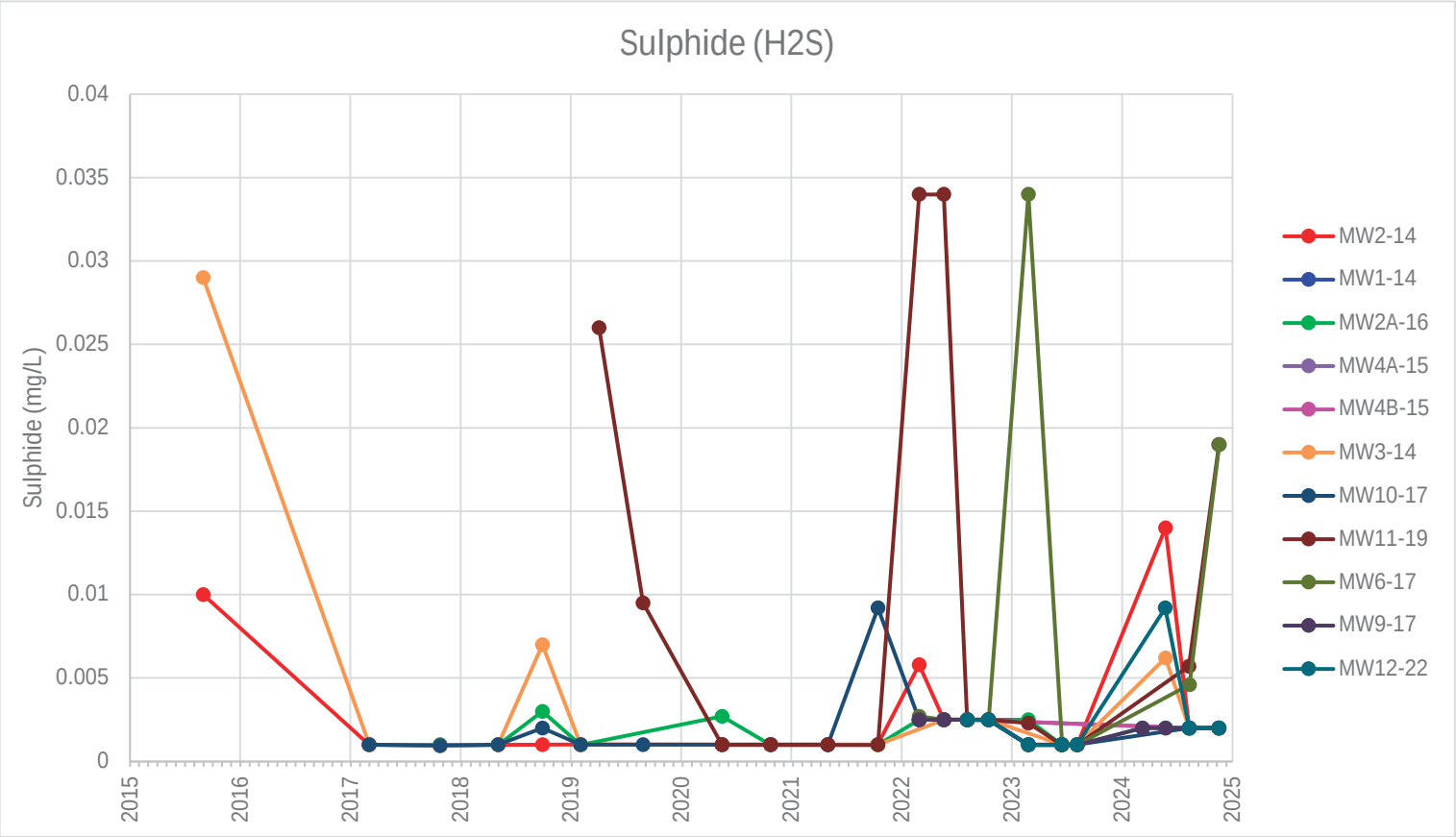

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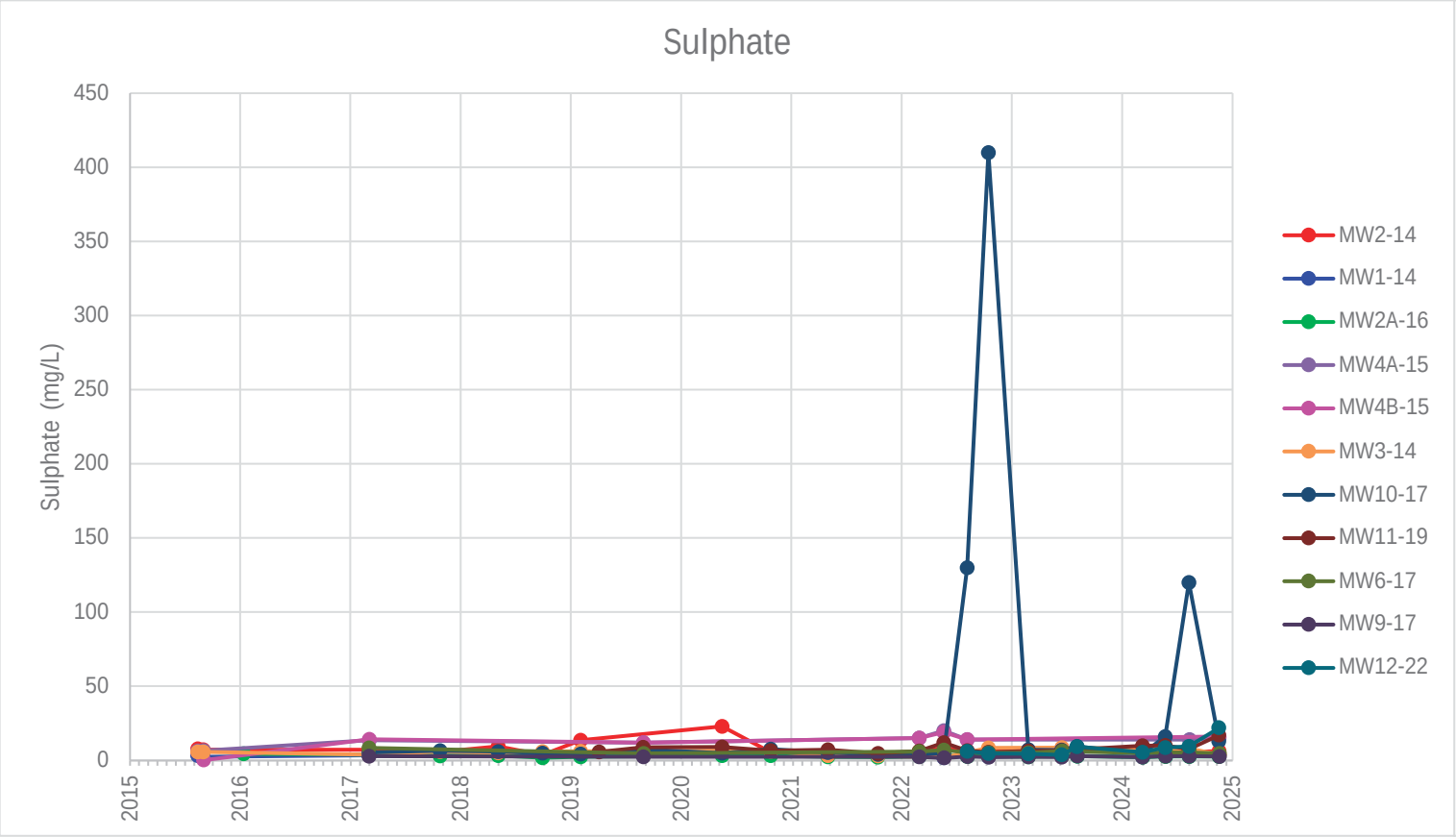

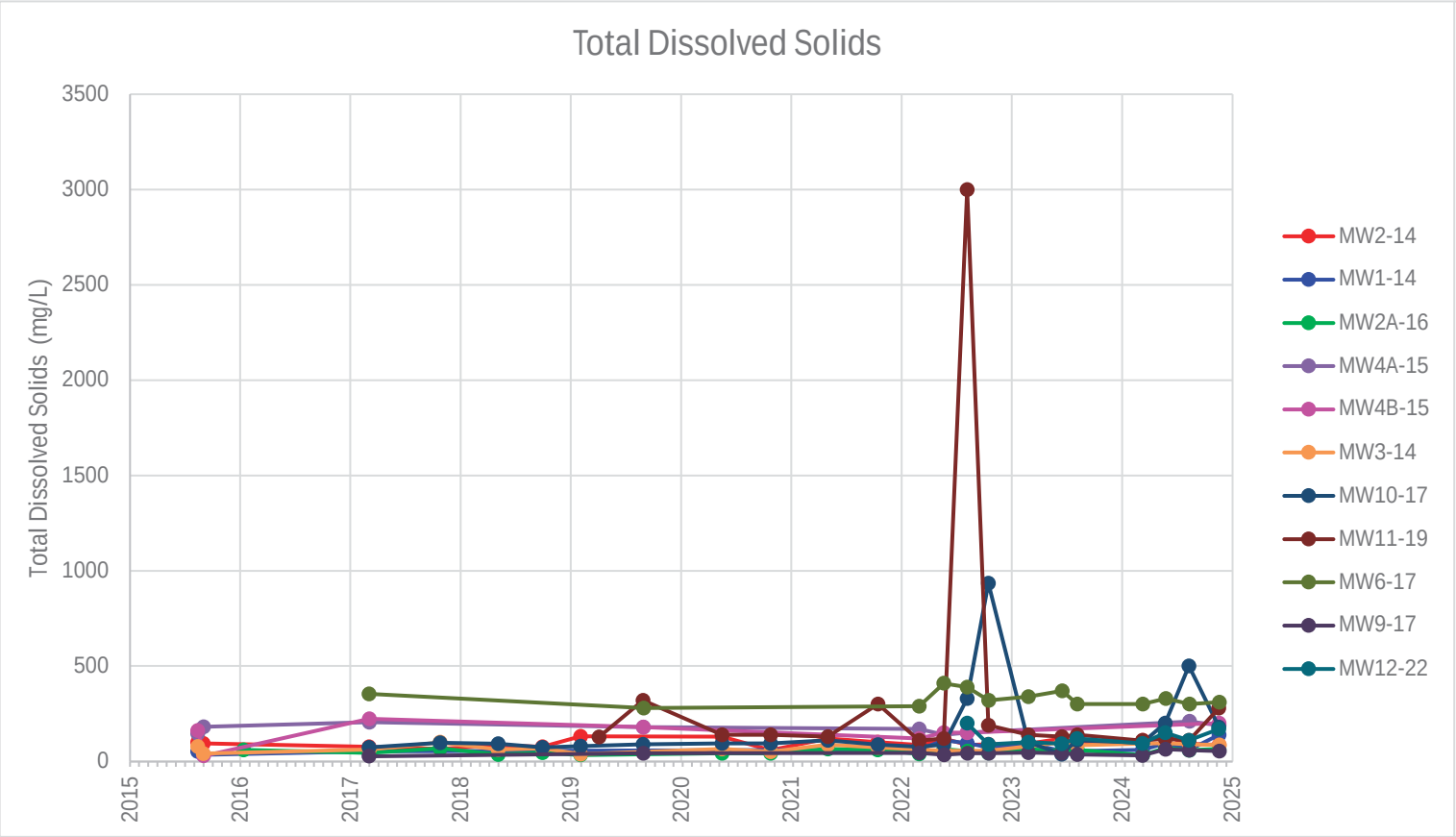

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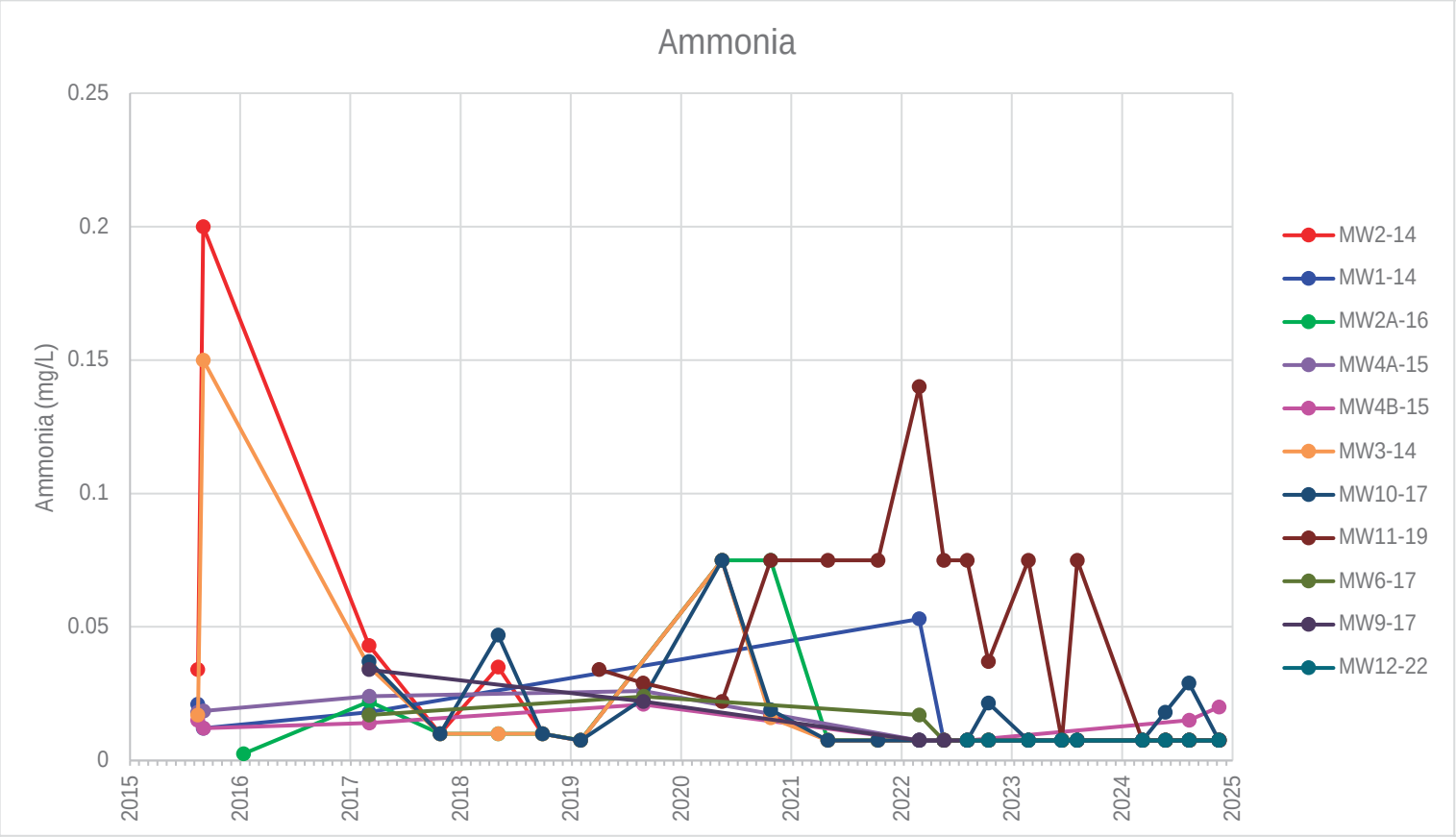

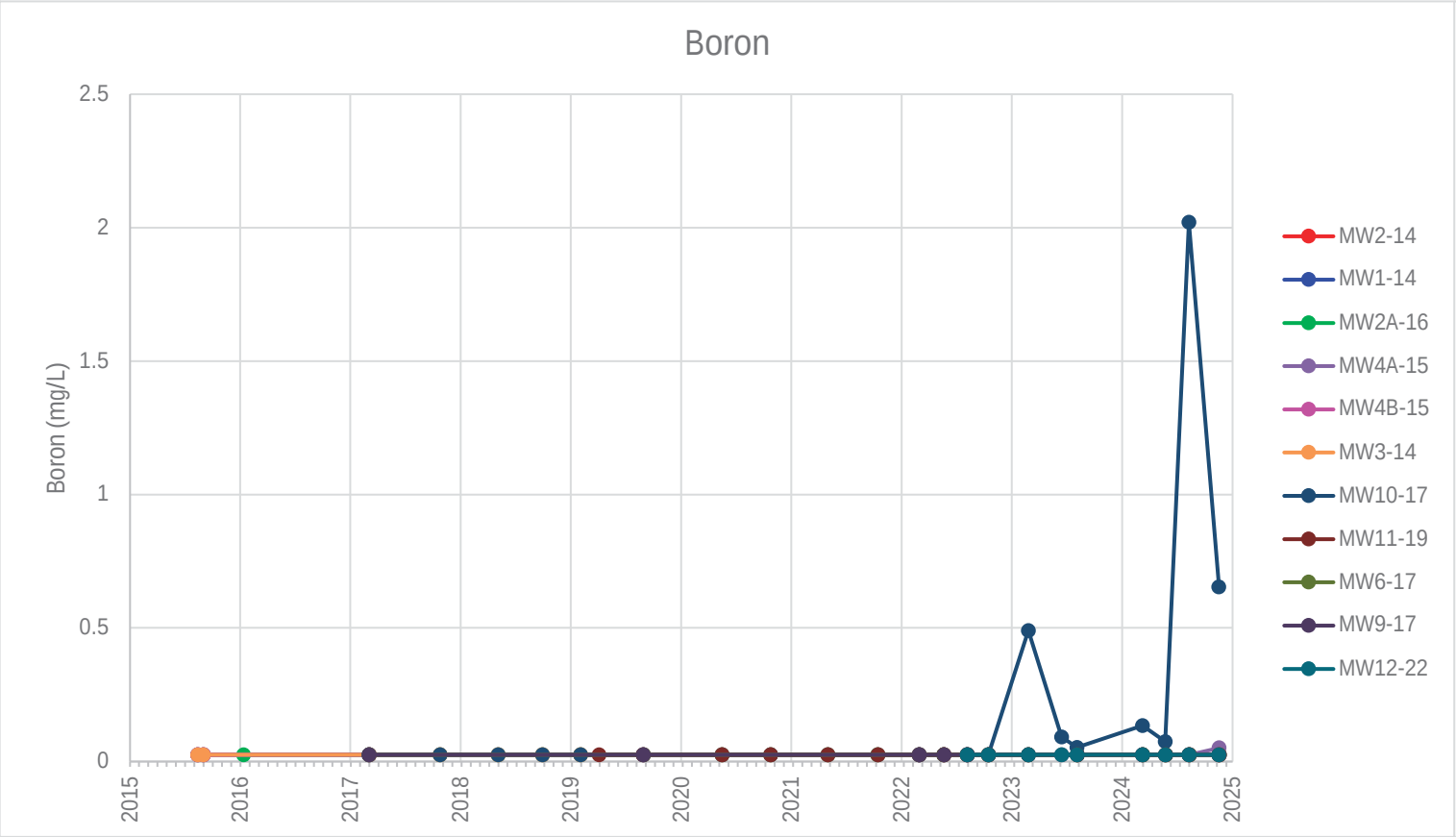

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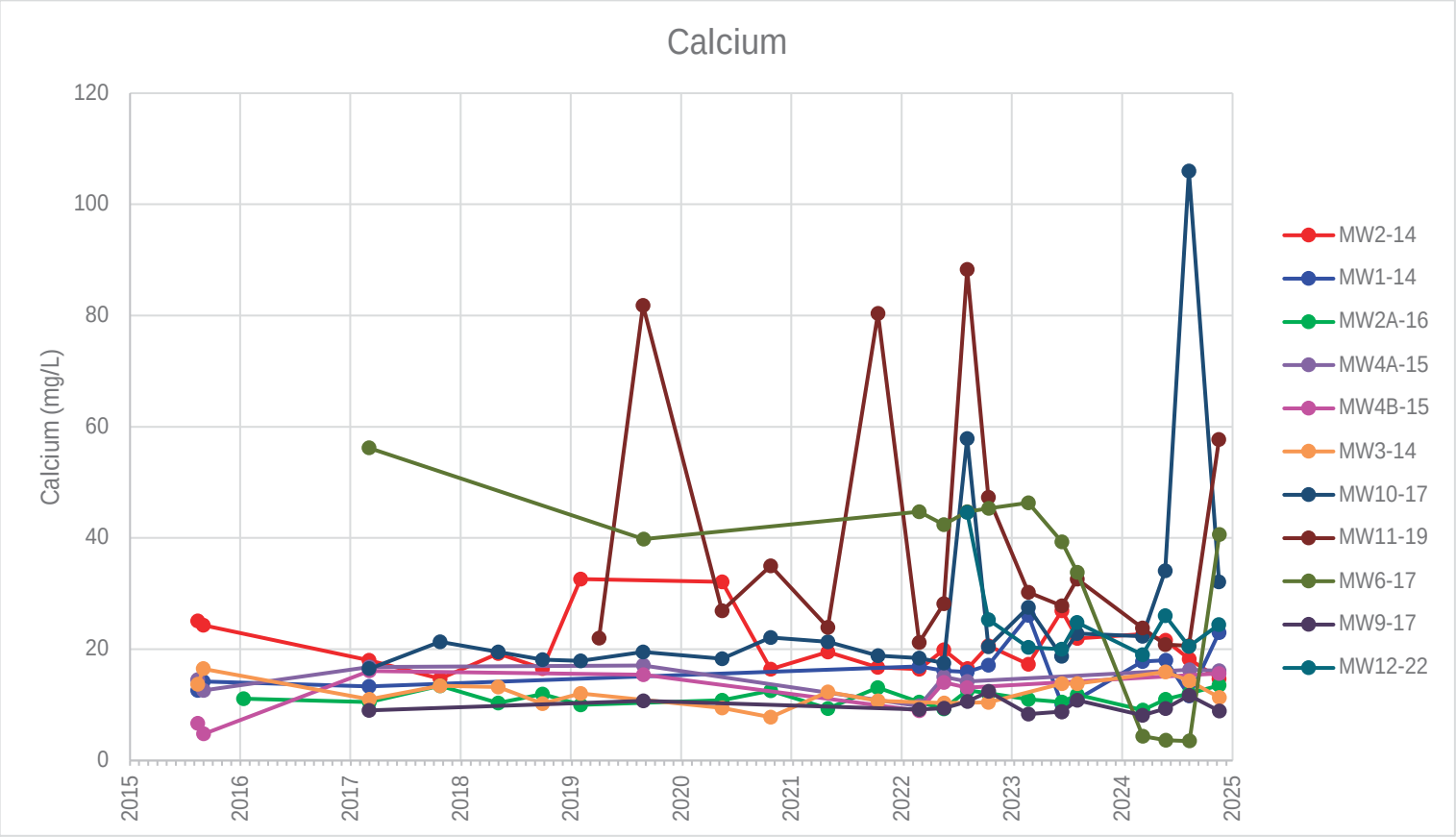

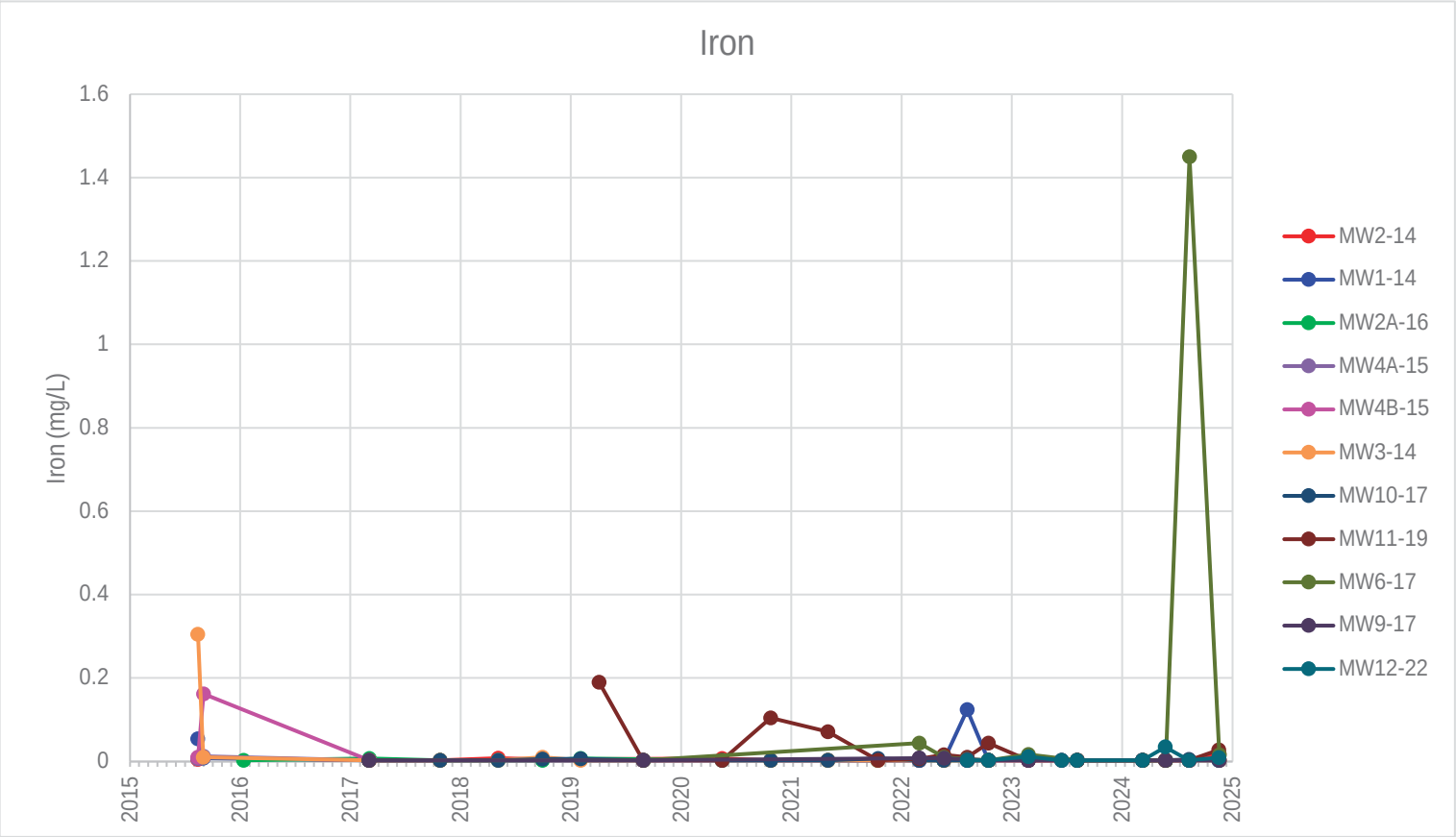

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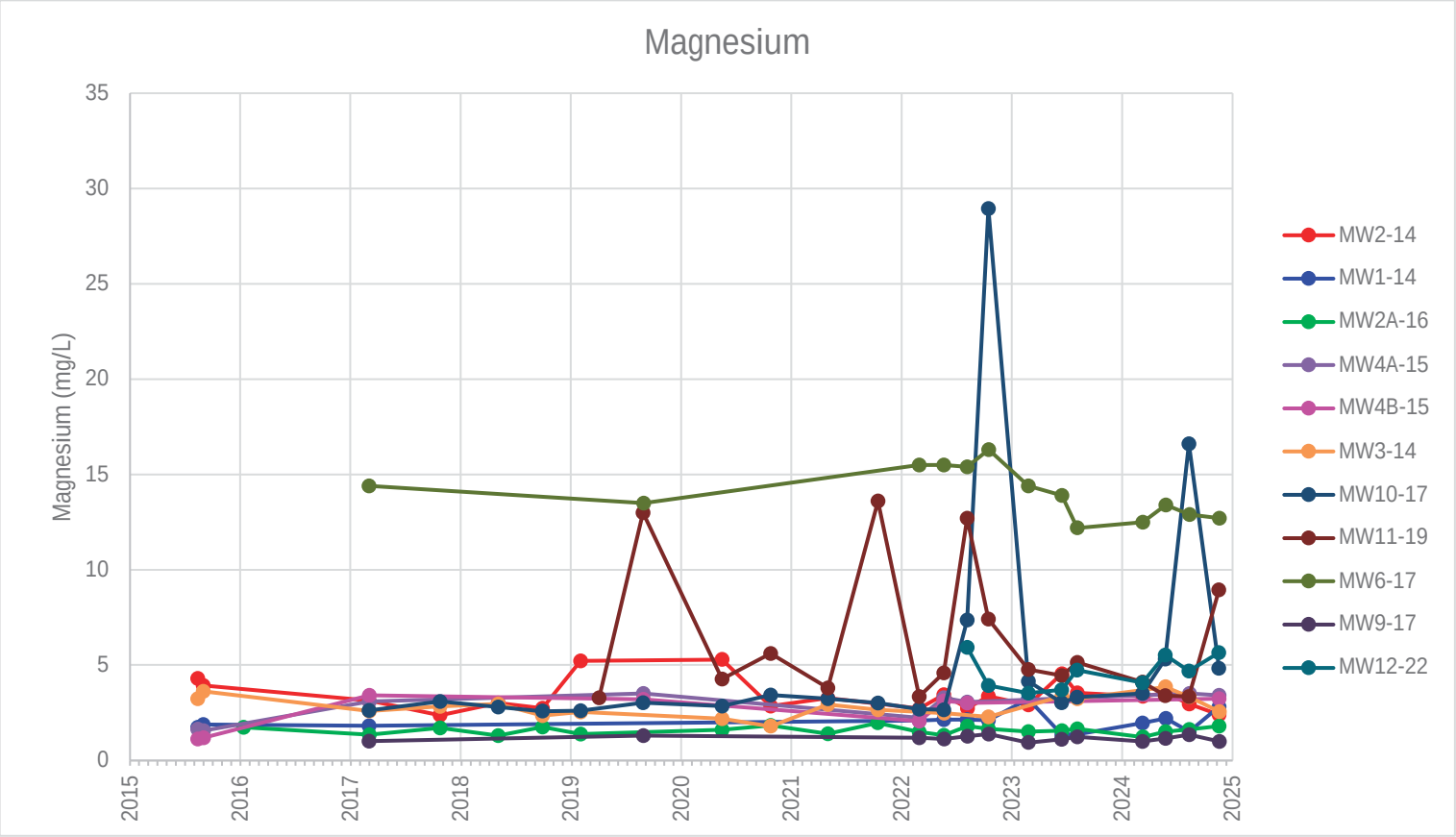

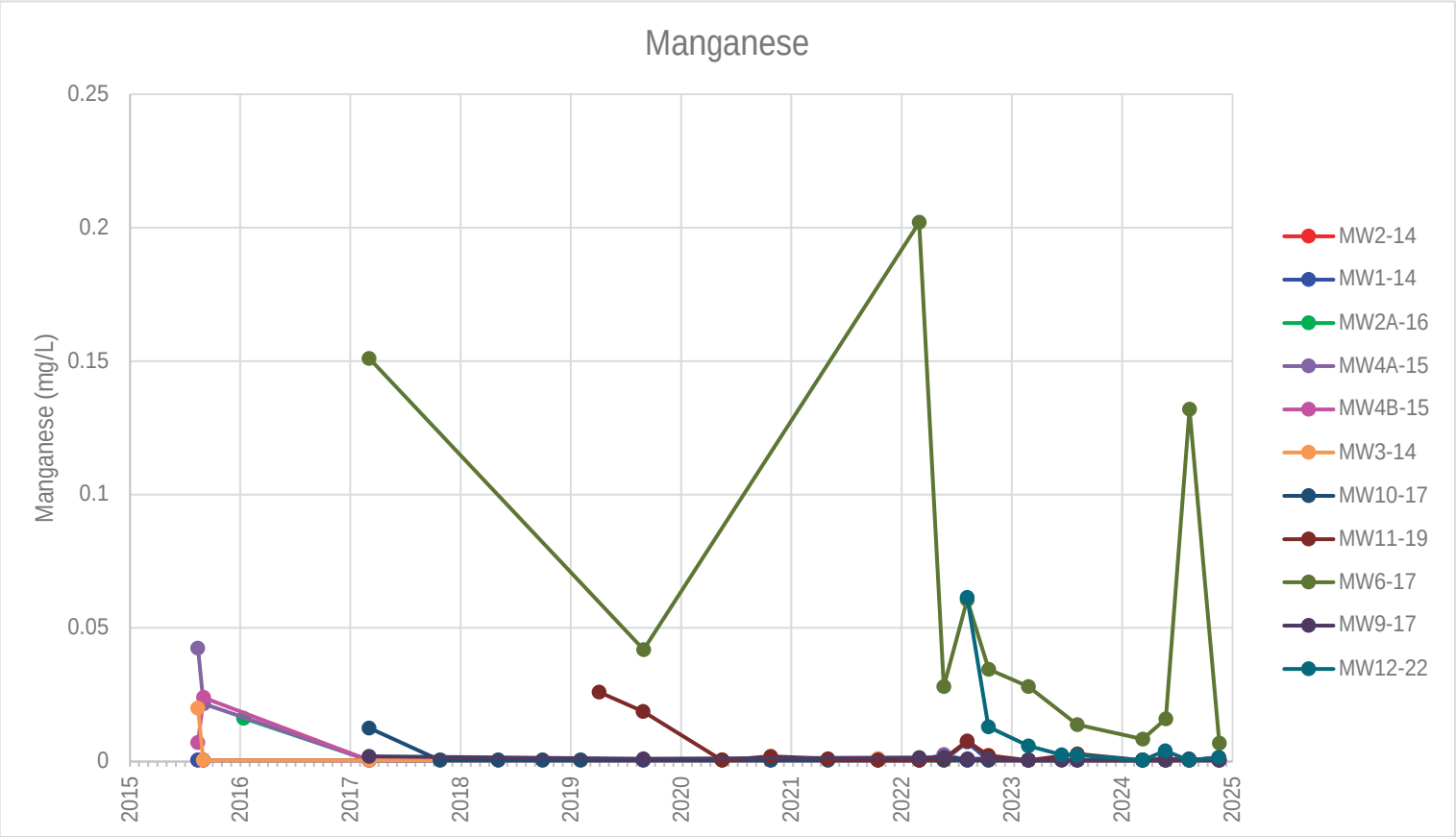

APPENDIX E:
EnviroChem 2024 Q4 Water Monitoring / Sampling Program Report

March 27, 2025
File No.: 24209
Revision: 1

Northwin Environmental Ltd.
7295 Gold River Highway
Campbell River, BC

Attn: Brian Fagan

Re: 2024 Q4 Water Monitoring / Sampling Program – New Landfill
7295 Gold River Highway, Campbell River, BC

1.0 INTRODUCTION

Northwin Environmental Ltd. (Northwin) retained Envirochem Services Inc. (Envirochem) to provide environmental consulting services related to annual groundwater, surface water, and leachate monitoring / sampling at an area designated as the New Landfill located at 7295 Gold River Highway, Campbell River, BC (the Site). A Site Location Map is presented on **Figure 1** in **Attachment 1**. A Site Plan is presented on **Figure 2**, with the New Landfill Site Plan as of January 29, 2025, shown on **Figure 3** in **Attachment 1**.

1.1 Project Understanding

Northwin operates a landfill consisting of two general areas at the Site: 1) an Original Landfill (closed) and 2) a New Landfill (operational – refer to **Figures 2 and 3** in **Attachment 1**). The New Landfill has been in operation since 2019 and is the subject of this report. At the New Landfill, Northwin is authorized to discharge wastes under the provincial Ministry of Environment and Parks (BC ENV) Operational Certificate 107689 (Permit) and 2021 Design, Operations and Closure Plan (DOCP).[1] The authorized characteristics of the waste discharges under the Permit include: construction and demolition (C&D) waste; land clearing waste; industrial (IL) waste quality soil (i.e., soil concentrations greater than provincial IL quality standards and less than hazardous waste standards) (amended on April 26, 2022); sludge from leachate management works or stormwater management works; and other wastes as may be authorized by BC ENV.

It is understood that Sperling Hansen Associates Inc. (SHA) has been retained by Northwin to oversee the overall annual operations and monitoring program (the Program) for the Site. Envirochem's role within the project team is to support SHA by monitoring various groundwater, surface water, and leachate sampling points (refer to **Figure 4** in **Attachment 1**) and collecting measurements and samples from those locations, where applicable, to satisfy the requirements of the Permit / DOCP. It is also understood that Envirochem's findings (i.e., this report) will be incorporated into the annual operations and monitoring report for the Site prepared by SHA.

[1] *2021 Design, Operations and Closure Plan, Northwin Landfill, Upland Pit Property, Campbell River, British Columbia* prepared by GHD, dated July 8, 2021.

In its 2024 Environmental Monitoring Program Specification (2024 Specification)[2], GHD outlined the monitoring / sampling program for each quarter in 2024. GHD completed the 2024 Q1, Q2, and Q3[3] monitoring / sampling activities in general conformance with the 2024 Specification. Envirochem was retained to fulfil the 2024 Q4 groundwater, surface water, and leachate monitoring / sampling program laid out in the 2024 Specification.

1.2 Objectives

Based on our understanding of the project requirements, Envirochem interprets its objectives for the 2024 Q4 portion of the Program to be as follows:

- To complete the specified 2024 Q4 water monitoring field activities as per the 2024 Specification.
- To provide a report of the field activities and associated monitoring / sampling results for incorporation into the 2024 operations and monitoring report for the Site, which is being prepared by SHA.

2.0 SCOPE OF WORK

To fulfil the project objectives, Envirochem completed the scope of work described below.

2.1 Monitoring Locations

The monitoring locations targeted during the 2024 Q4 monitoring / sampling program are summarized as follows:

Table 2-1: Monitoring Locations

Type	Monitoring Location Identifications				
Up-gradient Groundwater Monitoring Wells	MW1-14	MW4A-15	MW4B-15	MW6-17	MW9-17
Cross-gradient Groundwater Monitoring Wells	MW2-14	MW2A-16	-	-	-
Down-Gradient Groundwater Monitoring Wells	MW3-14	MW10-17	MW11-19	MW12-22	MW13 [1]
Additional Groundwater Monitoring Wells [2]	MW5A-15	MW5B-15	MW7-17	MW8-17	MW15A-18
	MW15B-18	PZ1-19	-	-	-

[2] Appendix J in GHD's *2023 Operations and Monitoring Report, New Landfill* report dated March 27, 2024.
[3] Quarterly monitoring events have typically occurred in March/April (Q1), June (Q2), August/September (Q3), and November (Q4).

Type	Monitoring Location Identifications				
Surface Water	Rico Gauge	McIvor Lake	SW15-01	SW15-02	-
Leachate	S06-21	S07-24	TLIP	-	-
Leak Detection	LDS	LDMP-1	LDMP-2	LDMP-3	LDMP-4

Table 2-1 Notes:

1. Monitoring well MW13 has yet to be installed.
2. Water level measurements only. No samples to be taken.

2.2 Monitoring Activities

The following monitoring activities were completed during the 2024 Q4 monitoring / sampling program:

- Water level measurements were collected at all monitoring locations listed in **Table 2-1**, above, with the exception of the locations identified as Additional Groundwater Monitoring Wells.
  - Water level measurements for monitoring well locations and select leak detection locations were taken using a Heron Instruments water level meter.
  - Water level measurements for surface water locations were taken as follows:
    - McIvor Lake (SW15-01) – water level for Ladore Dam obtained on day of monitoring using the following link:

      https://www.bchydro.com/energy-in-bc/operations/transmission-reservoir-data/previous-reservoir-elevations/vancouver_island/ladore_ldr.html
    - Rico Gauge (SW15-02) – existing gauge at monitoring location.
- Field parameter measurements were collected at all groundwater, surface water, leachate, and leak detection monitoring locations listed in **Table 2-1**, above, excluding the locations identified as Additional Groundwater Monitoring Wells.
  - Parameters measured in the field included:
    - conductivity (µS/cm)
    - dissolved oxygen (mg/L)
    - oxidation reduction potential (mV)
    - pH
    - temperature (°C)
    - total dissolved solids (TDS, mg/L)
    - turbidity (NTU)
- Samples were collected from those groundwater, surface water, leachate, and leak detection monitoring locations listed in **Table 2-1**, above, which contained sufficient water for sampling, excluding the locations identified as Additional Groundwater Monitoring Wells.
  - Chemical parameters analyzed in the laboratory:
    - General Chemistry (all monitoring locations):

    - Alkalinity (speciated)
    - Conductivity
    - Chloride
    - Sulphate
    - Total sulphide (low level) + H_2S calculation
    - Total sulphide, un-ionized (as H_2S) (calc)
    - Nitrate (as N)
    - Nitrite (as N)
    - Nitrite/Nitrate (N+N)
    - Orthophosphate
    - TDS (excluding surface water monitoring locations)
- General Chemistry (surface water, leachate, and leak detection monitoring locations only):
    - Total suspended solids (TSS)
- General Chemistry (leachate and leak detection monitoring locations only):
    - Biochemical oxygen demand (BOD5)
    - Chemical oxygen demand (COD)
- Nutrients (all monitoring locations):
    - Ammonia nitrogen
- Metals (groundwater monitoring locations only):
    - Dissolved metals, including mercury (BC Contaminated Sites Regulation list)
    - Dissolved hardness (as $CaCO_3$)
- Metals (surface water, leachate, and leak detection monitoring locations only):
    - Total metals, including mercury (BC CSR list)
    - Dissolved hardness (as $CaCO_3$)
- Other
    - Groundwater, leachate, and leak detection monitoring locations only:
        - Light and heavy extractable petroleum hydrocarbons (LEPH, HEPH) (incl. EPH)
        - Polycyclic aromatic hydrocarbons (PAH)
    - Leachate and leak detection monitoring locations only:
        - Benzene, toluene, ethylbenzene, xylenes (BTEX)
        - Volatile petroleum hydrocarbons (VPH)
        - Chlorinate phenols
        - Non-chlorinated phenols
        - Nitrophenols

- Hydroxy phenols

Collected samples were submitted under chain of custody to Bureau Veritas (BV) on a standard 5-7 business day turnaround time (TAT).

Quality assurance / quality control (QA/QC) samples, including field blank(s), trip blank(s) (volatile substances only), and field duplicates were submitted to supplement Q1-Q3 QA/QC samples such that an overall annual frequency of approximately 20% was achieved.

Analytical results for all water / leachate samples were tabulated and compared to the BC Contaminated Sites Regulation (BC CSR) drinking water (DW) quality standards.

Landfill gas in soil monitoring at monitoring locations LFG1-22 and LFG2-22 was not included in the scope of work for 2024 Q4. Based on conversations with Northwin, this work will be completed by others.

3.0 METHODOLOGY

3.1 Sample Collection

Envirochem conducted field activities for the Q4 program on December 20, 2024, and January 17 and 24, 2025. Due to various factors, supplemental site visits targeting sampling locations S06-21, SW15-01, and/or SW15-02 were conducted in January 2025 to ensure the full complement of 2024 Q4 analyses were performed.

Monitoring / sampling activities were completed in general conformance with the BC Field Sampling Manual.[4]

- Groundwater samples were collected from the targeted monitoring wells using a low flow (i.e., minimal drawdown) groundwater sampling procedure. Implementation of this groundwater sample collection technique was intended to increase the representativeness of the data generated during the investigation.

  Due to the depth of the wells, HDPE tubing with inertial foot valves coupled with a Waterra Hydrolift actuator were used to extract groundwater from the monitoring wells. A YSI multiparameter water quality instrument with flow-through cell was used to monitor groundwater characteristics.

  The tubing was inserted at approximately the mid-point of the saturated screened interval. Groundwater was purged at a rate that minimized drawdown (i.e., pump typically set to lowest setting) until such time that the groundwater characteristics stabilized (i.e., pH within +/-0.1, conductivity within +/- 3%, and temperature within +/- 0.2°C).

  Following stabilization, individual laboratory-supplied sample containers containing appropriate preservatives, as applicable, were filled directly from the tubing.

- Surface water samples were collected by slowly submerging a 1 L, laboratory-supplied container approximately 30 cm below the surface of the water. Individual laboratory-supplied

[4] BC Ministry of Environment and Climate Change Strategy (2020). *British Columbia Field Sampling Manual for Continuous Monitoring Plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples*. https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual

sample containers containing appropriate preservatives, as applicable, were filled by decanting water from the recently submerged / filled 1 L container.

- Leachate samples (i.e., S06-21) were collected directly from the leachate sump (i.e., via pump / tap) into individual laboratory-supplied sample containers containing appropriate preservatives, as applicable.
- An in-line 0.45 µm filter was used during the collection of samples for dissolved metals analysis.
- All equipment and tubing placed into the monitoring well was single-use and dedicated to the well. Equipment and water / leachate samples were handled with dedicated nitrile gloves.
- Collected water / leachate samples were placed in a cooler containing ice packs and delivered under chain of custody documentation to the project laboratory.

3.2 QA/QC Samples

A quality assurance / quality control (QA/QC) program was implemented as part of the 2024 Q4 in an effort to ensure that the groundwater samples collected from the Site were representative of actual site conditions. The QA/QC program, consisting of well-documented sample collection, storage, and transportation procedures, provides a record of any deviation from the methodologies described above. This provides a measure of confidence in the data being collected and used to draw conclusions regarding potential environmental impacts at a site. For this investigation, the field QA/QC program consisted of the following:

- Protocols designed to reduce the incidents of cross-contamination of samples during the field work including replacing chemical resistant nitrile gloves after collecting each sample and utilizing dedicated and disposable single-use sampling equipment.
- Detailed records of all aspects of the sampling program (e.g., field notes and chain-of-custody forms) and noting any deviations that could potentially cause sampling bias.
- Collection of samples in clean laboratory supplied jars and bottles. Proper labelling of samples for identification and storage of sample containers in coolers during field work and transportation.
- Submission of samples under chain-of-custody to a laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA), that is qualified to analyze the samples using BC ENV approved procedures.
- Adherence to laboratory sampling and analysis protocols (e.g., hold times, detection limits, approved methodology).
- Quality assurance / quality control (QA/QC) samples, including field blank(s), trip blank(s) (volatile substances only), and/or field duplicates were submitted to supplement Q1-Q3 QA/QC samples such that an overall annual frequency of approximately 20% was achieved.
  - Field duplicates:
    - MW2A-16 / MW2A-16 DUP (December 19, 2024).
    - MW9-17 / MW9-17 DUP (December 19, 2024).
    - S06-21 / S06-21 DUP (January 14, 2025).

    - S06-21 / S06-21 DUP (January 27, 2025).
  - Trip blanks:
    - TRIP BLANK (January 14, 2025).

In addition, the project laboratory followed its independent internal QA/QC program in which samples were replicated and analyzed and the results compared. The laboratories provide details of their QA/QC procedures and findings in the Laboratory Certificates of Analysis, which are presented in **Attachment C**.

4.0 WATER QUALITY CRITERIA

4.1 Groundwater Quality Criteria

In British Columbia, environmental standards are governed by the *Contaminated Sites Regulation* (CSR), which makes up a component of the *Environmental Management Act* (EMA). The standards prescribed in the CSR are dependent on the land use of the Site and the uses of groundwater beneath the Site. Based on information provided in prior reports by GHD, the following standards were applied at the Site:

- Schedule 3.2 – Generic Numerical Water Standards, Column 6: Drinking Water (DW).

Envirochem notes that groundwater at the Site is not currently being used for drinking water. However, as outlined in BC ENV Protocol 21, drinking water use standards (based on potential future requirements) must be considered applicable by default unless site conditions warrant their exclusion. To prove that drinking water standards do not apply according to BC ENV requirements, additional work would be required at the Site (e.g., hydraulic response testing).

Aquatic life, irrigation, and livestock standards in the CSR were excluded previously by GHD based on the following rationales:

- GHD completed an aquatic life assessment (as described in its 2023 Operations and Monitoring Report for the Site, which cites a Hydrogeology and Hydrology Characterization Report (HHCR), dated May 27, 2016, and last amended May 4, 2021) that established groundwater from the Site does not discharge into a surface water body located within 500 m of the Site. Aquatic life standards were excluded on this basis.
- There are no known agricultural activities (i.e., no groundwater extraction points for irrigation / livestock watering) occurring within 500 m of the Site.

Iron and manganese were analyzed in all groundwater samples (including background locations), with the data presented herein, and evaluated against CSR Schedule 3.2 criteria for screening purposes only. Footnotes listed below the standards tables in CSR Schedule 3.2 indicate iron and manganese standards only apply at select properties where specified industrial / commercial uses listed in CSR Schedule 2 are occurring or have occurred. Based on available information, the Site's activities do not trigger the applicability of these standards.

In accordance with BC ENV Protocol 9, a local background concentration can be established by directly applying regional background concentration estimates provided by BC ENV for specified inorganic substances. The Site does not fall within any of the listed regional boundaries, so regional background

concentration estimates were not applied at the Site. Notwithstanding, the interim cobalt value of 20 μg/L remains in effect for the remaining regions of the province; this standard was applied at the Site rather than the default standard listed in CSR Schedule 3.2.

Based on the above rationale, the BC CSR DW standards were applied to the analytical groundwater quality results for the Site.

4.2 Surface Water and Leachate Quality Criteria

Although not directly applicable, CSR DW standards were also used to evaluate the analytical surface water and raw leachate quality results as preliminary screening criteria based on a continuation of the past monitoring program conducted by GHD. It is understood that this comparison would yield an indication whether surface water and/or leachate quality could potentially have an impact on the groundwater quality at the Site and whether additional actions or evaluation would be necessary. Again, for surface water, past hydrogeological studies by others indicate the landfill would not flow to the nearby surface water bodies being sampled as part of the monitoring program.

5.0 RESULTS & DISCUSSION

5.1 Water Level Monitoring

Monitoring wells were inspected for depth to groundwater on December 18-20, 2024. Surface water elevations were recorded on January 27, 2025. **Table 1** in **Attachment B** lists the water level measurements and corresponding elevations.

Hydraulic monitoring records for 2024 Q1-Q3 monitoring periods conducted by GHD were not available to Envirochem prior to preparation of this report. Therefore, this information is not included in **Table 1** in **Attachment B**. Additionally, all leak detection monitoring points (i.e., LDS, LDMP-1 to LDMP-4) were dry in 2024 Q4.

Based on the information collected, and communications with SHA, the inferred direction of groundwater flow, as interpreted by SHA, is towards the southeast (i.e., from McIvor Lake towards the southeast corner of the Site). This groundwater flow direction is consistent with historical results. Refer to **Figure 5** in **Attachment A** for a depiction of the inferred groundwater elevation contours and groundwater flow direction, and refer to the 2024 operations and monitoring report for further interpretation and details.

5.2 Leachate Quality

Envirochem collected samples from the raw leachate sump (i.e., sampling point S06-21) on December 20, 2024, and January 14 and 27, 2025. Multiple sampling events were needed to ensure all parameters were accounted for as there were logistical and laboratory communication challenges during the 2024 Q4 program. GHD also collected leachate samples from S06-21 during the 2024 Q1-Q3 monitoring periods. Treated leachate (i.e., sampling point TLIP) was not sampled during the 2024 Q1-Q4 field program.

Analytical results for the leachate samples collected from S06-21 for all 2024 monitoring periods are presented on **Table 2** in **Attachment B**. Although not applicable to leachate, the analytical results were compared to BC CSR DW groundwater standards. Leachate quality concentrations that were measured at levels greater than the BC CSR DW standards are highlighted red. For instances where the laboratory

detection limits were greater than the BC CSR DW standards, those concentrations are highlighted blue. As would be expected for raw leachate, several substance concentrations were measured at levels greater than the BC CSR DW standards.

A summary of the key leachate indicator parameter concentrations measured in leachate at S06-21 in 2024 are presented in **Table 5-1**, below. A summary of the 2023 concentrations as previously reported by GHD are also included for reference.

Table 5-1: 2024 Summary of Leachate Indicator Parameters in Leachate at S06-21

Leachate Indicator Parameter	Units	2023 Leachate Concentration Range (GHD, 2023)	2024 Leachate Concentration Range
ORP (field)	mV	(-376) – 60	(-317.2) – 174
TDS (lab)	mg/L	2,300 – 3,700	1,400 – 2,700
Hardness (dissolved)	mg/L	1,010 – 1,560	946 – 1,120
Conductivity (lab)	mg/L	3,200 – 4,400	2,300 – 3,800
Bicarbonate (total)	mg/L	31 – 1000	800 – 1,000
Alkalinity (total)	mg/L	26 – 840	650 – 820
Chloride (dissolved)	mg/L	190 – 310	120 – 290
Sulphate (dissolved)	mg/L	720 – 2,000	220 – 1,100
Sulphide as H_2S (total)	mg/L	0.020 – 13	0.010 – 14
Boron (total)	µg/L	1,240 – 12,200	6,850 – 15,900
Iron (total)	µg/L	1,970 – 26,500	249 – 3,280
Manganese (total)	µg/L	923 – 4,790	1,350 – 2,090
Sulphur (total)	µg/L	235,000 – 648,000	49,000 – 333,000
Total PAH	µg/L	4.0 – 4.2	1.1 – 29

The 2024 concentration ranges are generally consistent with those reported in 2023 GHD.

5.3 Leak Detection System Water Quality

All inspected leak detection monitoring points (i.e., LDS, LDMP-1 to LDMP-4) (between the primary base liner and secondary base liner) were dry in 2024 Q4. No analytical data was provided for these sampling points in the 2024 Q1-Q3 data provided by GHD.

Although there is no water data from the leak detection monitoring points from 2024 Q1-Q3, an inference could be made that the leak detection monitoring points were also dry for those monitoring periods based on the 2024 Q4 data obtained in the ‘wet’ season.

5.4 Groundwater Quality

Envirochem collected samples from the up-gradient (i.e., MW1-14, MW4A-15, MW4B-15, MW6-17, MW9-17), cross-gradient (i.e., MW2-14, MW2A-16), and down-gradient (i.e., MW3-14, MW10-17, MW11-19, MW12-22) on December 18-20, 2024. GHD also collected groundwater samples from the monitoring wells during the 2024 Q1-Q3 monitoring periods.

Analytical results for the groundwater samples collected during all 2024 monitoring periods are presented on **Table 3** in **Attachment B**. The analytical results were compared to BC CSR DW groundwater standards. Groundwater concentrations that were measured at levels greater than the BC CSR DW standards are highlighted red. There were no reported instances where the laboratory detection limits were greater than the BC CSR DW standards. A comparison of the analytical results with the applied reference criteria indicates all measured substance concentrations were reported at levels below the BC CSR DW standards, with the exception of the following exceedance:

- **Benzo(a)pyrene** - the concentration of benzo(a)pyrene (0.018 μg/L) measured in GHD groundwater sample WG-11222680-100424-KH-11 collected from MW6-17 in 2024 Q1 exceeded the BC CSR DW standard (0.01 μg/L).

This exceedance appears to be a false positive. The benzo(a)pyrene concentrations measured in the groundwater samples collected from MW6-17 during the Q2, Q3, and Q4 monitoring periods were all below the laboratory detection limit of 0.0050 μg/L and, therefore, below the BC CSR DW standard.

Additionally, the turbidity measured in the field for sample WG-11222680-100424-KH-11 collected at MW16-17, as reported by GHD, was somewhat elevated (i.e., highest turbidity level measured in 2024). Elevated turbidity can lead to “false positive” PAH concentrations in groundwater. As the benzo(a)pyrene concentrations in MW6-17 were below laboratory detection limits for all other 2024 monitoring periods, Envirochem infers this temporary increase in PAH concentration is unlikely indicative of contamination but, rather, an indication of elevated turbidity. Irrespective of this interpretation, MW6-17 is up-gradient of site operations and, therefore, not susceptible to contamination from those operations.

A summary of the key leachate indicator parameter concentrations measured in groundwater in 2024 are presented in **Table 5-2**, below.

Table 5-2: 2024 Summary of Leachate Indicator Parameters in Groundwater

Leachate Indicator Parameter	Units	Up-gradient Wells Concentration Range	Cross-gradient Wells Concentration Range	Down-gradient Wells Concentration Range
ORP (field)	mV	(-298) – 198	(-290) – 183	(-215) – 196
TDS (lab)	mg/L	32 – 330	34 – 130	86 – 500
Hardness (dissolved)	mg/L	24.2 – 161	27.6 – 70.5	38.7 - 334
Conductivity (lab)	mg/L	59 – 490	64 – 170	100 – 760
Bicarbonate (total)	mg/L	31 – 130	34 – 74	51 – 230
Alkalinity (total)	mg/L	26 – 110	28 – 61	42 – 190
Chloride (dissolved)	mg/L	<1.0 – 88	<1.0 – 11	<1.0 – 38

Leachate Indicator Parameter	Units	Up-gradient Wells Concentration Range	Cross-gradient Wells Concentration Range	Down-gradient Wells Concentration Range
Sulphate (dissolved)	mg/L	2.2 – 16	2.2 – 7.6	3.9 – 120
Sulphide as H_2S (total)	mg/L	<0.0020 – 0.019	<0.0020 – 0.014	<0.0020 – 0.019
Boron (dissolved)	μg/L	<50 – 51	<50	<50 – 2020
Iron (dissolved)	μg/L	<5.0 – 1450	<5.0 – 18.8	<5.0 – 34.9
Manganese (dissolved)	μg/L	<1.0 – 132	<1.0 – 1.3	<1.0 – 4.0
Sulphur (dissolved)	μg/L	<3,000 – 5,100	<3,000	<3,000 – 40,200
Total PAH	μg/L	<0.1 – 0.18	<0.1	<0.1

The 2024 concentration ranges are generally consistent with those reported in 2023 by GHD. However, Envirochem offers the following comments with respect to select parameters:

- **Negative ORP measurements in Q4** – measurement of negative ORP values in the monitoring wells during the Q4 monitoring period is inconsistent with past results and expected values. Envirochem suspects this inconsistency is due to an issue with equipment calibration by the supplier rather than an indicator of a potential problem at the Site.
- **Elevated iron and manganese concentrations at MW6-17 in Q3** – when the Q3 concentrations of iron and manganese at MW6-17 (1,450 μg/L and 132 μg/L, respectively) are excluded, the concentration ranges for up-gradient wells (<5.0 μg/L for iron at all sampling points and <1.0 – 15.9 μg/L for manganese) are more consistent with the reported 2023 ranges (<5.0 – 7.3 μg/L for iron and <1.0 – 28.1 μg/L for manganese). As the iron and manganese concentrations at MW6-17 returned to historically typical levels in Q4, there does not appear to be cause for action at present.
- **Elevated boron and sulphur concentrations at MW10-17 in Q3** – when the Q3 concentrations of boron and sulphur at MW10-17 (2,020 μg/L and 40,200 μg/L, respectively) are excluded, the concentration ranges for down-gradient wells (<50 – 654 μg/L for boron and <3,000 – 6,800 μg/L for sulphur) are more consistent with the reported 2023 ranges (<50 – 171 μg/L for boron and <3,000 – 16,400 μg/L for sulphur). As the boron and sulphur concentrations at MW10-17 returned to historically typical levels in Q4, there does not appear to be cause for action at present.

5.5 Surface Water Quality

GHD's 2023 Operations and Monitoring Report for the Site references a Hydrogeology and Hydrology Characterization Report (HHCR) previously conducted by GHD in 2016 (amended 2021), which interpreted that both McIvor Lake and Rico Lake are not receptors of groundwater discharge from the Site. However, as Rico Lake discharges to McIvor Lake and McIvor Lake recharges the sand and gravel aquifer beneath the Site, the surface water quality in these up-gradient water bodies assists with understanding overall water conditions at the Site.

Envirochem collected samples from the surface water sampling station (i.e., SW15-01 (McIvor Lake) and SW15-02 (Rico Lake)) on December 20, 2024, and January 27, 2025. Multiple sampling events were needed to ensure all parameters were accounted for as there were logistical and laboratory communication challenges during the 2024 Q4 program. GHD also collected a surface water sample from SW16-03 during the 2024 Q1 monitoring period. The location of SW16-03 is described as the bottom of the south road just outside the landfill footprint; however, the exact location of this sampling point is presently unknown as it does not appear on the site plans provided in prior GHD reports for the Site.

Analytical results for the surface water samples collected during all 2024 monitoring periods are presented on **Table 4** in **Attachment B**. Although not applicable to surface water, the analytical results were compared to BC CSR DW groundwater standards. A comparison of the analytical results with the applied reference criteria indicates all measured substance concentrations were reported at levels below the BC CSR DW standards. There were no reported instances where the laboratory detection limits were greater than the BC CSR DW standards.

A summary of the key leachate indicator parameter concentrations measured in surface water at SW15-01 and SW15-02 in 2024 are presented in **Table 5-3**, below.

Table 5-3: 2024 Summary of Leachate Indicator Parameters in Surface Water (SW15-01 / SW15-02)

Leachate Indicator Parameter	Units	Up-gradient GW Concentration Range	SW15-01 (McIvor Lake) Concentration Range	SW15-02 (Rico Lake) Concentration Range
ORP (field)	mV	(-298) – 198	119	86.7
TDS (lab)	mg/L	32 – 330	-	-
Hardness (dissolved)	mg/L	24.2 – 161	21.8	18.7
Conductivity (lab)	mg/L	59 – 490	37	63
Bicarbonate (total)	mg/L	31 – 130	13	22
Alkalinity (total)	mg/L	26 – 110	10	18
Chloride (dissolved)	mg/L	<1.0 – 88	2.2	4.6
Sulphate (dissolved)	mg/L	2.2 – 16	<1.0	1.1
Sulphide as H_2S (total)	mg/L	<0.0020 – 0.019	<0.0020	<0.0020
Boron (total)	µg/L	<50 – 51	<50	<50
Iron (total)	µg/L	<5.0 – 1450	21	182
Manganese (total)	µg/L	<1.0 – 132	2.5	8.8
Sulphur (total)	µg/L	<3,000 – 5,100	<3,000	<3,000
Total PAH	µg/L	<0.1 – 0.18	-	-

The 2024 concentrations are generally consistent with those reported in 2023 by GHD.

5.6 Quality Assurance / Quality Control Samples

Overall, for the 2024 monitoring period, QA/QC samples were collected at a rate of approximately 20%. A total of 10 field duplicates and 1 trip blank were collected during the 2024 monitoring period. A field blank was listed in the 2024 Specification for collection in Q3; however, it is unclear from the information provided by GHD whether this sample was collected / analyzed. Notwithstanding, there appears to be sufficient QA/QC data to conclude that the analytical data collected is reliable:

- The trip blank (i.e. TRIP BLANK) was collected by Envirochem on January 14, 2025, and analyzed for volatile substances (i.e., BTEX, MTBE, styrene, VPH). All substance concentrations were reported below the laboratory detection limit. The analytical results are shown on the Laboratory Certificates of Analysis, which are presented in **Attachment C**.

- The analytical results for the field duplicate samples are presented on **Tables 2 and 3** in **Attachment B**, shaded grey. The Laboratory Certificates of Analysis for field duplicates collected by Envirochem are presented in **Attachment C**. In accordance with the BC Field Sampling Manual, Envirochem applied a data quality objective (DQO) of 50% (i.e., indicative of “a definite problem”) to the variance between original / duplicate sample pairs, as measured using relative percent difference (RPD). All calculated RPDs were less than 50%, with the exception of the following:

    - An RPD of 81% was calculated for the orthophosphate concentrations in leachate sample pair WL-11222680-120924-DT-01 / WL-11222680-120924-DT-02 collected by GHD from sampling point S06-21 in 2024 Q3. Potential reasons for the variance are unclear as Envirochem was not able to review field notes for the GHD Q3 sampling event and RPDs for all other parameters are well below the applied DQO.

    - An RPD of 103% was calculated for the dissolved aluminum concentrations in groundwater sample pair WG-11222680-110924-DT-06 / WG-11222680-110924-DT-07 collected by GHD from monitoring well MW2A-16 in 2024 Q3. As both the original and duplicate dissolved aluminum concentrations (3.6 μg/L and 11.3 μg/L, respectively) are less than five times the detection limit of 3.0 μg/L, larger variance can be expected. Additionally, as the measured concentrations are two orders of magnitude less than the BC CSR DW standard (9,500 μg/L), the variance does not alter the conclusions of this report with respect to groundwater quality.

6.0 CONCLUSIONS

Following completion of the 2024 Q4 monitoring / sampling program, Envirochem offers the following conclusions based on a review of the analytical data:

- **Water Levels and Groundwater Flow**: Water levels as measured in 2024 appear consistent with historical measurements. See **Table 1** in **Attachment B**.
- **Leachate Quality**: Select parameters were measured in leachate samples at concentrations greater than BC CSR DW standards (screening level criteria), which is to be expected in raw leachate derived from a landfill system. The substance concentration ranges appear to be consistent with historical levels as reported by GHD in 2023. See **Table 2** in **Attachment B**.
- **Leak Detection System Water Quality**: The leachate detection system inspection points were all dry during the 2024 monitoring period. The absence of water within the leak detection system inspection points suggests the landfill liners are functioning as intended.
- **Groundwater Quality**: With the exception of a single benzo(a)pyrene concentration measured in GHD groundwater sample WG-11222680-100424-KH-11 collected from MW6-17 in 2024 Q1, which was likely attributable to elevated turbidity in the sample, all reported substance concentrations in groundwater were below the BS CSR DW standards and generally consistent with 2023 levels. See **Table 3** in **Attachment B**.
- **Surface Water Quality:** A comparison of the surface water analytical results with the applied reference criteria indicates all measured substance concentrations were reported at levels below the BC CSR DW standards and at levels consistent with reported 2023 data. See **Table 4** in **Attachment B**.

This report is intended to support the 2024 operations and monitoring report being prepared by SHA. Limited interpretation and evaluation of data is presented herein.

7.0 CLOSURE

We trust this report meets your current requirements. If you have any questions or comments regarding this report, please contact the undersigned. The limitations of this report are presented in **Attachment D**.

Yours truly,

Envirochem Services Inc.
EGBC Permit to Practice No. 1002708

27-MAR-2025

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Senior Environmental Engineer

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Contributions by: Darryl Stowe, P.Chem.

Attachments:

Attachment A – Figures
Attachment B – Analytical Tables
Attachment C – Laboratory Certificates of Analysis
Attachment D – Limitations

File: 24209\9-Report\2024 Q4\2025-03-27_rep_24209_Northwin_2024Q4WaterSampling_Final_rev01

ATTACHMENT A

Figures

X:\PRJ\PRJ24\PRJ24074 - NORTHWIN LANDFILL 2024 ENGINEERING\06_AUTOCAD DRAWINGS\01_DRAWINGS\PRJ24074 SITE LOCATION MAP.DWG

SPERLING HANSEN ASSOCIATES

Landfill Services Group
- Landfill Siting
- Design & Operations Plans
- Landfill Closure
- Environmental Monitoring

#8 - 1225 Keith Road East
North Vancouver, B.C. V7J 1J3
Phone: (604) 986-7723

LEGEND:

- UTM GRIDLINE
- PROPERTY BOUNDARY
- ROAD

CLIENT: NORTHWIN

PROJECT: NORTHWIN LANDFILLL 2024 ENGINEERING

TITLE: SITE LOCATION MAP

SCALE:	DATE:	PROJECT NO:
1:40,000	2025/03/11 yyyy/mm/dd	PRJ 24074
DESIGNED	-	DRAWING NO:
DRAWN	NL	FIGURE 1
CHECKED	TS	

SPERLING HANSEN ASSOCIATES

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LEGEND:
- UTM GRID LINE
- CONTOUR - EXISTING (5m)
- PROPERTY BOUNDARY
- LEACHATE TREATMENT SYSTEM
- LANDFILL BASE LINER EXTENTS
- SURVEY CONTROL POINT

TOPO SURFACE SURVEYED JANUARY 29, 2025 BY NORTHWIN. UTM83-10N / GEOID UNKNOWN

SITE ORTHO IMAGE BY NORTHWIN - JAN 29, 2025
OTHER IMAGE BY BING MAPS

CLIENT: NORTHWIN

PROJECT: NORTHWIN LANDFILLL 2024 ENGINEERING

TITLE: SITE PLAN

SCALE:	DATE:	PROJECT NO:
1:3000	2025/03/11 yyyy/mm/dd	PRJ 24074
DESIGNED	-	DRAWING NO:
DRAWN	NL	FIGURE 2
CHECKED	TS	

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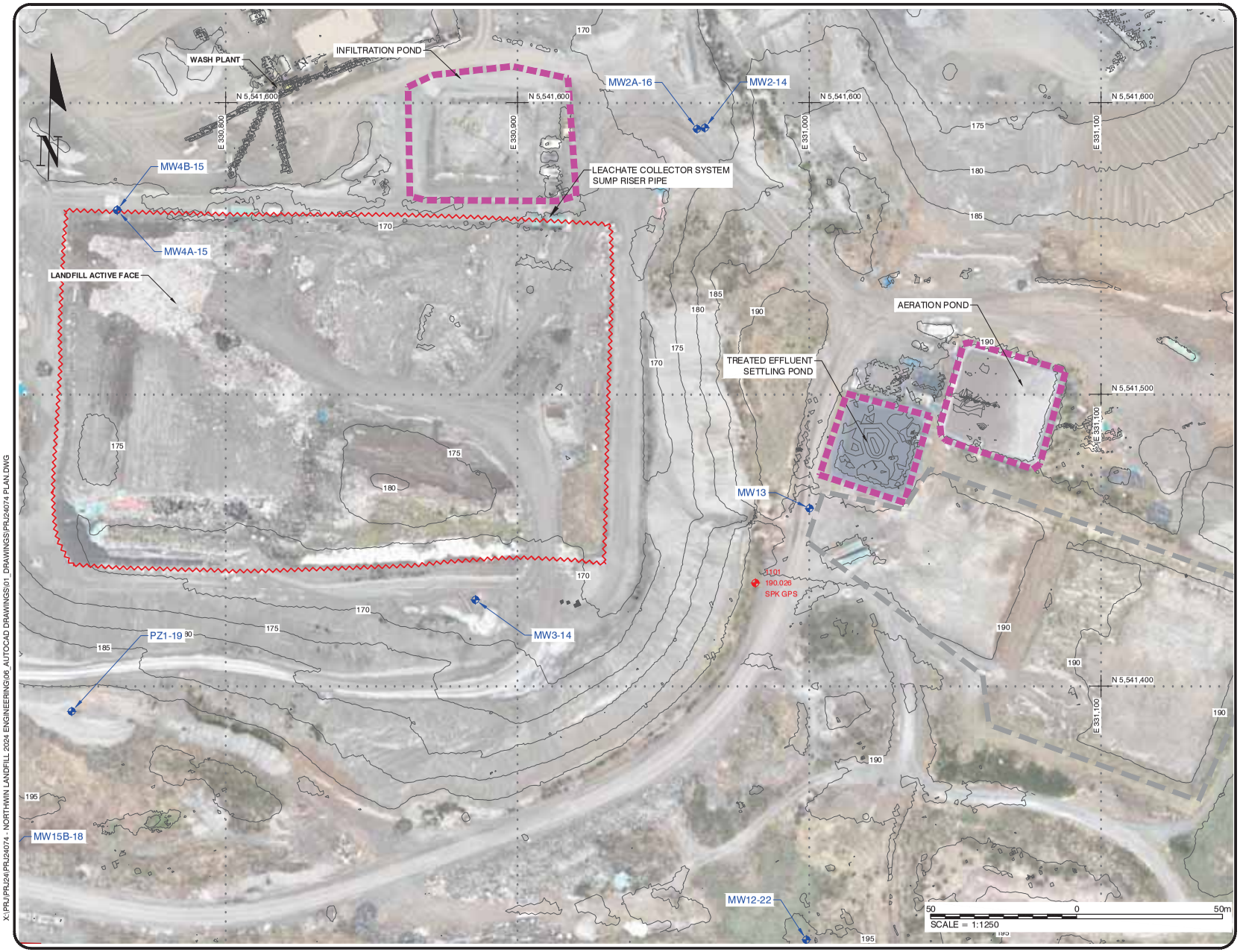

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- Design & Operations Plans
- Landfill Closure
- Environmental Monitoring

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LEGEND:

- UTM GRID LINE
- CONTOUR - EXISTING (5m)
- PROPERTY BOUNDARY
- LEACHATE TREATMENT SYSTEM
- ORIGINAL LANDFILL (DECOMMISSIONED)
- LANDFILL BASE LINER EXTENTS
- MONITORING WELL
- SURVEY CONTROL POINT

TOPO SURFACE SURVEYED JANUARY 29, 2025 BY NORTHWIN. UTM83-10N / GEOID UNKNOWN

SITE ORTHO IMAGE BY NORTHWIN - JAN 29, 2025

CLIENT: NORTHWIN

PROJECT: NORTHWIN LANDFILLL 2024 ENGINEERING

TITLE: NEW LANDFILL SITE PLAN - EXISTING TOPO JAN. 29, 2025

SCALE:	DATE:	PROJECT NO:
1:1250	2025/03/11 yyyy/mm/dd	PRJ 24074
DESIGNED	-	DRAWING NO:
DRAWN	NL	FIGURE 3
CHECKED	TS	