86054

BORING RECORD

Report No 2263/C	BORING RECORD	
Contract: KNOCK/CLAREMORRIS BY-PASS		Borehole No 9600 (L) Sheet
Location	Type and Diameter: Cable Tool 200mm	
Client: MAYO COUNTY COUNCIL	Ground Level	
	Date: 15.7.93	

Description	Reduced Level	Legend	Depth	Samples Ref No	Type	Depth	Field Records And Tests
MADE GROUND-gravel			0.90				
Soft dark very organic CLAY				7210	D	1.00	
			1.90				
Soft grey stony SILT			2.00	7211	D	2.00	(2.00)N=10
Medium dense clay bound silty sandy GRAVEL				7212	D	2.50	
			3.40				(3.50)29/150 & refusal
Compact fine to coarse sandy GRAVEL with cobbles				7213	D	4.00	
							(4.50)N=71
			5.00				
Refusal at 5.00m							

*Vane Test @ 1.20m

Shear strength : 14.6 kN/m²
Remould : 10.1 kN/m²

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
15.2.93	2.90	2.90	2.90	Water noted
	5.00	Nil	1.00	End of boring

Remarks

Chiselling at 3.70=1hr
Chiselling 3.40-3.50=2hrs

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86041

Report No 2263/C	BORING RECORD	

Contract	Borehole No 800
KNOCK/CLAREMORRIS BY-PASS	Sheet
Location	Type and Diameter: Cable Tool 200mm
Client: MAYO COUNTY COUNCIL	Ground Level
	Date 6.7.93 - 7.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No.	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND - gravelly CLAY with cobbles and boulders				2274	D	1.00	
			1.70	2275	D	1.80	
Soft dark brown silty PEAT							2.00 Vane
				2276	U	2.50	
			3.60				
Grey sandy gravelly CLAY			4.00	2277	D	4.00	4.00 N=18
Firm grey gravelly SILT			4.20				
Compact grey slightly silty sandy GRAVEL with cobbles (Refusal at 6.00)				2278	D	4.50	
							5.50 N=36
			6.00				

Clearing area for rig : 1½ hrs

Vane test at 2.00

Shear strength : 27 kN/m²
Remoulded : 197 kN/m²

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
6.7.93	-	-	-	No free water

Remarks

Chiselling in fill : 1hr
do boulder at 3.60: 1 hr
do at 6.00: 2 hrs.

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86056

Report No 2263	BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 10500

Sheet:

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 19.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No.	Samples Type	Samples Depth	Field Records And Tests
Firm to stiff grey sandy gravelly CLAY with cobbles				7220	D	1.00	
							(1.50)35/150mm
			1.80				(1.80)N=R
Refusal at 1.80 (Possibly bedrock)							
*Difficult location - 3hrs setting up rig							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
19.7.93			DRY	No free water

Remarks

Chiselling at 1.80=2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

36055

Report No	2263	BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 9600R

Sheet:

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 20.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
TOPSOIL			0.40				
Firm grey silty sandy gravelly CLAY			1.30	7221	D	1.00	
Firm brown sandy gravelly CLAY with cobbles			2.40	7222	D	1.50	(1.50)N=11
Medium dense to compact fine to coarse sandy GRAVEL with cobbles			4.90	7223	D	2.50	(3.00)N=13 (4.00)N=54
Refusal at 4.90m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
20.7.93	2.80	2.80	2.80	Water noted
	4.90	Nil	2.00	End of boring

Remarks

Chiselling at 2.30=1hr

Chiselling at 4.90 = 2hrs

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86057

Report No. 2263

BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 11150L

Sheet:

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 21.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND			0.40				
Firm to stiff grey silty sandy gravelly CLAY				7224	D	1.00	
							(1.50)N=20
			2.80				
Medium dense fine to coarse GRAVEL with some sand				7225	D	3.00	(3.00)N=24
			3.70				
Compact fine to coarse angular slightly sandy GRAVEL with a slight silt binding				7226	D	4.00	(4.00)N=14
							(5.00)N=37
							(6.00)N=44
							(7.20)N=47
			7.70				
Fragments of boulders			7.80	7227	D	7.80	
Refusal at 7.80m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
21.7.93	2.80	2.80	2.80	Water sealed
	7.80	Nil	1.00	End of boring

Remarks:
Chiselling cobbles at 6.80=1hr
Chiselling 7.70-7.80=2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86058

Report No	2263	BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 11150R

Sheet:

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 22.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
FILL-Stones, gravels			0.60				
Firm to stiff grey silty sandy gravelly CLAY				7228	D	1.00	(1.50)N=24
			2.70				
medium dense fine to coarse sandy GRAVEL				7229	D	3.00	(3.00)N=24
							(4.00)N=23
			4.10				
Compact grey angular fine to coarse silty sandy GRAVEL with cobbles and boulders				7230	D	5.50	(5.50)N=42
							(6.50)30/150mm
			6.80				(6.80)N=R
Refusal at 6.80m Probably boulders							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
22.7.93	2.70	2.70	2.70	Water noted
	6.80	Nil	1.60	End of boring

Remarks

Chiselling at 6.40m=¼hr

Chiselling at 6.80m=2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86059

Report No. 2263

BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 11950

Sheet

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level

Date: 23.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Soft dark brown peaty silty CLAY			1.00	7231	D	1.00	
Firm grey silty sandy gravelly CLAY improving to stiff with penetration							(1.50)N=18
							(3.00)N=29
			4.50	7232	D	4.50	
Stiff grey very gravelly CLAY with boulders			5.00				(5.00)N=R
Refusal at 5.00m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
23.7.93	4.10	4.10	4.10	Water seepage
	5.00	Nil	3.10	End of boring

Remarks

Chiselling at 5.00m = 2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

36060

Report No. 2263	BORING RECORD	

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No. 13050

Sheet

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level

Date 26.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No.	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND-coarse material, boulders and cobbles			0.70				
Soft dark brown PEAT with fragments of decomposed timber				7233	D	1.00	(1.20)Vane Te (1.50)N=1
			2.60				
Medium dense silty sandy GRAVEL with cobbles				7234	D	3.00	(3.00)N=25
			3.70				
Compact grey silty sandy GRAVEL with cobbles				7235	D	4.00	(4.00)33/150
			4.50				(4.50)N=R
Refusal at 4.50m							

Vane at 1.20m

Shear strength : 12.8 kN/m^2
Remould : 9.1 kN/m^2

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
26.7.93	4.50	4.50	4.50	Water noted
	4.50	Nil	3.60	End of boring

Remarks

Chiselling FILL=1hr

Chiselling at 4.50m=2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86061

Report No 2263	BORING RECORD	

Contract: KNOCK / CLAREMORRIS BY-PASS	Borehole No: 13775
	Sheet
Location: CO.MAYO	Type and Diameter: Cable Tool 200mm
Client: MAYO COUNTY COUNCIL	Ground Level
	Date: 28.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Brown sandy claybound GRAVEL with cobbles			0.90	7248	D	0.90	
Compact fine to coarse sandy GRAVEL with cobbles and boulders							(1.50)N=50
			2.70	7249	D	2.50	(2.70)N=R
Refusal at 2.70m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
28.7.93	2.30	2.30	2.30	Water noted
	2.70	Nil	2.30	End of boring

Remarks
Chiselling at 0.90m=¾hr
Chiselling at 2.70m=2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86062

Report No. 2263

BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 14025

Sheet:

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 28.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Soft dark PEAT			0.30				
Soft grey silty CLAY with traces of gravel and occ. cobbles				7250	D	1.00	(1.60)N=6
			2.10				
Compact grey fine to coarse silty GRAVEL				7251	D	2.50	(3.00)N=46
			3.20				
Compact fine to coarse angular slightly sandy GRAVEL with cobbles and boulders				7252	D	4.00	(4.00)18/150mm
			4.40				(4.40)N=R
Borehole complete at 4.40m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
28.7.93	2.90	2.90	2.90	Water noted
	4.40	Nil	1.50	End of boring

Remarks

Chiselling at 4.40m=2hrs

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86063

Report No 2263

BORING RECORD

Contract
KNOCK / CLAREMORRIS BY-PASS

Borehole No 14675
Sheet

Location CO.MAYO

Type and Diameter
Cable Tool 200mm

Client
MAYO COUNTY COUNCIL

Ground Level

Date 29.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Firm brown sandy gravelly CLAY				7253	D	1.00	
			1.20				
Medium dense fine to coarse sandy GRAVEL with occasional cobbles							(1.50)N=26
				7254	D	2.00	
			2.30				
Compact fine to coarse sandy GRAVEl with cobbles							(3.00)N=36
				7255	D	3.50	
			4.00				
Borehole complete at 4.00m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
29.7.93	1.90	1.90	1.90	Water noted
	4.00	Nil	1.50	End of boring

Remarks

Chiselling cobbles 2 hours

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86053

Report No.	BORING RECORD
2263/C	

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No.: 9275

Sheet:

Location:

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 15.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
TOPSOIL			0.20				
Firm to stiff yellow grey silty sandy CLAY with some stones			1.70	7215	D	1.00	(1.50)N=17
Stiff grey silty sandy gravelly CLAY			3.80	7216	D	2.50	(3.00)N=56
Refusal at 3.80m							
*Attempted U100 Samples on two occasions-ground too granular							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
15.7.93	3.80	3.80	Nil	No free water

Remarks

Chiselling boulders=2½hrs

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86042

Report No 2263/C	BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS	Borehole No: 1250 L Sheet
Location	Type and Diameter: Cable Tool 200mm
Client: MAYO COUNTY COUNCIL	Ground Level
	Date: 6.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Type	Depth	Field Records And Tests
MADE GROUND (gravel)			0.60				
Soft brown fibrous PEAT			1.40	2270	D	1.00	1.20 Vane
				2271	D	1.50	1.50 N=24
Firm to stiff grey silty sandy gravelly CLAY with cobbles			2.70	2272	D	2.80	
Compact fine to coarse angular sandy GRAVEL with cobbles			3.70	2273	W	Water	3.20 N=44

Refusal at 3.70

Vane Test at 1.20

Shear strength : 11.5 kN/m²
Remould : 8.7 kN/m²

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
6.7.93	2.70	2.70	2.70	Water noted
	3.70	Nil	1.50	Final Level

Remarks

Chiselling cobbles @ 1.70: 45 mi[illegible]
" at 3.70 : 2 hrs

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86052

Report No	BORING RECORD
2263/C	

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No: 8525

Sheet

Location

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level

Date: 16.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Stone FILL			0.30				
Firm brown silty CLAY				7217	D	1.00	(1.50)N=18
			1.70				
STiff grey silty sandy gravelly CLAY with cobbles				7218	D	2.00	
				7219	D	3.00	(3.00)N=42
			3.70				
Borehole complete at 3.70m to refusal							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
16.7.93				No free water

Remarks
Chiselling 0.00-0.30=½hr
Chiselling at 3.70=1hr

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

8605

Report No	BORING RECORD
2263/C	

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No: 7625

Sheet:

Location:

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 14.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Soft mottled grey brown silty sandy CLAY			1.50	7207	D	1.40	(1.50)N=23
Firm grey silty sandy gravelly CLAY			2.20	7208	D	2.00	
Compact fine to coarse slightly sandy GRAVEL with cobbles			3.70	7209	D	3.00	(3.00)N=33
Refusal at 3.70							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
14.7.93	1.90	1.90	1.90	Water noted
	3.70	Nil	1.30	End of boring

Remarks

Chiselling at 3.70=2hrs

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

36045

Report No 2263/C	BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS	Borehole No 2400 Sheet
Location	Type and Diameter: Cable Tool 200mm
Client: MAYO COUNTY COUNCIL	Ground Level Date 7.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND (gravel)			0.90				
Soft dark brown silty fibrous PEAT				2279	D	1.00	1.20 Vane
				2280	U	2.00	
			3.70				
Soft grey-white silty MARL				2281	D	3.80	4.00 Vane
				2282	U	4.20	
			4.60	2283	D	4.70	
Soft grey sandy SILT			4.90				4.90 N=17
Compact fine to coarse sandy GRAVEL with cobbles				2284	D	5.00	5.40 N=45
				2285	D	5.50	
			5.70				
(Refusal at 5.70)							

Vane Tests : At 1.20

Shear strength : 22.4 kN/m^2
Remould : 14.8 kN/m^2

At 4.00

Shear strength : 13.5 kN/m^2
Remould : 9.60 kN/m^2

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
7.7.93	4.90	4.90	4.90	Water noted
	5.70	Nil	5.70	End of boring

Remarks

Chiselling at 5.70: 2 hrs.

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86044

Report No 2263/C

BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No: 1875 L

Sheet:

Location:

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 9.7.93 - 12.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No.	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND -stony clay			0.80				
Firm to stiff brown silty sandy gravelly CLAY with cobbles				2294	D	1.00	
							1.50 N 11
				2295	D	2.20	
							3.00 N 39
				2296	U	4.50	
			5.00				
*Excavated by hand to 1.00m for services							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
9.7.93			Dry	No free water

Remarks

Chiselling cobbles : 1 hr.
do @ 5.00 : 1 hr.

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86043

Report No. 2263/C	BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS	Borehole No. 1250R Sheet
Location	Type and Diameter: Cable Tool 200mm
Client: MAYO COUNTY COUNCIL	Ground Level
	Date 5.7.93

Description	Reduced Level	Legend	Depth	Samples Ref. No.	Samples Type	Samples Depth	Field Records And Tests
MADE GROUND (sandy gravel)			1.10	2266	D	1.10	
Soft dark brown silty fibrous PEAT			3.00	2267	D	3.10	1.50 Vane 3.00 19/150: & Refusal
Compact fine to coarse angular sandy GRAVEL with some cobbles			3.80				
Fragments of grey ROCK			3.90	2268	D	3.90	3.90 Refusal
				2269	W	Water	
Vane test at 1.50							
Shear strength : 7.7 kN/m2 Remould : 5.2 kN/m2							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
5.7.93	2.90	2.90	2.90	Water noted
	3.90	Nil	2.00	End of boring

Remarks

Chiselling at 3.40 : 1½ hrs.
do at 3.80-3.90: 2 hrs

Sample/Test key	
U-Tube Sample	C-Cone Penetration Test
D-Disturbed Sample	N-Blows/0.3 metres
W-Water Sample	R-Refusal
S-Standard Penetration Test	V-Vane

86064

Report No	2263	BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 15250

Sheet:

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 29.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Firm grey silty sandy gravelly CLAY with cobbles			1.50	7256	D	1.40	(1.50)N=22
Medium dense fine to coarse sandy GRAVEL			2.30	7257	D	2.00	
Stiff brown silty sandy gravelly CLAY			4.50	7258	D	3.50	(3.00)N=44 (4.00)N=56
Borehole complete at 4.50m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
29.7.93	1.70	1.70	1.70	Water noted
	2.40	2.40	Nil	Water sealed
	4.50	4.50	4.50	Water noted
	4.50	Nil	1.70	End of boring

Remarks

Chiselling cobbles at 1.20=¼hr

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86065

Report No. 2263	BORING RECORD

Contract: KNOCK / CLAREMORRIS BY-PASS

Borehole No: 15625

Sheet:

Location: CO.MAYO

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 29.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Medium dense brown sandy GRAVEL				7259	D	1.00	
			1.50				(1.50)N=27
Compact fine to coarse sandy GRAVEL with cobbles				7260	D	2.00	
							(3.00)N=51
			3.60	7261	D	3.60	
Refusal at 3.60m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
29.7.93	3.00	3.00	3.00	Water noted
	3.60	Nil	3.00	End of boring

Remarks

Chiselling at 3.60m=1hr

25

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86046

Report No. 2263/C	BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No. 3200

Sheet

Location

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level

Date 8.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Firm brown sandy gravelly CLAY with cobbles			1.20	2286	D	1.30	
Firm grey sandy gravelly CLAY			1.60				1.50 N=13
Compact silty sandy GRAVEL with cobbles			3.70				3.00 N=35
Stiff grey sandy gravelly CLAY with cobbles				2288	D	4.00	
				2289	D	4.50	4.50 Refusal
			5.50	2290	D	5.50	5.50 25/150 & Refusal
Stiff brown sandy stony CLAY with cobbles			6.00				

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
8.7.93	1.60	1.60	1.60	Water noted
	2.90	2.90	Nil	Water sealed
	5.80	5.80	5.80	Water noted
	6.00	Nil	1.80	End of boring

Remarks

Chiselling @ 6.00 : 1½ hrs
do @ 4.50 : 1 hr.

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

86047

Report No. 2263/C

BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No: 3675

Sheet

Location

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level

Date: 8.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
FILL (brown sandy CLAY)			0.70				
Soft dark brown PEAT			1.60	2291	D	1.00	1.60 N=22
Medium dense to dense fine to coarse sandy GRAVEL with cobbles and boulders				2292	D	2.50	3.00 N=32
				2293	D	3.80	
Refusal at 4.50			4.50				4.50 Refusa

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
8.7.93	1.80	1.80	1.80	Water noted
	4.50	Nil	1.30	End of boring

Remarks

Chiselling in cobbles: 1 hr

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86048

Report No 2263/C	BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No: 4325

Sheet:

Location:

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 13.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
TOPSOIL with loose sandy clay and root fibres			1.30				
Firm brown sandy CLAY			1.60	2299	D	1.50	1.50 N=14
Firm mottled grey brown silty CLAY			2.30	7202	D	2.00	
Firm brown silty sandy CLAY				7203	D	2.50	
							3.00 N=9
			4.10				
Compact fine to coarse slightly silty sandy GRAVEL with cobbles and boulders				7204	D	4.50	4.50 N=28
							6.00 N=47
			6.50				
Refusal at 6.50m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
13.7.93	3.90	3.90	3.90	Water noted
	6.50	Nil	3.60	End of boring

Remarks

Chiselling 4.10 - 6.50: 2 hrs

Sample/Test key	
U Tube Sample	C Cone Penetration Test
D Disturbed Sample	N Blows/0.3 metres
W Water Sample	R Refusal
S Standard Penetration Test	V Vane

86049

Report No 2263/C	BORING RECORD

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No: 6200

Sheet:

Location:

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level:

Date: 13.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
TOPSOIL with loose sandy CLAY			1.30				
Firm brown sandy gravelly CLAY with cobbles			1.60	2297	D	1.40	1.50 N=13
Compact silty clayey sandy GRAVEL with cobbles			3.50	2298	D	2.50	3.00 21/15 & Ref.
REFUSAL at 3.50							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
13.7.93	3.50	-	Nil	No free water

Remarks

Chiselling at 3.50 : 2 hrs.

Sample/Test key
U Tube Sample
D Disturbed Sample
W Water Sample
S Standard Penetration Test
C Cone Penetration Test
N Blows/0.3 metres
R Refusal
V Vane

86050

Report No	BORING RECORD
2263/C	

Contract: KNOCK/CLAREMORRIS BY-PASS

Borehole No: 6950

Sheet

Location

Type and Diameter: Cable Tool 200mm

Client: MAYO COUNTY COUNCIL

Ground Level

Date: 14.7.93

Description	Reduced Level	Legend	Depth	Samples Ref No	Samples Type	Samples Depth	Field Records And Tests
Firm brown silty CLAY with some cobbles			0.90	7205	D	0.80	
Firm tostiff grey silty sandy gravelly CLAY with large cobbles							1.50 Refusal (Boulder
				7206	D	2.00	
							3.00 22/150 & Refusal
			3.60				
Refusal at 3.60m							

Water Level Observations during Boring

Date	Hole Depth	Casing Depth	Depth to Water	Remarks
14.7.93	3.60	3.60	Nil	No free water

Remarks
Chiselling at 1.50: 1½ hrs.
do at 3.60: 2 hrs.

Sample/Test key
U-Tube Sample
D-Disturbed Sample
W-Water Sample
S-Standard Penetration Test
C-Cone Penetration Test
N-Blows/0.3 metres
R-Refusal
V-Vane

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 5

LandGEM Summary Reports

Summary Report

Landfill Name or Identifier: Claremorris Historical Landfill - Co.Kerry

Date: Thursday 27 February 2020

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} k L_o \left(\frac{M_i}{10} \right) e^{-k t_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation *(m^3/year)*
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate *($year^{-1}$)*
L_o = potential methane generation capacity (*m^3/Mg*)

M_i = mass of waste accepted in the i^{th} year (*Mg*)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**1982**	
Landfill Closure Year (with 80-year limit)	**1996**	
Actual Closure Year (without limit)	***1996***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**168,000**	*megagrams*

MODEL PARAMETERS

Methane Generation Rate, k	**0.050**	*$year^{-1}$*
Potential Methane Generation Capacity, L_o	**170**	*m^3/Mg*
NMOC Concentration	**4,000**	*ppmv as hexane*
Methane Content	**50**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
1982	11,200	12,320	0	0
1983	11,200	12,320	11,200	12,320
1984	11,200	12,320	22,400	24,640
1985	11,200	12,320	33,600	36,960
1986	11,200	12,320	44,800	49,280
1987	11,200	12,320	56,000	61,600
1988	11,200	12,320	67,200	73,920
1989	11,200	12,320	78,400	86,240
1990	11,200	12,320	89,600	98,560
1991	11,200	12,320	100,800	110,880
1992	11,200	12,320	112,000	123,200
1993	11,200	12,320	123,200	135,520
1994	11,200	12,320	134,400	147,840
1995	11,200	12,320	145,600	160,160
1996	11,200	12,320	156,800	172,480
1997	0	0	168,000	184,800
1998	0	0	168,000	184,800
1999	0	0	168,000	184,800
2000	0	0	168,000	184,800
2001	0	0	168,000	184,800
2002	0	0	168,000	184,800
2003	0	0	168,000	184,800
2004	0	0	168,000	184,800
2005	0	0	168,000	184,800
2006	0	0	168,000	184,800
2007	0	0	168,000	184,800
2008	0	0	168,000	184,800
2009	0	0	168,000	184,800
2010	0	0	168,000	184,800
2011	0	0	168,000	184,800
2012	0	0	168,000	184,800
2013	0	0	168,000	184,800
2014	0	0	168,000	184,800
2015	0	0	168,000	184,800
2016	0	0	168,000	184,800
2017	0	0	168,000	184,800
2018	0	0	168,000	184,800
2019	0	0	168,000	184,800
2020	0	0	168,000	184,800
2021	0	0	168,000	184,800

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	(short tons/year)	(Mg)	(short tons)
2022	0	0	168,000	184,800
2023	0	0	168,000	184,800
2024	0	0	168,000	184,800
2025	0	0	168,000	184,800
2026	0	0	168,000	184,800
2027	0	0	168,000	184,800
2028	0	0	168,000	184,800
2029	0	0	168,000	184,800
2030	0	0	168,000	184,800
2031	0	0	168,000	184,800
2032	0	0	168,000	184,800
2033	0	0	168,000	184,800
2034	0	0	168,000	184,800
2035	0	0	168,000	184,800
2036	0	0	168,000	184,800
2037	0	0	168,000	184,800
2038	0	0	168,000	184,800
2039	0	0	168,000	184,800
2040	0	0	168,000	184,800
2041	0	0	168,000	184,800
2042	0	0	168,000	184,800
2043	0	0	168,000	184,800
2044	0	0	168,000	184,800
2045	0	0	168,000	184,800
2046	0	0	168,000	184,800
2047	0	0	168,000	184,800
2048	0	0	168,000	184,800
2049	0	0	168,000	184,800
2050	0	0	168,000	184,800
2051	0	0	168,000	184,800
2052	0	0	168,000	184,800
2053	0	0	168,000	184,800
2054	0	0	168,000	184,800
2055	0	0	168,000	184,800
2056	0	0	168,000	184,800
2057	0	0	168,000	184,800
2058	0	0	168,000	184,800
2059	0	0	168,000	184,800
2060	0	0	168,000	184,800
2061	0	0	168,000	184,800

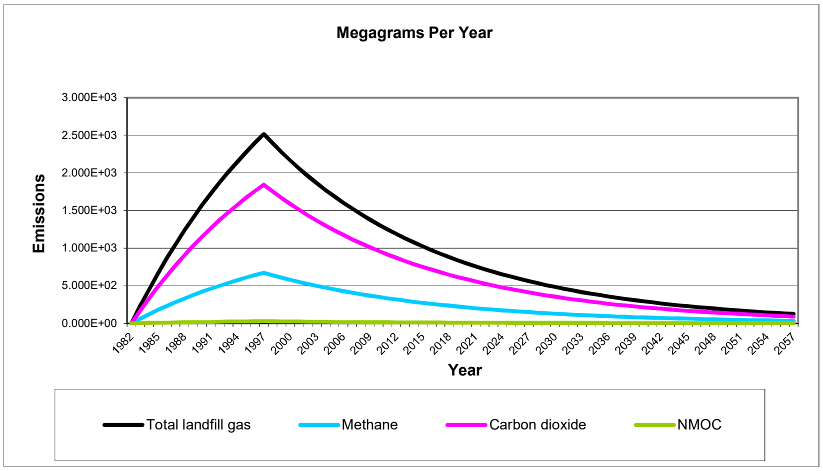
Pollutant Parameters

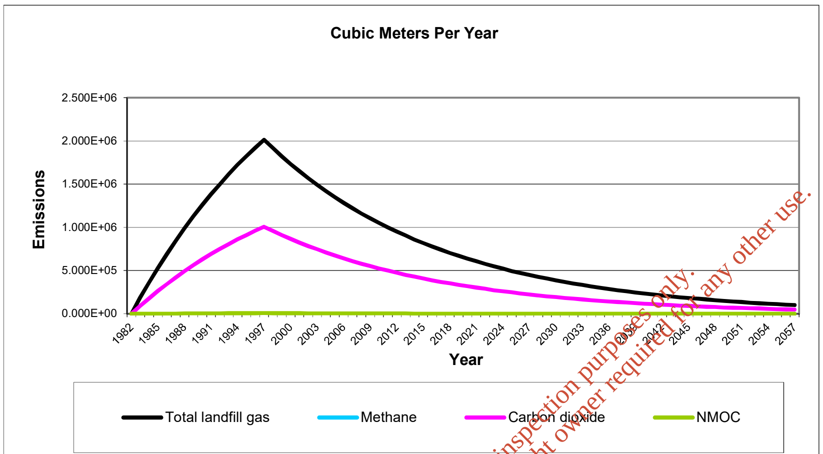
	Compound	Gas / Pollutant Default Parameters: Concentration (*ppmv*)	Molecular Weight	User-specified Pollutant Parameters: Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

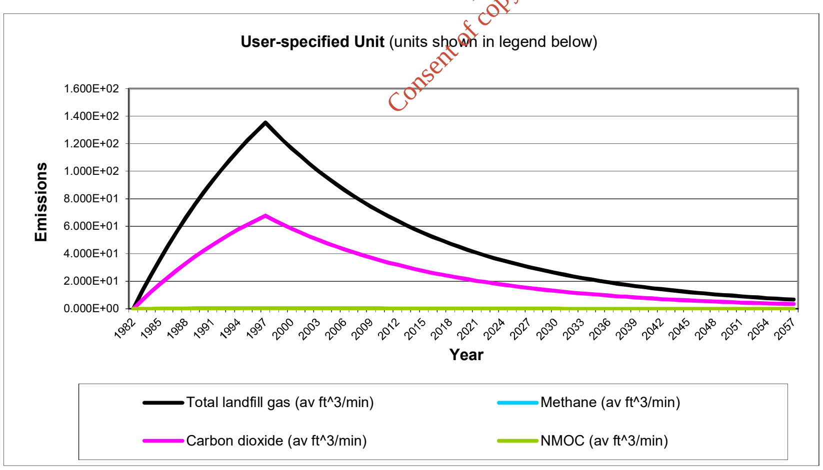
Pollutant Parameters (Continued)

	Gas / Pollutant Default Parameters:			User-specified Pollutant Parameters:	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
1982	0	0	0	0	0	0
1983	2.325E+02	1.862E+05	1.251E+01	6.211E+01	9.309E+04	6.255E+00
1984	4.537E+02	3.633E+05	2.441E+01	1.212E+02	1.816E+05	1.220E+01
1985	6.641E+02	5.318E+05	3.573E+01	1.774E+02	2.659E+05	1.786E+01
1986	8.642E+02	6.920E+05	4.650E+01	2.308E+02	3.460E+05	2.325E+01
1987	1.055E+03	8.444E+05	5.674E+01	2.817E+02	4.222E+05	2.837E+01
1988	1.236E+03	9.894E+05	6.648E+01	3.300E+02	4.947E+05	3.324E+01
1989	1.408E+03	1.127E+06	7.575E+01	3.761E+02	5.637E+05	3.787E+01
1990	1.572E+03	1.259E+06	8.456E+01	4.198E+02	6.293E+05	4.228E+01
1991	1.728E+03	1.383E+06	9.295E+01	4.615E+02	6.917E+05	4.647E+01
1992	1.876E+03	1.502E+06	1.009E+02	5.011E+02	7.510E+05	5.046E+01
1993	2.017E+03	1.615E+06	1.085E+02	5.387E+02	8.075E+05	5.426E+01
1994	2.151E+03	1.722E+06	1.157E+02	5.746E+02	8.612E+05	5.786E+01
1995	2.279E+03	1.825E+06	1.226E+02	6.086E+02	9.123E+05	6.130E+01
1996	2.400E+03	1.922E+06	1.291E+02	6.411E+02	9.609E+05	6.456E+01
1997	2.515E+03	2.014E+06	1.353E+02	6.719E+02	1.007E+06	6.767E+01
1998	2.393E+03	1.916E+06	1.287E+02	6.391E+02	9.580E+05	6.437E+01
1999	2.276E+03	1.823E+06	1.225E+02	6.080E+02	9.113E+05	6.123E+01
2000	2.165E+03	1.734E+06	1.165E+02	5.783E+02	8.668E+05	5.824E+01
2001	2.059E+03	1.649E+06	1.108E+02	5.501E+02	8.246E+05	5.540E+01
2002	1.959E+03	1.569E+06	1.054E+02	5.233E+02	7.844E+05	5.270E+01
2003	1.863E+03	1.492E+06	1.003E+02	4.978E+02	7.461E+05	5.013E+01
2004	1.773E+03	1.419E+06	9.537E+01	4.735E+02	7.097E+05	4.769E+01
2005	1.686E+03	1.350E+06	9.072E+01	4.504E+02	6.751E+05	4.536E+01
2006	1.604E+03	1.284E+06	8.630E+01	4.284E+02	6.422E+05	4.315E+01
2007	1.526E+03	1.222E+06	8.209E+01	4.075E+02	6.109E+05	4.104E+01
2008	1.451E+03	1.162E+06	7.808E+01	3.877E+02	5.811E+05	3.904E+01
2009	1.381E+03	1.105E+06	7.427E+01	3.687E+02	5.527E+05	3.714E+01
2010	1.313E+03	1.052E+06	7.065E+01	3.508E+02	5.258E+05	3.533E+01
2011	1.249E+03	1.000E+06	6.721E+01	3.337E+02	5.001E+05	3.360E+01
2012	1.188E+03	9.515E+05	6.393E+01	3.174E+02	4.757E+05	3.196E+01
2013	1.130E+03	9.051E+05	6.081E+01	3.019E+02	4.525E+05	3.041E+01
2014	1.075E+03	8.609E+05	5.785E+01	2.872E+02	4.305E+05	2.892E+01
2015	1.023E+03	8.189E+05	5.502E+01	2.732E+02	4.095E+05	2.751E+01
2016	9.728E+02	7.790E+05	5.234E+01	2.599E+02	3.895E+05	2.617E+01
2017	9.254E+02	7.410E+05	4.979E+01	2.472E+02	3.705E+05	2.489E+01
2018	8.803E+02	7.049E+05	4.736E+01	2.351E+02	3.524E+05	2.368E+01
2019	8.373E+02	6.705E+05	4.505E+01	2.237E+02	3.352E+05	2.252E+01
2020	7.965E+02	6.378E+05	4.285E+01	2.127E+02	3.189E+05	2.143E+01
2021	7.576E+02	6.067E+05	4.076E+01	2.024E+02	3.033E+05	2.038E+01
2022	7.207E+02	5.771E+05	3.877E+01	1.925E+02	2.885E+05	1.939E+01
2023	6.855E+02	5.489E+05	3.688E+01	1.831E+02	2.745E+05	1.844E+01
2024	6.521E+02	5.222E+05	3.508E+01	1.742E+02	2.611E+05	1.754E+01
2025	6.203E+02	4.967E+05	3.337E+01	1.657E+02	2.484E+05	1.669E+01
2026	5.900E+02	4.725E+05	3.175E+01	1.576E+02	2.362E+05	1.587E+01
2027	5.613E+02	4.494E+05	3.020E+01	1.499E+02	2.247E+05	1.510E+01
2028	5.339E+02	4.275E+05	2.873E+01	1.426E+02	2.138E+05	1.436E+01
2029	5.079E+02	4.067E+05	2.732E+01	1.357E+02	2.033E+05	1.366E+01
2030	4.831E+02	3.868E+05	2.599E+01	1.290E+02	1.934E+05	1.300E+01
2031	4.595E+02	3.680E+05	2.472E+01	1.227E+02	1.840E+05	1.236E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	(m^3/year)	(av ft^3/min)	(Mg/year)	(m^3/year)	(av ft^3/min)
2032	4.371E+02	3.500E+05	2.352E+01	1.168E+02	1.750E+05	1.176E+01
2033	4.158E+02	3.330E+05	2.237E+01	1.111E+02	1.665E+05	1.119E+01
2034	3.955E+02	3.167E+05	2.128E+01	1.056E+02	1.584E+05	1.064E+01
2035	3.762E+02	3.013E+05	2.024E+01	1.005E+02	1.506E+05	1.012E+01
2036	3.579E+02	2.866E+05	1.926E+01	9.559E+01	1.433E+05	9.628E+00
2037	3.404E+02	2.726E+05	1.832E+01	9.093E+01	1.363E+05	9.158E+00
2038	3.238E+02	2.593E+05	1.742E+01	8.650E+01	1.297E+05	8.711E+00
2039	3.080E+02	2.467E+05	1.657E+01	8.228E+01	1.233E+05	8.286E+00
2040	2.930E+02	2.346E+05	1.576E+01	7.827E+01	1.173E+05	7.882E+00
2041	2.787E+02	2.232E+05	1.500E+01	7.445E+01	1.116E+05	7.498E+00
2042	2.651E+02	2.123E+05	1.426E+01	7.082E+01	1.062E+05	7.132E+00
2043	2.522E+02	2.019E+05	1.357E+01	6.736E+01	1.010E+05	6.784E+00
2044	2.399E+02	1.921E+05	1.291E+01	6.408E+01	9.605E+04	6.454E+00
2045	2.282E+02	1.827E+05	1.228E+01	6.095E+01	9.136E+04	6.139E+00
2046	2.171E+02	1.738E+05	1.168E+01	5.798E+01	8.691E+04	5.839E+00
2047	2.065E+02	1.653E+05	1.111E+01	5.515E+01	8.267E+04	5.555E+00
2048	1.964E+02	1.573E+05	1.057E+01	5.246E+01	7.864E+04	5.284E+00
2049	1.868E+02	1.496E+05	1.005E+01	4.990E+01	7.480E+04	5.026E+00
2050	1.777E+02	1.423E+05	9.562E+00	4.747E+01	7.115E+04	4.781E+00
2051	1.691E+02	1.354E+05	9.095E+00	4.516E+01	6.768E+04	4.548E+00
2052	1.608E+02	1.288E+05	8.652E+00	4.295E+01	6.438E+04	4.326E+00
2053	1.530E+02	1.225E+05	8.230E+00	4.086E+01	6.124E+04	4.115E+00
2054	1.455E+02	1.165E+05	7.829E+00	3.887E+01	5.826E+04	3.914E+00
2055	1.384E+02	1.108E+05	7.447E+00	3.697E+01	5.542E+04	3.723E+00
2056	1.317E+02	1.054E+05	7.084E+00	3.517E+01	5.271E+04	3.542E+00
2057	1.252E+02	1.003E+05	6.738E+00	3.345E+01	5.014E+04	3.369E+00
2058	1.191E+02	9.539E+04	6.409E+00	3.182E+01	4.770E+04	3.205E+00
2059	1.133E+02	9.074E+04	6.097E+00	3.027E+01	4.537E+04	3.048E+00
2060	1.078E+02	8.632E+04	5.800E+00	2.879E+01	4.316E+04	2.900E+00
2061	1.025E+02	8.211E+04	5.517E+00	2.739E+01	4.105E+04	2.758E+00
2062	9.753E+01	7.810E+04	5.248E+00	2.605E+01	3.905E+04	2.624E+00
2063	9.278E+01	7.429E+04	4.992E+00	2.478E+01	3.715E+04	2.496E+00
2064	8.825E+01	7.067E+04	4.748E+00	2.357E+01	3.533E+04	2.374E+00
2065	8.395E+01	6.722E+04	4.517E+00	2.242E+01	3.361E+04	2.258E+00
2066	7.985E+01	6.394E+04	4.296E+00	2.133E+01	3.197E+04	2.148E+00
2067	7.596E+01	6.083E+04	4.087E+00	2.029E+01	3.041E+04	2.043E+00
2068	7.226E+01	5.786E+04	3.888E+00	1.930E+01	2.893E+04	1.944E+00
2069	6.873E+01	5.504E+04	3.698E+00	1.836E+01	2.752E+04	1.849E+00
2070	6.538E+01	5.235E+04	3.518E+00	1.746E+01	2.618E+04	1.759E+00
2071	6.219E+01	4.980E+04	3.346E+00	1.661E+01	2.490E+04	1.673E+00
2072	5.916E+01	4.737E+04	3.183E+00	1.580E+01	2.369E+04	1.591E+00
2073	5.627E+01	4.506E+04	3.028E+00	1.503E+01	2.253E+04	1.514E+00
2074	5.353E+01	4.286E+04	2.880E+00	1.430E+01	2.143E+04	1.440E+00
2075	5.092E+01	4.077E+04	2.739E+00	1.360E+01	2.039E+04	1.370E+00
2076	4.843E+01	3.878E+04	2.606E+00	1.294E+01	1.939E+04	1.303E+00
2077	4.607E+01	3.689E+04	2.479E+00	1.231E+01	1.845E+04	1.239E+00
2078	4.383E+01	3.509E+04	2.358E+00	1.171E+01	1.755E+04	1.179E+00
2079	4.169E+01	3.338E+04	2.243E+00	1.114E+01	1.669E+04	1.121E+00
2080	3.965E+01	3.175E+04	2.134E+00	1.059E+01	1.588E+04	1.067E+00
2081	3.772E+01	3.020E+04	2.029E+00	1.008E+01	1.510E+04	1.015E+00
2082	3.588E+01	2.873E+04	1.930E+00	9.584E+00	1.437E+04	9.652E-01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2083	3.413E+01	2.733E+04	1.836E+00	9.117E+00	1.367E+04	9.182E-01
2084	3.247E+01	2.600E+04	1.747E+00	8.672E+00	1.300E+04	8.734E-01
2085	3.088E+01	2.473E+04	1.662E+00	8.249E+00	1.236E+04	8.308E-01
2086	2.938E+01	2.352E+04	1.581E+00	7.847E+00	1.176E+04	7.903E-01
2087	2.794E+01	2.238E+04	1.503E+00	7.464E+00	1.119E+04	7.517E-01
2088	2.658E+01	2.129E+04	1.430E+00	7.100E+00	1.064E+04	7.151E-01
2089	2.528E+01	2.025E+04	1.360E+00	6.754E+00	1.012E+04	6.802E-01
2090	2.405E+01	1.926E+04	1.294E+00	6.424E+00	9.630E+03	6.470E-01
2091	2.288E+01	1.832E+04	1.231E+00	6.111E+00	9.160E+03	6.155E-01
2092	2.176E+01	1.743E+04	1.171E+00	5.813E+00	8.713E+03	5.854E-01
2093	2.070E+01	1.658E+04	1.114E+00	5.530E+00	8.288E+03	5.569E-01
2094	1.969E+01	1.577E+04	1.059E+00	5.260E+00	7.884E+03	5.297E-01
2095	1.873E+01	1.500E+04	1.008E+00	5.003E+00	7.500E+03	5.039E-01
2096	1.782E+01	1.427E+04	9.587E-01	4.759E+00	7.134E+03	4.793E-01
2097	1.695E+01	1.357E+04	9.119E-01	4.527E+00	6.786E+03	4.559E-01
2098	1.612E+01	1.291E+04	8.674E-01	4.306E+00	6.455E+03	4.337E-01
2099	1.534E+01	1.228E+04	8.251E-01	4.096E+00	6.140E+03	4.126E-01
2100	1.459E+01	1.168E+04	7.849E-01	3.897E+00	5.841E+03	3.924E-01
2101	1.388E+01	1.111E+04	7.466E-01	3.707E+00	5.556E+03	3.733E-01
2102	1.320E+01	1.057E+04	7.102E-01	3.526E+00	5.285E+03	3.551E-01
2103	1.256E+01	1.005E+04	6.756E-01	3.354E+00	5.027E+03	3.378E-01
2104	1.194E+01	9.564E+03	6.426E-01	3.190E+00	4.782E+03	3.213E-01
2105	1.136E+01	9.098E+03	6.113E-01	3.035E+00	4.549E+03	3.056E-01
2106	1.081E+01	8.654E+03	5.815E-01	2.887E+00	4.327E+03	2.907E-01
2107	1.028E+01	8.232E+03	5.531E-01	2.746E+00	4.116E+03	2.765E-01
2108	9.779E+00	7.830E+03	5.261E-01	2.612E+00	3.915E+03	2.631E-01
2109	9.302E+00	7.448E+03	5.005E-01	2.485E+00	3.724E+03	2.502E-01
2110	8.848E+00	7.085E+03	4.761E-01	2.363E+00	3.543E+03	2.380E-01
2111	8.417E+00	6.740E+03	4.528E-01	2.248E+00	3.370E+03	2.264E-01
2112	8.006E+00	6.411E+03	4.307E-01	2.139E+00	3.205E+03	2.154E-01
2113	7.616E+00	6.098E+03	4.097E-01	2.034E+00	3.049E+03	2.049E-01
2114	7.244E+00	5.801E+03	3.898E-01	1.935E+00	2.900E+03	1.949E-01
2115	6.891E+00	5.518E+03	3.707E-01	1.841E+00	2.759E+03	1.854E-01
2116	6.555E+00	5.249E+03	3.527E-01	1.751E+00	2.624E+03	1.763E-01
2117	6.235E+00	4.993E+03	3.355E-01	1.665E+00	2.496E+03	1.677E-01
2118	5.931E+00	4.749E+03	3.191E-01	1.584E+00	2.375E+03	1.596E-01
2119	5.642E+00	4.518E+03	3.035E-01	1.507E+00	2.259E+03	1.518E-01
2120	5.367E+00	4.297E+03	2.887E-01	1.433E+00	2.149E+03	1.444E-01
2121	5.105E+00	4.088E+03	2.747E-01	1.364E+00	2.044E+03	1.373E-01
2122	4.856E+00	3.888E+03	2.613E-01	1.297E+00	1.944E+03	1.306E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
1982	0	0	0	0	0	0
1983	1.704E+02	9.309E+04	6.255E+00	2.669E+00	7.447E+02	5.004E-02
1984	3.325E+02	1.816E+05	1.220E+01	5.209E+00	1.453E+03	9.764E-02
1985	4.867E+02	2.659E+05	1.786E+01	7.624E+00	2.127E+03	1.429E-01
1986	6.334E+02	3.460E+05	2.325E+01	9.922E+00	2.768E+03	1.860E-01
1987	7.729E+02	4.222E+05	2.837E+01	1.211E+01	3.378E+03	2.269E-01
1988	9.056E+02	4.947E+05	3.324E+01	1.419E+01	3.958E+03	2.659E-01
1989	1.032E+03	5.637E+05	3.787E+01	1.616E+01	4.509E+03	3.030E-01
1990	1.152E+03	6.293E+05	4.228E+01	1.805E+01	5.034E+03	3.383E-01
1991	1.266E+03	6.917E+05	4.647E+01	1.983E+01	5.533E+03	3.718E-01
1992	1.375E+03	7.510E+05	5.046E+01	2.154E+01	6.008E+03	4.037E-01
1993	1.478E+03	8.075E+05	5.426E+01	2.316E+01	6.460E+03	4.340E-01
1994	1.576E+03	8.612E+05	5.786E+01	2.470E+01	6.890E+03	4.629E-01
1995	1.670E+03	9.123E+05	6.130E+01	2.616E+01	7.298E+03	4.904E-01
1996	1.759E+03	9.609E+05	6.456E+01	2.755E+01	7.687E+03	5.165E-01
1997	1.844E+03	1.007E+06	6.767E+01	2.888E+01	8.057E+03	5.414E-01
1998	1.754E+03	9.580E+05	6.437E+01	2.747E+01	7.664E+03	5.149E-01
1999	1.668E+03	9.113E+05	6.123E+01	2.613E+01	7.290E+03	4.898E-01
2000	1.587E+03	8.668E+05	5.824E+01	2.486E+01	6.935E+03	4.659E-01
2001	1.509E+03	8.246E+05	5.540E+01	2.365E+01	6.597E+03	4.432E-01
2002	1.436E+03	7.844E+05	5.270E+01	2.249E+01	6.275E+03	4.216E-01
2003	1.366E+03	7.461E+05	5.013E+01	2.139E+01	5.969E+03	4.010E-01
2004	1.299E+03	7.097E+05	4.769E+01	2.035E+01	5.678E+03	3.815E-01
2005	1.236E+03	6.751E+05	4.536E+01	1.936E+01	5.401E+03	3.629E-01
2006	1.175E+03	6.422E+05	4.315E+01	1.841E+01	5.137E+03	3.452E-01
2007	1.118E+03	6.109E+05	4.104E+01	1.752E+01	4.887E+03	3.283E-01
2008	1.064E+03	5.811E+05	3.904E+01	1.666E+01	4.648E+03	3.123E-01
2009	1.012E+03	5.527E+05	3.714E+01	1.585E+01	4.422E+03	2.971E-01
2010	9.624E+02	5.258E+05	3.533E+01	1.508E+01	4.206E+03	2.826E-01
2011	9.155E+02	5.001E+05	3.360E+01	1.434E+01	4.001E+03	2.688E-01
2012	8.708E+02	4.757E+05	3.196E+01	1.364E+01	3.806E+03	2.557E-01
2013	8.284E+02	4.525E+05	3.041E+01	1.298E+01	3.620E+03	2.432E-01
2014	7.880E+02	4.305E+05	2.892E+01	1.234E+01	3.444E+03	2.314E-01
2015	7.495E+02	4.095E+05	2.751E+01	1.174E+01	3.276E+03	2.201E-01
2016	7.130E+02	3.895E+05	2.617E+01	1.117E+01	3.116E+03	2.094E-01
2017	6.782E+02	3.705E+05	2.489E+01	1.062E+01	2.964E+03	1.992E-01
2018	6.451E+02	3.524E+05	2.368E+01	1.011E+01	2.819E+03	1.894E-01
2019	6.137E+02	3.352E+05	2.252E+01	9.613E+00	2.682E+03	1.802E-01
2020	5.837E+02	3.189E+05	2.143E+01	9.145E+00	2.551E+03	1.714E-01
2021	5.553E+02	3.033E+05	2.038E+01	8.699E+00	2.427E+03	1.631E-01
2022	5.282E+02	2.885E+05	1.939E+01	8.274E+00	2.308E+03	1.551E-01
2023	5.024E+02	2.745E+05	1.844E+01	7.871E+00	2.196E+03	1.475E-01
2024	4.779E+02	2.611E+05	1.754E+01	7.487E+00	2.089E+03	1.403E-01
2025	4.546E+02	2.484E+05	1.669E+01	7.122E+00	1.987E+03	1.335E-01
2026	4.324E+02	2.362E+05	1.587E+01	6.774E+00	1.890E+03	1.270E-01
2027	4.114E+02	2.247E+05	1.510E+01	6.444E+00	1.798E+03	1.208E-01
2028	3.913E+02	2.138E+05	1.436E+01	6.130E+00	1.710E+03	1.149E-01
2029	3.722E+02	2.033E+05	1.366E+01	5.831E+00	1.627E+03	1.093E-01
2030	3.541E+02	1.934E+05	1.300E+01	5.546E+00	1.547E+03	1.040E-01
2031	3.368E+02	1.840E+05	1.236E+01	5.276E+00	1.472E+03	9.890E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2032	3.204E+02	1.750E+05	1.176E+01	5.019E+00	1.400E+03	9.407E-02
2033	3.047E+02	1.665E+05	1.119E+01	4.774E+00	1.332E+03	8.948E-02
2034	2.899E+02	1.584E+05	1.064E+01	4.541E+00	1.267E+03	8.512E-02
2035	2.757E+02	1.506E+05	1.012E+01	4.320E+00	1.205E+03	8.097E-02
2036	2.623E+02	1.433E+05	9.628E+00	4.109E+00	1.146E+03	7.702E-02
2037	2.495E+02	1.363E+05	9.158E+00	3.909E+00	1.090E+03	7.326E-02
2038	2.373E+02	1.297E+05	8.711E+00	3.718E+00	1.037E+03	6.969E-02
2039	2.258E+02	1.233E+05	8.286E+00	3.537E+00	9.866E+02	6.629E-02
2040	2.147E+02	1.173E+05	7.882E+00	3.364E+00	9.385E+02	6.306E-02
2041	2.043E+02	1.116E+05	7.498E+00	3.200E+00	8.927E+02	5.998E-02
2042	1.943E+02	1.062E+05	7.132E+00	3.044E+00	8.492E+02	5.706E-02
2043	1.848E+02	1.010E+05	6.784E+00	2.895E+00	8.078E+02	5.428E-02
2044	1.758E+02	9.605E+04	6.454E+00	2.754E+00	7.684E+02	5.163E-02
2045	1.672E+02	9.136E+04	6.139E+00	2.620E+00	7.309E+02	4.911E-02
2046	1.591E+02	8.691E+04	5.839E+00	2.492E+00	6.953E+02	4.672E-02
2047	1.513E+02	8.267E+04	5.555E+00	2.371E+00	6.614E+02	4.444E-02
2048	1.439E+02	7.864E+04	5.284E+00	2.255E+00	6.291E+02	4.227E-02
2049	1.369E+02	7.480E+04	5.026E+00	2.145E+00	5.984E+02	4.021E-02
2050	1.302E+02	7.115E+04	4.781E+00	2.040E+00	5.692E+02	3.825E-02
2051	1.239E+02	6.768E+04	4.548E+00	1.941E+00	5.415E+02	3.638E-02
2052	1.179E+02	6.438E+04	4.326E+00	1.846E+00	5.151E+02	3.461E-02
2053	1.121E+02	6.124E+04	4.115E+00	1.756E+00	4.899E+02	3.292E-02
2054	1.066E+02	5.826E+04	3.914E+00	1.671E+00	4.661E+02	3.131E-02
2055	1.014E+02	5.542E+04	3.723E+00	1.589E+00	4.433E+02	2.979E-02
2056	9.649E+01	5.271E+04	3.542E+00	1.512E+00	4.217E+02	2.833E-02
2057	9.178E+01	5.014E+04	3.369E+00	1.438E+00	4.011E+02	2.695E-02
2058	8.731E+01	4.770E+04	3.205E+00	1.368E+00	3.816E+02	2.564E-02
2059	8.305E+01	4.537E+04	3.048E+00	1.301E+00	3.630E+02	2.439E-02
2060	7.900E+01	4.316E+04	2.900E+00	1.238E+00	3.453E+02	2.320E-02
2061	7.515E+01	4.105E+04	2.758E+00	1.177E+00	3.284E+02	2.207E-02
2062	7.148E+01	3.905E+04	2.624E+00	1.120E+00	3.124E+02	2.099E-02
2063	6.800E+01	3.715E+04	2.496E+00	1.065E+00	2.972E+02	1.997E-02
2064	6.468E+01	3.533E+04	2.374E+00	1.013E+00	2.827E+02	1.899E-02
2065	6.153E+01	3.361E+04	2.258E+00	9.638E-01	2.689E+02	1.807E-02
2066	5.852E+01	3.197E+04	2.148E+00	9.168E-01	2.558E+02	1.719E-02
2067	5.567E+01	3.041E+04	2.043E+00	8.721E-01	2.433E+02	1.635E-02
2068	5.296E+01	2.893E+04	1.944E+00	8.296E-01	2.314E+02	1.555E-02
2069	5.037E+01	2.752E+04	1.849E+00	7.891E-01	2.201E+02	1.479E-02
2070	4.792E+01	2.618E+04	1.759E+00	7.506E-01	2.094E+02	1.407E-02
2071	4.558E+01	2.490E+04	1.673E+00	7.140E-01	1.992E+02	1.338E-02
2072	4.336E+01	2.369E+04	1.591E+00	6.792E-01	1.895E+02	1.273E-02
2073	4.124E+01	2.253E+04	1.514E+00	6.461E-01	1.802E+02	1.211E-02
2074	3.923E+01	2.143E+04	1.440E+00	6.146E-01	1.715E+02	1.152E-02
2075	3.732E+01	2.039E+04	1.370E+00	5.846E-01	1.631E+02	1.096E-02
2076	3.550E+01	1.939E+04	1.303E+00	5.561E-01	1.551E+02	1.042E-02
2077	3.377E+01	1.845E+04	1.239E+00	5.290E-01	1.476E+02	9.915E-03
2078	3.212E+01	1.755E+04	1.179E+00	5.032E-01	1.404E+02	9.432E-03
2079	3.055E+01	1.669E+04	1.121E+00	4.786E-01	1.335E+02	8.972E-03
2080	2.906E+01	1.588E+04	1.067E+00	4.553E-01	1.270E+02	8.534E-03
2081	2.765E+01	1.510E+04	1.015E+00	4.331E-01	1.208E+02	8.118E-03
2082	2.630E+01	1.437E+04	9.652E-01	4.120E-01	1.149E+02	7.722E-03

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2083	2.501E+01	1.367E+04	9.182E-01	3.919E-01	1.093E+02	7.345E-03
2084	2.379E+01	1.300E+04	8.734E-01	3.728E-01	1.040E+02	6.987E-03
2085	2.263E+01	1.236E+04	8.308E-01	3.546E-01	9.892E+01	6.646E-03
2086	2.153E+01	1.176E+04	7.903E-01	3.373E-01	9.409E+01	6.322E-03
2087	2.048E+01	1.119E+04	7.517E-01	3.208E-01	8.951E+01	6.014E-03
2088	1.948E+01	1.064E+04	7.151E-01	3.052E-01	8.514E+01	5.721E-03
2089	1.853E+01	1.012E+04	6.802E-01	2.903E-01	8.099E+01	5.442E-03
2090	1.763E+01	9.630E+03	6.470E-01	2.761E-01	7.704E+01	5.176E-03
2091	1.677E+01	9.160E+03	6.155E-01	2.627E-01	7.328E+01	4.924E-03
2092	1.595E+01	8.713E+03	5.854E-01	2.499E-01	6.971E+01	4.684E-03
2093	1.517E+01	8.288E+03	5.569E-01	2.377E-01	6.631E+01	4.455E-03
2094	1.443E+01	7.884E+03	5.297E-01	2.261E-01	6.307E+01	4.238E-03
2095	1.373E+01	7.500E+03	5.039E-01	2.151E-01	6.000E+01	4.031E-03
2096	1.306E+01	7.134E+03	4.793E-01	2.046E-01	5.707E+01	3.835E-03
2097	1.242E+01	6.786E+03	4.559E-01	1.946E-01	5.429E+01	3.648E-03
2098	1.182E+01	6.455E+03	4.337E-01	1.851E-01	5.164E+01	3.470E-03
2099	1.124E+01	6.140E+03	4.126E-01	1.761E-01	4.912E+01	3.300E-03
2100	1.069E+01	5.841E+03	3.924E-01	1.675E-01	4.673E+01	3.140E-03
2101	1.017E+01	5.556E+03	3.733E-01	1.593E-01	4.445E+01	2.986E-03
2102	9.674E+00	5.285E+03	3.551E-01	1.515E-01	4.228E+01	2.841E-03
2103	9.202E+00	5.027E+03	3.378E-01	1.442E-01	4.022E+01	2.702E-03
2104	8.753E+00	4.782E+03	3.213E-01	1.371E-01	3.826E+01	2.570E-03
2105	8.327E+00	4.549E+03	3.056E-01	1.304E-01	3.639E+01	2.445E-03
2106	7.920E+00	4.327E+03	2.907E-01	1.241E-01	3.462E+01	2.326E-03
2107	7.534E+00	4.116E+03	2.765E-01	1.180E-01	3.293E+01	2.212E-03
2108	7.167E+00	3.915E+03	2.631E-01	1.123E-01	3.132E+01	2.104E-03
2109	6.817E+00	3.724E+03	2.502E-01	1.068E-01	2.979E+01	2.002E-03
2110	6.485E+00	3.543E+03	2.380E-01	1.016E-01	2.834E+01	1.904E-03
2111	6.168E+00	3.370E+03	2.264E-01	9.663E-02	2.696E+01	1.811E-03
2112	5.868E+00	3.205E+03	2.154E-01	9.192E-02	2.564E+01	1.723E-03
2113	5.581E+00	3.049E+03	2.049E-01	8.744E-02	2.439E+01	1.639E-03
2114	5.309E+00	2.900E+03	1.949E-01	8.317E-02	2.320E+01	1.559E-03
2115	5.050E+00	2.759E+03	1.854E-01	7.912E-02	2.207E+01	1.483E-03
2116	4.804E+00	2.624E+03	1.763E-01	7.526E-02	2.100E+01	1.411E-03
2117	4.570E+00	2.496E+03	1.677E-01	7.159E-02	1.997E+01	1.342E-03
2118	4.347E+00	2.375E+03	1.596E-01	6.810E-02	1.900E+01	1.276E-03
2119	4.135E+00	2.259E+03	1.518E-01	6.477E-02	1.807E+01	1.214E-03
2120	3.933E+00	2.149E+03	1.444E-01	6.162E-02	1.719E+01	1.155E-03
2121	3.741E+00	2.044E+03	1.373E-01	5.861E-02	1.635E+01	1.099E-03
2122	3.559E+00	1.944E+03	1.306E-01	5.575E-02	1.555E+01	1.045E-03

Calculator		S-P-R Values	Maximum Score	Linkage	Normalised Score
Leachate migration through combined groundwater and surface water pathways					
SPR1	1a x (2a + 2b + 2c) x 3e	**63**	300	Leachate => surface water	21%
SPR2	1a x (2a + 2b + 2c) x 3b	**0**	300	Leachate => SWDTE	0%
Leachate migration through groundwater pathway					
SPR3	1a x (2a + 2b) x 3a	**49**	240	Leachate => human presence	20%
SPR4	1a x (2a + 2b) x 3b	**0**	240	Leachate => GWDTE or SWDTE	0%
SPR5	1a x (2a + 2b) x 3c	**245**	400	Leachate => Aquifer	**61%**
SPR6	1a x (2a + 2b) x 3d	**147**	560	Leachate =>Public Supply	26%
SPR7	1a x (2a + 2b) x 3e	**49**	240	Leachate => Surface Water	20%
Leachate migration through surface water pathway					
SPR8	1a x 2c x 3e	**14**	60	Leachate => Surface Water	23%
SPR9	1a x 2c x 3b	**0**	60	Leachate => SWDTE	0%
Landfill gas migration pathway (lateral & vertical)					
SPR10	1b x 2d x 3f	**35**	150	Landfill Gas => Human Presence	23%
SPR11	1b x 2e x 3f	**35**	250	Landfill Gas => Human Presence	14%
Site maximum S-P-R Score					**61%**
Risk Classification					**Class B**

- Highest Risk (Class A): Greater than 70 for any individual SPR linkage
- Moderate Risk (Class B): 41-69 for any individual SPR linkage
- Lowest Risk (Class C): Less than 40 for any individual SPR linkage

FEHILY TIMONEY
30 YEARS

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 6

Japanese Knotweed Management and Treatment Plan Including Biosecurity Measures

Japanese Knotweed Management & Treatment Plan Including Biosecurity Measures

Proposed Solar Farm at Clare, Claramorris, Co Mayo

Management Plan *Doc. File Name:* 089/JKM/20	THE JAPANESE KNOTWEED COMPANY Main Office – Meanus, Killorglin, Co Kerry - 066 9796612 Dublin – 01 539 4189 Mayo – 096 54102	*Client Information* Mayo County Council – Claremorris & Western District Energy Co-Op *Site Address* Clare, Claremorris Co Mayo
Authorisation Report A | 1 | 14/02/2020 Status | Rev | Date	Designed & Created by: Peter Byrne 16/01/2020	Checked by: Kieren O' Shea 14/02/2020

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1.0 Introduction & Background to Japanese Knotweed

The optimum survey period for Japanese knotweed requires an understanding of the plant's complex life cycle. In order to provide details, and supporting information, with respect to the optimum survey period, it is important to first illustrate the origin, habitats, invasive qualities & dispersal mechanisms, life cycle and growth forms of this invasive species.

1.1 Origins of Plant

Native to Japan & northern China, Japanese knotweed (Fallopia japonica) is an invasive perennial herbaceous plant which was introduced to Europein the 1820's. The first record for Japanese knotweed in Europe appears to be from an artificial swamp habitat created in a garden of the UK Horticultural Society in Chiswick, London.

A second introduction to Europe is known from 1847, to a nursery in The Netherlands by the German physician and botanist Philippe von Siebold. Japanese knotweed plants were made available for sale by von Siebold at his nursery, as an ornamental species. Thereafter, in the same year Japanese knotweed was awarded a gold medal by the Society of Agriculture & Horticulture at Utrecht as "the most interesting new ornamental plant of the year".

In 1850, Japanese knotweed plants were sent to the Royal Botanical Gardens at Kew, UK, (Conolly, 1977) by Philippe von Siebold; in an unsolicited parcel of plants from his nursery. By 1854, the plant, had also arrived at the Royal Botanic Gardens in Edinburgh, from where it was further distributed across the UK. Japanese knotweed plants were sold by a large number of commercial nursery gardens around the UK (Bailey & Conolly 2000) and Europe and soon became one of the most popular garden plants of the 19th Century; the sharing of cuttings and the discarding of unwanted rhizomes became the primary pathway for dispersal. While it was originally planted for its foliage and "attractive" white flowers, in later years Japanese knotweed was also promoted as a potential source of forage or animal fodder.

Further dispersal occurred by vegetative means as Japanese knotweed spread naturally along watercourses, and in later years Japanese knotweed was dispersed by anthropogenic means in soil containing rhizome fragments; which was moved during road building and construction schemes. The first naturalised record of Japanese Knotweed in Ireland is dated 1905 from a garden in Dublin. Since its introduction to Ireland, it has spread across the island, particularly along watercourses, transport routes and in waste or disturbed ground. Of note is that the plant could still be found widely available for sale in garden centres in the 1930s and even up until the 1980s in the UK (Bailey & Connolly, 2000).

1.2 Habitats

Native Countries

In its native countries, Japanese knotweed is found growing along riverbanks, roadside verges, managed pastures and in sunny places on hills and high mountains. Over thousands of years, it has evolved to become one of the first species to colonise lands within 20 years of volcanic activity and is replaced by other herbaceous species after 50 years or so. It typically reaches 0.3 - 1.5m tall and is attacked by a suite of 226 natural enemies, including insects and fungi, which keep it in check.

Ireland

In Ireland (and other countries to which it has been introduced worldwide), the absence of natural enemies, combined with its ability to colonise and penetrate volcanic landscapes, means that the plant can grow unchecked reaching heights of up to 3-4m, to form dense stands, and like a number of tree species has the capability of accessing existing weaknesses

or joints in bitumen, concrete, masonry and hard standing areas. No correlation between soil type, plant size or vigour has been identified, suggesting that it can grow on any substrate.
Its ability to penetrate existing weaknesses and joints comes from its underground network of stems known as rhizomes and its large central 'crown'.

1.3 Invasive Qualities
1.3.1 Growth Stages

Crown
In more mature Japanese Knotweed plants (typically 4 years old), a central rhizome 'crown', develops from which the main stems emerge above ground.

Underneath, the crown, the radial rhizomes twist together to form a sizeable and considerable upward penetrating force. As the plant matures the crown expands. Where Japanese knotweed is growing in close proximity to hard landscaping, the expanding crown can open up existing weaknesses in cracks or joints which may cause damage to footpaths and other infrastructure.
The crown also acts as the plants' carbohydrate food store during the winter months when the leaves die back and the plant goes into its natural winter dormancy period.

Rhizomes
When the rhizome network of a Japanese knotweed plant is spreading, it sends out new radial rhizomes (or underground stems) laterally underground from the central crown. The plant will then send up new shoots and adventitious roots along the length of these rhizomes. The new shoots are not only a sign that a rhizome network is spreading, they also provide an indication of the direction of new rhizome growth, and the overall pattern of growth of the plant.

While most of the plants' rhizomes are found in the top 1 metre of the soil, they can also go deep into the soil and extend up to several metres out from the plant, depending on ground conditions and disturbance regimes. The standard 7m rule or buffer zone described in Irish and UK government guideline documents, suggests that Japanese knotweed rhizomes may extend seven metres laterally from a crown or parent plant.

Fennell et al. (2018) demonstrated that even large stands of Japanese knotweed do not usually produce rhizomes that extend further than 4m. The study found that Japanese knotweed rhizomes rarely extend more than 4m from above ground plants and are typically found within 2m for small stands and 2.5m for large stands. Similarly, the mean vertical extent recorded averaged between 1.02m for the small stands and 1.64m for the large stands, (with a maximum of 3.2m recorded).

In terms of ecology, landscapes and amenities, Japanese knotweed is known to have potential significant negative ecological impacts on native habitats and species, on landscape character and quality, and on visual and recreational amenities. With regards to increased flood risk, built infrastructure and land-uses, Japanese knotweed once established can dominate watercourses where it may impede water flow through the obstruction of conveyance (or drainage) in ditches, streams and rivers particularly when water levels are high; thus, contributing to flooding. During winter dieback, Japanese knotweed may leave river banks exposed to erosion, leading to bank collapse. Land use and access to lands and infrastructure can also be impacted or impeded where large dense monospecific stands block access routes, invade landscaped areas such as gardens and urban parks/woodlands, impact on the quiet enjoyment and use of domestic gardens, encroach on roadways and agricultural fields and occupy large swathes of lands. Signage and sightlines on roadways can also be impinged. In addition to these impacts as described above, Japanese knotweed, like certain tree species also has the ability to access existing weaknesses and joints, and may in certain situations cause damage to hard landscaping and infrastructure.

1.3.2 Reproduction

Sexual Reproduction

Japanese Knotweed is generally not considered capable of producing viable seed. In simplistic terms only female cloned (male sterile1) plants are considered to be present in Ireland (Bailey & Connolly, 2002). Reproduction is, therefore, almost entirely asexual with very little viable seed produced (0% to <2%) (Tiébré et al.2007).

Japanese knotweed, does however have the ability to hybridise with close relatives e.g. Giant Knotweed (Fallopia sachalinensis) to produce Bohemian Knotweed (Fallopia x bohemica) which is capable of producing viable seed. It can also hybridise with Russian Vine (Fallopia baldschuanica) to produce Connolly's Knotweed (Fallopia connollyana); and may backcross with Russian Vine to produce viable seeds (Bailey, 2001; Tiébré et al., 2007); although limited numbers survive beyond one year's growth.

Asexual Reproduction - vegetative

In Ireland (and other countries into which it has been introduced worldwide) the plant species displays an extraordinary ability to disperse and rapidly regenerate from rhizome or stem fragments to colonise and invade disturbed land. Less than 0.7g of a rhizome can produce roots and shoots in 10 days.

1.3.3 Dispersal

During landscaping and construction activities Japanese Knotweed can be disturbed by machinery, and spread within or be brought onto a site, in the form of plant fragments within the soil load or on the tyres of machinery and dumpsters, especially on machinery with tracks. The maintenance of Japanese Knotweed by mechanical methods such as cutting and strimming can distribute fragments, which can then be carried along road corridors by wind or on the tyres of vehicles including cars (see Wace, 1977; Wilcox, 1989). Fragments can also be carried on the footwear of pedestrians.

In relation to semi-natural habitats, the species out-competes native herbaceous and juvenile woody plants, reducing species diversity. Once established the height, dense canopy and aggressive nature of the plant essentially excludes other species. In addition, Japanese Knotweed has also been shown to have allelopathic effects on native vegetation; permitting germination but limiting biomass. Along riverbanks, new shoots have been observed developing primarily from floating stems from which fragments can be broken off by floods which lodge downstream to form new outlier populations; therefore, an upstream catchment wide management approach is required to achieve eradication of knotweed species along habitats where there is upstream surface water connectivity.

It is found primarily in open sites. Under favourable conditions the plant can grow up to 10cm a day and can rapidly invade disturbed ground in the absence of native vegetation. It tolerates semi-shaded but not fully shaded areas.

In the presence of dense native vegetation, it can in certain situations struggle for resources due to competition. Its growth and abundance are depressed in heavily shady sites (Beerling, 1991; Seiger, 1993); and it is consequently unable to successfully dominate the ground flora, shrub and tree layer in the understorey of dense woodland canopies; it rarely flowers beneath woodland canopies.

In Ireland, Japanese Knotweed is associated with roadsides, railways, car parks, quarries, maintenance depots, landfill sites, abandoned waste ground and in particular, disturbed areas where native vegetation is absent and where fly-tipping of spoil has occurred.

1.3.4 Plant Defence Mechanisms

In terms of undertaking surveys for Japanese knotweed, it is important to understand the plants' defence mechanisms. The use of chemical herbicide and the mowing of Japanese knotweed can result in the creation of bonsai regrowth which can go undetected unless surveys are undertaken by a specialist. In response to the use of chemical herbicide and burial at depth, the plant also has the ability to remain dormant or persist for long periods of time underground. In this regard the importance of completing a thorough forensic investigation including a detailed desktop study which examines existing records of Japanese knotweed (plant databases), and a review of available aerial imagery and Google Streetview to identify historic and ongoing sources and pathways for dispersal cannot be underestimated as part of a survey report.

Japanese Knotweed can respond to cutting or burial by deploying a number of plant defence mechanisms. Cutting, flailing, mowing, digging or burying the plant may result in:

- Dispersal of plant fragments which can regrow elsewhere
- Bonsai regrowth
- Rapid regrowth and increase in the height and extent of the plant
- Lateral growth of rhizomes and the development of new radial shoots
- Regrowth of buried rhizomes (buried rhizomes can survive for several years)
  Knotweed also has the ability to execute a number of plant defence mechanisms in response to chemical herbicide including:
- Sub-lethal bonsai regrowth
- Lateral growth of rhizomes and development of new radial shoots
- Dormancy - rhizomes can lay dormant and viable for a number of years before regrowth
- Compartmentalisation

Given its complex reproductive capabilities, Japanese Knotweed has essentially two 'lifecycles' in the Irish context (in the absence of viable seed).

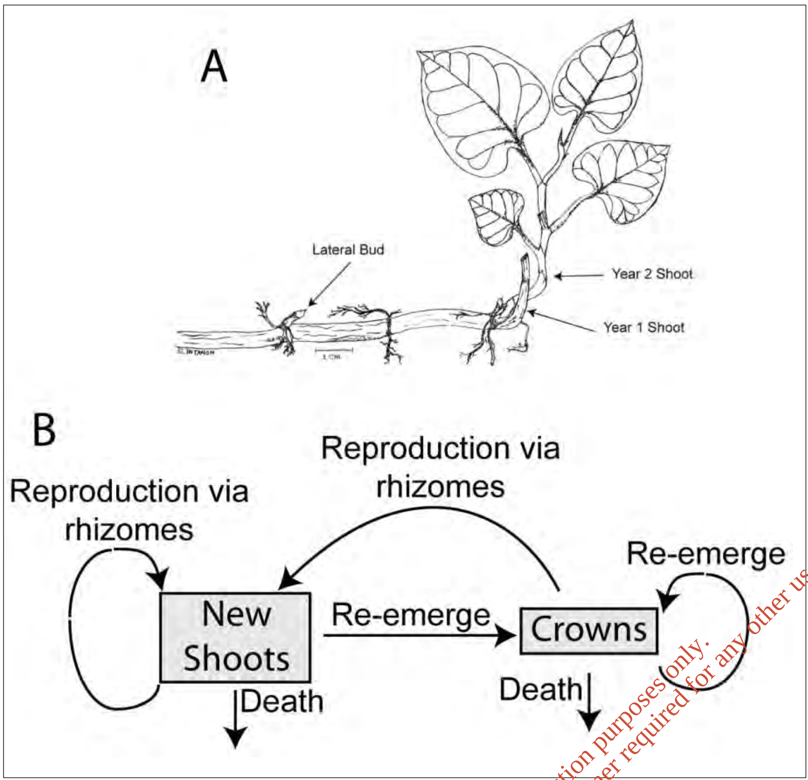
- The first is the lifecycle of Japanese knotweed which revolves around the 'crown' structure
- The second is the lifecycle of a rhizome fragment which has broken away from the crown as a result of disturbance e.g. soil movement

1.3.5 Lifecycle of a Japanese Knotweed Crown

A crown will typically produce shoots which are much 'stronger' than those produced from a rhizome fragment and will display the following characteristics

- Red/purple shoots appear early in spring which often resemble an 'asparagus' like appearance but, as the canes grow, the leaves unfurl and the plant takes on its more characteristic appearance.
- The mature canes are like bamboo, being hollow, and are light green with characteristic reddish-brown flecks. The plant can grow to over 3m in height.
- Flowering occurs in late summer/autumn (end July – typically August) and consists of small off-white- creamy to greenish flowers.

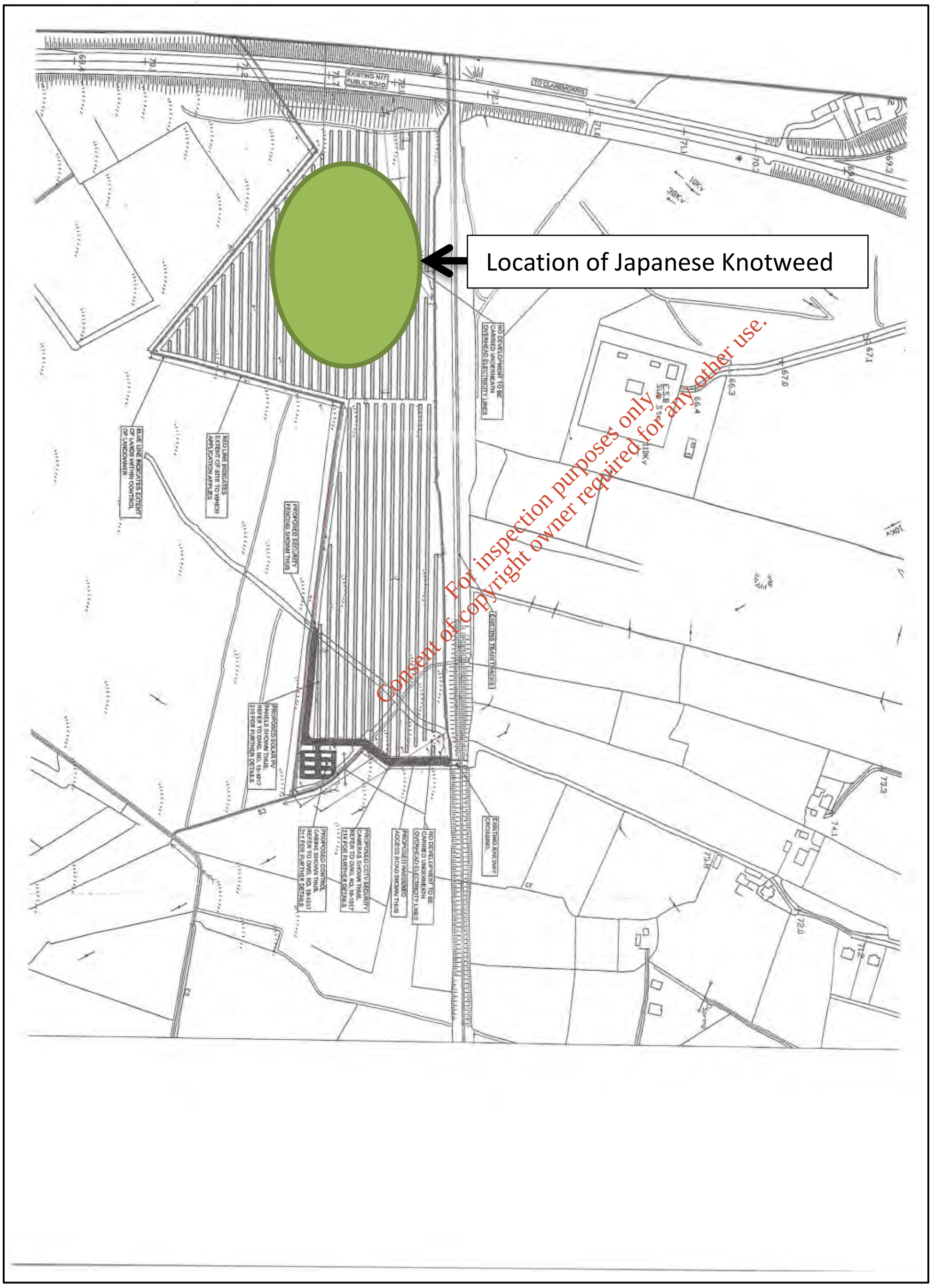
- In autumn, the leaves turn yellow as senescence (winter dieback) sets in.
- During the winter the canopy of leaves die back to reveal the crown and the orange/brown woody erect "zig-zag" stems - which later turn silver.



2.0 Introduction to Site

2.1 Description of the Site

This site is located to the east of the N17 highway in the townland of Clare, Claremorris, Co. Mayo, (Easting 532068 & Northing 776300). This site was previously used as a county council landfill, however, the landfill activity has ceased since a number of years. Native scrub and flora are present throughout this site, no protected plant species were present on this site during the site surveys that have been carried out to date. The non-native invasive plant Japanese knotweed is present at several locations throughout this site, the area of infestation is indicated on the map below.



2.2 Known Herbicide Treatment History at Site

Mayo county council employed contractors to carry out herbicide treatments at this site in September 2014 & 2015 and a non-persistent herbicide designed for aquatic use was administered to the Japanese knotweed infestations that are present on this site. There were no further treatments carried out on this site, however monitoring of the infestations was carried out in August 2018 & 2019. In September 2019, an updated report created by The Japanese Knotweed Company recommended that a further herbicide treatment be carried out at these lands for a minimum of 4 years going forward and this was to be followed by an ongoing monitoring programme.

2.3 Site Management Objectives

The site management objectives relevant to this management plan are to gain control and subsequent management of the infestations of Japanese Knotweed that are present, so that no further threat is posed to this site as a whole or to the biodiversity of the surrounding environments. The solar PV farm that is proposed for this site will afford an opportunity for access to be gained to all areas of these lands so that herbicide treatments and the aforementioned ongoing monitoring programme can be implemented in conjunction with the proposed works. All essential biosecurity measures as set out in this document must be strictly adhered to at all times, no proposed works should be carried out without the presence of a certified surveyor of non-native invasive plants.

2.4 Limitations and Threats to Management Objectives

Herbicide treatment that is administered correctly by qualified personnel at the correct time of year will achieve management and control of the Japanese Knotweed infestation present on this site over the 4 year herbicide treatment programme. This methodology gains control by forcing the growth of the plant into a state of consequential dormancy, however, re-emergence of the plant in the form of bonsai growth will occur, the ongoing monitoring programme will identify this regrowth and herbicide treatment of this regrowth will be necessary in order to keep control of the plant maintained throughout the site as a whole.

As machinery will be imported to site to carry out tree felling, site clearance & the creation of hard standings, the essential biosecurity measures as detailed throughout this document will need to be strictly adhered to in full. Machinery can act as a vector for the further spread of this non-native invasive plant throughout the site, thereby posing a threat to the management objectives.

2.5 Legislative Framework

At an international level Ireland has signed up to a number of treaties and conventions, including the **Convention on Biological Diversity.** Such treaties and conventions require the Irish Government to address issues of invasive alien species. This has been implemented through the **Wildlife Act 1976 and 2000** and further regulated through the **European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477 of 2011)**

Regulation 49

'a person shall be guilty of an offence if they: plant; disperse; allow or cause to disperse; spread or cause to grow the plant in the Republic of Ireland'. The list of species in the Third Schedule includes Japanese Knotweed, Giant Knotweed and their hybrid Bohemian Knotweed.

Regulation 50

'an offence to or intend to; import; buy; sell; breed; reproduce or propagate; offer or expose for sale; advertise; publish a price list; transport; and distribute any plant species or vector material listed in the Third Schedule'.

Non-native species subject to restrictions under Regulations 49 and 50 are included in the third schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I 477 of 2011. The invasive species listed in the Third Schedule include: Japanese Knotweed, Giant Knotweed, Giant Rhubarb, Himalayan Balsam, Himalayan Knotweed, Bohemian Knotweed and Rhododendron.

The vector material (i.e. facilitates spread), referred to in the regulations (Third Schedule Part 3) which applies to Knotweed species is:

"Soil or spoil taken from places infested with Japanese Knotweed, Giant Knotweed or their hybrid Bohemian Knotweed"

The Waste Management Act 1996, as amended and associated regulations must be complied with if Japanese Knotweed contaminated material is to be moved off site.

It is a requirement to dispose of this material to a fully licenced wasted facility, capable of accepting such contaminated material. This disposal requirement applies to all Japanese Knotweed material including untreated and treated plant material. It also applies to soil containing the plant material, i.e. a 7m radius around the above ground stand and up to 3m deep below the stand, this is site specific.

If Japanese Knotweed contaminated material is removed off site it will require a **licence from the National Parks and Wildlife Service** in advance of any removal, in accordance with the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477)

2.6 Guidance Documents

The following guidance documents and literature sources were consulted during the preparation of this report:

- National Roads Authority NRA (2010). *Guidelines on management of noxious weeds and non-native invasive plant species on national roads.*
- Crushell, P., Foss P., Hurley C. & O' Loughlin B. (2011). *County Kerry Invasive Species Survey 2011 – Pilot Mapping Study of the River Lee Catchment, Tralee.* Report prepared for Kerry County Council and The Heritage Council
- Environmental Agency (UK) (2013). *The Knotweed Code of Practice: Managing Japanese Knotweed on Development Sites (Version 3, amended in 2013*
- Stokes, K., O' Neill K., & McDonald R.A*. (2004) Invasive Species in Ireland* Unpublished Report
- NPWS (2011) *Actions for Biodiversity* 2011-2016, *Irelands second National Biodiversity Plan.* Department of Arts Heritage and the Gaeltacht.
- Department of Environment (2013). An invasive alien Species Strategy for Northern Ireland. www.doeni.gov.uk
- Irish Water Report. Information and Guidance Document on Japanese Knotweed Asset Strategy and Sustainability

3.0 Overview of Management Plan

3.1 Prevention Measures Prior to Development Stage

The proposed access route that is located at the north eastern corner of the site will require a fenced in clean down zone to be created. This clean down zone will require a layer of high quality geotextile membrane to be laid over an area large enough to be able to accept incoming machinery and vehicles to be inspected and cleaned down where necessary prior to gaining access to the site.

A 150mm layer of 804 hardcore will need to be placed on top of the geotextile membrane to protect the membrane from being punctured and to ensure no cross contamination occurs.
It is recommended that a high quality geotextile membrane is laid prior to the hardcore being placed along this route that runs from north to south allowing access to be gained to the proposed control cabins.

Access to and from the proposed solar PV farm should be controlled at points along the access route, each access point will require a footbath and clean down station to be created as machinery and footwear can act as vectors for the spread of the non-native invasive plant Japanese Knotweed. Signage highlighting the presence of the non-native invasive plant Japanese Knotweed will need to be erected throughout the site and remain in place for the duration of these works.

Should the proposed works commence within the botanical growing season, from early March to September it is recommended that a herbicide treatment be administered to the Japanese Knotweed 21 days prior to the commencement of works. The herbicide administrator will be required to have a registered pesticide user number (PUN) and be trained in PA1, PA6, PA6AW & PA6ING (City & Guilds PTC) The Herbicide administrator must complete, sign & date a **Site Herbicide Recording Sheet (Appendix B)** identifying their individual PUN.

3.2 Works At Development Stage

All personnel involved in these works must attend a tool box talk on working in close proximity to non-native invasive plants and the ease with which these plants can be spread unwittingly or accidentally further on the site as a whole or indeed off site and onto another.
This tool box talk will be delivered by a certified surveyor of non-native invasive plants.
All machinery that gains access to the works area of this site must use the dedicated access routes and must not be allowed to leave identified infested areas without being inspected and cleaned down where necessary, by trained personnel.

It is understood at this stage that the solar panels will be placed on precast concrete bases, this will be dependent on ground conditions. It is inevitable that given the size of the planned solar PV farm that some ground disturbance will have to take place. It is therefore recommended that any ground disturbance or any movement of soils within this site is carried out under the supervision of a certified surveyor of non-native invasive plants.
All planned works must adhere to the biosecurity measures in full, as set out in **Section 4.3 Biosecurity Measures** of this document. It is recommended that these biosecurity measures are carried out under the supervision of a certified surveyor of non-native invasive plants, the individual that is tasked with the implementation of these biosecurity measures must complete, sign & date the **Daily Onsite Biosecurity & Management Forms (Appendix A)**

3.3 Four Year Herbicide Treatment Programme

It is recommended that a 4 year herbicide treatment programme be carried out on an annual basis from late August time to the middle of October. Foliar spray, weed wipe and stem injection are the treatment administration methods that will be utilised on the infestations that are present on this site, the condition of the plant on the day that the treatment is to be administered, will determine the method that is to be utilised for maximum effect.

A non-persistent herbicide application shall be delivered using an approved applicator by a trained operative equipped with suitable personal protective equipment (PPE). The operator must have completed relevant training including City & Guilds NPTC Pesticide Training PA1 – Safe use of pesticides in conjunction with PA2a and PA6 as a minimum qualification. The operator must be registered as a Professional User (with valid PU number) with the Department of Agriculture's Pesticides Registration & Control Divison.

The herbicide shall be applied at a rate and in a manner that is in accordance with the manufacturer's specification. Application of the herbicide shall not occur during periods of rainfall or during windy conditions. The application of herbicide shall also not occur at any stage where rainfall is predicted or expected within 1 hour of the chemical application. Extreme care shall be exercised during application of the herbicide to ensure pedestrians or passing vehicular traffic are not affected or contaminated by the herbicide application.

The herbicide application shall be conducted in a manner to ensure the following are not affected:

- Domestic Water Supply contamination
- Rivers, streams, ditches and other natural sources of water
- Neighbouring crops, pets and livestock
- Wildlife and beneficial insects
- Hedgerows, surrounding vegetation and gardens
- SAC's, SPA's, NHA's etc.

The Herbicide administrator must complete, sign & date a **Site Herbicide Recording Sheet (Appendix B)** identifying their individual PU number.

It is recommended that on completion of year 1 herbicide that a site walkover survey be carried out in May of the following year to evaluate the regrowth, this action should occur after each treatment has been administered throughout the 4 year programme.

3.4 Ongoing Monitoring

On the completion of the 4 year herbicide treatment programme a twice yearly monitoring programme should commence, the initial monitoring should commence in the middle of May of the following year and any minute regrowth should be marked on a map and identified on the ground with a precaution sign erected in the regrowth area. A further monitoring should take place in middle of August and all identified regrowth subjected to a further herbicide treatment as required.

All monitoring should be documented photographically and this documentation attached to the management plan, all further herbicide treatment that maybe required must be carried out as detailed in **Section 3.3 Four Year Herbicide Treatment Programme** of this document.

4.0 Specific Control Plans for Japanese Knotweed

4.1 Management Objectives

The objectives of this management plan are to gain control of the infestations of Japanese Knotweed that are present on this site in a sustainable and environmentally sensitive manner. Once control of the Japanese Knotweed has been achieved, the management and ongoing monitoring of this site in conjunction with the planned solar PV farm, will ensure that this non-native invasive plant poses no further threat to the surrounding biodiversity and environment of the site as a whole.

4.2 Management Options Rationale

The 4 year herbicide treatment programme with subsequent ongoing monitoring was the preferred management options for this site both environmentally and economically. Other options that were explored proved to be unsustainable and non-viable for a site such as this.

4.3 Biosecurity

- A clean down zone is to be identified and created at the entrance to the access road prior to the commencement of any works, this clean down zone must be clearly identified with signage
- Footbaths and clean down stations must be placed at all entry and exit locations to the site prior to the commencement of any works, these clean down stations must be clearly identified by signage
- All clean down areas must be clearly identified and a suitable membrane put in place to protect the soils beneath from further infestation, this membrane must be protected with a 150mm layer of 804 hardcore
- Tool box talks on invasive plant material to be provided to all relevant personnel involved in the works being undertaken prior to access to site being permitted
- A 3 metre buffer zone should be erected outside of the identified infested areas, no unauthorised personnel to be admitted within this 3 metre buffer zone, all works carried out within this buffer zone should be done so under the supervision of a certified surveyor in non-native invasive plants
- All machinery being brought to site must be inspected at the clean down zone for any soils that may contain invasive plant material before being allowed to enter the work zone
- At no time should the excavators or vehicles involved in the works breach the 3 metre buffer zone – should it be necessary for an excavator to work within the 3 metre zone, a certified surveyor in invasive plants should be present
- Excavators or machinery used within the 3 metre buffer zone must not be allowed to leave this area without being thoroughly inspected and cleaned down by the certified surveyor
- No delivery vehicles are to be allowed entry or exit to this site without being thoroughly inspected and cleaned to ensure that no non-native invasive material is unwittingly or accidently imported to site or escapes off site onto another
- On completion of these works all machinery must be thoroughly inspected and cleaned down before being allowed to leave this site
- As materials / aggregates will be imported to this site, it is vital that these materials be inspected at source to ensure that no non-native invasive plant material is imported to site
- All debris that is collected at the clean down areas and footbath stations needs to be deposited back into the already infested areas of the site
- At no time should any soils be removed from this site without this management plan being updated and a licence being obtained from the National Parks & Wildlife Services

On completion of the planned works for the solar PV farm, all footbath and clean down stations must remain on site and continue to be utilised for maintenance staff and the ongoing treatment of the Japanese Knotweed that is present.

4.4 Actions Planned on site

All works will be carried out in accordance with this management plan, should this management plan need to be amended due to any unforeseen constraints, these changes must be documented, dated and signed by a certified surveyor of invasive plants.

Records of all inductions and biosecurity checks must be documented and attached to this management plan for transparency. Clear signage must be erected throughout the site highlighting the dangers associated with cross contamination of the non-native invasive plant Japanese Knotweed.

4.5 How Actions will be Evaluated

The certified surveyor will conduct monitoring prior to any works being carried out to act as a baseline for future monitoring. Recording sheets will document any further visits and action taken.

4.6 Resources Required to Design & Create Management Plan

- Liaise with Mayo county council – Parks department
- Site surveyed
- Desk top study
- Design & create management plan

4.7 Results of evaluations

Site inspection forms contained within the appendix, this activity is carried out during the process. An audit trail shall be part of the completion package.

5.0. Summary of Information

The Japanese Knotweed that is present at this site can be controlled and managed successfully to allow the proposed solar PV farm to proceed. This management plan and the site specific biosecurity details are based on the condition of the site and data that was collected at the initial site survey.

All access routes and entry points referred to throughout this management plan were identified on the site layout maps supplied to The Japanese Knotweed Company by Claremorris & Western District Co-Op

Table 1	Priority Areas	Risk
Japanese Knotweed	The site as a whole	Medium Risk

Table 2	Control Methods	Risk
Japanese Knotweed	Implementation of biosecurity measures	Medium Risk
Japanese Knotweed	4 year herbicide treatment	Medium Risk
Japanese Knotweed	Ongoing monitoring programme	Medium Risk

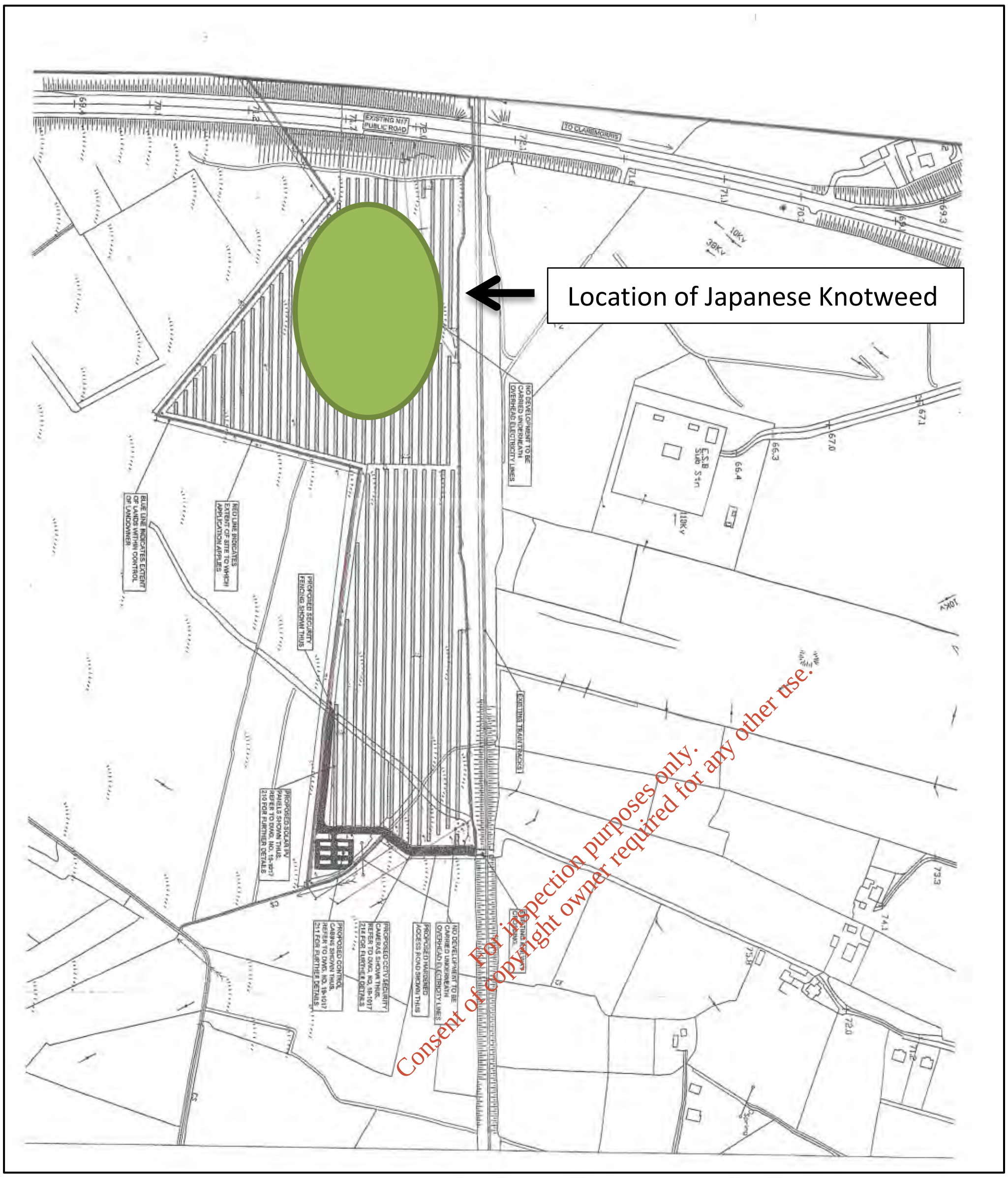
Table 3	Implementation Schedule
Phase 1: Initial site survey	Completed 06th & 07th January 2020
Phase 2: Management Plan	Completed 27th Januaray 2020
Phase 3: Enabling works / Tool box talks/fencing & signage	To be Confirmed
Phase 4: Implementation of pre-works biosecurity measures	To be Confirmed
Phase 5: Initial herbicide treatment prior to the commencement of works (21 days)	To be Confirmed
Phase 6: Development stage	To be Confirmed
Phase 7: Implementation of 4 year herbicide treatment programme	To be Confirmed
Phase 8: Implementation of ongoing monitoring on completion of 4 year herbicide treatment programme	To be Confirmed
Phase 9: All recording sheets & documentation to be attached to this management plan	All attachments to be added on an ongoing basis

6.0 Tier 3 Capping Option

A tier 3 treatment option for the historic landfill at Claremorris, Co Mayo is being discussed for this site. Should an application for a tier 3 capping be successful this management plan will be updated to include and reflect same.

Appendix A – Location Map

Appendix B – Location of JK



Appendix C

Daily Onsite Biosecurity & Management Forms

Date:		
Inspected by:	Initial:	Sign:
Site:		
Client:		

Transport routes free of soils/debris	**Yes**	**No**	**Comment**
Fencing	**Still in place**	**Damaged/Removed**	**Comment**
Clear Signage	**Still in place**	**Damaged/Removed**	**Comment**
Clean Zones Inspected	**Yes**	**No**	**Comment**
All Machinery/Plant inspected			
Have any vehicles left or entered the site ?			
Is the site secure?			

Notes/Comments

A new form is to be used on each working day – it must be signed and dated by the appointed certified surveyor – it must be attached to the management plan at all times for transparency

Appendix D: Site Herbicide Record Sheet

Date:		
Inspected by:	Initial:	Sign:
Site:		
Client:		

Dose of Product	Volume Applied	Product	Total area Treated	Start Time	Finish Time

Names / Certificate Nos of Other Operators	

PPE		WORN
Gloves		
Boots		
Coverall		
Apron		
Face Shield		
Hard Hat		
Respirator		

Notes: Harvest interval, exclusion period, problems, equipment faults/repairs, notification of neighbour	Wind Direction	N	NE	E	SE	S	SW	W	NW
Technicians need to be fully qualified in PA1, PA6, PA6 AW & PA6 ING – Must also be a registered pesticide user Registered Pesticide Number Signed By:	Wind Speed	Nil		Light		Moderate		Strong	
	Temperature	Cold		Cool		Warm		Hot	
	COSHH Sheets Present	Yes				No			
	Warning signs in place	Yes				No			

This form is to be used on each separate site visit and herbicide treatment – it must be attached to the management plan at all times for transparency

Appendix E: Environmental Risk Assessment **Classifications – Extreme – High – Medium – Low Risk – No Risk**

Hazard	Source	Pathway	Receptor	Risk	Abatement Measures
Hybrid Knotweed & Infested soils	Excavation of soils	Ground	Cross contamination onsite		All infested areas on infestation are to be fenced off 7 m from the nearest stems using high visibility fencing; signs will be displayed notifying all workers on site of the presence of invasive weeds. All infested soils to be contained within identified holding area. All machinery to be cleaned before moving to a different area.
Particulates	Plant & Machinery	Air	Residents - site staff		Ensure vehicles and plant in good operating condition.
Spillage's of oils & fuels	Plant & Machinery	Ground	Ground Water		Bulk Fuels to be contained within a bunded fuel tank. Vehicles to be inspected for leaks. Ensure vehicles & plant in good operation condition. Provide spillage control equipment.
Noise	Plant & Machinery	Air	Residents – site staff		Ensure vehicles and plant in good operation with silencers. Locate plant to minimise effect. Use plant at appropriate time.
Mud & Debris	Plant & Machinery	Ground	Public roadway - residents		All machinery shall be cleaned before leaving site. If required provide wheel wash facilities. If required provide road sweeper.
Dust	Plant Movement	Air	Adjoining land Residents Site staff		Spray water during dry spells. Deploy water bowser. Employ road sweeper to damp down roads.
Dated:			**Signed:**		

This form is to be used on each separate site visit and herbicide treatment – it must be attached to the management plan at all times for transparency

Appendix F: Control of Substances Hazardous to Health Assessment

Substance/Contaminant/Chemical : Herbicides

Activity / Element	Hazards in contact with	Who / What Risk	Initial Rating L	Initial Rating C	Initial Rating R	Control Measures Specified	Residual Risk Rating L	Residual Risk Rating C	Residual Risk Rating RRR
Decanting	Eyes	Operatives				Training/ Awareness of the task, the equipment and the chemicals involved must be given to anyone about to use this system. Attention must be drawn and information must be given and readily available for refresher reasons on the effects of this chemical; • How to store it safely. • How to decant it safely. • How to use it. • What to do in case someone has been affected by it. First Aid Eyes – flush immediately with water for about 15 mins. If the irritation persists seek medical advice Skin – Remove affected clothing and wash the underlying skin with copious amounts of soap and water. If the irritation persists seek medical advice Swallowing – Seek medical aid immediately and take the chemicals information (Material Safety Data Sheet) with you			
Spraying	Skin	Other site personnel							
Storage	Air passage ways	Members of the public							
Transport	Digestive System	Other							
Other	Other								
Notes:	Notes	Notes							

L = Likelihood	1 = Improbable, 2 = Unlikely, 3 = Likely, 4 = Very Likely, 5 = Certain
C = Consequence	1 = Injury no lost time, 2 = Minor injury less than 3 days, 3 = Injury more than 3 lost days, 4 = Major Injury, 5 = Fatality
R = Risk Rating	The risk rating is the value given to the Risk when the likelihood is multiplied by the Consequence
RRR = Residual Risk	The residual risk rating is the value of the risk once all the control measures have been put into place and practise

In the case of an environmental affect the Consequences rating should reflect the severity of that effect

Date of Assessment:		**Name of Assessor:**	
Review Date:		**Reviewed By:**	

This form is to be used on each separate site visit and herbicide treatment – it must be attached to the management plan at all times for transparency

All information relevant to this management plan will be attached on an ongoing basis for the duration of the proposed works identified within this document. All monitoring and results of evaluations to be fully documented and recorded with photographic evidence to be attached to this management plan

Kieren O'Shea 27/01/2020

Certified Surveyor

The Japanese Knotweed Company

CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

APPENDIX 7

Remediation Design Drawings

Legend

- Site Boundary/Extent of Solar Development
- SWX Proposed SW Monitoring Locations (T.B.A)
- Approximate Capping Boundary 31,925m² (to be Confirmed by Additional SI)
- BHXX Existing Boreholes
- BHXX Proposed Boreholes (Locations T.B.A)
- W Surface Water
- Flow Direction

Notes:

All remediation works subject to EPA approval, detailed design and Certificate of Authorisation.

Historic Landfill Engineered Cap

Engineered cap shall comprise:

- 200 mm topsoil, on
- 800 mm subsoil, on
- Subsurface drainage geocomposite and collection pipework or similar, on
- 1mm LLDPE Barrier, on
- Gas collection geocomposite and collection pipework or similar,
- Reprofiled Existing/Imported Layer, above
- Historical Waste

Subject to detailed design and Certificate of Authorisation.

Topsoil

Topsoil shall be compliant to BS3882:2015 or equal approved and graded to ensure no localized surface depressions are present.

Subsoil

Subsoil shall be provided using a uniformly graded material with stone sizes not greater that 100 mm or equal approved.

Subsurface Drainage

A subsurface drainage layer on the cap barrier (hydraulic conductivity should be equal to or greater than 1x10-4 m/s for a thickness of 500 mm) or equal approved geocomposite

Surface Drainage

Surface drainage layouts using grassed waterways shall collect and direct surface water runoff including subsurface drainage outfall flows to one or more dedicated surface drainage outfalls into existing surface water perimeter drain(s).

LLDPE Barrier System

The barrier system shall use 1.0 mm LLDPE or similar approved.

This barrier will require vertical cut-offs on all boundaries to mitigate the risk of landfill gas migration and leachate egress following secondary consolidation. Subject to Detailed Design

Landfill Gas Management

Shall comprise a under-liner gas collection geocomposite or similar approved stone drainage later. As per EPA Landfill Site Design manual, should not be less than a 150 mm stone layer with a hydraulic permeability of 1x10-4m/s or equivalent.

Landfill gas management subject to risk assessment and detailed design

Environmental Monitoring

Environmental Monitoring infrastructure as per Remediation Plan schedule and Certificate of Authorisation

Invasive Species

All works subject to the recommendation of the prepared Invasive Species management plan.

Solar Farm Development

All proposed works to be cognisant of proposed after use of site as a solar farm as appropriate

0m 10m 20m 30m 40m 50m 60m 70m 80m 90m 100m

Scale 1:1000

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Rev.	Description	App By	Date
A	ISSUE FOR COMMENT	BG	03.03.20

PROJECT

CLAREMORRIS HISTORIC LANDFILL REMEDIATION PLAN

SHEET

LOCATIONS OF PROPOSED ENVIRONMENT MONITORING POINTS

CLIENT

MAYO COUNTY COUNCIL

Date	Project number	Scale (@ A1-)
03.03.20	P2348	1:1000

Drawn by	Drawing Number	Rev
SOC	P2348-0400-0001	A
Checked by: JON		

O:\ACAD\2020\P2348\P2348-0400-0001

05 March 2020

Legend

Site Boundary/Extent of Solar Development

Approximate Capping Boundary 31,925m²
(to be Confirmed by Additional SI)

Notes:

All remediation works subject to EPA approval, detailed design and Certificate of Authorisation.

Historic Landfill Engineered Cap

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- Gas collection geocomposite and collection pipework or similar,
- Reprofiled Existing/Imported Layer, above
- Historical Waste

Subject to detailed design and Certificate of Authorisation.

Topsoil

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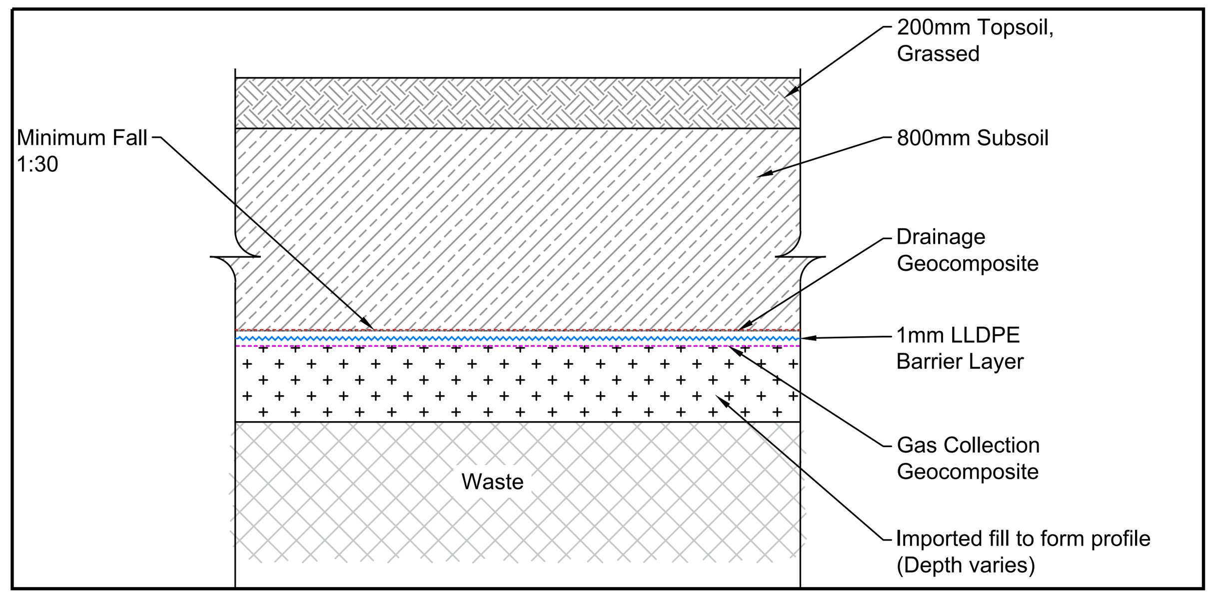
Solar Farm Development

All proposed works to be cognisant of proposed after use of site as a solar farm as appropriate



TYPICAL CAPPING DETAIL - HISTORIC LANDFILL

Scale 1:25

PLAN

Scale 1:500

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Rev.	Description	App By	Date
A	ISSUE FOR COMMENT	BG	03.03.20

PROJECT	CLAREMORRIS HISTORIC LANDFILL REMEDIATION PLAN
CLIENT	MAYO COUNTY COUNCIL
SHEET	PROPOSED REMEDIATION PLAN
Date	03.03.20
Project number	P2348
Scale (@ A1-)	As Shown
Drawn by	SOC
Checked by	JON
Drawing Number	P2348-0400-0002
Rev	A

O:\ACAD\2020\P2348\P2348-0400-0002

05 March 2020

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