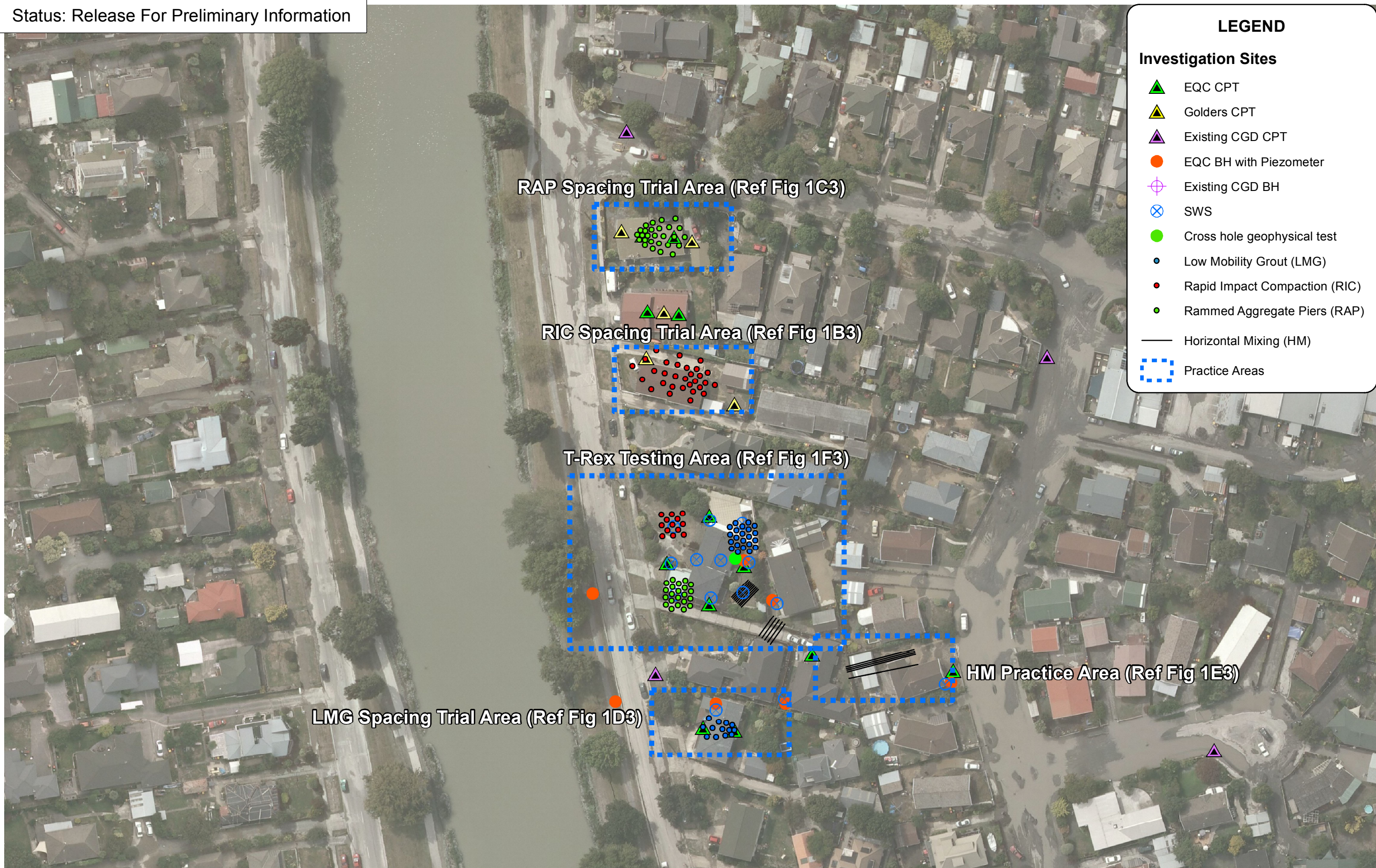




LEGEND

Investigation Sites

EQC CPT

Golders CPT

Existing CGD CPT

EQC BH with Piezometer

Existing CGD BH

SWS

Cross hole geophysical test

Low Mobility Grout (LMG)

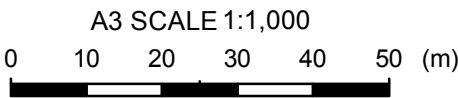
Rapid Impact Compaction (RIC)

Rammed Aggregate Piers (RAP)

Horizontal Mixing (HM)

Practice Areas

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EQC

EARTHQUAKE COMMISSION

Kōmihana Rūwhenua

DRAWN	CXP	Jul.13
CHECKED	VL	Jul.13
APPROVED		
ARCFILE		
52020-0200-TRX030		
SCALE (AT A3 SIZE)		
1:1,000		
Prepared by Tonkin & Taylor Ltd.		
Ref: 52020-0200		

Ground Improvement Trials

Site 3 (Wainoni)

Trial Area Layout



LEGEND

Investigation Sites

EQC CPT

Golders CPT

Existing CGD CPT

Post ground improvement
CPT after 15 days

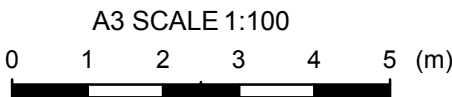
Post ground improvement
CPT after 29 days

Rapid Impact
Compaction (RIC) location

Centerline

ID	Coordinate (mN)	Coordinate (mE)	Date constructed	Order in which constructed	Applied Hammer drop height	# blows	Penetration depth (mm)	ID	Coordinate (mN)	Coordinate (mE)	Date constructed	Order in which constructed	Applied Hammer drop height	# blows	Penetration depth (mm)
RIC1	5744277.3	2484404.07	22/05/2013	1	75%	32	240	RIC16	5744271.19	2484423.2	22/05/2013	16	75%	29	170
RIC2	5744273.5	2484406.9	22/05/2013	2	75%	41	240	RIC17	5744272.54	2484424.78	22/05/2013	17	75%	39	250
RIC3	5744270.73	2484409.38	22/05/2013	3	75%	30	190	RIC18	5744269.46	2484424.35	22/05/2013	18	75%	43	330
RIC4	5744275.98	2484410.26	22/05/2013	4	75%	20	120	RIC19	5744271.91	2484427.46	22/05/2013	19	75%	34	220
RIC5	5744275.33	2484413.23	22/05/2013	5	75%	17	100	RIC20	5744279.24	2484407.75	22/05/2013	20	75%	18	110
RIC6	5744272.39	2484412.8	22/05/2013	6	75%	21	100	RIC21	5744281.72	2484410.88	22/05/2013	21	75%	26	110
RIC7	5744269.41	2484414.63	22/05/2013	7	75%	33	200	RIC22	5744278.33	2484413.71	22/05/2013	22	75%	17	290
RIC8	5744271.44	2484415.41	22/05/2013	8	75%	25	180	RIC23	5744280.31	2484417.46	22/05/2013	23	75%	42	320
RIC9	5744274.49	2484416.25	22/05/2013	9	75%	17	110	RIC24	5744277.63	2484416.88	22/05/2013	24	75%	21	110
RIC10	5744273.67	2484419.11	22/05/2013	10	75%	17	100	RIC25	5744275.46	2484425.4	22/05/2013	25	75%	30	190
RIC11	5744271.04	2484418.39	22/05/2013	11	75%	23	140	RIC26	5744274.59	2484423.21	22/05/2013	26	75%	30	210
RIC12	5744267.59	2484420.5	22/05/2013	12	75%	42	350	RIC27	5744276.45	2484422.31	22/05/2013	27	75%	24	130
RIC13	5744271.96	2484420.36	22/05/2013	13	75%	21	120	RIC28	5744278.85	2484423.37	22/05/2013	28	75%	41	400
RIC14	5744270.04	2484421.29	22/05/2013	14	75%	26	170	RIC29	5744275.06	2484420.71	22/05/2013	29	75%	19	110
RIC15	5744272.99	2484421.9	22/05/2013	15	75%	22	120	RIC30	5744276.84	2484419.49	22/05/2013	30	75%	20	200

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EQC

EARTHQUAKE COMMISSION

Kōmihana Rūwhenua

DRAWN

CXP

Jul.13

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ARCFILE

52020-0200-TRX031

SCALE (AT A3 SIZE)

1:100

Prepared by Tonkin & Taylor Ltd.

Ref: 52020-0200

FIGURE No.

1B3

Rev.

0

Ground Improvement Trials

Site 3 (Wainoni)

Rapid Impact Compaction Spacing Area

Status: Release For Preliminary Information

LEGEND

Investigation Sites

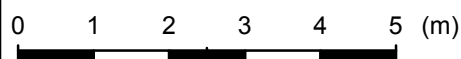
-  EQC CPT
-  Golders CPT
-  Existing CGD CPT
-  Post ground improvement CPT after 3 days
-  Post ground improvement CPT after 27 days
-  Rammed Aggregate Piers (RAP) location
-  Centerline



ID	Coordinate (mN)	Coordinate (mE)	Date constructed	Order in which constructed	Depth of Pier (m)	Volume of aggregate used	ID	Coordinate (mN)	Coordinate (mE)	Date constructed	Order in which constructed	Depth of Pier (m)	Volume of aggregate used
RAP1	5744313.95	2484418.88	31/05/2013	1	4	1.4	RAP15	5744314.19	2484412.91	4/06/2013	15	4	1.4
RAP2	5744316.49	2484417.47	31/05/2013	2	4	1.4	RAP16	5744312.07	2484411.65	4/06/2013	16	4	1.4
RAP3	5744311.39	2484417.28	31/05/2013	3	4	1.4	RAP17	5744316.36	2484411.71	4/06/2013	17	4	1.4
RAP4	5744308.92	2484415.49	31/05/2013	4	4	1.4	RAP18	5744314.32	2484410.44	4/06/2013	18	4	1.4
RAP5	5744309.59	2484412	31/05/2013	5	4	1.4	RAP19	5744312.56	2484409.4	4/06/2013	19	4	1.4
RAP6	5744310.54	2484409.82	31/05/2013	6	4	1.4	RAP20	5744316.06	2484409.52	4/06/2013	20	4	1.4
RAP7	5744311.54	2484414.2	4/06/2013	7	4	1.4	RAP21	5744314.37	2484408.41	4/06/2013	21	4	1.4
RAP8	5744311.59	2484407.65	4/06/2013	8	4	1.4	RAP22	5744313.2	2484406.04	4/06/2013	22	4	1.4
RAP9	5744319.16	2484416.24	4/06/2013	9	4	1.4	RAP23	5744315.84	2484406.35	4/06/2013	23	4	1.4
RAP10	5744318.79	2484412.39	4/06/2013	10	4	1.4	RAP24	5744314.59	2484405.46	4/06/2013	24	4	1.4
RAP11	5744318.04	2484409.86	4/06/2013	11	4	1.4	RAP25	5744313.09	2484407.63	4/06/2013	25	4	1.4
RAP12	5744317.23	2484407.9	4/06/2013	12	4	1.4	RAP26	5744315.74	2484407.76	4/06/2013	26	4	1.4
RAP13	5744314.06	2484415.93	4/06/2013	13	4	1.4	RAP27	5744314.46	2484406.91	4/06/2013	27	4	1.4
RAP14	5744316.7	2484414.47	4/06/2013	14	4	1.4							

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A3 SCALE 1:100



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ARCFILE		
52020-0200-TRX032		
SCALE (AT A3 SIZE)		
1:100		
Prepared by Tonkin & Taylor Ltd.		
Ref: 52020-0200		

Ground Improvement Trials
Site 3 (Wainoni)
Rammed Aggregate Piers Spacing Area

FIGURE No.

1C3

ev. 0

Date: 17/07/2013 Time: 2:07:14 p.m.

LEGEND

Investigation Sites

EQC CPT

Golders CPT

Existing CGD CPT

Post ground improvement
CPT after 15 days

Post ground improvement
CPT after 29 days

Low Mobility
Grout (LMG) location

Centerline



ID	Coordinate (mN)	Coordinate (mE)	Order top bulbs constructed	Date top bulb constructed	Depth to centre of top bulb	Volume of grout in top bulb (m3)	Observed ground heave for top bulb	Order bottom bulbs constructed in	Date lower bulbs constructed	Depth to cente of bottom bulb	Volume of grout for bottom bulb	Observed ground heave for lower bulb
LMG1	5744174.1	2484432.98	1	22/05/2013	1.5	0.147	Grout ejected at surface - 40	1	24/05/2013	3	0	Grout surfaced, casing jumped
LMG2	5744175.58	2484432.38	3	22/05/2013	1.5	0.287	100	3	24/05/2013	3	0	Grout surfaced
LMG3	5744172.88	2484432.18	2	22/05/2013	1.5	0.063	Grout ejected at surface - 15	2	24/05/2013	3	Couldn't pound through top bulb	-
LMG4	5744174.15	2484431.54	4	22/05/2013	1.5	0.196	Grout ejected at surface - 20	4	24/05/2013	3		110
LMG5	5744176.16	2484430.71	6	22/05/2013	1.5	0.287	100	6	24/05/2013	3		102
LMG6	5744172.57	2484430.44	5	22/05/2013	1.5	0.112	Grout ejected at surface - 16	5	24/05/2013	3	0.42	Grout surfaced - 50
LMG7	5744174.36	2484429.56	7	22/05/2013	1.5	0.287	100	7	24/05/2013	3	0.224	Grout surfaced - 10
LMG8	5744176.53	2484428.54	9	22/05/2013	1.5	0.077	Grout ejected at surface - 10	9	24/05/2013	3	0	would not take grout
LMG9	5744174.76	2484426.82	10	22/05/2013	1.5	0.196	Grout ejected at surface - 10	10	24/05/2013	3	0.504	94
LMG10	5744172.2	2484427.78	8	22/05/2013	1.5	0.056	Grout ejected at surface - 20	8	24/05/2013	3	0.133	Grout surfaced - 8
LMG11	5744177.49	2484425.74	12	22/05/2013	1.5	0.217	Grout ejected at surface - 5	12	24/05/2013	3	0.392	Grout surfaced - 18
LMG12	5744174.96	2484424.1	13	22/05/2013	1.5	0.154	Grout ejected at surface - 10	13	24/05/2013	3	0.252	Grout surfaced - 12
LMG13	5744172.29	2484425.18	11	22/05/2013	1.5	0.049	Grout ejected at surface - 5	11	24/05/2013	3	0.329	Grout surfaced - 24

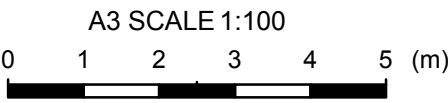
LEGEND

Scala at 3.5m marker

Scala at 6m marker

HM 1 (29-5-13)							
Distance (m)	Δ dist. (m)	Mix	Grout volume (L)	Cement %	Time to drill (m:s)	Pump pressure (PSI)	Comments
0	-	104	60	4	-	-	
1	-	104	50	3	-	-	
2	-	104	50	3	-	-	
3	-	104	10	1	-	-	
4	-	104	-	-	-	-	
10	-	106	36	17	0:45	-	Mixing head locked up - had to dig trench to free up
11	-	106	28	13	0:35	-	Soil mixing resumed at 10m marker with different
12	-	106	20	9	0:40	20	
13	-	106	60	28	0:50	20	
14	-	106	14	7	0:50	-	
15	-	106	18	8	1:00	8	
16	-	106	46	22	1:15	8	
17	-	106	28	13	0:55	8	
18	-	106	18	8	0:35	10	
19	-	106	22	10	0:50	10	
HM 2 (29-5-13)							
Distance (m)	Δ dist. (m)	Mix	Grout volume (L)	Cement %	Time to drill (m:s)	Pump pressure (PSI)	Comments
-3	-	106	24	11	0:50	-	
-2	-	106	14	7	0:40	8	
-1	-	106	32	15	-	20	
0	-	106	42	20	2:25	12	
1	-	106	22	10	0:50	4	
2	-	106	22	10	0:50	4	
3	-	106	52	24	2:43	4	
4	-	106	48	22	1:30	6	
5	-	106	16	7	0:30	6	
6	-	106	42	20	1:25	-	
7	-	106	34	16	0:50	-	Drill stalled temporarily
8	-	106	30	14	0:50	-	
9	-	106	32	15	-	4	
10	-	106	32	15	0:55	4	Drill stalled temporarily
11	-	106	32	15	1:00	6	
12	-	106	34	16	1:05	6	
13	-	106	32	15	1:00	6	
14	-	106	32	15	0:55	-	
15	-	106	52	24	2:30	-	
16	-	106	42	20	1:15	6	
17	-	106	38	18	1:05	2	
18	-	106	30	14	1:05	2	
19	-	106	32	15	1:00	2	
20	-	106	38	18	1:05	2	
21	-	106	18	8	0:35	2	Hit river run gravels...old soak pit?
HM 3 (30-5-13)							
Distance (m)	Δ dist. (m)	Mix	Grout volume (L)	Cement %	Time to drill (m:s)	Pump pressure (PSI)	Comments
1	-	Mix 106	26	12	:50	-	
2	-	Mix 106	18	8	0:54	-	
3	-	Mix 106	16	7	0:56	-	
4	-	Mix 106	32	15	1:00	6	Drill stalled temporarily 14 18L
5	-	Mix 106	42	20	2:05	2	Drill stalled temporarily
6	-	Mix 106	46	22	1:55	2	Drill stalled temporarily
7	-	Mix 106	76	36	3:00	-	Drill stalled temporarily
8	-	Mix 106	74	35	3:16	-	Drill stalled temporarily
9	-	Mix 106	36	17	0:59	-	
10	-	Mix 106	32	15	1:07	-	
11	-	Mix 106	28	13	1:18	-	
12	-	Mix 106	20	9	1:05	-	Drill stalled temporarily
13	-	Mix 106	40	19	1:30	-	Drill stalled temporarily
14	-	Mix 106	38	18	1:30	-	
15	-	Mix 106	50	23	1:45	-	Hard to pull
16	-	Mix 106	26	12	0:55	-	
17	-	Mix 106	30	14	1:05	-	
18	-	Mix 106	72	34	2:25	-	Drill stalled temporarily
19	-	Mix 106	56	26	1:40	-	
20	-	Mix 106	40	19	1:30	-	
21	-	Mix 106	34	16	1:00	-	
22	-	Mix 106	42	20	1:10	2	
23	-	Mix 106	58	27	2:20	-	Drill stalled temporarily
24	-	Mix 106	88	41.20	4:00	-	Drill stalled temporarily
HM 4 (31-5-13)							
Distance (m)	Δ dist. (m)	Mix	Grout volume (L)	Cement %	Time to drill (m:s)	Pump pressure (PSI)	Comments
-1	-	107	42	20	:50	4	
0	-	107	24	11	:50	-	
1	-	107	20	9	1:10	-	
2	-	107	30	14	0:45	-	
3	-	107	32	15	1:50	-	Hard to pull
4	-	107	52	24	2:50	-	Hard to pull
5	-	107	32	15	1:25	-	
6	-	107	18	8	1:10	-	
7	-	107	26	12	2:20	2	
8	-	107	22	10	1:10	2	
9	-	107	20	9	1:00	-	
10	-	107	18	8	1:05	-	
11	-	107	32	15	1:15	-	
12	-	107	42	20	1:30	2	
13	-	107	42	20	1:05	2	Hard to pull
14	-	107	52	24	2:35	2	
15	-	107	28	13	1:35	-	
16	-	107	26	12	1:25	-	
17	-	107	32	15	1:25	-	
18	-	107	26	12	1:26	-	
19	-	107	22	10	0:54	-	
HM 5 (31-5-13)							
Distance (m)	Δ dist. (m)	Mix	Grout volume (L)	Cement %	Time to drill (m:s)	Pump pressure (PSI)	Comments
1	-	Mix 106	26	12	:50	-	
2	-	Mix 106	18	8	0:54	-	
3	-	Mix 106	16	7	0:56	-	
4	-	Mix 106	32	15	1:00	6	Drill stalled temporarily 14 18L
5	-	Mix 106	42	20	2:05	2	Drill stalled temporarily
6	-	Mix 106	46	22	1:55	2	Drill stalled temporarily
7	-	Mix 106	76	36	3:00	-	Drill stalled temporarily
8	-	Mix 106	74	35	3:16	-	Drill stalled temporarily
9	-	Mix 106	36	17	0:59	-	
10	-	Mix 106	32	15	1:07	-	
11	-	Mix 106	28	13	1:18	-	
12	-	Mix 106	20	9	1:05	-	Drill stalled temporarily
13	-	Mix 106	40	19	1:30	-	Drill stalled temporarily
14	-	Mix 106	38	18	1:30	-	
15	-	Mix 106	50	23	1:45	-	Hard to pull
16	-	Mix 106	26	12	0:55	-	
17	-	Mix 106	30	14	1:05	-	
18	-	Mix 106	72	34	2:25	-	Drill stalled temporarily
19	-	Mix 106	56	26	1:40	-	
20	-	Mix 106	40	19	1:30	-	
21	-	Mix 106	34	16	1:00	-	
22	-	Mix 106	42	20	1:10	2	
23	-	Mix 106	58	27	2:20	-	Drill stalled temporarily
24	-	Mix 106	88	41.20	4:00	-	Drill stalled temporarily

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ARCFIELD 52020-0200-TRX038		
SCALE (AT A3 SIZE) 1:100		
Prepared by Tonkin & Taylor Ltd. Ref: 52020-0200		

Ground Improvement Trials

Site 3 (Wainoni)

Horizontal Mixing Practice Area 1