

Appendix D

Groundwater (Level) Management Plan – Trigger Levels

Groundwater (Level) Management Plan (GMP)

Revision History

Revision N°	Prepared By	Description	Date
Version 1.0	Ann Williams	For internal review	09.05.2013
Version 1.1	Ann Williams	Draft for GWRC Review and Comments	-
Version 1.2	Ann Williams	Final draft for GWRC review (as per Condition G.18A)	17.05.13

Independent Review

Action	Name	Signed	Date
Reviewed by	Wayne Russell		To be completed

Document Acceptance

Action	Name	Signed	Date
Prepared by	Ann Williams		09.05.2013
Reviewed by	Kylie Eltham/Anna Lewis		17.05.2013
Approved by	Alan Orange Alliance Project Manager		17.05.2013
on behalf of	M2PP Alliance		

Final Draft for GWRC Review

Action	Name	Signed	Date
Regulatory Manager Approval	Al Cross		
on behalf of	Greater Wellington Regional Council		

Certification

Action	Name	Signed	Date
Regulatory Manager Approval	Al Cross		
on behalf of	Greater Wellington Regional Council		

Monitoring of water levels – Ground Settlement

A buffer distance of 200 m has been selected for monitoring of water level changes near the Expressway. This distance is approximately double the distance of anticipated drawdown or mounding effects in most locations and the greatest extent of calculated ground settlement effects at any location along the route.

The main purpose of groundwater level monitoring in these areas is to avoid the potential for deleterious ground settlement. The predicted groundwater drawdowns set out in Technical Report 21 are not expected to result in deleterious ground settlements, as described in Technical Report 35. Therefore the groundwater level alerts have been set at the lowest recorded level minus the predicted drawdown, reduced by 25 % or 200 mm, whichever is the larger.

High level triggers have been set to check against the potential for surface ponding of water, in particular on the upgradient side of the Expressway. These triggers have been set as a maximum of 200 mm below ground surface, except where existing groundwater level already reaches higher than this.

Alert and alarm levels for individual piezometers are:

Alert Level	Lowest recorded level – (predicted drawdown x 0.75 %) or Lowest recorded level – 200 mm, whichever is the greater
Action level	A further 0.1 m variation, however in some cases where the piezometer is in proximity to a temporary construction water abstraction site that could have a short term effect on levels, a larger variation may be tolerated

Monitoring Alert and Action Levels for ground settlement and flooding are defined in Table 4. No alert or action level is established for piezometers that are located in greenfields areas or more than 200 m from the Project works, however these piezometers will continue to be monitored and will be considered should an alert level the vicinity be triggered.

Table 4 – Low and High Trigger levels (Ground Settlement)

Piezometer ID	Low Trigger Levels (mRL)		High Trigger Levels (mRL)		Piezometer Location
	Alert	Action	Alert	Action	
2011/BH206 NE	3.67	3.52			Alignment
2011/BH206 SW	4.66	4.51			Alignment
2011/BH204 E	3.74	3.54			Alignment
2011/BH204 W	3.56	3.36			Alignment
2010/BH05	4.93	4.83			Alignment
2012/CPT14 E	2.81	2.71			Alignment
2012/CPT14 W	4.43	4.33			Alignment
2011/BH205	–	–			Peripheral
2010/BH04	–	–			Peripheral
2012/BH02 GW E	3.84	3.74	5.17	5.27	Alignment
2012/BH02 GW W	6.23	6.13	–	–	Alignment
2007/BH-A	3.88	3.68	5.04	5.14	Alignment
2012/BH03 E	4.22	4.02	7.00	7.10	Alignment
2012/BH03 W	3.47	3.27	4.64	4.74	Alignment
2012/BH03 GW	2.50	2.40	4.12	4.22	Alignment
2012/BH04 GW	1.95	1.85	3.55	3.65	OSA 3A
2011/BH213 N	2.35	2.25	4.50	4.60	Alignment
2011/BH213 S	3.60	3.50	–	–	Alignment
2011/BH303 N	2.04	1.94	–	–	OSA 2
2011/BH303 S	2.02	1.92	–	–	OSA 2
2011/HA WM10	–	–	–	–	OSA 2
2011/HA WM09	dry	dry	–	–	OSA 2
2012/BH24 GW	2.42	2.32	4.34	4.44	Alignment
2012/BH06 GW	1.00	0.90	4.05	4.15	Alignment
2011/HA WM08	–	–	–	–	OSA 3A
2012/BH05 GW	0.74	0.64	4.14	4.24	Alignment
2007/BH-B	–	–			Peripheral
2012/BH07 GW (N)	3.92	3.72	5.31	5.41	Alignment
2012/BH07 GW (S)	dry	dry	8.23	8.33	Alignment
2007/BH-U	3.42	3.32	4.87	4.97	Alignment
2007/BH-E	3.93	3.73	5.53	5.63	Alignment
2007/BH-D	–	–			Peripheral
2007/BH-T	4.35	4.25	5.79	5.89	Alignment
2012/BH09 GW	4.52	4.32	6.23	6.33	Alignment
2007/BH-J	5.23	4.88			Alignment
2012/HA25	–	–			Alignment
2007/BH-I	–	–	7.57	7.67	Peripheral
2011/BH214	–	–			Peripheral
2007/BH-K	4.38	4.28			Alignment

Piezometer ID	Low Trigger Levels (mRL)		High Trigger Levels (mRL)		Piezometer Location
	Alert	Action	Alert	Action	
2008/BH202	-	-			Peripheral
2007/BH-M	1.39	1.19			Alignment
2012/BH14 GW	0.97	0.77			Alignment
2011/BH216	5.13	5.03	7.05	7.15	Alignment
2007/BH-V	5.34	5.24	7.01	7.11	Alignment
2012/BH20 N	1.61	1.51	2.91	3.01	Alignment
2012/BH20 S	2.06	1.96	2.77	2.87	Alignment
2007/BH-N(A)	1.78	1.68	2.86	2.96	Alignment
2007/BH-N	2.05	1.95	2.94	3.04	Alignment
2008/BH204	3.09	2.99	4.68	4.78	Alignment
2011/BH215	2.61	2.51	3.10	3.20	Alignment
2008/BH205	-	-			Peripheral
2007/BH-R	2.84	2.74	3.59	3.69	Alignment
2012/BH22 GW (E)	2.15	2.05	3.10	3.20	Alignment
2012/BH22 GW (W)	2.19	2.09	3.14	3.24	Alignment
2010/BH07	1.93	1.83	2.85	2.95	Alignment
2012/BH26	0.41	0.31	2.40	2.50	Alignment
2011/BH207 E	1.96	1.76	2.75	2.85	Alignment
2011/BH207 W	1.26	1.06			Alignment
2007/BH-S	-	-			Peripheral
2007/BH-Q	-	-			Peripheral
2012/BH17 GW	dry	dry			Alignment
2011/BH208	4.06	3.86			Alignment
2010/BH12	4.85	4.75			Alignment
2011/BH211	3.70	3.55			Alignment
2011/BH211A	3.82	3.72			Alignment
2012/BH 20 GW	4.62	4.52			Alignment
2012/BH23 GW	3.77	3.67			Alignment
2011/BH210	4.21	4.11			Alignment
2010/BH13 N	5.80	-			Alignment
2010/BH13 S	5.94	5.84			Alignment
2011/BH309 N	6.82	6.72	-	-	Alignment
2011/BH309 S	6.61	6.51	-	-	Alignment
2011/BH308 N	5.98	5.88	-	-	Alignment
2011/BH308 S	5.94	5.84	-	-	Alignment
2012/BH37 E	-	-	-	-	Alignment
2012/BH37 W	-	-	-	-	Alignment
2011/BH310 E	-	-	-	-	Alignment
2011/BH310 W	-	-	-	-	Alignment
2010/BH16	8.77	8.67			Alignment

Appendix E

Buildings Identified in Areas of Potential Settlement

	Vibration Risk Med	Vibration Risk High	Dwellings within 20m of peat treatment extent	Dwellings where predicted settlement >12.5mm (and 10m beyond this boundary)	Specific Buildings for assessment	Adjacent to new stormwater features - dwellings within >0.1m of groundwater drawdown
112 Leinster Ave		X	X			
108 Leinster Ave		X	X			
106 Leinster Ave		X	X			
105 Leinster Ave	X					
109 Leinster Ave			X			
107 Leinster Ave		X	X			
240 Main road (Front house)		X				
10 Conifer Court		X				
12 Conifer Court		X				
110 Raumati Road		X				
90 Raumati Road	X					
260 Main road subdivision (Shalom village, 2 Eastern most dwellings)	X					
218b Matai Road	X					
90 Raumati Road	X					
65 Rata Road						X
65a Rata Road						X
67 Rata Road						X
44 Rata Road						X
48 Rata Road						X
60a/b/c Rata Road						X
62 Rata Road						X
62b Rata Road						X
64 Rata Road						X
70 Rata Road						X
72 Rata Road						X
74 Rata Road						X
76 Rata Road						X
76a Rata Road						X
78a Rata Road						X
78b Rata Road						X
80 Rata Road						X
82 Rata Road						X
84 Rata Road						X
84b Rata Road						X
86 Rata Road						X
88 Rata Road						X
90 Rata Road						X
1 Wedgewood Grove						X
2 Wedgewood Grove						X
3 Wedgewood Grove						X
4 Wedgewood Grove						X
5 Wedgewood Grove						X
6 Wedgewood Grove						X
7 Wedgewood Grove						X
9 Wedgewood Grove						X
10 Wedgewood Grove						X
12 Wedgewood Grove						X
14 Wedgewood Grove						X
1 Konini Grove						X
2 Konini Grove						X
3 Konini Grove						X
4 Konini Grove						X
5a/b Konini Grove						X
6 Konini Grove						X
7 Konini Grove						X
8 Konini Grove						X
9 Konini Grove						X
10 Konini Grove						X
11 Konini Grove						X
12 Konini Grove						X
14 Konini Grove						X
17 Konini Grove						X
1 Manawa Avenue						X
3 Manawa Avenue						X
4 Manawa Avenue						X

5a/b Manawa Avenue						X
6 Manawa Avenue						X
6a Manawa Avenue						X
7a/b Manawa Avenue						X
8 Manawa Avenue						X
9 Manawa Avenue						X
10 Manawa Avenue						X
11 Manawa Avenue						X
12a/b Manawa Avenue						X
13 Manawa Avenue						X
14a/b Manawa Avenue						X
15 Manawa Avenue						X
15a Manawa Avenue						X
16 Manawa Avenue						X
16a Manawa Avenue						X
17 Manawa Avenue						X
17a Manawa Avenue						X
18a Manawa Avenue						X
19a Manawa Avenue						X
10 Nugget Grove						X
12 Nugget Grove						X
14 Nugget Grove						X
16 Nugget Grove						X
17 Nugget Grove						X
19 Nugget Grove						X
21 Nugget Grove						X
15 Observation Place	X					
21 Observation Place		X		X		
23 Observation Place		X		X		
24 Observation Place		X				
26 Observation Place		X				
27 Observation Place	X					
29 Observation Place		X				
39 Observation Place		X				
41 Observation Place		X				
84 Kapiti Road		X				
86 Kapiti Road		X				
88 Kapiti Road		X				
90 Kapiti Road		X				
92 Kapiti Road		X				
94 Kapiti Road		X				
13 Greenwood Place		X				
15a Greenwood Place		X				
5 Elder Grove - Garage	X					
7 Elder Grove		X	X			
8 Elder Grove		X				
8a Elder Grove		X				
9 Elder Grove		X				
9a Elder Grove		X				
59 Milne Drive		X				
55 Milne Drive		X	X	X		
51 Milne Drive		X	X	X		
27 Milne Drive					X	
31 Milne Drive					X	
3 Milne Drive					X	
11 Milne Drive					X	
102 Milne Drive					X	
106 Milne Drive					X	
106b Milne Drive					X	
13 Greenwood Place		X				
15 Greenwood Place		X	X			
15a Greenwood Place		X				
16 Greenwood Place			X			
17 Greenwood Place		X	X	X		
18 Greenwood Place		X	X	X		
104 Sheffield Street			X			
13 Sheffield Street			X	X	X	
15 Sheffield Street			X	X	X	
104 Sheffield Street					X	
11 Sheffield Street					X	
16 Manchester Street					X	
18 Manchester Street					X	
20 Manchester Street					X	
13 Cypress Grove			X			
14b Cypress Grove		X	X			
16b Cypress Grove		X	X			

18 Cypress Grove (+Garage)	X		X			
19 Cypress Grove (+Garage)	X					
20 Cypress Grove (+Garage)	X					
20b Cypress Grove (+Garage)	X					
22 Cypress Grove		X				
24 Cypress Grove		X				
26 Cypress Grove	X					
28a Cypress Grove						
28b Cypress Grove		X				
15 Spackman Crescent		X	X			
17 Spackman Crescent	X		X			
19 Spackman Crescent			X			
21 Spackman Crescent	X		X			
25 Spackman Crescent (+Garage)	X					
27 Spackman Crescent (+Garage)	X					
29 Spackman Crescent	X					
31 Spackman Crescent	X					
33 Spackman Crescent	X	X	X			
35 Spackman Crescent		X	X			
37a Spackman Crescent	X					
37b Spackman Crescent		X	X			
63a/b Makarini Street		X	X			
65 Makarini Street		X	X			
67 Makarini Street		X	X			
69 Makarini Street		X	X			
71 Makarini Street		X	X			
73 Makarini Street		X				
75 Makarini Street		X				
77 Makarini Street		X				
79 Makarini Street		X	X			
81 Makarini Street		X	X			
83 Makarini Street		X	X			
85 Makarini Street		X	X			
87 Makarini Street		X	X			
89 Makarini Street		X	X			
91 Makarini Street		X	X			
93 Makarini Street		X	X			
95 Makarini Street	X					
97a Makarini Street	X					
97b Makarini Street		X	X			
99b Makarini Street		X	X			
105 Makarini Street		X	X			
107 Makarini Street		X				
6b Palmer Court		X	X			
8 Palmer Court		X				
8b Palmer Court		X	X			
10 Palmer Court		X	X			
12 Palmer Court	X					
14 Palmer Court		X				
16 Palmer Court		X				
18a Palmer Court		X				
18b Palmer Court		X				
24 Palmer Court		X				
24 St James Court		X				
15 St James Court		X				
11 St James Court		X	X			
9 St James Court (+Pool)		X	X			
20 Chilton Drive		X				
22 Chilton Drive		X				
37a Chilton Drive	X					
37b Chilton Drive		X	X			
41 Chilton Drive (Pool)		X				
45 Chilton Drive		X	X			
345 Mazengarb Road		X				
353 Mazengarb Road		X				
60a Ratanui Road		X				
45 Quadrant Heights	X					
47 Quadrant Heights	X					
17 Datum Way	X					
2/24 Cheltenham Drive	X					
3/24 Cheltenham Drive	X					

26 Cheltenham Drive	X					
28 Cheltenham Drive	X					
30 Cheltenham Drive	X					
32 Cheltenham Drive	X					
34 Cheltenham Drive	X					
42 Cheltenham Drive	X					
44 Cheltenham Drive	X					
46 Cheltenham Drive	X			X		
48 Cheltenham Drive	X			X		
50 Cheltenham Drive	X					
52 Cheltenham Drive				X		
2 Oxford Court				X		
4 Oxford Court		X		X		
6 Oxford Court		X		X		
8 Oxford Court		X		X		
10 Oxford Court		X		X		
12 Oxford Court		X		X		
KCDC WWTP Fyfield Place						X (multiple buildings and structures, refer Table 4 of Tech Report 35)
El Rancho 15 buildings Kauri Road	X (25a)					X (15 Buildings, refer Table 5 of Tech Report 35)
18 Kauri Road (+Pool)	X	X				
20 Kauri Road		X				
23 Kauri Road		X				
31 Puriri Road	X					
53 Puriri Road	X					
67 Puriri Road				X		
145 Te Moana Road		X				
145a Te Moana Road	X					
156 Te Moana Road				X		
164 Te Moana Road (2 houses)	X					
168 Te Moana Road				X		
160 Te Moana Road				X		
190b Te Moana Road		X				
49 Killalea Place	X					
61 Killalea Place	X					
20 Peka Peka Road		X				
21 Peka Peka Road					X	
31 Peka Peka Road		X				
343 State Highway 1 (Kensington Farm)					X	
27 Te Kowhai Road		X				
29 Te Kowhai Road				X		

Table 4 – KCDC Wastewater Treatment Plant Summary

Building ID	Building Name	Description of structure	Sensitivity to movement 1
a	Office building	1–storey office building of both timber and reinforced concrete wall construction.	B
b	Storage shed	1–storey storage shed of concrete block construction.	A
c	Storage shed	1–storey storage shed of timber and steel construction.	B
d	Tank	Tank is reinforced concrete construction and sits in the ground.	B
e	Fuel storage shed	Two separate structures, one is of steel construction and the other consists of precast concrete panels.	B
f	Organic Filters	Low structure of concrete block and timber construction.	A
g	Mixing tanks	Each of the three mixing tanks is of similar construction. They consist of reinforced concrete and extend approximately 5m below ground level.	B
h	UV treatment shed	1–storey building with precast concrete panel facades.	B
i	Small timber shed	Small 1–storey timber structure.	B
j	Concrete tanks	These two large tanks are of similar construction and the main structure consists of reinforced concrete.	B
k	Small Concrete Block Structures	Two concrete block structures.	A

1 – Sensitivity of movement:

Type A – Expected to be susceptible to visual cracking in the event of slight differential ground movement due to cladding type.

Type B –Not expected to be susceptible to visual cracking in the event of slight differential ground movement.

Table 5 – El Rancho Buildings Summary

Building Name	Description of structural form	Sensitivity to movement ¹
Kauri Hall	A timber or steel portal frame building. Each façade is constructed of a board material that appeared flexible. The entrances consist of columns that have a plaster surface.	B
Poplar Lodge	A 1–storey timber building with timber facades.	B
Oregon Lodge	A 2–storey timber building with timber facades.	B
Willow Lodge and Workshop	Timber buildings.	B
Redwood Hall/Dining Room	A 2–storey structure is constructed from various materials consisting of timber, brick and plaster facades with sections of concrete blocks at the base.	A
Rata Lodge, Rimu Lodge and Toilet Block	Timber buildings on a concrete slab foundation.	B
Office	A plaster façade with the rest of the building being clad in a board/timber material.	A
Elm Court	A series of timber/board buildings.	B
Apiti Chapel	Timber building.	B
Staff #2	This building is constructed from both timber and plaster facades.	A
Cafe	Timber building.	B
Pinewood Dining and Pinewood Hall	Pinewood Dining and Pinewood Hall both have facades constructed from both brick and concrete block.	A
Villas	2–storey timber building.	B
Caravan Kitchen	Timber building.	B
<p>1 – Sensitivity of movement:</p> <p>Type A – Expected to be susceptible to visual cracking in the event of slight differential ground movement due to cladding type.</p> <p>Type B –Not expected to be susceptible to visual cracking in the event of slight differential ground movement.</p>		

Appendix F

Settlement Reporting Templates

3 December 2010

Ref: 0406

Naveen Kumar
Auckland Regional Council
Private Bag 92-012
Auckland 1142

Dear Naveen

VPT - November 2010 Settlement Monitoring Results (Permit No. 32454)

Ground and Building Settlement Monitoring

Please find attached the vertical monitoring results from the month of November 2010. The records include surveys of the following markers:

- Ground settlement monitoring markers S1 to S34 and CB1 to CB8;
- Building settlement monitoring markers B1 to B90; and
- Prism building settlement monitoring markers A1a to A18a.

These records are appended to this letter and have been reviewed in terms of both the total settlement criteria (relative to adopted minimum survey level) and angular distortions.

As at 30th November 2010 tunnel excavation has been progressed as follows:

- Break-through of the two excavations, i.e. now one single excavation extending from Victory Christian Church (CH1880) through to mid Victoria Park (CH1580);
 - Base slab poured between CH1800 to CH1870 and CH1620 to CH1720;
 - Site concrete poured between CH1600 to CH1620 and CH1720 to CH1740; and

- o Open excavation between CH1580 to CH1600, CH1740 to CH1800 and CH1870 to CH1880

The calculated angular distortion between CB1 - S8c (grass verge adjacent Beaumont Apartments) are shown as exceeding alert trigger levels. However marker S8c was installed some time after CB1 and so their initial base line readings are from different seasons, this then skews the angular distortion calculations. The calculated angular distortions on adjacent building markers are all better than 1:6,000 confirming that angular distortions are well above trigger levels at this location.

The calculated angular distortion between B8 and B9 (Franklin Mews) are shown as exceeding trigger alert levels. However the surveyed levels are consistent with those measured for the same time period last year and the calculated angular distortion is therefore consistent with historical movement.

For all other markers vertical movements are within the seasonal range and associated angular distortions are minor.

Current construction activities within Victory Christian Church (VCC) prevent access to markers S19 to S22 and B49 to B51, as soon as access is allowed monitoring will recommence. URS have supplied settlement monitoring data associated with the VCC excavation (including marker pins in comparable areas). This data confirms that as at 12.11.2010, movement of settlement markers was within expected seasonal tolerances.

Wall Deflection Monitoring

Inclinometers will be installed progressively as the excavation is advanced. To date 11 inclinometers have been installed and are being monitored in accordance with consent conditions.

Do not hesitate to contact either Sian France in the first instance or myself if you have any further questions.

Yours sincerely,



Grant Newby

Victoria Park Alliance

Attachments

VPT-GT-001 & 002: VPT Site Plan (2 A3 pages)

Settlement Monitoring Results (4 A4 pages)

Appendix G

Independent Review Comments

Appendix H

KCDC Review Comments

KCDC REVIEW OF SETTLEMENT EFFECTS MANAGEMENT PLAN

Reviewed by: Brydon Hughes

Date of Review: 24 May 2013

Signature of Reviewer:

<i>Condition Reference</i>	<i>Condition Summary</i>	<i>KCDC Reviewer's comment</i>	<i>Page/paragraph/section reference within Management Plan</i>	<i>Management Plan Author's response</i>
N/A	N/A	While Section 3.2 of the SEMP provides details of a proposed settlement monitoring regime involving surveying of nominated monitoring points/benchmarks and physical inspection of buildings, the document does not refer to the general alignment groundwater level monitoring outlined in the GMP. Given the importance of groundwater levels as an indicator of the potential for ground settlement to occur, I consider it would be appropriate for the SEMP to reference the monitoring regime (including the nominated trigger levels) specified in the GMP. It is also recommended that the SEMP identify any additional surveying of building inspections that may be initiated when the nominated low groundwater level alert or action triggers are exceeded.	Section 3.2	Agreed, new section 3.2.2, addition to 3.3, and extract from the GMP included as Appendix D
N/A	N/A	Similarly, I consider that the reporting outlined in Section 3.3 of the SEMP should include results from the general alignment groundwater level monitoring outlined in the GMP, with particular reference to any identified departures from the baseline which may indicate increased potential for land subsidence effects to occur.	Section 3.3	Agreed, added to section 3.3
N/A	N/A	Overall, the suggested modifications to the SEMP are intended to ensure better integration between monitoring requirements and effects covered by the individual environmental monitoring plans developed for the project.	General	Agreed

Appendix I

Consultation Record

