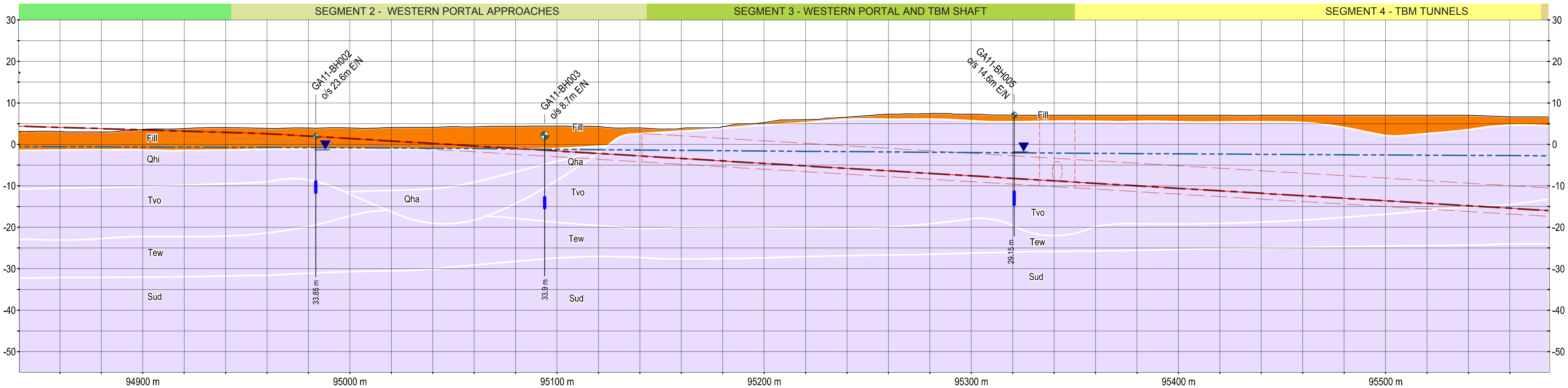
PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

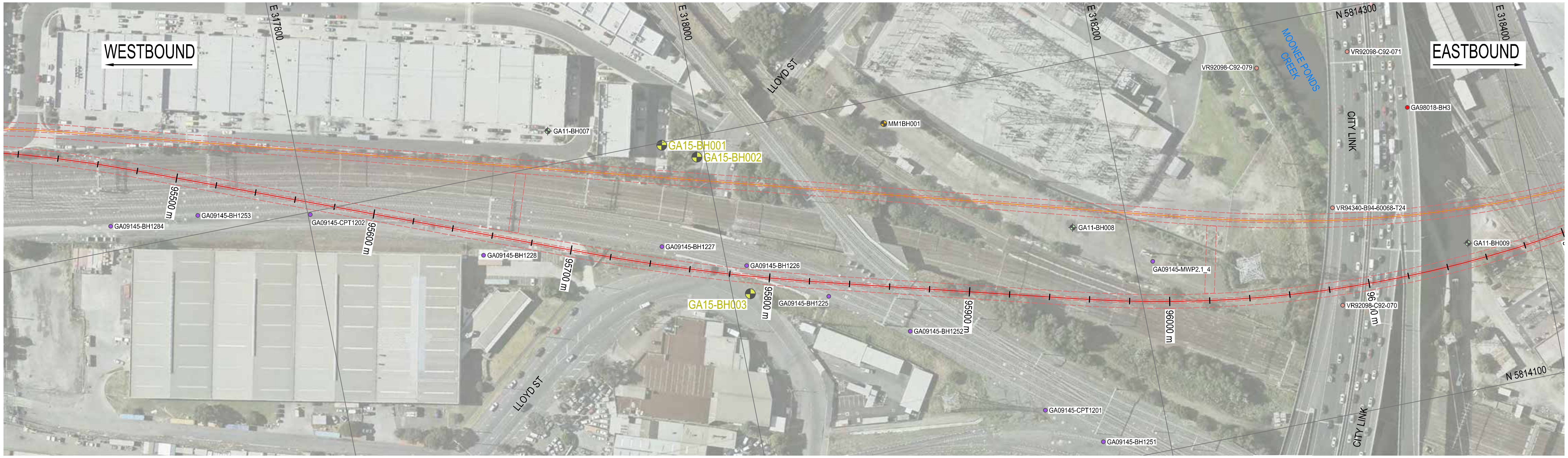
AJM Joint Venture — aurecon JACOBS Mott MacDonald in association with GRIMSHAW

Melbourne Metro Rail Project

Title: GEO. SECTION - RELIABILITY		SHEET 20 OF 35	
Drawing Number: MMR-AJM-PWAA-DR-NN-500450			Revision: P1.1
Drawn By: GOLDER	Approved By: SLVB	Date: 23-03-2016	Map Size: A3

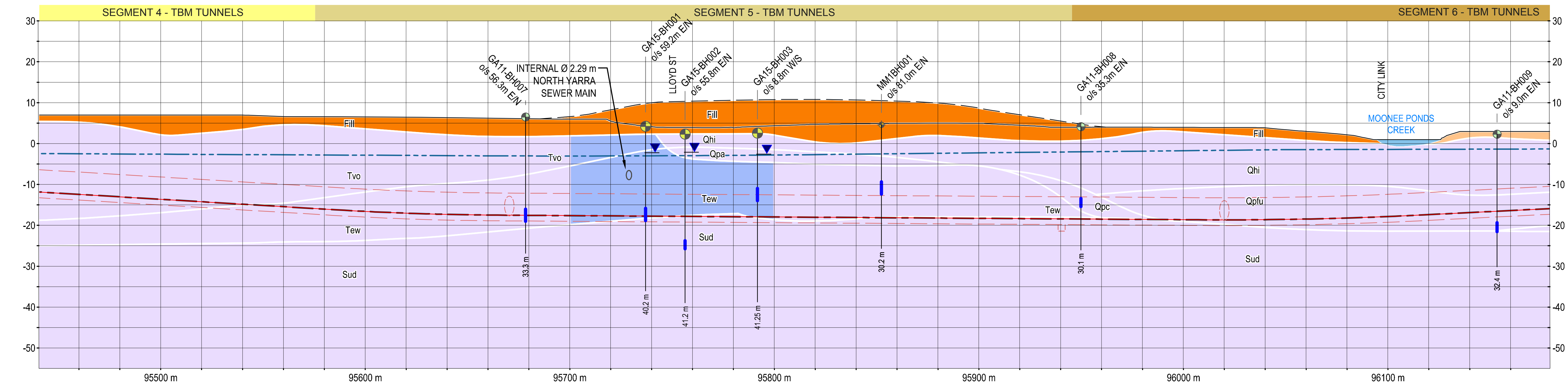
HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 20 OF 35



REFER TO SHEET 22 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES
1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

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Melbourne Metro Rail Project

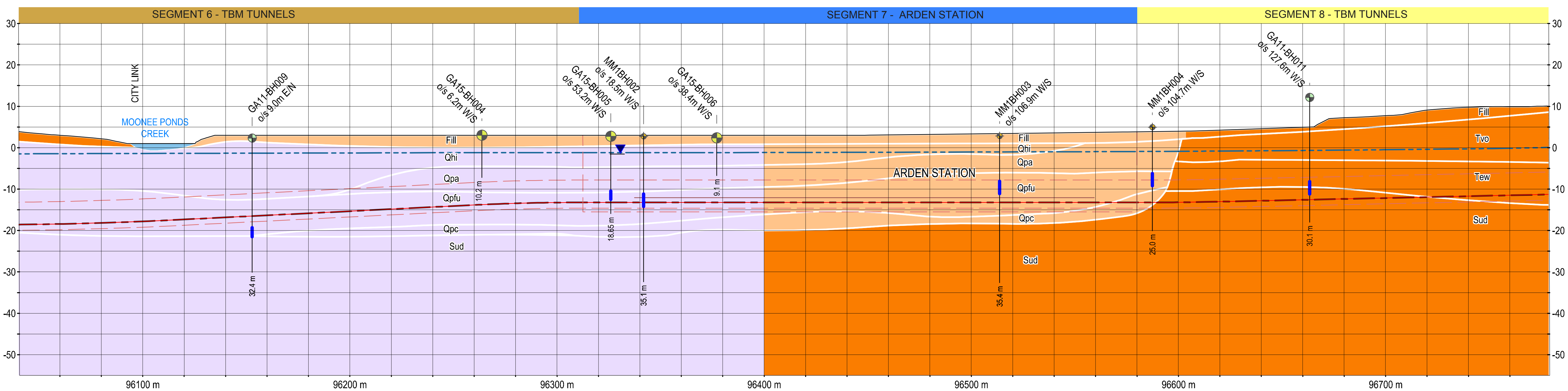
Title: GEO. SECTION - RELIABILITY		SHEET 21 OF 35	
Drawing Number: MMR-AJM-PWAA-DR-NN-500450			Revision: P1.1
Drawn By: GOLDER	Approved By: SLVB	Date: 23-03-2016	Map Size: A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 21 OF 35

REFER TO SHEET 23 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture
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Melbourne Metro Rail Project

Title: GEO. SECTION - RELIABILITY		SHEET 22 OF 35	
Drawing Number: MMR-AJM-PWAA-DR-NN-500450			Revision: P1.1
Drawn By: GOLDER	Approved By: SLVB	Date: 23-03-2016	Map Size: A3

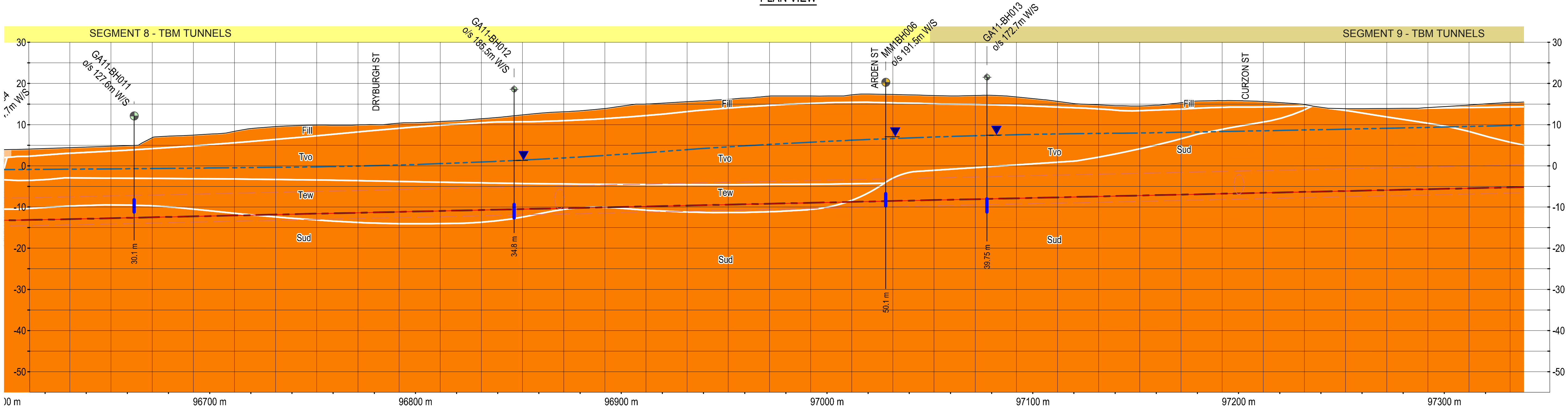
HOR. 0 25 50 75 100m

VER. 0 10 20 30 40 50m

REFER TO SHEET 22 OF 35

REFER TO SHEET 24 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture

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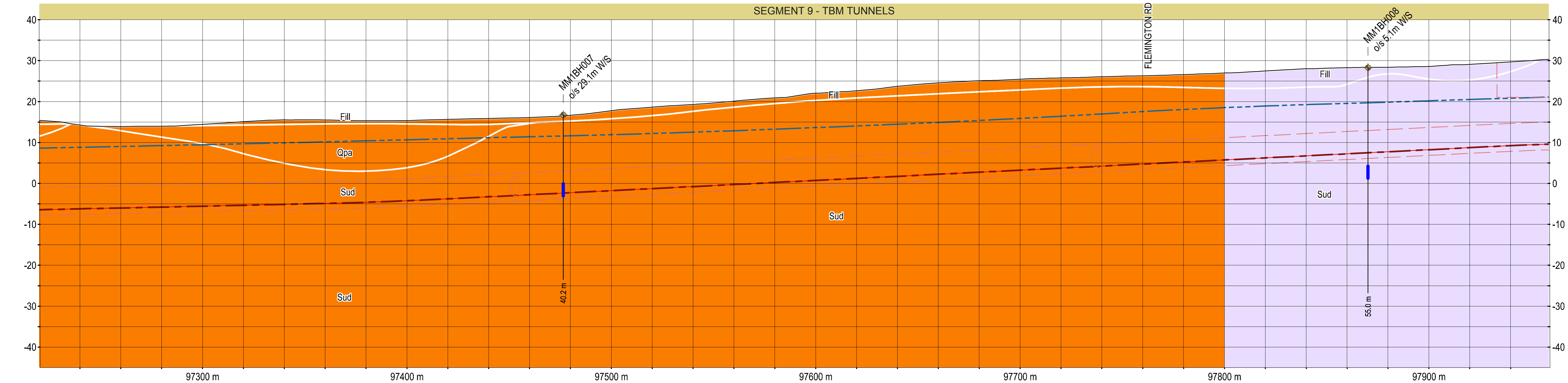
Melbourne Metro Rail Project

Title GEO. SECTION - RELIABILITY		SHEET 23 OF 35	
Drawing Number MMR-AJM-PWAA-DR-NN-500450			Revision P1.1
Drawn By GOLDER	Approved By SLVB	Date 23-03-2016	Map Size A3

HOR. 0 25 50 75 100m

VER. 0 10 20 30 40 50m

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES
1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture

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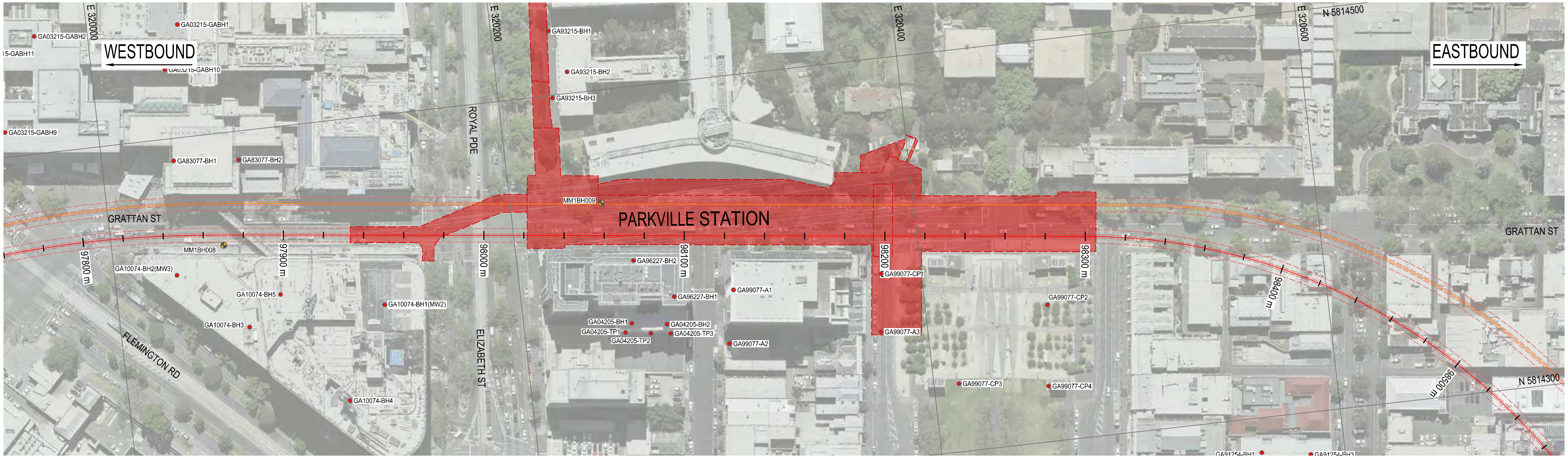
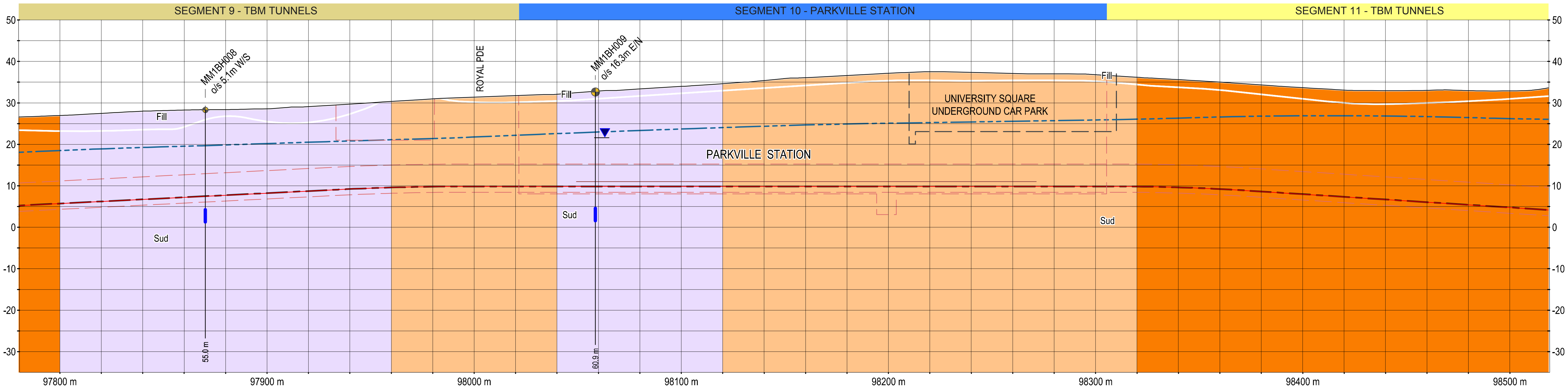
Melbourne Metro Rail Project

Title			
GEO. SECTION - RELIABILITY		SHEET 24 OF 35	
Drawing Number			Revision
MMR-AJM-PWAA-DR-NN-500450			P1.1
Drawn By	Approved By	Date	Map Size
GOLDER	SLVB	23-03-2016	A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m



PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES
1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture — aurecon JACOBS Mott MacDonald in association with GRIMSHAW

Melbourne Metro Rail Project

Title: GEO. SECTION - RELIABILITY	SHEET 25 OF 35
Drawing Number: MMR-AJM-PWAA-DR-NN-500450	Revision: P1.1

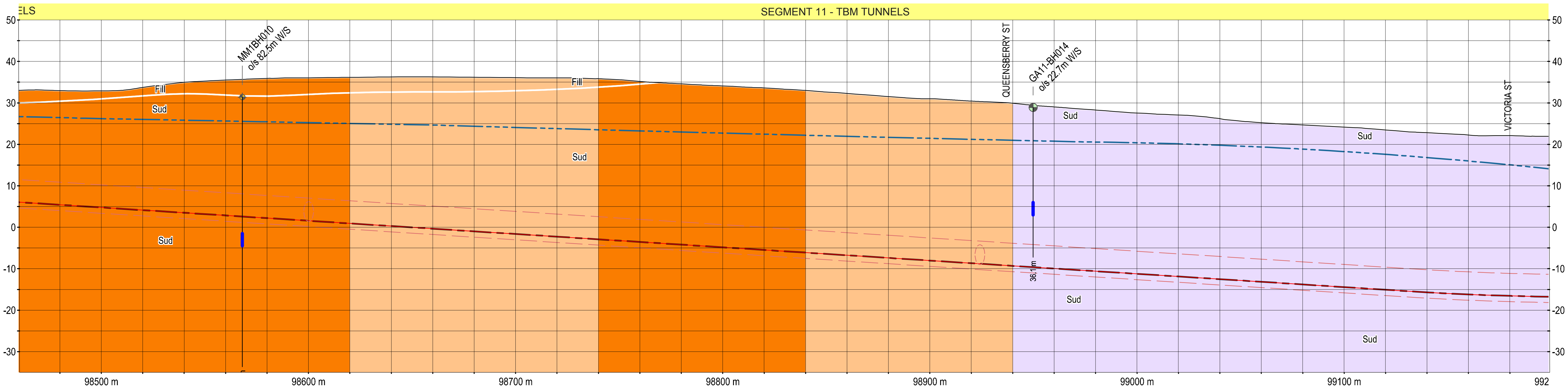
Drawn By	Approved By	Date	Map Size
GOLDER	SLVB	23-03-2016	A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 25 OF 35

REFER TO SHEET 27 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES
1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

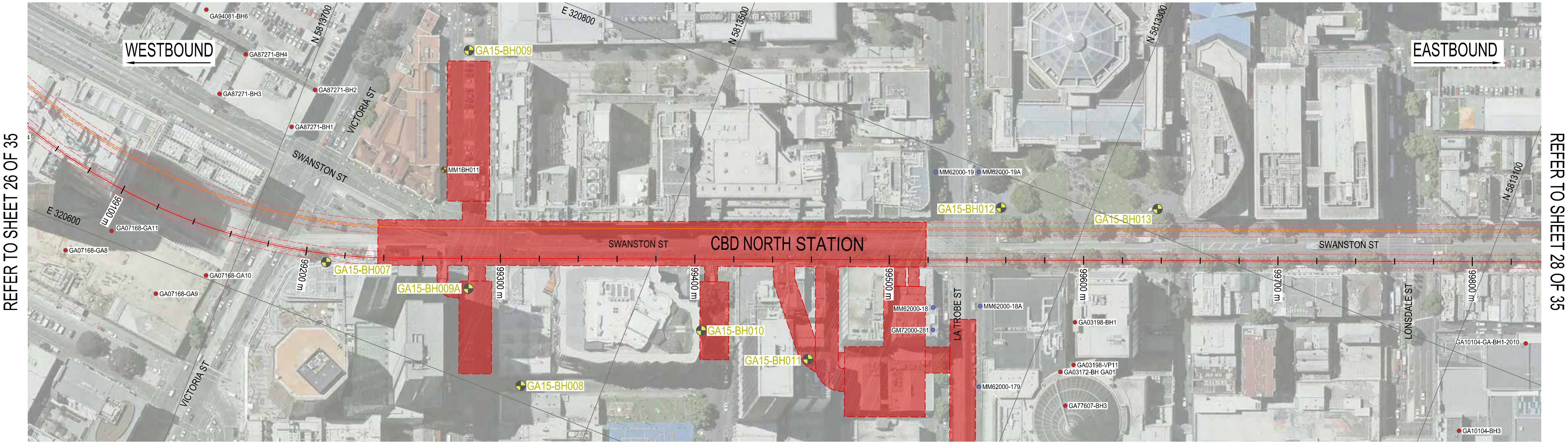
MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture — aurecon JACOBS Mott MacDonald in association with GRIMSHAW

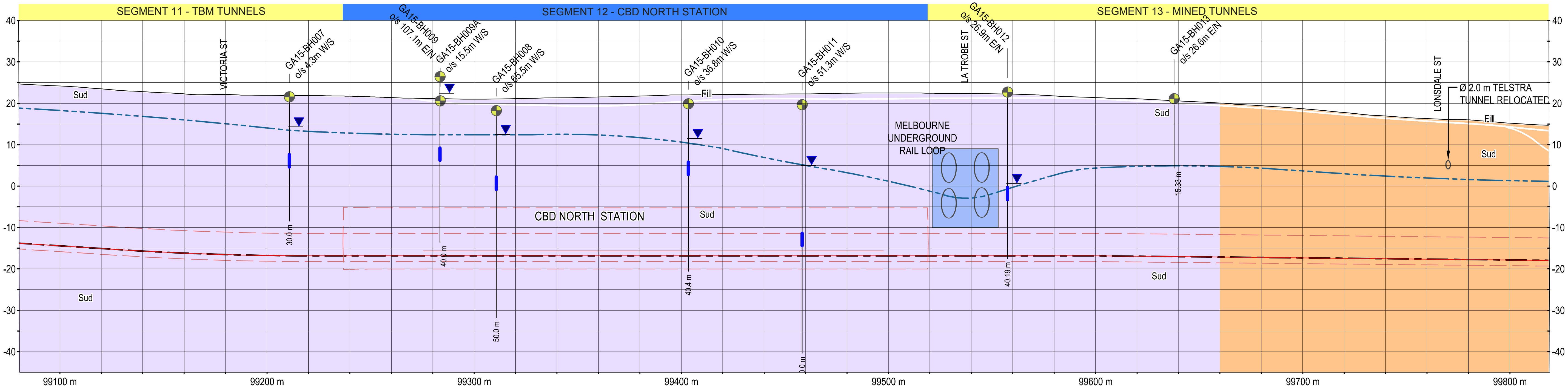
Melbourne Metro Rail Project

Title: GEO. SECTION - RELIABILITY		SHEET 26 OF 35	
Drawing Number: MMR-AJM-PWAA-DR-NN-500450			Revision: P1.1
Drawn By: GOLDER	Approved By: SLVB	Date: 23-03-2016	Map Size: A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m



PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

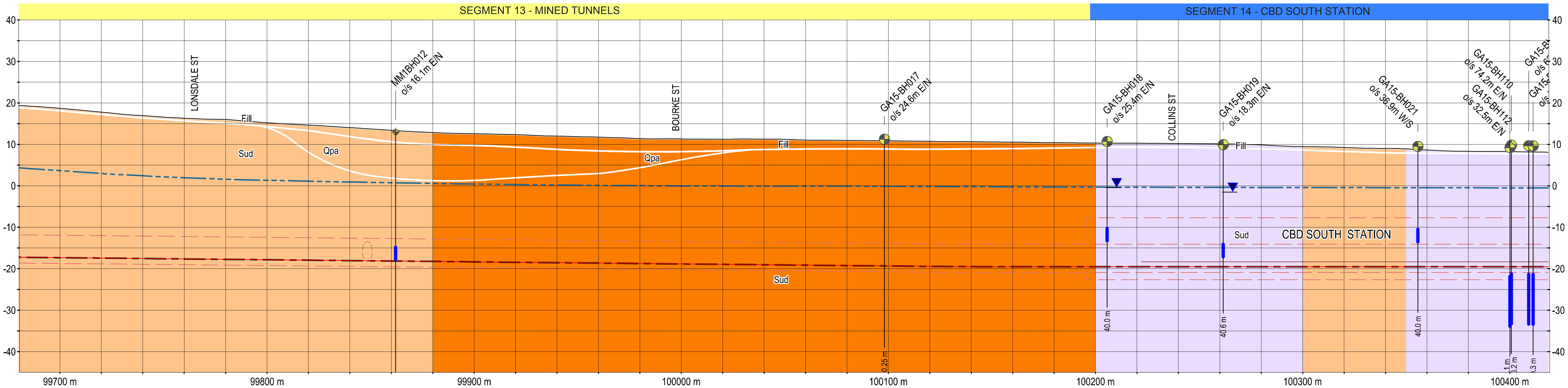
AJM Joint Venture — aurecon JACOBS Mott MacDonald in association with GRIMSHAW

Melbourne Metro Rail Project

Title: GEO. SECTION - RELIABILITY		SHEET 27 OF 35	
Drawing Number: MMR-AJM-PWAA-DR-NN-500450			Revision: P1.1
Drawn By: GOLDER	Approved By: SLVB	Date: 23-03-2016	Map Size: A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture
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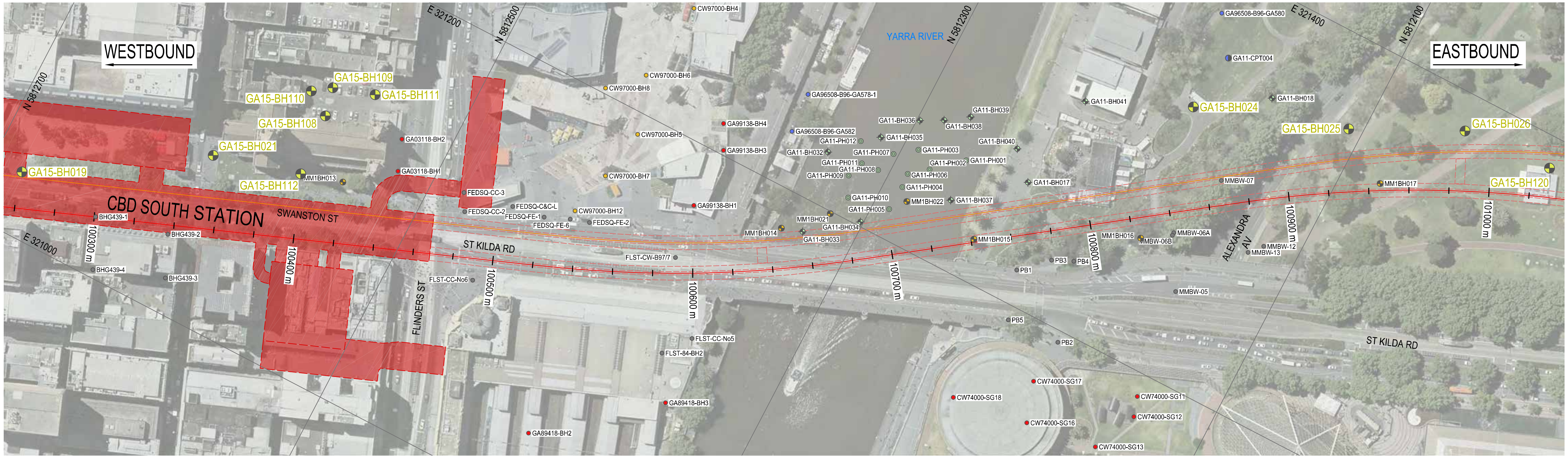
Melbourne Metro Rail Project

Title	GEO. SECTION - RELIABILITY		SHEET 28 OF 35
Drawing Number	MMR-AJM-PWAA-DR-NN-500450		Revision P1.1
Drawn By GOLDER	Approved By SLVB	Date 23-03-2016	Map Size A3

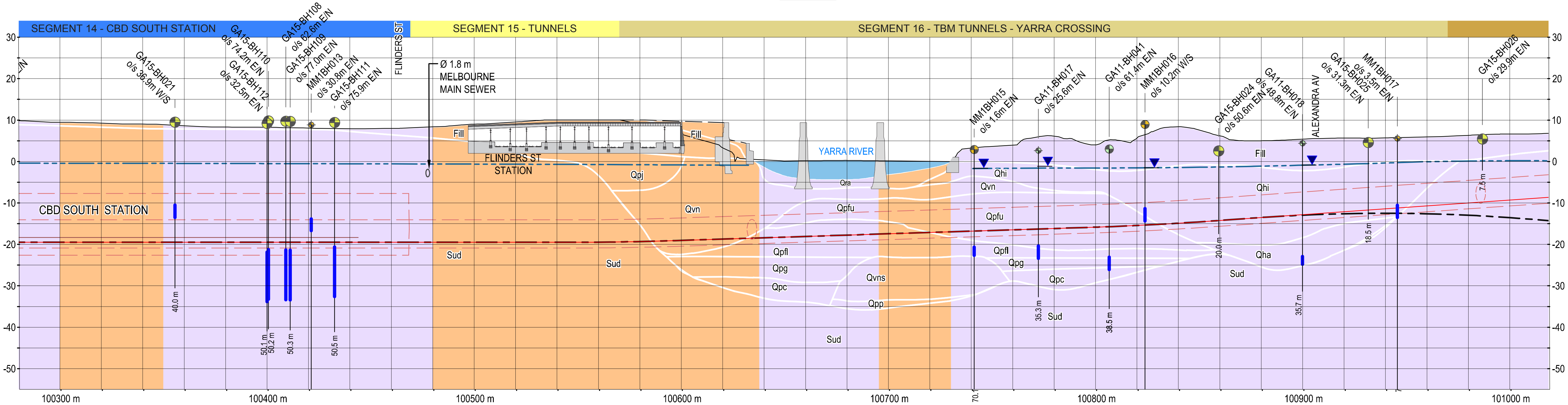
HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 28 OF 35



PLAN VIEW

REFER TO SHEET 31 OF 35



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES
1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

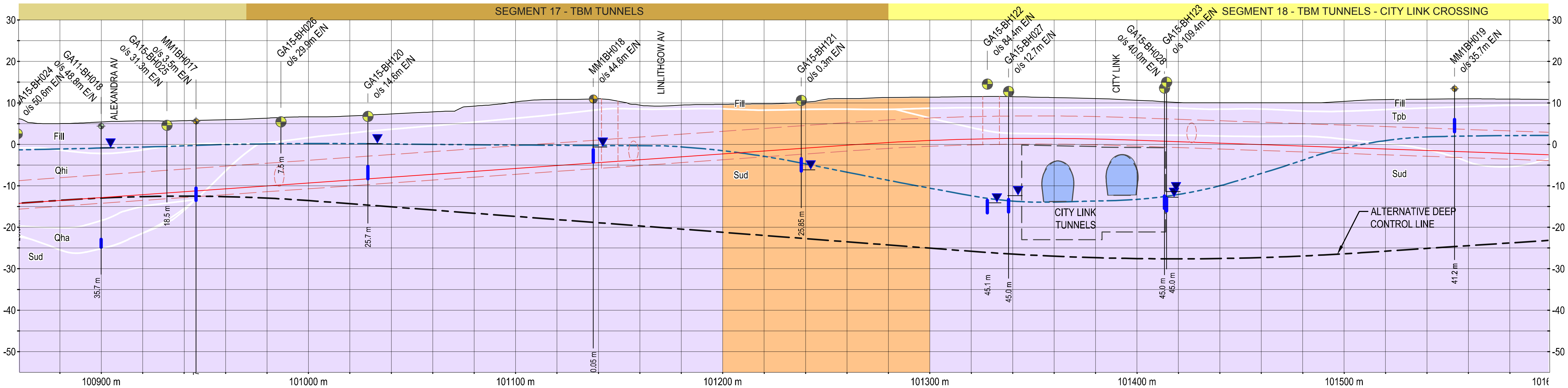
AJM Joint Venture
aurecon
JACOBS
Mott MacDonald in association with
GRIMSHAW

Melbourne Metro Rail Project

Title GEO. SECTION - RELIABILITY		SHEET 29 OF 35	
Drawing Number MMR-AJM-PWAA-DR-NN-500450			Revision P1.1
Drawn By GOLDER	Approved By SLVB	Date 23-03-2016	Map Size A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES
1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

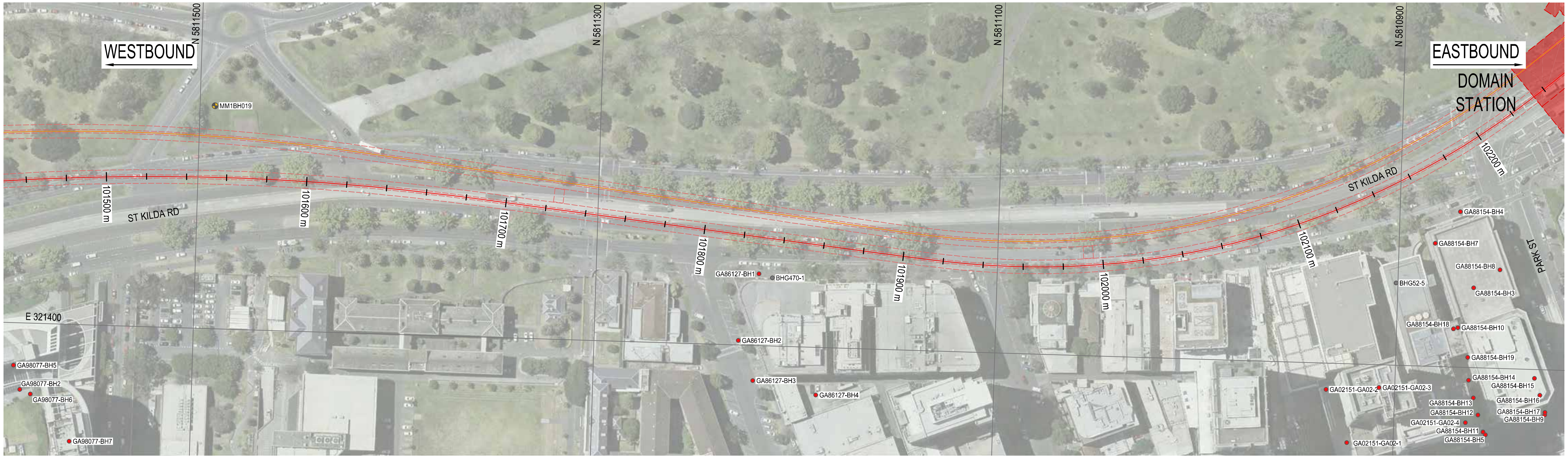
AJM Joint Venture — aurecon JACOBS Mott MacDonald GRIMSHAW

Melbourne Metro Rail Project

Title: GEO. SECTION - RELIABILITY	SHEET 30 OF 35
Drawing Number: MMR-AJM-PWAA-DR-NN-500450	Revision: P1.1
Drawn By: GOLDER / Approved By: SLVB / Date: 23-03-2016	Map Size: A3

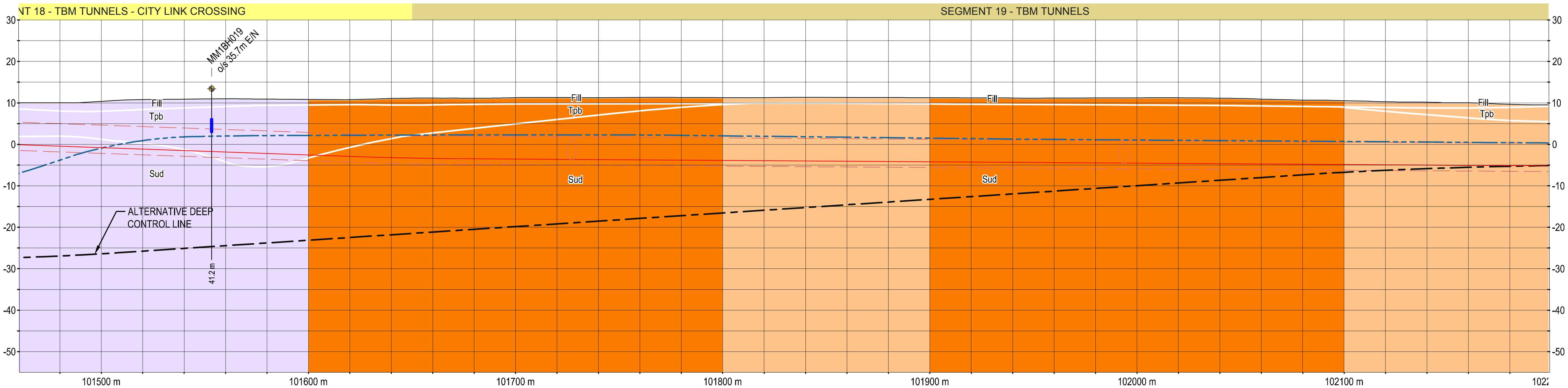
HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 30 OF 35



REFER TO SHEET 32 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
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Note:
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MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture

aurecon JACOBS Mott MacDonald in association with GRIMSHAW

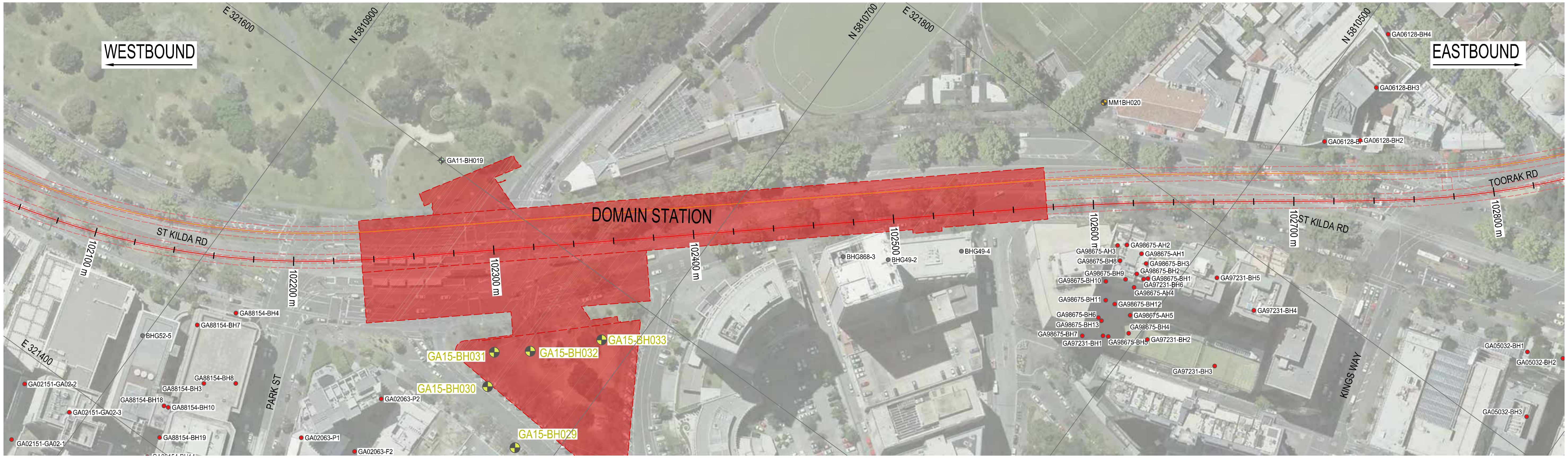
Melbourne Metro Rail Project

Title GEO. SECTION - RELIABILITY		SHEET 31 OF 35	
Drawing Number MMR-AJM-PWAA-DR-NN-500450			Revision P1.1
Drawn By GOLDER	Approved By SLVB	Date 23-03-2016	Map Size A3

HOR. 0 25 50 75 100m

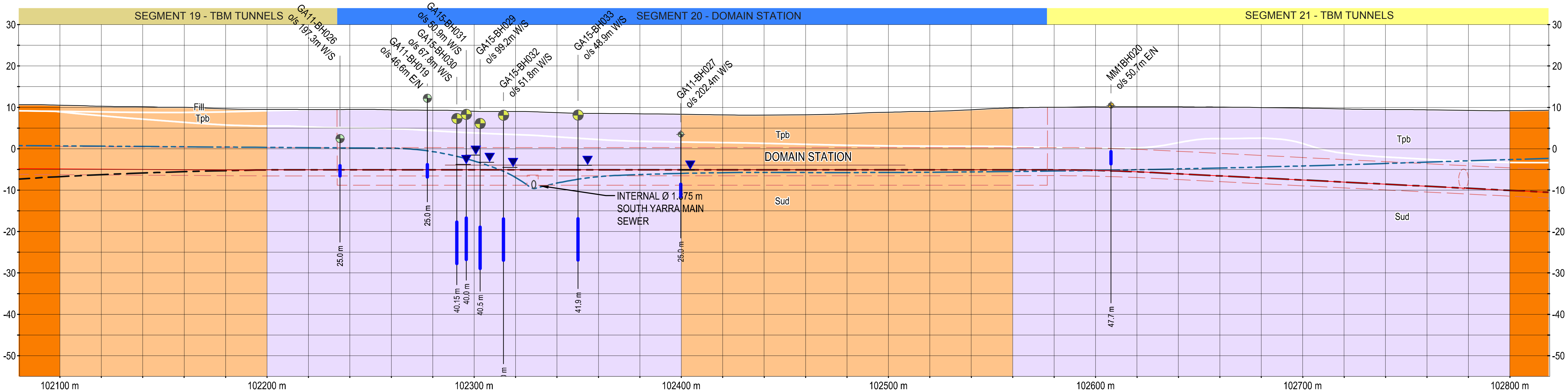
VER. 0 10 20 30 40 50m

REFER TO SHEET 31 OF 35



REFER TO SHEET 33 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
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4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture

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JACOBS
Mott MacDonald in association with
GRIMSHAW

Melbourne Metro Rail Project

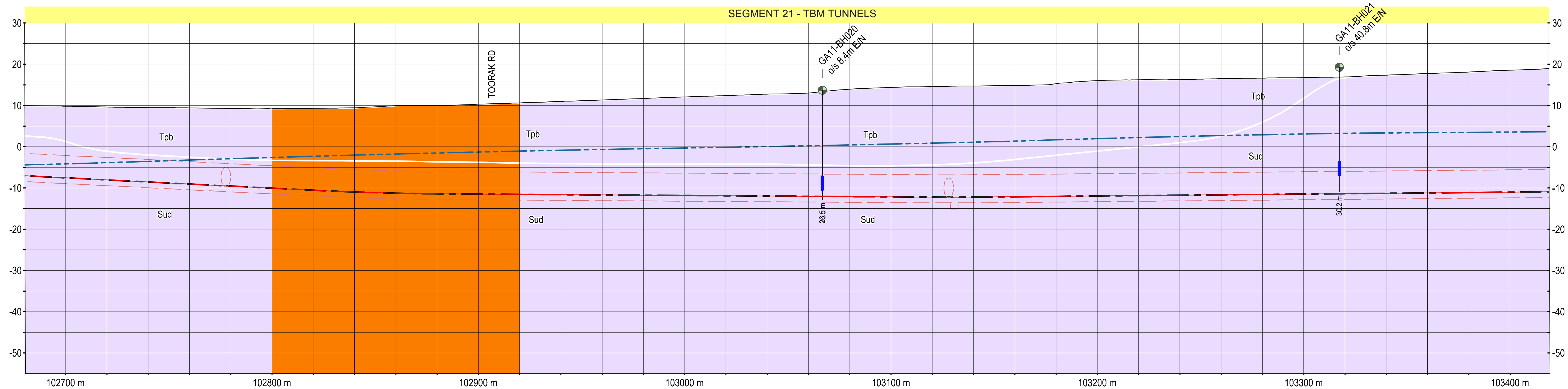
Title: GEO. SECTION - RELIABILITY		SHEET 32 OF 35	
Drawing Number: MMR-AJM-PWAA-DR-NN-500450			Revision: P1.1
Drawn By: GOLDER	Approved By: SLVB	Date: 23-03-2016	Map Size: A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 32 OF 35

REFER TO SHEET 34 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES
1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture — aurecon, JACOBS, Mott MacDonald in association with GRIMSHAW

Melbourne Metro Rail Project

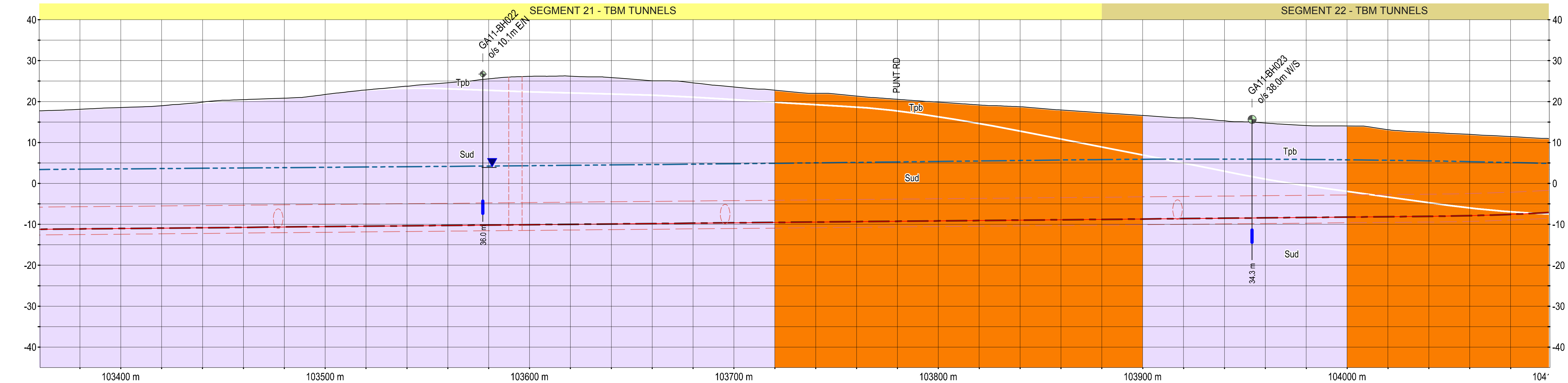
Title: GEO. SECTION - RELIABILITY		SHEET 33 OF 35	
Drawing Number: MMR-AJM-PWAA-DR-NN-500450			Revision: P1.1
Drawn By: GOLDER	Approved By: SLVB	Date: 23-03-2016	Map Size: A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 33 OF 35

REFER TO SHEET 35 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture
aurecon JACOBS Mott MacDonald in association with GRIMSHAW

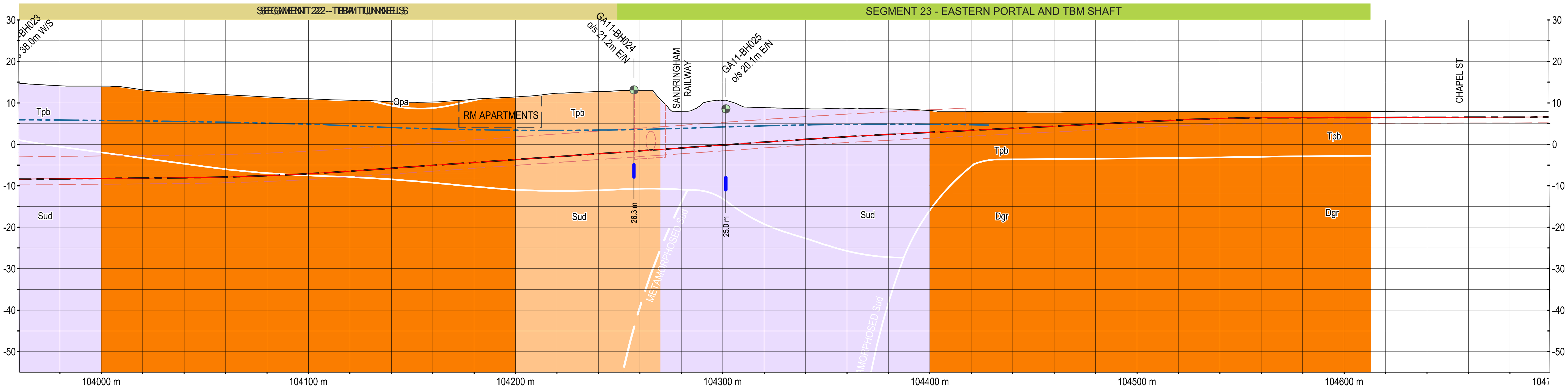
Melbourne Metro Rail Project

Title				
GEO. SECTION - RELIABILITY			SHEET 34 OF 35	
Drawing Number				Revision
MMR-AJM-PWAA-DR-NN-500450				P1.1
Drawn By	Approved By	Date		Map Size
GOLDER	SLVB	23-03-2016		A3

HOR. 0 25 50 75 100m
VER. 0 10 20 30 40 50m

REFER TO SHEET 34 OF 35

PLAN VIEW



SECTION WESTBOUND TUNNEL ALIGNMENT

NOTES

1. REFER FIGURE MMR-AJM-PWAA-DR-NN-500450, SHEET 1 OF 35 FOR NOTES AND LEGEND.
2. ALL LEVELS ARE IN METRES TO AHD.
3. ALL COORDINATES ARE IN METRES TO MGA-Z55
4. INTERPRETED SUBSURFACE CONDITIONS SHOWN ON LONG SECTION TO BE USED FOR EES PURPOSES ONLY.

Note:
Surface works are not shown

NOT FOR CONSTRUCTION

MELBOURNE METRO RAIL AUTHORITY

AJM Joint Venture

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Melbourne Metro Rail Project

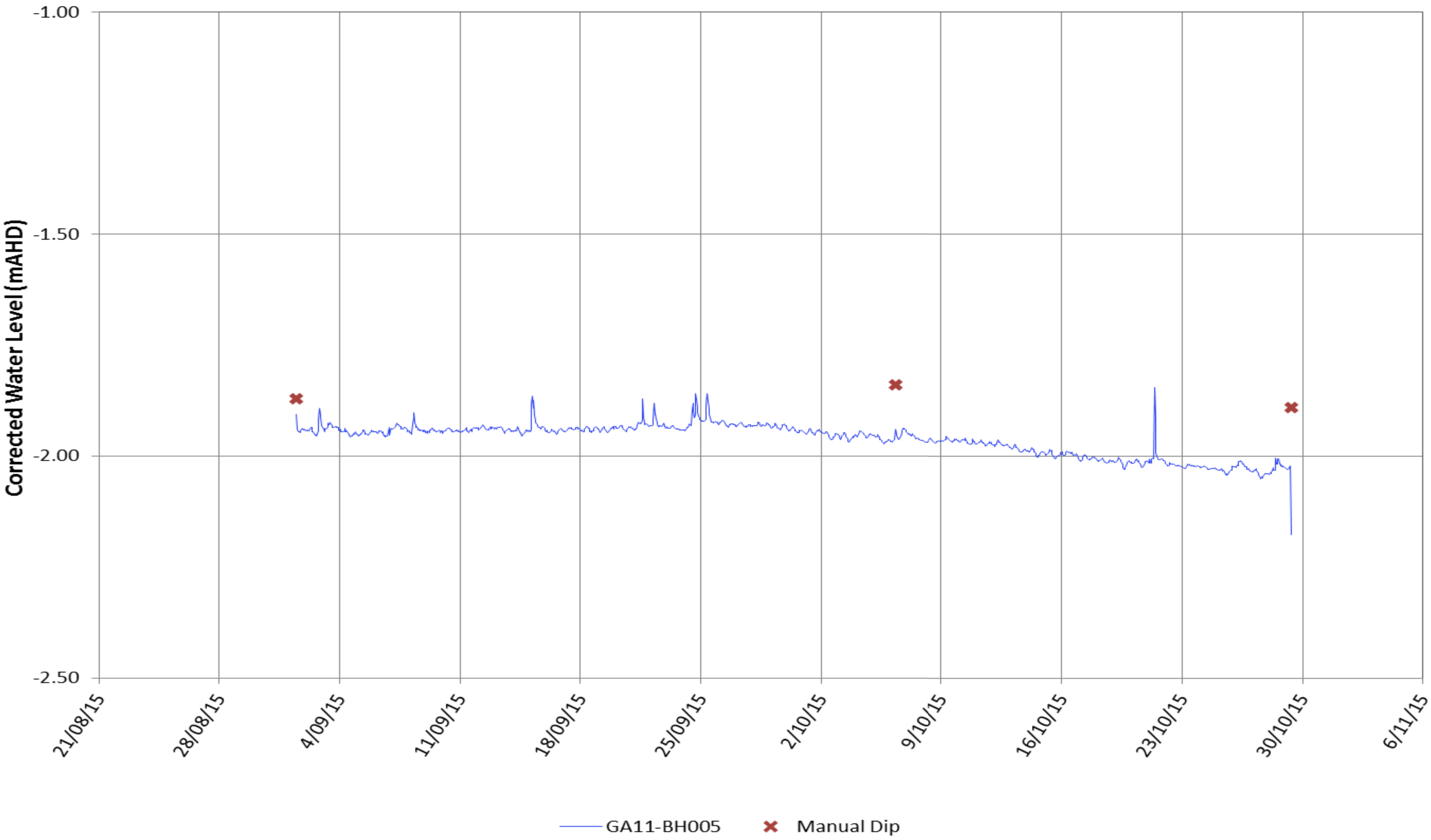
Title			SHEET 35 OF 35
GEO. SECTION - RELIABILITY			
Drawing Number			Revision
MMR-AJM-PWAA-DR-NN-500450			P1.1
Drawn By	Approved By	Date	Map Size
GOLDER	SLVB	23-03-2016	A3

HOR. 0 25 50 75 100m

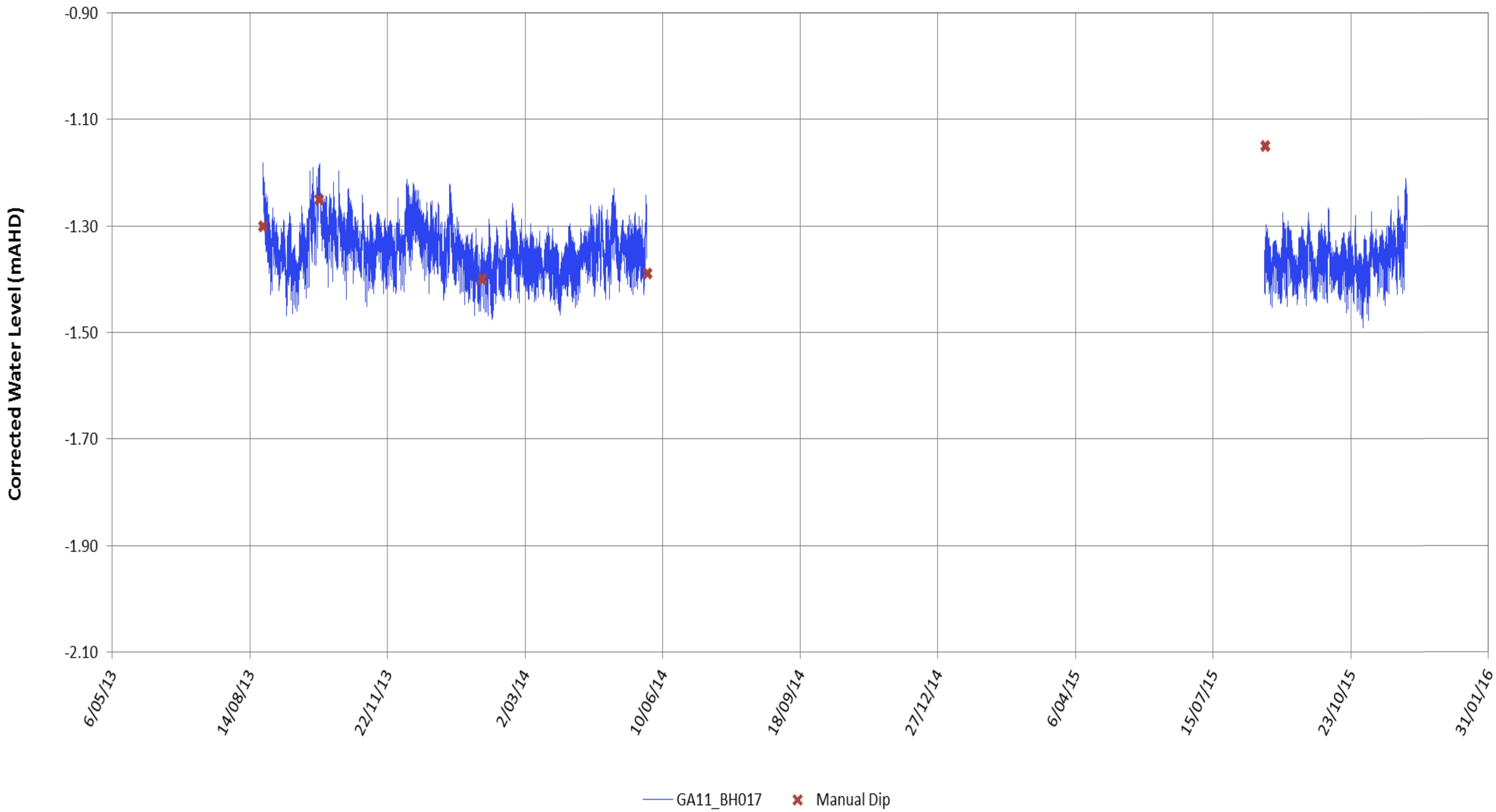
VER. 0 10 20 30 40 50m

APPENDIX B

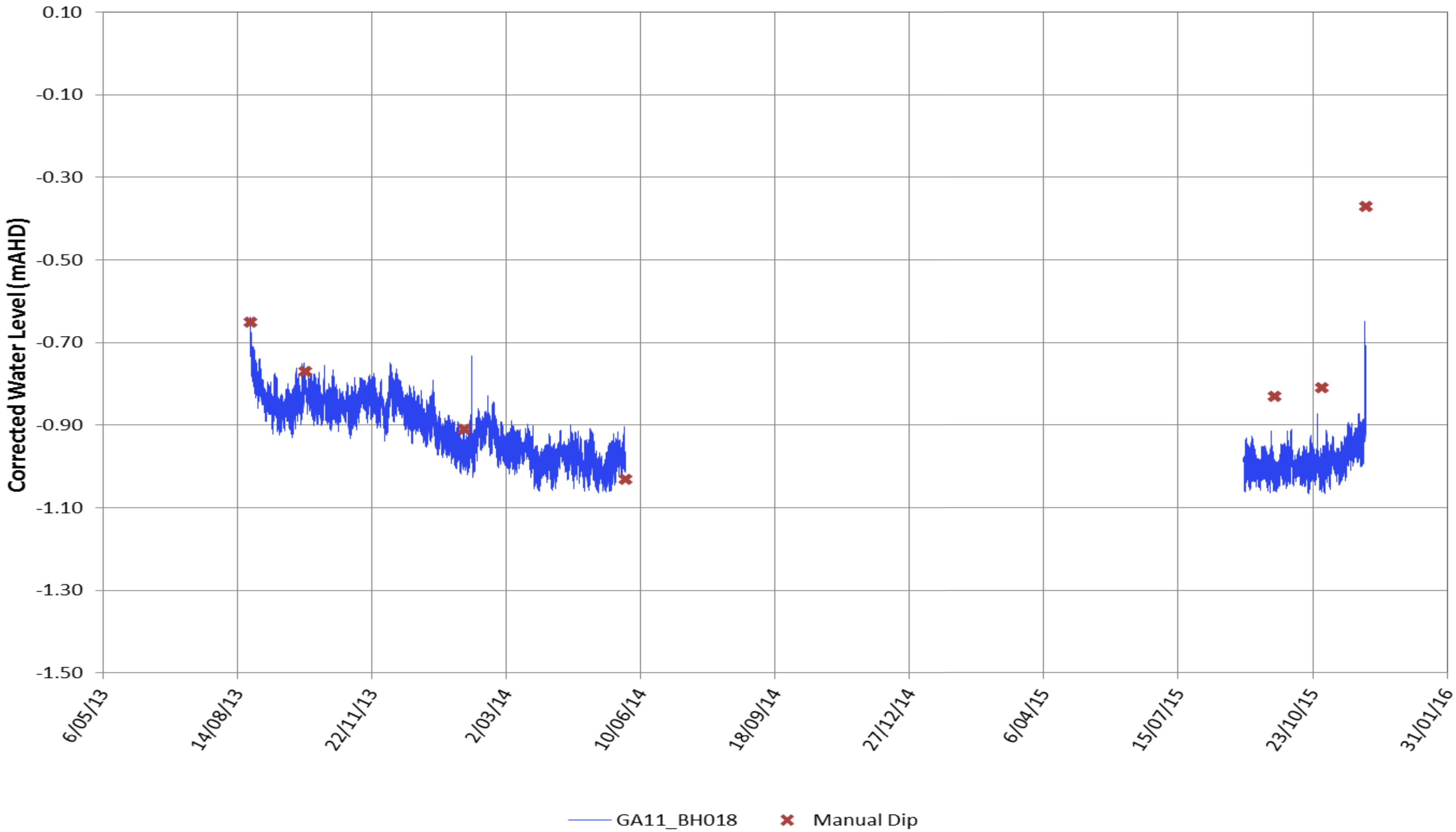
Data Logger Results



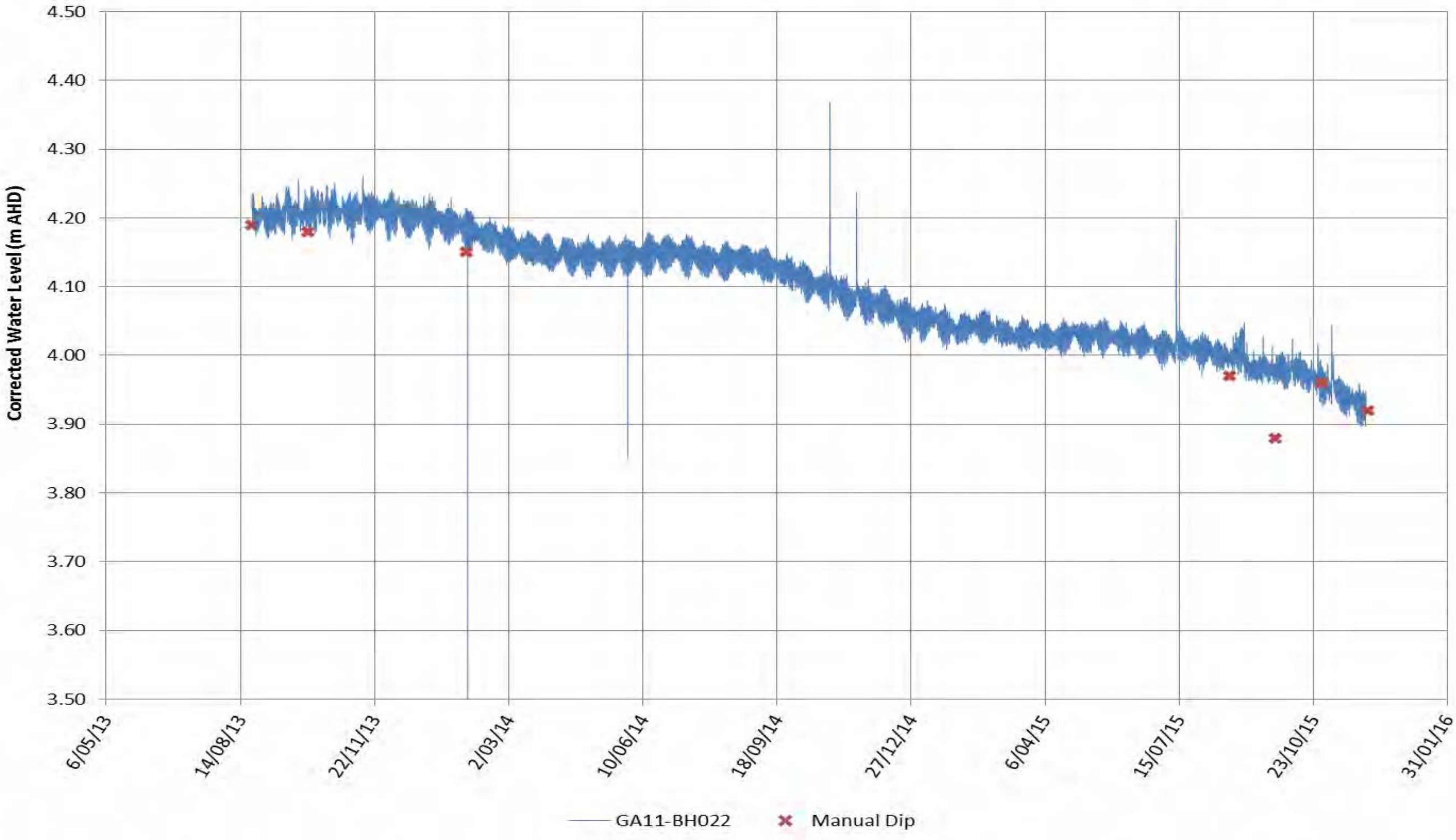
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA11_BH005**	
	Checked:	Date:		
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project	
	Scale: NTS	**A4**	Project No: 1525532	**FIGURE B1**



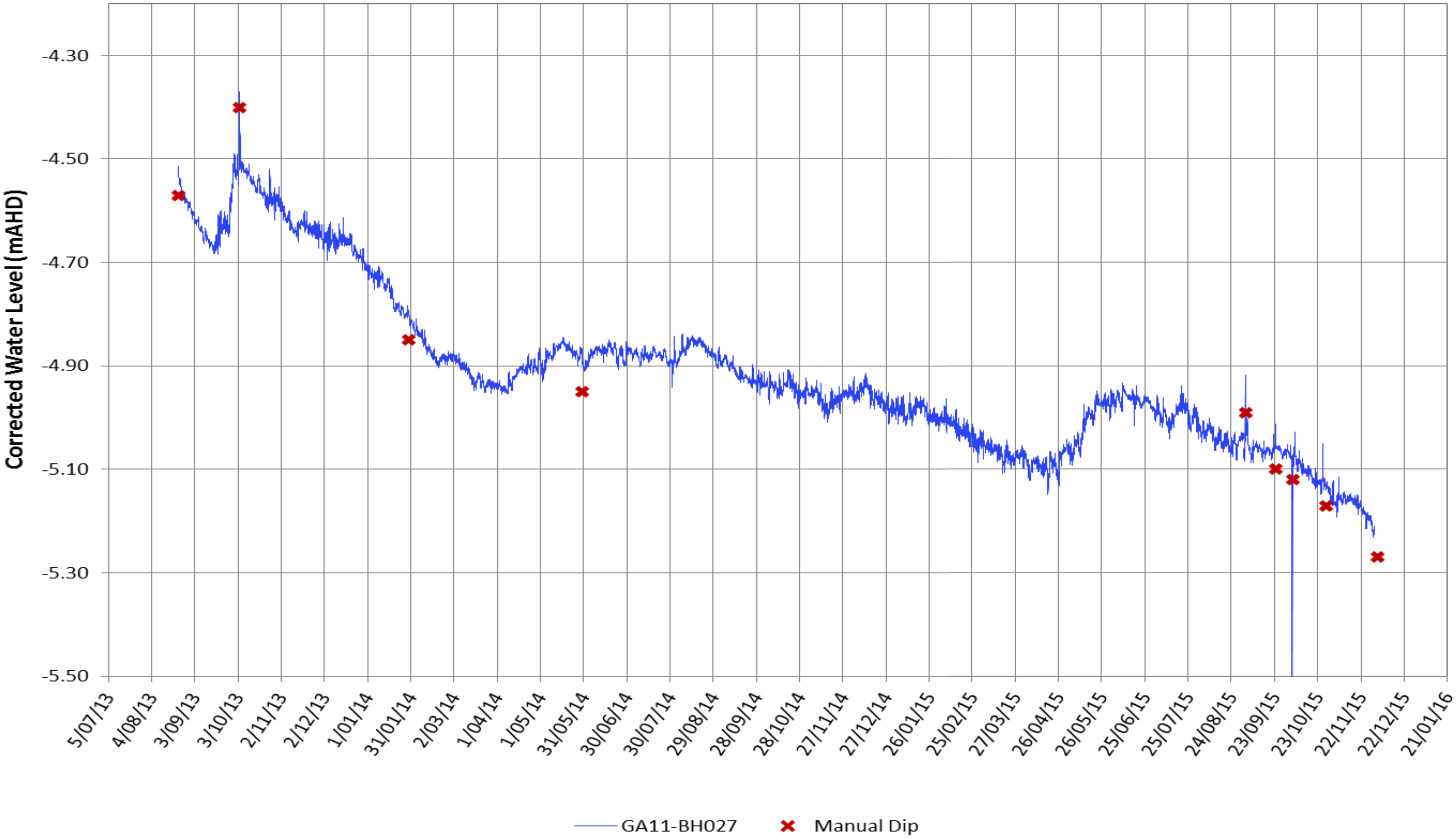
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA11_BH017**	
	Checked:	Date:		
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project	
	Scale: NTS	**A4**	Project No: 1525532	**FIGURE B2**



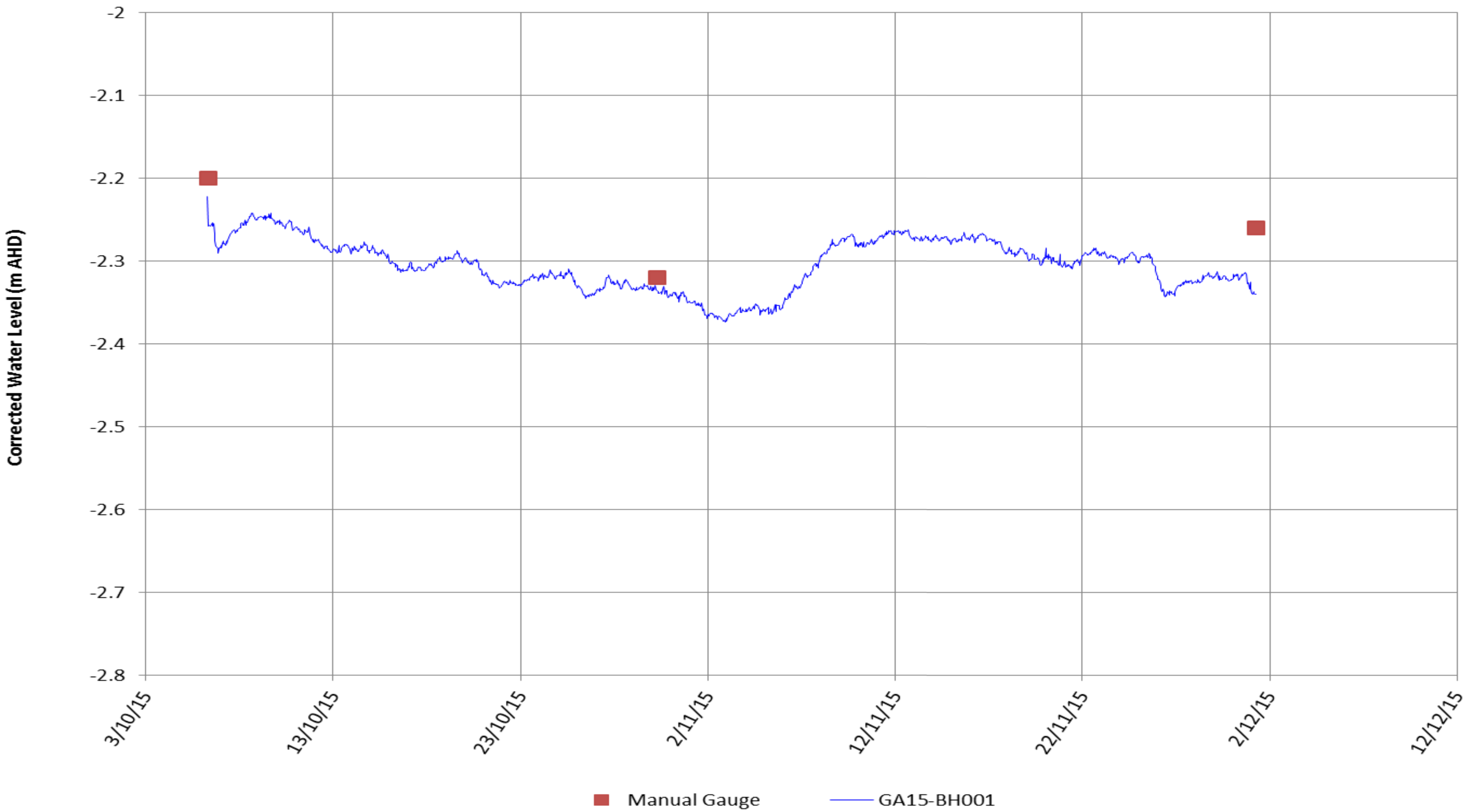
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA11_BH018**
	Checked:	Date:	
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project
	Scale: NTS	**A4**	Project No: 1525532 — **FIGURE B3**



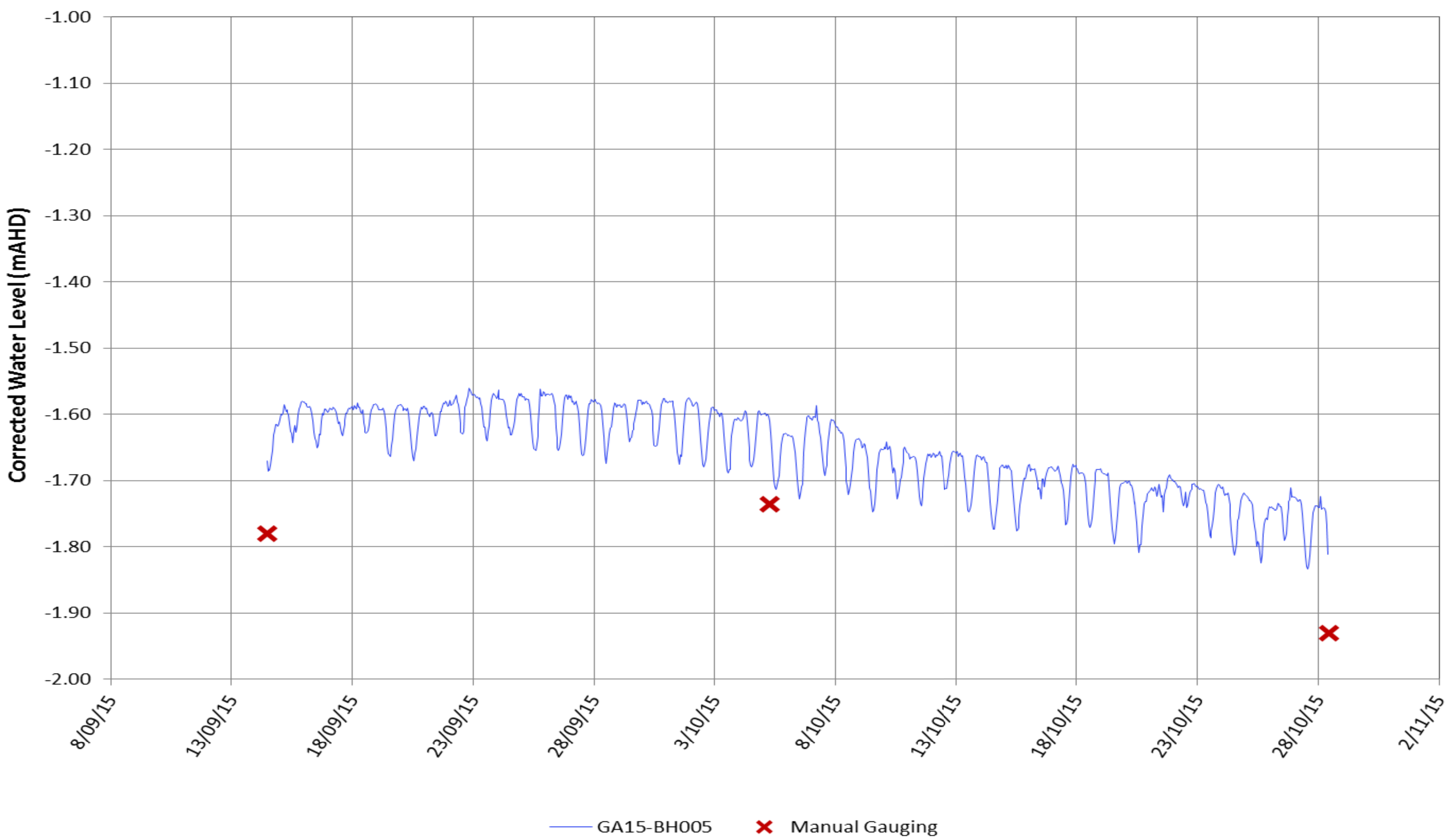
Golder Associates	Drawn: CB	Date: 08/12/2015		**Long Term Water Levels Monitoring Results: GA11_BH022**
	Checked:	Date:		
	Revision:	Date:		AJM JV, Melbourne Metro Rail Project
	Scale: NTS		**A4**	Project No: 1525532 — **FIGURE B4**



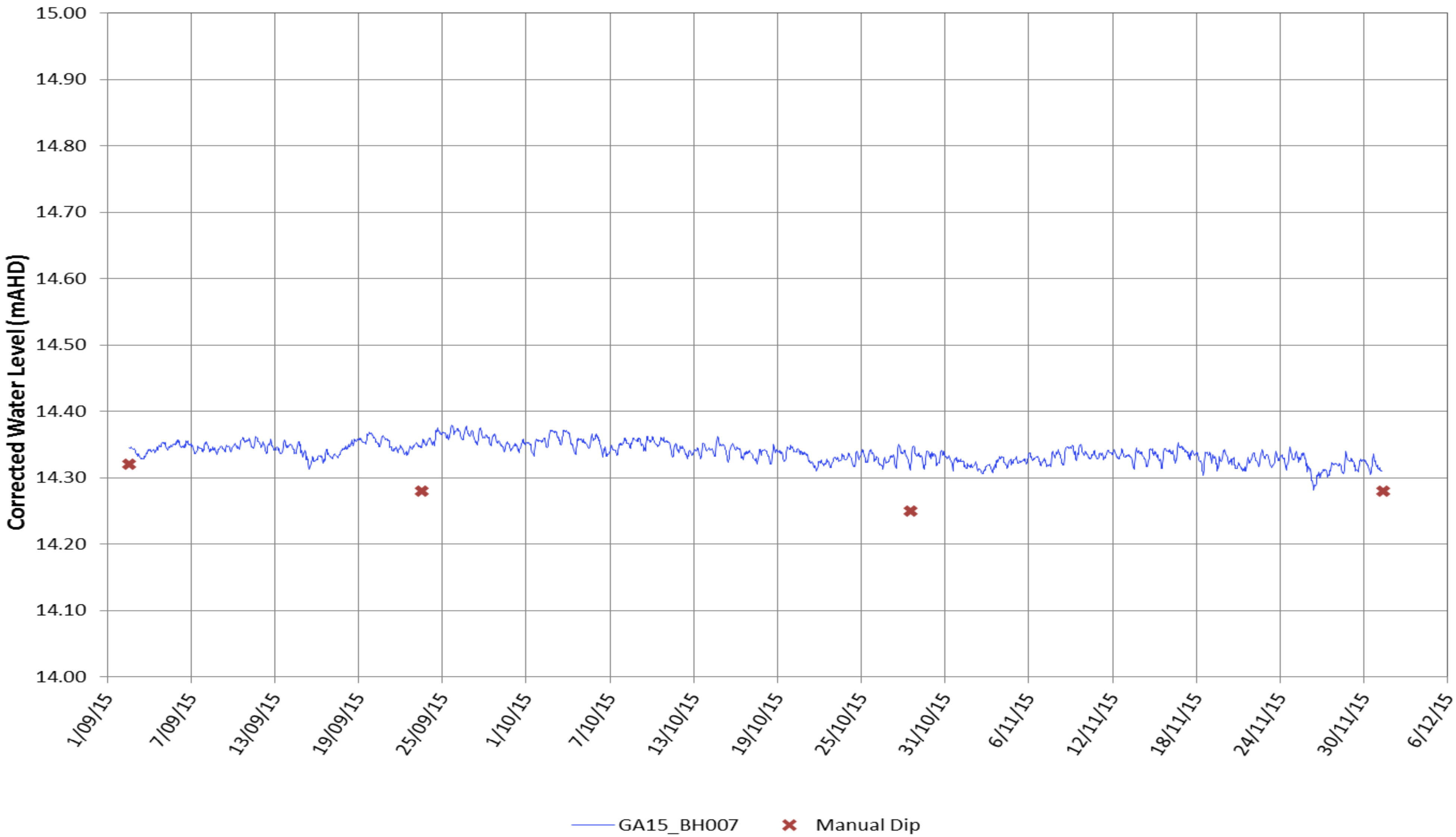
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA11_BH027**
	Checked:	Date:	
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project
	Scale: NTS	**A4**	Project No: 1525532 — **FIGURE B5**



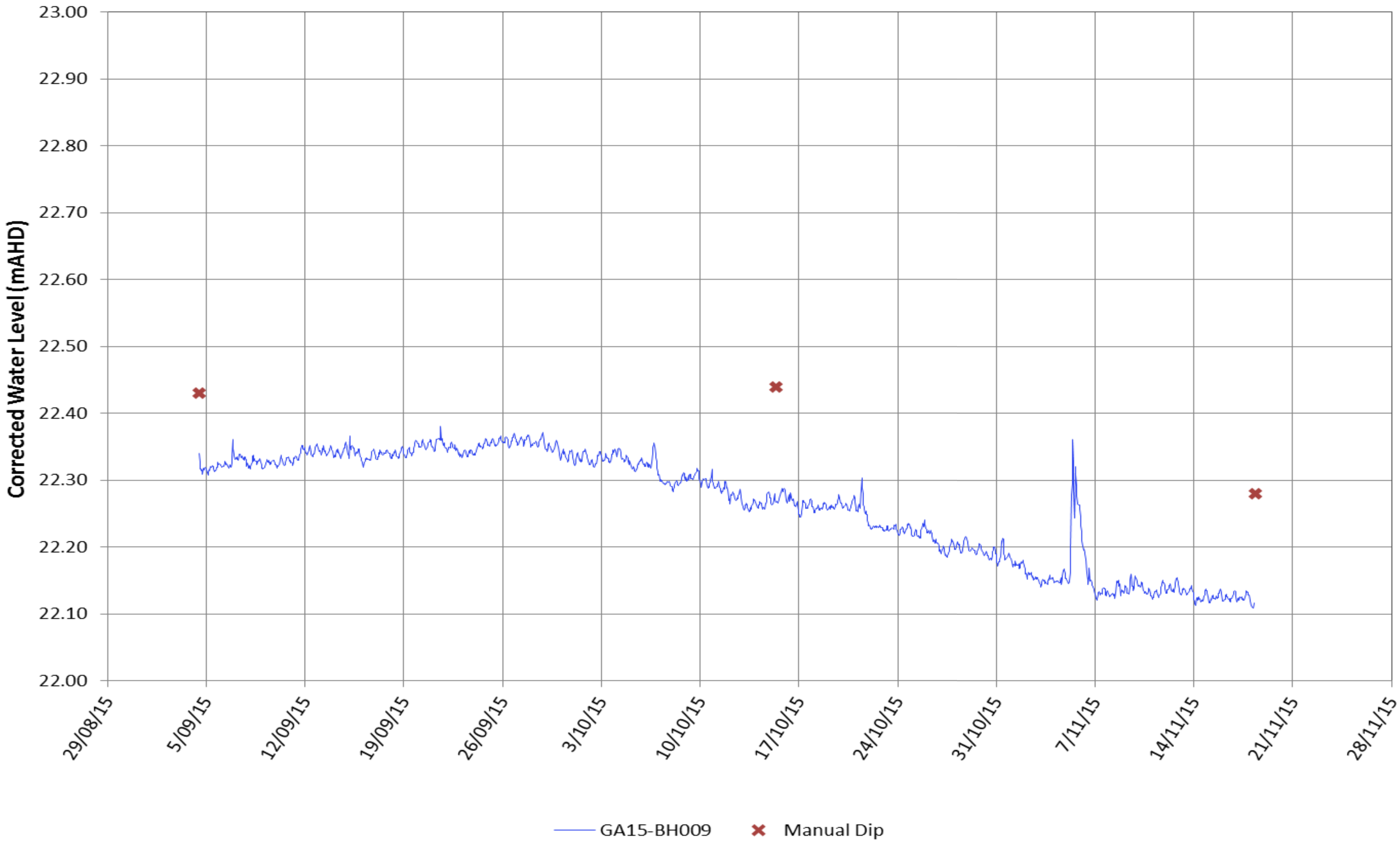
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA15-BH001**	
	Checked:	Date:		
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project	
	Scale: NTS	**A4**	Project No: 1525532	**FIGURE B6**



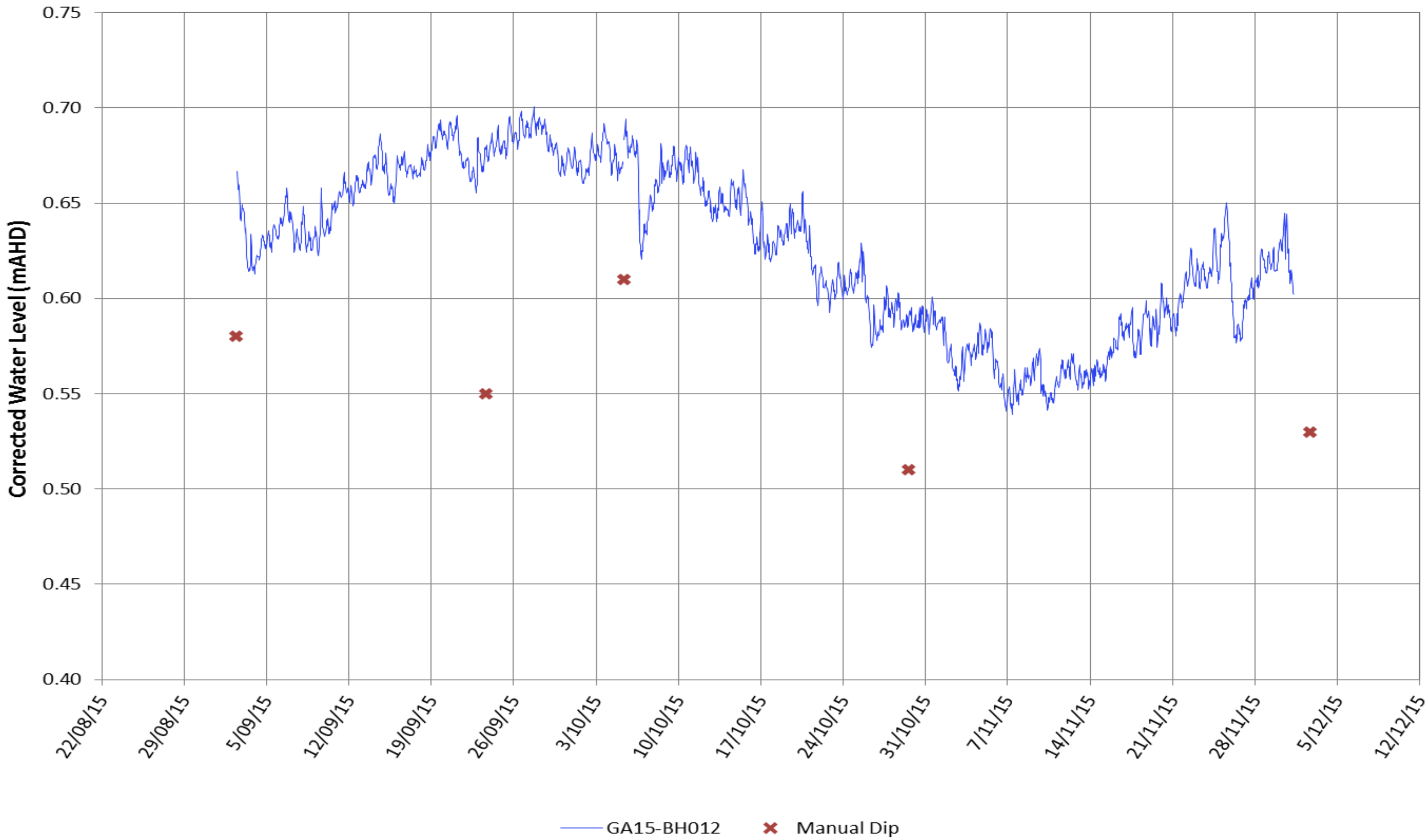
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA15-BH005**	
	Checked:	Date:		
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project	
	Scale: NTS	**A4**	Project No: 1525532	**FIGURE B7**



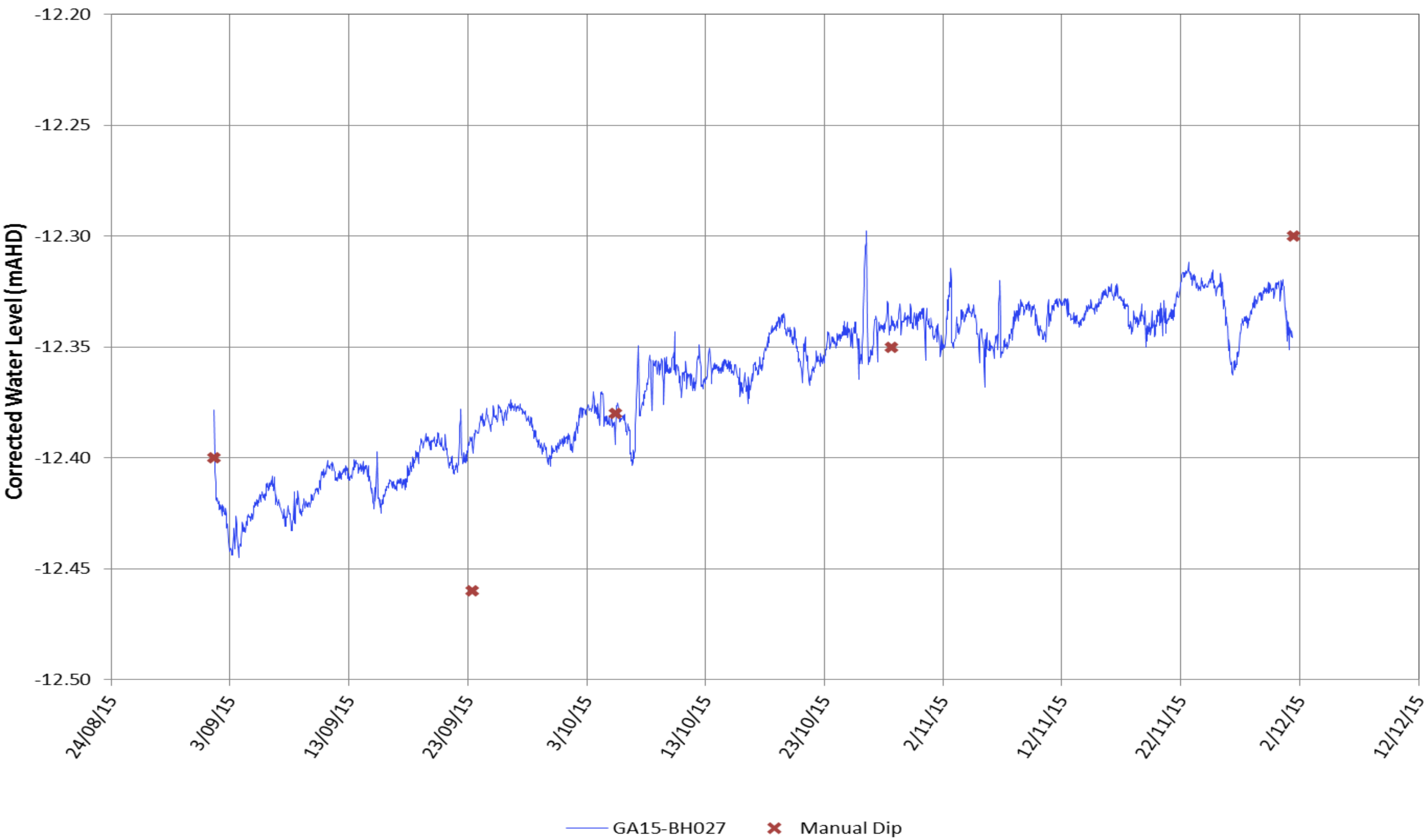
Golder Associates	Drawn: CB	Date: 08/12/2015		**Long Term Water Levels Monitoring Results: GA15-BH007**
	Checked:	Date:		
	Revision:	Date:		AJM JV, Melbourne Metro Rail Project
	Scale: NTS		**A4**	Project No: 1525532 — **FIGURE B8**



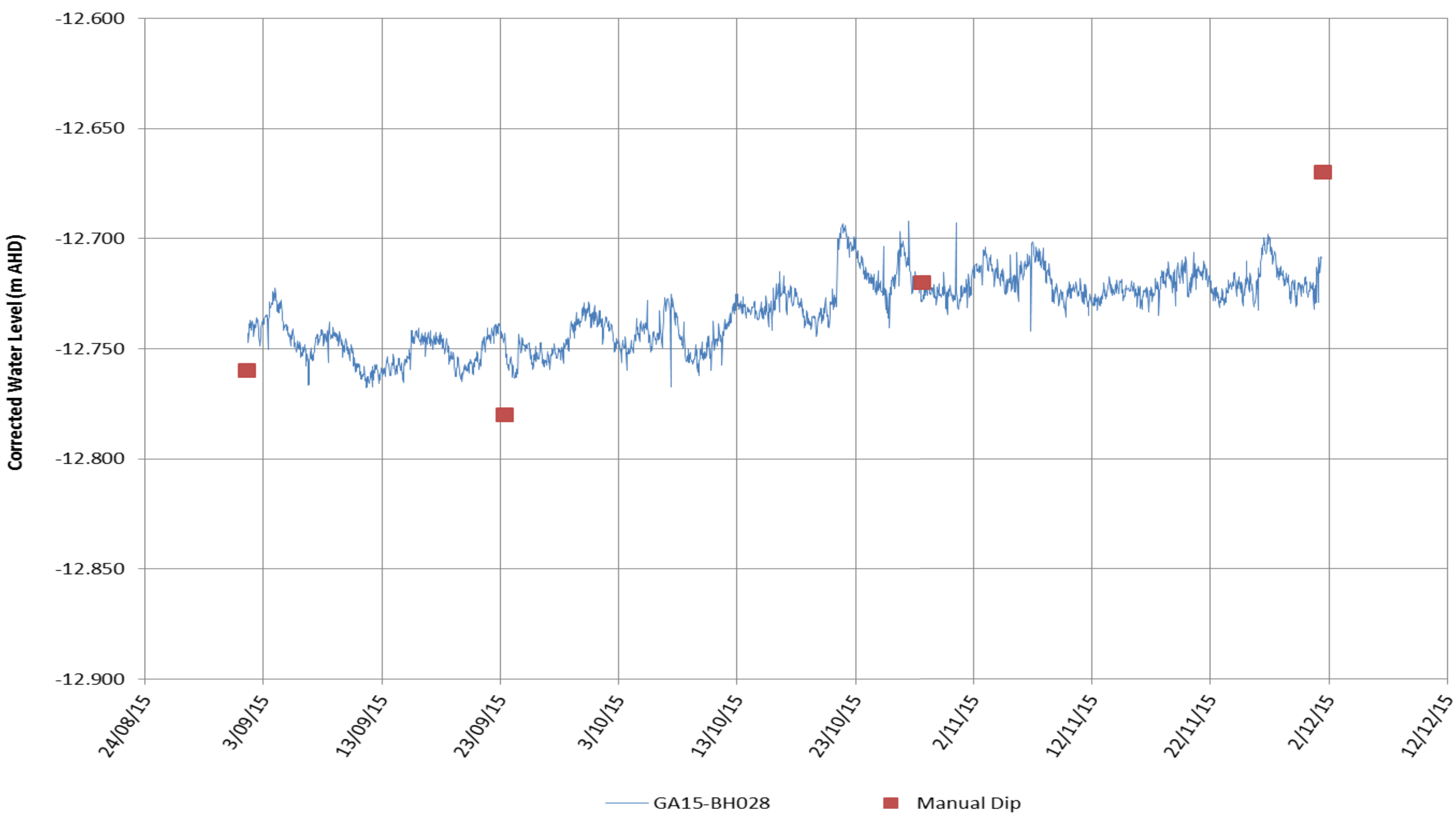
	Drawn: CB	Date: 08/12/2015		**Long Term Water Levels Monitoring Results: GA15-BH009**	
Golder Associates	Checked:	Date:			
	Revision:	Date:		AJM JV, Melbourne Metro Rail Project	
	Scale: NTS		**A4**	Project No: 1525532	**FIGURE B9**



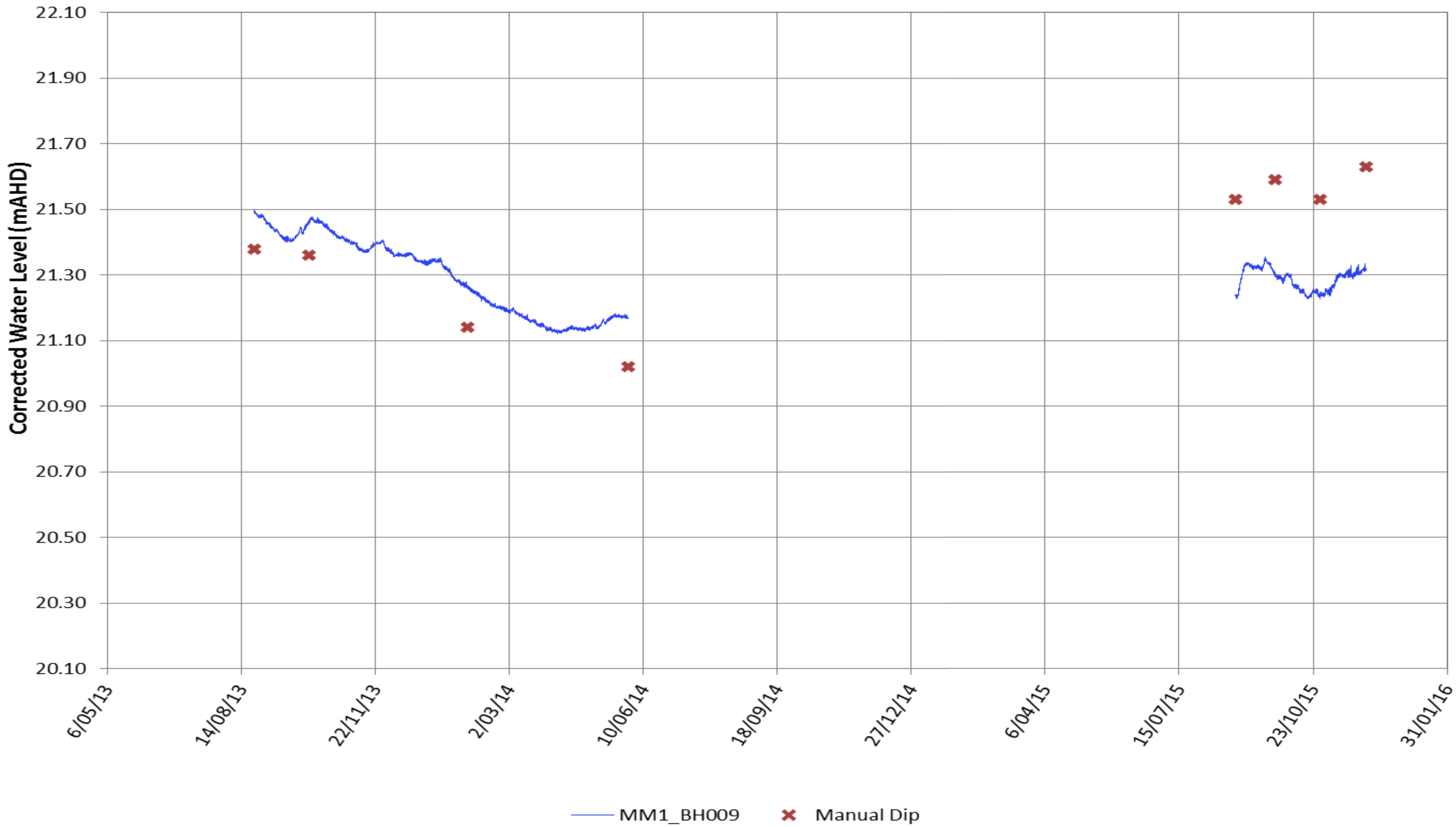
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA15-BH012**
	Checked:	Date:	
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project
	Scale: NTS	**A4**	Project No: 1525532 — **FIGURE B10**



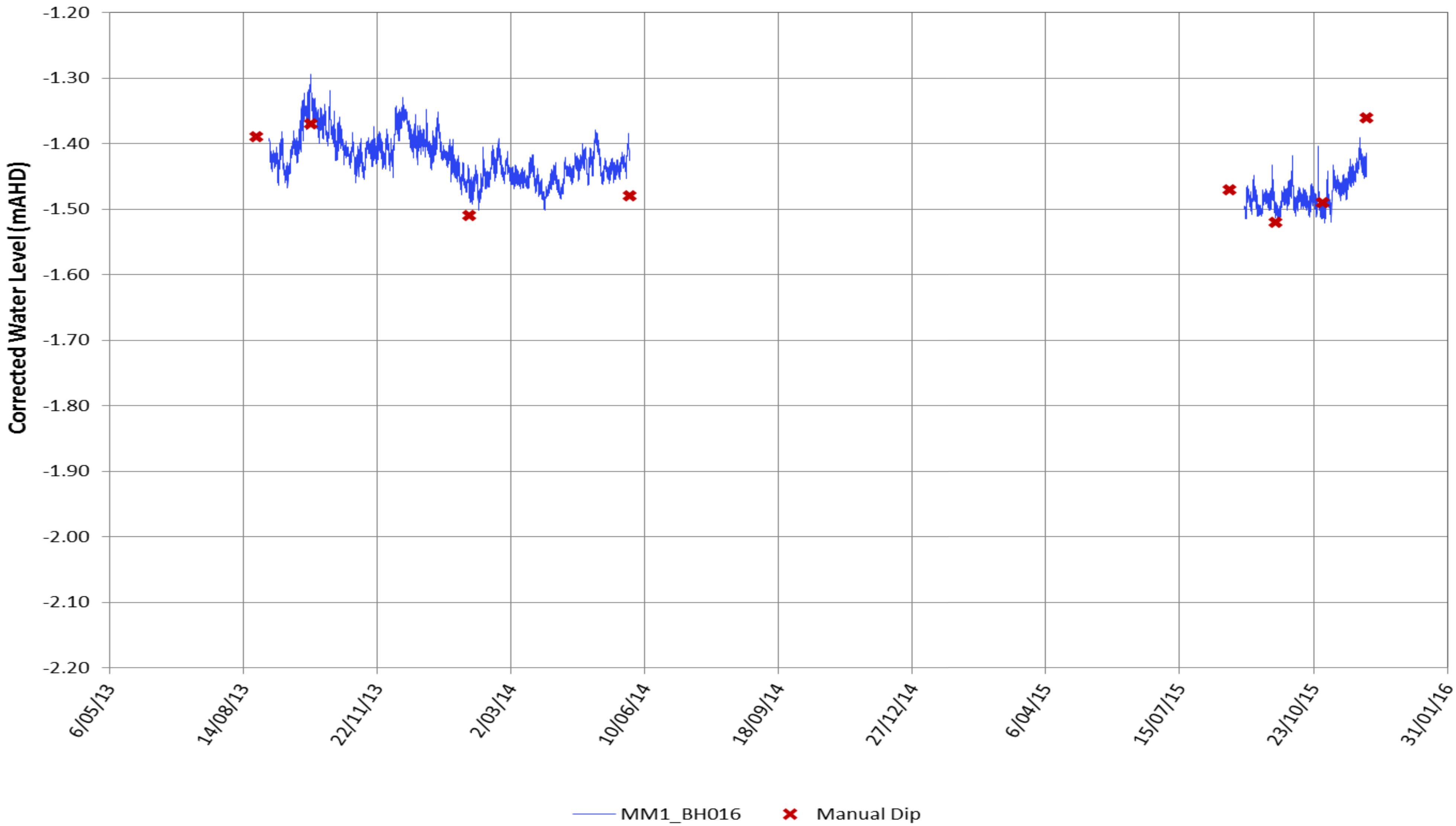
Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: GA15-BH027**
	Checked:	Date:	
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project
	Scale: NTS	**A4**	Project No: 1525532 — **FIGURE B11**



Golder Associates	Drawn: CB	Date 08/12/2015	**Long Term Water Levels Monitoring Results: GA15-BH028**	
	Checked:	Date:		
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project	
	Scale: NTS	**A4**	Project No: 1525532	**FIGURE B12**



Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: MM1-BH009**	
	Checked:	Date:		
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project	
	Scale: NTS	**A4**	Project No: 1525532	**FIGURE B13**



Golder Associates	Drawn: CB	Date: 08/12/2015	**Long Term Water Levels Monitoring Results: MM1-BH016**
	Checked:	Date:	
	Revision:	Date:	AJM JV, Melbourne Metro Rail Project
	Scale: NTS	**A4**	Project No: 1525532 — **FIGURE B14**

APPENDIX C

Hydraulic Testing Summary (Tables C1 and C2) and Pumping Test Interpretation (Figures C1 to C7)

TABLE C1 - PACKER TEST INTERPRETATION SUMMARY TABLE

Well ID	Packer Test Interval (mbgl)		Lugeon Value (uL)	Hydraulic Conductivity (m/s)		Rock Weathering[7]
	Top of Interval	Bottom of Interval		Based on Lugeon[1] Value	Based on Method 1[2]	
GA15-BH002	26.3	28.9	15.9	1.59E-06	1.68E-06	MW
GA15-BH002	28.4	31.0	7.5	7.50E-07	7.68E-07	MW-SW
GA15-BH003	26.0	28.6	24.9	2.49E-06	2.56E-06	MW-SW
GA15-BH003	28.6	31.2	23.6	2.36E-06	2.45E-06	SW
GA15-BH007	17.8	20.4	1.8	1.80E-07	1.89E-07	HW
GA15-BH007	20.4	23.0	2.6	2.60E-07	2.74E-07	MW
GA15-BH008[6]	15.0	17.6	<0.1	<1.00E-08	<1.20E-08	MW
GA15-BH008[6]	17.6	20.2	<0.1	<1.00E-08	<5.00E-09	MW
GA15-BH008[6]	20.2	22.8	<0.1	<1.00E-08	1.03E-08	MW-SW
GA15-BH008[6]	22.8	25.4	<0.1	<1.00E-08	1.43E-08	MW-SW
GA15-BH008[6]	25.4	28.0	<0.1	<1.00E-08	<6.00E-09	SW
GA15-BH008	28.0	30.6	0.6	6.00E-08	6.11E-08	SW
GA15-BH008[6]	30.6	33.2	<0.1	<1.00E-08	<5.70E-09	SW-FR
GA15-BH008	33.2	35.8	3.9	3.90E-07	4.20E-07	SW-FR
GA15-BH008	35.8	38.4	5.1	5.10E-07	5.30E-07	SW-FR
GA15-BH008	38.4	41.0	5.7	5.70E-07	5.86E-07	SW-FR
GA15-BH008	41.0	43.6	1.3	1.30E-07	1.36E-07	SW-FR
GA15-BH009	17.6	20.2	No Flow[3]			EW
GA15-BH009	20.2	22.8	No Flow[3]			EW-HW
GA15-BH011	16.0	18.6	Test Abandoned[4]			HW-MW
GA15-BH011	18.6	21.2	0.2	2.00E-08	2.70E-08	HW-MW
GA15-BH011	21.2	23.8	0.2	2.00E-08	1.58E-08	MW-SW
GA15-BH011	23.8	26.4	0.3	3.00E-08	2.90E-08	MW-SW
GA15-BH011	26.4	29.0	0.3	3.00E-08	3.41E-08	MW-SW
GA15-BH011	29.0	31.6	0.3	3.00E-08	2.88E-08	SW
GA15-BH011	31.6	34.2	0.8	8.00E-08	8.01E-08	SW
GA15-BH017	18.4	21.0	6.5	6.50E-07	6.87E-07	MW
GA15-BH017[6]	21.0	23.6	<0.016	<1.60E-09	<1.60E-09	MW-SW
GA15-BH017	23.6	26.2	No Flow[3]			MW-SW
GA15-BH017	26.2	28.8	0.069	6.90E-09	7.21E-09	SW
GA15-BH017[6]	28.8	31.4	<0.06	<6.00E-09	<6.40E-09	SW

Well ID	Packer Test Interval (mbgl)		Lugeon Value (uL)	Hydraulic Conductivity (m/s)		Rock Weathering[7]
	Top of Interval	Bottom of Interval		Based on Lugeon[1] Value	Based on Method 1[2]	
GA15-BH017	31.4	34.0	2.0	2.00E-07	2.15E-07	SW
GA15-BH018	16.0	18.6	Test Abandoned[5]			MW
GA15-BH018[6]	18.6	21.2	<0.1	<1.00E-08	<1.4E-08	MW
GA15-BH018	21.2	23.8	0.7	7.00E-08	7.73E-08	MW-SW
GA15-BH018	23.8	26.4	0.6	6.00E-08	6.02E-08	MW-SW
GA15-BH018	26.4	29.0	0.5	5.00E-08	5.01E-08	SW
GA15-BH019	18.8	21.1	1.2	1.20E-07	1.19E-07	MW-SW
GA15-BH019	21.4	23.7	0.9	9.00E-08	9.33E-08	MW-SW
GA15-BH019	24.3	26.6	1.0	1.00E-07	1.01E-07	MW-SW
GA15-BH019	26.6	28.9	0.5	5.00E-08	4.84E-08	SW
GA15-BH019	30.2	32.5	4.9	4.90E-07	4.96E-07	SW
GA15-BH021	17.0	19.3	0.5	5.00E-08	5.56E-08	MW
GA15-BH021	19.6	21.9	0.5	5.00E-08	5.14E-08	MW-SW
GA15-BH021	22.2	24.5	No Flow[3]			SW
GA15-BH021	24.8	27.1	0.6	6.00E-08	6.33E-08	SW
GA15-BH021	27.4	29.7	0.6	6.00E-08	6.13E-08	SW
GA15-BH029	22.0	24.6	0.5	5.00E-08	5.12E-08	HW
GA15-BH029[6]	24.6	27.2	<0.03	<3.20E-09	<3.60E-09	HW-MW
GA15-BH029	27.2	29.8	0.1	1.00E-08	9.96E-09	SW
GA15-BH029[6]	29.8	32.4	<0.04	<4.30E-09	<4.40E-09	SW
GA15-BH029	32.4	35.0	0.5	5.00E-08	5.49E-08	SW
GA15-BH030	18.0	20.6	0.2	2.00E-08	1.67E-08	HW
GA15-BH030[6]	20.6	23.2	<0.01	<8.00E-10	<8.50E-10	HW
GA15-BH030[6]	23.2	25.8	<0.02	<2.00E-09	<1.90E-09	HW
GA15-BH030	25.8	28.4	0.30	3.00E-08	3.22E-08	MW-SW
GA15-BH030[6]	28.4	31.0	<0.04	<4.00E-09	<4.40E-09	SW
GA15-BH031	13.0	15.6	Test Abandoned[4]			HW-MW
GA15-BH031	15.6	18.2	0.2	2.00E-08	1.96E-08	EW-HW
GA15-BH031	18.2	20.8	0.007	7.00E-10	7.31E-10	EW-HW
GA15-BH031	20.8	23.4	0.6	6.00E-08	6.38E-08	HW
GA15-BH031	23.4	26.0	0.6	6.00E-08	6.68E-08	EW-HW
GA15-BH031	26.0	28.6	1.1	1.10E-07	1.07E-07	EW
GA15-BH031	28.6	31.2	0.2	2.00E-08	2.09E-08	EW

Well ID	Packer Test Interval (mbgl)		Lugeon Value (uL)	Hydraulic Conductivity (m/s)		Rock Weathering[7]
	Top of Interval	Bottom of Interval		Based on Lugeon[1] Value	Based on Method 1[2]	
GA15-BH032	18.0	20.6	Test Abandoned[4]			EW-HW
GA15-BH032	20.6	23.2	Test Abandoned[4]			EW-HW
GA15-BH032	23.2	25.8	0.1	1.00E-08	1.37E-08	HW-MW
GA15-BH032	25.8	28.4	Test Abandoned[4]			HW-MW
GA15-BH032	28.4	31.0	1.0	1.00E-07	1.03E-07	EW-HW
GA15-BH032	31.0	33.6	1.6	1.60E-07	1.73E-07	HW
GA15-BH032	33.6	36.2	0.4	4.00E-08	4.38E-08	MW-SW + HW
GA15-BH033	14.6	17.2	7.2	7.20E-07	7.19E-08	HW
GA15-BH033[6]	17.2	19.8	<0.01	<7.00E-10	<7.30E-10	EW-HW + HW + MW
GA15-BH033	19.8	22.4	No Flow[3]			SW
GA15-BH033	22.3	24.9	No Flow[3]			SW
GA15-BH033[5]	25.0	27.6	<0.2	<2.00E-08	<2.30E-08	MW-SW + EW
GA15-BH033	27.7	30.3	0.2	2.00E-08	2.22E-08	MW-SW
GA15-BH033	30.2	32.8	0.1	1.00E-08	1.10E-08	MW-SW
GA15-BH033[6]	32.8	35.4	<0.1	<1.00E-08	<1.10E-08	SW
GA15-BH033	35.4	38.0	0.7	7.00E-08	7.50E-08	SW
GA15-BH108	13.0	16.3	0.3	3.00E-08	3.14E-08	MW
GA15-BH108	16.3	19.6	2.1	2.10E-07	2.38E-07	HW + MW
GA15-BH108	19.6	22.6	2.2	2.20E-07	2.46E-07	MW-SW + HW-MW
GA15-BH108	22.6	26.2	0.6	6.00E-08	6.54E-08	MW-SW + MW
GA15-BH108	26.2	29.5	1.4	1.40E-07	1.52E-07	MW + SW
GA15-BH108	29.5	32.8	2.7	2.70E-07	2.96E-07	SW
GA15-BH108	32.8	36.1	15.9	1.59E-06	1.69E-06	SW + FR
GA15-BH108	36.1	39.4	54.8	5.48E-06	5.99E-06	SW
GA15-BH108	39.4	42.7	7.1	7.10E-07	7.95E-07	SW
GA15-BH108	42.7	46.0	1.6	1.60E-07	1.73E-07	SW
GA15-BH109	13.0	16.3	1.5	1.50E-07	1.69E-07	MW + MW-SW
GA15-BH109	16.3	19.6	1.2	1.20E-07	4.37E-08	MW
GA15-BH109	19.6	22.6	2.7	2.70E-07	1.68E-07	HW-MW + MW
GA15-BH109	22.6	26.2	3.8	3.80E-07	2.51E-07	HW + MW
GA15-BH109	26.2	29.5	6.1	6.10E-07	3.40E-07	MW + SW
GA15-BH109	29.5	32.8	27.2	2.72E-06	1.61E-06	MW-SW + SW

Well ID	Packer Test Interval (mbgl)		Lugeon Value (uL)	Hydraulic Conductivity (m/s)		Rock Weathering[7]
	Top of Interval	Bottom of Interval		Based on Lugeon[1] Value	Based on Method 1[2]	
GA15-BH109	32.8	36.1	17.3	1.73E-06	1.32E-06	SW
GA15-BH109	36.1	39.4	2.7	2.70E-07	2.99E-07	SW + SW-FR
GA15-BH109	39.4	42.7	0.5	5.00E-08	5.77E-08	SW-FR
GA15-BH109	42.7	46.0	3.6	3.60E-07	2.64E-07	SW-FR
GA15-BH110	19.4	22.0	1.8	1.80E-07	1.70E-07	MW
GA15-BH110	22.0	24.6	2.5	2.50E-07	2.60E-07	MW
GA15-BH110	24.6	27.2	42.8	4.28E-06	4.60E-06	MW
GA15-BH110	27.2	29.8	53	5.30E-06	5.50E-06	MW
GA15-BH110	29.8	32.4	18.6	1.86E-06	1.70E-06	MW-SW
GA15-BH110	32.4	35.0	48.9	4.89E-06	5.00E-06	MW-SW
GA15-BH110	35.0	37.6	4.9	4.90E-07	5.00E-07	SW
GA15-BH110	37.6	40.2	27.4	2.74E-06	2.80E-06	SW–FR
GA15-BH110	40.2	42.8	69.3	6.93E-06	6.80E-06	SW–FR
GA15-BH110	42.8	45.4	4.3	4.30E-07	4.50E-07	SW–FR
GA15-BH110	45.4	48.0	1.4	1.40E-07	1.50E-07	SW–FR
GA15-BH111	13.0	16.3	0.6	6.00E-08	6.51E-08	MW
GA15-BH111	16.3	19.6	0.8	8.00E-08	9.13E-08	MW-SW
GA15-BH111	19.6	22.6	0.7	7.00E-08	8.03E-08	MW-SW + SW
GA15-BH111	22.6	26.2	0.5	5.00E-08	5.52E-08	MW-SW
GA15-BH111	26.2	29.5	6.6	6.60E-07	7.20E-07	MW + MW-SW
GA15-BH111	29.5	32.8	6.5	6.50E-07	7.19E-07	MW-SW + HW-MW + SW
GA15-BH111	32.8	36.1	0.2	2.00E-08	2.18E-08	SW
GA15-BH111	36.1	39.4	1.5	1.50E-07	1.66E-07	SW
GA15-BH111	39.4	42.7	4.8	4.80E-07	5.28E-07	SW
GA15-BH111	42.7	46.0	0.1	1.00E-08	1.16E-08	SW
GA15-BH112	16.3	19.6	0.4	4.00E-08	4.72E-08	SW
GA15-BH112[6]	19.6	22.6	<0.2	<2.00E-08	<1.80E-08	MW-SW + SW
GA15-BH112	22.6	26.2	0.1	1.00E-08	1.24E-08	MW-SW + SW
GA15-BH112	26.2	29.5	0.1	1.00E-08	1.11E-08	MW-SW + SW
GA15-BH112	29.5	32.8	4.9	4.90E-07	5.39E-07	MW-SW
GA15-BH112	32.8	36.1	0.9	9.00E-08	1.05E-07	SW
GA15-BH112	36.1	39.4	7.5	7.50E-07	8.21E-07	SW
GA15-BH112	39.4	42.7	2.0	2.00E-07	2.25E-07	SW

Well ID	Packer Test Interval (mbgl)		Lugeon Value (uL)	Hydraulic Conductivity (m/s)		Rock Weathering[7]
	Top of Interval	Bottom of Interval		Based on Lugeon[1] Value	Based on Method 1[2]	
GA15-BH112	42.7	46.0	2.0	1.98E-07	2.14E-07	SW
MM1BH004	17.6	20.5	0	0.00E+00	N/A	MW-SW
MM1BH004	21.7	24.6	0	0.00E+00	N/A	SW-FR
MM1BH006	22.7	25.7	0	0.00E+00	N/A	HW
MM1BH006	25.7	28.7	0	0.00E+00	N/A	MW-SW
MM1BH006	28.7	31.6	0	0.00E+00	N/A	SW-FR
MM1BH006	36.0	39.0	0	0.00E+00	N/A	FR
MM1BH006	46.4	49.3	0	0.00E+00	N/A	FR
MM1BH007	21.7	24.0	0	0.00E+00	N/A	MW-SW
MM1BH007	24.0	26.9	0	0.00E+00	N/A	SW-FR
MM1BH007	26.4	29.9	18	1.80E-06	N/A	FR
MM1BH007	36.4	39.4	21	2.10E-06	N/A	FR
MM1BH008	11.0	14.8	0	0.00E+00	N/A	HW
MM1BH008	20.1	22.9	0	0.00E+00	N/A	HW
MM1BH008	23.9	27.5	1	1.00E-07	N/A	HW
MM1BH008	28.1	31.9	0	0.00E+00	N/A	HW + MW-SW
MM1BH008	33.4	36.3	0	0.00E+00	N/A	SW
MM1BH009	12.8	17.0	22	2.20E-06	N/A	MW
MM1BH009	21.0	26.0	17	1.70E-06	N/A	MW
MM1BH009	29.5	33.4	8	8.00E-07	N/A	MW
MM1BH009	42.2	44.2	>44	>4.40E-06	N/A	FR
MM1BH009	52.3	55.5	7	7.00E-07	N/A	FR
MM1BH010	25.5	28.5	0	0.00E+00	N/A	SW
MM1BH010	28.5	31.4	0	0.00E+00	N/A	SW
MM1BH010	31.4	34.4	27	2.70E-06	N/A	SW
MM1BH010	34.4	37.3	0	0.00E+00	N/A	FR
MM1BH010	61.1	64.0	8	8.00E-07	N/A	FR
MM1BH011	34.9	37.9	4	4.00E-07	N/A	MW + SW
MM1BH011	41.4	44.4	29	2.90E-06	N/A	SW
MM1BH011	50.3	53.1	0	0.00E+00	N/A	FR
MM1BH011	54.7	57.9	12	1.20E-06	N/A	FR
MM1BH012	30.7	33.9	0	0.00E+00	N/A	MW + SW
MM1BH012	33.5	36.8	2	2.00E-07	N/A	SW + HW

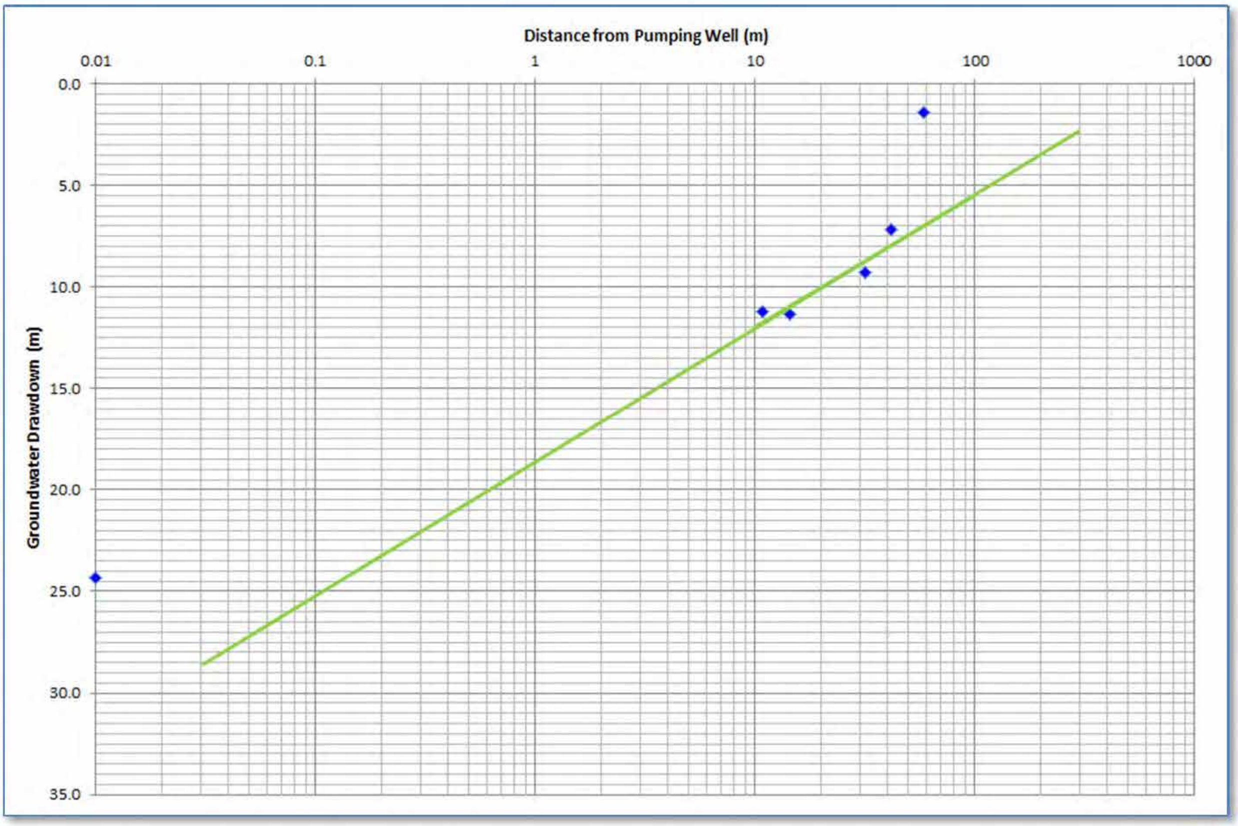
Well ID	Packer Test Interval (mbgl)		Lugeon Value (uL)	Hydraulic Conductivity (m/s)		Rock Weathering[7]
	Top of Interval	Bottom of Interval		Based on Lugeon[1] Value	Based on Method 1[2]	
MM1BH012	36.2	39.2	4	4.00E-07	N/A	SW
MM1BH012	49.9	53.6	16	1.60E-06	N/A	FR
MM1BH013	8.6	11.6	1	1.00E-07	N/A	MW + HW
MM1BH013	19.4	22.2	11	1.10E-06	N/A	MW
MM1BH013	24.3	27.2	24	2.40E-06	N/A	MW
MM1BH013	26.5	29.7	24	2.40E-06	N/A	MW
MM1BH013	41.3	43.8	11	1.10E-06	N/A	FR
MM1BH015	42.0	45.0	0	0.00E+00	N/A	FR
MM1BH015	60.1	63.1	0	0.00E+00	N/A	FR
MM1BH016	40.8	43.8	2	2.00E-07	N/A	SW
MM1BH016	55.6	58.5	<1	<1.00E-07	N/A	FR
MM1BH018	24.1	27.1	0	0.00E+00	N/A	MW
MM1BH018	27.1	30.0	0	0.00E+00	N/A	MW
MM1BH018	30.0	33.0	0	0.00E+00	N/A	MW
MM1BH018	33.0	35.9	0	0.00E+00	N/A	MW + SW
MM1BH018	56.2	59.1	0.2	2.00E-08	N/A	FR
MM1BH019	15.5	18.4	0	0.00E+00	N/A	HW
MM1BH019	21.4	24.3	0	0.00E+00	N/A	HW
MM1BH019	24.3	27.3	55	5.50E-06	N/A	EW + HW
MM1BH019	28.8	31.7	0	0.00E+00	N/A	EW + HW + HW-MW

Notes:
[1] – Calculated based on Lugeon value K = uL x 1.0E-07.
[2] – Analytical Method 1 (ref = Golder geotechnical field notes draft 1997): K = Q/H x 6.10889 x 10-6 x ((log(2L/D))/L).
[3] – No flow into formation could be achieved, i.e., low permeability.
[4] – Test abandoned due to observed bypass.
[5] – Test abandoned due to equipment failure.
[6] – Inferred low permeability or error at some test stages. Lugeon value and hydraulic conductivity expected to be less than the calculated value.
[7] – All tests were conducted within the Melbourne Formation; EW – extremely weathered, HW – highly weathered, MW – moderately weathered, SW – slightly weathered, FR – fresh. Test sections where rock weathering classification varies is represented in the above table as '+'.
[8] – All 'MM' series bore depths have been adjusted for bore angle.

TABLE C2 – RESULTS OF SLUG TESTING

Well ID	Top of Well Screen (mbgl)	Base of Well Screen (mbgl)	Hydraulic Conductivity (m/s)
GA15-BH001	20.0	23.0	8.7E-07
GA15-BH002	26.0	28.0	8.7E-06
GA15-BH003	13.5	16.5	5.3E-05
GA15-BH005	13.2	15.2	6.6E-05
GA15-BH007	14.0	17.0	2.8E-06
GA15-BH008	16.0	19.0	4.0E-08
GA15-BH009	17.2	20.2	6.1E-08
GA15-BH010	14.0	17.0	3.3E-08
GA15-BH012	23.0	26.0	2.1E-07
GA15-BH018	21.0	24.0	2.3E-07
GA15-BH019	24.0	27.0	2.0E-08
GA15-BH021	20.0	23.0	6.4E-08
GA15-BH027	26.0	29.0	4.3E-08
GA15-BH028	26.0	29.0	1.0E-09
GA15-BH112	31.0	43.0	1.1E-06
GA15-BH122	28.0	31.0	1.7E-10
GA15-BH123	28.0	31.0	4.7E-08
GA11-BH002	11.0	13.5	3.00E-06
GA11-BH003	15.0	17.5	1.50E-06
GA11-BH005	18.5	21.5	6.00E-07
GA11-BH007	22.5	25.5	2.00E-04
GA11-BH008	17.5	19.5	8.50E-05
GA11-BH009	21.6	23.6	1.30E-05
GA11-BH013	29.5	32.7	3.50E-06
GA11-BH018	27.3	29.2	2.00E-06
GA11-BH019	16.0	19.0	6.50E-05
GA11-BH019	16.0	19.0	4.00E-08
GA11-BH023	27.0	30.0	2.20E-05
GA11-BH024	18.0	21.0	4.80E-08
GA11-BH026	6.5	9.0	N/A
GA11-BH027	12.0	15.0	3.50E-08
GA11-BH041	26.05	29.05	2.70E-04
MM1BH001	13.9	16.9	5.9E-05
MM1BH002	13.9	16.9	2.5E-07
MM1BH003	10.9	13.9	3.5E-05
MM1BH004	11.2	14.1	7.0E-05
MM1BH006	26.6	29.5	2.9E-07
MM1BH007	16.8	19.8	7.9E-07

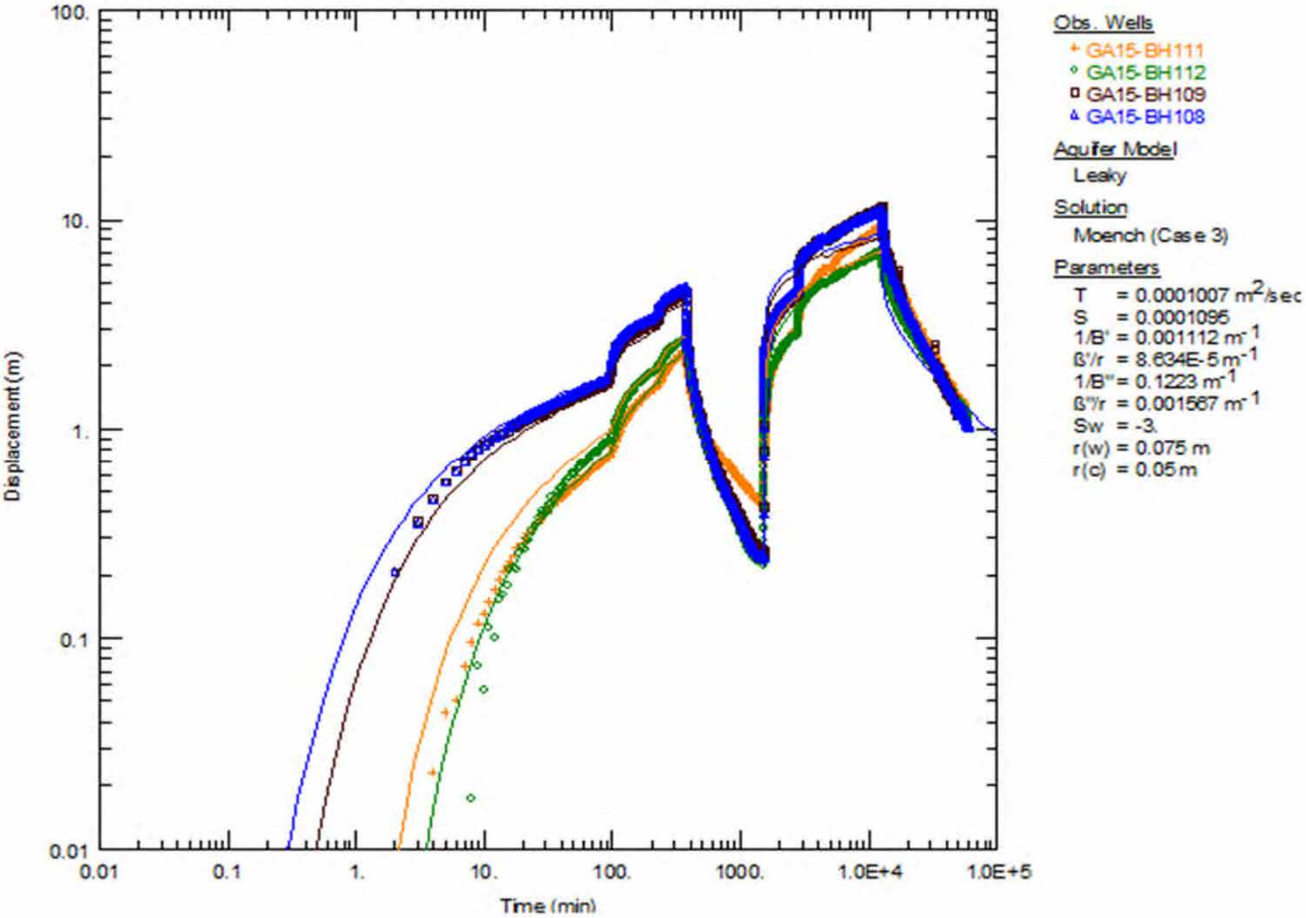
Well ID	Top of Well Screen (mbgl)	Base of Well Screen (mbgl)	Hydraulic Conductivity (m/s)
MM1BH009	27.6	30.5	6.2E-07
MM1BH010	32.9	35.8	4.0E-07
MM1BH012	27.8	30.7	2.0E-06
MM1BH013	22.7	25.5	8.6E-07
MM1BH015	23.5	25.5	2.0E-05
MM1BH017	16.1	19.1	9.7E-06
MM1BH018	12.0	14.9	N/A
MM1BH020	11.2	14.1	N/A



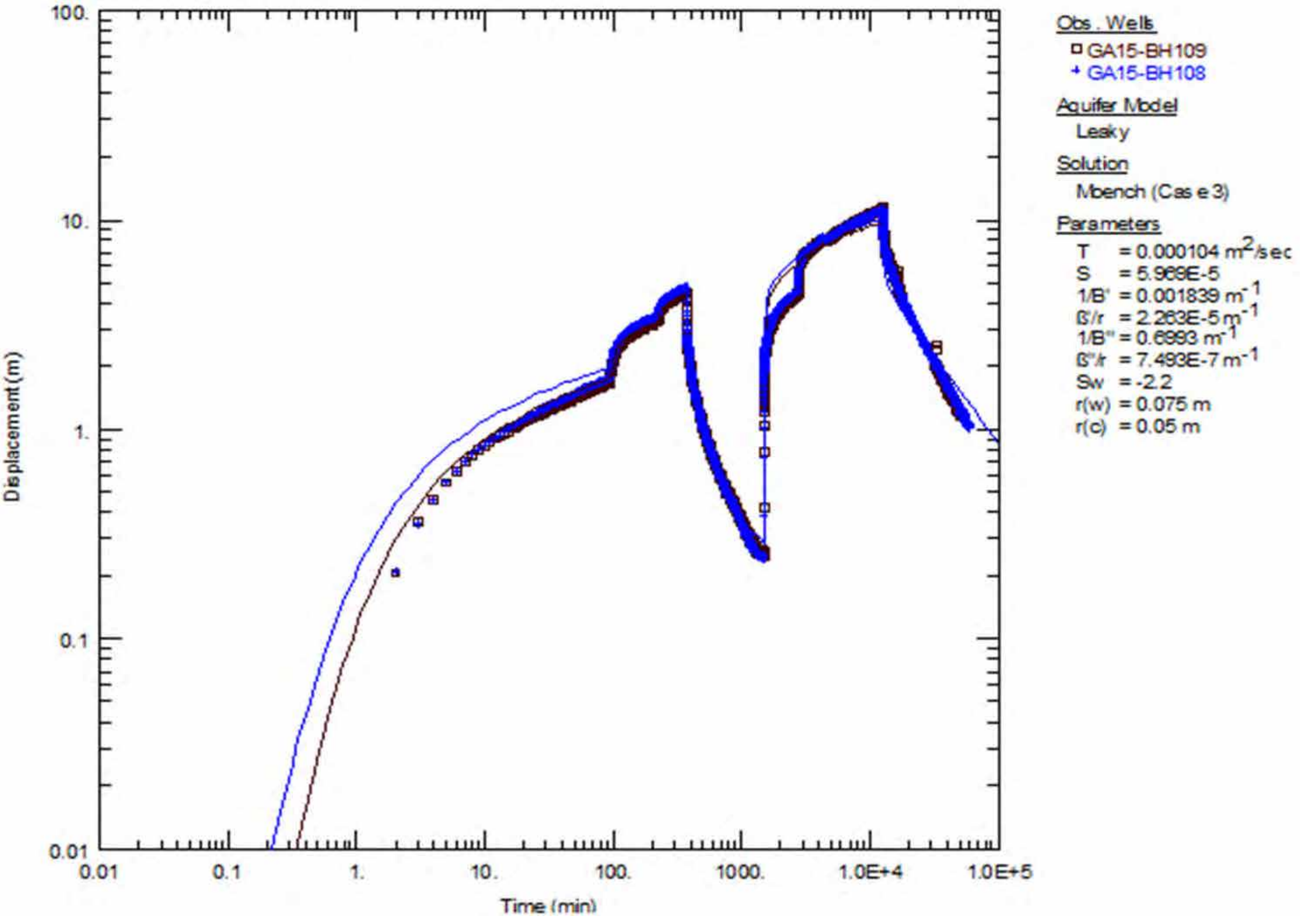
Well ID	Distance (m)	Drawdown (m)
GA15-BH110	0.01	24.34
GA15-BH109	10.80	11.56
GA15-BH108	14.30	11.48
GA15-BH111	31.90	9.32
GA15-BH112	41.70	7.22
GA15-BH021	58.70	1.42

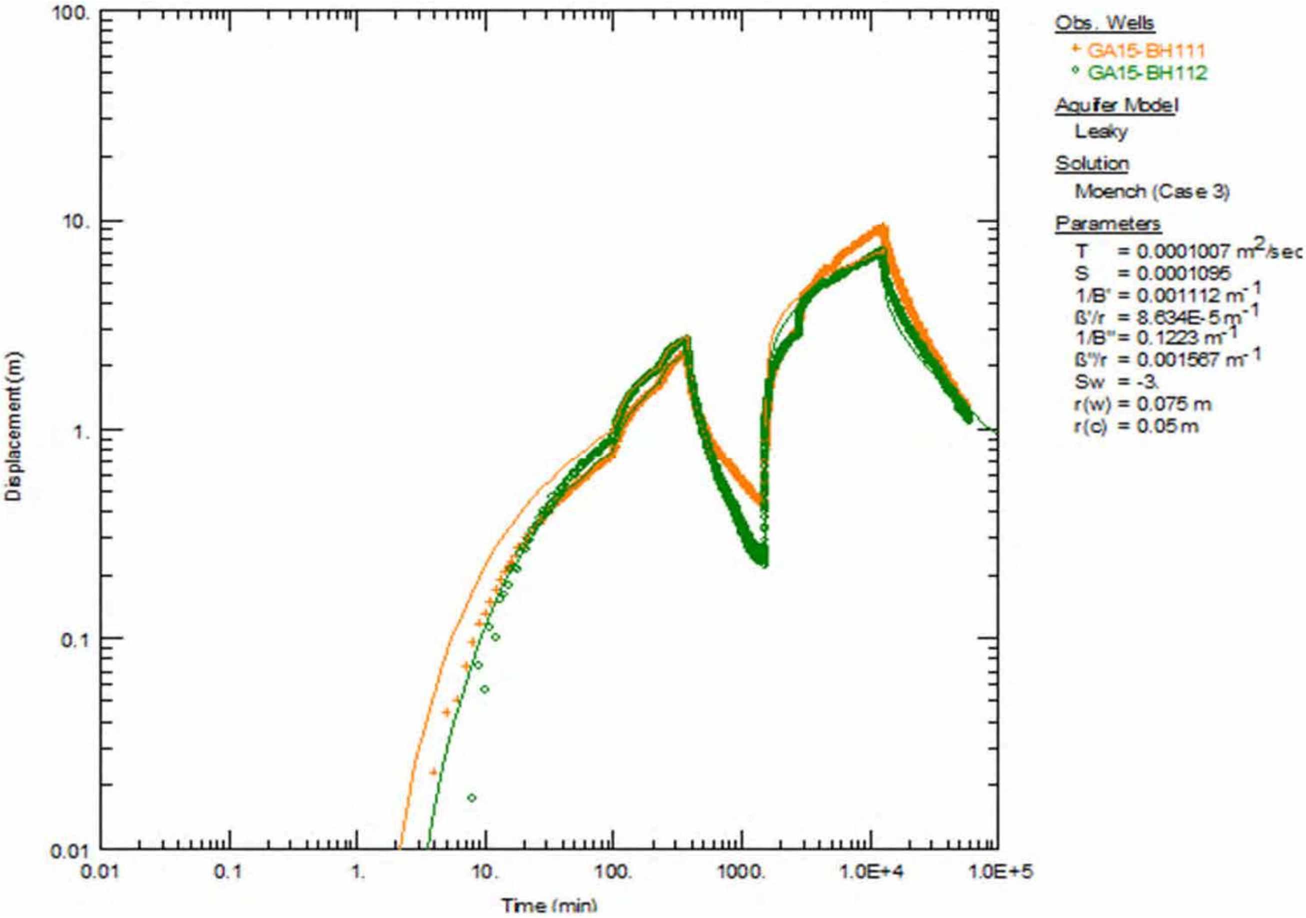
Average pumping rate (L/s)	0.97
Average pumping rate (m3/s)	9.7E-04
Aquifer thickness (m)	23
Drawdown over a log cycle (m)	6.5
T (m2/s)	**5.5E-05**
K (m/s)	**2.4E-06**
K (m/day)	**0.21**
Ss calculated based on aquifer and water compressibility , and aquifer porosity (m-1)	**2.4E-06**

Golder Associates	Drawn: IKH	Date: 12/11/2015		AJM Joint Venture, Melbourne Metro Rail Project	
	Checked: FC	Date:		**Final (End of Test) Drawdowns vs Distance from Pumping Well**	
	Revision:	Date:			
	Scale:		**A4**	Project No: 1525532	**FIGURE C1**

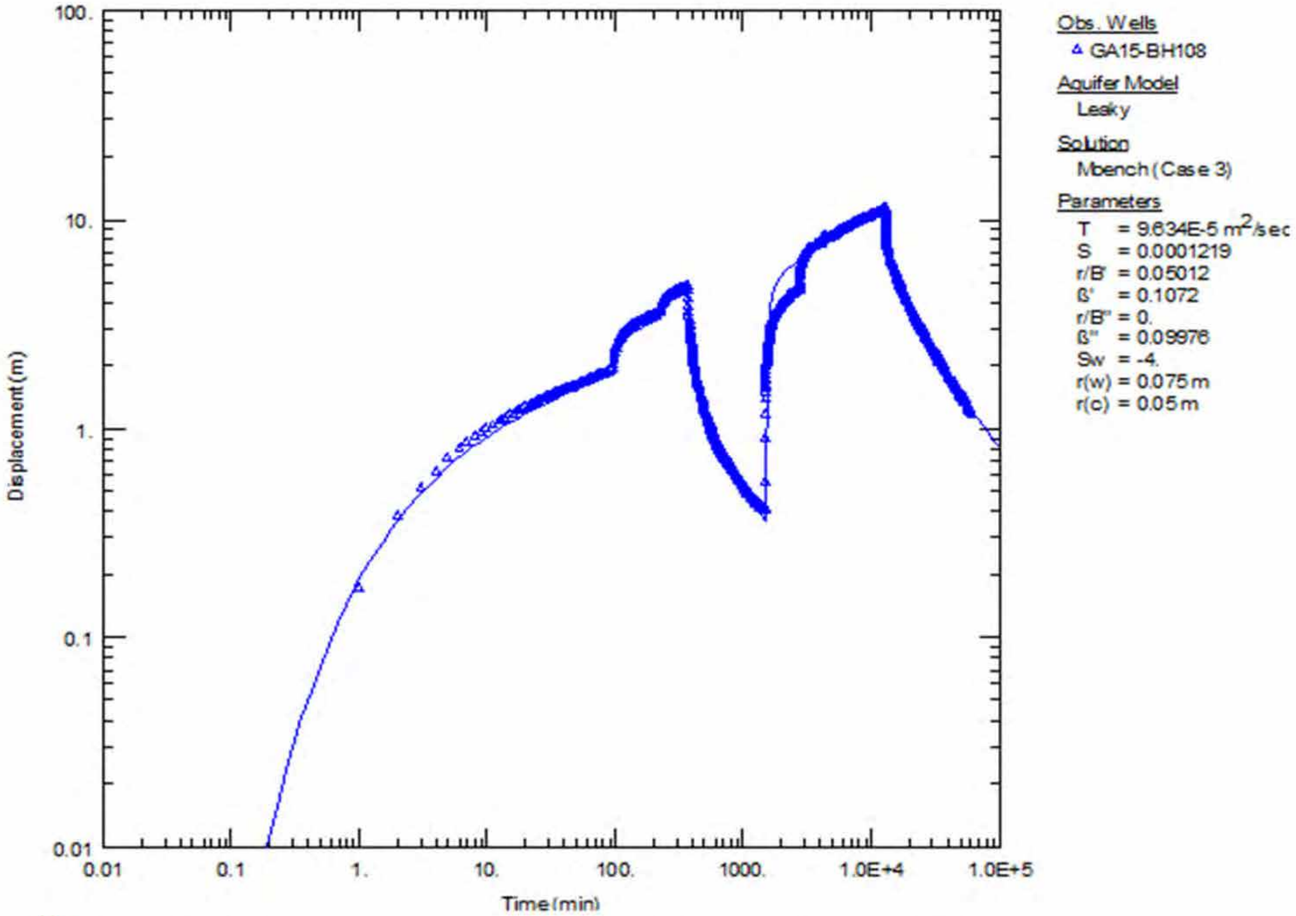


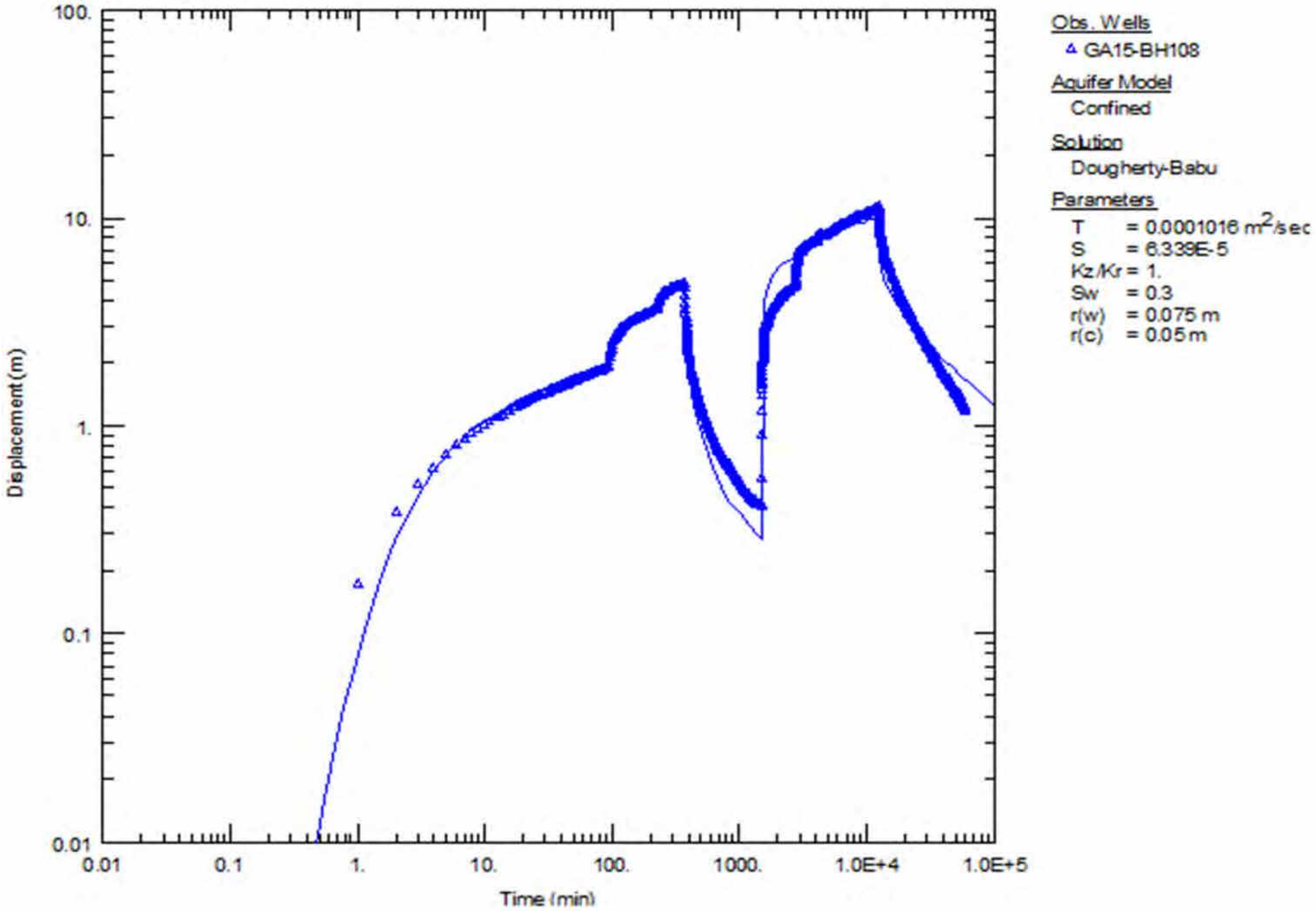
Golder Associates	Drawn: IKH	Date: 12/11/2015	AJM Joint Venture, Melbourne Metro Rail Project
	Checked: FC	Date:	**Pumping Test Results, All Monitoring Wells Combined**
	Revision:	Date:	
	Scale:	A4	Project No: 1525532 — **FIGURE C2**



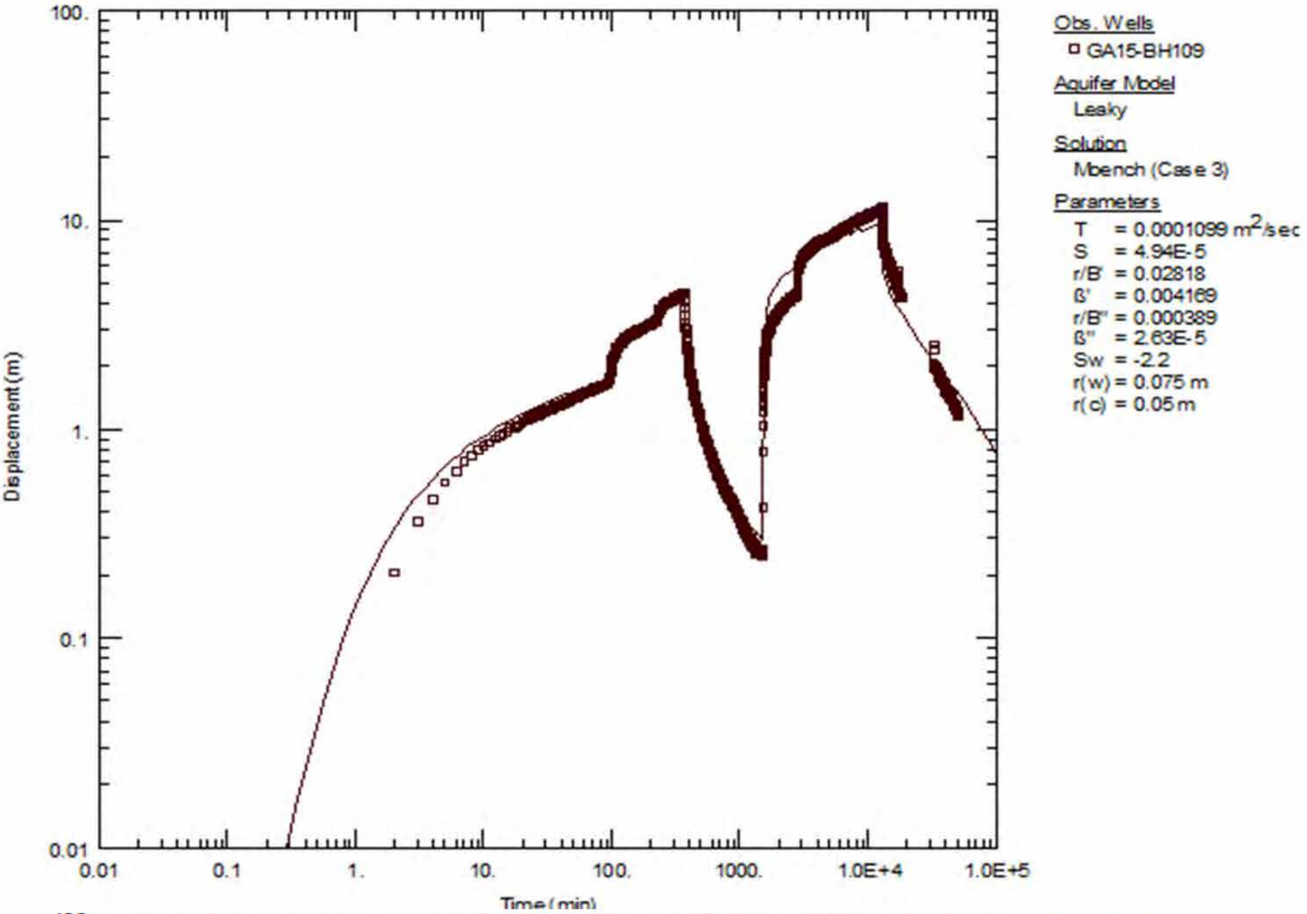


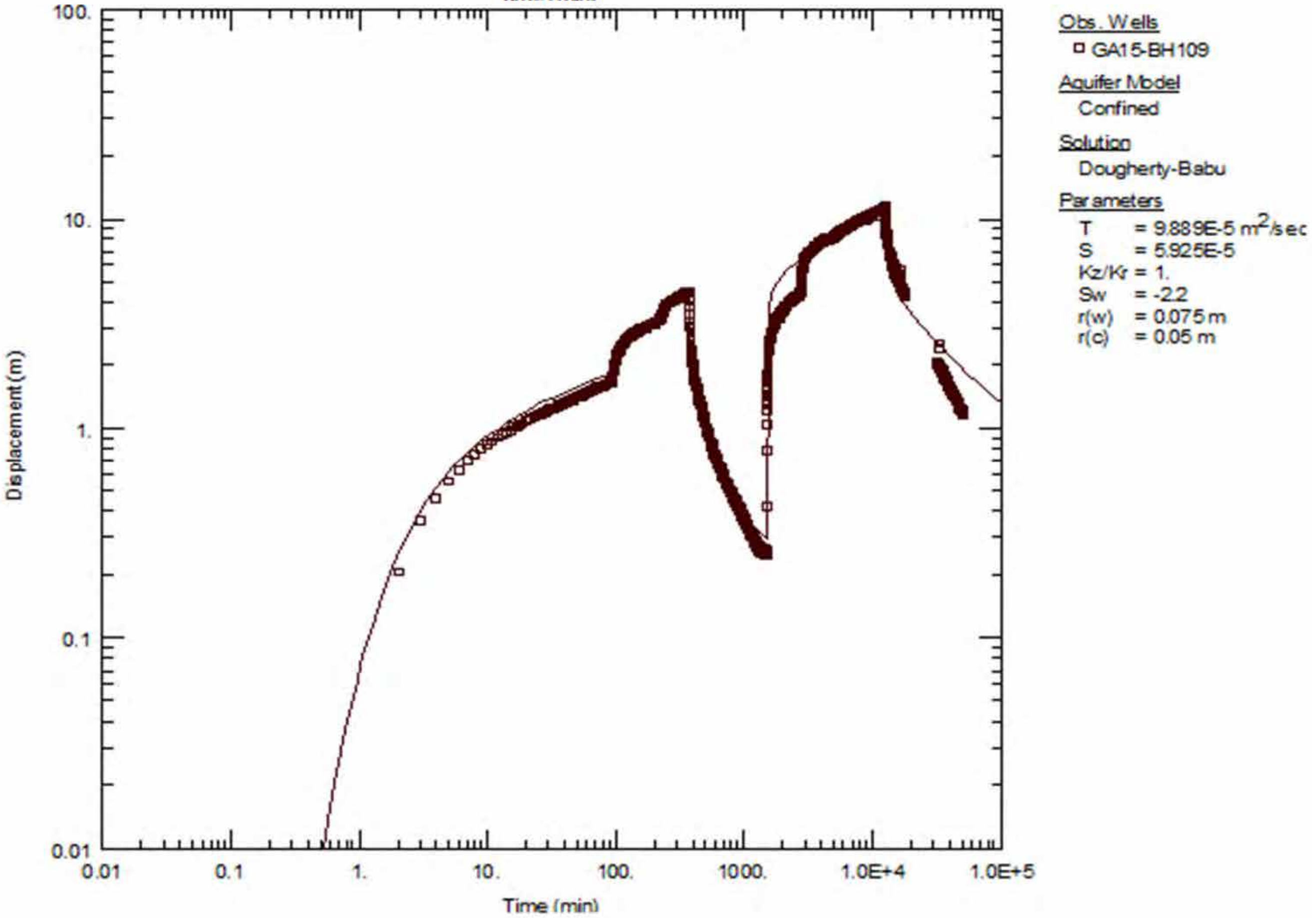
Golder Associates	Drawn: IKH	Date: 12/11/2015	AJM Joint Venture, Melbourne Metro Rail Project
	Checked: FC	Date:	**Pumping Test Results, Monitoring Wells Combined**
	Revision:	Date:	
	Scale:	**A4**	Project No: 1525532 — **FIGURE C3**



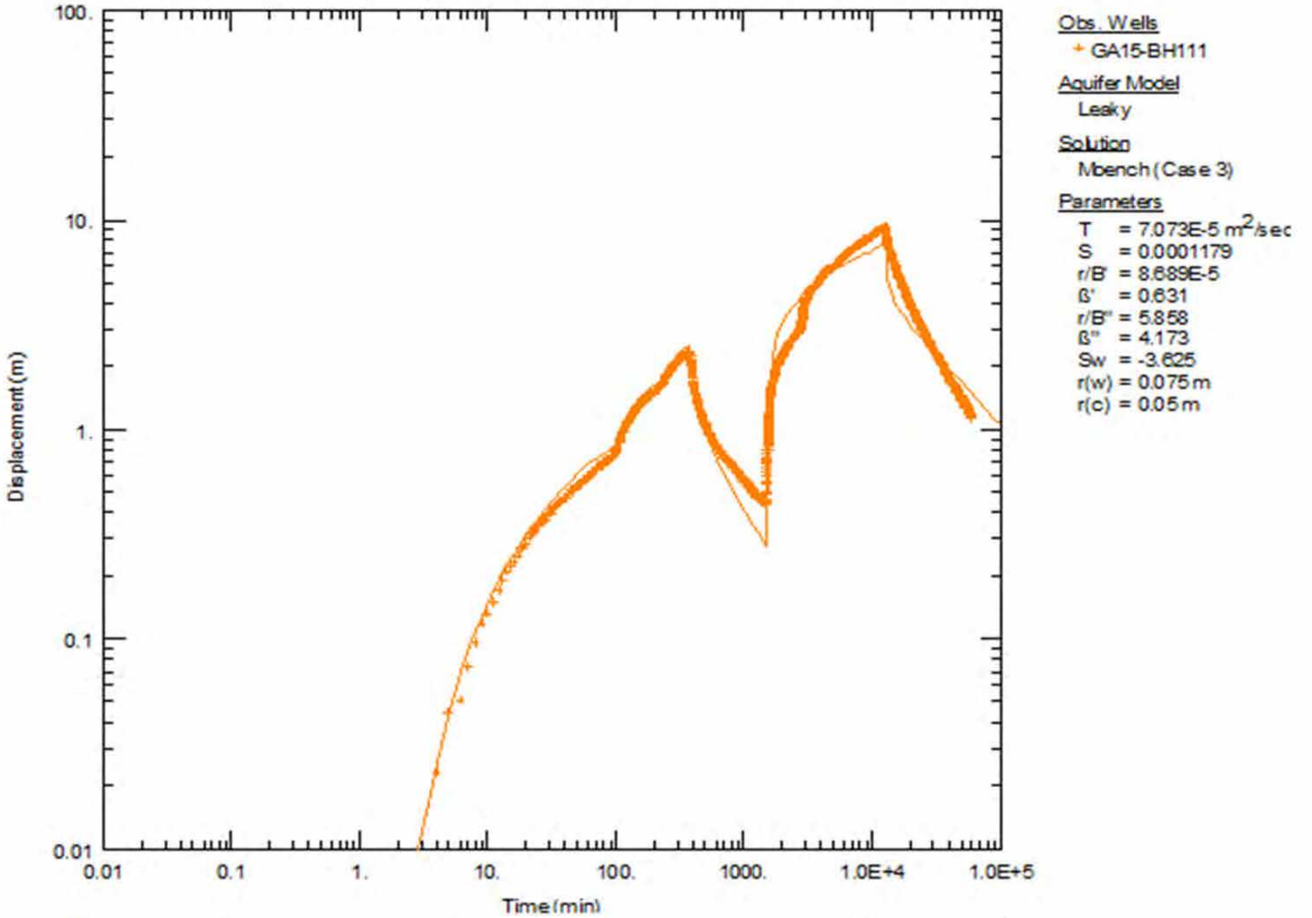


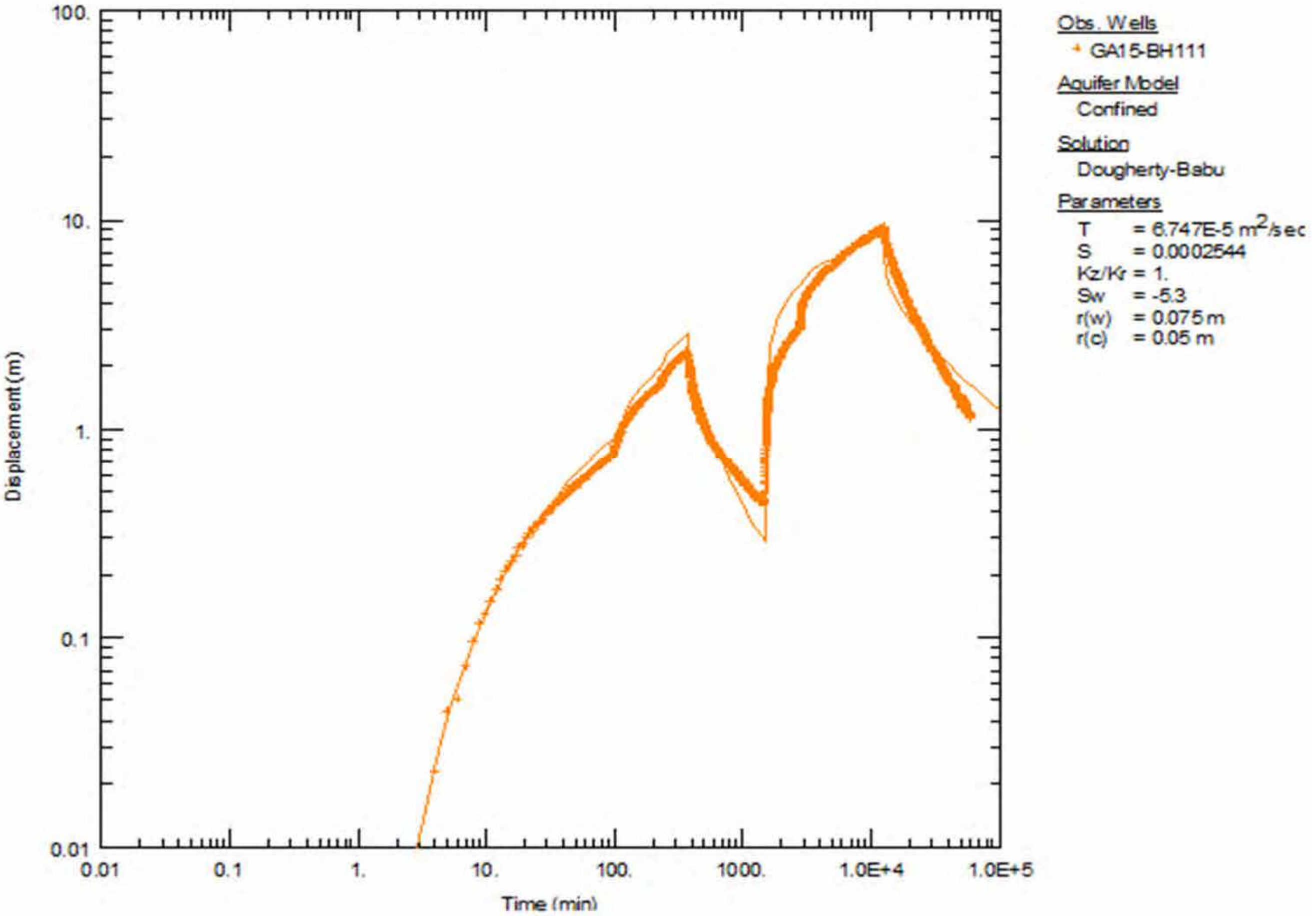
Golder Associates	Drawn: IKH	Date: 12/11/2015		AJM Joint Venture, Melbourne Metro Rail Project	
	Checked: FC	Date:		**Pumping Test Results, GA15-BH108**	
	Revision:	Date:			
	Scale:		**A4**	Project No: 1525532	**FIGURE C4**



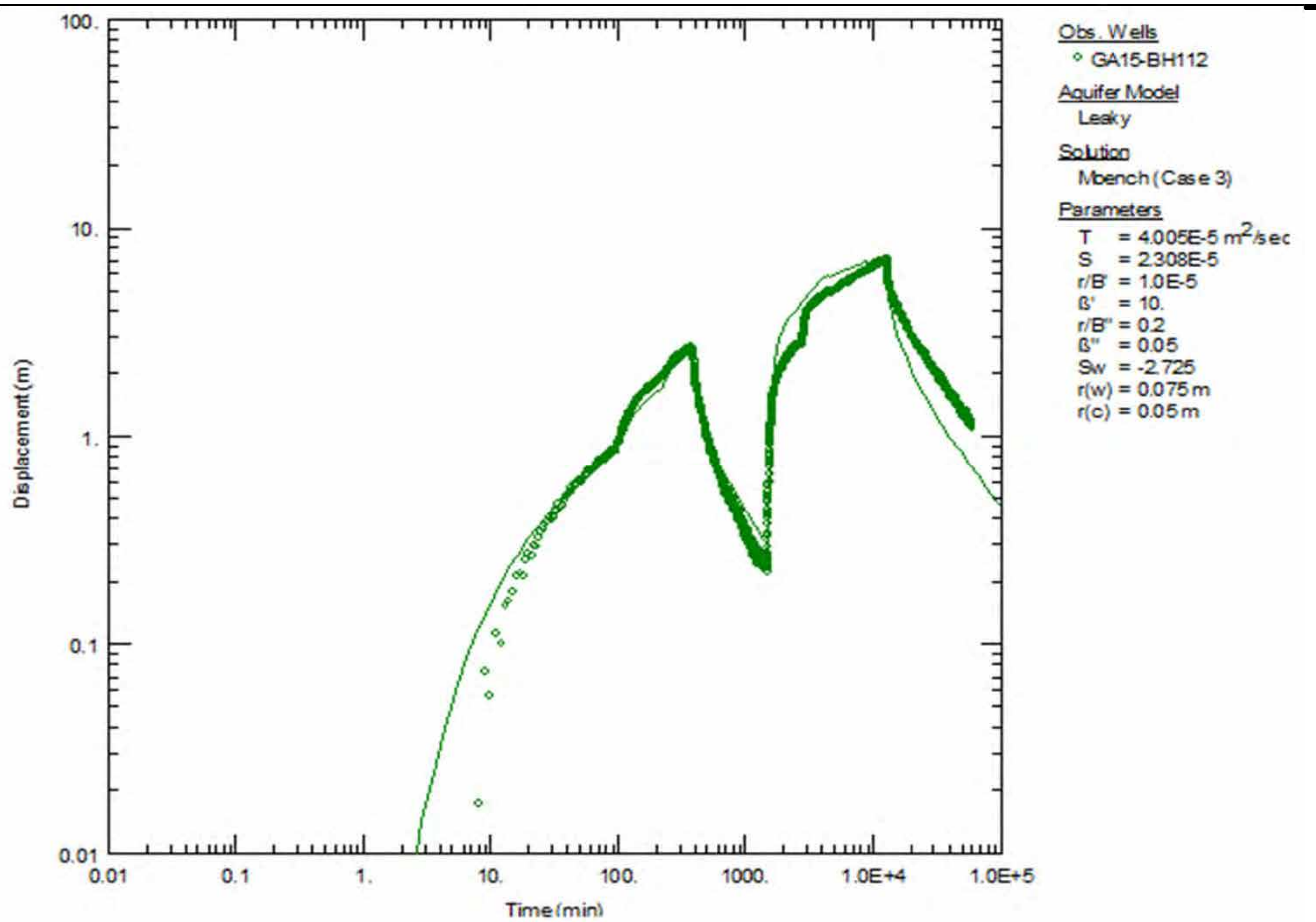


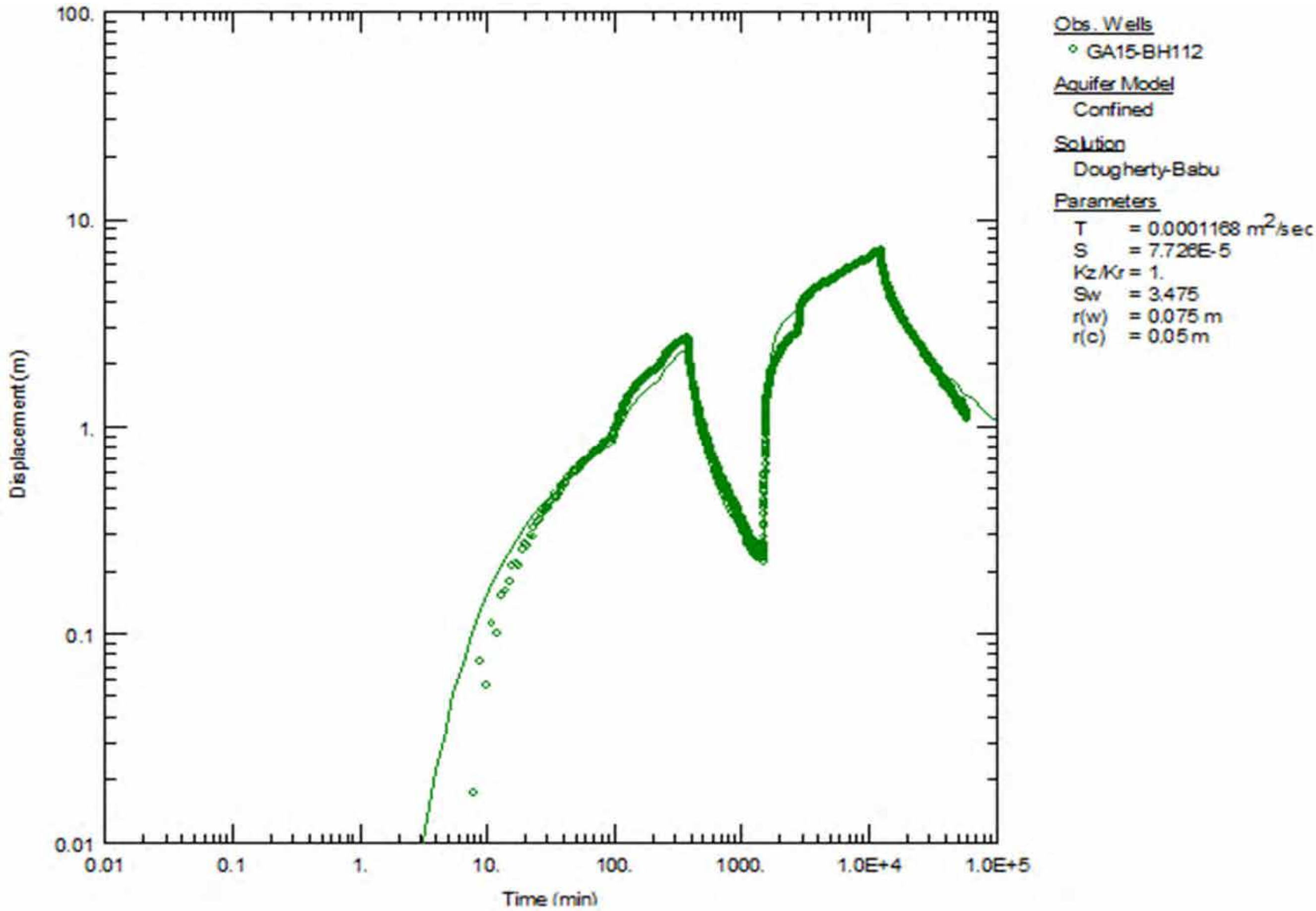
Drawn: IKH	Date: 12/11/2015	AJM Joint Venture, Melbourne Metro Rail Project
Checked: FC	Date:	**Pumping Test Results, GA15-BH109**
Revision:	Date:	
Scale: A4	Project No: 1525532	**FIGURE C5**





Golder Associates	Drawn: IKH	Date: 12/11/2015	AJM Joint Venture, Melbourne Metro Rail Project
	Checked: FC	Date:	**Pumping Test Results, GA15-BH111**
	Revision:	Date:	
	Scale:	A4	Project No: 1525532 — **FIGURE C6**





Golder Associates	Drawn: IKH	Date: 12/11/2015	AJM Joint Venture, Melbourne Metro Rail Project
	Checked: FC	Date:	**Pumping Test Results, GA15-BH112**
	Revision:	Date:	
	Scale:	**A4**	Project No: 1525532 / **FIGURE C7**

APPENDIX D

Analytical Schedules

FULL SUITE

- pH
- Electrical Conductivity
- Total Dissolved Solids
- Carbon Dioxide (Free)
- Bromine
- Major Cations including Hardness (Ca, Mg, Na, K)
- Major Anions (Cl, SO_4, Alkalinity)
- Nutrients (Total N and P (incl. Nox & Total Kjeldhal N), NO_2, NO_3, Ammonia as N)
- Heavy Metals (As, B, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Se, V, Zn)
- Additional Metals (Fe)
- Total Organic Carbon (TOC)
- Sulphate Reducing Bacteria
- Total Cyanide
- Additional Metals
  (Ag, Fe, Hg, Mo, Sn)
- TRH (C_6-C_{36} or $_{40}$)
- BTEXN
- PAH
- Phenols
- Organochlorine Pesticides
- Solvents
- PCB
- Volatile Organics Compounds (VOCs)

BASE SUITE

- pH
- Electrical Conductivity
- Total Dissolved Solids
- Carbon Dioxide (Free)
- Bromine
- Major Cations including Hardness (Ca, Mg, Na, K)
- Major Anions (Cl, SO_4, Alkalinity)
- Nutrients (Total N and P (incl. Nox & Total Kjeldhal N), NO_2, NO_3, Ammonia as N)
- Heavy Metals (As, B, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Se, V, Zn)
- Additional Metals (Fe)
- Total Organic Carbon (TOC)
- Sulphate Reducing Bacteria

EXTRA FULL SUITE

- pH
- Electrical Conductivity
- Total Dissolved Solids
- Carbon Dioxide (Free)
- Bromine
- Major Cations including Hardness (Ca, Mg, Na, K)
- Major Anions (Cl, $SO_{4,}$ Alkalinity)
- Nutrients (Total N and P (incl. Nox & Total Kjeldhal N), NO_2, NO_3, Ammonia as N)
- Heavy Metals (As, B, Ba, Be, Cd, Co, Cr, Cu, Mn, Ni, Pb, Se, V, Zn)
- Additional Metals (Fe)
- Total Organic Carbon (TOC)
- Sulphate Reducing Bacteria
- Total Cyanide
- Additional Metals
(Ag, Fe, Hg, Mo, Sn)
- TRH (C_6-C_{36} or $_{40}$)
- BTEXN
- PAH
- Phenols
- Organochlorine Pesticides
- Solvents
- PCB
- Volatile Organics Compounds (VOCs)
- Biological oxygen demand
- Thallium
- Chlorine and iodine
- Phenoxyacetic acids and derivatives
- Acetone, acrolein, formaldehyde and acrylonitrile
- Cumene, nitrotoluene, 2,4-dinitrotoluene and 2,6-dinitrotoluene

- Hexachloroethane, chlorodibromomethane, 1,1-dichloropropane, 1,2-dichloropropane
- Ethyl acrylate and methyl methacrylate
- Glyphosate, trifuralin and epichlorohydrin
- Polybrominated biphenyls, chlorodibenzo-p-dioxins and chloro-dibenzo-furans.

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APPENDIX E

Groundwater Quality Data Screened Against Drinking Water Criteria

Golder Associates

								Field Parameters					Lab pH and Salinity			Major Ions, Sulphur Species, Alkalinity and Hardness															
								Dissolved Oxygen (Field)	Electrolytic Conductivity (Field)	pH (Field)	Redox Potential (Field)	Temp (Field)	Electrical Conductivity @ 25°C	pH (Lab)	Total Dissolved Solids @180°C	Water Type	Ion Balance Error (Calculated)	Sodium (Filtered)	Potassium (Filtered)	Calcium (Filtered)	Magnesium (Filtered)	Chloride	Sulphate (as SO4) (Filtered)	Sulphide	Sulphur (Total Oxidised as SO4)	Bicarbonate Alkalinity (as CaCO3)	Carbonate Alkalinity (as CaCO3)	Hydroxide Alkalinity (as CaCO3)	Total Alkalinity (as CaCO3)	Hardness (as CaCO3) (Filtered)	Ammonia (as N)
								mg/L	uS/cm	pH_Units	mV	oC	uS/cm	pH_Units	mg/L			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL													1	0.01	5			1	1	1	1	1	1	0.1	1	1	1	1	1	1	0.01
ADWG 2011 Health																							5000								
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																															
Well ID	**Segment**	**Screening aquifer intersects tunnel**	**Area**	**Date**	**Aquifer Unit**	**Screen Interval (m bgl)**	**Screen Interval (m AHD)**																								
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	0.98	34364	8.44	-108.2	17.4	39,800	6.93	29,800	Na/Cl	-1	7140	160	416	967	13,500	1630	-	-	457	<1	<1	457	5020	23.7
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	1.03	10485	7.04	-121.5	16.6	12,600	7.29	7630	Na/ClSO_4	-5.16	2540	79	67	144	2650	2150	-	-	1100	<1	<1	1100	760	0.06
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	0.82	7040	7.48	-52	16.9	8370	7.64	5000	Na/SO_4ClHCO_3	-6.76	1640	70	42	82	835	2320	-	-	1100	<1	<1	1100	442	0.75
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	0.2	3590	7.81	-175.7	17.1	4060	7.94	2160	Na/ClHCO_3SO_4	-3.45	870	22	6	12	590	517	-	-	757	<1	<1	757	64	0.29
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	0.98	11,550	7.36	131	18	13,200	7.59	7920	Na/Cl	-5.11	2390	33	146	282	4310	897	-	-	445	<1	<1	445	1520	0.06
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	0.96	43,940	6.78	-93.2	17.6	48,900	6.93	37,200	NaMg/Cl	-3	8760	209	698	1490	18,000	2340	-	-	754	<1	<1	754	7880	6.3
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	1.96	44,490	6.09	11	17.9	55,600	6.51	44,200	NaMg/Cl	1	10,700	217	693	1720	19,900	2720	-	-	763	<1	<1	763	8810	11.5
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	2.17	28,781	5.31	-5	18.5	37,600	5.68	25,300	NaMg/Cl	1	6290	127	622	1130	12,600	1490	-	-	226	<1	<1	226	6210	1.13
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	1.89	37,473	6.21	-98.2	17.7	46,800	6.6	31,500	NaMg/Cl	-2	7750	137	583	1420	16,400	1070	-	-	899	<1	<1	899	7300	21
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	0.57	44,240	7.16	-124.5	17.7	51,300	7.07	38,000	NaMg/Cl	-4	8440	185	510	1360	18,400	698	-	-	1100	<1	<1	1100	6870	49.4
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	0.25	31,240	6.58	25.4	17.5	38,200	6.83	22,600	NaMg/Cl	-3	6070	128	530	1210	13,200	1390	-	-	710	<1	<1	710	6310	15.4
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	0.33	31,753	6.57	75.2	18.7	38,900	7.43	24,900	NaMg/Cl	-5	5830	130	498	938	11,900	2420	-	-	668	<1	<1	668	5110	7.06
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	0.36	7,898	7.72	199.4	18.6	9500	7.7	5740	Na(Mg)/Cl	1.67	1750	23	98	234	2600	600	-	-	506	<1	<1	506	1210	0.03
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	0.41	6,000	7.66	159.3	18.3	7190	7.49	4400	Na/Cl	4.43	1460	13	40	108	1820	383	-	-	422	<1	<1	422	545	0.36
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	0.27	5955	7.51	139.4	18.8	6890	7.31	4270	Na/Cl	-0.23	1320	27	20	64	1540	335	-	-	618	<1	<1	618	313	0.05
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	0.78	2942	6.76	96.2	18.2	3750	6.79	2280	Na/ClHCO_3	-5.69	715	14	31	4	759	222	-	-	565	<1	<1	565	94	0.06
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	3	7131	7.08	23.1	16.7	6850	7.93	4710	Na/Cl	-1.98	1700	19	34	83	2130	450	-	-	829	<1	<1	829	427	0.05
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	3.31	6671	6.8	101.3	18.4	8050	7.01	4400	Na/ClHCO_3	-5.43	1420	19	21	68	1880	353	-	-	769	<1	<1	769	332	0.14
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	3.87	4987	5.93	188.2	17.2	6710	6.32	3620	Na/ClHCO_3	-5.28	1190	11	12	37	1370	411	-	-	708	<1	<1	708	182	0.12
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	0.6	10,684	5.86	158.4	19.5	13,100	6.13	6960	Na/ClHCO_3	-7.96	2560	36	45	162	3790	413	-	-	2100	<1	<1	2100	779	0.08
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	5.75	1906	7.74	11.6	17.1	2380	7.73	1410	Na/HCO_3Cl	-5.3	483	7	2	6	363	121	-	-	569	<1	<1	569	30	0.04
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	1.11	2625	7.01	180	15.4	3500	7.17	2030	Na/ClHCO_3	-9.12	646	11	9	12	710	185	-	-	574	<1	<1	574	72	0.11
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	3.37	3760	5.93	435.5	16.5	4960	5.91	2810	Na/ClHCO_3	-10.19	913	12	9	15	1070	288	-	-	735	<1	<1	735	84	0.09
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	1.15	1838	6.86	104.4	19.4	2470	6.99	1450	Na/ClHCO_3	-8.54	457	8	6	5	473	138	<0.1	139	404	<1	<1	404	36	0.34
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	0.54	4307	7.19	67.4	17.4	5430	7.3	3250	Na/ClHCO_3	-3.27	992	18	24	48	1150	304	<0.1	269	663	<1	<1	663	258	0.08
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	-	-	-	8090	7.19	4280	Na/ClHCO_3	-0.26	1610	13	10	67	1820	399	-	-	849	<1	<1	849	301	0.02
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	-	-	-	9890	7.15	5300	Na/Cl	-5.47	1820	22	28	113	2620	498	-	-	822	<1	<1	822	535	0.07
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	2.06	5935	6.34	-13.3	17.3	4350	6.72	3000	Na/ClHCO_3	-7.47	966	14	10	37	1160	305	-	-	713	<1	<1	713	177	0.04
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	1.27	38,040	6.82	75.7	19	38,800	6.77	25,000	NaMg/Cl	1	7750	171	409	1180	14,400	1430	-	-	819	<1	<1	819	5880	59
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	0.24	22,487	6.51	-112.8	16.5	26,400	6.84	17,500	Na/Cl	-5	4250	131	145	597	8750	200	-	-	1630	<1	<1	1630	2820	171
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	0.19	37,767	7.03	-47.4	17.9	45,700	6.92	27,400	NaMg/Cl	-3	7930	163	399	1180	16,000	1980	-	-	399	<1	<1	399	5860	40.7
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	3.6	2288	5.88	311.6	15.1	3130	6.09	1790	Na/HCO_3Cl	-4.12	639	20	11	12	380	241	-	-	806	<1	<1	806	77	0.17
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	2.56	1120	7	105.2	14.2	1430	7.29	8380	Na/HCO_3 *ClSO_4*	-12.41	264	4	2	1	143	185	-	-	362	<1	<1	362	<10	0.26
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	6.29	9249	6.92	146.8	16.3	9950	6.99	6650	Na/Cl	-4.52	2090	38	39	149	3300	447	-	-	680	<1	<1	680	711	0.14
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	7.44	7086	6.76	151.8	17.7	7670	6.52	4810	Na/Cl	-2.69	1620	26	38	72	2410	386	-	-	362	<1	<1	362	391	0.07
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	3.74	15,940	7.03	125.9	17.9	17,000	7.08	10,100	Na/Cl	-4	3160	46	121	328	5750	392	-	-	756	<1	<1	756	1650	0.01
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	0.7	1930	7.47	18.9	18.5	2160	7.67	1520	Na/HCO_3Cl	-1.88	460	6	7	9	273	180	-	-	507	<1	<1	507	54	0.25
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	1.18	3380	6.89	-49.8	20	3080	7.02	1660	Na/Cl	-2	493	18	40	57	860	111	-	-	159	<1	<1	159	335	0.54
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	2.56	9500	5.89	-131.9	22.3	11,200	6.41	6500	Na/Cl	-6.48	1780	34	81	224	3730	233	-	-	229	<1	<1	229	1120	0.06
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	2.27	11,397	5.77	428	17.8	14,800	6.17	7470	Na/Cl	-4.43	2240	40	136	335	4510	376	-	-	497	<1	<1	497	1720	0.07
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	5.55	8766	5.49	-78.6	17.5	11,600	5.8	6360	Na/Cl	-7.12	1810	33	82	246	3950	230	-	-	178	<1	<1	178	1220	0.11
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	1.27	9750	6.09	49.1	18.5	11,000	6.35	6220	NaMg/Cl	-3.07	1940	38	85	295	3780	402	-	-	300	<1	<1	300	1430	0.07
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	1.31	1990	6.82	45.7	18.2	2310	6.32	1380	Na/ClHCO_3	-4.22	448	13	4	17	428	141	-	-	375	<1	<1	375	80	0.1
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	0.93	10,570	6	-2.7	19.7	11,900	6.3	7000	NaMg/Cl	-3.24	1910	24	77	384	4110	443	-	-	94	<1	<1	94	1770	<0.01
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	1.05	7970	5.74	-41.4	18.7	9200	6.35	5200	Na/Cl	-4.82	1580	26	82	181	3010	356	-	-	248	<1	<1	248	-	0.44
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	3.07	8050	5.78	124.7	19.2	9270	5.56	5000	NaMg/Cl	-6.85	1390	15	43	243	3000	369	-	-	44	<1	<1	44	-	0.11
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	3.58	8700	5.12	237.2	18.7	10300	5.38	5680	NaMg/Cl	-4.56	1640	16	36	269	3430	355	-	-	33	<1	<1	33	-	0.35

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	Nutrients							TOC/BOD		Other Ions				Other				Microbial Analysis							
								Nitrate (as N)	Nitrite (as N)	Nitrogen (Total Oxidised)	Total Kjeldahl Nitrogen (as N)	Nitrogen (Total)	Total Phosphorus (as P)	Total Phosphate (as P)	Biological Oxygen Demand	Total Organic Carbon	Bromide	Fluoride	Iodine (Filtered)	Cyanide (total)	Carbon Dioxide	CO2 (Free)	Formaldehyde	Residual Chlorine	Escherichia coli (Collilert)	Sulphate Reducing Bacteria Population Estimate	Sulphate-reducing bacteria (MPN/100mL)	Sulphate-reducing bacteria (ORG/100mL)	Antimony	Arsenic (Filtered)	Barium (Filtered)	Beryllium (Filtered)
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	orgs/mL	pac/mL	MPN/100mL	ORG/100mL	mg/L	mg/L	mg/L	mg/L
EQL								0.01	0.01	0.01	0.1	0.1	0.01	0.05	2	1	0.01	0.1	0.1	0.004	1	1	0.1	0.02	0.001	1	2	300	0.0002	0.001	0.001	0.001
ADWG 2011 Health																		**15**		**0.08**			**0.5**						**0.03**	**0.1**	**20**	**0.6**
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table								**32**	**2**																							
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	0.02	<0.01	0.02	24.5	-	0.13	-	-	-	48.8	-	-	-	510	107	-	-	-	-	-	>110,000	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	<0.01	<0.01	<0.01	<0.1	-	0.34	-	-	-	12.2	-	-	-	1080	113	-	-	-	-	-	>110,000	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	<0.01	<0.01	<0.01	1.7	-	0.11	-	-	70	8.38	0.6	-	0.013	-	50	-	-	-	-	>11,000	-	-	0.004	0.083	<0.001
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	0.03	<0.01	0.03	0.5	-	0.49	-	-	27	2.23	-	-	-	-	17	-	-	-	-	>110,000	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	8.02	0.17	8.19	0.1	-	0.09	-	-	4	15.1	0.2	-	<0.004	-	23	-	-	-	-	1500	-	-	<0.001	0.088	<0.001
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	0.02	<0.01	0.02	7.5	-	0.53	-	-	13	63.9	0.2	-	<0.004	-	177	-	-	-	-	>11,000	-	-	<0.001	0.193	<0.001
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	0.01	<0.01	0.01	12.2	12.2	0.06	-	-	7	105	0.3	-	<0.004	-	472	-	-	-	27,000	-	-	-	0.002	0.278	<0.002
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	0.01	<0.01	0.01	1.3	1.3	0.09	-	-	2	-	0.3	-	-	-	944	-	-	-	>1100	-	-	-	0.012	0.047	<0.002
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	<0.01	<0.01	<0.01	20.8	20.8	0.1	-	-	5	-	0.4	-	<0.004	-	452	-	-	-	75	-	-	-	0.002	0.204	<0.002
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	<0.01	<0.01	<0.01	49.9	-	2.13	-	-	37	71.6	-	-	-	-	187	-	-	-	-	>110,000	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	0.01	<0.01	0.01	17.5	-	0.1	-	-	-	46.3	0.6	-	<0.004	835	210	-	-	-	-	-	15,000	-	<0.001	0.042	<0.001
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	0.02	<0.01	0.02	7.3	7.3	0.11	-	-	7	-	0.3	-	<0.004	-	343	-	-	-	500,000	-	-	-	0.002	0.127	<0.001
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	21	**2.29**	23.3	<0.1	-	0.27	-	-	-	8.92	1	-	<0.004	465	20	-	-	-	-	-	900	-	0.003	0.066	<0.001
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	8.62	1.68	10.3	0.4	-	0.06	-	-	-	6.12	-	-	-	399	27	-	-	-	-	-	24,000	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	26.3	0.73	27	<0.1	-	0.05	-	-	-	4.72	1.5	-	<0.004	604	60	-	-	-	-	-	110,000	-	0.001	0.085	<0.001
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	0.01	0.71	0.72	0.4	1.1	0.03	-	-	96	-	2.6	-	<0.004	-	318	-	-	-	6000	-	-	-	0.004	0.061	<0.001
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	3.63	0.06	3.69	0.1	3.8	0.03	-	-	4	-	1.1	-	<0.004	-	55	-	-	-	5,000,000	-	-	-	0.003	0.134	<0.001
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	14.5	0.7	15.2	0.2	15.4	0.04	-	-	4	-	1.3	-	<0.004	-	150	-	-	-	120,000	-	-	-	0.002	0.038	<0.001
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	7.49	0.09	7.58	0.4	8	0.03	-	-	5	-	1.7	-	-	-	1230	-	-	-	6000	-	-	-	0.001	0.106	<0.001
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	0.03	<0.01	0.03	<0.1	<0.1	0.02	-	-	6	-	0.7	-	<0.004	-	3110	-	-	-	27,000	-	-	-	0.002	0.061	<0.001
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	1.17	<0.01	1.17	0.4	1.6	0.21	-	-	4	-	5.3	-	<0.004	-	14	-	-	-	120,000	-	-	-	0.002	0.026	<0.001
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	6.23	0.41	6.64	1.1	7.7	0.08	-	-	3	-	2.8	-	-	-	78	-	-	-	120,000	-	-	-	0.002	0.009	<0.001
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	4	0.17	4.17	0.3	4.5	0.04	-	-	5	-	2.4	-	-	-	1810	-	-	-	320	-	-	-	0.002	0.194	<0.001
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	5.68	0.23	5.91	0.7	6.6	0.43	-	3	2	-	7.4	0.6	<0.004	-	83	0.2	0.06	0	120,000	-	-	-	0.003	0.235	<0.001
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	0.12	<0.01	0.12	0.3	0.4	0.08	-	3	2	-	1.8	2	<0.004	-	66	<0.1	0.06	0	120,000	-	-	-	0.002	0.048	<0.001
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	1.97	0.02	1.99	0.2	2.2	0.03	-	-	2	-	0.2	-	<0.004	-	110	-	-	-	500,000	-	-	-	0.001	0.007	<0.001
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	2.25	0.02	2.27	0.1	2.4	0.02	-	-	2	-	1.1	-	<0.004	-	116	-	-	-	500,000	-	-	-	0.001	0.006	<0.001
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	0.01	<0.01	0.01	<0.1	<0.1	0.04	-	-	3	-	2	-	<0.004	-	272	-	-	-	500,000	-	-	-	0.005	0.037	<0.001
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	0.03	<0.01	0.03	67.9	-	0.2	-	-	12	49.6	-	-	-	-	278	-	-	-	-	1500	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	<0.01	<0.01	<0.01	180	-	1.65	-	-	-	29.5	0.3	-	<0.004	1900	471	-	-	-	-	-	>110,000	-	0.015	2.57	<0.001
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	0.04	<0.01	0.04	52.3	-	0.65	-	-	-	58.1	0.4	-	<0.004	447	96	-	-	-	-	-	4300	-	0.001	0.167	<0.001
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	8.69	0.41	9.1	1	10.1	0.34	-	-	4	-	5.8	-	-	-	1310	-	-	-	9	-	-	-	0.003	0.04	<0.001
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	0.26	0.03	0.29	3	3.3	3.74	-	-	17	-	3.5	-	-	-	37	-	-	-	150	-	-	-	0.013	0.033	<0.001
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	1.7	0.05	1.75	0.4	2.2	0.08	-	-	4	-	1.8	-	-	-	139	-	-	-	27,000	-	-	-	0.001	0.29	<0.001
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	0.37	0.05	0.42	0.7	1.1	0.11	-	-	7	-	1	-	-	-	219	-	-	-	6000	-	-	-	0.001	0.551	<0.001
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	0.71	0.05	0.76	0.5	-	0.07	-	-	18	13.7	0.9	-	0.004	-	126	-	-	-	-	24,000	-	-	0.002	0.152	<0.001
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	6.91	0.22	7.13	1	-	0.18	-	-	7	1.32	1.8	-	0.004	-	22	-	-	-	-	>110,000	-	-	0.001	0.081	<0.001
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	0.14	0.1	0.24	1.1	-	0.02	-	-	4	2.58	-	-	-	-	30	-	-	-	-	46,000	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	0.02	<0.01	0.02	1.3	1.3	<0.01	-	-	8	-	0.4	-	<0.004	-	178	-	-	-	500,000	-	-	-	0.002	0.218	<0.001
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	0.38	0.08	0.46	0.1	0.6	0.04	-	-	3	-	0.3	-	<0.004	-	1140	-	-	-	<20	-	-	-	<0.001	0.105	<0.001
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	0.02	<0.01	0.02	0.1	0.1	0.05	-	-	<1	-	0.2	-	-	-	564	-	-	-	500,000	-	-	-	0.002	0.096	<0.001
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	0.1	0.02	0.12	0.2	-	<0.01	-	-	5	8.87	-	-	-	-	268	-	-	-	-	-	>110,000	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	11.2	0.42	11.6	1.3	-	<0.01	-	-	6	0.988	-	-	-	-	359	-	-	-	-	-	>110,000	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	<0.01	<0.01	<0.01	<0.1	-	0.04	-	-	5	9.5	0.6	-	<0.004	-	94	-	-	-	-	-	>110,000	-	0.008	0.171	<0.001
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	0.02	<0.01	0.02	1.1	-	0.1	-	-	8	8.1	0.5	-	<0.004	-	222	-	-	-	-	-	-	-	0.002	0.128	<0.001
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	27.5	<0.01	27.5	0.5	-	<0.01	-	-	3	8.95	0.3	-	<0.004	-	242	-	-	-	-	-	-	-	0.002	0.044	<0.001
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	0.01	0.01	0.02	0.6	-	<0.01	-	-	2	9.25	-	-	-	-	275	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	Metals																			Total Recoverable Hyd						
								Boron (Filtered)	Bromine (Filtered)	Cadmium (Filtered)	Chromium (Filtered)	Chromium (hexavalent)	Cobalt (Filtered)	Copper (Filtered)	Iron (Filtered)	Lead (Filtered)	Manganese (Filtered)	Mercury (Filtered)	Molybdenum (Filtered)	Nickel (Filtered)	Selenium (Filtered)	Silver (Filtered)	Thallium (Filtered)	Tin (Filtered)	Vanadium (Filtered)	Zinc (Filtered)	TRH C6 - C9 Fraction	TRH C10 - C14 Fraction	TRH C15 - C28 Fraction	TRH C29 - C36 Fraction	TRH+C10 - C36 (Sum of total) (Lab Reported)	TRH+C10 - C40 (Sum of total) (Lab Reported)	TRH C6 - C10 Fraction F1
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.05	0.1	0.0001	0.001	0.001	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.001	0.01	0.001	0.001	0.001	0.01	0.005	0.02	0.05	0.1	0.05	0.05	0.1	0.02
ADWG 2011 Health								**40**		**0.02**		**0.5**		**20**		**0.1**	**5**	**0.001**	**0.5**	**0.2**	**0.1**	**1**											
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table															**14**																		
Well ID	**Segment**	**Screening aquifer intersects tunnel**	**Area**	**Date**	**Aquifer Unit**	**Screen Interval (m bgl)**	**Screen Interval (m AHD)**																										
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	6.38	-	4.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	0.86	-	0.911	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	4.89	-	<0.0001	<0.001	-	0.003	0.011	0.42	<0.001	0.637	<0.0001	0.011	0.033	<0.01	<0.001	-	<0.001	-	0.029	<0.02	<0.05	0.33	0.08	0.41	0.37	<0.02
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	0.46	-	0.165	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	0.36	-	<0.0001	0.008	-	0.003	0.008	<0.05	<0.001	0.147	<0.0001	0.013	0.024	0.01	<0.01	-	<0.001	-	0.021	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	1.58	-	<0.0001	<0.001	-	0.054	0.009	**16.7**	<0.001	**10.2**	<0.0001	0.009	0.059	<0.01	<0.01	-	<0.001	-	0.018	<0.02	<0.05	0.22	<0.05	0.22	0.18	<0.02
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	1.8	-	<0.0002	<0.002	-	0.107	0.007	9.48	<0.002	**18**	<0.0001	0.002	0.043	<0.02	0.003	-	<0.002	<0.02	0.04	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	0.65	24.8	<0.0002	<0.002	-	0.006	0.002	3.87	<0.002	0.154	<0.0001	-	0.024	<0.02	-	-	-	<0.02	0.1	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	1.28	35.5	<0.0002	<0.002	-	0.102	<0.002	3.92	<0.002	4.3	<0.0001	0.002	0.039	<0.02	<0.002	-	<0.002	<0.02	0.034	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	**22.9**	-	1.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	0.5	-	0.0002	<0.001	-	0.008	0.005	<0.05	<0.001	2.9	-	0.003	0.009	<0.01	<0.001	-	<0.001	-	0.01	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	0.02
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	0.94	47.6	0.0002	<0.001	-	0.03	0.025	0.07	<0.001	**5.8**	<0.0001	0.003	0.053	<0.01	<0.001	-	<0.001	<0.01	0.041	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	0.4	-	<0.0001	0.003	-	0.004	0.006	<0.05	0.002	0.758	-	0.009	0.018	0.02	<0.001	-	<0.001	-	0.043	<0.02	<0.08	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	<0.05	-	0.342	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	0.17	-	<0.0001	<0.001	-	0.002	0.004	0.23	0.005	0.254	-	0.018	0.004	<0.01	<0.001	-	<0.001	-	0.027	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	0.33	2.7	<0.0001	0.016	-	<0.001	0.004	<0.05	<0.001	0.035	<0.0001	0.015	0.013	<0.01	0.002	-	<0.001	<0.01	0.052	<0.02	0.08	0.56	<0.05	0.64	0.66	<0.02
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	0.28	8.2	<0.0001	0.008	-	<0.001	0.005	<0.05	<0.001	0.021	<0.0001	0.002	0.017	<0.01	<0.001	-	<0.001	<0.01	0.05	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	0.33	6.5	<0.0001	0.001	-	0.006	0.008	0.08	<0.001	0.209	<0.0001	0.004	0.037	<0.01	<0.001	-	<0.001	<0.01	0.048	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	0.41	5.2	<0.0001	0.001	-	0.003	0.015	<0.05	0.003	0.22	<0.0001	-	0.145	<0.01	-	-	-	<0.01	0.237	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	0.21	11.3	<0.0001	<0.001	-	0.003	0.022	0.38	0.001	0.241	<0.0001	0.004	0.024	<0.01	<0.001	-	<0.001	<0.01	0.096	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	0.57	1.7	<0.0001	0.003	-	<0.001	0.004	<0.05	0.001	0.016	<0.0001	0.002	0.009	<0.01	-	-	<0.001	<0.01	0.019	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	0.21	2	<0.0001	0.002	-	<0.001	0.002	<0.05	<0.001	0.039	-	-	0.049	<0.01	-	-	-	<0.01	0.02	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	0.21	3	<0.0001	<0.001	-	<0.001	0.023	0.09	0.004	0.533	<0.0001	-	0.11	<0.01	-	-	-	<0.01	0.341	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	0.28	1.3	<0.0001	0.002	-	<0.001	0.002	<0.05	<0.001	0.046	<0.0001	0.005	0.039	<0.01	0.001	<0.001	<0.001	<0.01	0.018	<0.02	<0.05	1.02	0.57	1.59	1.74	<0.02
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	0.12	3.4	<0.0001	<0.001	-	0.003	0.001	<0.05	<0.001	0.16	<0.0001	0.004	0.02	<0.01	0.002	<0.001	<0.001	<0.01	0.023	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	0.16	<0.1	<0.0001	<0.001	-	<0.001	<0.001	0.21	<0.001	0.077	<0.0001	<0.001	0.001	<0.01	-	-	<0.001	<0.01	0.009	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	0.16	8.3	<0.0001	<0.001	-	<0.001	0.001	0.17	<0.001	0.078	<0.0001	<0.001	0.002	<0.01	<0.001	-	<0.001	<0.01	0.005	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	0.16	3.9	<0.0001	<0.001	-	0.001	0.002	0.25	<0.001	0.102	<0.0001	0.006	0.009	<0.01	<0.001	-	<0.001	<0.01	0.021	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	0.08	-	1.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	0.53	-	0.0006	<0.001	-	0.002	0.005	**21**	<0.001	0.131	-	0.005	0.033	<0.01	<0.001	-	<0.001	-	0.024	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	0.84	-	<0.0001	<0.001	-	0.005	0.005	8.36	<0.001	1.51	-	0.009	0.013	<0.01	<0.001	-	0.001	-	0.034	<0.02	0.48	0.66	<0.05	1.14	1.09	<0.02
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	0.25	0.8	<0.0001	<0.001	-	<0.001	0.005	<0.05	<0.001	0.108	<0.0001	-	0.068	<0.01	-	-	-	<0.01	0.168	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	0.18	0.5	<0.0001	0.003	-	0.001	0.012	0.84	0.002	0.016	-	-	0.007	<0.01	-	-	-	<0.01	0.022	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	0.18	11.6	0.0002	0.004	-	0.002	0.015	<0.05	<0.001	0.17	-	-	0.008	<0.01	-	-	-	<0.01	0.065	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	0.15	8.3	0.0004	<0.001	-	0.002	0.018	<0.05	<0.001	0.285	-	-	0.013	<0.01	-	-	-	<0.01	0.113	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	<0.05	-	0.0001	0.004	-	0.001	0.01	<0.05	<0.001	0.066	<0.0001	0.011	0.027	0.03	<0.01	-	<0.001	-	0.038	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	0.3	-	<0.0001	<0.001	-	<0.001	0.004	0.08	<0.001	0.119	<0.0001	0.016	0.007	<0.01	<0.001	-	<0.001	-	0.03	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	2.53	-	0.437	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	0.14	11.3	0.0002	<0.001	-	0.006	0.011	0.96	0.002	0.238	<0.0001	0.006	0.036	<0.01	<0.001	-	<0.001	<0.01	0.144	<0.02	0.06	<0.1	<0.05	0.06	<0.1	<0.02
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	0.11	13.8	0.0002	0.001	-	0.017	0.042	<0.05	<0.001	0.257	<0.0001	<0.001	0.119	<0.01	<0.001	-	<0.001	<0.01	0.095	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	0.13	11.8	0.0004	0.002	-	<0.001	0.012	4.11	0.001	0.144	-	-	0.075	0.01	-	-	-	<0.01	0.14	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	8.54	-	0.623	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	0.16	-	0.134	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	0.05	-	<0.0001	<0.001	-	0.075	0.006	**37**	<0.001	**7.16**	<0.0001	0.005	0.105	<0.01	<0.001	-	<0.001	-	0.276	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	0.08	-	<0.0001	<0.001	-	0.002	0.004	**20.8**	<0.001	0.343	<0.0001	<0.001	0.043	<0.01	<0.001	-	<0.001	-	0.024	0.02	0.06	0.21	<0.05	0.27	0.19	0.03
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	<0.05	-	0.0002	<0.001	-	0.055	0.017	3.41	<0.001	0.232	<0.0001	<0.001	0.117	<0.01	<0.001	-	<0.001	-	0.213	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	9.56	-	0.118	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	TRH C6 - C10 Fraction Less BTEX F1	TRH >C10 - C16 Fraction F2	TRH >C10 - C16 Fraction Less Naphthalene F2	TRH >C16 - C34 Fraction F3	TRH >C34 - C40 Fraction F4	1,2,4-trimethylbenzene	1,3,5-Trimethylbenzene	Benzene	Toluene	Isopropylbenzene	n-Butylbenzene	n-Propylbenzene	p-Isopropyltoluene	sec-Butylbenzene	Styrene	tert-Butylbenzene	Ethylbenzene	Xylenes (m & p)	Xylene (o)	Xylenes (Sum of total) (Lab Reported)	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methylphenol	2-Nitrophenol	3- & 4- Methylphenol	Phenol
								ocarbons					Monocyclic Aromatic Hydrocarbons															Phenols					
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.02	0.1	0.1	0.1	0.1	0.005	0.005	0.001	0.002	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.002	0.002	0.002	0.002	0.001	0.03	0.001	0.001	0.002	0.001
ADWG 2011 Health															**0.001**	**0.8**						**0.03**		**0.3**			**0.6**						
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																																	**5.8**
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	<0.02	<0.1	-	0.37	<0.1	<0.005	<0.005	<0.001	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	<0.02	<0.1	-	0.18	<0.1	<0.005	<0.005	<0.001	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	<0.02	0.11	0.11	0.55	<0.1	<0.005	<0.005	<0.001	0.004	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	0.0017
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	<0.02	<0.1	<0.1	1.5	0.24	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	<0.002	<0.002	<0.002
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	<0.02	1.09	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	<0.02	<0.1	<0.1	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	**0.002**	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	0.02	0.19	-	<0.1	<0.1	0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	0.007	0.003	0.01	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	<0.02	<0.1	-	<0.1	<0.1	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,6-Dichlorophenol	2-Chlorophenol	4-Chloro-3-methylphenol	Pentachlorophenol	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(a)pyrene (TEQs)	Benzo(a)pyrene TEQ (lower bound)*	Benzo(b)&(j)fluoranthene	Benzo(b+j) & Benzo(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene
								Chlorophenols							Polycyclic Aromatic Hydrocarbons																
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.0005	0.0005	0.0005	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
ADWG 2011 Health									0.02	0.2		0.3		0.01					0.00001												
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																															
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	-	<0.004	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.002	<0.002	<0.002	<0.002	<0.002	-	<0.002	-	<0.004	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

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Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	Naphthalene	Phenanthrene	Pyrene	Hal 1,1,1,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,2,3-Trichloropropane	1,2-Dibromo-3-chloropropane	1,2-Dibromoethane	1,1-Dichloroethane	1,2-Dichloroethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-dichloroethene	1,2-Dichloropropane	1,3-Dichloropropane	2,2-Dichloropropane	1,1-Dichloropropene	cis-1,3-Dichloropropene	trans-1,3-dichloropropene	cis-1,4-Dichloro-2-butene	trans-1,4-Dichloro-2-butene	Acrolein
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.001	0.001	0.001	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0025
ADWG 2011 Health																	**0.001**		**0.003**	**0.03**											
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																					**0.036**										
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.007**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0025
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0025
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)

Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,

Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

								ogenated Compounds																							
								Allyl chloride	Bromochloromethane	Bromodichloromethane	Bromoform	Bromomethane	Carbon disulfide	Carbon tetrachloride	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane	Dibromomethane	Dichlorodifluoromethane	Dichloromethane	Epichlorohydrin	Hexachlorobutadiene	Hexachloroethane	Iodomethane	Pentachloroethane	Trichloroethene	Tetrachloroethene	Trichlorofluoromethane	Vinyl chloride	2-Hexanone
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.001	0.001	0.005	0.005	0.05	0.005	0.005	0.005	0.05	0.005	0.05	0.005	0.05	0.005	0.0002	0.002	0.002	0.005	0.005	0.005	0.005	0.05	0.05	0.05
ADWG 2011 Health												**0.001**		**0.003**							**0.004**	**0.0005**	**0.0007**							**0.0003**	
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																	**0.00022**											**0.011**			
Well ID	**Segment**	**Screening aquifer intersects tunnel**	**Area**	**Date**	**Aquifer Unit**	**Screen Interval (m bgl)**	**Screen Interval (m AHD)**																								
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	**0.012**	<0.05	<0.05	<0.05
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	**0.01**	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	<0.005	<0.0002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	<0.005	<0.0002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	0.006	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

								Ethers			Chloroaromatics												Explosives											
Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	Acetone	Acrylonitrile	Vinyl acetate	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	2-Chlorotoluene	4-Chlorotoluene	Bromobenzene	Chlorobenzene	Hexachlorobenzene	Pentachlorobenzene	Nitrobenzene	1,3,5-Trinitrobenzene	1,3-Dinitrobenzene	TNT	2,4-Dinitrotoluene	2,6-Dinitrotoluene	2,4-& 2,6-Dinitrotoluene (Isomeric Mixture)	2-Amino-4,6-Dinitrotoluene	4-Amino-2,6-Dinitrotoluene	4-& 2-Amino-Dinitrotoluene (Isomeric Mixture)	2-Nitrotoluene	3-Nitrotoluene	4-Nitrotoluene
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.05	0.001	0.05	0.005	0.002	0.002	0.002	0.002	0.005	0.005	0.005	0.005	0.000002	0.002	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
ADWG 2011 Health													1.5		0.04				0.3															
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																																		
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	<0.05	<0.001	<0.05	<0.005	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.002	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.05	<0.001	<0.05	<0.005	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.002	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

														Herbicides																				
								HMX	Nitroglycerine	PETN	RDX	Tetryl	2,4,5-Trichlorophenoxy Acetic Acid	2,4,6-Trichlorophenoxy-acetic acid	2,4-D	2,4-Dichlorprop	2,6-D	2-Methyl-4-chlorophenoxyacetic acid	2-Methyl-4-Chlorophenoxy Butanoic Acid	4-(2,4-Dichlorophenoxy) butyric acid (2,4-DB)	4-Chlorophenoxyacetic acid	Clopyralid	Dicamba	Dinoseb	Fenoprop	Fluroxypyr	Glyphosate	Mecoprop	Picloram	Triclopyr	Trifluralin	PCB (Sum of Total-Lab Reported)	a-BHC	Aldrin
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.02	0.2	0.2	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.000002	0.000002
ADWG 2011 Health													0.1		0.03	0.1		0.04				2	0.1		0.01		1		0.3	0.02	0.09			
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																																		
Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)																											
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	<0.02	<0.2	<0.2	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.0005	<0.0005
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.02	<0.2	<0.2	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.0005	<0.0005
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	Aldrin & Dieldrin (Sum of total) (Lab Reported)	b-BHC	Chlordane (Sum of total)	cis-Chlordane	trans-Chlordane	d-BHC	DDD	DDE	DDT	DDT+DDE+DDD (Sum of total) (Lab Reported)	Dieldrin	Endosulfan	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone
								Pesticides																	
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002
ADWG 2011 Health								0.0003		0.002						0.009			0.02						
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table																									
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

Golder Associates

Well ID	Segment	Screening aquifer intersects tunnel	Area	Date	Aquifer Unit	Screen Interval (m bgl)	Screen Interval (m AHD)	g-BHC	Heptachlor	Heptachlor epoxide	Methoxychlor	Oxychlordane	Toxaphene
								mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL								0.000002	0.000001	0.000002	0.000002	0.000002	0.01
ADWG 2011 Health								**0.01**	**0.0003**		**0.3**		
USEPA 2015 Regional Screening Levels (RSL) - Resident Tapwater Table													
GA11-BH001	Segment 01	No	Western Portal	9/07/2013	Late Pleistocene Aquifer	20.2-23.4	-18.3 to -21.5	-	-	-	-	-	-
GA11-BH031	Segment 01	No	Western Portal	8/07/2013	Older Volcanics	16.5-19.5	-14.94 to -17.94	-	-	-	-	-	-
GA11-BH002	Segment 02	No	Western Portal	21/02/2012	Older Volcanics	11-13.5	-9.207 to -11.707	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH003	Segment 02	Yes	Western Portal	22/02/2012	Older Volcanics	15-17.5	-12.947 to -15.447	-	-	-	-	-	-
GA11-BH005	Segment 03	Yes	Western Portal	21/02/2012	Older Volcanics	18.5-21.5	-11.575 to -14.575	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH007	Segment 05	Yes	Western Portal	21/02/2012	Werribee Formation	22.5-25.5	-16.094 to -19.094	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH001	Segment 05	Yes	Arden Station	3/07/2015	Werribee Formation	20-23	-15.83 - -18.83	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH002	Segment 05	No	Arden Station	6/07/2015	Silurian - Deep	26-28	-23.79 - -25.79	-	-	-	-	-	-
GA15-BH003	Segment 05	Yes	Arden Station	6/07/2015	Werribee Formation	13.5-16.5	-11.02 - -14.02	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH008	Segment 06	Yes	Arden Station	24/02/2012	Early Pleistocene Aquifer	17.5-19.5	-13.581 to -15.581	-	-	-	-	-	-
GA11-BH009	Segment 06	Yes	Arden Station	30/08/2013	Early Pleistocene Aquifer	21.6-23.8	-19.61 to -21.81	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH005	Segment 07	Yes	Arden Station	7/08/2015	Early Pleistocene Aquifer	13.2-15.2	-10.48 - -12.48	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH011	Segment 08	Yes	Arden Station	23/07/2013	Werribee Formation	20.3-23.3	-8.27 to -11.27	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH013	Segment 08	Yes	Arden Station	23/07/2013	Silurian - Deep	29.5-32.7	-8.07 to -11.27	-	-	-	-	-	-
GA11-BH014	Segment 11	Yes	CBD North	25/07/2013	Silurian - Deep	22.9-25.9	5.78 to 2.78	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH007	Segment 11	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	7.45 - 4.45	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH008	Segment 12	Yes	CBD North	31/08/2015	Silurian - Shallow	16-19	2.08 - -0.92	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH009	Segment 12	Yes	CBD North	3/08/2015	Silurian - Shallow	17.2-20.2	9.1 - 6.1	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH010	Segment 12	Yes	CBD North	7/07/2015	Silurian - Shallow	14-17	5.73 - 2.73	-	-	-	-	-	-
GA15-BH011	Segment 12	Yes	CBD North	15/10/2015	Silurian - Deep	31-34	-11.49 - -14.49	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH012	Segment 13	Yes	CBD North	27/08/2015	Silurian - Shallow	23-26	-0.47 - -3.47	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH018	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	21-24	-10.4 - -13.4	-	-	-	-	-	-
GA15-BH019	Segment 14	Yes	CBD South	8/07/2015	Silurian - Shallow	24-27	-14.2 - -17.2	-	-	-	-	-	-
GA15-BH021	Segment 14	Yes	CBD South	31/07/2015	Silurian - Shallow	20-23	-10.61 - -13.61	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH110	Segment 14	Yes	CBD South	4/08/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH110	Segment 14	Yes	CBD South	2/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH110	Segment 14	Yes	CBD South	7/09/2015	Silurian - Deep	31-43	-21.52 - -33.52	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH112	Segment 14	Yes	CBD South	28/08/2015	Silurian - Deep	31-43	-21.89 - -33.89	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH017	Segment 16	No	Yarra Crossing	22/02/2012	Moray Street Gravels	23-26	-20.504 to -23.504	-	-	-	-	-	-
GA11-BH018	Segment 16	No	Yarra Crossing	8/07/2013	Holocene Alluvium	27.3-29.2	-23.11 to -25.01	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH041	Segment 16	No	Yarra Crossing	23/07/2013	Moray Street Gravels	26.05-29.05	-23.15 to -26.15	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH120	Segment 17	Yes	Domain	6/07/2015	Silurian - Shallow	12-15	-5.35 - -8.35	-	-	-	-	-	-
GA15-BH121	Segment 17	Yes	Domain	20/08/2015	Silurian - Shallow	14-17	-3.52 - -6.52	-	-	-	-	-	-
GA15-BH027	Segment 18	Yes	Domain	20/08/2015	Silurian - Deep	26-29	-13.4 - -16.4	-	-	-	-	-	-
GA15-BH028	Segment 18	Yes	Domain	19/08/2015	Silurian - Deep	26-29	-12.6 - -15.6	-	-	-	-	-	-
GA11-BH019	Segment 20	Yes	Domain	23/02/2012	Silurian - Shallow	16-19	-3.93 to -6.93	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH026	Segment 20	No	Domain	23/02/2012	Silurian - Shallow	6.5-9	-4.15 to -6.65	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH027	Segment 20	Yes	Domain	22/02/2012	Silurian - Shallow	12-15	-8.627 to -11.627	-	-	-	-	-	-
GA15-BH029	Segment 20	Yes	Domain	6/10/2015	Silurian - Deep	25-35	-19.07 - -29.07	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH031	Segment 20	Yes	Domain	28/09/2015	Silurian - Deep	25-35	-16.89 - -26.89	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA15-BH033	Segment 20	Yes	Domain	7/10/2015	Silurian - Deep	25-35	-17.01 - -27.01	-	-	-	-	-	-
GA11-BH020	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	21-24	-7.422 to -10.422	-	-	-	-	-	-
GA11-BH021	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	23-26	-3.893 to -6.893	-	-	-	-	-	-
GA11-BH022	Segment 21	Yes	Eastern Portal	18/01/2013	Silurian - Deep	31-34	-4.444 to -7.444	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH023	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	27-30	-11.487 to -14.487	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH024	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	18-21	-4.984 to -7.984	<0.0005	<0.0005	<0.0005	<0.002	-	-
GA11-BH025	Segment 22	Yes	Eastern Portal	17/01/2013	Silurian - Deep	16.5-19.5	-8.085 to -11.085	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)
Note 2. Includes USEPA 2015 Regional Screening Levels for Resident Tapwater for chloroform, cis-1,2,Dichloroethene. iron, nitrate (as N), nitrite (as N), phenol and tetrachloroethene,
Note 3. The ADWG 2011 Health guidelines for inorganics (excuding cyanide) and metals (excluding mercury) have been multiplied by a factor of 10

APPENDIX F

Groundwater Quality Data Screened Against Trade Waste Agreement Criteria

TABLE 1 - TWADC

Well ID	Segments	Aquifer Unit	Tunnel/Station within the aquifer unit?	Date	Field Parameters: Dissolved Oxygen (Field) (Filtered)	Electrolytic Conductivity (Field)	pH (Field)	Redox Potential (Field)	Temp (Field)	Lab pH and Salinity: Electrical Conductivity @ 25°C	pH (Lab)	Total Dissolved Solids @180°C	Average Total Dissolved Solids (average is only for aquifer units in which tunnel/stations are to be constructed)	Sodium (Filtered)	Potassium (Filtered)	Calcium (Filtered)	Magnesium (Filtered)	Chloride	Sulphate (as SO4) (Filtered)	Sulphide	Sulphur (Total Oxidised as SO4)	Oxidised Sulphur (as S)[2]	Bicarbonate Alkalinity (as CaCO3)	Carbonate Alkalinity (as CaCO3)	Hydroxide Alkalinity (as CaCO3)	Total Alkalinity (as CaCO3)	Hardness (as CaCO3) (Filtered)
					mg/L	uS/cm	pH_Units	mV	oC	uS/cm	pH_Units	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL										1	0.01	5		1	1	1	1	1	1	0.1	1		1	1	1	1	1
City West Water Discharge Criteria									38		6-10									1		100					
South East Water Discharge Criteria									38		6-10									1		100					
GA11-BH001	Segment 01	Late Pleistocene Aquifer	No	9/07/2013	0.98	34364	8.44	-108.2	17.4	39,800	6.93	29,800	-	7140	160	416	967	13500	1630	-	-	543	457	<1	<1	457	5020
GA11-BH031	Segment 01	Older Volcanics	No	8/07/2013	1.03	10485	7.04	-121.5	16.6	12,600	7.29	7630		2540	79	67	144	2650	2150	-	-	717	1100	<1	<1	1100	760
GA11-BH002	Segment 02	Older Volcanics	No	21/02/2012	0.82	7040	7.48	-52	16.9	8370	7.64	5000	2160	1640	70	42	82	835	2320	-	-	773	1100	<1	<1	1100	442
GA11-BH003	Segment 02	Older Volcanics	Yes	22/02/2012	0.2	3590	7.81	-176	17.1	4060	7.94	2160		870	22	6	12	590	517	-	-	172	757	<1	<1	757	64
GA11-BH005	Segment 03	Older Volcanics	Yes	21/02/2012	0.98	11,550	7.36	131	18	13,200	7.59	7920	7920	2390	33	146	282	4310	897	-	-	299	445	<1	<1	445	1520
GA11-BH007	Segment 05	Werribee Formation	Yes	21/02/2012	0.96	43,940	6.78	-93	17.6	48,900	6.93	37,200	37,633	8760	209	698	1490	18000	2340	-	-	780	754	<1	<1	754	7880
GA15-BH001	Segment 05	Werribee Formation	Yes	3/07/2015	1.96	44,490	6.09	11	17.9	55,600	6.51	44,200		10,700	217	693	1720	19900	2720	-	-	907	763	<1	<1	763	8810
GA15-BH002	Segment 05	Silurian - Deep	No	6/07/2015	2.17	28,781	5.31	-5	18.5	37,600	5.68	25,300		6290	127	622	1130	12600	1490	-	-	497	226	<1	<1	226	6210
GA15-BH003	Segment 05	Werribee Formation	Yes	6/07/2015	1.89	37,473	6.21	-98	17.7	46,800	6.60	31,500		7750	137	583	1420	16400	1070	-	-	357	899	<1	<1	899	7300
GA11-BH008	Segment 06	Early Pleistocene Aquifer	Yes	24/02/2012	0.57	44,240	7.16	-125	17.7	51,300	7.07	38,000	30,300	8440	185	510	1360	18400	698	-	-	233	1100	<1	<1	1100	6870
GA11-BH009	Segment 06	Early Pleistocene Aquifer	Yes	30/08/2013	0.25	31,240	6.58	25.4	17.5	38,200	6.83	22,600		6070	128	530	1210	13200	1390	-	-	463	710	<1	<1	710	6310
GA15-BH005	Segment 07	Early Pleistocene Aquifer	Yes	7/08/2015	0.33	31,753	6.57	75	18.7	38,900	7.43	24,900	24,900	5830	130	498	938	11900	2420	-	-	807	668	<1	<1	668	5110
GA11-BH011	Segment 08	Werribee Formation	Yes	23/07/2013	0.36	7,898	7.72	199.4	18.6	9500	7.70	5740	5070	1750	23	98	234	2600	600	-	-	200	506	<1	<1	506	1210
GA11-BH013	Segment 08	Silurian - Deep	Yes	23/07/2013	0.41	6,000	7.66	159.3	18.3	7190	7.49	4400		1460	13	40	108	1820	383	-	-	128	422	<1	<1	422	545
GA11-BH014	Segment 11	Silurian - Deep	Yes	25/07/2013	0.27	5955	7.51	139.4	18.8	6890	7.31	4270	3275	1320	27	20	64	1540	335	-	-	112	618	<1	<1	618	313
GA15-BH007	Segment 11	Silurian - Shallow	Yes	7/07/2015	0.78	2942	6.76	96	18.2	3750	6.79	2280		715	14	31	4	759	222	-	-	74	565	<1	<1	565	94
GA15-BH008	Segment 12	Silurian - Shallow	Yes	31/08/2015	3	7131	7.08	23	16.7	6850	7.93	4710	4923	1700	19	34	83	2130	450	-	-	150	829	<1	<1	829	427
GA15-BH009	Segment 12	Silurian - Shallow	Yes	3/08/2015	3.31	6671	6.8	101	18.4	8050	7.01	4400		1420	19	21	68	1880	353	-	-	118	769	<1	<1	769	332
GA15-BH010	Segment 12	Silurian - Shallow	Yes	7/07/2015	3.87	4987	5.93	188	17.2	6710	6.32	3620		1190	11	12	37	1370	411	-	-	137	708	<1	<1	708	182
GA15-BH011	Segment 12	Silurian - Deep	Yes	15/10/2015	0.6	10,684	5.86	158	19.5	13,100	6.13	6960		2560	36	45	162	3790	413	-	-	138	2100	<1	<1	2100	779
GA15-BH012	Segment 13	Silurian - Shallow	yes	27/08/2015	5.75	1906	7.74	12	17.1	2380	7.73	1410	1410	483	7	2	6	363	121	-	-	40.3	569	<1	<1	569	30
GA15-BH018	Segment 14	Silurian - Shallow	Yes	31/07/2015	1.11	2625	7.01	180	15.4	3500	7.17	2030	3160	646	11	9	12	710	185	-	-	61.7	574	<1	<1	574	72
GA15-BH019	Segment 14	Silurian - Shallow	Yes	8/07/2015	3.37	3760	5.93	436	16.5	4960	5.91	2810		913	12	9	15	1070	288	-	-	96	735	<1	<1	735	84
GA15-BH021	Segment 14	Silurian - Shallow	Yes	31/07/2015	1.15	1838	6.86	104	19.4	2470	6.99	1450		457	8	6	5	473	138	<0.1	139	46	404	<1	<1	404	36
GA15-BH110	Segment 14	Silurian - Deep	Yes	4/08/2015	0.54	4307	7.19	67	17.4	5430	7.30	3250		992	18	24	48	1150	304	<0.1	269	101	663	<1	<1	663	258
GA15-BH110	Segment 14	Silurian - Deep	Yes	2/09/2015	-	-	-	-	-	8090	7.19	4280		1610	13	10	67	1820	399	-	-	133	849	<1	<1	849	301
GA15-BH110	Segment 14	Silurian - Deep	Yes	7/09/2015	-	-	-	-	-	9890	7.15	5300		1820	22	28	113	2620	498	-	-	166	822	<1	<1	822	535
GA15-BH112	Segment 14	Silurian - Deep	Yes	28/08/2015	2.06	5935	6.34	-13	17.3	4350	6.72	3000		966	14	10	37	1160	305	-	-	102	713	<1	<1	713	177
GA11-BH017	Segment 16	Moray Street Gravels	No	22/02/2012	1.27	38,040	6.82	76	19	38,800	6.77	25,000	-	7750	171	409	1180	14400	1430	-	-	477	819	<1	<1	819	5880
GA11-BH018	Segment 16	Holocene Alluvium	No	8/07/2013	0.24	22,487	6.51	-112.8	16.5	26,400	6.84	17,500		4250	131	145	597	8750	200	-	-	66.7	1630	<1	<1	1630	2820
GA11-BH041	Segment 16	Moray Street Gravels	No	23/07/2013	0.19	37,767	7.03	-47.4	17.9	45,700	6.92	27,400		7930	163	399	1180	16000	1980	-	-	660	399	<1	<1	399	5860
GA15-BH120	Segment 17	Silurian - Shallow	Yes	6/07/2015	3.6	2288	5.88	312	15.1	3130	6.09	1790	5085	639	20	11	12	380	241	-	-	80.3	806	<1	<1	806	77
GA15-BH121	Segment 17	Silurian - Shallow	Yes	20/08/2015	2.56	1120	7	105	14.2	1430	7.29	8380		264	4	2	1	143	185	-	-	61.7	362	<1	<1	362	<10
GA15-BH027	Segment 18	Silurian - Deep	Yes	20/08/2015	6.29	9249	6.92	147	16.3	9950	6.99	6650	5730	2090	38	39	149	3300	447	-	-	149	680	<1	<1	680	711
GA15-BH028	Segment 18	Silurian - Deep	Yes	19/08/2015	7.44	7086	6.76	152	17.7	7670	6.52	4810		1620	26	38	72	2410	386	-	-	129	362	<1	<1	362	391
GA11-BH019	Segment 20	Silurian - Shallow	Yes	23/02/2012	3.74	15,940	7.03	126	17.9	17,000	7.08	10,100	6,418	3160	46	121	328	5750	392	-	-	131	756	<1	<1	756	1650
GA15-BH029	Segment 20	Silurian - Deep	Yes	6/10/2015	2.56	9500	5.89	-131.9	22.3	11,200	6.41	6500		1780	34	81	224	3730	233	-	-	77.7	229	<1	<1	229	1120
GA15-BH031	Segment 20	Silurian - Deep	Yes	28/09/2015	2.27	11,397	5.77	428	17.8	14,800	6.17	7470		2240	40	136	335	4510	376	-	-	125	497	<1	<1	497	1720
GA15-BH033	Segment 20	Silurian - Deep	Yes	7/10/2015	5.55	8766	5.49	-78.6	17.5	11,600	5.80	6360		1810	33	82	246	3950	230	-	-	76.7	178	<1	<1	178	1220
GA11-BH026	Segment 20	Silurian - Shallow	No	23/02/2012	0.7	1930	7.47	19	18.5	2160	7.67	1520		460	6	7	9	273	180	-	-	60	507	<1	<1	507	54
GA11-BH027	Segment 20	Silurian - Shallow	Yes	22/02/2012	1.18	3380	6.89	-50	20	3080	7.02	1660		493	18	40	57	860	111	-	-	37	159	<1	<1	159	335
GA11-BH020	Segment 21	Silurian - Deep	Yes	18/01/2013	1.27	9750	6.09	49	18.5	11,000	6.35	6220	4,867	1940	38	85	295	3780	402	-	-	134	300	<1	<1	300	1430
GA11-BH021	Segment 21	Silurian - Deep	Yes	18/01/2013	1.31	1990	6.82	46	18.2	2310	6.32	1380		448	13	4	17	428	141	-	-	47	375	<1	<1	375	80
GA11-BH022	Segment 21	Silurian - Deep	Yes	18/01/2013	0.93	10,570	6	-3	19.7	11,900	6.30	7000		1910	24	77	384	4110	443	-	-	148	94	<1	<1	94	1770
GA11-BH023	Segment 22	Silurian - Deep	Yes	17/01/2013	1.05	7970	5.74	-41	18.7	9200	6.35	5200	5293	1580	26	82	181	3010	356	-	-	119	248	<1	<1	248	-
GA11-BH024	Segment 22	Silurian - Deep	Yes	17/01/2013	3.07	8050	5.78	125	19.2	9270	5.56	5000		1390	15	43	243	3000	369	-	-	123	44	<1	<1	44	-
GA11-BH025	Segment 22	Silurian - Deep	Yes	17/01/2013	3.58	8700	5.12	237	18.7	10300	5.38	5680		1640	16	36	269	3430	355	-	-	118	33	<1	<1	33	-

Well ID	Date	Nutrients: Nitrate (as N)	Nitrite (as N)	Nitrogen (Total Oxidised)	Ammonia (as N)	Total Kjeldahl Nitrogen (as N)	Nitrogen (Total)	Total Phosphorus (as P)	TOC/BOD: Biological Oxygen Demand	Total Organic Carbon	Other Ions: Bromide	Fluoride	Iodine (Filtered)	Cyanide (total)	Other: Carbon Dioxide	CO2 (Free)	Formaldehyde	Residual Chlorine	Microbial Analyses: Escherichia coli (Colilert)	Sulphate Reducing Bacteria Population Estimate	Sulphate-reducing bacteria (MPN/100mL)	Sulphate-reducing bacteria (ORG/100mL)	Metals: Antimony	Arsenic (Filtered)	Barium (Filtered)	Beryllium (Filtered)	Boron (Filtered)	Bromine (Filtered)	Cadmium (Filtered)	Chromium (Filtered)	Chromium (hexavalent)	Cobalt (Filtered)	Copper (Filtered)	Iron (Filtered)	Lead (Filtered)	Manganese (Filtered)
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	orgs/mL	pac/mL	MPN/100mL	ORG/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL		0.01	0.01	0.01	0.01	0.1	0.1	0.01	2	1	0.01	0.1	0.1	0.004	1	1	0.1	0.02	0.001	1	2	300	0.0002	0.001	0.001	0.001	0.05	0.1	0.0001	0.001	0.001	0.001	0.001	0.05	0.001	0.001
City West Water Discharge Criteria					50	500			4000			30	5	10			200						0.001	1	150	30	25	5	2	10	0.001	10	10	100	10	10
South East Water Discharge Criteria					50	500			4000			30	5	10			200						0.001	1	150	30	25	5	2	10	0.001	10	10	100	10	10
GA11-BH001	9/07/2013	0.02	<0.01	0.02	23.7	24.5	-	0.13	-	-	48.8	-	-	-	510	107	-	-	-	-	-	>110,000	-	-	-	-	-	-	-	-	-	-	-	6.38	-	4.44
GA11-BH031	8/07/2013	<0.01	<0.01	<0.01	0.06	<0.1	-	0.34	-	-	12.2	-	-	-	1080	113	-	-	-	-	-	>110,000	-	-	-	-	-	-	-	-	-	-	-	0.86	-	0.911
GA11-BH002	21/02/2012	<0.01	<0.01	<0.01	0.75	1.7	-	0.11	-	70	8.38	0.6	-	0.013	-	50	-	-	-	-	>11,000	-	-	0.004	0.083	<0.001	4.89	-	<0.0001	<0.001	-	0.003	0.011	0.42	<0.001	0.637
GA11-BH003	22/02/2012	0.03	<0.01	0.03	0.29	0.5	-	0.49	-	27	2.23	-	-	-	-	17	-	-	-	-	>110,000	-	-	-	-	-	-	-	-	-	-	-	-	0.46	-	0.165
GA11-BH005	21/02/2012	8.02	0.17	8.19	0.06	0.1	-	0.09	-	4	15.1	0.2	-	<0.004	-	23	-	-	-	-	1500	-	-	<0.001	0.088	<0.001	0.36	-	<0.0001	0.008	-	0.003	0.008	<0.05	<0.001	0.147
GA11-BH007	21/02/2012	0.02	<0.01	0.02	6.3	7.5	-	0.53	-	13	63.9	0.2	-	<0.004	-	177	-	-	-	-	>11,000	-	-	<0.001	0.193	<0.001	1.58	-	<0.0001	<0.001	-	0.054	0.009	16.7	<0.001	10.2
GA15-BH001	3/07/2015	0.01	<0.01	0.01	11.5	12.2	12.2	0.06	-	7	105	0.3	-	<0.004	-	472	-	-	-	27,000	-	-	-	0.002	0.278	<0.002	1.8	-	<0.0002	<0.002	-	0.107	0.007	9.48	<0.002	18
GA15-BH002	6/07/2015	0.01	<0.01	0.01	1.13	1.3	1.3	0.09	-	2	-	0.3	-	-	-	944	-	-	-	>1100	-	-	-	0.012	0.047	<0.002	0.65	24.8	<0.0002	<0.002	-	0.006	0.002	3.87	<0.002	0.154
GA15-BH003	6/07/2015	<0.01	<0.01	<0.01	21	20.8	20.8	0.1	-	5	-	0.4	-	<0.004	-	452	-	-	-	75	-	-	-	0.002	0.204	<0.002	1.28	35.5	<0.0002	<0.002	-	0.102	<0.002	3.92	<0.002	4.3
GA11-BH008	24/02/2012	<0.01	<0.01	<0.01	49.4	49.9	-	2.13	-	37	71.6	-	-	-	-	187	-	-	-	-	>110,000	-	-	-	-	-	-	-	-	-	-	-	-	22.9	-	1.92
GA11-BH009	30/08/2013	0.01	<0.01	0.01	15.4	17.5	-	0.1	-	-	46.3	0.6	-	<0.004	835	210	-	-	-	-	-	15,000	-	<0.001	0.042	<0.001	0.5	-	0.0002	<0.001	-	0.008	0.005	<0.05	<0.001	2.9
GA15-BH005	7/08/2015	0.02	<0.01	0.02	7.06	7.3	7.3	0.11	-	7	-	0.3	-	<0.004	-	343	-	-	-	500,000	-	-	-	0.002	0.127	<0.001	0.94	47.6	0.0002	<0.001	-	0.03	0.025	0.07	<0.001	5.8
GA11-BH011	23/07/2013	21	2.29	23.3	0.03	<0.1	-	0.27	-	-	8.92	1	-	<0.004	465	20	-	-	-	-	-	900	-	0.003	0.066	<0.001	0.4	-	<0.0001	0.003	-	0.004	0.006	<0.05	0.002	0.758
GA11-BH013	23/07/2013	8.62	1.68	10.3	0.36	0.4	-	0.06	-	-	6.12	-	-	-	399	27	-	-	-	-	-	24,000	-	-	-	-	-	-	-	-	-	-	-	<0.05	-	0.342
GA11-BH014	25/07/2013	26.3	0.73	27	0.05	<0.1	-	0.05	-	-	4.72	1.5	-	<0.004	604	60	-	-	-	-	-	110,000	-	0.001	0.085	<0.001	0.17	-	<0.0001	<0.001	-	0.002	0.004	0.23	0.005	0.254
GA15-BH007	7/07/2015	0.01	0.71	0.72	0.06	0.4	1.1	0.03	-	96	-	2.6	-	<0.004	-	318	-	-	-	6000	-	-	-	0.004	0.061	<0.001	0.33	2.7	<0.0001	0.016	-	<0.001	0.004	<0.05	<0.001	0.035
GA15-BH008	31/08/2015	3.63	0.06	3.69	0.05	0.1	3.8	0.03	-	4	-	1.1	-	<0.004	-	55	-	-	-	5,000,000	-	-	-	0.003	0.134	<0.001	0.28	8.2	<0.0001	0.008	-	<0.001	0.005	<0.05	<0.001	0.021
GA15-BH009	3/08/2015	14.5	0.7	15.2	0.14	0.2	15.4	0.04	-	4	-	1.3	-	<0.004	-	150	-	-	-	120,000	-	-	-	0.002	0.038	<0.001	0.33	6.5	<0.0001	0.001	-	0.006	0.008	0.08	<0.001	0.209
GA15-BH010	7/07/2015	7.49	0.09	7.58	0.12	0.4	8	0.03	-	5	-	1.7	-	-	-	1230	-	-	-	6000	-	-	-	0.001	0.106	<0.001	0.41	5.2	<0.0001	0.001	-	0.003	0.015	<0.05	0.003	0.22
GA15-BH011	15/10/2015	0.03	<0.01	0.03	0.08	<0.1	<0.1	0.02	-	6	-	0.7	-	<0.004	-	3110	-	-	-	27,000	-	-	-	0.002	0.061	<0.001	0.21	11.3	<0.0001	<0.001	-	0.003	0.022	0.38	0.001	0.241
GA15-BH012	27/08/2015	1.17	<0.01	1.17	0.04	0.4	1.6	0.21	-	4	-	5.3	-	<0.004	-	14	-	-	-	120,000	-	-	-	0.002	0.026	<0.001	0.57	1.7	<0.0001	0.003	-	<0.001	0.004	<0.05	0.001	0.016
GA15-BH018	31/07/2015	6.23	0.41	6.64	0.11	1.1	7.7	0.08	-	3	-	2.8	-	-	-	78	-	-	-	120,000	-	-	-	0.002	0.009	<0.001	0.21	2	<0.0001	0.002	-	<0.001	0.002	<0.05	<0.001	0.039
GA15-BH019	8/07/2015	4	0.17	4.17	0.09	0.3	4.5	0.04	-	5	-	2.4	-	-	-	1810	-	-	-	320	-	-	-	0.002	0.194	<0.001	0.21	3	<0.0001	<0.001	-	<0.001	0.023	0.09	0.004	0.533
GA15-BH021	31/07/2015	5.68	0.23	5.91	0.34	0.7	6.6	0.43	3	2	-	7.4	0.6	<0.004	-	83	0.2	0.06	0	120,000	-	-	-	0.003	0.235	<0.001	0.28	1.3	<0.0001	0.002	-	<0.001	0.002	<0.05	<0.001	0.046
GA15-BH110	4/08/2015	0.12	<0.01	0.12	0.08	0.3	0.4	0.08	3	2	-	1.8	2	<0.004	-	66	<0.1	0.06	0	120,000	-	-	-	0.002	0.048	<0.001	0.12	3.4	<0.0001	<0.001	-	0.003	0.001	<0.05	<0.001	0.16
GA15-BH110	2/09/2015	1.97	0.02	1.99	0.02	0.2	2.2	0.03	-	2	-	0.2	-	<0.004	-	110	-	-	-	500,000	-	-	-	0.001	0.007	<0.001	0.16	<0.1	<0.0001	<0.001	-	<0.001	<0.001	0.21	<0.001	0.077
GA15-BH110	7/09/2015	2.25	0.02	2.27	0.07	0.1	2.4	0.02	-	2	-	1.1	-	<0.004	-	116	-	-	-	500,000	-	-	-	0.001	0.006	<0.001	0.16	8.3	<0.0001	<0.001	-	<0.001	0.001	0.17	<0.001	0.078
GA15-BH112	28/08/2015	0.01	<0.01	0.01	0.04	<0.1	<0.1	0.04	-	3	-	2	-	<0.004	-	272	-	-	-	500,000	-	-	-	0.005	0.037	<0.001	0.16	3.9	<0.0001	<0.001	-	0.001	0.002	0.25	<0.001	0.102
GA11-BH017	22/02/2012	0.03	<0.01	0.03	59	67.9	-	0.2	-	12	49.6	-	-	-	-	278	-	-	-	-	1500	-	-	-	-	-	-	-	-	-	-	-	-	0.08	-	1.14
GA11-BH018	8/07/2013	<0.01	<0.01	<0.01	171	180	-	1.65	-	-	29.5	0.3	-	<0.004	1900	471	-	-	-	-	-	>110,000	-	0.015	2.57	<0.001	0.53	-	0.0006	<0.001	-	0.002	0.005	21	<0.001	0.131
GA11-BH041	23/07/2013	0.04	<0.01	0.04	40.7	52.3	-	0.65	-	-	58.1	0.4	-	<0.004	447	96	-	-	-	-	-	4300	-	0.001	0.167	<0.001	0.84	-	<0.0001	<0.001	-	0.005	0.005	8.36	<0.001	1.51
GA15-BH120	6/07/2015	8.69	0.41	9.1	0.17	1	10.1	0.34	-	4	-	5.8	-	-	-	1310	-	-	-	9	-	-	-	0.003	0.04	<0.001	0.25	0.8	<0.0001	<0.001	-	<0.001	0.005	<0.05	<0.001	0.108
GA15-BH121	20/08/2015	0.26	0.03	0.29	0.26	3	3.3	3.74	-	17	-	3.5	-	-	-	37	-	-	-	150	-	-	-	0.013	0.033	<0.001	0.18	0.5	<0.0001	0.003	-	0.001	0.012	0.84	0.002	0.016
GA15-BH027	20/08/2015	1.7	0.05	1.75	0.14	0.4	2.2	0.08	-	4	-	1.8	-	-	-	139	-	-	-	27,000	-	-	-	0.001	0.29	<0.001	0.18	11.6	0.0002	0.004	-	0.002	0.015	<0.05	<0.001	0.17
GA15-BH028	19/08/2015	0.37	0.05	0.42	0.07	0.7	1.1	0.11	-	7	-	1	-	-	-	219	-	-	-	6000	-	-	-	0.001	0.551	<0.001	0.15	8.3	0.0004	<0.001	-	0.002	0.018	<0.05	<0.001	0.285
GA11-BH019	23/02/2012	0.71	0.05	0.76	0.01	0.5	-	0.07	-	18	13.7	0.9	-	0.004	-	126	-	-	-	-	24,000	-	-	0.002	0.152	<0.001	<0.05	-	0.0001	0.004	-	0.001	0.01	<0.05	<0.001	0.066
GA15-BH029	6/10/2015	0.02	<0.01	0.02	0.06	1.3	1.3	<0.01	-	8	-	0.4	-	<0.004	-	178	-	-	-	500,000	-	-	-	0.002	0.218	<0.001	0.14	11.3	0.0002	<0.001	-	0.006	0.011	0.96	0.002	0.238
GA15-BH031	28/09/2015	0.38	0.08	0.46	0.07	0.1	0.6	0.04	-	3	-	0.3	-	<0.004	-	1140	-	-	-	-	-	-	-	<0.001	0.105	<0.001	0.11	13.8	0.0002	0.001	-	0.017	0.042	<0.05	<0.001	0.257
GA15-BH033	7/10/2015	0.02	<0.01	0.02	0.11	0.1	0.1	0.05	-	<1	-	0.2	-	-	-	564	-	-	-	500,000	-	-	-	0.002	0.096	<0.001	0.13	11.8	0.0004	0.002	-	<0.001	0.012	4.11	0.001	0.144
GA11-BH026	23/02/2012	6.91	0.22	7.13	0.25	1	-	0.18	-	7	1.32	1.8	-	0.004	-	22	-	-	-	-	>110,000	-	-	0.001	0.081	<0.001	0.3	-	<0.0001	<0.001	-	<0.001	0.004	0.08	<0.001	0.119
GA11-BH027	22/02/2012	0.14	0.1	0.24	0.54	1.1	-	0.02	-	4	2.58	-	-	-	-	30	-	-	-	-	46,000	-	-	-	-	-	-	-	-	-	-	-	-	2.53	-	0.437
GA11-BH020	18/01/2013	0.1	0.02	0.12	0.07	0.2	-	<0.01	-	5	8.87	-	-	-	-	268	-	-	-	-	-	>110,000	-	-	-	-	-	-	-	-	-	-	-	8.54	-	0.623
GA11-BH021	18/01/2013	11.2	0.42	11.6	0.1	1.3	-	<0.01	-	6	0.988	-	-	-	-	359	-	-	-	-	-	>110,000	-	-	-	-	-	-	-	-	-	-	-	0.16	-	0.134
GA11-BH022	18/01/2013	<0.01	<0.01	<0.01	<0.01	<0.1	-	0.04	-	5	9.5	0.6	-	<0.004	-	94	-	-	-	-	-	>110,000	-	0.008	0.171	<0.001	0.05	-	<0.0001	<0.001	-	0.075	0.006	37	<0.001	7.16
GA11-BH023	17/01/2013	0.02	<0.01	0.02	0.44	1.1	-	0.1	-	8	8.1	0.5	-	<0.004	-	222	-	-	-	-	-	-	-	0.002	0.128	<0.001	0.08	-	<0.0001	<0.001	-	0.002	0.004	20.8	<0.001	0.343
GA11-BH024	17/01/2013	27.5	<0.01	27.5	0.11	0.5	-	<0.01	-	3	8.95	0.3	-	<0.004	-	242	-	-	-	-	-	-	-	0.002	0.044	<0.001	<0.05	-	0.0002	<0.001	-	0.055	0.017	3.41	<0.001	0.232
GA11-BH025	17/01/2013	0.01	0.01	0.02	0.35	0.6	-	<0.01	-	2	9.25	-	-	-	-	275	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.56	-	0.118

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Control section of the Factual Report (1525532-055-R-RevB)

Well ID	Segments	Aquifer Unit	Tunnel/Station within the aquifer unit?	Date	Mercury (Filtered)	Molybdenum (Filtered)	Nickel (Filtered)	Selenium (Filtered)	Silver (Filtered)	Thallium (Filtered)	Tin (Filtered)	Vanadium (Filtered)	Zinc (Filtered)	TRH C6 - C9 Fraction	TRH C10 - C14 Fraction	TRH C15 - C28 Fraction	TRH C29 - C36 Fraction	TRH+C10 - C36 (Sum of total) (Lab Reported)	TRH+C10 - C40 (Sum of total) (Lab Reported)	TRH C6 - C10 Fraction F1	TRH C6 - C10 Fraction Less BTEX F1	TRH >C10 - C16 Fraction F2	TRH >C10 - C16 Fraction Less Naphthalene F2	TRH >C16 - C34 Fraction F3	TRH >C34 - C40 Fraction F4
														Total Recoverable Hydrocarbons											
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					0.0001	0.001	0.001	0.01	0.001	0.001	0.001	0.01	0.005	0.02	0.05	0.1	0.05	0.05	0.1	0.02	0.02	0.1	0.1	0.1	0.1
City West Water Discharge Criteria					1	10	10	0.001	5	20	10	0.001	10	1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
South East Water Discharge Criteria					1	10	10	0.001	5	20	10	0.001	10	1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
GA11-BH001	Segment 01	Late Pleistocene Aquifer	No	9/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	Older Volcanics	No	8/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	Older Volcanics	No	21/02/2012	<0.0001	0.011	0.033	<0.01	<0.001	-	<0.001	-	0.029	<0.02	<0.05	0.33	0.08	0.41	0.37	<0.02	<0.02	<0.1	-	0.37	<0.1
GA11-BH003	Segment 02	Older Volcanics	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Older Volcanics	Yes	21/02/2012	<0.0001	0.013	0.024	0.01	<0.01	-	<0.001	-	0.021	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA11-BH007	Segment 05	Werribee Formation	Yes	21/02/2012	<0.0001	0.009	0.059	<0.01	<0.01	-	<0.001	-	0.018	<0.02	<0.05	0.22	<0.05	0.22	0.18	<0.02	<0.02	<0.1	-	0.18	<0.1
GA15-BH001	Segment 05	Werribee Formation	Yes	3/07/2015	<0.0001	0.002	0.043	<0.02	0.003	-	<0.002	<0.02	0.04	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH002	Segment 05	Silurian - Deep	No	6/07/2015	<0.0001	-	0.024	<0.02	-	-	-	<0.02	0.1	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Werribee Formation	Yes	6/07/2015	<0.0001	0.002	0.039	<0.02	<0.002	-	<0.002	<0.02	0.034	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA11-BH008	Segment 06	Early Pleistocene Aquifer	Yes	24/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Early Pleistocene Aquifer	Yes	30/08/2013	-	0.003	0.009	<0.01	<0.001	-	<0.001	-	0.01	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	0.02	0.02	<0.1	-	<0.1	<0.1
GA15-BH005	Segment 07	Early Pleistocene Aquifer	Yes	7/08/2015	<0.0001	0.003	0.053	<0.01	<0.001	-	<0.001	<0.01	0.041	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA11-BH011	Segment 08	Werribee Formation	Yes	23/07/2013	-	0.009	0.018	0.02	<0.001	-	<0.001	-	0.043	<0.02	<0.08	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA11-BH013	Segment 08	Silurian - Deep	Yes	23/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Silurian - Deep	Yes	25/07/2013	-	0.018	0.004	<0.01	<0.001	-	<0.001	-	0.027	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA15-BH007	Segment 11	Silurian - Shallow	Yes	7/07/2015	<0.0001	0.015	0.013	<0.01	0.002	-	<0.001	<0.01	0.052	<0.02	0.08	0.56	<0.05	0.64	0.66	<0.02	<0.02	0.11	0.11	0.55	<0.1
GA15-BH008	Segment 12	Silurian - Shallow	Yes	31/08/2015	<0.0001	0.002	0.017	<0.01	<0.001	-	<0.001	<0.01	0.05	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH009	Segment 12	Silurian - Shallow	Yes	3/08/2015	<0.0001	0.004	0.037	<0.01	<0.001	-	<0.001	<0.01	0.048	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH010	Segment 12	Silurian - Shallow	Yes	7/07/2015	<0.0001	-	0.145	<0.01	-	-	-	<0.01	0.237	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Silurian - Deep	Yes	15/10/2015	<0.0001	0.004	0.024	<0.01	<0.001	-	<0.001	<0.01	0.096	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH012	Segment 13	Silurian - Shallow	yes	27/08/2015	<0.0001	0.002	0.009	<0.01	-	-	<0.001	<0.01	0.019	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH018	Segment 14	Silurian - Shallow	Yes	31/07/2015	-	-	0.049	<0.01	-	-	-	<0.01	0.02	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Silurian - Shallow	Yes	8/07/2015	<0.0001	-	0.11	<0.01	-	-	-	<0.01	0.341	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Silurian - Shallow	Yes	31/07/2015	<0.0001	0.005	0.039	<0.01	0.001	<0.001	<0.001	<0.01	0.018	<0.02	<0.05	1.02	0.57	1.59	1.74	<0.02	<0.02	<0.1	<0.1	1.5	0.24
GA15-BH110	Segment 14	Silurian - Deep	Yes	4/08/2015	<0.0001	0.004	0.02	<0.01	0.002	<0.001	<0.001	<0.01	0.023	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH110	Segment 14	Silurian - Deep	Yes	2/09/2015	<0.0001	<0.001	0.001	<0.01	-	-	<0.001	<0.01	0.009	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH110	Segment 14	Silurian - Deep	Yes	7/09/2015	<0.0001	<0.001	0.002	<0.01	<0.001	-	<0.001	<0.01	0.005	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH112	Segment 14	Silurian - Deep	Yes	28/08/2015	<0.0001	0.006	0.009	<0.01	<0.001	-	<0.001	<0.01	0.021	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA11-BH017	Segment 16	Moray Street Gravels	No	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	Holocene Alluvium	No	8/07/2013	-	0.005	0.033	<0.01	<0.001	-	<0.001	-	0.024	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA11-BH041	Segment 16	Moray Street Gravels	No	23/07/2013	-	0.009	0.013	<0.01	<0.001	-	0.001	-	0.034	<0.02	0.48	0.66	<0.05	1.14	1.09	<0.02	<0.02	1.09	-	<0.1	<0.1
GA15-BH120	Segment 17	Silurian - Shallow	Yes	6/07/2015	<0.0001	-	0.068	<0.01	-	-	-	<0.01	0.168	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Silurian - Shallow	Yes	20/08/2015	-	-	0.007	<0.01	-	-	-	<0.01	0.022	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Silurian - Deep	Yes	20/08/2015	-	-	0.008	<0.01	-	-	-	<0.01	0.065	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Silurian - Deep	Yes	19/08/2015	-	-	0.013	<0.01	-	-	-	<0.01	0.113	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Silurian - Shallow	Yes	23/02/2012	<0.0001	0.011	0.027	0.03	<0.01	-	<0.001	-	0.038	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA15-BH029	Segment 20	Silurian - Deep	Yes	6/10/2015	<0.0001	0.006	0.036	<0.01	<0.001	-	<0.001	<0.01	0.144	<0.02	0.06	<0.1	<0.05	0.06	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH031	Segment 20	Silurian - Deep	Yes	28/09/2015	<0.0001	<0.001	0.119	<0.01	<0.001	-	<0.001	<0.01	0.095	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1
GA15-BH033	Segment 20	Silurian - Deep	Yes	7/10/2015	-	-	0.075	0.01	-	-	-	<0.01	0.14	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH026	Segment 20	Silurian - Shallow	No	23/02/2012	<0.0001	0.016	0.007	<0.01	<0.001	-	<0.001	-	0.03	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA11-BH027	Segment 20	Silurian - Shallow	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Silurian - Deep	Yes	18/01/2013	<0.0001	0.005	0.105	<0.01	<0.001	-	<0.001	-	0.276	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA11-BH023	Segment 22	Silurian - Deep	Yes	17/01/2013	<0.0001	<0.001	0.043	<0.01	<0.001	-	<0.001	-	0.024	0.02	0.06	0.21	<0.05	0.27	0.19	0.03	0.02	0.19	-	<0.1	<0.1
GA11-BH024	Segment 22	Silurian - Deep	Yes	17/01/2013	<0.0001	<0.001	0.117	<0.01	<0.001	-	<0.001	-	0.213	<0.02	<0.05	<0.1	<0.05	<0.05	<0.1	<0.02	<0.02	<0.1	-	<0.1	<0.1
GA11-BH025	Segment 22	Silurian - Deep	Yes	17/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Well ID	Date	1,2,4-trimethylbenzene	1,3,5-Trimethylbenzene	Benzene	Toluene	Isopropylbenzene	n-Butylbenzene	n-Propylbenzene	p-Isopropyltoluene	sec-Butylbenzene	Styrene	tert-Butylbenzene	Ethylbenzene	Xylenes (m & p)	Xylene (o)	Xylenes (Sum of total) (Lab Reported)	Total BTEX	2,4-Dimethylphenol	2,4-Dinitrophenol	2-Methylphenol	2-Nitrophenol	3- & 4- Methylphenol	Phenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol	2,4-Dichlorophenol	2,6-Dichlorophenol	2-Chlorophenol	4-Chloro-3-methylphenol	Pentachlorophenol	Acenaphthene	Acenaphthylene	Anthracene
		Monocyclic Aromatic Hydrocarbons																Phenols						Chlorophenols									
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL		0.005	0.005	0.001	0.002	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.002	0.002	0.002	0.002	0.001	0.001	0.03	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
City West Water Discharge Criteria		0.001	0.001	1	2	0.001	0.001	0.001	0.001	0.001	2	0.001	2	0.001	0.001	2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	5	0.001	0.001	0.001
South East Water Discharge Criteria		0.001	0.001	1	2	0.001	0.001	0.001	0.001	0.001	2	0.001	2	0.001	0.001	2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	5	0.001	0.001	0.001
GA11-BH001	9/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	8/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	21/02/2012	<0.005	<0.005	<0.001	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH003	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	21/02/2012	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH007	21/02/2012	<0.005	<0.005	<0.001	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH001	3/07/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH002	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	6/07/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH008	24/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	30/08/2013	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH005	7/08/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH011	23/07/2013	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH013	23/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	25/07/2013	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH007	7/07/2015	<0.005	<0.005	<0.001	0.004	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	0.004	<0.001	-	<0.001	<0.001	<0.002	0.0017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH008	31/08/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH009	3/08/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH010	7/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	15/10/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH012	27/08/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH018	31/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	8/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	31/07/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.002	<0.002	<0.002
GA15-BH110	4/08/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.004	<0.002	<0.002	<0.002
GA15-BH110	2/09/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH110	7/09/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH112	28/08/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH017	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	8/07/2013	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH041	23/07/2013	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH120	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	19/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	23/02/2012	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH029	6/10/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH031	28/09/2015	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA15-BH033	7/10/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH026	23/02/2012	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH027	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	18/01/2013	<0.005	<0.005	0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	0.002	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH023	17/01/2013	0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	0.007	0.003	0.01	0.01	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH024	17/01/2013	<0.005	<0.005	<0.001	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	-	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001
GA11-BH025	17/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Co

Polycyclic Aromatic Hydrocarbons

Well ID	Segments	Aquifer Unit	Tunnel/Station within the aquifer unit?	Date	Benz(a)anthracene	Benzo(a)pyrene	Benzo(a)pyrene (TEQs)	Benzo(a)pyrene TEQ (lower bound)*	Benzo(b)&(j)fluoranthene	Benzo(b+j) & Benzo(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAH (Sum of Common 16 PAHs - Lab Reported)
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					0.001	0.0005	0.0005	0.0005	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.0005
City West Water Discharge Criteria					0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
South East Water Discharge Criteria					0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
GA11-BH001	Segment 01	Late Pleistocene Aquifer	No	9/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	Older Volcanics	No	8/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	Older Volcanics	No	21/02/2012	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH003	Segment 02	Older Volcanics	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Older Volcanics	Yes	21/02/2012	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH007	Segment 05	Werribee Formation	Yes	21/02/2012	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH001	Segment 05	Werribee Formation	Yes	3/07/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH002	Segment 05	Silurian - Deep	No	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Werribee Formation	Yes	6/07/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH008	Segment 06	Early Pleistocene Aquifer	Yes	24/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Early Pleistocene Aquifer	Yes	30/08/2013	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH005	Segment 07	Early Pleistocene Aquifer	Yes	7/08/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH011	Segment 08	Werribee Formation	Yes	23/07/2013	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH013	Segment 08	Silurian - Deep	Yes	23/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Silurian - Deep	Yes	25/07/2013	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH007	Segment 11	Silurian - Shallow	Yes	7/07/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH008	Segment 12	Silurian - Shallow	Yes	31/08/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH009	Segment 12	Silurian - Shallow	Yes	3/08/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH010	Segment 12	Silurian - Shallow	Yes	7/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Silurian - Deep	Yes	15/10/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH012	Segment 13	Silurian - Shallow	yes	27/08/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH018	Segment 14	Silurian - Shallow	Yes	31/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Silurian - Shallow	Yes	8/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Silurian - Shallow	Yes	31/07/2015	<0.002	<0.002	-	<0.002	-	<0.004	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
GA15-BH110	Segment 14	Silurian - Deep	Yes	4/08/2015	<0.002	<0.002	-	<0.002	-	<0.004	-	<0.002	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
GA15-BH110	Segment 14	Silurian - Deep	Yes	2/09/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH110	Segment 14	Silurian - Deep	Yes	7/09/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH112	Segment 14	Silurian - Deep	Yes	28/08/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH017	Segment 16	Moray Street Gravels	No	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	Holocene Alluvium	No	8/07/2013	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH041	Segment 16	Moray Street Gravels	No	23/07/2013	<0.001	<0.0005	-	<0.0005	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH120	Segment 17	Silurian - Shallow	Yes	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Silurian - Shallow	Yes	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Silurian - Deep	Yes	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Silurian - Deep	Yes	19/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Silurian - Shallow	Yes	23/02/2012	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH029	Segment 20	Silurian - Deep	Yes	6/10/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH031	Segment 20	Silurian - Deep	Yes	28/09/2015	<0.001	<0.0005	-	<0.0005	<0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA15-BH033	Segment 20	Silurian - Deep	Yes	7/10/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH026	Segment 20	Silurian - Shallow	No	23/02/2012	<0.001	<0.0005	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH027	Segment 20	Silurian - Shallow	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Silurian - Deep	Yes	18/01/2013	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH023	Segment 22	Silurian - Deep	Yes	17/01/2013	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH024	Segment 22	Silurian - Deep	Yes	17/01/2013	<0.001	<0.0005	<0.0005	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0005
GA11-BH025	Segment 22	Silurian - Deep	Yes	17/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Halogenated Compounds

Well ID	Date	1,1,1,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,2,3-Trichloropropane	1,2-Dibromo-3-chloropropane	1,2-Dibromoethane	1,1-Dichloroethane	1,2-Dichloroethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	trans-1,2-dichloroethene	1,2-Dichloropropane	1,3-Dichloropropane	2,2-Dichloropropane	1,1-Dichloropropene	cis-1,3-Dichloropropene	trans-1,3-dichloropropene	cis-1,4-Dichloro-2-butene	trans-1,4-Dichloro-2-butene	Acrolein	Allyl chloride	Bromochloromethane	Bromodichloromethane	Bromoform	Bromomethane	Carbon disulfide	Carbon tetrachloride	Chlorodibromomethane	Chloroethane	Chloroform	Chloromethane
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.0025	0.001	0.001	0.005	0.005	0.05	0.005	0.005	0.005	0.05	0.005	0.05
City West Water Discharge Criteria		0.001	0.001	3	3	0.001	0.001	0.001	5	5	0.001	0.001	0.001	5	0.001	0.001	5	0.001	0.001	0.001	0.001	0.1	0.001	0.001	1	0.001	0.001	0.001	1	5	0.001	1	0.001
South East Water Discharge Criteria		0.001	0.001	3	3	0.001	0.001	0.001	5	5	0.001	0.001	0.001	5	0.001	0.001	5	0.001	0.001	0.001	0.001	0.1	0.001	0.001	1	0.001	0.001	0.001	1	5	0.001	1	0.001
GA11-BH001	9/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	8/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	21/02/2012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH003	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	21/02/2012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH007	21/02/2012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH001	3/07/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH002	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	6/07/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH008	24/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	30/08/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH005	7/08/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH011	23/07/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH013	23/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	25/07/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH007	7/07/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	0.01	<0.05
GA15-BH008	31/08/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH009	3/08/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH010	7/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	15/10/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH012	27/08/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH018	31/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	8/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	31/07/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0025	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH110	4/08/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0025	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH110	2/09/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH110	7/09/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH112	28/08/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH017	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	8/07/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH041	23/07/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH120	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	19/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	23/02/2012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH029	6/10/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH031	28/09/2015	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA15-BH033	7/10/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH026	23/02/2012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	0.006	<0.05
GA11-BH027	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	18/01/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH023	17/01/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH024	17/01/2013	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-	-	<0.005	<0.005	<0.05	<0.005	<0.005	<0.005	<0.05	<0.005	<0.05
GA11-BH025	17/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Co

Golder Associates

Well ID	Segments	Aquifer Unit	Tunnel/Station within the aquifer unit?	Date	Dibromomethane	Dichlorodifluoromethane	Dichloromethane	Epichlorohydrin	Hexachlorobutadiene	Hexachloroethane	Iodomethane	Pentachloroethane	Trichloroethene	Tetrachloroethene	Trichlorofluoromethane	Vinyl chloride	2-Hexanone	Acetone	Acrylonitrile	Vinyl acetate	1,2,3-Trichlorobenzene	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	2-Chlorotoluene	4-Chlorotoluene	Bromobenzene	Chlorobenzene	Hexachlorobenzene	Pentachlorobenzene	Nitrobenzene	1,3,5-Trinitrobenzene	1,3-Dinitrobenzene	TNT	2,4-Dinitrotoluene	2,6-Dinitrotoluene	2,4-& 2,6-Dinitrotoluene (Isomeric Mixture)	2-Amino-4,6-Dinitrotoluene	4-Amino-2,6-Dinitrotoluene	4-& 2-Amino-Dinitrotoluene (Isomeric Mixture)	2-Nitrotoluene	3-Nitrotoluene	4-Nitrotoluene	HMX	Nitroglycerine	PETN	RDX	Tetryl	2,4,5-Trichlorophenoxy Acetic Acid	2,4,6-Trichlorophenoxy-acetic acid	2,4-D	2,4-Dichlorprop	2,6-D	2-Methyl-4-chlorophenoxyacetic acid	2-Methyl-4-Chlorophenoxy Butanoic Acid	4-(2,4-Dichlorophenoxy) butyric acid (2,4-DB)	4-Chlorophenoxyacetic acid	Clopyralid
																					Chloroaromatics												Explosives																	Herbicides									
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					0.005	0.05	0.005	0.0002	0.002	0.002	0.005	0.005	0.005	0.005	0.05	0.05	0.05	0.05	0.001	0.05	0.005	0.002	0.002	0.002	0.002	0.005	0.005	0.005	0.005	0.000002	0.002	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.2	0.2	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
City West Water Discharge Criteria					0.001	1	0.001	0.3	0.001	1	0.001	0.001	1	1	1	0.5	0.001	50	1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	10	10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
South East Water Discharge Criteria					0.001	1	0.001	0.3	0.001	1	0.001	0.001	1	1	1	0.5	0.001	50	1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	10	10	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
GA11-BH001	Segment 01	Late Pleistocene Aquifer	No	9/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	Older Volcanics	No	8/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	Older Volcanics	No	21/02/2012	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH003	Segment 02	Older Volcanics	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Older Volcanics	Yes	21/02/2012	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH007	Segment 05	Werribee Formation	Yes	21/02/2012	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH001	Segment 05	Werribee Formation	Yes	3/07/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH002	Segment 05	Silurian - Deep	No	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Werribee Formation	Yes	6/07/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH008	Segment 06	Early Pleistocene Aquifer	Yes	24/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Early Pleistocene Aquifer	Yes	30/08/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH005	Segment 07	Early Pleistocene Aquifer	Yes	7/08/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH011	Segment 08	Werribee Formation	Yes	23/07/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH013	Segment 08	Silurian - Deep	Yes	23/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Silurian - Deep	Yes	25/07/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	0.012	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH007	Segment 11	Silurian - Shallow	Yes	7/07/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH008	Segment 12	Silurian - Shallow	Yes	31/08/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH009	Segment 12	Silurian - Shallow	Yes	3/08/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH010	Segment 12	Silurian - Shallow	Yes	7/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Silurian - Deep	Yes	15/10/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH012	Segment 13	Silurian - Shallow	yes	27/08/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH018	Segment 14	Silurian - Shallow	Yes	31/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Silurian - Shallow	Yes	8/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Silurian - Shallow	Yes	31/07/2015	<0.005	<0.05	<0.005	<0.0002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.05	<0.001	<0.05	<0.005	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.002	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.2	<0.2	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
GA15-BH110	Segment 14	Silurian - Deep	Yes	4/08/2015	<0.005	<0.05	<0.005	<0.0002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	<0.05	<0.001	<0.05	<0.005	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.0005	<0.002	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.2	<0.2	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
GA15-BH110	Segment 14	Silurian - Deep	Yes	2/09/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH110	Segment 14	Silurian - Deep	Yes	7/09/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH112	Segment 14	Silurian - Deep	Yes	28/08/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH017	Segment 16	Moray Street Gravels	No	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	Holocene Alluvium	No	8/07/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH041	Segment 16	Moray Street Gravels	No	23/07/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH120	Segment 17	Silurian - Shallow	Yes	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Silurian - Shallow	Yes	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Silurian - Deep	Yes	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Silurian - Deep	Yes	19/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Silurian - Shallow	Yes	23/02/2012	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH029	Segment 20	Silurian - Deep	Yes	6/10/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH031	Segment 20	Silurian - Deep	Yes	28/09/2015	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH033	Segment 20	Silurian - Deep	Yes	7/10/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH026	Segment 20	Silurian - Shallow	No	23/02/2012	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH027	Segment 20	Silurian - Shallow	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Silurian - Deep	Yes	18/01/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH023	Segment 22	Silurian - Deep	Yes	17/01/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH024	Segment 22	Silurian - Deep	Yes	17/01/2013	<0.005	<0.05	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.05	<0.05	<0.05	-	-	<0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH025	Segment 22	Silurian - Deep	Yes	17/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Co

Well ID	Segments	Aquifer Unit	Tunnel/Station within the aquifer unit?	Date	Dicamba	Dinoseb	Fenoprop	Fluroxypyr	Glyphosate	Mecoprop	Picloram	Triclopyr	Trifluralin	PCB (Sum of Total-Lab Reported)	a-BHC	Aldrin	Aldrin & Dieldrin (Sum of total) (Lab Reported)	b-BHC	Chlordane (Sum of total)	cis-Chlordane	trans-Chlordane	d-BHC	DDD	DDE	DDT	DDT+DDE+DDD (Sum of total) (Lab Reported)	Dieldrin	Endosulfan	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone	g-BHC	Heptachlor	Heptachlor epoxide	Methoxychlor
					s										Pesticides																							
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL					0.01	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.001	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000002	0.000001	0.000002	0.000002
City West Water Discharge Criteria					0.001	0.001	0.001	0.001	10	0.001	0.001	0.001	10	0.002	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001
South East Water Discharge Criteria					0.001	0.001	0.001	0.001	10	0.001	0.001	0.001	10	0.002	0.001	0.001	0.001	0.001	0.006	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.001	0.001
GA11-BH001	Segment 01	Late Pleistocene Aquifer	No	9/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH031	Segment 01	Older Volcanics	No	8/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH002	Segment 02	Older Volcanics	No	21/02/2012	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH003	Segment 02	Older Volcanics	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH005	Segment 03	Older Volcanics	Yes	21/02/2012	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH007	Segment 05	Werribee Formation	Yes	21/02/2012	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH001	Segment 05	Werribee Formation	Yes	3/07/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH002	Segment 05	Silurian - Deep	No	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH003	Segment 05	Werribee Formation	Yes	6/07/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH008	Segment 06	Early Pleistocene Aquifer	Yes	24/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH009	Segment 06	Early Pleistocene Aquifer	Yes	30/08/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH005	Segment 07	Early Pleistocene Aquifer	Yes	7/08/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH011	Segment 08	Werribee Formation	Yes	23/07/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH013	Segment 08	Silurian - Deep	Yes	23/07/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH014	Segment 11	Silurian - Deep	Yes	25/07/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH007	Segment 11	Silurian - Shallow	Yes	7/07/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH008	Segment 12	Silurian - Shallow	Yes	31/08/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH009	Segment 12	Silurian - Shallow	Yes	3/08/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH010	Segment 12	Silurian - Shallow	Yes	7/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH011	Segment 12	Silurian - Deep	Yes	15/10/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH012	Segment 13	Silurian - Shallow	yes	27/08/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH018	Segment 14	Silurian - Shallow	Yes	31/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH019	Segment 14	Silurian - Shallow	Yes	8/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH021	Segment 14	Silurian - Shallow	Yes	31/07/2015	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH110	Segment 14	Silurian - Deep	Yes	4/08/2015	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH110	Segment 14	Silurian - Deep	Yes	2/09/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH110	Segment 14	Silurian - Deep	Yes	7/09/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH112	Segment 14	Silurian - Deep	Yes	28/08/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH017	Segment 16	Moray Street Gravels	No	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH018	Segment 16	Holocene Alluvium	No	8/07/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH041	Segment 16	Moray Street Gravels	No	23/07/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH120	Segment 17	Silurian - Shallow	Yes	6/07/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH121	Segment 17	Silurian - Shallow	Yes	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH027	Segment 18	Silurian - Deep	Yes	20/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA15-BH028	Segment 18	Silurian - Deep	Yes	19/08/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH019	Segment 20	Silurian - Shallow	Yes	23/02/2012	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH029	Segment 20	Silurian - Deep	Yes	6/10/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH031	Segment 20	Silurian - Deep	Yes	28/09/2015	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA15-BH033	Segment 20	Silurian - Deep	Yes	7/10/2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH026	Segment 20	Silurian - Shallow	No	23/02/2012	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH027	Segment 20	Silurian - Shallow	Yes	22/02/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH020	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH021	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GA11-BH022	Segment 21	Silurian - Deep	Yes	18/01/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH023	Segment 22	Silurian - Deep	Yes	17/01/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH024	Segment 22	Silurian - Deep	Yes	17/01/2013	-	-	-	-	-	-	-	-	-	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002
GA11-BH025	Segment 22	Silurian - Deep	Yes	17/01/2013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note 1. Methyl Ethyl Ketone has been removed from the chemistry output table. Refer to the Quality Assurance and Quality Co

APPENDIX G

Limitations

IMPORTANT INFORMATION RELATING TO THIS REPORT

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

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Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

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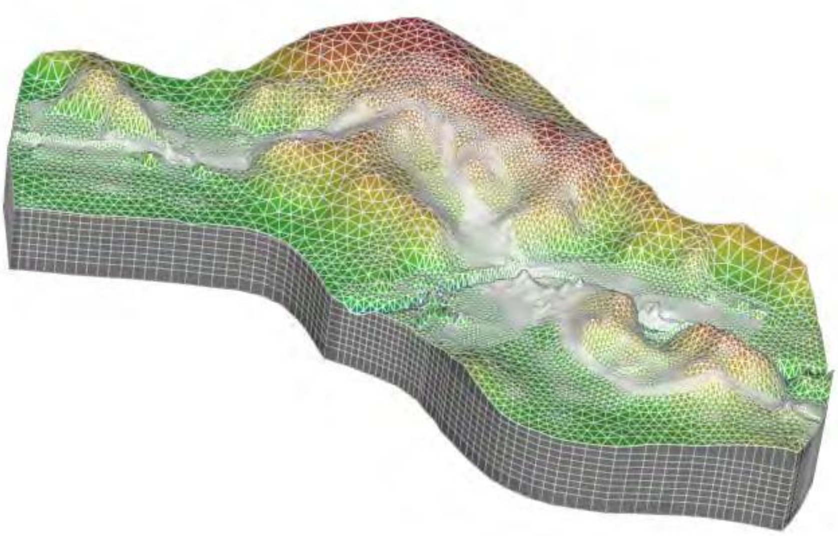
Appendix H Golder Associates Pty Ltd. Melbourne Metro Rail Project Concept Design – Regional Groundwater Numerical Modelling – EES Summary Report

14 April 2016

MELBOURNE METRO RAIL PROJECT

REGIONAL GROUNDWATER NUMERICAL MODELLING - EES SUMMARY REPORT

Submitted to:
AJM Joint Venture
121 Exhibition Street
Melbourne, Vic, 3000



Report Number. 1525532-221-R-Rev1

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REPORT

Glossary of Abbreviations, Nomenclature and Technical Terms

AHD	Australian Height Datum
bgl	Below Ground Level
CBD	Central Business District
3D	Three – Dimensional
D-Wall	Diaphragm Wall
EES	Environment Effects Statement
FEFLOW	Finite Element Numerical Modelling Code
K	Hydraulic Conductivity
Kx	Horizontal Hydraulic Conductivity in x-direction
Ky	Horizontal Hydraulic Conductivity in y-direction
Kz	Vertical Hydraulic Conductivity
Melbourne Metro	The Melbourne Metro Rail Project
MURL	Melbourne Underground Rail Loop (City Loop)
TBM	Tunnel Boring Machine
TDS	Total Dissolved Solids

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1.0 INTRODUCTION

1.1 Overview

Aurecon Jacobs Mott Macdonald Joint Venture (AJM JV) has engaged Golder Associates Pty Ltd (Golder) to provide hydrogeological services for the proposed Melbourne Metro Rail Project (Melbourne Metro). The services provided by Golder in 2015 and 2016 are to support the development of the Environment Effects Statement (EES) for the Melbourne Metro 'Concept Design'.

The Melbourne Metro Concept Design comprises approximately 9 km of rail tunnels running from Kensington to South Yarra, including five new stations. The proposed alignment would connect into the existing rail network near South Kensington Station, run beneath North Melbourne and Parkville, then continue south beneath Swanston Street, under the Yarra River, east of and beneath St Kilda Road, then east beneath Toorak Road and Fawkner Park. Melbourne Metro connects to the existing rail network, Caulfield Line, at South Yarra.

This EES summary report describes the regional numerical groundwater modelling which has been undertaken based on the Melbourne Metro Concept Design. This report should be read in conjunction with the Interpreted Geological Setting and Interpreted Hydrogeological Setting EES summary reports, which describe the geological and hydrogeological setting that formed the basis for the modelling.

The relationship of this report to the other EES specialist reports is summarised in Table 1.

Table 1: Relationships between EES Specialist Reports and the supporting Golder EES Summary Reports

		EES Specialist Reports			
		Ground movement and Land Stability	Future Development Loading	Groundwater	Contaminated Land and Spoil Management
Golder EES Summary Report	Ground Movement Assessment	■			
	Interpreted Geological Setting	■	■	■	■
	Interpreted Hydrogeological Setting			■	■
	Regional Groundwater Numerical Modelling			■	
	Contaminated Land Assessment			■	■

1.2 Background

Between 2011 and 2013, Golder was engaged by Public Transport Victoria (PTV) to support development of the business case for the Melbourne Metro. As a part of this stage of work a regional groundwater numerical model (Version 0) was developed by Golder. The model was required to assist with evaluation of potential risks associated with construction and operation of the tunnels and stations. This model was subsequently updated once the site investigation work for the business case was completed (Version 1). The updated, Version 1 Regional Model was then predominantly utilised to evaluate potential risks associated with rail tunnel impacts during operational phase. At the start of Melbourne Metro Concept Design, Golder also completed further numerical modelling utilising the Version 1 Regional Model to support development of the initial design concept. The Version 1 Regional model was then updated to reflect the concept design option which has been adopted for the EES. The updated model is referred to as the Version 2 model, the results of which, are summarized in this report. Construction methodologies, sequences and timing for all of the Version 2 model transient runs were provided by MMRA. The Version 2 model was also updated and re-calibrated based on the site investigation results obtained up to September 2015.

1.3 Limitations

Your attention is drawn to the document – “Limitations”, which is included in APPENDIX B of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

2.0 PROJECT DESCRIPTION

Melbourne Metro Concept Design comprises twin rail tunnels approximately 9 km in length between South Kensington in the west and South Yarra in the east. The proposed alignment would connect into the existing rail network at South Kensington station, run beneath North Melbourne and Parkville, then continue south beneath Swanston Street, under the Yarra River, south of and beneath St Kilda Road, then east beneath Toorak Road and Fawkner Park. Melbourne Metro connects to the existing rail network, Caulfield Line, at South Yarra.

For the purpose of this report the broad corridor around the proposed Melbourne Metro alignment between South Kensington station in Kensington and Toorak Road in South Yarra is referred to as the “study area”. This incorporates the project area, which has been defined by the project boundaries in the EES. The location of the proposed Melbourne Metro alignment, rail stations and the general study area are shown in Drawing 1.

3.0 OBJECTIVES AND SCOPE OF VERSION 2 NUMERICAL MODEL

The overall objective of the numerical modelling work was to develop a three-dimensional regional groundwater model that can be used to evaluate potential groundwater risks, which may be associated with the construction and operation of the project. Because of the scale of the project, it was also important to design the model in such a way that it could be used for evaluating risks both to individual project elements, as well as the overall scheme. Furthermore, the model needed to be flexible enough to incorporate results from various phases of investigation and minor variations in the rail tunnels and stations alignment without having to be rebuilt. The objectives of the Version 2 modelling work were to estimate:

- Construction inflows to stations, portals and the mined tunnel between CBD North and CBD South Stations;
- Groundwater drawdown associated with construction of the stations, portals and mined tunnels between CBD North and CBD South stations; and
- Groundwater drawdown associated with post-construction impacts of Melbourne Metro on the groundwater levels assuming different scenarios with respect to tunnel and station sealing.

This work included completion of the following set of predictive scenarios:

- Transient predictive runs simulating the groundwater inflow and drawdowns associated with construction of Arden, CBD North and CBD South stations. The CBD North station scenario included simulation of the mined tunnel construction between the CBD North and CBD South station. The Arden station scenario included simulation of diaphragm walls around the station footprint, with toe grouting extending 10 m beneath the walls
- Transient predictive runs simulating the groundwater inflow and drawdowns associated construction of the western portal which included the decline, cut and cover tunnel and TBM retrieval shaft. The modelled scenario included the use of secant pile walls for the structures, with toe grouting extending 5 m beneath the walls.
- Post-construction steady state scenarios simulating all tunnels and stations as a single structure. Two scenarios were completed with respect to waterproofing class of the rail tunnels.

No additional simulations of Domain station construction were undertaken in the Version 2 Regional model, as the design changes between the Version 1 and Version 2 models were considered to be relatively minor from a groundwater modelling perspective. The estimated groundwater inflows and drawdowns in this report for Domain station are therefore based on the Version 1 Regional model predictions.

4.0 REGIONAL GEOLOGICAL AND HYDROGEOLOGICAL SETTING

4.1 Main geological units

The regional geology, geological history and regional structures of the broad study area are presented in the Interpreted Geological Setting EES Summary Report. A summary of the stratigraphic units expected to be encountered along the Melbourne Metro Concept Design alignment is provided in Table 2 and a geological plan of the study area is provided in Drawing 2.

Table 2: Main Stratigraphic Units

Geological Period	Geological Epoch	Stratigraphic Unit	Description
Quaternary	Holocene	Coode Island Silt (Q_{hi})	Soft clayey sediments with shells and organic materials, and lenses or thin layers of sandy materials
		Holocene Alluvium (Q_{ha})[1]	Fine to medium grained alluvial sands
	Pleistocene	Jolimont Clay (Q_{pj})	Marine clay with minor silts and sands
		Newer Volcanics (Q_{vn}) (Burnley Basalt Flow)	Olivine basalt, variably weathered and fractured
		Pleistocene Alluvium (Q_{pa})	Alluvial sediments typically comprising clay, silt and sand. The proportion of each of these materials is variable, with firm to stiff silty or sandy clay being dominant material.
		Fishermens Bend Silt (Q_{pf})	Marine sediments with high contribution of continental origin materials along former shallow embayment. Clay, silt with sand size particles and occasionally sand lenses and interlayers. Proportion of sand is higher towards the base of the unit (lower Fishermens Bend Silt sub-unit, Q_{pfl}) and along former shallow embayment. Finer material encountered typically towards the top representative of deep sea depositional environment (upper Fishermens Bend Silt sub-unit, Q_{pfu}).
		Moray Street Gravels (Q_{pg})	Alluvial sediments, medium to coarse grained quartz sands with minor gravels, clay and silt.
		Fluvial Sediments (Q_{pc}) – Early Pleistocene Colluvial and Alluvial Sediments	Colluvial and alluvial sediments comprising medium to coarse sands, gravels and clays with coarse boulder and cobble typically of basalt material.
		Newer Volcanics (Q_{nvs}) – Swan Street Basalt	Olivine basalt variably weathered and fractured. Typically referred to as lower Newer Volcanics.
		Punt Road Sands (Q_{pp})	Colluvial and alluvial sediments comprising boulders and gravels of siltstone, and river gravels and sands.
Neogene	Pliocene	Brighton Group (T_{pb})	Sand, sandy clay, clayey sand, silt, clay and occasionally gravel.
Paleogene	Oligocene to Miocene	Older Volcanics (T_{vo})	Olivine and pyroxene basalt with abundant volcanic glass, variably weathered and fractured.
		Werribee Formation (T_{ew})	Fluvial quartz sand, minor gravels, silty clays and clays.
Devonian		Igneous rock (D_{gr})	Granodiorite and quartz porphyries, feldspar porphyries and lamprophyres dykes.
Silurian		Melbourne Formation (S_{ud})	Interbedded siltstone and sandstone, folded, fractured and variably weathered.

[1] In Geology of Victoria (Birch, 2003) a formal name of Batman Avenue Gravels was suggested for Holocene Alluvium. We kept the old terminology herein as the term "Alluvium" describes better the depositional environment of the unit.

4.2 Main Hydrostratigraphic Units

Stratigraphic units that are expected to be encountered along the alignment of the proposed Melbourne Metro were deposited/formed under variable conditions, which resulted in significant variability of materials contained within each unit. Consequently, hydrogeological characteristics of the units or parts of a unit, and their roles in groundwater flow system are often complex and highly variable. A summary of hydrogeological characteristics of main stratigraphic unit and their roles in the groundwater flow system, as inferred from field observations and testing, is provided in Table 3. Further details on the interpreted hydrogeological setting along the project corridor are provided in the Interpreted Hydrogeological Setting EES Summary Report.

Table 3: Hydrotratigraphic Units and Their Role in Groundwater Flow System

Stratigraphic Unit	Hydrogeological Classification	Main Occurrence
Coode Island Silt (Q_{hi})	Aquitard, porous medium, due to presence of sand layers and lenses, horizontal hydraulic conductivity (K_h) greater than vertical (K_v).	South Melbourne, Docklands, Moonee Pond Creek Valley Holocene Alluvium Valley
Holocene Alluvium (Q_{ha})	Aquifer, confined, porous medium, high yielding.	Holocene Alluvium Valley
Jolimont Clay (Q_{pj})	Aquitard, porous medium	Localised occurrence within Jolimont Valley (Richmond, southern parts of CBD and northern parts of South Melbourne)
Newer Volcanics (Q_{vn}) – Burnley Basalt Flow	Aquifer, unconfined to semi-confined, fractured rock medium, low (where weathered) to high hydraulic conductivity (where fractured).	Jolimont Valley (Richmond, southern parts of CBD and northern parts of South Melbourne)
Pleistocene Alluvium (Q_{pa})	Aquifer where sandy, confined, porous media, potentially low to medium hydraulic conductivity and yield (limited data available) Potentially leaky aquitard where fine materials dominate unit profile.	Maribyrnong River Valley, Mooney Ponds Creek Valley
Fishermens Bend Silt clayey upper horizons – (Q_{pfu})	Aquitard (both upper and lower sub-units), porous medium, due to fissuring vertical hydraulic conductivity may be greater than horizontal	Jolimont Valley, South Melbourne, Docklands area
Fishermens Bend Silt sandy lower horizons and former shallow sea embayment areas – (Q_{pfl})	Aquifer, confined, porous medium, medium to high hydraulic conductivity, potentially medium to high yielding when in direct connection with other high yielding aquifers.	Arden Station, Jolimont Valley
Moray Street Gravels (Q_{pg})	Aquifer, confined, porous medium, high yielding	Jolimont Valley, South Melbourne
Fluvial Sediments (Q_{pc})	Aquifer, confined, porous media, potentially high yielding (limited data available)	Broader Moonee Ponds Creek valley, Docklands, Jolimont Valley
Newer Volcanics (Q_{vns}) – Lower Basalt Flow	Aquifer of a localised extent and low significance due to discontinuity of the unit. Confined, fractured rock medium to low hydraulic conductivity.	Jolimont Valley, South Melbourne
Punt Road Sands (Q_{pp})	Aquifer, confined, porous medium, potentially of a high hydraulic conductivity but of a low yield and significance due to limited extent and thickness.	Jolimont Valley only
Brighton Group (T_{bb})	Aquifer, unconfined, porous medium, medium yielding aquifer where sandy but aquitard where clayey.	Botanical Gardens, western CBD fringes
Older Volcanics (T_{vo})	Aquifer, confined, fractured rock medium, low (where weathered) to high hydraulic conductivity (where fractured).	South Melbourne, western CBD fringes, Port Melbourne and Kensington
Werribee Formation (T_{ew})	Aquifer, confined porous medium, zones of potentially high yielding sub-aquifer(s) (lower zone).	South Melbourne, Docklands, Port Melbourne and Kensington

Stratigraphic Unit	Hydrogeological Classification	Main Occurrence
Melbourne Formation (S_{ud})	Aquifer, unconfined to semi-confined, fractured rock medium.	Bedrock

By definition, hydrostratigraphic units are hydraulically continuous, scale independent and mappable units that can be defined on the basis of their hydraulic properties. A hydrostratigraphic unit may include a formation, part of formation or a group of formations.

Some of the stratigraphic units that are inferred to have a similar role in the groundwater flow system, such as Morray Street Gravels and early Pleistocene Fluvial sediments, are indicated to be vertically continuous and potential acting as a single entity with respect to groundwater flow, i.e. a single hydraulic entity. In contrast, significant vertical and horizontal variation has been indicated within some units such as Fishermens Bend Silt. This suggests that different parts of a single unit may have a different role in the groundwater system, i.e., parts of stratigraphic unit being different hydraulic entity. Delineation of the main hydrostratigraphic units within a study area, therefore, has been a key element for understanding of the groundwater flow system.

The key hydrostratigraphic units of relevance to potential impacts of Melbourne Metro on the groundwater system are listed in Table 4:

Table 4: Key Hydrostratigraphic Units of Relevance

Hydrostratigrapic Name	Stratigraphic Units	Comment
Aquifers		
Silurian Aquifer	Melbourne Formation (S_{ud})	Basement aquifer, low to medium yielding
Werribee Formation Aquifer	Werribee Formation (T_{ew})	Medium to high yielding aquifer
Older Volcanics Aquifer	Older Volcanics (T_{vo})	Medium yielding aquifer
Moray Street Gravels Aquifer	Fluvial Sediments (Q_{pc}), Moray Street Gravels (Q_{pg}), lower horizons of lower Fishermens Bend Silt sub-unit (Q_{pfl})	High yielding aquifer
Early Pleistocene Aquifer	Fluvial Sediments (Q_{pc}), upper Fishermens Bend Silt (Q_{pfu}) deposited within shallow sea embayment	Medium to highly yielding aquifer
Late Pleistocene Aquifer	Pleistocene Alluvium (Q_{pa})	Medium yielding aquifer
Holocene Aquifer	Holocene Aluvium (Q_{ha})	High yielding aquifer
Basalt Aquifer	Newer Volcanics (Q_{vn}) – Burnley Basalt Flow	Medium yielding aquifer
Aquitards		
Fishermens Bend Silt	Upper Fishermens Bend Silt clayey horizons (Q_{pfu})	
Coode Island Silt	Coode Island Silt (Q_{hi})	

In addition to the main geological units, Quaternary age fluvial and colluvial sediments occur within the study area. These units are generally of a limited lateral and/or vertical extent. They comprise materials of highly variable composition ranging from fine grained materials (clays and silts) to very coarse materials (boulders and cobbles).

4.3 3D Geological Model of Study Area

A 3D geological model was developed based on review of the site investigation data obtained for the project up to September 2015 and Golder Associates knowledge of the geological conditions in the broader study area based on our work on past projects.

The Silurian age sediments of the Melbourne Formation form the bedrock for the younger formations. Within the study area the bedrock sediments are exposed in the hilly areas of the CBD and Botanic Gardens. Iso-contours of the Silurian palaeo-topography (i.e., where covered by younger units) are shown in Drawing 3 and a 3D view of the Silurian rock surface including the current and palaeo-topography is shown in Figure 1. The Silurian bedrock has been shaped by tectonic and erosion processes through geological time. The main events that had the most prominent effect on the basement topography were associated with formation of:

- Port Phillip Sedimentary Basin during the early Paleogene period
- Jolimont Valley during the early Quaternary period (early Pleistocene)
- “Holocene Sands” valley during the late Quaternary (late Pleistocene).

The Port Phillip Sedimentary Basin occupied the western portion of the study area (area shown in deep green colour in Figure 1). The basin covered current suburbs of Kensington, Docklands and parts of North and South Melbourne.

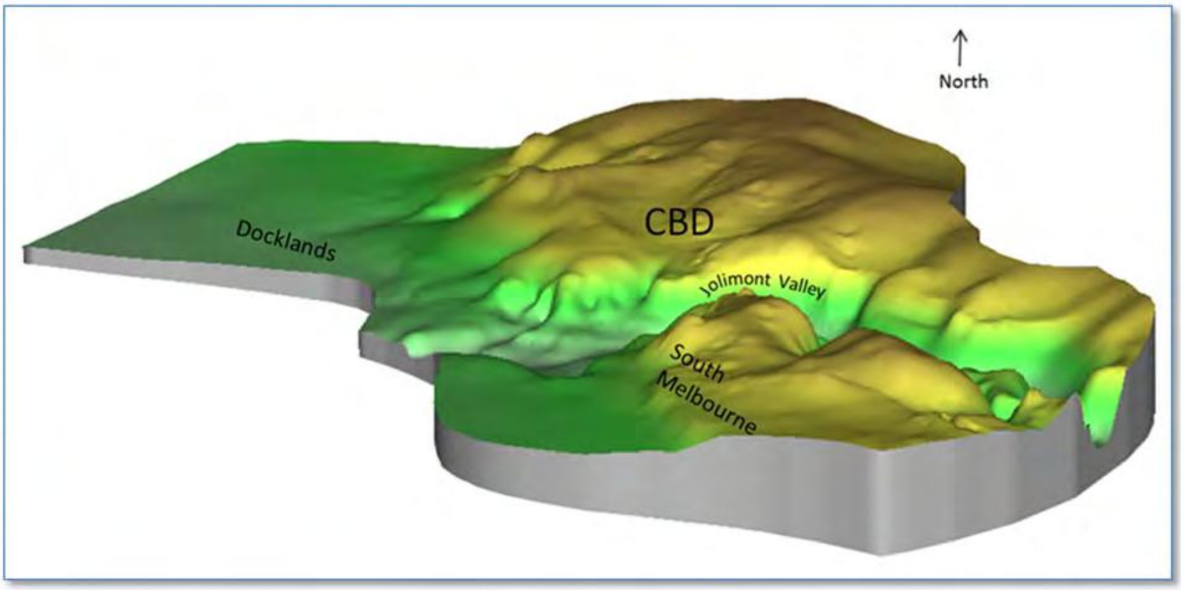


Figure 1: Silurian Basement 3D Surface

Elevations of the Silurian bedrock within this basin range from about RL -5 m AHD close to the north east of the study area, to RL -35 m AHD close to the south west boundary of the study area. During the Paleogene to Neogene period, the basin was infilled with the Werribee Formation and Brighton Group sediments and Older Volcanics basalt lava flow.

Following filling of the Port Phillip Sedimentary Basin and lowering of the global sea level in the early Pleistocene (Quaternary period), the ancestral course of the Yarra River carved the Jolimont Valley deeply into the Silurian bedrock (Figure 1). Concurrent with the Jolimont Valley development, the ancestral course of the Moonee Ponds Creek carved a valley into the Werribee Formation sediments within the former Port Phillip Sedimentary Basin. This valley was not sufficiently deep to cut through a thick sequence of the Werribee Formation sediments into the bedrock.

The Pleistocene valleys sloped relatively gently towards the sea. The base of the Jolimont Valley ranged from an elevation of about RL -36 m AHD at the western end (South Melbourne), where the valley carved deeply through the Werribee Formation sediments into the bedrock, to about RL -29 m AHD at the eastern end of the study area (Burnley). The base of the north-south trending Moonee Ponds Creek Valley ranged from about RL -30 m AHD at the south western boundary (Docklands area) to about RL -10 m AHD at the north edge of the study area (Kensington/North Melbourne). The historical evolution of the Jolimont Valley was discussed in a number of publications and reports associated with the CityLink project. A summary of this evolution is presented in the Interpreted Geological Setting EES Summary Report. The evolution of the Moonee Ponds creek is similar to that of the Jolimont Valley, as both the ancestral Yarra River (Jolimont Valley) and Moonee Ponds Creek were part of the same river system.

The Jolimont Valley, initially, was a narrow valley, which through cycles of fluvial erosion and sea flooding had been shaped and reshaped, and infilled by sequences of fluvial, marine, swamp and volcanic units. As discussed in the Interpreted Geological Setting EES Summary Report, the Lower Newer Volcanics basalt flow covered and preserved the early fluvial sediments at the base of the valley. Subsequently the Jolimont Valley was deepened and widened, with the new valley carving down at the edge of the basalt into the bedrock. The rock of the lower basalt unit was eroded and smoothed off into disconnected rounded hilly outcrops (palaeo-hills). The sea level rise that followed resulted in the rivers being depositional rather than erosive and deposition of gravelly, sandy and occasional clayey sediments occurred within the river valleys (Moray Street Gravels). The iso-contours of the base of the Moray Street Gravel sediments within the Jolimont Valley are shown in Drawing 4 along with outlines of the Lower Newer Volcanics basalt palaeo-hills. The 3D view of this valley is shown in Figure 2. It should be noted that in the absence of the Lower Newer Volcanics basalt it is difficult to distinguish the early fluvial sediments from the Moray Street Gravels and therefore, in some areas, the iso-contours presented in Drawing 4 are a reflection of both units combined.

Deposition of the alluvial sediments was interrupted by sea transgression during the mid-Pleistocene, which resulted in deposition of marine clayey and silty sediments (Fishermens Bend Silt) over a broad area, including the inland Jolimont and Moonee Ponds Creek valleys. The sea floor is indicated to have sloped gently towards the west within the Jolimont Valley and southwards within the Moonee Ponds Creek valley. The base of the Fishermens Bend Silt (i.e., top of Moray Street Gravels) within the Jolimont Valley ranges from about RL -20 m AHD within the area of South Melbourne to about RL -17 m AHD within Richmond and Burnley area (east of St Kilda Road). The sea level at this time was lower than the present sea level and typically the Fishermens Bend Silt sediments do not occur above RL -5 m AHD.

Following regression of the sea, the Fishermens Bend Silt was exposed to erosion and new river channels were carved into these deposits (soft clayey material). A deep and narrow channel was carved within the Jolimont Valley. The Fishermens Bend Silt is indicated to be fully eroded within this channel with parts of the valley cut straight into the underlying Moray Street Gravels. Volcanic eruptions to the north of Melbourne caused lava (Upper Newer Volcanics) to flow down the Jolimont Valley covering the valley and infilling the deep channel within. The outlines of the Upper Newer Volcanics basalt unit (Burnley Basalt Flow) and inferred position of the deep channel are shown in Drawing 5. The base of basalt elevations are typically between about RL -8 m AHD and RL -4 m AHD with the elevation within the deep channel from about RL -19 m AHD to RL -17 m AHD. Volcanic eruptions did not affect the environment within the Moonee Ponds Creek valley and deposition of the alluvial sediments continued uninterrupted through this period.

Sea rises led to deposition of marine Jolimont Clays and falls led to strengthening and erosion of the unit. Consequently the unit is typically encountered within isolated areas of limited extent. During the last Ice age (late Pleistocene) the sea level dropped significantly, resulting in development of a deep valley by the ancestral Yarra River to the south of Jolimont Valley, which by that time was covered by hard basalt rock. The new valley was carved at the southern edge of the Burnley Basalt Flow into the softer Silurian age sediments. The valley has been referred to as the Holocene Aquifer (HA) valley in this report, as it contains highly permeable Holocene alluvial sands. The base of the valley elevations ranged between about RL -26 m AHD west of St Kilda Road (Drawing 3) to about RL -16 m AHD at the eastern edge of the study area (Cremorne Railway Bridge). The location of the valley at and east of the Yarra River Crossing is shown in a 3D view in Figure 2.

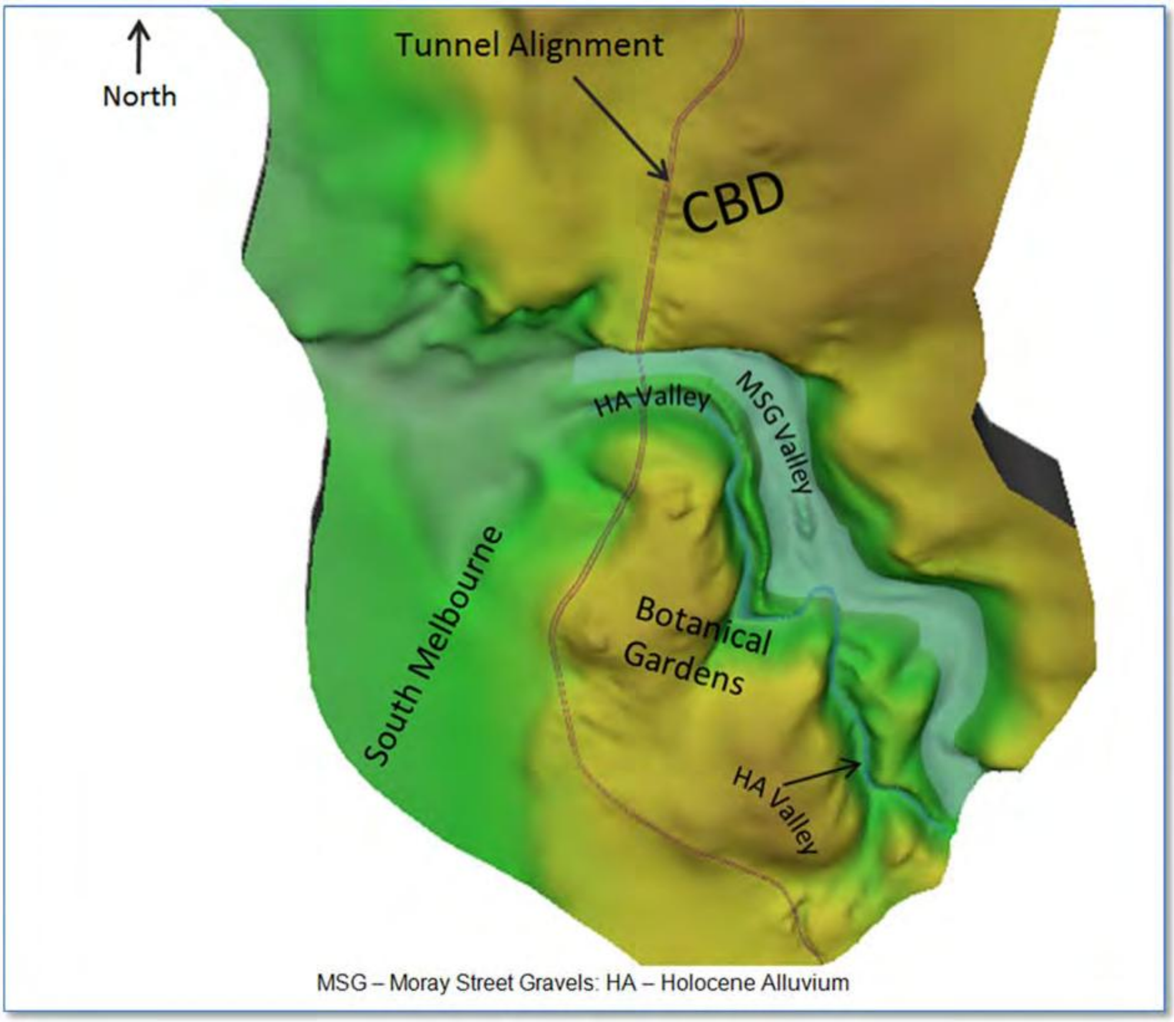


Figure 2: 3D View of Jolimont and Holocene Valleys

The Holocene Valley carved deeply into Silurian bedrock at and east of the Yarra River Crossing. The Moray Street Gravels aquifer and Holocene aquifer in these valley systems are generally separated by a ridge of Silurian rock within this area. The ridge, however, is absent in an area just north of Morell Bridge and about 300 m northwest of the Swan Street Bridge (Drawing 3). West of the Yarra River Crossing the valley carved through the Fishermens Bend Silt sediments into the Moray Street Gravels. Due to similar lithology it is often difficult to distinguish the Holocene Sands from the Moray Street Gravels within this area. The top of the unit elevations range from about RL -22 m AHD in South Melbourne area to about RL -14 m AHD at the eastern boundary of the study area (Cremorne Rail Bridge).

Due to sea rise that followed the late Pleistocene, river valleys were flooded and fine clayey material was deposited (Coode Island Silt). The iso-contours of the base of the Coode Island Silt are shown in Drawing 6.The sediments are the thickest within the deeper parts of the former Holocene Valley and former Moonee Ponds Creek Valley where they are typically between 15 m and 20 m thick. The Coode Island Silt sediments have never been drained through geological history and therefore remain normally to slightly over consolidated.

The geological plan of the study area (Drawing 2) indicates that the Coode Island Silt occurs in the area around Albert Park Lake. Review of the geological data from drilling investigations undertaken by Golder in this area indicates that Coode Island Silt is not present around the lake, but is likely to be present to the north in the South Melbourne Embayment.

The vertical relationship between the geological units is illustrated in a simplified geological cross section across the Jolimont Valley in Figure 3.

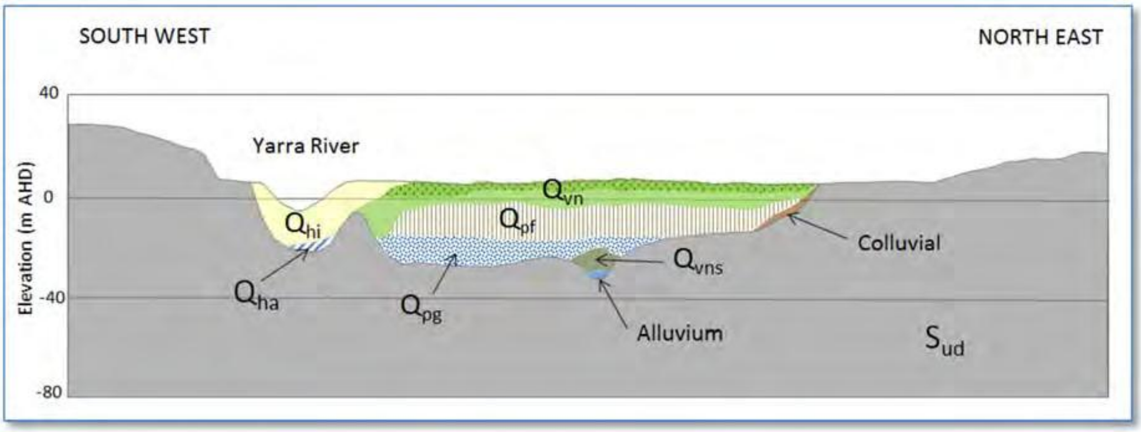


Figure 3: Simplified Geological Section Across Jolimont Valley Looking Down River

4.4 Characteristics of Hydrostratigraphic Units

4.4.1 Hydraulic Properties

Based on published literature and Golder's past project experience, typical hydraulic characteristics of the main hydrostratigraphic units within the broader extent of the study area are summarised in Table 5.

Table 5: Main Hydrostratigraphic Units and Their Characteristics

Geological Unit	Typical Hydraulic Conductivity Ranges
Coode Island Silt	K_h – 10^{-8} m/s to 10^{-7} m/s K_v – 10^{-9} m/s to 10^{-8} m/s
Holocene Aluvium	K – 10^{-5} m/s to 5 x 10^{-4} m/s
Jolimont Clay	K – 10^{-9} m/s to 10^{-8} m/s
Newer Volcanics	K – 10^{-7} m/s to 10^{-4} m/s
Fishermens Bend Silt	K_h – 10^{-9} m/s to 10^{-8} m/s K_v – 10^{-8} m/s
Moray Street Gravels	K – 10^{-5} m/s to 5 x 10^{-4} m/s
Early Pleistocene sediments	K – 10^{-5} m/s to 5 x 10^{-4} m/s
Brighton Group	K – 10^{-7} m/s to 5 x 10^{-6} m/s
Older Volcanics	K – 10^{-7} m/s to 10^{-5} m/s
Werribee Formation	K – 10^{-8} m/s to 10^{-5} m/s
Igneous rock	K – 10^{-9} m/s to 5 x 10^{-8} m/s
Melbourne Formation	K – 10^{-7} m/s to 10^{-5} m/s

For the purpose of characterisation of the main hydrostratigraphic unit's hydraulic properties, hydraulic testing was carried out at a number of locations. This included Lugeon testing in open boreholes, single bore aquifer tests (slug tests) in groundwater wells and a pumping test at St Paul's Cathedral car park.

A summary of hydraulic conductivity ranges calculated based on the results obtained from hydraulic tests undertaken within the Silurian rock are summarised in Table 6, along with testing interval depths (below ground surface) and log-averages. A summary of hydraulic conductivity ranges based on hydraulic testing undertaken in other aquifers is provided in Table 7.

Table 6: Summary of Silurian Aquifer Testing Results

Test interval	Number of Data Points	Hydraulic Conductivity (m/s)				
From – to (mbgl)		Minimum	Maximum	Geometric Mean	Arithmetic Mean	Median
Lugeon Testing Results[2]						
10-20	18	*1.0×10^{-10}*	7.2×10^{-7}	2.8×10^{-8}	1.3×10^{-7}	5.0×10^{-8}
20-30	50	*1.0×10^{-10}*	5.3×10^{-6}	2.5×10^{-8}	4.2×10^{-7}	5.0×10^{-8}
30-40	30	*1.0×10^{-10}*	5.5×10^{-6}	1.1×10^{-7}	7.8×10^{-7}	2.4×10^{-7}
40-50	14	1.0×10^{-8}	6.9×10^{-6}	2.9×10^{-7}	9.4×10^{-7}	2.8×10^{-7}
10-50	**112**	**1.0×10^{-10}**	**6.9×10^{-6}**	**5.2×10^{-8}**	**5.3×10^{-7}**	**9.0×10^{-8}**
Slug Tests Results						
10-20	10	5.0×10^{-9}	2.8×10^{-6}	6.7×10^{-8}	3.9×10^{-7}	4.0×10^{-8}
20-30	14	1.7×10^{-10}	2.2×10^{-5}	1.4×10^{-7}	2.5×10^{-6}	2.2×10^{-7}
30-40	3	4.0×10^{-7}	3.5×10^{-6}	2.2×10^{-7}	1.7×10^{-6}	1.6×10^{-6}
10-40	**27**	**1.7×10^{-10}**	**2.2×10^{-5}**	**1.4×10^{-7}**	**1.6×10^{-6}**	**4.8×10^{-6}**
Pumping Test (St Pauls' Cathedral) Results						
20-43	n/a	1.7×10^{-6}	4.7×10^{-6}	3.7×10^{-6}	3.8×10^{-6}	4.4×10^{-6}

Raymer's analysis technique (Raymer, 2001 and 2005), which is based on the assumption that the packer test data has a log-normal distribution, was also used to estimate likely ranges of the bulk hydraulic conductivities of the rock based on results from packer testing. Using this method, a median hydraulic conductivity value of about 9.0×10^{-8} m/s was calculated for the full data set (testing interval 10-50 mbgl), while a median hydraulic conductivity of 4×10^{-8} m/s was calculated for the shallower rock zone (test intervals 10-25 mbgl) and 1.5×10^{-7} m/s for the deeper rock zone (test intervals 25-50 mbgl),

The results of the hydraulic testing indicate a wide range of the hydraulic conductivities of the rock. This is to be expected for a fractured rock aquifer, with the rock conditions ranging from extremely to slightly weathered. A likely mean hydraulic conductivity of about 5.0×10^{-8} m/s to 1.0×10^{-7} m/s is indicated by the results of the slug and Lugeon testing that covered a diverse set of test locations. An average hydraulic conductivity of 4.0×10^{-6} m/s was calculated based on the pumping test results, which is about 1.5 orders higher than the log-average values indicated by the slug tests and Lugeon tests, suggesting a localised higher permeability zone within the rock is present at this location. The extent of this high permeability zone could not be defined based on the results of the pumping test; however the analytical methods used to interpret the test results suggest the zone may be bounded by lower permeability features at a distance between 250 m to 400 m away (in two parallel directions) from the pumping well. It is possible that this higher permeability zone may be associated with structural features within the Silurian rock; however such a feature was not encountered in the Melbourne Metro boreholes completed in this area.

Overall, the Melbourne Metro hydraulic testing data (slug tests and Lugeon tests) indicate a slight increase in the hydraulic conductivities of the rock with depth, with an average hydraulic conductivity within 10-30 mbgs

[2] A correlation factor of 1 Lugeon equal to 1.0 x 10-7 m/s was used for the calculation of the hydraulic conductivity values based results obtained from the Lugeon tests

depth interval in order of 10^{-8} m/s, and within 30-50 mbgl depth interval in order of 10^{-7} m/s. This suggests that two sub-aquifer zones (shallow and deeper) may exist within the Silurian aquifer.

Results of the pumping test at St Paul's Cathedral also suggest that lower zones of the Silurian aquifer may act as a distinctive sub-aquifer. Based on the groundwater level response to the pumping test, this lower sub-aquifer zone is indicated to behave as a confined aquifer, with a groundwater leakage from an upper lower permeability zone. A restricted connectivity between these two subzones is also suggested by the limited groundwater level response to the pumping test monitored in the shallow monitoring well GA15-BH021 located about 60 m northeast from the pumping well. This well is installed about 20 mbgl (about RL -14 m AHD) and within the weathered zone of the Silurian rock. A hydraulic conductivity of 6.4 x 10^{-8} m/s was indicated by slug testing in this well. The pumping well was installed approximately between RL -32 m AHD and RL -20 m AHD within fractured slightly weathered rock.

Table 7: Summary of Other Aquifer Testing Results

Hydrostratigraphic Unit	Hydraulic Conductivity (m/s)			Number of Data Points
	Range		Geometric Mean	
	Minimum	Maximum		
Coode Island Silt	4.5 x 10^{-8}	4.5 x 10^{-8}	-	1
Holocene aquifer (HA)	2.0 x 10^{-6}	2.0 x 10^{-6}	-	1
Early Pleistocene aquifer (EP)	2.5 x 10^{-7}	8.5 x 10^{-5}	1.9 x 10^{-5}	6
Moray Street Gravels aquifer	2.0 x 10^{-5}	2.7 x 10^{-4}	7.1 x 10^{-4}	3
Older Volcanics aquifer	6.0 x 10^{-7}	3.0 x 10^{-6}	1.4 x 10^{-6}	3
Werribee Formation aquifer	5.3 x 10^{-5}	2.0 x 10^{-4}	8.6 x 10^{-5}	4

The results from the slug testing indicate hydraulic conductivities of the Early Pleistocene, Moray Street Gravels and Werribee Formation aquifers to be, generally, within similar ranges, from a low of 10^{-5} m/s to a high of 10^{-4} m/s. Hydraulic conductivities of the Older Volcanics aquifer are indicated, in general, to be at least one order of magnitude lower. No slug test was undertaken within the Late Pleistocene aquifer and only one test was conducted within each of the Holocene aquifer and Coode Island Silt. Additionally, there is no groundwater well installed in the Newer Volcanics aquifer.

The majority of the hydraulic testing has been associated with single well tests. Storage data indicated by these tests are therefore not considered to be reliable and should not be used for an assessment of aquifer behaviour. The pumping test results indicate a specific storage of the lower sub-aquifer zone to be about 4 x 10^{-6} m^{-1}, which is consistent with what would be expected for a slightly weathered, sedimentary fractured rock. However, these results are applicable for an aquifer area localised around the St Paul's Cathedral pumping well and monitoring wells (maximum distance of the monitoring wells from the pumping well was about 50 m).

4.4.2 Relationship between Units of Interest

From a hydrogeological perspective, the following hydrostratigraphic units are considered to be the most significant for the project:

- The high yielding Moray Street Gravels aquifer, Early Pleistocene aquifer and Holocene aquifer
- The moderately yielding Newer Volcanics basalt aquifer (upper Burnley Basalt Flow) and low to moderately yielding Silurian aquifer
- The highly compressible Coode Island Silt sediments

The Moray Street Gravels, Early Pleistocene aquifer and Holocene aquifers are characterised by high hydraulic conductivities and high yield. They act as confined aquifers and when drained tend to produce high water flows and to transmit groundwater drawdown rapidly and extensively. The relationship and degree of hydraulic connection between these aquifers is indicated to be variable. In the area east of the Yarra River Crossing, the Moray Street Gravels and Holocene aquifers are typically separated by a ridge of Silurian rock and appear to act as separate aquifers based on our past project experience. Although the Silurian ridge was eroded in some areas (Section 4.3, Drawing 3), these aquifers appear still to act as separate aquifers. West of the Yarra River Crossing the Holocene aquifer, in general, directly overlies the Moray Street Gravels aquifer and here they are believed to be part of the same hydraulic system.

The Holocene aquifer and, in some areas of South Melbourne, the Moray Street Gravels aquifer are directly overlain by thick deposits of the Coode Island Silt. In previous studies within the broader Jolimont Valley area, it was shown that depressurisation of Holocene and Moray Street Gravels aquifers could have a significant influence on pore pressures within the Coode Island Silt.

The upper Newer Volcanics basalt, a fractured rock aquifer, is characterised by high variation in hydraulic conductivities in both vertical and horizontal directions. When highly fractured, and not affected by extensive weathering, hydraulic conductivities in the order of 10^{-5} m/s are indicated. In contrast, when extremely weathered, or fresh and massive, hydraulic conductivities in the order of 10^{-7} m/s and less are indicated for the basalt rock. Based on investigation throughout the study area, it appears that with exception of the upper few metres, the basalt is typically a medium to slightly weathered jointed rock. The basalt aquifer is not in connection with the Holocene aquifer as the formations occupy spatially different areas, i.e., different palaeo-valleys (Figure 3). Although both the Moray Street Gravels and basalt aquifers occupy the Jolimont Valley, they are typically separated by the lower permeability Fishermens Bend Silt (an aquitard). The exception is the deep pre-Burnley Basalt Flow channel (discussed in Section 4.3) that in part of the Jolimont Valley was carved deeply into the Moray Street Gravels. Within this channel the Moray Street Gravels and basalt aquifers are typically in direct connection and any lowering of the groundwater levels in the basalt aquifer in this area could quickly be transmitted into the Moray Street Gravels aquifer.

The Silurian bedrock is an anisotropic fractured rock aquifer with hydraulic conductivities potentially ranging within three or more orders of magnitude. Hydraulic conductivities at the higher end of the range reported for the Silurian rock (10^{-5} m/s in GA11-BH023, 4.0 x10^{-6} m/s from the pumping test) may be associated with some structural features within the rock. Hydraulic conductivities of a similar order of magnitude could also potentially be associated with stress relief joints bounding the palaeo-valleys such as the Jolimont Valley based on past project experience. Observations from the CityLink project indicate that groundwater drawdowns could extend rapidly and over large distances if highly conductive fractures/fracture zones are present. The Silurian aquifer is in direct contact with the basalt aquifer, Holocene aquifer and Moray Street Gravels aquifer (Figure 3). In part of the study area the Silurian aquifer also directly underlies the Coode Island Silt sediments. These areas, however, are of limited extent. Additionally the Coode Island Silt sediments are, in general, relatively thin (less than 5 m) within these areas.

5.0 GROUNDWATER FLOW SYSTEM

5.1 Groundwater Levels

The groundwater levels were recorded in a number of the monitoring wells during the 2015 site investigation. The most recent groundwater levels are listed in Table 8 (up to November 2015). The well locations are shown in Drawing 8. The groundwater elevations were calculated based on the measured depth to water, taking into consideration the borehole inclination. The groundwater elevations were also corrected to fresh water head to account for the density effect[3] based on the laboratory reported dissolved solids (TDS) concentrations or the inferred TDS for the wells where analytical data was not available.

Table 8: Groundwater Levels Observed During the RD Phase of Filed Work

Borehole ID	Hydrostratigraphic Unit Monitored	Date of Measurements	Corrected Groundwater Level (m AHD)[(1)]
MM1BH006	Werribee Formation aquifer	23-Sep-15	7.07
MM1BH009	Silurian aquifer	28-Oct-15	21.53
MM1BH015	Moray Street Gravels aquifer	23-Sep-15	-1.62
MM1BH016	Fishermens Bend Silt/Coode Island Silt	29-Oct-15	-1.49
MM1BH018	Silurian aquifer	23-Sep-15	-0.66
GA11-BH002	Older Volcanics aquifer	23-Sep-15	-1.32
GA11-BH005	Older Volcanics aquifer	29-Oct-15	-1.89
GA11-BH012	Werribee Formation aquifer	23-Sep-15	1.32
GA11-BH013	Silurian aquifer	23-Sep-15	7.47
GA11-BH017	Moray Street Gravels aquifer	21-Aug-15	-1.15
GA11-BH018	Holocene aquifer	29-Oct-15	-0.81
GA11-BH022	Silurian aquifer	29-Oct-15	3.96
GA11-BH027	Silurian aquifer	28-Oct-15	-5.17
GA11-BH031	Older Volcanics aquifer	23-Sep-15	-1.18
GA15-BH001	Werribee Formation aquifer	30-Oct-15	-2.32
GA15-BH002	Silurian aquifer	30-Oct-15	-2.15
GA15-BH003	Werribee Formation aquifer	23-Sep-15	-2.54
GA15-BH005	Early Pleistocene aquifer	28-Oct-15	-1.74
GA15-BH007	Silurian aquifer	28-Oct-15	14.25
GA15-BH008	Silurian aquifer	23-Sep-15	12.46
GA15-BH009	Silurian aquifer	15-Oct-15	22.44
GA15-BH010	Silurian aquifer	23-Sep-15	11.46
GA15-BH011	Silurian aquifer	23-Sep-15	5.01
GA15-BH012	Silurian aquifer	29-Oct-15	0.51
GA15-BH018	Silurian aquifer	23-Sep-15	-0.44
GA15-BH019	Silurian aquifer	23-Sep-15	-1.52
GA15-BH021	Silurian aquifer	31-Aug-15	-0.15
GA15-BH027	Silurian aquifer	28-Oct-15	-12.33

[3] The following equation was used to correct static water level measurement for density effect:

$hf * \rho f = hm * \rho m$ where hm is measured water column in the well, ρm is density of groundwater based on measured total dissolved solids (TDS), hf is equivalent fresh water column in the well and ρf is fresh water density (1.0 g/cm^3 was adopted for calculation). Total dissolved solids (TDS) concentrations and density values for each well used for density effect calculation, including calculation equation are listed in Table R2 in the Interpreted Hydrogeological Setting EES Summary Report.

Borehole ID	Hydrostratigraphic Unit Monitored	Date of Measurements	Corrected Groundwater Level (m AHD)(1)
GA15-BH028	Silurian aquifer	28-Oct-15	-12.71
GA15-BH029	Silurian aquifer	6-Oct-15	-3.26
GA15-BH030(2)	Silurian aquifer	5-Oct-15	-3.63
GA15-BH031	Silurian aquifer	6-Oct-15	-1.48
GA15-BH032(2)	Silurian aquifer	5-Oct-15	-4.09
GA15-BH033	Silurian aquifer	7-Oct-15	-3.98
GA15-BH108	Silurian aquifer	30-Aug-15	0.14
GA15-BH109	Silurian aquifer	30-Aug-15	0.12
GA15-BH110	Silurian aquifer	30-Aug-15	-0.20
GA15-BH111	Silurian aquifer	27-Aug-15	0.27
GA15-BH112	Silurian aquifer	30-Aug-15	0.16
GA15-BH120	Silurian aquifer	6-Jul-15	0.17
GA15-BH121	Silurian aquifer	23-Sep-15	-6.15
GA15-BH122	Silurian aquifer	23-Sep-15	-14.10
GA15-BH123	Silurian aquifer	23-Sep-15	-11.39

Notes: (1) groundwater elevation corrected for water density and well inclination;
(2) groundwater levels inferred to be affected by development of a nearby wells
m AHD – metres Australian Height Datum.

The groundwater levels ranged from RL -14 m AHD in monitoring well GA15-BH122 adjacent to the CityLink tunnel in the Royal Botanic Gardens, to about RL 22 m AHD in monitoring wells MM1BH009 and GA15-BH009 located between Parkville and CBD North Stations (Drawing 8).

Groundwater levels below sea level (RL 0 m AHD) were observed in a number of monitoring wells located in the vicinity of the North Yarra Main Sewer (Kensington and North Melbourne area), CityLink tunnels (South Melbourne, Royal Botanic Gardens), the City Square basement (close to the proposed CBD South station) and the South Yarra Main Sewer (South Melbourne) as shown in Drawing 8.

It should be noted that the majority of the groundwater level data available is for confined aquifer conditions. Interpretation of the groundwater levels at the water table across the study area has therefore been limited to a relatively small data set.

5.2 Conceptual Groundwater Flow System

A number of aquifers exist within the study area. The hydraulic relationship between the aquifers is complex and groundwater levels in aquifers are known to be effected by natural and man-made structures and processes.

Groundwater level measurements indicate that the highest groundwater levels occur within the broader Parkville area, East Melbourne area and potentially the Royal Botanic Gardens. Surface recharge to groundwater is considered to be the predominant process within these high topographic areas, where the Silurian aquifer occurs as the upper unit.

The groundwater levels are indicated to be the lowest in the low lying areas and around man-made structures: North Yarra and South Yarra Main Sewers, CityLink tunnels and deep basements.

As a part of on-going groundwater management a number of recharge wells were installed by CityLink to prevent extensive drawdowns within the vicinity of the CityLink tunnels. The main recharge wells are located within the Holocene aquifer (Morell Bridge, Royal Botanic Gardens Gate H in Alexandra Avenue) and Moray Street Gravels aquifer (Exhibition Street extension in Richmond, Power and Sturt Streets in South

Melbourne). Despite ongoing recharge, the groundwater levels in these aquifers within the broader CityLink tunnels area were observed to be below sea level, typically less than RL -0.8 m AHD. The impact of the CityLink tunnels on groundwater levels in the Silurian aquifer was also observed to be much greater than within the Holocene and Morays Street Gravels aquifers. An example of such impacts at the proposed Melbourne Metro CityLink crossing is illustrated in Figure 4.

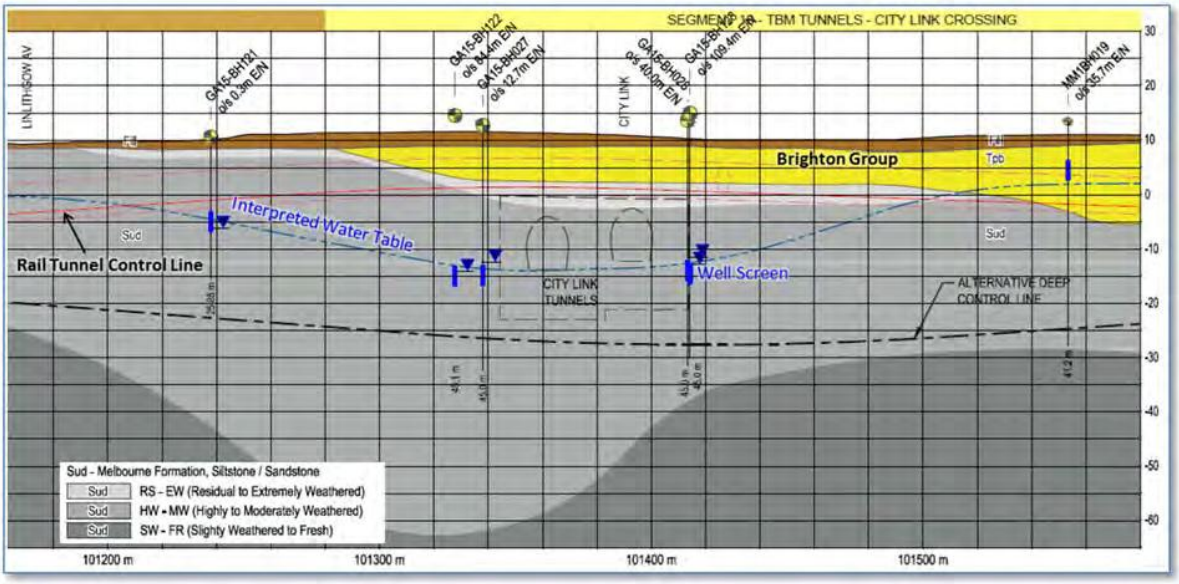


Figure 4: Effect of the CityLink Tunnels on Groundwater Levels, Botanical Gardens Area

Based on groundwater level observed in the monitoring wells GA15-BH008, GA15-BH010, GA15-BH011, GA15-BH012 and GA15-BH013 impact of the City Loop tunnels on the surrounding groundwater levels is also indicated to be significant as illustrated in Figure 5.

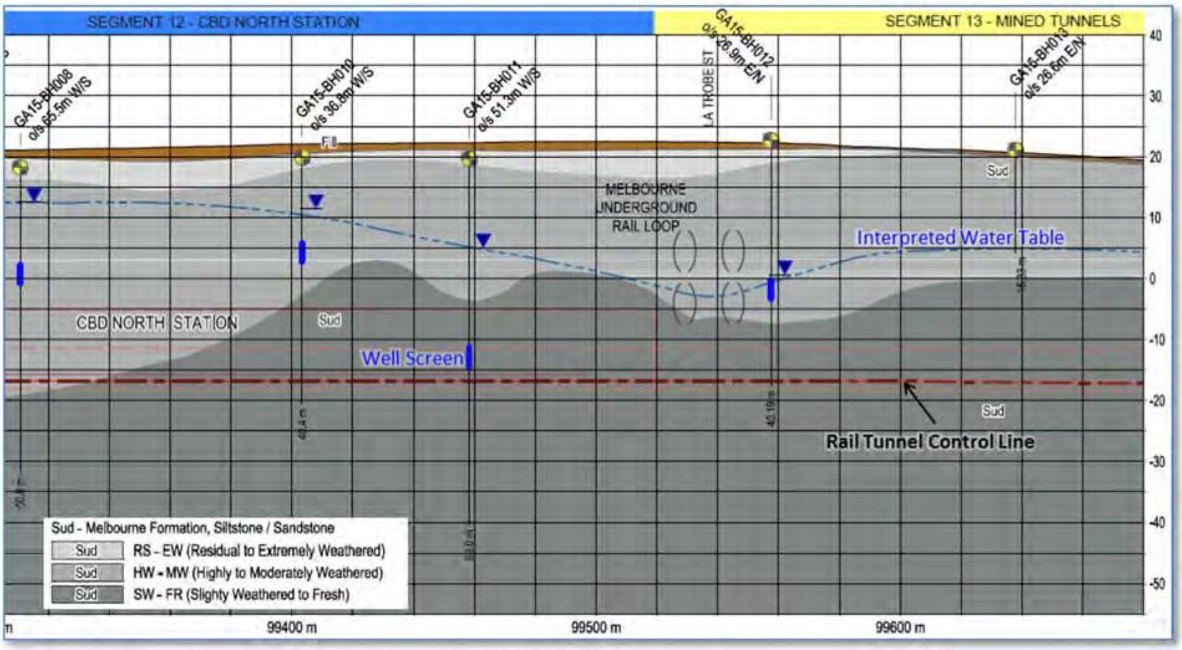


Figure 5: Effect of the MURL on Groundwater Levels, CBD North Area

The impact of the various sewers on the groundwater levels is evident by the groundwater measurements in monitoring wells in Kensington and North Melbourne area (between RL -2.5 m AHD and RL -0.5 m AHD) and South Melbourne, adjacent to the proposed Domain Station (between RL -5.2 m AHD and RL -1.5 m AHD). Limited data is available on the potential volumes and extent of leakage within these structures.

Groundwater levels between RL -1.52 m AHD and RL -0.44 m AHD were observed in the monitoring wells located in vicinity of proposed CBD South Station. These levels may be results of groundwater drainage to building basements in this area.

The Maribyrnong River, Moonee Ponds Creek and Yarra River are the main water courses within the study area. All three are under tidal influence. Based on Melbourne Water data, daily water levels in the Yarra River are indicated to range typically between RL -0.4 m AHD and RL 0.6 m AHD. The available pre-CityLink groundwater level data and data for areas outside the influence of CityLink, indicate that the groundwater levels within the upper zones of the basalt aquifer and Coode Island Silt have been, in general, above the average Yarra River levels. This suggests that the Yarra River has been a discharge point for surrounding groundwater. Observations during the CityLink tunnels construction, however, showed that the groundwater drawdowns in the Silurian and basalt aquifer transmitted quickly under and beyond the river, away from the tunnel excavation. This observation suggests a relatively weak connectivity exists between the river and groundwater system, potentially due to presence of the low permeability sediments in the riverbed. This is also supported by the long term groundwater levels in the basalt monitoring well B96-GA578-2 (2005 to 2012), observed to be on average close to RL -1.0 m AHD (Figure 6). This monitoring well is located on the northern bank of the Yarra River adjacent to Princes Bridge.

Figure 6: Long Term Groundwater Levels in Newer Volcanics Well B96 GA582 (2)

Under natural condition it would be expected that a groundwater flow system would be reflecting subdued topographical features with groundwater flow direction from topographical highs towards main rivers, creeks and low lying areas such as swamps and marshlands. Under such circumstances no groundwater levels below the sea level would also be expected to occur. However the current groundwater flow system across the study area is indicated to be a highly modified system with man-made structures being the main features governing the flow.

Based on the above discussion, it is considered that groundwater flow occurs from the higher elevations in the broader Parkville, Richmond and Royal Botanic Gardens areas towards City Loop, CityLink tunnels, the Yarra River and Moonee Ponds Creek and the deep main sewers as illustrated in Figure 7 and Drawing 8. Deep basements within the CBD and South Melbourne are also known to have affected the local groundwater levels and flow patterns, as well as the Prahran Sewer located close to the eastern extent of the study area.

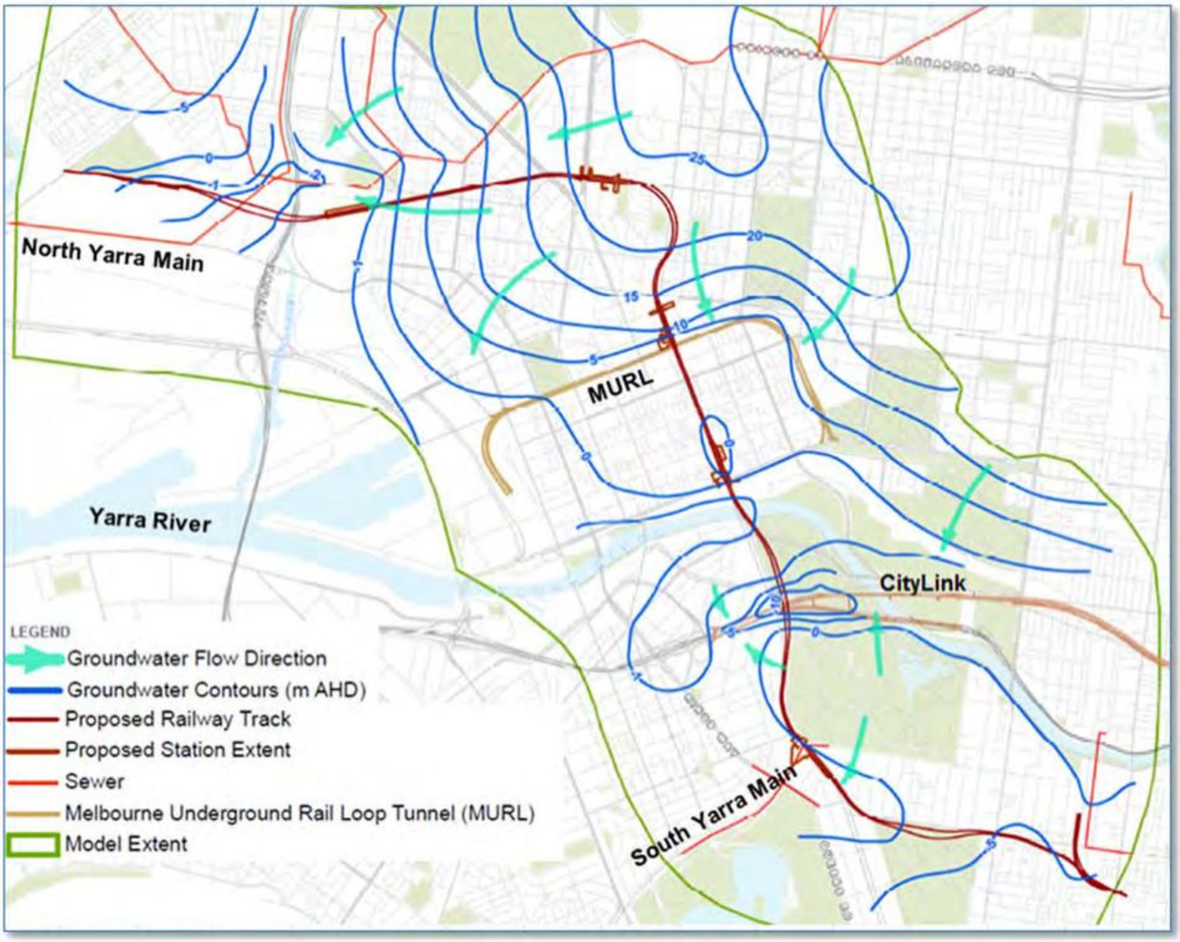


Figure 7: Conceptual Groundwater Flow Pattern across the Study Area

6.0 NUMERICAL GROUNDWATER MODEL DEVELOPMENT

6.1 General

The numerical model was developed using the FEFLOW modelling code (Version 6.2). FEFLOW is a finite element modelling code developed by Wasy Institute in Germany (DHI-WASY). The code is capable of simulating saturated and unsaturated groundwater flow under complex boundary conditions.

The finite element formulation of the groundwater flow equation allows for very efficient discretization of the numerical grid for a large study area and complex geological setting. Its use of constrained boundary conditions also allows for greater flexibility in the simulation of situations such as groundwater inflow into tunnels.

This code is extensively used in both the private and public sector and is widely recognised in the industry as one of the state-of-the-art codes for groundwater flow and contaminant transport modelling.

6.2 Model Set Up

The extent of the model domain is shown in Figure 8. The model covers an area of about 26 km^2, along an approximately 3.0 km wide corridor. The model area extends between MGA projection, Zone 55 grid lines 317,100 m and 323,800 m in the easterly direction and 5,809,350 m and 5,815,100 m in the northerly direction. The finite element mesh within the model domain consists of more than 500,000 triangular elements. The size of the elements varies over the model area with the mesh density increasing towards the tunnel centreline, within the station areas and along the boundaries between geological units (in a planar view). The size of the triangular elements in a horizontal projection ranges from about 0.5 m or less close to the tunnel alignment and/or other project structures (station, portals and shafts), to about 120 m close to the boundaries of the model domain.

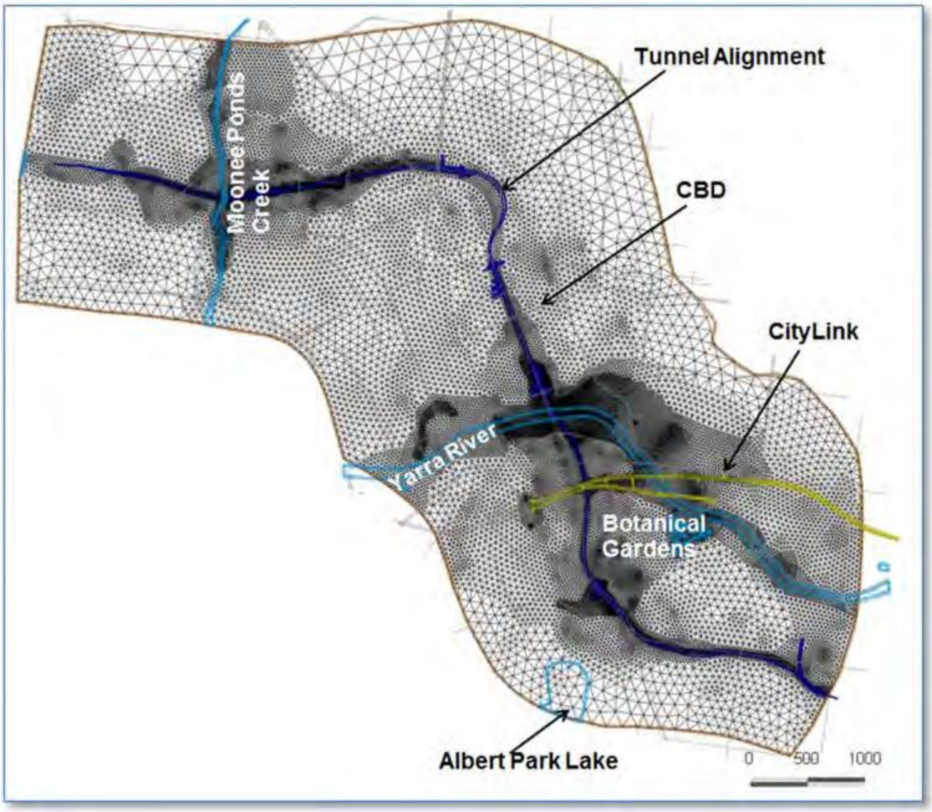


Figure 8: Model Domain and Finite Element Mesh

The top of the model was set to the topographic elevation obtained from 1 m topographical contours within the study area sourced from the Melbourne Metropolitan Board of Works surveys conducted in the 1970's and 1980's. The base of the model was set at an elevation of RL -60 m AHD, as it was judged that groundwater flow contribution from the deeper zones of the Silurian aquifer system would not likely be significant.

The stratigraphy within the model was developed using the 3D conceptual geological model for the study area (discussed in Section 4.3). The outlines of the geological units in the model at the topographical surface (top of the model) followed geological boundaries as per the 3D geological model and geological plan shown in Drawing 2. Fill, if present, was not included in the model. The Brighton Group sediments lying above the groundwater table were also not included in the model (north and east of Melbourne CBD). The surface outlines of the geological units as included in the model are shown in Figure 9.

Figure 9: Model Geological Units Outlines

The distribution of geological units in a vertical direction was determined based on the base of geological unit iso-contours (Drawing 3 to Drawing 6) and their interceptions with the mid-level elevation of a corresponding layer. This means that geological units were simplified as rectangular geometrical forms vertically across the model layers with a flat base, as illustrated in Figure 10[4].

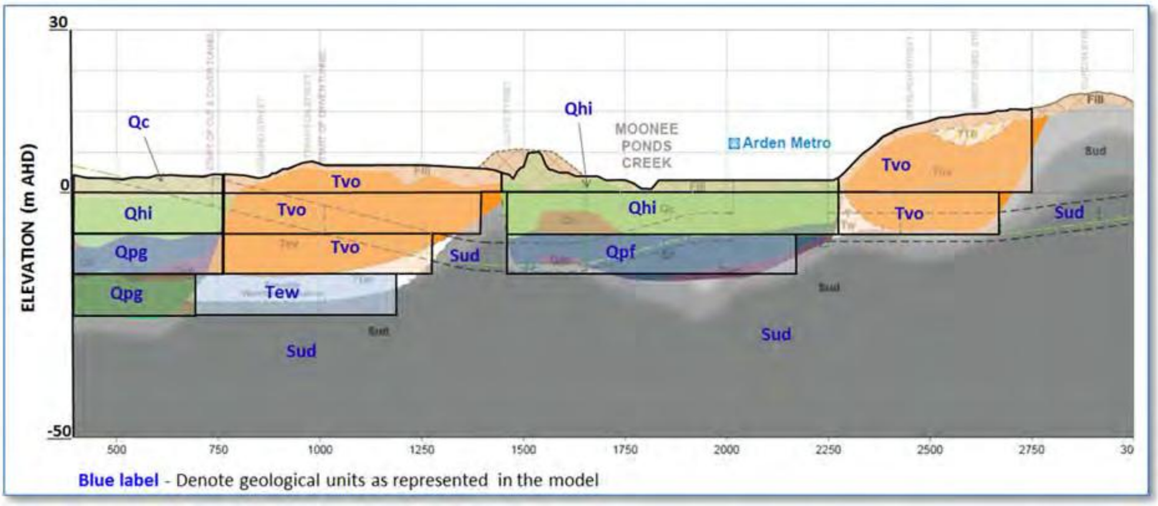


Figure 10: Vertical Interpretation of Geological Units across the Model Domain

Vertically the model was divided into 10 layers. With the exception of Layer 1 (the upper most layer) and Layer 2 below the water courses, the model layers were set at a uniform thickness across the model domain. The thickness of Layers 2 to 8 was set at 5 m, Layer 9 at 10 m and Layer 10 at 15 m. Thickness of Layer 1 varied through the model domain depending on the topographic elevation. However, where the river valleys cut deeply into the topography it was necessary to adopt a thickness of less than 5 m for the Layers 1 and 2. The adopted minimum thickness for these layers was set at 1 m.

The base of each model layer was set at a uniform elevation (flat base of the layers) as follows:

- base of Layer 1 equal to RL 0 m AHD
- base of Layer 2 equal to RL -5 m AHD
- base of Layer 3 equal to RL -10 m AHD
- base of Layer 4 equal to RL -15 m AHD
- base of Layer 5 equal to RL -20 m AHD
- base of Layer 6 equal to RL -25 m AHD
- base of Layer 7 equal to RL -30 m AHD
- base of Layer 8 equal to RL -35 m AHD
- base of Layer 9 equal to RL -45 m AHD
- base of Layer 10 equal to RL -60 m AHD.

The 3D view of the model domain is shown in Figure 11.

[4] Note, intention of this cross section is not to show the current geological interpretation along the tunnel alignment but to illustrate a concept behind the model layer set up.

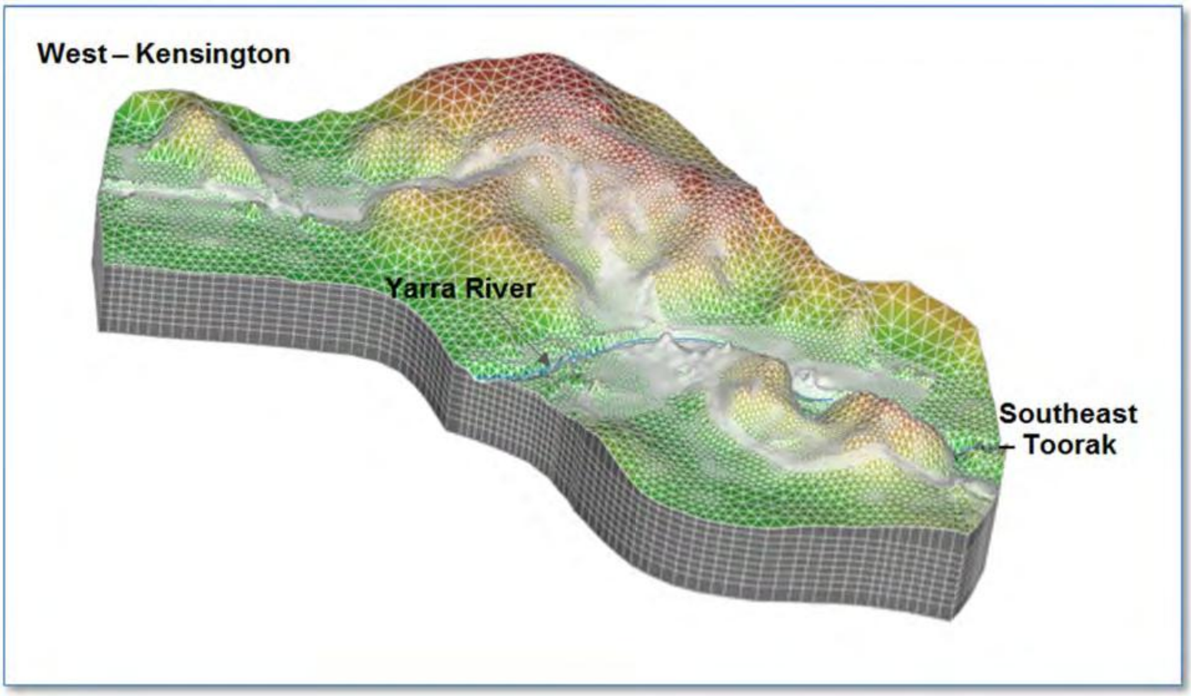


Figure 11: 3D Model View

6.3 Model Boundary Conditions

Four types of boundary condition were assigned to the model mesh: fixed head, head dependent flux, well boundary conditions and no-flow (zero flux). Positions of the boundary conditions in a plan view are shown in Figure 12. The boundaries were set in different layers, which corresponded to the conditions, elevations and types of the features represented by the assigned boundaries.

- ***Fixed head boundary conditions*** were applied to nodes along the northern and southern model boundaries, to allow for groundwater inflow to the model from the area up gradient of the MMRP tunnel alignment and outflow from the model domain, to areas down gradient from the tunnel alignment. The boundary conditions were set up based on the groundwater level contours presented in Figure 7.

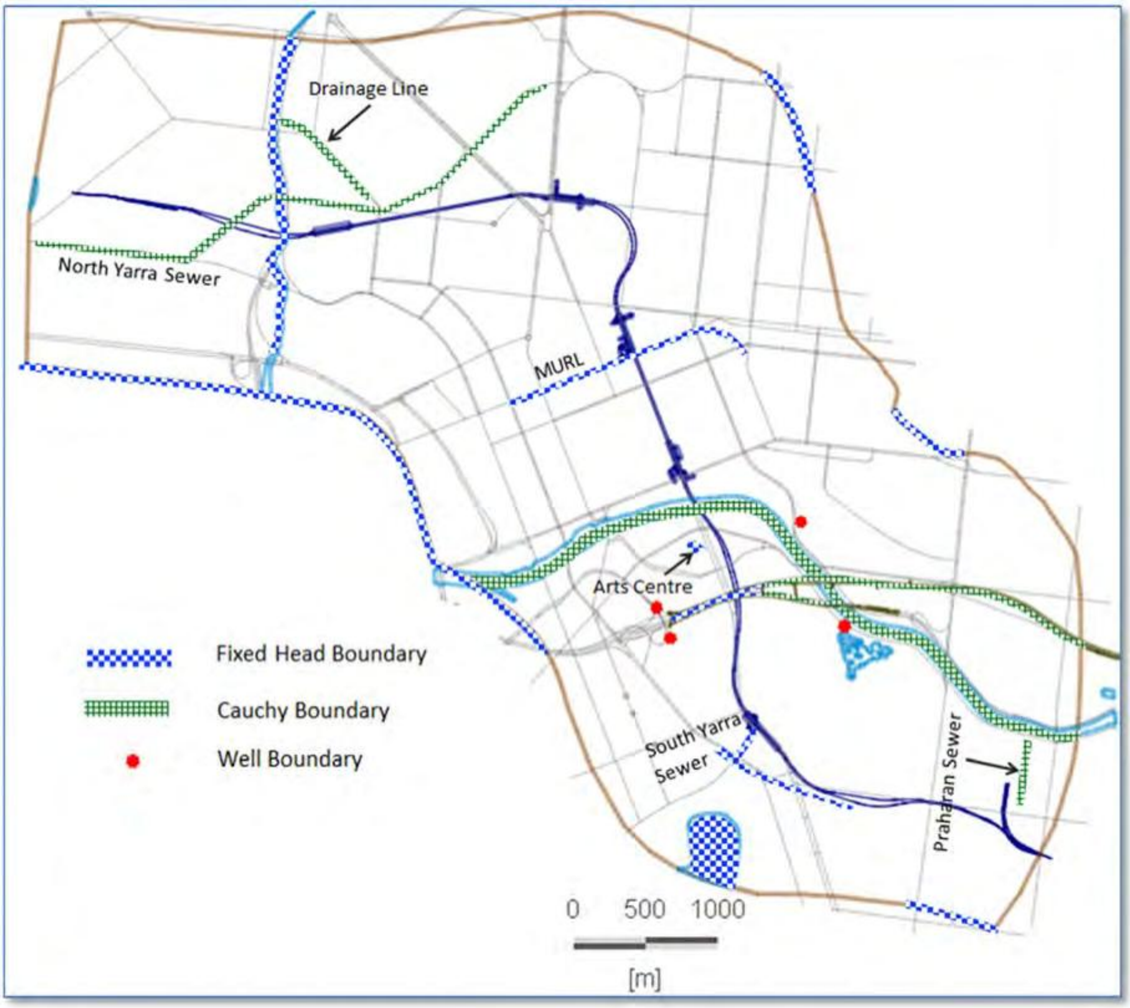
  Fixed head boundary conditions were also applied to nodes along some of the main natural features (creeks, rivers, drainage lines) and man-made structures (tunnels, sewers, basements) to simulate interactions of these features with the groundwater system, flow into and out of the features. These features included:

  - the City Loop tunnel
  - excavation associated with Melbourne Metro (when included in simulations)
  - drained sections of the CityLink Burnley and Domain tunnels
  - South Yarra Main Sewer and adjacent west-east running sewer
  - Moonee Ponds Creek, Maribyrnong River and Albert Park Lake
  - Arts Centre deep basement.

The nodes along the Maribyrnong River, Moonee Ponds Creek and Albert Park Lake were left unconstrained to allow for groundwater recharge from these water bodies into the model should the surrounding groundwater levels decrease below the boundary condition head level

All nodes along the tunnels and other man-made structures were constrained to allow only for groundwater inflow into the structures.

The boundary conditions initially set at the edges of the model domain, sewer lines[5] and along the City Loop tunnels were later adjusted during the calibration process to match the groundwater levels and head gradients inferred across the study area. The boundary conditions along the drained section of the CityLink Burnley and Domain tunnels were set at the tunnel invert level as per data previously provided to Golder during the CityLink construction work[6].



[5] Sewer invert levels were obtained for the South Yarra Main Sewer only. A short section of this main (perpendicular to the proposed Domain station) was simulated in the model. The head boundaries for this section were generally kept close to the sewer invert. A sewer line that is running in a west-east direction (generally parallel to the St Kilda Road) and which crossing South Yarra Main in the vicinity of the proposed Domain Station (see Figure 12) was also included into the model. No invert levels were available for this sewer line. To simulate effect of this feature, fixed head boundary conditions were adjusted to match groundwater levels observed in nearby vicinity of the sewer. This may have resulted in the heads not being set at the sewer tunnel invert levels. In practical terms this implies that sewer is not freely drawing groundwater to the invert level, potentially due to defects in the sewer lining being insufficiently large to allow for a full drainage of groundwater to occur.

[6] On request from MMRA, Transurban (current CityLink operator) has granted permission to Golder to use tunnel construction schedules data that Golder had in possession from previous involvement in the CityLink project

Figure 12: Model Boundary Conditions

- ***Head dependent flux boundary conditions*** (Cauchy boundary condition). This type of boundary condition allows flow to occur into or out of the model domain, depending on the groundwater level calculated at a model node and the head defined as the boundary condition. The direction of the flow (out of or into the model) depends on the relative difference between these two levels, i.e., whether the calculated groundwater level is above or below the boundary condition head level. The water flux is calculated based on the head difference and the connectivity (referred to in the model as transfer) between groundwater and the water (boundary) feature.

  A head dependent boundary condition was assigned for the:

  - Yarra River and drainage line north of Arden Station (Figure 12)
  - North Yarra Main Sewer and Prahran Sewer Lines
  - CityLink Domain and Burnley tunnels along the tanked section of the tunnels.

  The boundary condition values were defined based on the groundwater levels indicated in the monitoring bores close to the modelled feature or based on the groundwater levels expected within the area. The nodes along drainage line north of Arden station were constrained to allow for groundwater discharge only. The nodes along the Yarra River were left unconstrained to allow for groundwater recharge from these water bodies into the model should the surrounding groundwater levels decrease below the boundary condition head level.

  For the CityLink Domain and Burnley tunnels, the head boundary conditions were set at the tunnel invert levels along the tanked section of the tunnels. The tunnel lining along this section was simulated by transfer values applied to adjacent model elements.

- ***Well boundary conditions*** (single point source). This type of boundary condition allows for simulation of groundwater pumping or injection of water at a single point and requires pumping or injection flow rates to be assigned to the model nodes. This boundary condition was used to simulate groundwater recharge at the CityLink recharge wells (Figure 12) located in South Melbourne (Well R07-STU-03 and Well R07-POW-04), Botanical Gardens (Well R13-ALEX-04) and Richmond (Well R06-RIV-04). The average long term recharge rates were included in documentation provided to MMRA by Transurban.

- ***No-flow boundary conditions*** were assigned along the western and south eastern boundaries of the model domain. Additionally, a no flow boundary was set at the base of the model domain, as it was assumed that the groundwater flow contribution from the deeper zones of the Silurian aquifer was unlikely to contribute significantly to the groundwater inflow into the tunnel.

Recharge to groundwater was applied at the top slice of the model, i.e., the ground surface. The recharge values were adjusted during the calibration process to match the groundwater levels and head gradients inferred across the study area. In general, higher recharge values were assigned for the higher permeable formations and in areas of higher elevation.

7.0 MODEL CALIBRATION

7.1 Version 2 Regional Model Approach

The main objective of the model calibration was to find a set of model layer parameters and boundary conditions that result in the model simulated groundwater levels matching field measurements within an acceptable range of error. As a part of the early Version 2 modelling work, the Version 1 Regional Model was re-calibrated to also reflect data obtained during the 2015. This included the following additional information:

- Groundwater levels available for the RD wells (GA15 series of wells)
- Additional geological data obtained from the 2015 boreholes completed up to September 2015
- Groundwater levels data provided for the City Link monitoring wells.
- Groundwater pressures observed over the Burnley Tunnel (tanked portion). Data was available for months of January, March and April 2015.
- Groundwater recharge rates at the CityLink recharge wells R07-STU-03 (MSG[7]), R07-POW-04 (MSG), R06-RIV-04 (MSG) and R13-ALEX-04 (Holocene).
- Groundwater inflow rates into Burnley and Domain tunnel.

As with the Version 0 and 1 models, the Version 2 Regional Model was calibrated to steady state flow conditions. The groundwater dataset and information used in the Version 2 model calibration included:

- The averages of CityLink data reported for the 2014 to 2015 period.
- Injection rates for the CityLink recharge wells of:
  - Well R07-STU-03 at 0.25 L/s
  - Well R07-POW-04 at 1 L/s
  - Well R06-RIV-04 at 2 L/s
  - Well R13-ALEX-04 at 1 L/s.
- Inferred average water levels in the Yarra River, Moonee Ponds Creek and Maribyrnong River. Values of RL 0 m AHD were assigned to the Moonee Ponds Creek and Maribyrnong River, and RL 0.2 m AHD to the Yarra River (based on the average daily fluctuation levels).
- Invert levels of North Yarra and South Yarra Sewer mains. Information on invert levels was obtained from Melbourne Water in order to assign boundary conditions to the relevant layers (i.e. the appropriate hydrostratigraphic units). There were no data on the potential groundwater inflows into the sewers, so the boundary conditions assigned to the nodes along these structures were adjusted during the calibration process, with the aim of matching groundwater levels observed in the general area.

As with the Version 0 and Version 1 models, the following features were also included in the Version 2 model calibration despite the limited available data:

- City Loop alignment. Impacts of the City Loop tunnels on the groundwater levels within the CBD area were simulated using groundwater levels observed in GA15-BH011, and GA15-BH012 as shown Figure 5. No information on the potential inflow rates or invert drainage levels was available. Fixed head boundary conditions of RL 0 m AHD were adopted along the City Loop alignment nodes.
- Arts Centre deep basement. An impact of the Arts Centre deep basement on the surrounding groundwater levels has been indicated by various groundwater studies (both by Golder and other

[7] MSG – Morey Street Gravel aquifer

consultants). No data on the current groundwater inflow rates into the basement was available, so fixed head boundary conditions of RL -2.0 m AHD were adopted for the Art Centre nodes.

- Prahran Main Sewer and a drainage line north of the proposed Arden station. These two features were included into the model in order to match groundwater levels inferred for these two areas. No data were available related to potential inflow rates or relevant invert elevations. The exception was some general information about groundwater levels around Prahran Main Sewer that was available from the previous modelling work undertaken for the CityLink project.

  The adopted approach, therefore, was to assign the head values at the nodes corresponding to these features, based on the feature's inferred depth below the surrounding ground. For the Prahran Main Sewer, this corresponded to a depth of about 3 m below ground and for the northern drainage line about 2 m to 3 m below ground.

To be able to calibrate a model covering an extensive area, a large number of widespread monitoring locations are required. The groundwater level data were available for an elongated area adjacent to the Melbourne Metro alignment and parts of South Melbourne and the Royal Botanic Gardens. Given the size of the regional model and the complexity of the geological and hydrogeological setting, it was decided that a simplified approach to spatial distribution of hydraulic parameters within the model layers should be adopted. The hydraulic properties (hydraulic conductivities and storage parameters) of the hydrostratigraphic units, therefore, were kept generally uniform within each model layers with limited spatial variations.

7.2 Calibration Statistics

The Version 1 Regional model was used as a starting point for the construction and calibration of the Version 2 Regional model. The initial model parameters were therefore based on the Version 1 model and during the calibration process adjustments were made to:

- hydraulic properties and extents of the materials within the model;
- boundary conditions associated with the North Yarra Sewer and Prahran Sewer; and
- recharge rates over the Silurian topography.

Locations of the wells used for model calibration and absolute difference between observed and modelled groundwater levels at these wells are shown in Drawing 9. Groundwater levels observed in the monitoring wells and model calculated groundwater levels at locations of the monitoring wells are listed in Table R1 along with the absolute differences between observed and modelled levels. Calibration errors for the Version 2 Regional model are listed in Table 9 and a calibration graph is shown in Figure 13.

Table 9: Calibration Statistics, Version 2 Regional Model

Number of Observation Points	93
Maximum Residual (m)	3.76
Minimum Residual (m)	-5.67
Residual Mean (m)	-0.04
Absolute Residual (m)	1.13
Normalized Root Mean Squared (NRMS) (m)	4.5%
Correlation Factor (R^2) Observed vs Modelled Levels	0.92

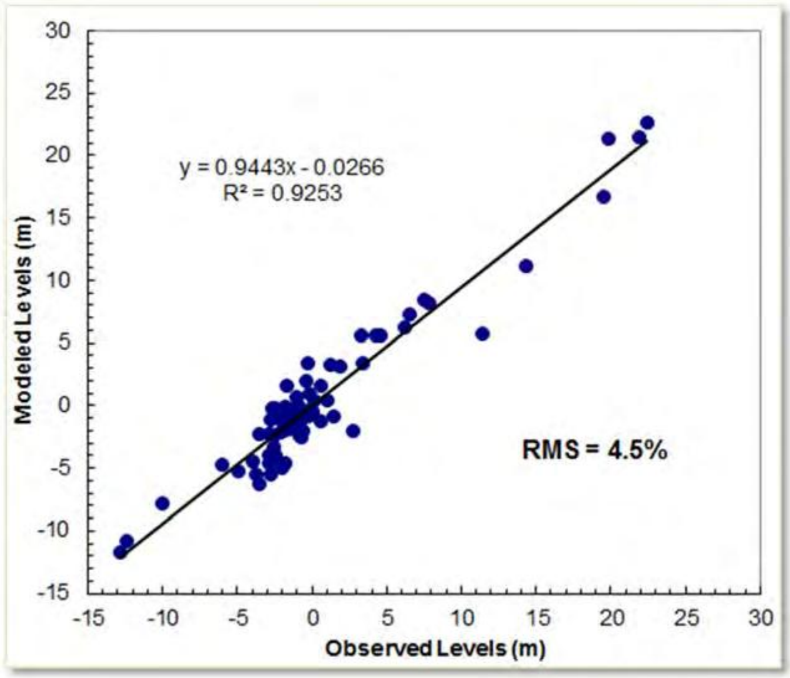


Figure 13: Calibration Graph, Version 2 Regional Model

A water balance error at the end of the calibration process of 0.04% was achieved. A summary of the water balance statistics is provided in Table 10.

Table 10: Water Balance Statistic

Boundary Conditions	**Water Flux (m3/day)**	
	Into Model	**Out of Model**
Fixed Head Boundaries	26.6	870.6
Cauchy Boundaries	64.3	561.9
Well Boundaries	367.8	0
Aerial Recharge	974.4	0
TOTAL	**1433.1**	**1432.5**
IMBALANCE	**0.6 (0.04%)**	

7.3 Calibration Results and Parameters Adopted

The groundwater level contours adopted at the end of the calibration process are shown in Figure 14 and the groundwater pressures above the tanked section of Burnley tunnel as calculated by the model and groundwater pressures reported by Transurban during the 2015 monitoring period are shown in Figure 15.

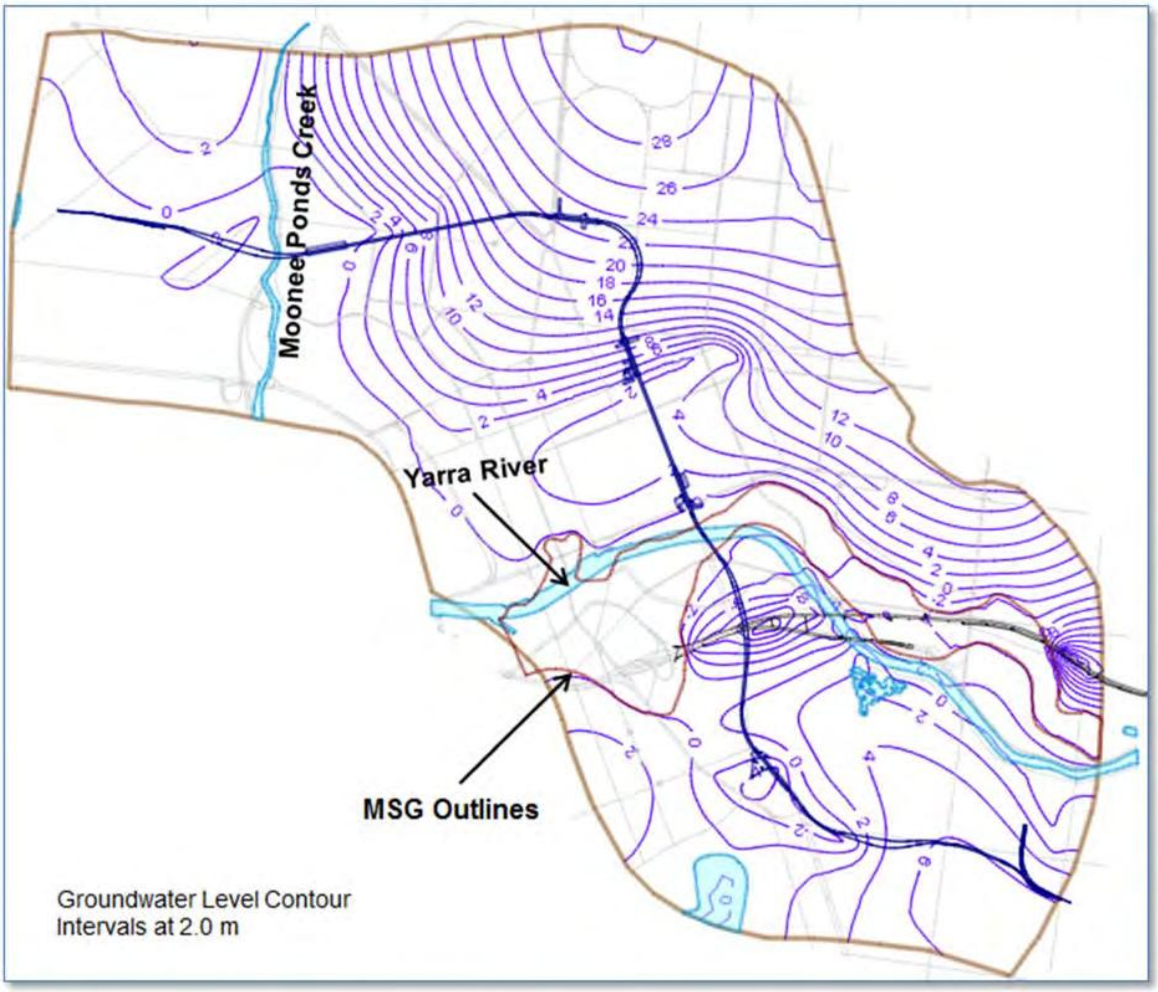


Figure 14: Calibrated Version 2 Regional Model Groundwater Levels

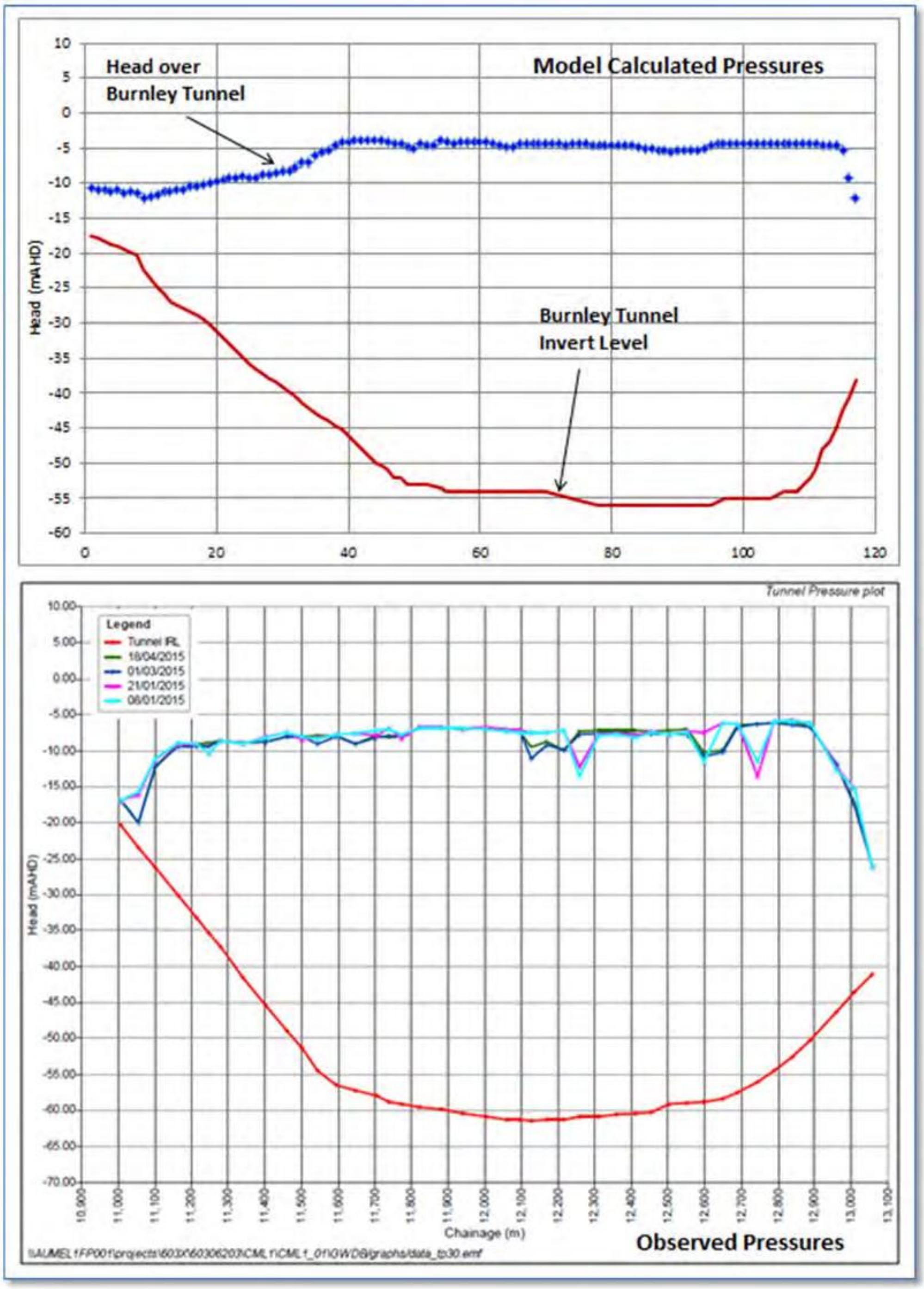


Figure 15: Groundwater Pressures over Tanked Section of Burnley Tunnel, Version 2 Regional Model

Hydraulic conductivities of the hydrostratigraphic units adopted for the model layers are shown in Figures A1 to A10 in APPENDIX A and a summary of the hydraulic conductivity ranges adopted for individual hydrostratigraphic units is provided in Table 11 along with storage parameters. Hydraulic conductivities in the x and y directions (Kx and Ky) were equal for all stratigraphic units presented in the model. Vertical hydraulic conductivity (Kz) for the Coode Island Silt was half an order magnitude lower than the Kx or Ky, but was equal to Kx and Ky for all of the other hydrostratigraphic units.

Table 11: Model Layer's Hydraulic Conductivity and Storage Parameters Summary

Hydrostratigraphic Unit	Hydraulic Conductivity Range, Kx=Ky (m/s)	Specific yield	Specific Storage (1/m)
Coode Island Silt	5×10^{-8} (Kz 1×10^{-8})	0.15	1×10^{-4}
Holocene Sands	1×10^{-4}	0.10	1×10^{-4}
Newer Volcanics	1×10^{-6}	0.03	1×10^{-5}
Fishermens Bend Silt	1×10^{-9}	0.07	1×10^{-4}
Moray Street Gravels aquifer	2.5×10^{-4}	0.10	1×10^{-4}
Early Pleistocene aquifer	from 5×10^{-7} to 1×10^{-4}	0.10	1×10^{-4}
Brighton Group	5×10^{-6}	0.08	1×10^{-4}
Older Volcanics	5×10^{-7} and 7×10^{-7}	0.05	1×10^{-5}
Werribee Formation	3×10^{-5}	0.08	1×10^{-4}
Melbourne Formation	from 6×10^{-8} to 4.5×10^{-7}	0.05	1×10^{-5}
Melbourne Formation (higher permeability zones – CBD South)	9×10^{-7} (Layer 10) and 4×10^{-6} (Layers 1 to 9)	0.05	4×10^{-6}
Melbourne Formation (higher permeability zones – CityLink, Botanical Gardens area)	5×10^{-5} (Layers 1 to 5)	0.05	1×10^{-5}

The transfer rate (leakage coefficient) associated with the Yarra River and Arden Drainage Line Cauchy boundary conditions were set at 2.5×10^{-5} 1/day for surface water to groundwater seepage conditions and at 5×10^{-3} 1/day for groundwater discharge into the surface water bodies. The transfer rate associated with the North Yarra Sewer and Prahran Main Sewer was set at 2.5×10^{-3} 1/day for groundwater discharge conditions only (no seepage back from sewer to groundwater was permitted in the model).

The transfer rates adopted for the Burnley and Domain tunnel tanked sections at the end of the calibration ranged from 5.1×10^{-6} 1/day to 1.0×10^{-4} 1/day. The recharge rates adopted at the end of calibration are summarised in Table 12 and water exchanged rates (recharge/discharge) calculated for the main features affecting the groundwater flow system are summarised in Table 13.

Table 12: Summary of Recharge Rates, Version 2 Regional Model

Geological Unit	Recharge Rates Adopted	
	$\times 10^{-5}$ m/day	mm/year
Coode Island Silt	1	3.6
Newer Volcanics	2 to 3	7.3 to 12.8
Brighton Group	4.5 to 7	16.4 to 25.6
Older Volcanics	5	18.2
Melbourne Formation	4 to 7	14.6 to 25.6

Table 13: Main Features Affecting Groundwater Flow System, Water Fluxes, Version 2 Regional Model

Main Features Affecting Groundwater Flow System	Recharge to Groundwater		Groundwater Discharge to Feature	
	m^3/day	L/s	m^3/day	L/s
Yarra River	62	0.72	2.0	0.02
City Link Domain Tunnel	0.0	0.00	121	1.40
City Link Burnley Tunnel	0.0	0.00	389	4.50
Moonee Ponds Creek	3.0	0.04	32	0.37
Art Centre	0	0.00	126	1.46
Albert Park Lake	0	0.00	29.5	0.34
MURL	0	0.00	179	2.07
Prahran Sewer	0	0.00	26	0.30
North Yarra Sewer	0	0.00	165	1.91
South Yarra Main Sewer	0	0.00	114	1.32

Overall the model was considered to have been calibrated to a satisfactory level based on the calibration statistics and the model's ability to match observed groundwater levels and fluxes. This calibrated model was used as a starting model (Null Case model) for all prediction runs and for calculation of groundwater drawdowns resulting from the project's effects on the groundwater flow system.

8.0 PREDICTION RUNS

8.1 General

Once calibrated, the numerical model was used for simulation of a number of predictive scenarios. The main objectives of these predictive scenarios were to evaluate:

- construction inflows to stations, portals and the mined tunnels between CBD North to CBD South stations
- groundwater drawdown associated with construction of stations, portals and the mined tunnels between CBD North to CBD South stations
- groundwater drawdown associated with post-construction impacts of the project on the groundwater levels assuming different scenarios with respect to station and tunnel lining.

The following post-construction (operational) scenarios were simulated using steady state modelling runs:

- Scenario 1: All stations, with the exception of the Parkville station, assumed to be lined to Haack Class 2. Parkville station, rail tunnels, portals and cut and cover structures assumed to be lined to Haack Class 3.
- Scenario 2: All stations, with the exception of the Parkville Station assumed to be lined to Haack Class 2 as well as a 150 m long section of rail tunnel in Alexandra Gardens. Parkville Station, rail tunnels (with the exception of the Alexandra Gardens section), portals and cut and cover structures assumed to be lined to Haack Class 3.

The following construction scenarios were simulated using transient modelling runs:

- construction of CBD South station with no pre-injection grouting of the underground excavations or temporary recharge wells
- construction of CBD North station and mined tunnel with no pre-injection grouting
- construction of Arden station including diaphragm wall around the station and toe grouting beneath the wall
- construction of western portal shaft and cut and cover structure including secant pile wall and toe grouting beneath the wall.

Construction of Domain station was not simulated in the Version 2 Regional model as the design changes between Version 1 and Version 2 models were considered to be relatively minor. The construction phase drawdown and inflow predictions summarised in this report for Domain station are therefore based on the Version 1 Regional model results (Section 8.3.4).

Each of above construction modelling scenarios included excavation of the individual project element, without consideration of the excavation of the other project elements. As a result the simulations do not consider the potential cumulative effect of the excavation of multiple project elements on the existing groundwater levels.

8.2 Operation Phase Modelling

The objective of this work was to assist with the assessment of potential operational phase impacts by assessing the potential effects of different rail tunnel and station watertightness criteria on groundwater levels within the study area. Two classes of waterproofing were considered for this work: Haack Class 2 and Haack Class 3, which are typically intended for road and rail tunnels (Haack, A., 1991). Permissible daily inflows for these two classes are as follows:

- Haack Class 2 – 0.05 L/m2 per 100 length
- Haack Class 3 – 0.10 L/m2 per 100 length

Scenarios 1 and 2 were both simulated as steady state runs to assess the long term effects on the groundwater levels during operation.

The groundwater inflow into the tunnels and stations was simulated in the model by applying a fixed head boundary at tunnel and station nodes to a corresponding floor elevation at that location. This head boundary was then constrained[8] by a maximum nodal inflow rate corresponding to the permissible water leakage rate, which was calculated based on an applicable seepage area and the distance between the nodes within the calculation area. Assumptions in these calculations were as follows:

- For the tunnels, the seepage area was calculated based on a tunnel diameter of 7.2 m.
- For the CBD South and CBD North station caverns the seepage area was calculated based on a cavern diameter of 23.5 m
- For the Arden, Parkville and Domain stations and CBD South and CBD North station shaftsm the seepage area was calculated based on the station footprint area. The seepage through the walls was not modelled because of the uncertainty associated with predicting, at the start of the model run, the wall area which would be subject to inflow. Due to limitation of the Feflow software used for regional model, localised models using other more appropriate software would have needed to be developed to assess potential inflows through the wall. The values obtained from these models would then be used as input parameters for the regional model. As a result a few iterations would have been required before a final total inflow rate into the stations could have been determined and this additional refinement was not considered necessary for the purposes of developing the Concept Design and EES.

The total inflow into the rail tunnels for Scenario 1 (all tunnels lined to Haack Class 3) was estimated by the model to be about 22.7 m^3/day and for Scenario 2 (150 m of twin tunnel lined to Haack Class 2 and the rest to Haack Class 3) about 22.5 m^3/day. The estimated inflow into the stations was same in both scenarios as they were lined to Haack Class 2 or Haack Class 3 (Parkville Station) in both modelling runs. A summary of the estimated operation phase inflows into the stations is provided in Table 14, along with the seepage area used for permissible inflow calculation.

[8] This means that as soon as inflow calculated by the model reaches a specified value, the fixed head boundary in the model is automatically switched to fixed flux (i.e. maximum inflow) boundary. If the groundwater level at the node decreases below the tunnel floor level, the specified node boundaries are fully switched off, i.e., both fixed head and flux boundaries become inactive.

Table 14: Summary of Operation Phase Station Inflows, Scenarios 1 and 2

Location	Groundwater Inflow (m^3/day)	Approximate seepage area used for permissible inflow calculation in RD model (m^2)
Arden Station	0.012	11,000
Parkville Station	0.002	10,000
CBD North Station	0.012	25,000
CBD South Station	0.010	25,500
Domain Station	0.007	17,000
Total Stations Inflow	**0.04**	

The operation phase contours of groundwater drawdown for Scenario 1 are shown in Figure 16

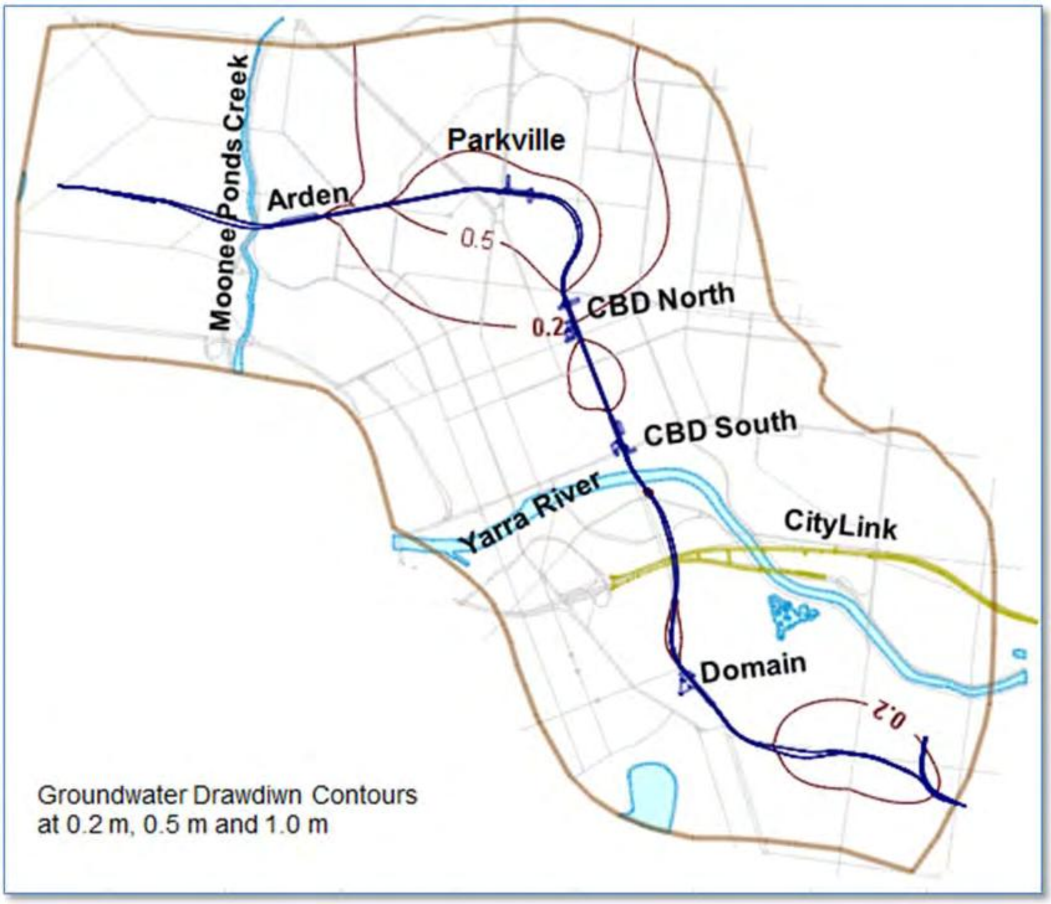


Figure 16: Operation Phase Groundwater Drawdowns, Scenario 1, Version 2 Regional Model

The model indicates that under the Scenario 1, the groundwater drawdowns within majority of the study area would generally be less than 0.5 m. Groundwater drawdowns slightly above 0.5 m but less than 0.6 m, were indicated locally around the Parkville Station and within the Alexandra Gardens immediately south of the Yarra River. A drawdown up to 0.6 m was indicated at the base of the Coode Island Silt within a localised area due to depressurisation of the low permeability Fishermens Bend Silt unit as shown in Figure 17./ This drawdown may be sufficient to potentially trigger localised consolidation of the Coode Island Silt, which is located directly above the Fishermens Bend Silt at this location.

The second operation phase scenario, Scenario 2, was then simulated to assess impacts to groundwater in this area if a 150 m long tunnel section through Alexandra Gardens was lined to Haack Class 2. A drawdown of less than 0.5 m under the base of the Coode Island Silt was indicated by this model scenario as shown in Figure 18.

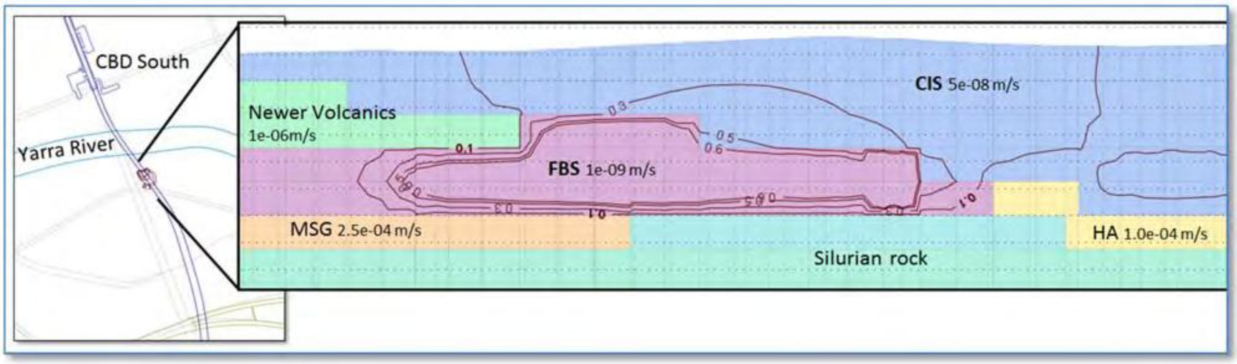


Figure 17: Operation Phase Groundwater Drawdown at the Base of Coode Island Silt, Alexandra Gardens, Model Scenario 1

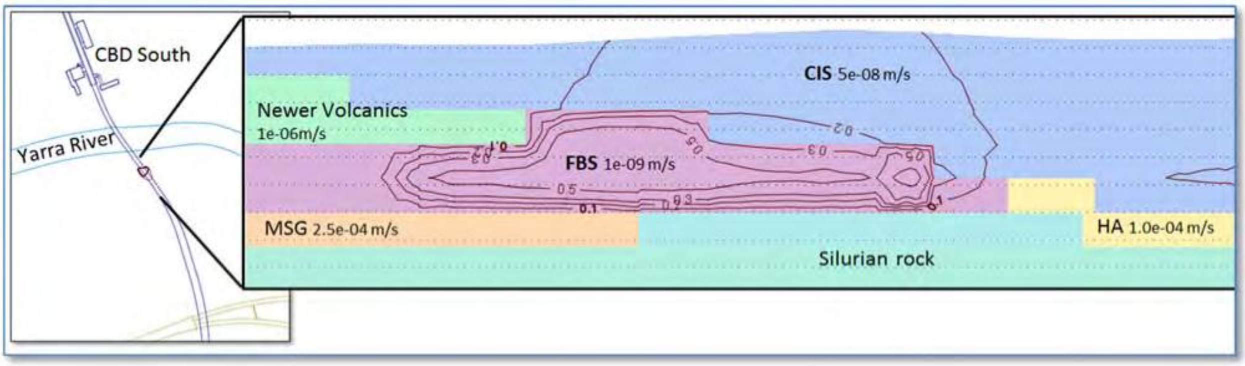


Figure 18: Operation Phase Groundwater Drawdown at the Base of Coode Island Silt, Alexandra Gardens, Model Scenario 2

In summary, the two steady state modelling scenarios indicated that varying lining of a 150 long section of the rail tunnels through the Alexandra Gardens from Haack Class 3 to Haack Class 2 would likely result in a limited decrease in groundwater drawdowns in this area. Once potential settlement ranges have been estimated for these predicted drawdowns, a decision can then be made if the consequences of the predicted ground movement justify the additional cost which would be associated with waterproofing this section of tunnel to Haack Class 2.

8.3 Construction Phase

8.3.1 CBD South Station

Based on the Melbourne Metro Concept Design, the CBD South station would include construction of:

- Three shafts located at the City Square (City Square shaft), Federation Square (Federation Square entrance shaft) and adjacent to Flinders Street Station (Flinders entrance shaft); and
- The station cavern, approximately 23.5 m in diameter, which would be connected to all three shafts.

A schematic drawing of the station in plan and long section is presented in Figure 19.

Construction of the CBD South station was simulated in a transient mode with construction schedules adopted as listed in Table 15. No mitigation measures, such as pre-injection grouting or the use of temporary groundwater recharge wells were simulated by the Version 2 Regional model.

Table 15: CBD South Station Construction Schedules, Version 2 Regional Model

	Start of Excavation	End of Excavation	Excavation Sealed	Final Excavation Level (m AHD)
Shafts				
City Square	1/06/2018	30/08/2018	31/05/2021	-14.5
Flinders Entrance	1/08/2019	30/11/2020	31/05/2021	-20.7
Federation Square Entrance	1/12/2019	31/03/2020	30/11/2020	-15.8
Station Cavern				
Top heading	1/01/2019	31/03/2019	31/05/2021	-14.5
Bench	1/04/2019	30/06/2019	31/05/2021	-20.0
Invert	1/07/2019	30/09/2019	31/05/2021	-24.6

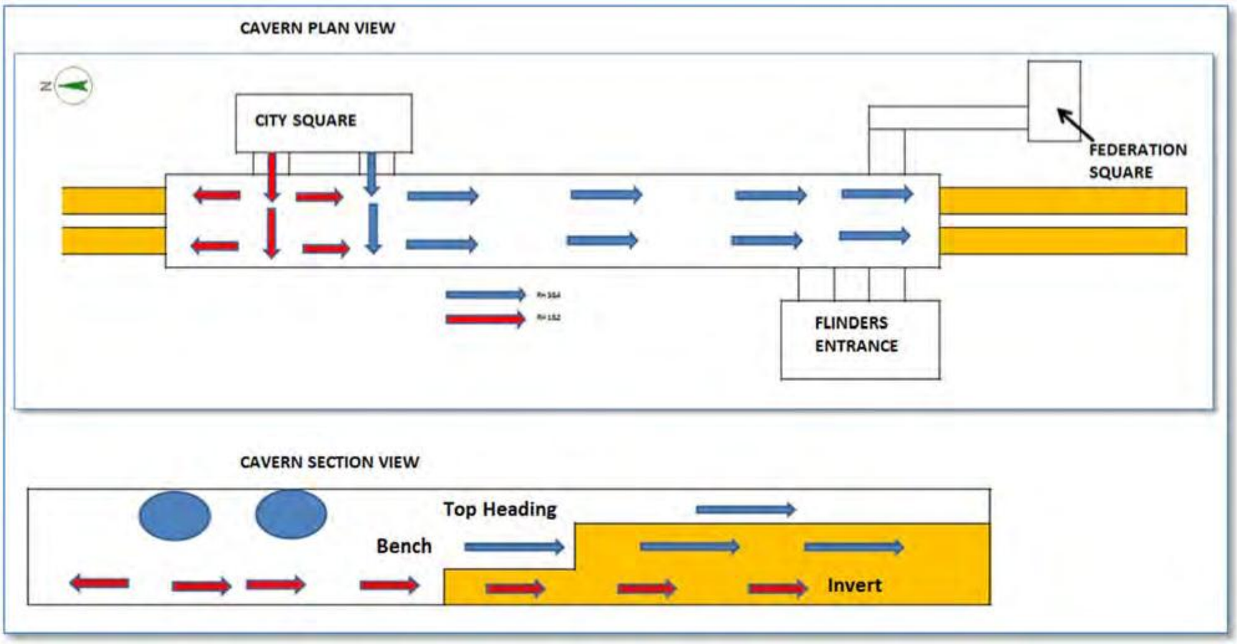


Figure 19: CBD South Station Schematic Plan and Long Section

Based on the modelling results, a total construction phase groundwater inflow into the station excavation of up to 450 m^3/day was predicted for the unmitigated station case (Table 16). The maximum groundwater inflow is indicated to occur at the time when excavation of the station cavern and the Federation Square entrance shaft are finished. This is indicated to follow by a decrease in the groundwater inflow into the excavation, with the groundwater inflow rate at the time immediately prior to sealing at about 340 m^3/day.

Table 16: Construction Phase Groundwater Inflows into CBD South Station

DATE	CONSTRUCTION STAGE	GROUNDWATER INFLOW	
		m^3/day	L/s*
30/08/2018	City Square Shaft Excavated	175	2.0
30/06/2019	Cavern Bench Excavated	375	4.3
30/09/2019	Cavern Invert Excavated	450	5.2
31/03/2020	Federation Square Entrance Shaft Excavated	420	4.9
30/11/2020	Flinders Entrance Shaft Excavated	360	4.2
31/05/2021	Immediately Before Sealing of Station	340	3.9

*inflow values expressed as L/s are direct conversions from values in m^3/day

The groundwater drawdowns within the Moray Street Gravels and Silurian aquifer (model Layer 6) at the end of construction are shown in Figure 20. The spatial hydraulic conductivity distribution within this model layer is shown in Figure A6 (Appendix A).

The model results indicate that the effect of the CBD South station construction on the Yarra River water balance would be relatively minor, both with respect to an increased recharge from the river to the groundwater system and groundwater discharge into the river. An increase in the river recharge to groundwater up to 6.5 m^3/day over the 5 km length of the river included in the model is indicated, with an increase of up to 2.5 m^3/day over a 3.0 km river section overlaying the Coode Island Silt in the model. The Yarra River/groundwater exchange fluxes at key times of station construction are provided in Table 17. No changes in the Albert Park Lake water balance was indicated due to CBD South station excavation.

Table 17: Yarra River Water Budget, CBD South Station Construction

DATE	CONSTRUCTION STAGE	YARRA RIVER WATER BALANCE			
		Recharge to Groundwater		Groundwater Discharge to River	
		m^3/day	L/s*	m^3/day	L/s*
SS State Conditions		*62.2*	*0.72*	*1.7*	*0.02*
30/08/2018	City Square Shaft Excavated	62.4	0.72	1.7	0.02
30/06/2019	Cavern Bench Excavated	64.1	0.74	1.7	0.02
30/09/2019	Cavern Invert Excavated	64.4	0.75	1.7	0.02
31/03/2020	Federation Square Entrance Shaft Excavated	66.5	0.77	1.6	0.02
30/11/2020	Flinders Entrance Shaft Excavated	67.9	0.79	1.5	0.02
31/05/2021	Immediately Before Sealing of Station	68.7	0.80	1.5	0.02

Notes to table: *inflow values expressed as L/s are direct conversions from values in m3/day
Length of the Yarra River in the model = 5,000 m
Average width of the Yarra River in the model = 60 m
Area of the River in the model = 300,000 m2 (30 ha)

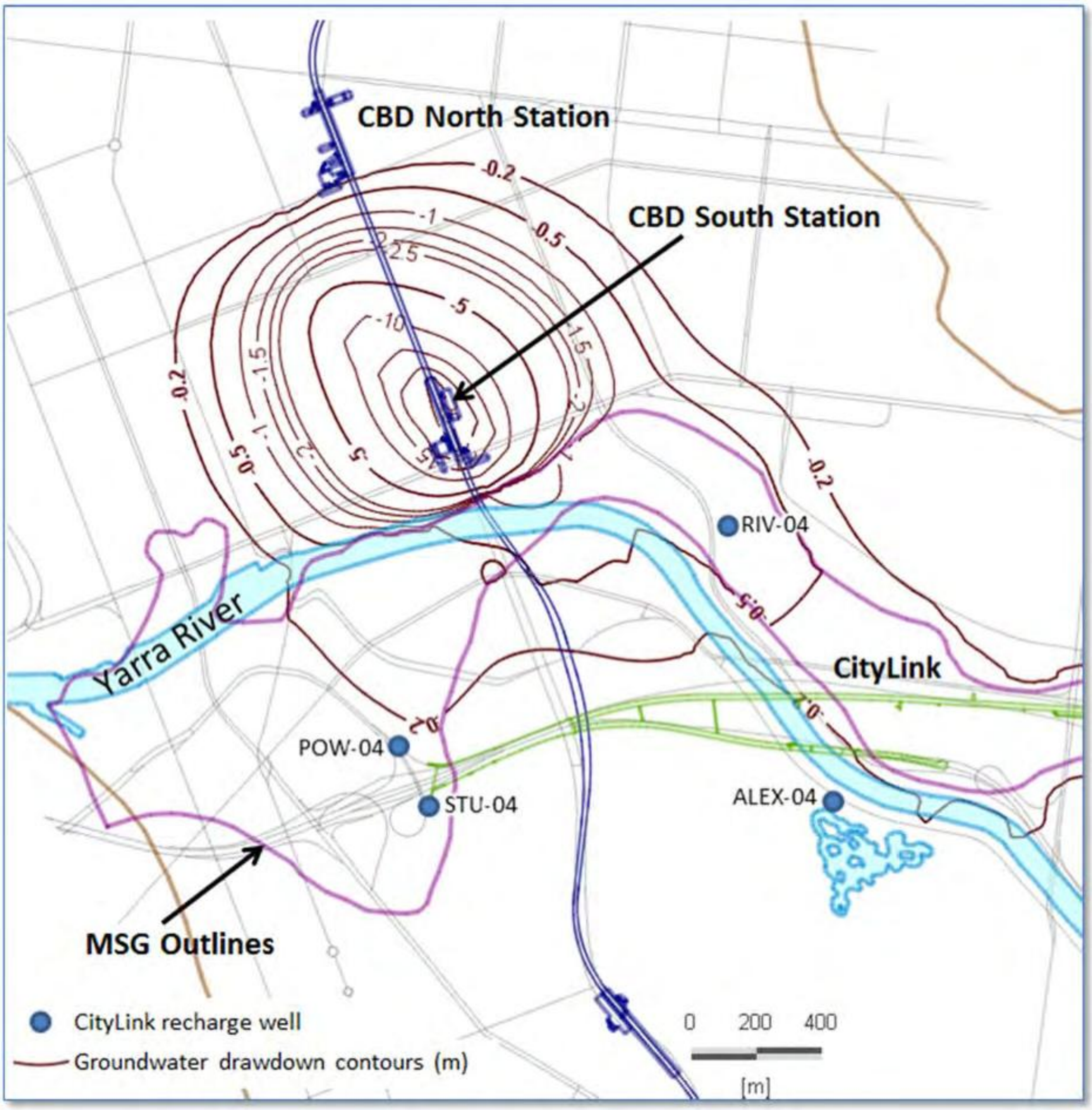


Figure 20: Groundwater Drawdown at End of CBD South Station Construction

The model indicated groundwater drawdowns at the end of the CBD South station construction of about 1 m in the Morey Street Gravels aquifer beneath the northern banks of the Yarra River. This corresponded to groundwater drawdowns at the base of the Coode Island Silt of about 0.5 m within Alexandra Gardens. It should be noted that this is in addition to the groundwater drawdowns which have already been induced by the CityLink tunnels in this area. Additionally, the following groundwater drawdowns are indicated by the model at the CityLink recharge wells at the end of the CBD South station construction:

- 0.15 m at the well R07-STU-03 located in South Melbourne;
- 0.17 m at the well R07-POW-04 located in South Melbourne;
- 0.60 m at the well R06-RIV-04 located in Richmond; and

- 0.12 m at the well R13-ALEX-04 located in Alexandra Gardens.

Further modelling work will be required to assess potential impacts of the CBD Station construction on the CityLink wells with mitigation measures (i.e., temporary injection wells) included in the model simulation.

8.3.2 CBD North Station

Based on the MMRP Concept Design, the CBD North station would include construction of:

- Four shafts: Franklin Street East, Franklin Street West, A'Beckett and Melbourne Central; and
- The station cavern, approximately 23.5 m in diameter, which would be connected to all four shafts.

Additionally, mined tunnels for rail tracks would be launched from this station to CBD South station.

A schematic drawing of the station in plan is presented in Figure 21.

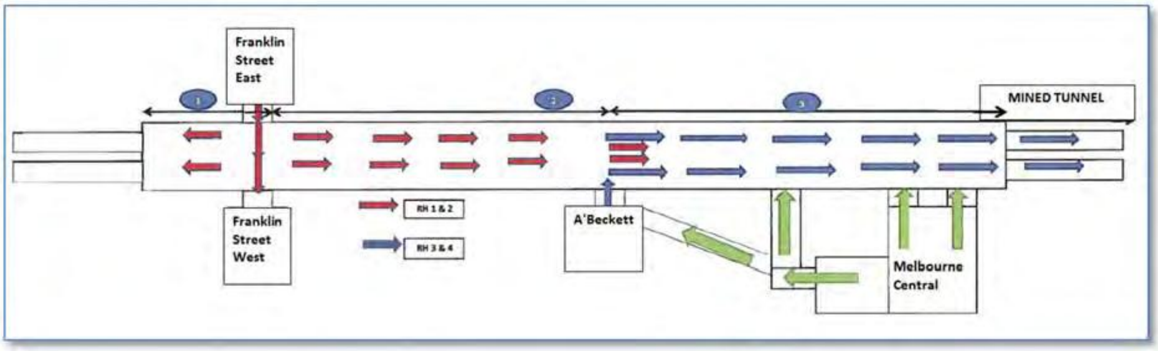


Figure 21: CBD North Station Schematic Plan

Construction of the CBD North station and the mined tunnel excavations were simulated in a transient mode with construction schedules adopted as listed in Table 18. No mitigation measures, such as pre-injection grouting was simulated in the model.

Table 18: CBD North Station Construction Schedules, Version 2 Regional Model

	Start of Excavation	End of Excavation	Excavation Sealed	Final Excavation Level (m AHD)
Shafts				
Franklin Street East	1/03/2017	1/09/2017	1/10/2017	-11.0
Franklin Street West	1/03/2017	30/04/2017	30/04/2018	-18.0
A'Beckett	1/03/2017	31/08/2017	30/09/2017	-11.0
Melbourne Central	1/09/2017	30/06/2018	31/08/2019	-17.0
Station Cavern				
Stage 1				
Top heading	1/12/2017	31/01/2018	31/03/2020	-11.0
Bench	1/01/2018	28/02/2018	31/03/2020	-17.0
Invert	1/02/2018	31/03/2018	31/03/2020	-22.0
Stage 2				
Top heading	1/04/2018	31/05/2018	31/03/2020	-11.0
Bench	1/05/2018	30/06/2018	31/03/2020	-17.0
Invert	1/06/2018	31/08/2018	31/03/2020	-22.0
Stage 3				

	Start of Excavation	End of Excavation	Excavation Sealed	Final Excavation Level (m AHD)
Top heading	1/12/2017	28/02/2018	31/03/2020	-11.0
Bench	1/02/2018	30/04/2018	31/03/2020	-17.0
Invert	1/04/2018	30/06/2018	31/03/2020	-22.0
Mined Tunnel				
Starting from CBD North - 675 m long	1/08/2018	31/01/2019	30/11/2019	-21 to -18

Based on the modelling results, a total groundwater inflow into the station excavation of up to 480 m^3/day was predicted for the unmitigated case (Table 19). The maximum groundwater inflow is indicated to occur at the end of mined tunnel excavation. This is indicated to follow by a decrease in the groundwater inflow into the excavation, with the groundwater inflow at the time immediately prior to station sealing (30 March 2020) at about 310 m^3/day.

Table 19: Construction Phase Groundwater Inflow into CBD North Station and Mined Tunnel

DATE	CONSTRUCTION STAGE	GROUNDWATER INFLOW	
		m^3/day	L/s*
1/05/2018	Stage 1 excavated, Stage 3 Invert and Melbourne	210	2.4
30/06/2018	Stage 3 Invert Excavated, Stage 2 Invert Being	250	2.9
1/08/2018	Immediately Before Tunnelling Started	220	2.5
31/08/2019	Tunnel Excavation Finished	480	5.6
31/03/2020	Immediately Before Sealing of Station	310	3.6

*inflow values expressed as L/s are direct conversions from values in m^3/day

The groundwater drawdowns within the Moray Street Gravels and Silurian aquifer (model Layer 6) at the end of construction are shown in Figure 22. The spatial hydraulic conductivity distribution within this model layer is shown in Figure A6 (Appendix A).

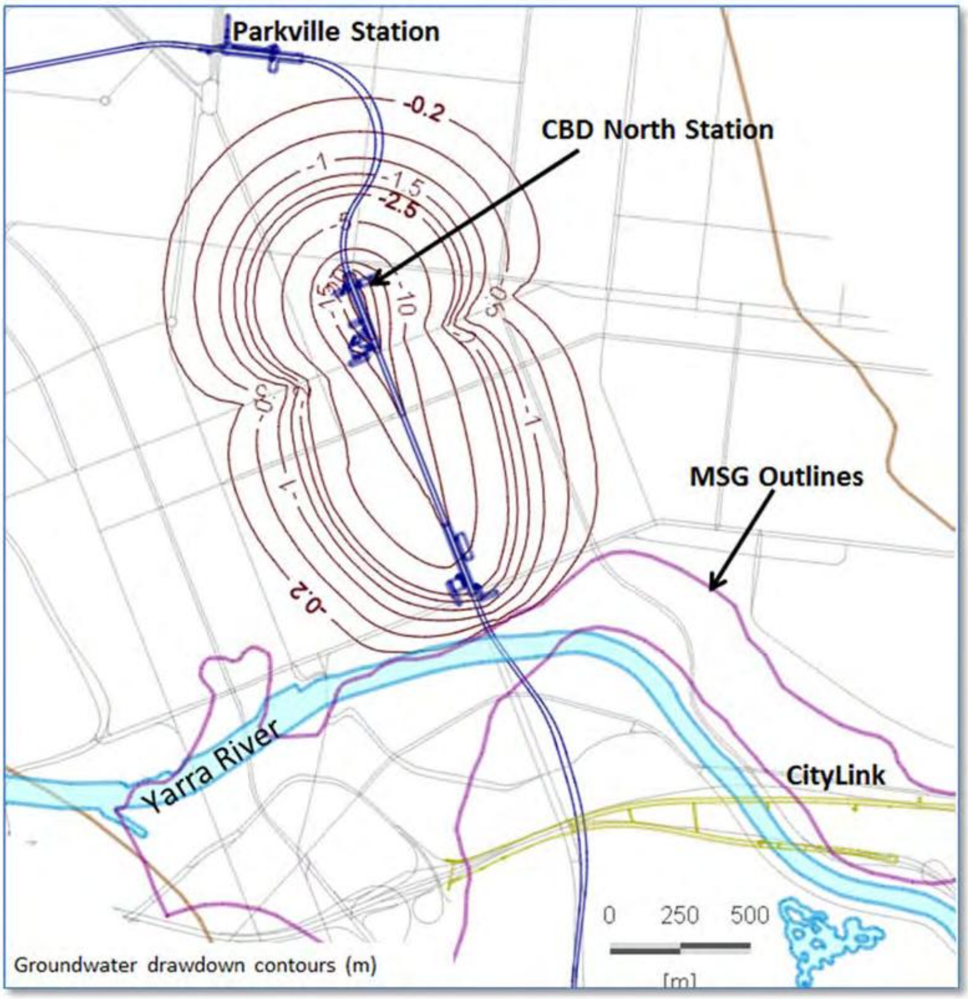


Figure 22: Construction Phase Groundwater Drawdown at End of CBD North Station and Mined Tunnel Construction

The model indicated groundwater drawdowns at the end of the CBD North station and mined tunnel construction of less than 0.2 m in the Moray Street Gravels aquifer and at the base of the Coode Island Silt.

8.3.3 Arden Station

It is understood that Arden station would be constructed using diaphragm walls around the perimeter of the station box, with toe grouting extending 10 m beneath the wall adopted as an additional mitigation measure to limit groundwater inflow through the base. Both mitigation measures would be in place prior to commencement of excavation.

A schematic of the modelled diaphragm wall and toe grouting design is shown in Figure 23 and construction schedules are summarised in Table 20.

A hydraulic conductivity value of 1 x10^{-9} m/s was adopted for the model elements representing the diaphragm wall and 1x10^{-7} m/s for the model elements simulating the toe grouting beneath the wall.

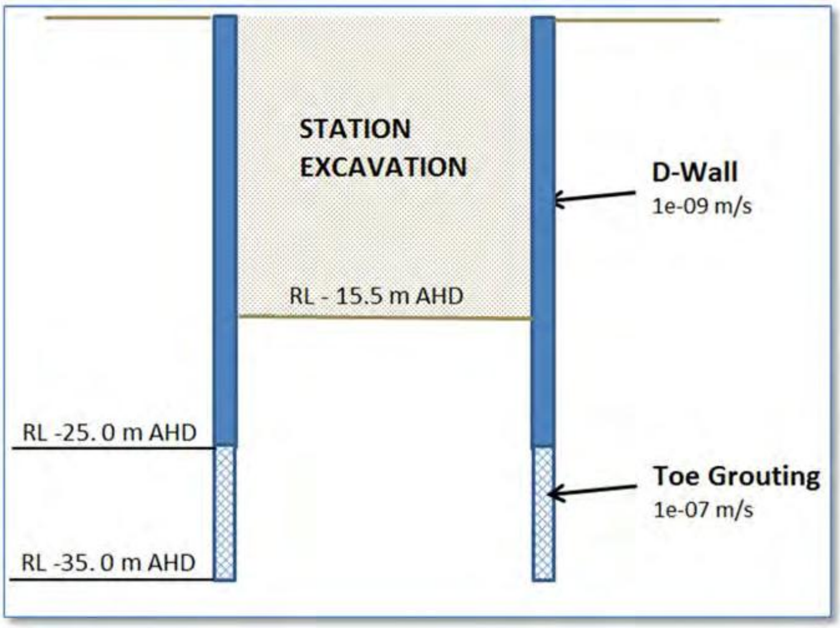


Figure 23: Arden Station Diaphragm Wall and Toe Grouting Design, Version 2 Regional Model

Table 20: Arden Station Construction Schedules, Version 2 Regional Model

Date	Construction Stage	Excavation Level (m AHD)
1/07/2018	Start of Excavation	4.0
31/12/2018	Excavation Finished	-15.5
30/06/2019	Station Sealed	-15.5

A construction phase groundwater inflow into the station excavation up to 185 m^3/day was predicted in the model (Table 21). The maximum groundwater inflow is indicated to occur once the maximum excavation depth (RL –15.5 m AHD) is reached. The groundwater inflow is indicated to decrease to about 125 m^3/day just prior to sealing of the station on 30 June 2019.

Table 21: Construction Phase Groundwater Inflow into Arden Station Excavation, Version 2 Regional Model

DATE	Excavation Level (m AHD)	GROUNDWATER INFLOW	
		m^3/day	L/s*
13/11/2018	-10.39	145	1.7
26/11/2018	-11.77	155	1.8
31/12/2018	-15.50	185	2.1
30/06/2019	-15.50	125	1.4

*inflow values expressed as L/s are direct conversions from values in m^3/day

The groundwater drawdowns at the end of construction and at the top of the model Layer 4 (RL -10 m AHD) are shown in Figure 24. The extent of drawdowns at the top of this model layer, which includes the Early Pleistocene sediments (K of 1 x 10^{-4} m/s) is considered to be the most relevant for estimating the potential drawdowns which may be experienced at the base of the Coode Island Silt, as it lays directly on the top of the Early Pleistocene sediments in this area.

The spatial hydraulic conductivity distribution within this model layer is shown in Figure A4 (Appendix A).

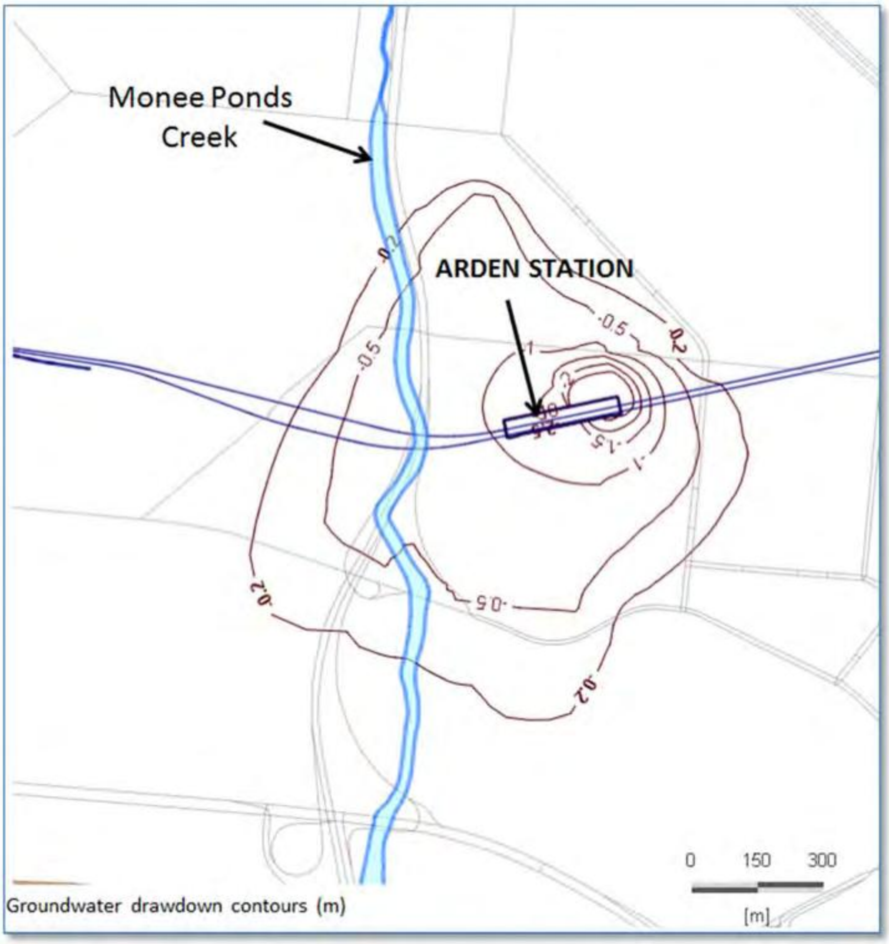


Figure 24: Construction Phase Groundwater Drawdowns, Arden Station (Including Diaphragm Wall and Toe Grouting)

The model indicated maximum construction phase groundwater drawdowns occur just prior to station sealing. At this time, groundwater drawdowns of up to 1.5 m under the base of the Coode Island Silt are indicated in the model (Figure 24). However in the areas where the greatest drawdowns are indicated, the Coode Island Silt sediments are estimated to only be about 5 m thick or less. Where the Coode Island Silt is thicker, the groundwater drawdowns are generally indicated to be between 0.5 m and 1.0 m.

8.3.4 Domain Station

Two construction phase scenarios were simulated in the Version 1 Regional Model for the Domain station:

- Scenario 1T: This scenario considered that a soldier pile wall would provide lateral support to the station excavation around the whole station footprint and no grouted zone would be present below the base of the excavation.
- Scenario 2T: This scenario considered placement of a diaphragm wall around the whole station footprint. In the model the diaphragm wall was represented as being continuous, with a uniform thickness of about 0.5 m. An embedment depth of 5 m below the final excavation levels was also adopted in this modelling scenario.

The model layer properties (hydraulic conductivities, specific yield, specific storage) remained the same as for the CBD South Station modelling runs.

The construction schedules adopted in the model were the same for both scenarios and are summarised in Table 22.

Table 22: Domain Station Construction Schedules

DATE		CONSTRUCTION STAGE
From	To	
1/04/2020	1/06/2021	Excavation in progress, linear excavation rate from RL 0 m AHD to RL -11.98 m AHD, both scenarios
1/06/2021	1/12/2021	Casting of the slab, both scenarios
1/12/2021		Station Sealed - Scenario 2T only
1/12/2021	1/05/2022	Walls built-up for the DS Scenario 1T only
2/05/2022		Station Sealed - Scenario 1T only

A construction phase groundwater inflow rate into the station excavation of up to 150 m^3/day was predicted by Scenario 1T (soldier pile wall case) and up to 70 m^3/day by Scenario 2T (diaphragm wall case) as summarised in Table 23. The maximum groundwater inflow is indicated, in both scenarios, to occur once the excavation is finalised and casting of the slab commences.

Table 23: Construction Phase Groundwater Inflow into Domain Station, Version 1 Regional Model

DATE	SCENARIO 1T			SCENARIO 2T		
	Groundwater Inflow		Construction Stage	Groundwater Inflow		Construction Stage
	(m^3/day)	L/s*		(m^3/day)	L/s*	
1/01/2021	45	0.5	Excavation in progress	35	0.4	Excavation in progress
1/04/2021	125	1.4	Excavation in progress	65	0.8	Excavation in progress
1/06/2021	150	1.7	Casting of the slab	70	0.8	Casting of the slab
1/12/2021	95	1.1	Walls built-up	-	-	Station sealed

*inflow values expressed as L/s are direct conversions from values in m^3/day

The groundwater drawdowns within the Silurian aquifer at the end of construction are shown in Figure 25 for Scenario 1T and Figure 26 for Scenario 2T. These are both at the top of model layer 4 (at RL – 10 m AHD), which is considered to be the most representative for estimating drawdowns at the base of the Coode Island Silt in this area.

The spatial hydraulic conductivity distribution within this model layer is shown in Figure A4 (Appendix A).

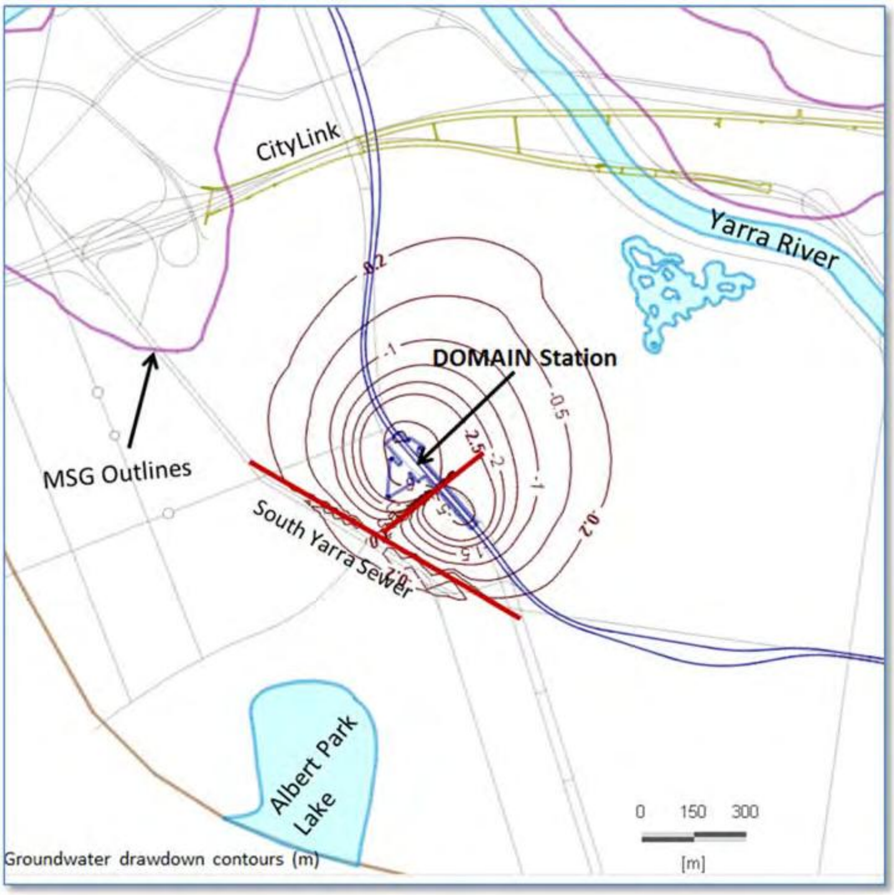


Figure 25: Construction Phase Groundwater Drawdown, Domain Station Scenario 1T, Version 1 Regional Model

The model results indicated no construction phase groundwater drawdowns occur within the Moray Street Gravels to the north of the station in both scenarios. Maximum groundwater drawdowns at the base of the Coode Island Silt (South Melbourne area) at the end of construction are predicted to be between 0.3 m and 0.4 m for Scenario 1T and less than 0.1 m for Scenario 2T.

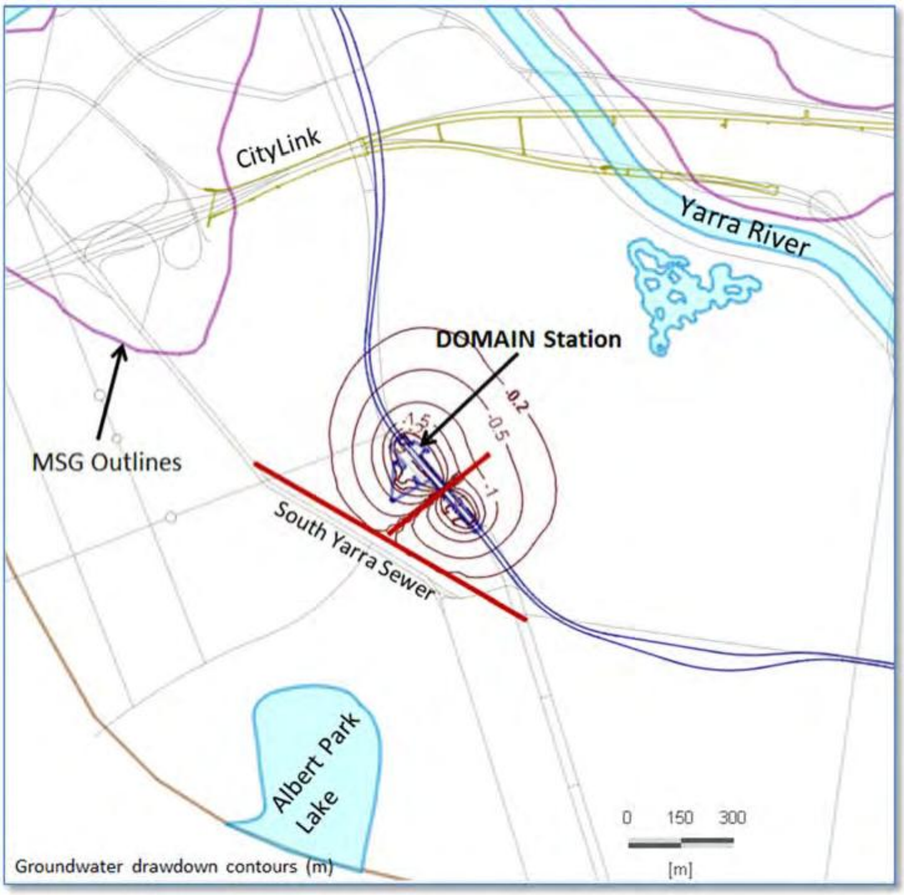


Figure 26: Construction Phase Groundwater Drawdown, Domain Station Scenario 2T, Version 1 Regional Model

8.3.5 Western Portal Shaft and Cut and Cover Structure

It is understood that the western portal would be constructed using a secant pile wall around the perimeter of the dive structure, cut and cover structure and the TBM retrieval shaft, with toe grouting extending 5 m beneath the wall adopted as an additional mitigation measure to limit groundwater inflow through the base of the excavations. Both mitigation measures would be in place prior to commencement of excavation.

A schematic of the modelled secant pile wall and toe grouting design is shown in Figure 27 for the shaft and Figure 28 for the cut and cover structure. Excavation of the cut and cover structure was only simulated in the section where it passes below the current water table, which for this area is about RL 0 to -1.0 m AHD.

A hydraulic conductivity value of 1 x10^{-9} m/s was adopted for the model elements representing the diaphragm wall and 1x10^{-7} m/s for the model elements simulating the toe grouting beneath the wall. No other mitigation measures were included into the modelled scenario.

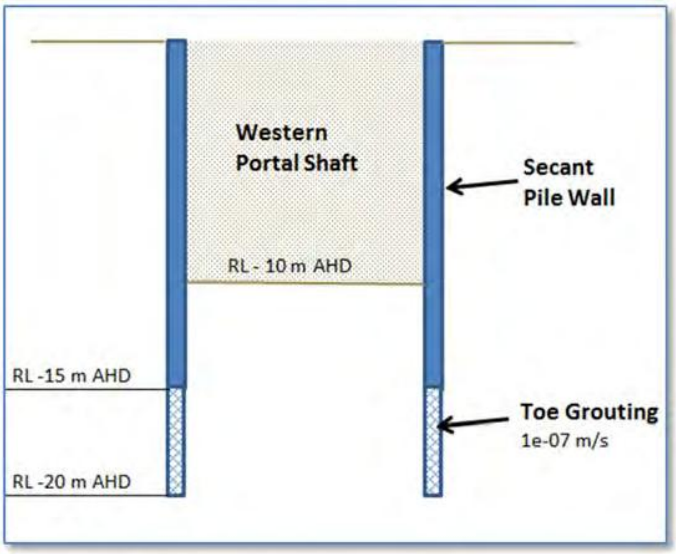


Figure 27: Western Portal Shaft Construction Details, Version 2 Regional Model

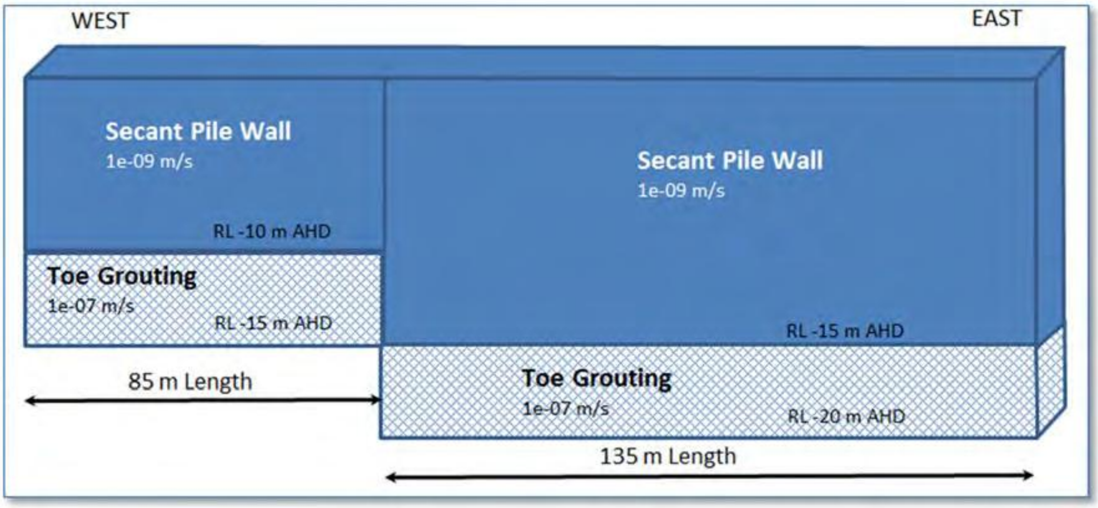


Figure 28: Cut and Cover Structure Design Details Along the Wall, Version 2 Regional Model

Construction schedules for the TBM retrieval shaft and cut and cover structure are summarised in Table 24.

Table 24: Western Portal Shaft and Cut and Cover Structure Construction Schedules

Date	Construction Stage	Excavation Level (m AHD)
TBM Retrieval Shaft		
1/09/2018	Start of Excavation	7.0
1/04/2019	Excavation Finished	-10.0
1/08/2019	Station Sealed	-10.0
Cut and Cover Structure		
1/10/2019	Start of Excavation	Surface Level
1/03/2020	Excavation Finished	-8.8 to -1.0
31/05/2020	Cut and Cover Structure Sealed	-8.8 to -1.1

Construction phase groundwater inflow rates of up to 45 m^3/day were predicted in the model as summarised in Table 25. The highest inflows are indicated to be associated with the cut and cover structure excavation and are predicted to occur once the cut and cover structure is fully excavated. The groundwater inflow is then indicated to decrease slightly just prior to sealing of the cut and cover structure on 31 May 2020.

Table 25: Groundwater Inflow into Western Portal Structure, Version 2 Regional Model

DATE	CONSTRUCTION STAGE	EXCAVATION LEVEL (m AHD)	GROUNDWATER INFLOW	
			m^3/day	L/s*
29/01/2019	Shaft Being Excavated	-5.0	10	0.1
1/04/2019	Shaft Excavation Completed	-10.0	12	0.1
1/08/2019	Prior to Sealing of Shaft	-10.0	11	0.1
1/03/2020	Cut and Cover Structure Excavated	-8.8 to -1.0	45	0.5
31/05/2020	Prior to Sealing of Cut and Cover Structure	-8.8 to -1.0	43	0.5

*inflow values expressed as L/s are direct conversions from values in m^3/day

The estimated construction phase groundwater drawdowns at the top of the model layer 4 (RL -10 m AHD) are shown in Figure 29. The extent of drawdowns at the top of this model layer, which is within the Older Volcanics (K of 5 x 10^{-7} m/s), is considered to be the most significant for estimating the drawdowns at the base of the Coode Island Silt. The spatial hydraulic conductivity distribution within this model layer is shown in Figure A4 (Appendix A).

Maximum groundwater drawdowns are indicated to occur just prior to sealing of the cut and cover structure. Groundwater drawdowns of up to 2.0 m are indicated at the base of the Coode Island Silt at this time. Groundwater drawdowns associated with construction of the TBM retrieval shaft are indicated to be limited to the Older Volcanics rock only and no drawdowns at the base of the Coode Island Silt are indicated prior to sealing of the shaft on 1 August 2019.

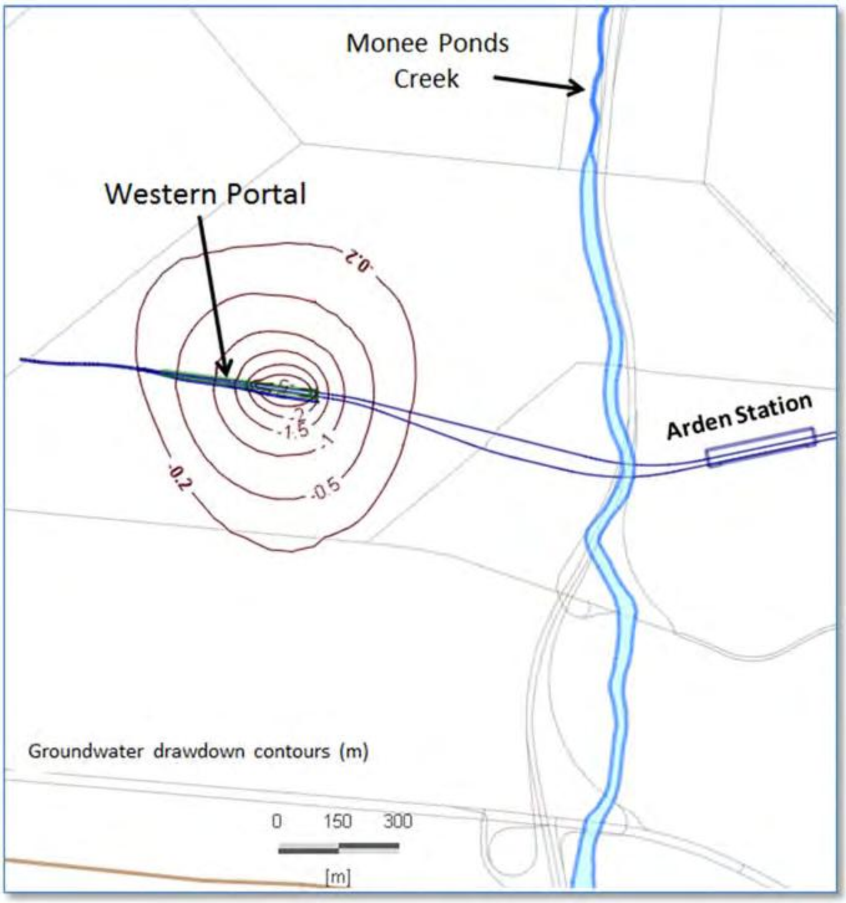


Figure 29: Groundwater Drawdowns, Western Portal Structures, Version 2 Regional Model

8.3.6 Summary of Version 2 Modelling Results

Construction Phase Inflows

Results of the Version 2 Regional model indicate maximum groundwater inflows during construction range from 45 m^3/day for the western portal cut and cover structure to 450 m^3/day for CBD North station excavation which includes those into the mined tunnel. The maximum inflows are indicated, typically, to occur once the maximum excavation depths are reached, or in the case of CBD North Station and mined tunnel when the excavation of the mind tunnel is completed. These inflow rates are considered to be moderate and can be managed using standard groundwater inflow control measures during construction.

Construction Phase Drawdowns

The Version 2 Regional Model results for the construction phase scenarios indicate that groundwater levels within the Moray Street Gravel aquifer may be affected during construction of the CBD South station only. In the construction phase scenario for CBD South station, groundwater drawdowns in the Moray Street Gravel aquifer up to 1 m were predicted at the end of this station construction. Although not simulated by the Version 2 Regional model, these groundwater drawdowns are considered to be manageable and likely can be further mitigated if necessary by pre-injection grouting around the cavern excavation and toe grouting at the base of the shaft walls. The modelling also indicates that the use of temporary injection wells during construction at CBD South would also likely be required, based on the predicted drawdowns without injection wells. The need to install temporary injection wells during construction should therefore be incorporated into the station design. Further assessment will also be required to refine the injection well design to demonstrate that it is likely to maintain the predicted groundwater drawdowns, including those associated with any cumulative effects, within allowable limits during construction..

Results of the numerical modelling for the Domain station construction suggest that groundwater drawdowns within Coode Island Silt in the South Melbourne area are likely to be less than 0.4 m for the soldier pile wall construction scenario and less than 0.1 m for the diaphragm wall construction scenario. These groundwater drawdowns are unlikely to be significant, considering they are likely within the range that has been experienced historically in this area. However the extent of groundwater drawdown within this part of the study area may be very dependent on the whether higher hydraulic conductivity zones are present, such as those which may be associated with the Melbourne Warp or other structures within the Silurian. Procurement phase site investigations and pumping test planned to be undertaken adjacent to proposed Domain station location would provide additional information with respect to the potential presence of such zones in the vicinity of the station.

Results of the Version 2 model for Arden station and the western portal indicate groundwater drawdowns beneath the Coode Island Silt of up to 1.5 m at the Arden Station and up to 2.0 m at the Western Portal cut and cover structure may be induced during construction based on the modelled designs. These drawdowns indicate that temporary injection wells would also likely be required in both areas based on the predicted drawdowns without injection wells. Temporary injection wells should therefore be incorporated into the Western Portal and Arden station designs. Further assessment will also be required to refine these injection well designs, to demonstrate that they are likely to maintain the predicted groundwater drawdowns within allowable limits during construction.

Operation Phase Drawdowns

The Version 2 Regional Model results for the operational phase scenarios indicate that the groundwater drawdowns within the majority of the study area are likely to be less than 0.5 m during the operational phase. However the modelling also indicates that groundwater drawdowns up to 0.6 m are possible locally at the base of the Coode Island Silt within Alexandra Gardens, if the rail tunnels in this area are lined to Haack Class 3. The modelling also suggests that lining of the rail tunnel to Haack Class 2 along a 150 m section of the twin tunnels in this area would result in a slight reduction of the operation phase drawdowns to less than 0.5 m at the base of the Coode Island Silt.

In summary, the two steady state modelling scenarios indicated that lining of a 150 long section of the rail tunnels through the Alexandra Gardens from Haack Class 3 to Haack Class 2 would likely result in a limited decrease in groundwater drawdowns in this area. Once potential settlement ranges have been estimated for these predicted drawdowns, a decision can then be made if the consequences of the predicted ground movement justify the additional cost which would be associated with waterproofing this section of tunnel to Haack Class 2.

9.0 MODEL LIMITATIONS

The model developed and presented in this report represents an approximation of the groundwater flow system inferred for the study area. It is based, largely, on Golder's past experience on other projects within the study area, published work completed by others and results of the Melbourne Metro site investigations completed up to September 2015. The groundwater levels coverage and historical level data have been limited over the study area. The available data, however, were considered to be sufficiently detailed to allow the potential hydrogeological risks to be better defined and understood, which in turn, would help focus future site investigation and numerical modelling work.

The main limitations of this model are considered to be as follows and the results from this model should be considered with these limitations in mind.

- The groundwater level coverage was limited in comparison to the study area coverage as the majority of the Melbourne Metro groundwater wells are located along the proposed tunnel alignment and the CityLink wells are concentrated within a limited area of South Melbourne and the Royal Botanic Gardens. With the exception of the Silurian rock aquifer, only a limited number of the wells have been installed in other aquifers, so interpretation of the groundwater flow within aquifers and between aquifers is still at a conceptual level.
- Limited information was available in respect to potential groundwater inflows into the known man-made structures such as the City Loop, North Yarra, South Yarra and Prahran Main Sewers, and the Arts Centre deep basement. Potentially there are other man-made structures within the study area impacting the groundwater flow system, such as deep basements, which were not included in the model. Additionally no data was available for some local drainage lines that may potentially impact upon the local groundwater flow system.
- No sensitivity analyses were undertaken for the Version 2 Regional Model to assess potential impacts of a range of hydraulic conductivities and specific storage properties for various hydrostratigraphic units on the results predicted.
- Structures such as cross passages and access shafts were not included in the Version 2 Regional model which could cause additional localised drawdowns beneath the Coode Island Silt to the west of Moonee Ponds Creek and to the south of the Yarra River.
- The potential for cumulative impacts associated with elements of the project being constructed concurrently were not considered in the Version 2 Regional Model. Based on the modelling work completed for the EES, Golder does not consider that such combined effects would materially change the findings of this assessment. We, therefore, consider the proposed mitigation measures of grouting and temporary injection wells for CBD South Station will be adequate to maintain the likely cumulative drawdowns within allowable limits.
- The potential beneficial effects of additional mitigation strategies such as pre-injection grouting and temporary recharge were not considered in the Version 2 Regional Model for CBD South station. The potential beneficial effects of temporary recharge were also not considered at Arden Station and the Western Portal cut and cover structure.

Based on Table 2-1 included in the Australian groundwater modelling guidelines (Barnett et al, 2012), the regional model could broadly be classified as Class 2 model considering that the model was calibrated for steady state conditions but was used for transient predictions. However, some elements of the Class 3 model as defined in Table 2-1 are applicable for the regional model, in particular, related to calibrations statistic and an ongoing review of the model by an experienced and independent reviewer. For this modelling work, the independent ongoing review of the model's development was completed by AJM JV. AJM JV also subsequently reviewed the modelling results and this summary report describing the work undertaken and associated findings.

It should be noted that the regional model is only one representation of the groundwater system within the project area. Inherently, as applicable for all numerical models, it is likely that there would be some inaccuracy with respect to model predictions. The model presented here, however, is our best approximation of the groundwater system within the time and data limitations within which the modelling had to be completed. Further uncertainty and sensitivity analyses will need to be completed to understand the potential variability of the modelling results to the assumptions made.

Notwithstanding the above limitations, the model developed is considered to be adequate for a preliminary assessment of the potential groundwater impacts associated with Melbourne Metro for the purposes of informing the Environment Effects Statement based on Golder's past project experience.

10.0 REFERENCES

Barnett et al, 2012: Australian Groundwater Modelling Guidelines, Waterlines Report, National Water Commission, Canberra

Haack, A., 1991: Water Leakages in Subsurface Facilities: Required Watertightness, Contractual Matters, and Method of Redevelopment, prepared for ITA Working Group on Research, Tunnelling and Underground Space Technology Vol. 6, No 3, pp 273-282, 1991

Raymer, L.H., 2001. Predicting Groundwater Inflow into Hard-Rock Tunnels: Estimating the High-End of the Permeability Distribution. Rapid Excavation and Tunnelling Conference, San Diego 2001, pp 1027-1039.

Raymer L.H., 2005. Predicting Groundwater Inflow into Hard-Rock Tunnels: A New Look at Inflow Equations, Rapid Excavation and Tunnelling Conference Seattle 2005, pp 457-468.

Report Signature Page

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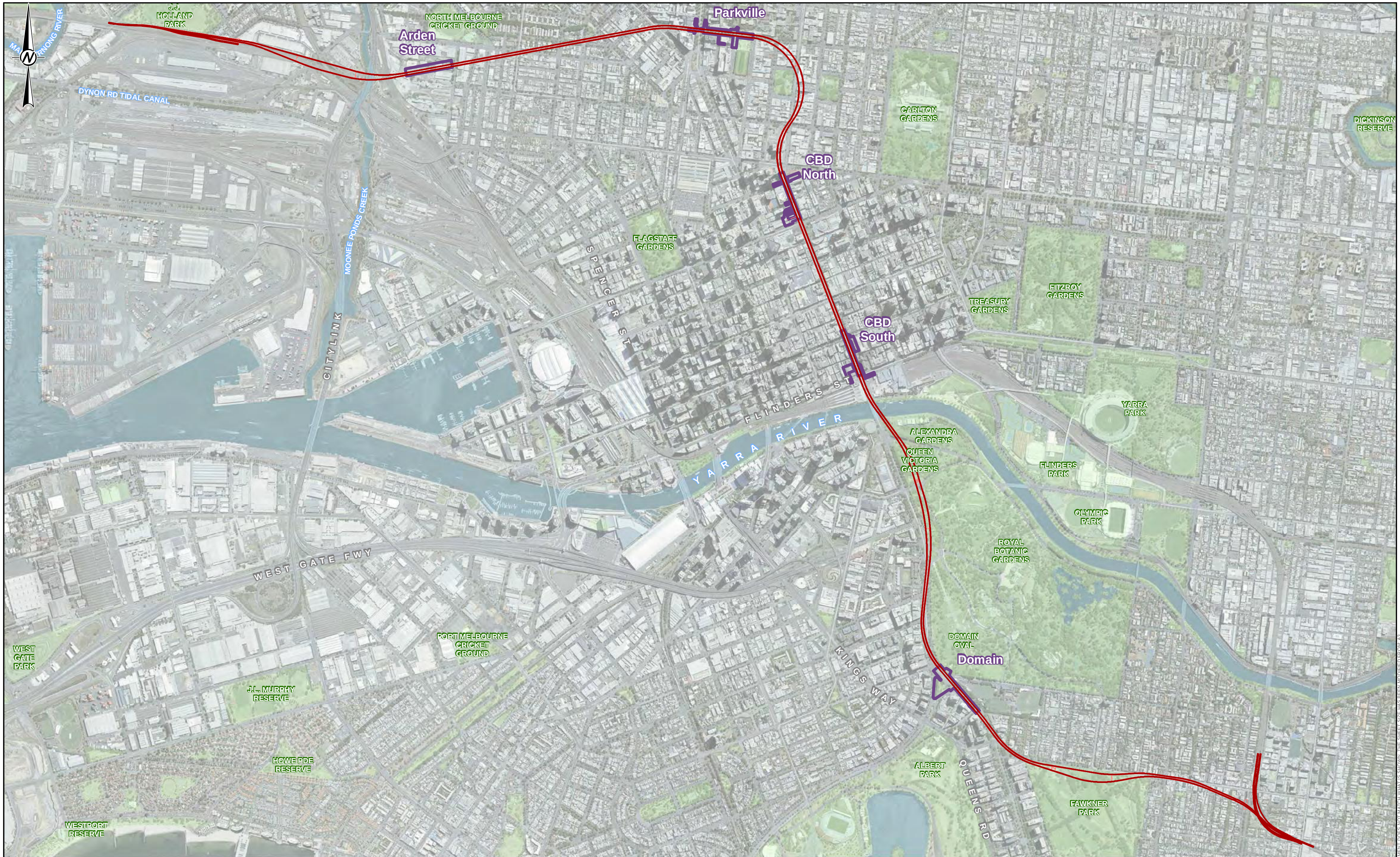

LEGEND

- Water
- Proposed Rail Track
- Proposed Rail Infrastructure
- Proposed Station Extent

MAP INFORMATION

The information and data contained in this map is for Melbourne Metro Rail Project, and is for information purposes only. It is to be used for reference only and may not be suitable for any other purpose including design. The information may not be accurate, current or otherwise reliable.

NOTES

1. Rail alignment sourced from AJM JV, revision P2.3 dated 28-10-2015.
2. Aerial imagery sourced from Public Transport Victoria, image resolution 10cm and date of capture February 2015.
3. Road and hydro information sourced from Victorian Government Data Directory 2015.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 200 400 600 800 1,000
METRES

REFERENCE SCALE: 1:20,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

TITLE
RAIL ALIGNMENT

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-17
PREPARED	JPH / CJS
DESIGN	-
REVIEW	FC
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	DRAWING
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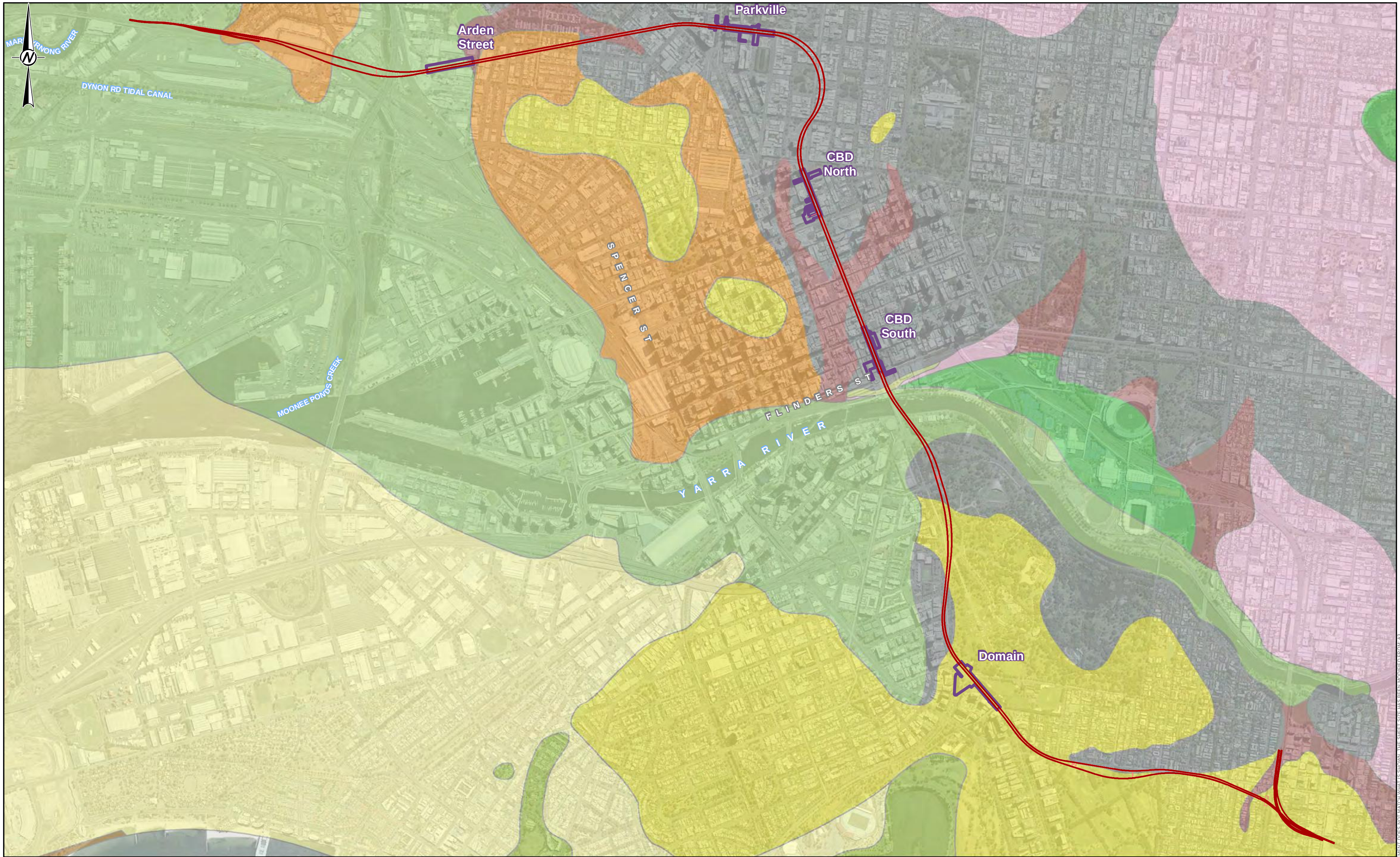

LEGEND

- Proposed Rail Track
- Proposed Rail Infrastructure
- Proposed Station Extent

Surface Geology

- Fill
- Coode Island Silt (Qhi)
- Port Melbourne Sand (Qhp)
- Coastal Swamp Deposits (Qrs)
- Pleistocene Alluvium (Qpa)
- Recent Silt (Qra)
- Newer Volcanics (Qvn)
- Melbourne Formation (Sud)
- Brighton Group (Tpb)
- Older Volcanics (Tvo)
- Jolimont Clay (Qpj)

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2. Aerial imagery sourced from Public Transport Victoria, image resolution 10cm and date of capture February 2015.
3. Road and hydro information sourced from Victorian Government Data Directory 2015.
4. Geology data digitized from Melbourne Geology Map 1:63,000 (1974). Captured at a Scale of 1:10,000. The data has been altered when more accurate data has become available.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

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METRES

REFERENCE SCALE: 1:20,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
GEOLOGY PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-02-17
PREPARED	JPH / CJS
DESIGN	-
REVIEW	IKH
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	DRAWING
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LEGEND

Top of Silurian Bedrock

- 5m Interval (mAHD)
- Less then 5m Interval (mAHD)
- Proposed Rail Track
- Proposed Rail Infrastructure
- Proposed Station Extent
- CityLink Tunnel
- Melbourne Underground Rail Loop Tunnel (MURL)
- Model Extent

MAP INFORMATION

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2. Road and hydro information sourced from Victorian Government Data Directory 2015.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 200 400 600 800 1,000
METRES

REFERENCE SCALE: 1:30,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
TOP OF SILURIAN BEDROCK ISO-CONTOURS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-17
PREPARED	JPH / CJS
DESIGN	-
REVIEW	IKH
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	DRAWING
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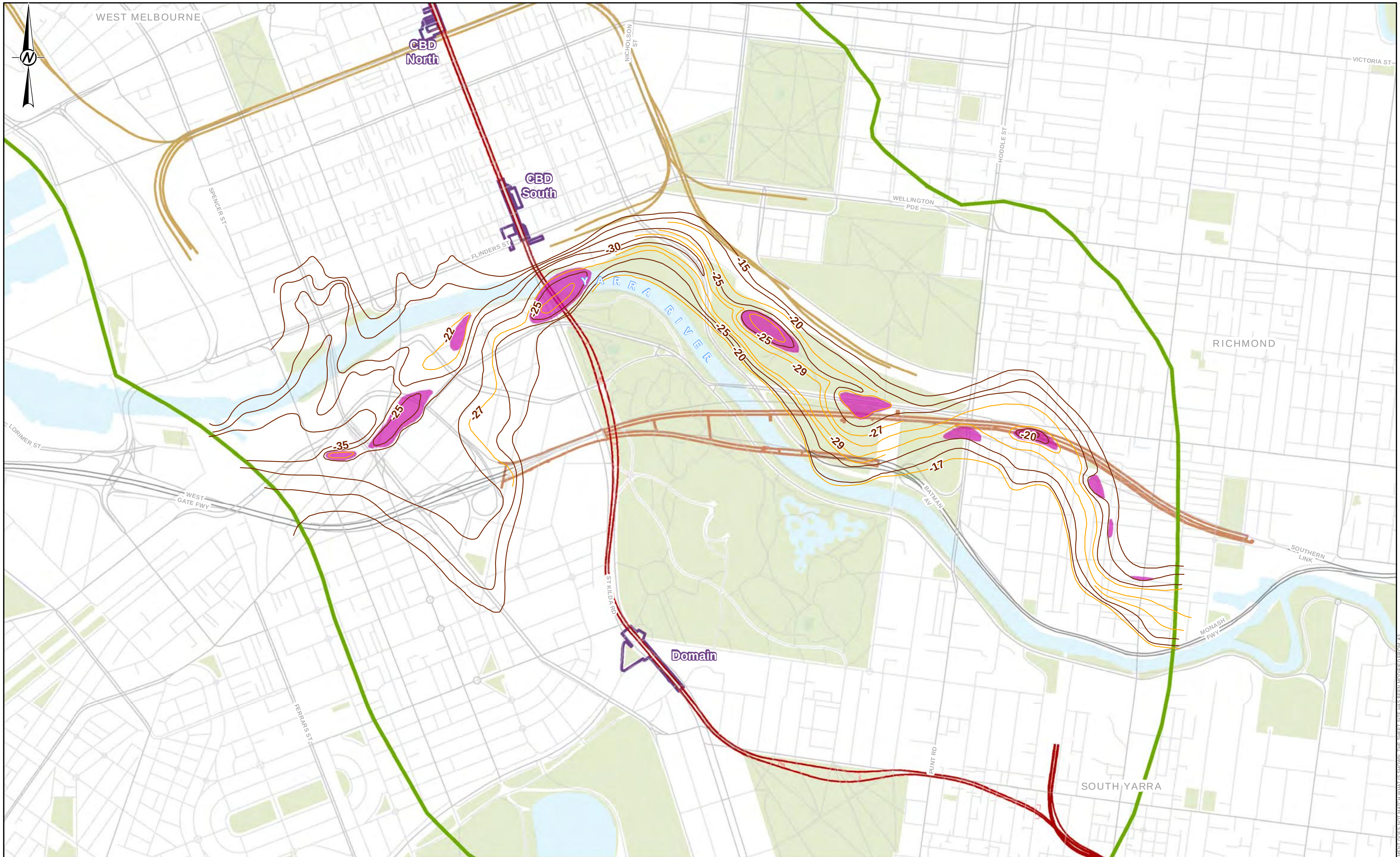

LEGEND

Base of Moray Street Gravels

- 5m Interval (mAHD)
- Less Than 5m Interval (mAHD)
- Lower Newer Volcanics Palaeo-hills
- Proposed Railway Track
- Proposed Rail Infrastructure
- Proposed Station Extent
- CityLink Tunnel
- Melbourne Underground Rail Loop Tunnel (MURL)
- Model Extent

MAP INFORMATION

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2. Road and hydro information sourced from Victorian Government Data Directory 2015.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 200 400 600 800 1,000
METRES

REFERENCE SCALE: 1:15,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
BASE OF MORAY STREET GRAVELS ISO-CONTOURS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-17
PREPARED	JPH / CJS
DESIGN	-
REVIEW	IKH
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	DRAWING
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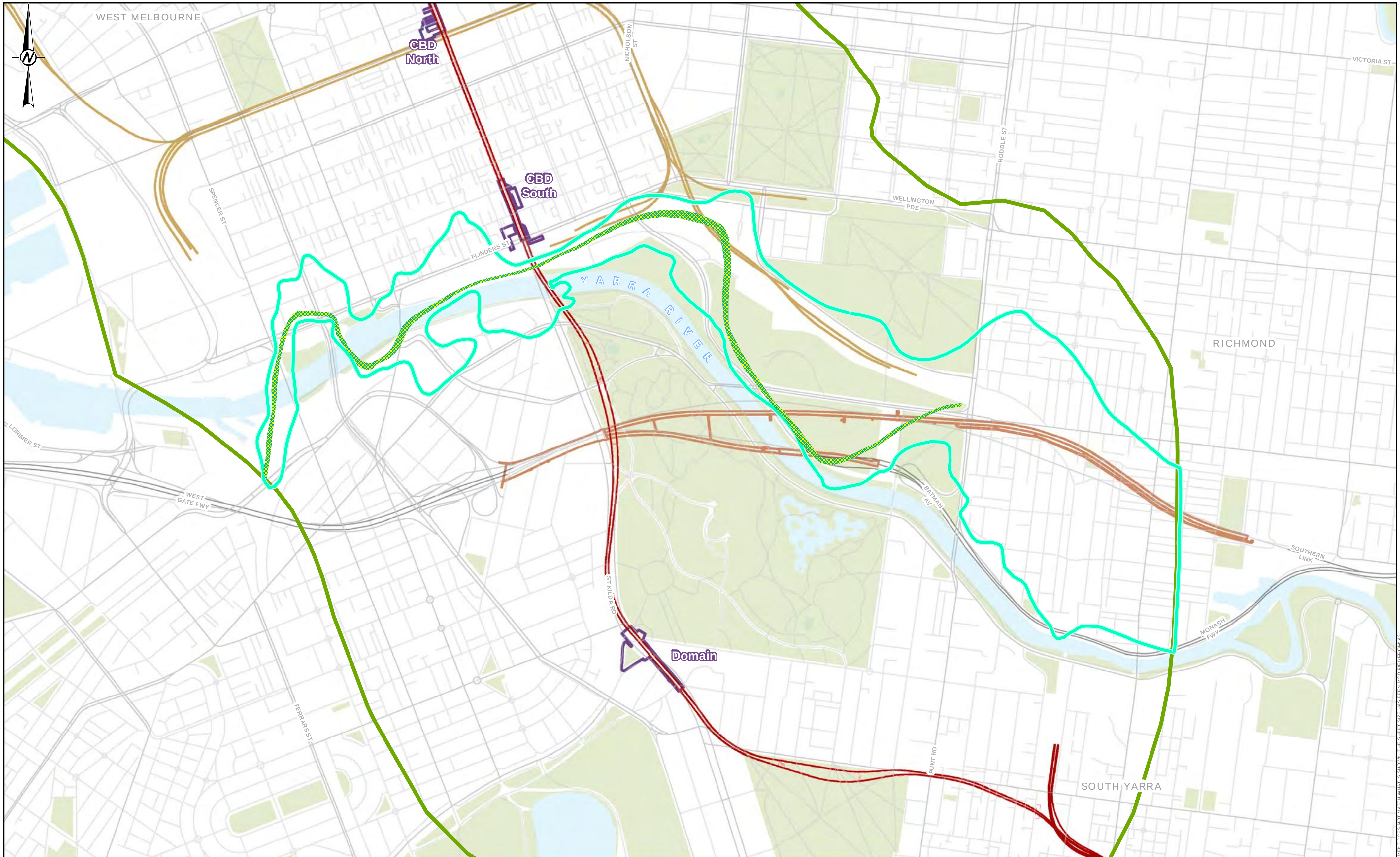

LEGEND

- Basalt Deep Valley
- Basalt Outline
- Proposed Rail Track
- Proposed Rail Infrastructure
- Proposed Station Extent
- CityLink Tunnel
- Melbourne Underground Rail Loop Tunnel (MURL)
- Model Extent

MAP INFORMATION

The information and data contained in this map is for Melbourne Metro Rail Project, and is for information purposes only. It is to be used for reference only and may not be suitable for any other purpose including design. The information may not be accurate, current or otherwise reliable.

NOTES

1. Rail alignment sourced from AJM JV, revision P2.3 dated 28-10-2015.
2. Road and hydro information sourced from Victorian Government Data Directory 2015.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 200 400 600 800 1,000
METRES

REFERENCE SCALE: 1:15,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
BURNLEY BASALT FLOW OUTLINES

CONSULTANT
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YYYY-MM-DD	2016-02-17
PREPARED	JPH / CJS
DESIGN	-
REVIEW	IKH
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	DRAWING
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LEGEND

Base of Coode Island Silt

- 5m Interval (mAHD)
- Less then 5m Interval (mAHD)
- Proposed Rail Track
- Proposed Rail Infrastructure
- Proposed Station Extent
- Melbourne Underground Rail Loop Tunnel (MURL)
- Model Extent

MAP INFORMATION

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NOTES

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2. Road and hydro information sourced from Victorian Government Data Directory 2015.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 200 400 600 800 1,000
METRES

REFERENCE SCALE: 1:30,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
BASE OF COODE ISLAND SILT ISO-CONTOURS

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YYYY-MM-DD	2016-02-17
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DESIGN	-
REVIEW	IKH
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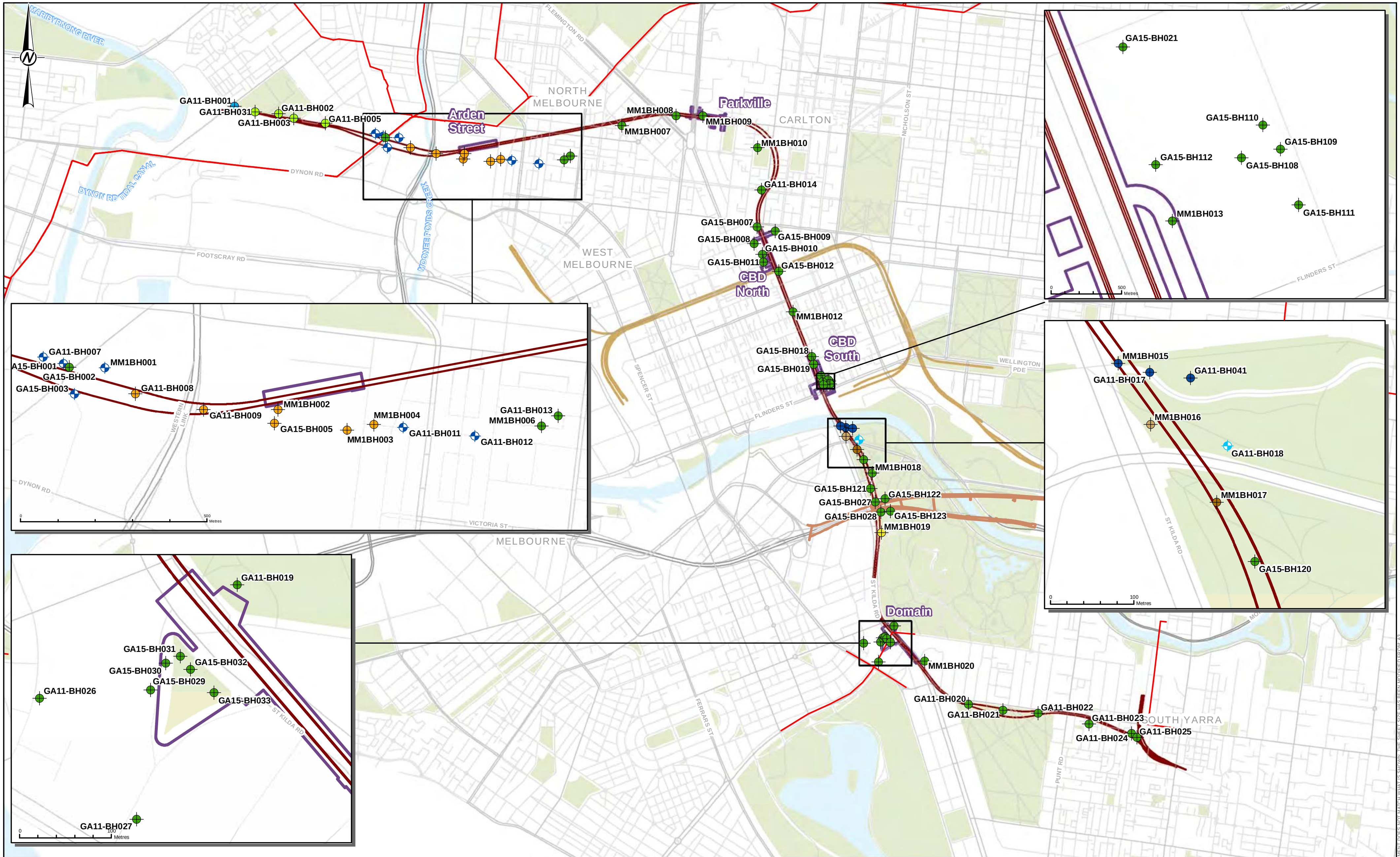

LEGEND

Groundwater Well (by Monitoring Unit)

- Brighton Group
- Coode Island Silt
- Early Pleistocene Aquifer
- Fishermans Bend Silt/Coode Island Silt
- Holocene Aquifer
- Late Pleistocene Aquifer
- Moray Street Gravels Aquifer
- Older Volcanics Aquifer
- Silurian Aquifer
- Werribee Formation Aquifer
- Major Sewer
- Proposed Railway Track
- Proposed Station Extent
- CityLink Tunnel
- Melbourne Underground Rail Loop Tunnel (MURL)

MAP INFORMATION

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NOTES

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2. Road and hydro information sourced from Victorian Government Data Directory 2015.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 200 400 600 800 1,000
METRES

REFERENCE SCALE: 1:25,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
MMRP GROUNDWATER MONITORING WELLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-17
PREPARED	JPH / CJS
DESIGN	-
REVIEW	IKH
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	DRAWING
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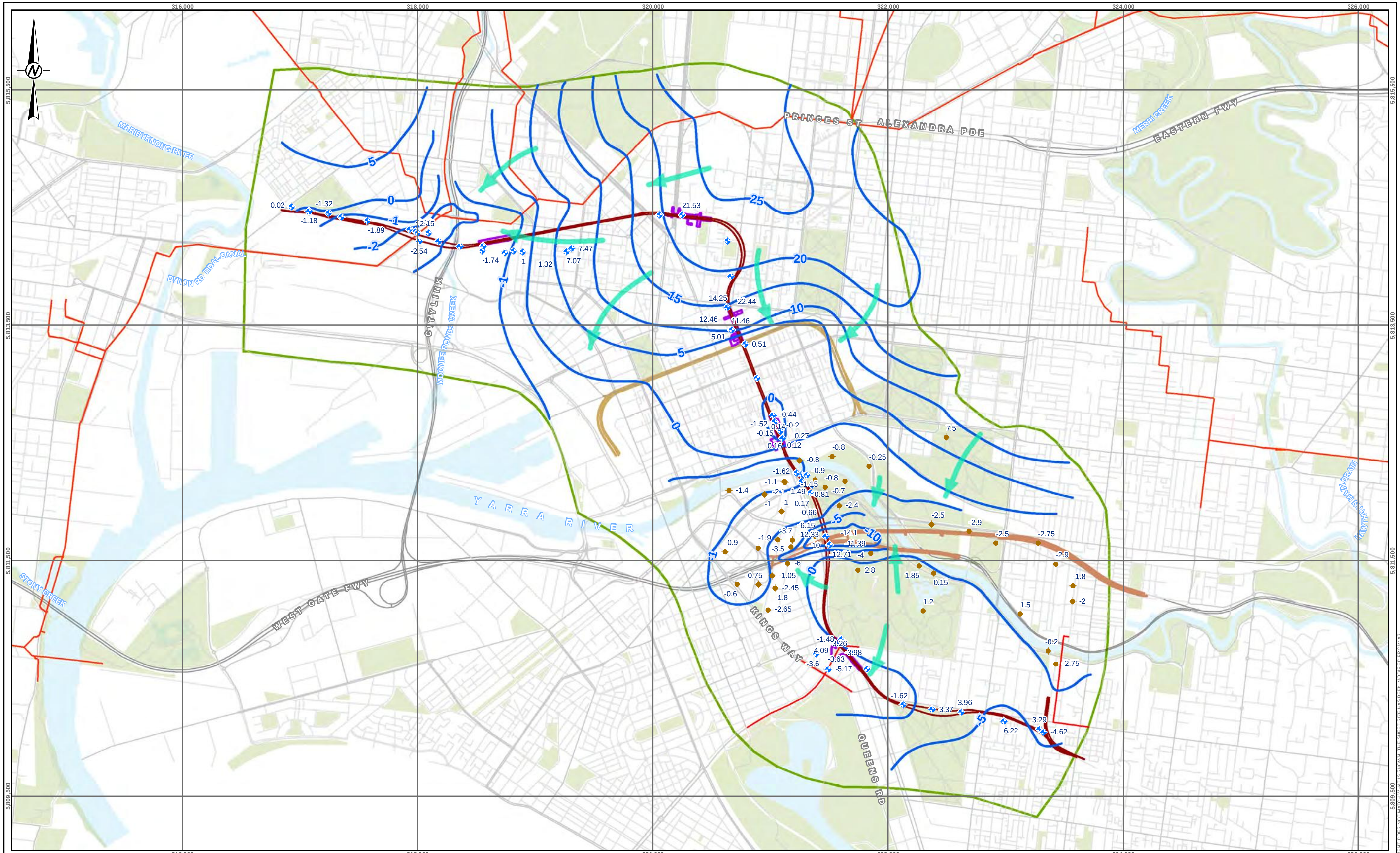

LEGEND

- MMRP Groundwater Well
- CityLink Groundwater Well
- 21.53 Groundwater Elevation (m AHD)
- Groundwater Flow Direction
- Groundwater Contours (m AHD)
- CityLink Tunnel
- Proposed Rail Track
- Proposed Station Extent
- Sewer
- Melbourne Underground Rail Loop Tunnel (MURL)
- Model Extent

MAP INFORMATION

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NOTES

1. Rail alignment/station extents sourced from AJM JV, dated 28-10-2015 for Concept Design.
2. Aerial imagery sourced from Public Transport Victoria, image resolution 10cm and date of capture October 2014.
3. Road and hydro information sourced from Victorian Government Data Directory 2015.

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AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 500 1,000 1,500 2,000 2,500 METRES

REFERENCE SCALE: 1:30,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
CONCEPTUAL GROUNDWATER FLOW

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-02-17
PREPARED	CJS
DESIGN	-
REVIEW	FC
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	FIGURE
1525532	221-R	0	8

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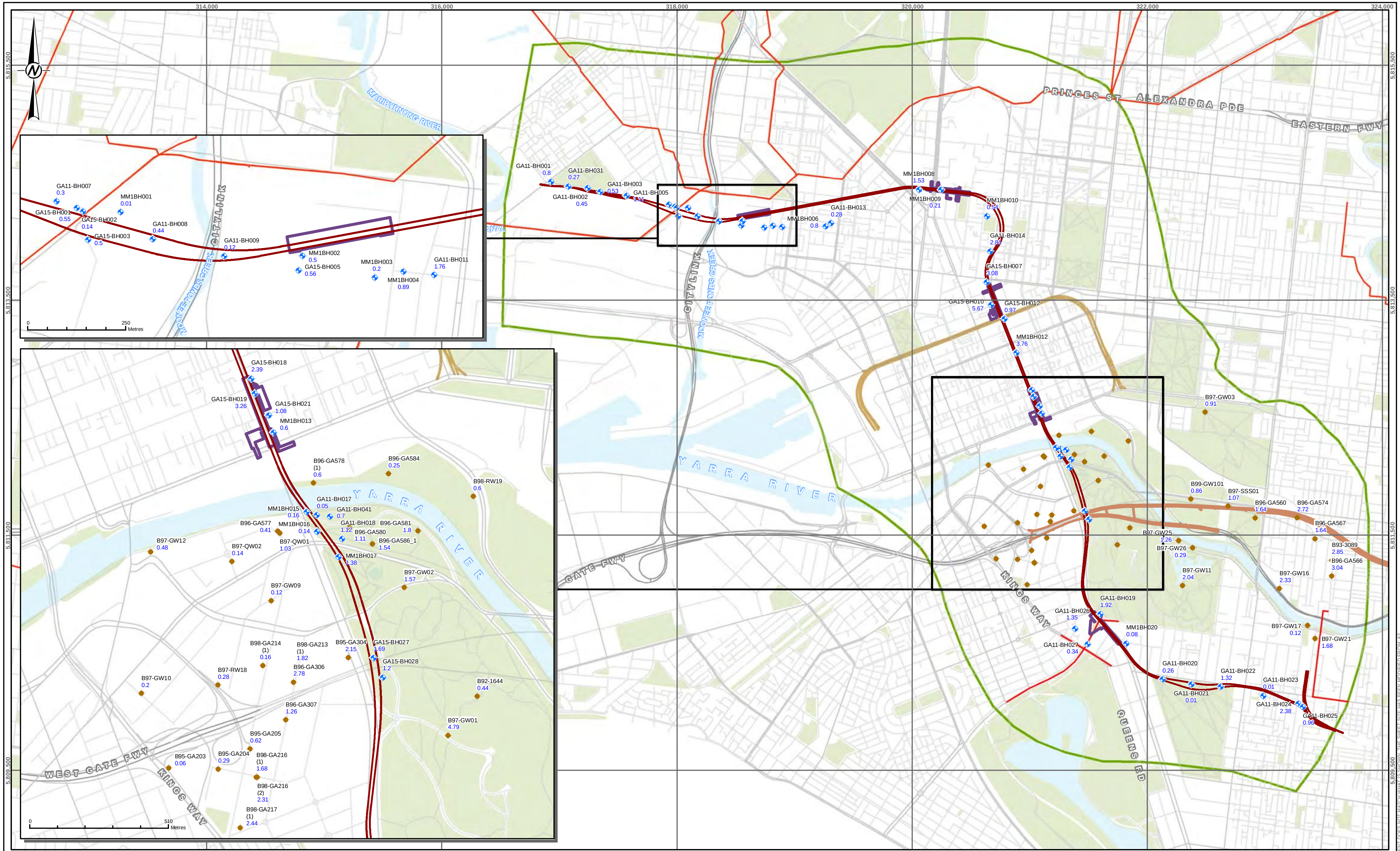

LEGEND

- MMRP Groundwater Well
- CityLink Groundwater Well
- 0.48 Absolute difference between observed and modelled levels (m)
- Proposed Rail Track
- Proposed Station Extent
- CityLink Tunnel
- Sewer
- Melbourne Underground Rail Loop Tunnel (MURL)
- Model Extent

MAP INFORMATION

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NOTES

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2. Aerial imagery sourced from Public Transport Victoria, image resolution 10cm and date of capture December 2014.
3. Road and hydro information sourced from Victorian Government Data Directory 2015.

CLIENT
AJM JOINT VENTURE

PROJECT
MELBOURNE METRO RAIL PROJECT

0 500 1,000 1,500 2,000 2,500
METRES

REFERENCE SCALE: 1:30,000 (at A3)
PROJECTION: GDA 1994 MGA Zone 55

TITLE
VERSION 2 MODEL CALIBRATION ERRORS AT MONITORING WELLS

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-02-17
PREPARED	CJS
DESIGN	-
REVIEW	FC
APPROVED	IKH

PROJECT No.	CONTROL	Rev.	DRAWING
1525532	221-R	0	9

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25mm

TABLE R1

Version 2 Regional Model Calibration Statistics

Observed vs Modelled Groundwater Levels, Version 2 Regional Model

Well ID	Observed Groundwater Levels (m AHD)	Calculated Groundwater Levels (m AHD)	Absolute Difference between Observed and Modelled Levels (m)
MM1BH001	-2.15	-2.14	0.01
GA11-BH021	3.37	3.38	0.01
GA11-BH023	6.22	6.21	0.01
B95-GA203	-0.50	-0.54	0.04
GA11-BH017	-1.51	-1.56	0.05
B95-GA203	-0.60	-0.54	0.06
MM1BH020	-1.36	-1.28	0.08
B97-GW09	-1.00	-1.12	0.12
GA11-BH009	-1.22	-1.10	0.12
B97-GW17	-0.20	-0.32	0.12
B97-QW02	-1.00	-1.14	0.14
GA15-BH002	-2.54	-2.40	0.14
MM1BH016	-1.58	-1.72	0.14
MM1BH015	-1.70	-1.54	0.16
B98-GA214 (1)	-1.90	-2.06	0.16
MM1BH003	-1.00	-0.80	0.20
B97-GW10	-0.90	-0.70	0.20
MM1BH009	22.40	22.61	0.21
B95-GA204	-0.70	-0.46	0.24
B96-GA584	-0.80	-1.05	0.25
GA11-BH020	-1.62	-1.36	0.26
GA11-BH031	-1.00	-0.73	0.27
B97-RW18	-0.80	-0.52	0.28
GA11-BH013	7.88	8.16	0.28
B97-GW26	0.15	0.44	0.29
B95-GA204	-0.75	-0.46	0.29
GA11-BH007	-1.57	-1.87	0.30
GA11-BH027	-4.94	-5.28	0.34
B96-GA577	-1.10	-1.51	0.41
B92-1644	-4.00	-4.44	0.44
GA11-BH008	-1.78	-1.34	0.44
GA11-BH002	0.02	-0.43	0.45
B95-GA205	-0.90	-0.43	0.47
B97-GW12	-1.40	-0.92	0.48
MM1BH002	-1.55	-1.05	0.50
GA15-BH003	-2.77	-2.27	0.50
GA11-BH003	-0.93	-0.40	0.53
MM1BH010	21.96	21.42	0.54

Well ID	Observed Groundwater Levels (m AHD)	Calculated Groundwater Levels (m AHD)	Absolute Difference between Observed and Modelled Levels (m)
GA15-BH001	-2.83	-2.28	0.55
GA15-BH005	-1.60	-1.04	0.56
B96-GA578 (1)	-0.80	-1.40	0.60
MM1BH013	1.06	0.46	0.60
B98-RW19	-0.25	-0.85	0.60
B95-GA205	-1.05	-0.43	0.62
GA11-BH041	-0.82	-1.52	0.70
MM1BH006	6.50	7.30	0.80
GA11-BH001	0.02	-0.78	0.80
B99-GW101	-2.50	-3.36	0.86
MM1BH004	-0.90	-0.01	0.89
B97-GW03	7.50	8.41	0.91
GA11-BH025	4.62	5.58	0.96
GA15-BH012	0.64	1.61	0.97
B97-QW01	-2.10	-1.07	1.03
B97-SSS01	-2.90	-3.97	1.07
GA15-BH021	-0.14	0.94	1.08
B96-GA580	-0.90	-2.01	1.11
GA11-BH005	-1.52	-0.41	1.11
GA11-BH018	-0.83	-1.95	1.12
GA15-BH028	-12.86	-11.66	1.20
B97-GW25	1.85	3.11	1.26
B96-GA307	-6.00	-4.74	1.26
GA11-BH022	4.29	5.61	1.32
GA11-BH026	-3.56	-2.21	1.35
MM1BH017	-0.62	-2.00	1.38
MM1BH008	19.80	21.33	1.53
B96-GA586_1	-0.80	-2.34	1.54
B97-GW02	-2.40	-3.97	1.57
B96-GA567	-2.90	-4.54	1.64
B96-GA560	-2.50	-4.14	1.64
B97-GW21	-2.75	-1.07	1.68
B98-GA216 (1)	-1.80	-0.12	1.68
GA15-BH027	-12.43	-10.74	1.69
GA11-BH011	-1.00	0.76	1.76
B96-GA581	-0.70	-2.50	1.80
B98-GA213 (1)	-3.70	-5.52	1.82
GA11-BH019	0.62	-1.30	1.92
B97-GW11	1.20	3.24	2.04

Well ID	Observed Groundwater Levels (m AHD)	Calculated Groundwater Levels (m AHD)	Absolute Difference between Observed and Modelled Levels (m)
B95-GA304	-10.00	-7.85	2.15
B98-GA216 (2)	-2.45	-0.14	2.31
B97-GW16	1.50	-0.83	2.33
GA11-BH024	3.29	5.67	2.38
GA15-BH018	-0.36	2.03	2.39
B98-GA217 (1)	-2.65	-0.21	2.44
B96-GA574	-2.75	-5.47	2.72
B96-GA306	-3.50	-6.28	2.78
GA11-BH014	19.51	16.70	2.81
B93-3089	-1.80	-4.65	2.85
B96-GA566	-2.00	-5.04	3.04
GA15-BH007	14.29	11.21	3.08
GA15-BH019	-1.66	1.60	3.26
MM1BH012	-0.30	3.46	3.76
B97-GW01	2.80	-1.99	4.79
GA15-BH010	11.40	5.73	5.67

APPENDIX A

Hydraulic Conductivity Distribution within Model Layers

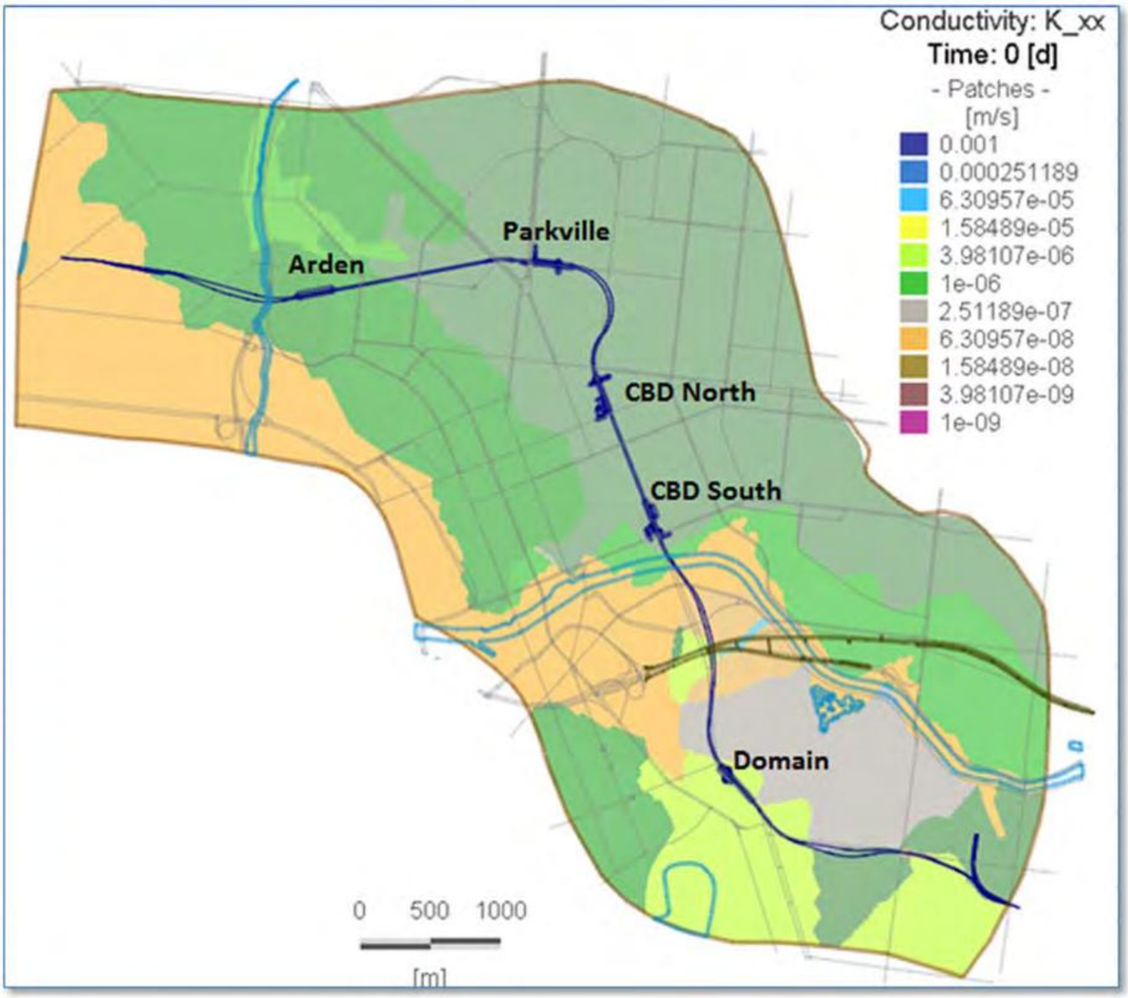

Figure 1A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 1

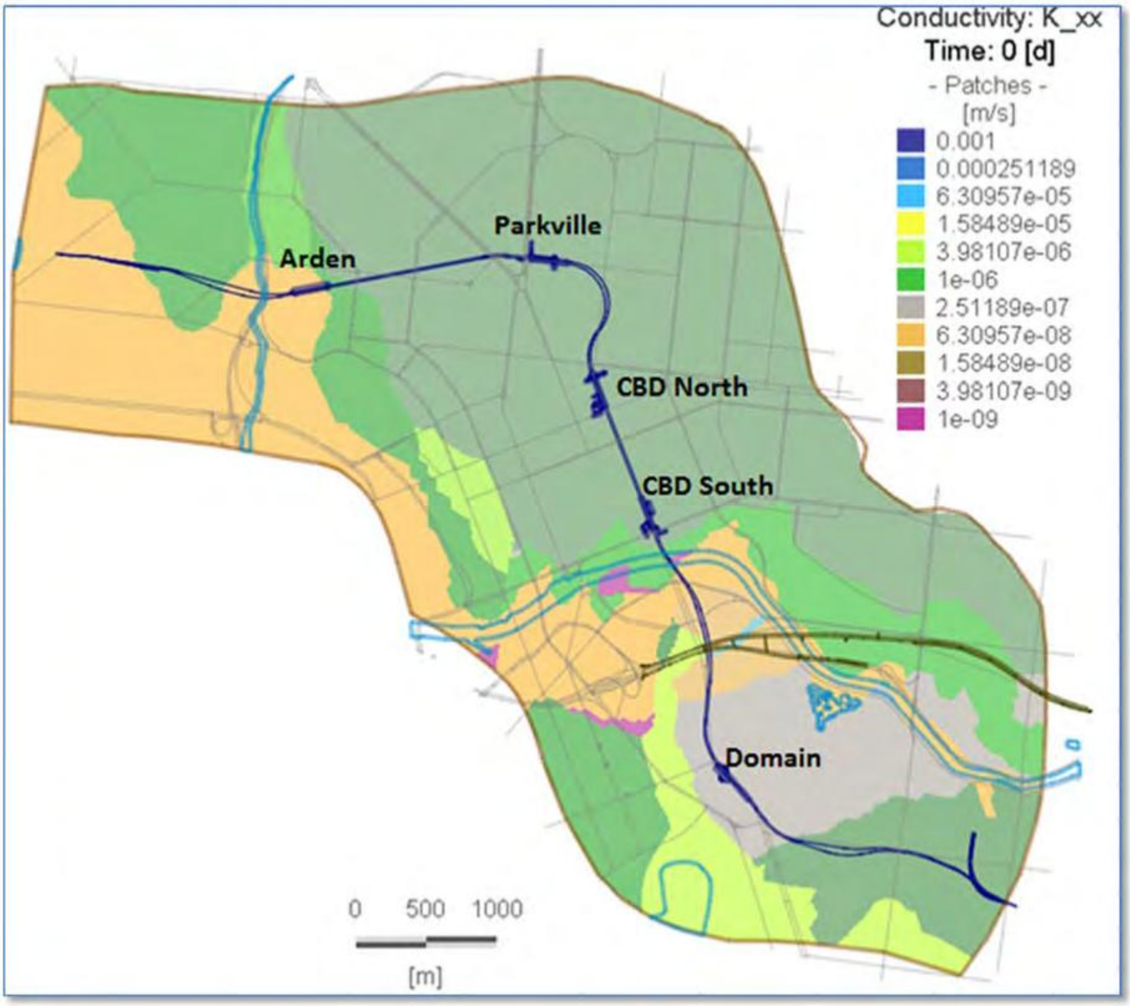

Figure 2A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 2

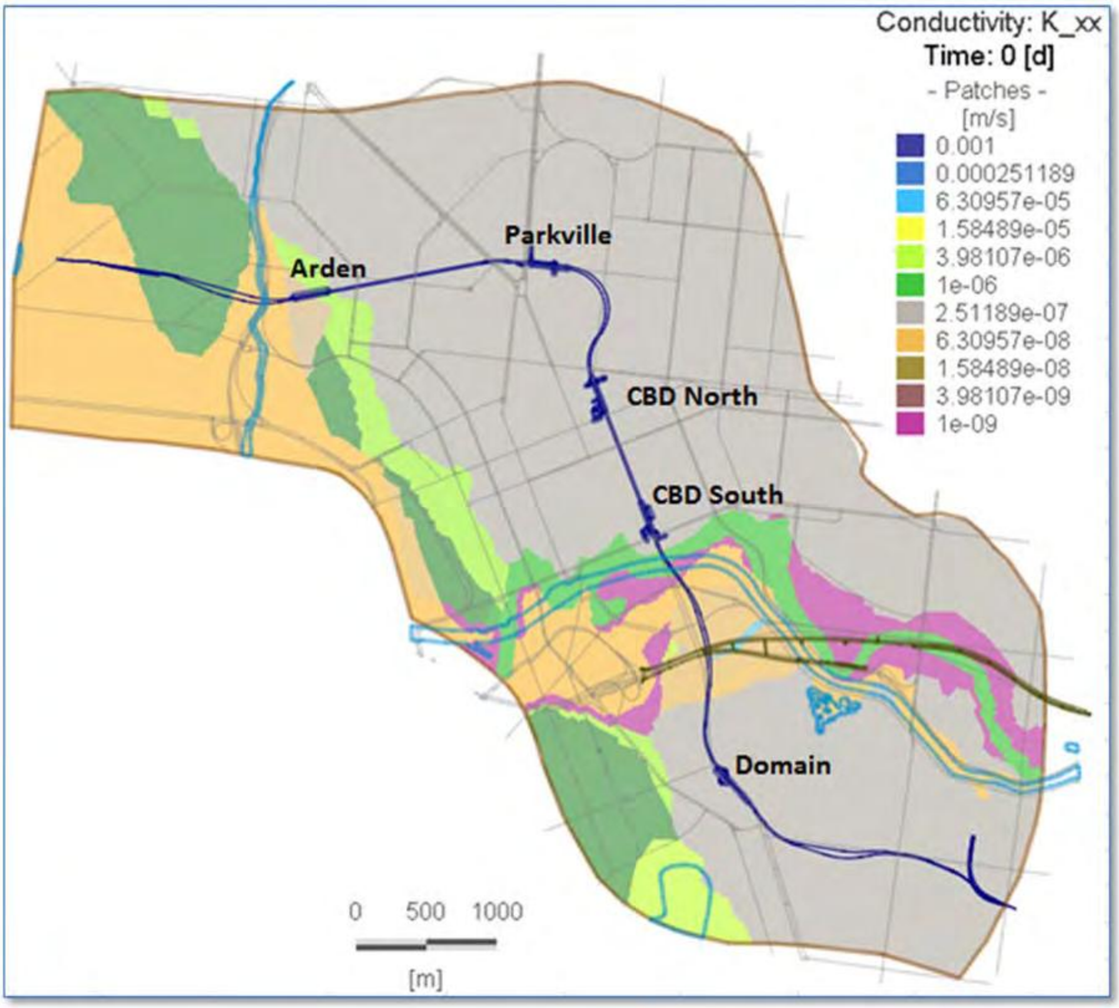

Figure 3A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 3

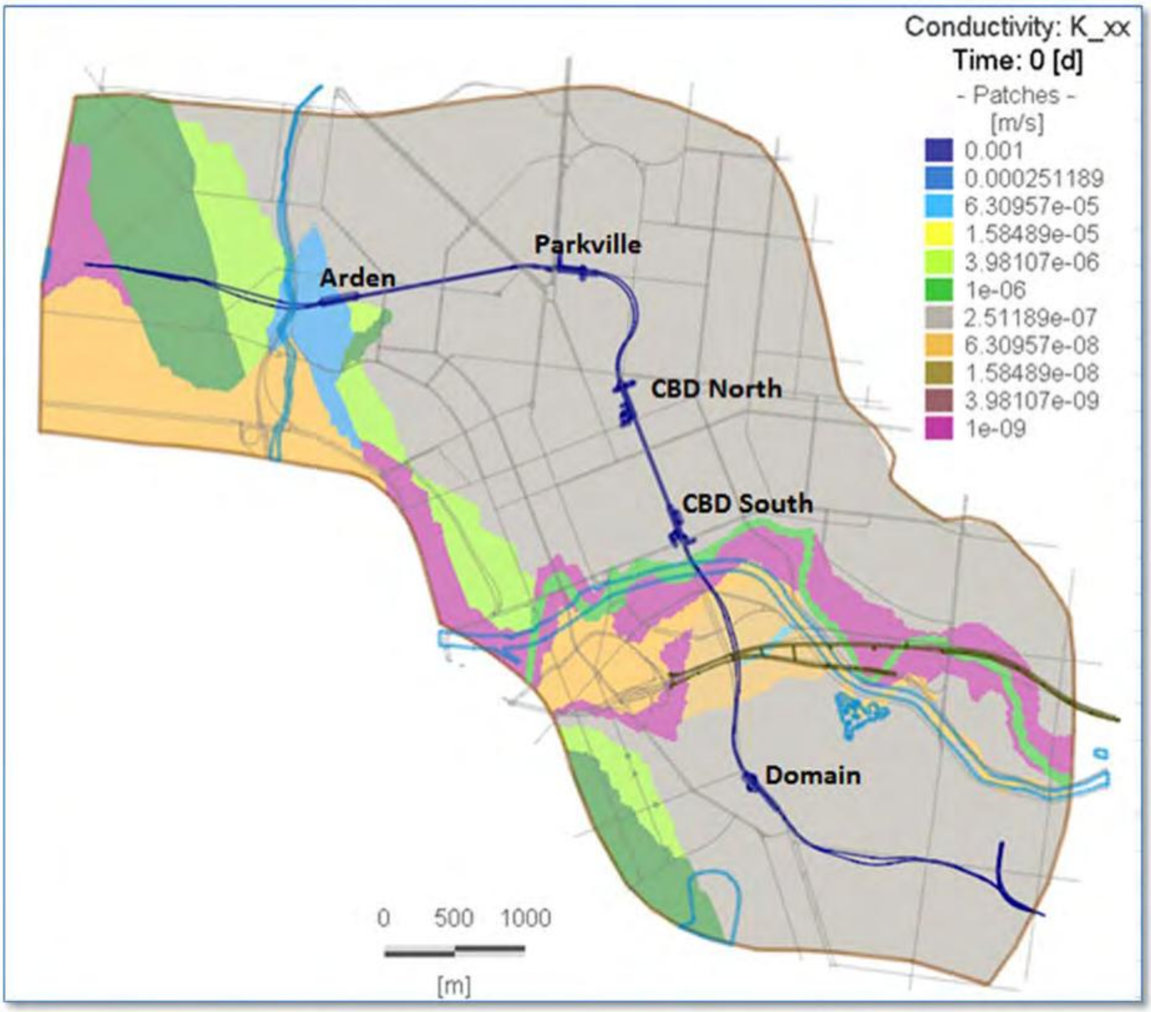

Figure 4A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 4

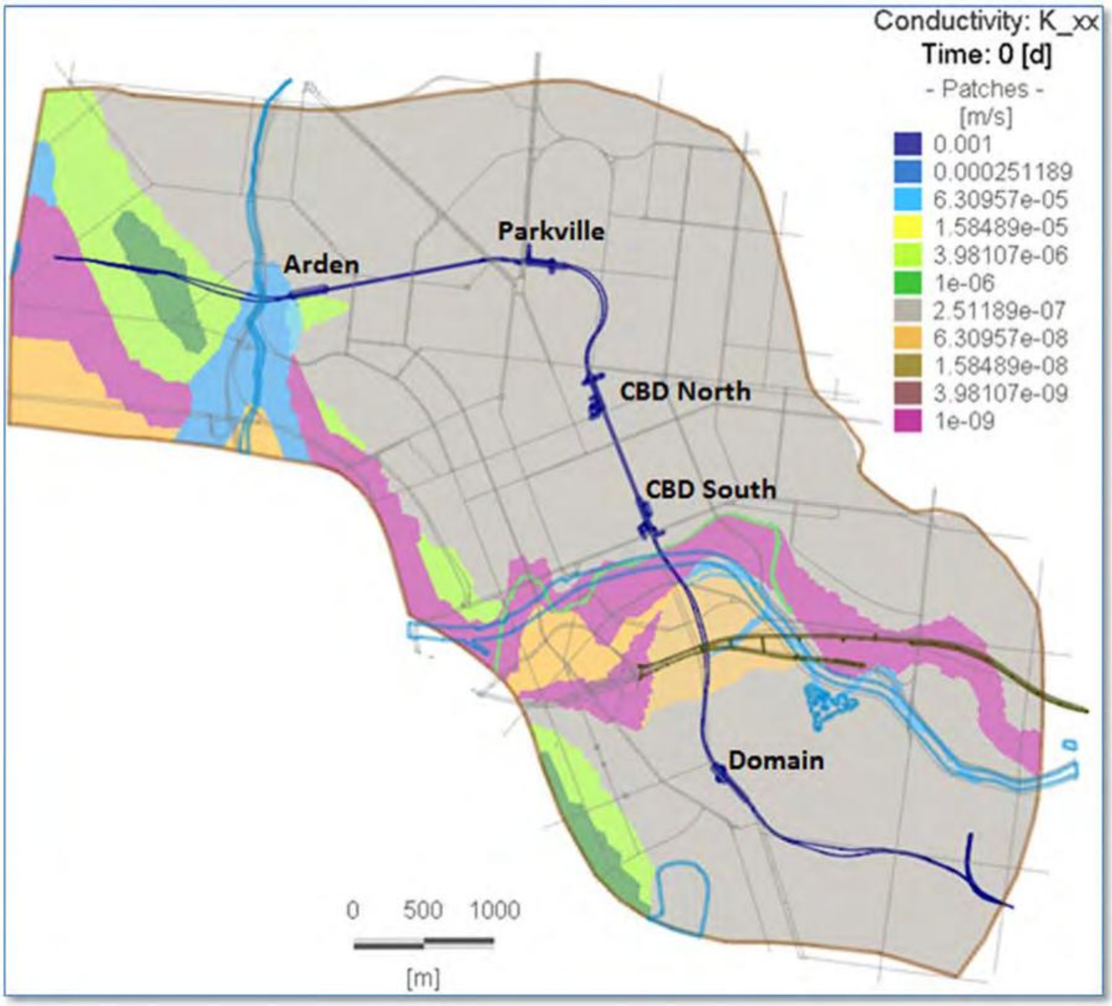

Figure 5A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 5

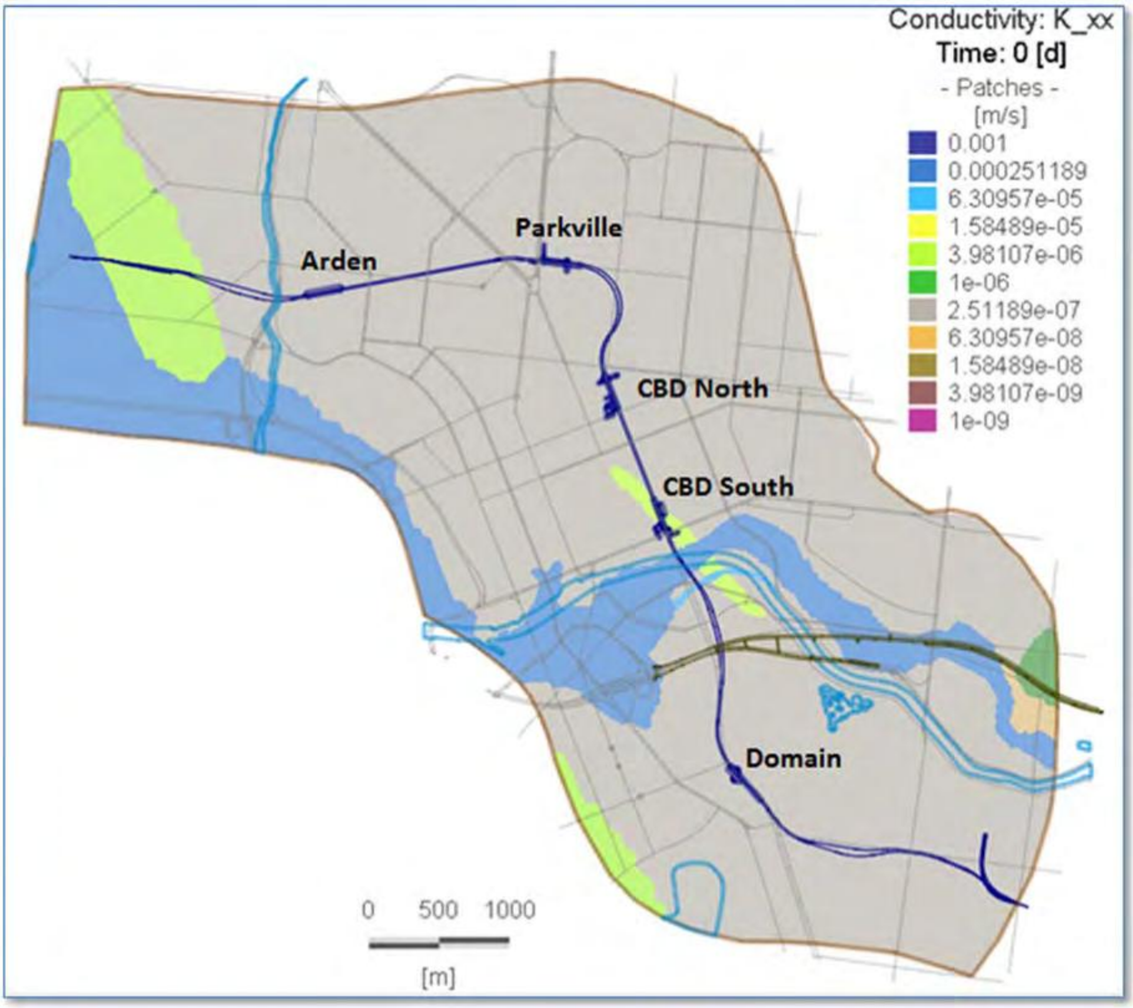

Figure 6A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 6

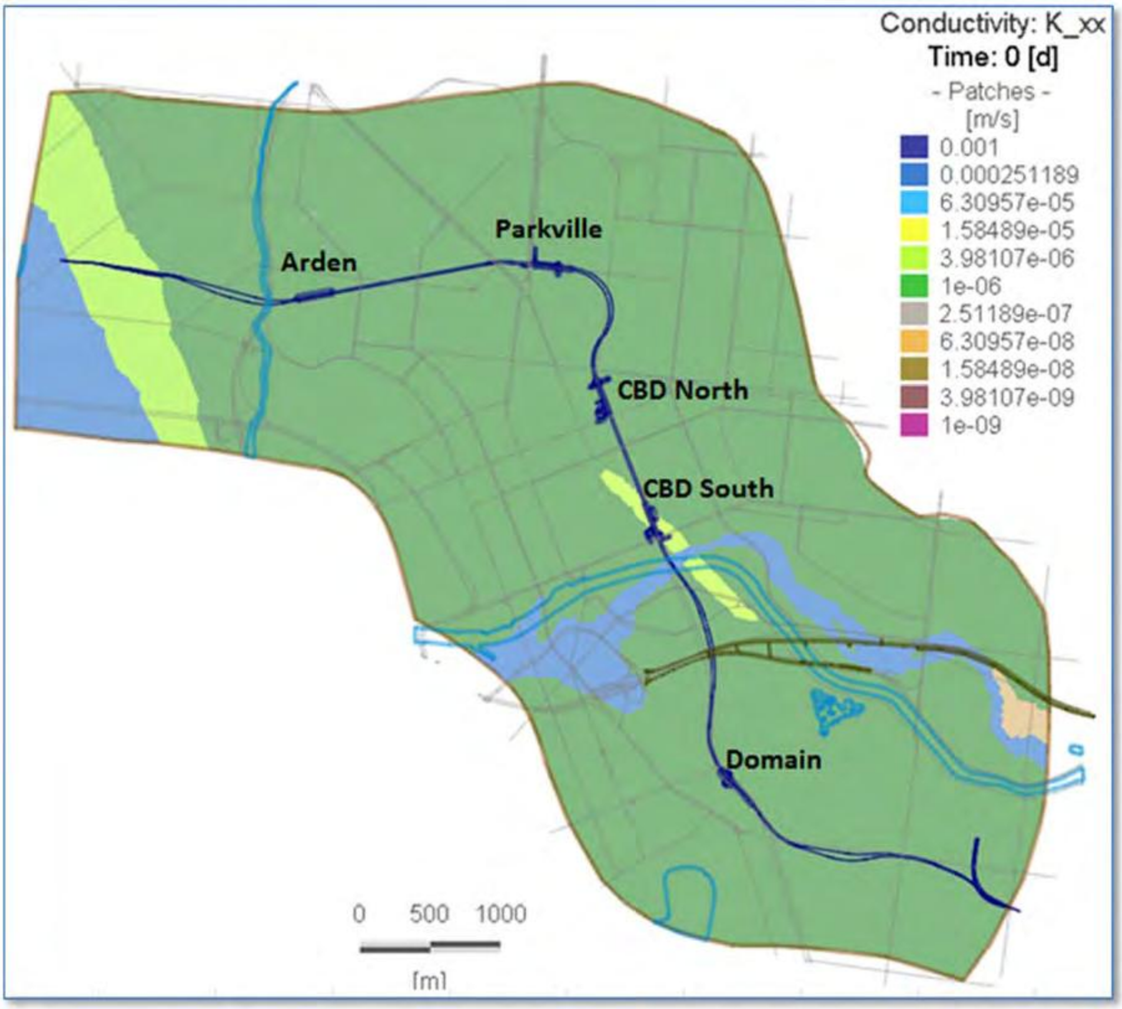

Figure 7A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 7

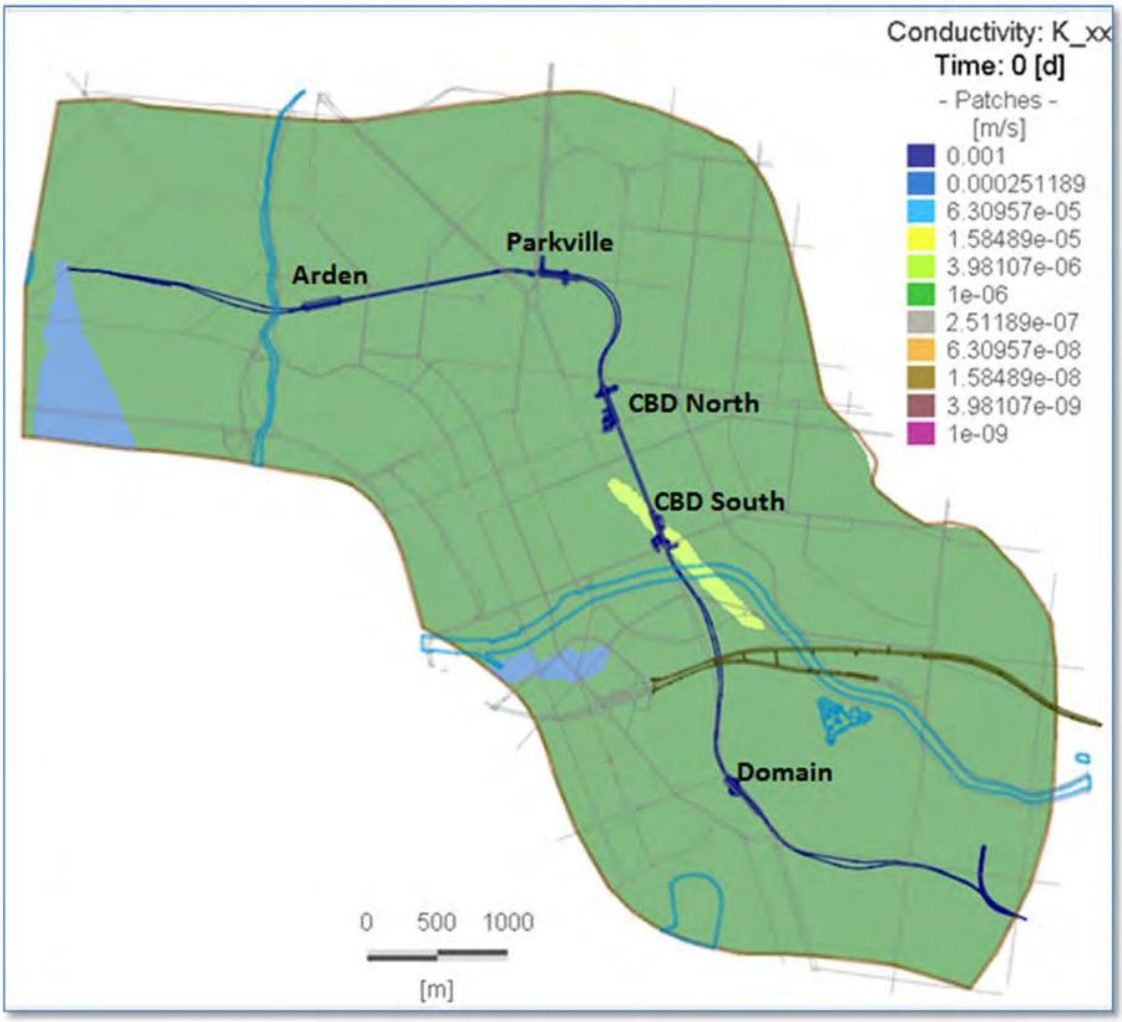

Figure 8A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 8

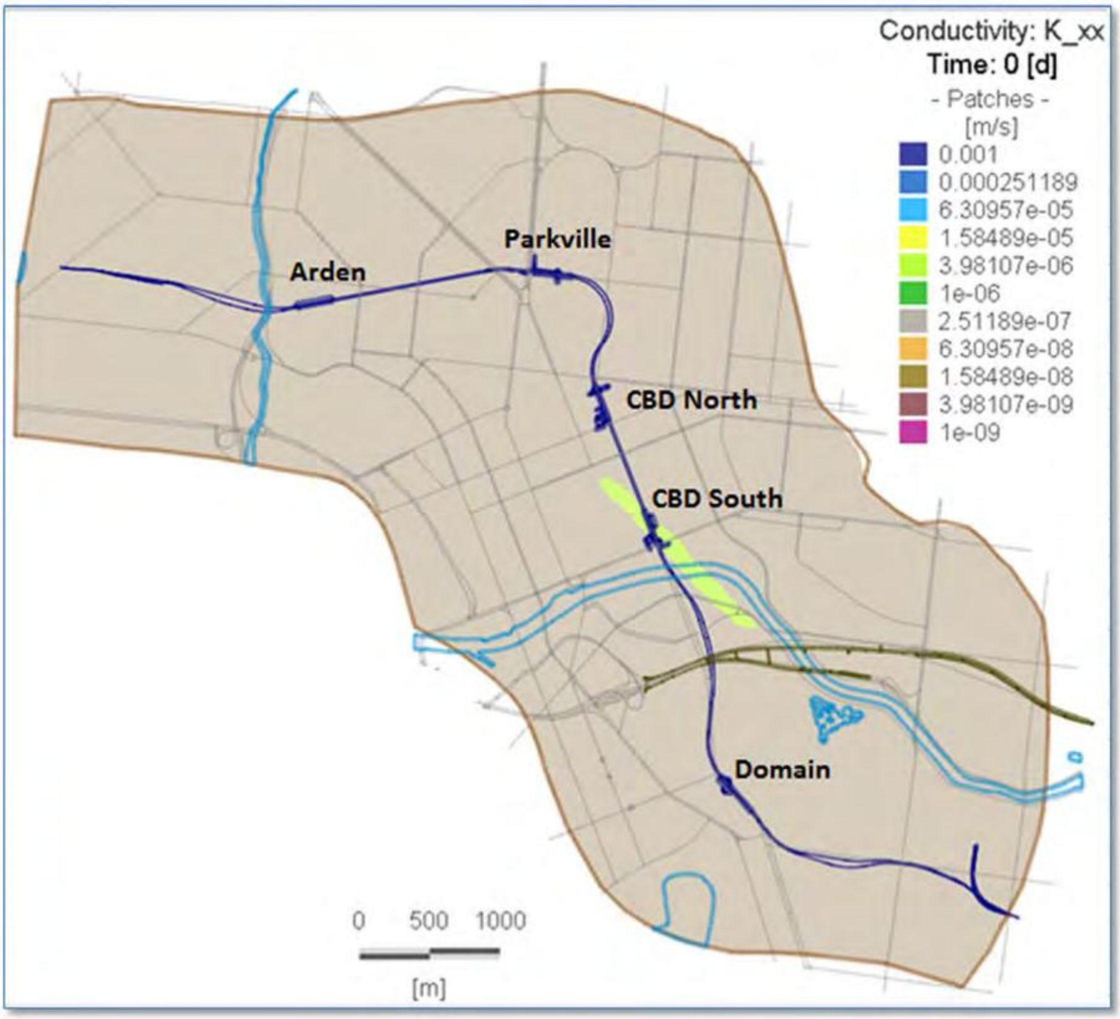

Figure 9A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 9

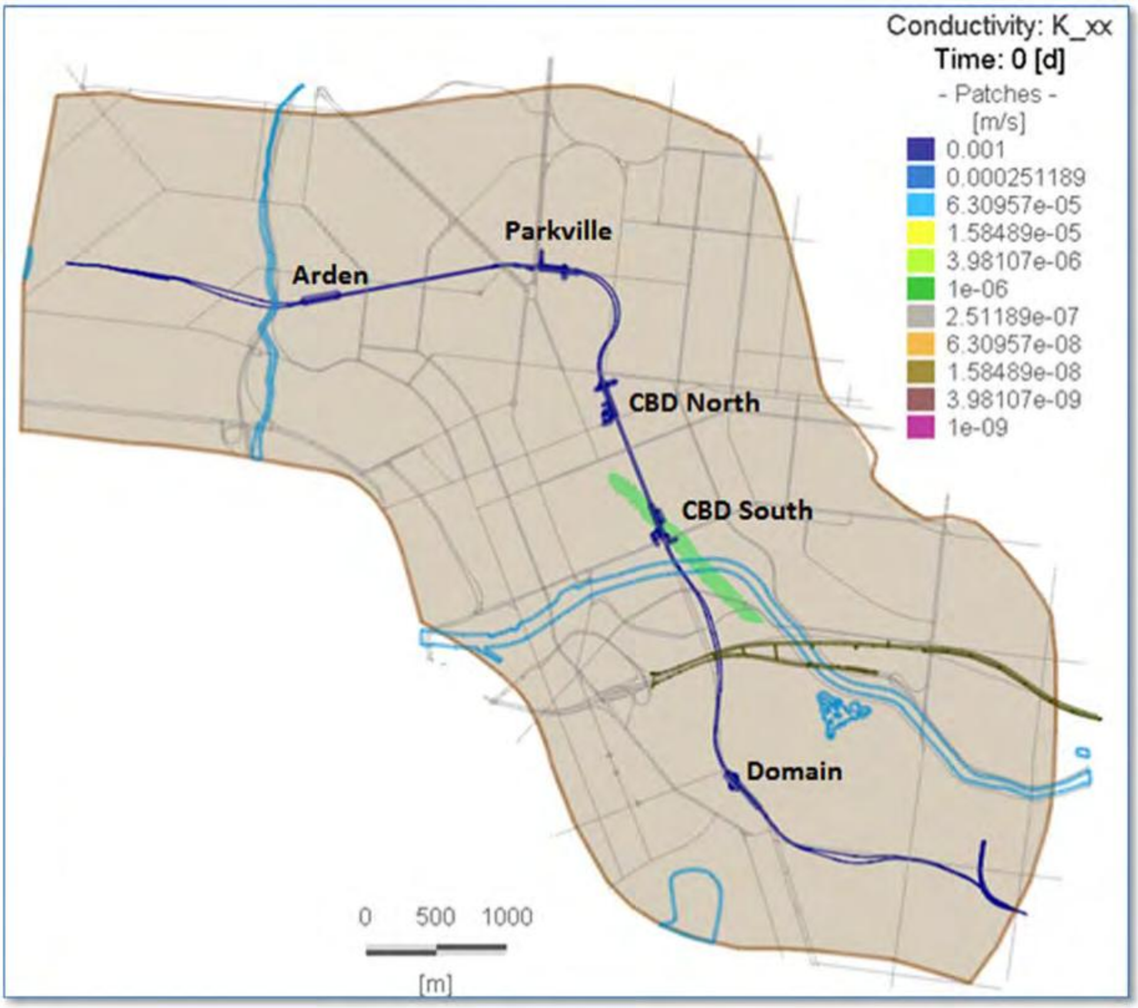

Figure 10A: Hydraulic conductivity (horizontal hydraulic conductivity) distribution within Layer 10

APPENDIX B

Limitations

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Golder Associates

Appendix I Groundwater Disposal Strategy

GROUNDWATER DISPOSAL STRATEGY

MELBOURNE METRO RAIL AUTHORITY

April 2016

Version 1.0

Table of Contents

Table of Tables

Table of Figures

Document Control

Revision	Date	Revision Particulars	Author	Verifier	Approver
1.0	15/04/2016	Final for EES	S. Beatton	K. Watt	P. Thomas

Glossary & Abbreviations

PROJECT	
Melbourne Metro Project	MM (used in tables)

KEY LEGISLATION / PROCESSES / DOCUMENTS	
Australian Standard 4482 Guide to the investigation and sampling of sites with potentially contaminated soil: Parts 1 & 2	AS4482
Australian Groundwater Modelling Guidelines – Waterlines Report Series No.82	
Environmental Effects Act 1978 (Victoria)	*EE Act*
Environment Effects Statement	EES
Environment Protection Act 1970 (Victoria)	*EP Act*
Environment Protection Authority Publications Publication 275 Construction techniques for sediment pollution control 1991 Publication 480 Environmental guidelines for major construction sites 1996 Publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines 2006 Publication 669 Groundwater Sampling Guidelines 2000 Publication 840.1 The clean-up and management of polluted groundwater 2014 Publication 1287 Guidelines for risk assessment of wastewater discharges to waterways 2009	
Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)	*EPBC Act*
Environment Protection (Industrial Waste Resource) Regulations 2009 (Victoria)	IWR Regulations
NHMRC Guidelines for Managing Risks in Recreational Waters	
NHMRC Australian Drinking Water Guidelines	
Industrial Waste Resource Guidelines IWRG701 Sampling & Analysis of Waters Wastewaters, Soils & Wastes 2009	IWRG
National Environmental Protection Council Act 1995 (Victoria)	*NEPC Act*
National Environment and Protection (Management of Contaminated Land) Measure, 2013 (Commonwealth).	NEPM
Occupational Health and Safety Act 2004 (Victoria) & *Regulations 2007* (Victoria)	*OH&S Act & Regulations*
Planning & Environment Act 1978 (Victoria)	*P&E Act*
State Environment Protection Policies (Groundwaters of Victoria) 1997 (Prevention and Management of Contamination of Land) 2013 (Waters of Victoria) 1998	SEPP

ENTITIES	
Environmental Protection Authority (Victoria)	EPA
Melbourne Metro Rail Authority	MMRA

TERMINOLOGY & ACRONYMS	
CEMP	Construction Environment Management Plan
Cut & Cover	Method where void is excavated and roofed over with an overhead support system strong enough to carry the load of what is to be built above the excavation.
EMP	Environment Management Plan
Fill Material	Uncontaminated material classified in accordance with the IWR Regulations, specifically IWRG621 Soil Hazard Categorisation and Management 2010
GDS	Groundwater Disposal Strategy
Haack tightness classification (Haack 1991)	A five tier classification system that describes the tightness of constructed tunnels in terms of the volume of inflows that can seep into the tunnel.
ML	Megalitre
Tanked	
TBM	Tunnel Boring Machine A machine used to excavate a driven tunnel.
TDS	Total Dissolved Solids Groundwater salinity parameter.

1 Introduction

Melbourne Metro is proposed to be constructed at or below the ground water level in a number of locations and would therefore directly interact with groundwater. This strategy outlines the approach to managing the interaction of Melbourne Metro with the groundwater water.

1.1 Purpose

The purpose of this Groundwater Disposal Strategy (GDS) for Melbourne Metro (MM) is to:

- Provide guidance for performance-based standards for groundwater disposal and management to be incorporated into the Construction Environment Management Plan (CEMP),
- Define and demonstrate that feasible options are available to manage groundwater inflow during construction on the project that mitigate potential human health and environmental impacts, and
- Provide supplementary information to the Environment Effects Statement (EES) which has been prepared by MMRA in accordance with the requirements of the *Environment Effects Act* 1978 (Victoria).

1.2 Scope

This GDS has been structured to provide project wide details on the:

- Groundwater generation activities, volumes and parameters,
- Groundwater management and protection in accordance with the *State Environment Protection Policies (SEPPs),* in particular *SEPP (Groundwaters of Victoria)*, and
- Requirements for the Contractor(s)' Construction Environment Management Plan (CEMP).

The GDS is a live document and will continue to be further developed and revised during the detailed design and construction planning phases as appropriate.

1.3 Strategy Summary

A summary of the key scope parameters and the strategy's response are provided in Table 1-1.

Table 1-1: Groundwater management strategy summary

<table>
<tr><th>Parameter</th><th>Strategy Response</th><th>Relevant Report Section</th></tr>
<tr><td>Groundwater generation[1]</td><td>An estimated volume of 380 megalitres (ML) of groundwater would be produced during construction of the project based on the Concept Design[1].</td><td>Section 3.1</td></tr>
<tr><td>Groundwater generation locations[1]</td><td>The following estimated inflow rates & volumes of groundwater would be generated at the site locations during the main works construction period from late 2017 to late 2021[1]. These are mitigated inflow rates based on the Concept Design construction program and apply the mitigations listed in Section 1.5.
<table>
<tr><th>Location</th><th colspan="2">Inflow (L/S)</th><th>Estimated Volume[1] (ML)</th></tr>
<tr><th></th><th>Peak</th><th>Average</th><th></th></tr>
<tr><td>Site Locations:</td><td></td><td></td><td></td></tr>
<tr><td>Western Portal</td><td>0.5</td><td>0.2</td><td>16</td></tr>
<tr><td>Arden</td><td>2.1</td><td>1.1</td><td>63</td></tr>
<tr><td>Parkville Station</td><td>0.3</td><td>0.2</td><td>9</td></tr>
<tr><td>CBD North</td><td>1.7</td><td>0.9</td><td>87</td></tr>
<tr><td>CBD South</td><td>1.6</td><td>1.2</td><td>111</td></tr>
<tr><td>Domain Station</td><td></td><td></td><td></td></tr>
<tr><td>Scenario 1T</td><td>1.7</td><td>0.8</td><td>45</td></tr>
<tr><td>Scenario 2T</td><td>0.8</td><td>0.4</td><td>20</td></tr>
<tr><td>Eastern Portal</td><td>0.5</td><td>0.3</td><td>17</td></tr>
<tr><td>Intervention Shafts:</td><td></td><td></td><td></td></tr>
<tr><td>Linlithgow Avenue</td><td>0.7</td><td>0.4</td><td>11</td></tr>
<tr><td>Fawkner Park</td><td>0.5</td><td>0.3</td><td>6</td></tr>
<tr><td>Cross Passages</td><td></td><td></td><td></td></tr>
<tr><td>Cross Passage 2</td><td>0.9</td><td>0.5</td><td>8</td></tr>
<tr><td>Cross Passage 3</td><td>0.9</td><td>0.5</td><td>11</td></tr>
<tr><td>Cross Passage 13</td><td>0.01</td><td>0.01</td><td>0.09</td></tr>
<tr><td></td><td></td><td>TOTAL</td><td>383</td></tr>
<tr><td></td><td></td><td colspan="2">(with Domain Scenario 1T)</td></tr>
</table>
Lower rate groundwater inflows could also occur during Early Works.
At completion of construction and once Melbourne Metro is operational, all the completed station and tunnel structures would be tanked structures with minimal groundwater inflows occurring</td><td>Section 3.1</td></tr>
</table>

Parameter	Strategy Response	Relevant Report Section
Total Dissolved Solids (TDS)	A key parameter for groundwater and management and disposal is TDS. Current testing has determined TDS concentrations as follows: **Location** — **Average TDS Concentration (mg/L)** **Site Locations:** Western Portal — 12,000 Arden — 10,200 Parkville — 10,400 CBD North — 3,300 CBD South — 2,900 Domain — 4,400 Eastern Portal — 5,300 **Intervention Shafts:** Linlithgow Avenue — 4,600 Fawkner Park — 5,000 **Cross Passages:** Cross Passage 2 — 44,200 Cross Passage 3 — 32,500 Cross Passage 13 — 4,600	Section 3.2.1
Groundwater sampling & testing	Groundwater sampling and analysis would be undertaken in accordance with the following Policy, IWRGs, Publications and standards: • IWRG701 Sampling & Analysis of Waters Wastewaters, Soils & Wastes 2009. • EPA Publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines 2006 • EPA Publication 669 Groundwater Sampling Guidelines 2000 • Australian Standard AS4482 Guide to the investigation and sampling of sites with potentially contaminated soil • Australian Standard 5667 Water Quality – Sampling	Section 3.2.3
Groundwater Management Options	There are four practical hierarchical areas of groundwater management with associated options that can be applied to some or all of the impact areas on MM as follows: 1. Avoidance through a. Design b. Construction techniques c. Modelling, monitoring & recharge regime 2. Reuse a. Onsite b. Aquifer reinjection c. 3rd parties for industrial or irrigation purposes 3. Disposal a. Discharge to sewer (approach adopted for the Environmental Effects Statement) b. Discharge to stormwater c. Disposal to 3rd party facility Treatment may be required for reuse and disposal options.	Section 4

Table Notes:

1. Refer Section 1.5 for assumptions & limitations including the groundwater inflow construction mitigations assumed as part of the model.

1.4 Statutory Framework

The primary legislation for protection of the environment in Victoria is the *Environmental Protection Act 1970 (Victoria)* (EP Act). The Act designates the Environment Protection Authority (EPA) as the responsible body for administering the EP Act and associated regulations and orders to minimise pollution, wastes and environmental risks.

State Environmental Protection Policies (SEPPs) are contained within the EP Act and provide more detailed requirements and guidance for application of the Act. The key SEPPs that are relevant to the protection of groundwater in Victoria are:

- State Environment Protection Policy (Prevention and Management of Contamination of Land) 2013,
- State Environment Protection Policy (Waters of Victoria) 1998, and
- State Environment Protection Policy (Groundwaters of Victoria) 1997.

Also relevant to the protection of groundwater in Victoria is the National Environment and Protection (Management of Contaminated Land) Measure, 2013 (Commonwealth) effected by the *National Environmental Protection Council Act 1995 (Victoria).*

The EPA has also produced a series of guidelines and publications to assist with implementation and management of SEPPs. Those relevant to groundwater and Melbourne Metro are:

- Industrial Waste Resource Guidelines (IWRG)
  - IWRG701 Sampling & Analysis of Waters Wastewaters, Soils & Wastes 2009.
- Environment Protection Authority Publications
  - Publication 275 Construction techniques for sediment pollution control 1991
  - Publication 480 Environmental guidelines for major construction sites 1996
  - Publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines 2006
  - Publication 669 Groundwater Sampling Guidelines 2000
  - Publication 840.1 The cleanup and management of polluted groundwater 2014
  - Publication 1287 Guidelines for risk assessment of wastewater discharges to waterways 2009

1.5 Assumptions & Limitations

The following assumptions and limitations apply to this strategy:

Table 1-2: Strategy assumptions & limitations

Item	Description
1	Inflow rate data sourced from Golder Associates (GA) Presentation RD Regional Numerical Model Results 17/02/2016 (Ref: 1525532-211-R-RevB).
2	Total Groundwater inflow is the predicted volume over the Concept Design project construction duration. It does not include Operational inflows.

Item	Description
3	The predicted inflow rates and volumes within this document are mitigated inflows, with mitigations applied as listed in Item 4 below.
4	Predicted construction groundwater inflows were modelled using the following inflow mitigations: a. Western Portal - Secant pile wall and toe grouting per GA model. b. Arden - Diaphragm wall and toe grouting per GA model. c. Parkville - Assumes flow rate mitigated by 70%. Considered reasonable based on the assumed construction techniques. d. CBD North & South - Assumes flow rate mitigated by 70%. Considered reasonable based on the assumed construction techniques. e. Domain - Scenario 1T fully drained, Scenario 2T diaphragm wall per GA model. f. Eastern Portal – Secant pile wall per GA model. g. Linlithgow Avenue & Fawkner Park Intervention Shafts – Flow rate as per GA Model. h. Cross passages 2, 3 & 13 - Assumes flow rate mitigated by 70%. Considered reasonable based on assumed construction techniques. i. Western Portal - Secant pile wall per GA model.
5	Average recorded groundwater parameter concentrations at some locations are based on a small sampling dataset and further sampling may be required to confirm concentration more accurately.
6	Average groundwater parameter inflow is based on average concentration.

2 Project Overview

The Melbourne Metro Rail Authority (MMRA) is proposing to deliver the Melbourne Metro to provide increased capacity across the city's rail network. The key project infrastructure includes:

- Twin nine-kilometre underground rail tunnels from Kensington in the western suburbs to South Yarra in the south-east connecting the Sunbury and Dandenong rail corridors comprising:
  - Mined cavern tunnel construction between CBD North and CBD South station,
  - TBM tunnel construction in the west between the Western Portal and CBD North, and
  - TBM tunnel construction in the east between CBD South and the Eastern Portal.
- Five new underground railway stations located at Arden, Parkville, CBD North, CBD South and Domain.
- Cut & cover rail tunnel portal entrances at Kensington and South Yarra.
- Rail passenger interchanges at:
  - CBD North to Melbourne Central Station, and
  - CBD South to Flinders Street Station.
- Associated surface works including intervention shafts at Linlithgow Avenue and Fawkner Park for emergency access/egress.
- Early works required to facilitate the above including:
  - demolition of acquired buildings,
  - construction of access shafts,
  - utility relocations and upgrades,
  - provision of electrical (HV) supply to TBM sites, and
  - traffic, tram and pedestrian infrastructure upgrades and diversions.

Figure 2-1 provides an overview of the Melbourne Metro alignment and components.

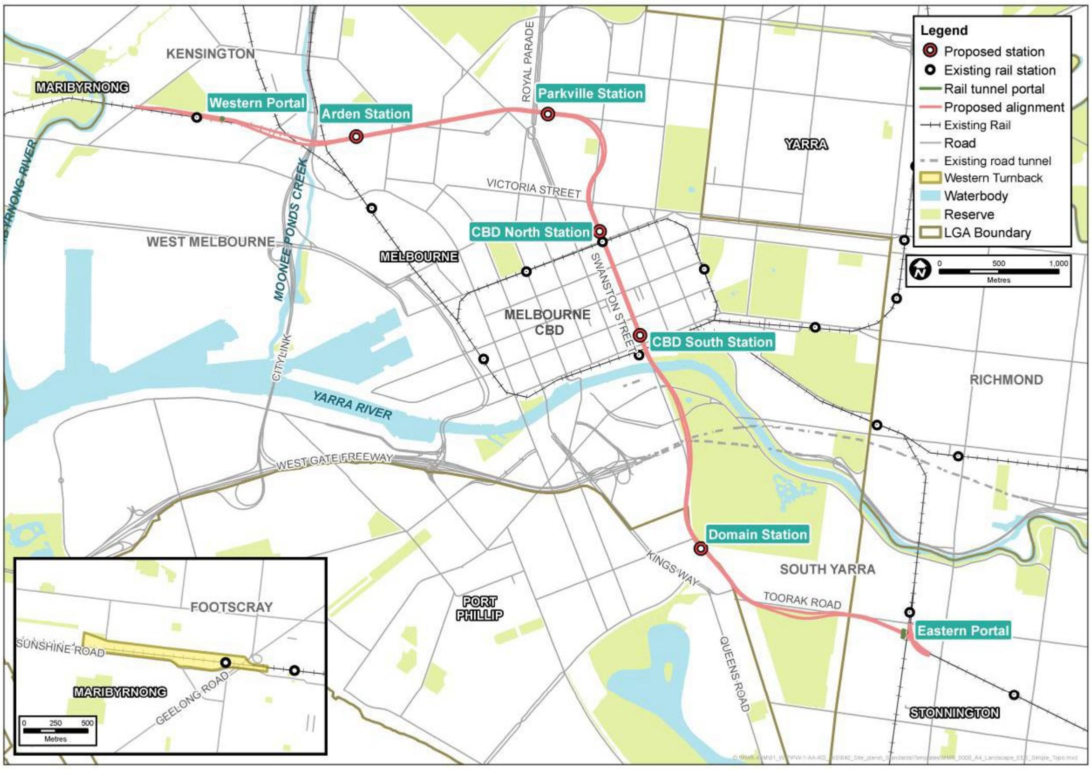

Figure 2-1: Melbourne Metro overview

Indicative timings for the delivery of the project are provided in Table 2-1.

Table 2-1: Milestone summary and construction dates

Date	Activity
2015-2016	• Site investigations • Complete development of Melbourne Metro Concept Design • Community consultation • EES submitted, exhibited and assessment released by the Minister for Planning • Prepare and submit Business Case • Enabling works before major construction
2017-2018	• Finalise planning and environmental approvals based on Minister for Planning decision. • Procurement for major construction contract • Early works before major construction • Award major construction contract for tunnels and stations • Start major construction works • Demolition of acquired buildings
2022	• Civil and structural works at stations, portals and tunnels completed
2024	• Station fit out and rail systems installation completed
2025	• Systems integration and operational readiness
2026	**Project complete**

2.1 Construction Techniques

2.1.1 Tunnels

Bored Tunnels

TBMs would be utilised to construct the majority of the tunnels required for the project. Two sections of the Melbourne Metro tunnels would be bored tunnels, constructed using TBMs as follows:

- Western Portal to CBD North station: TBMs have been assumed to operate from Arden Station
- CBD South to Eastern Portal: TBMs have been assumed to operate from:
  - Domain, or
  - Domain and Fawkner Park.

Mined Tunnels & Adits

The remaining section of tunnel between CBD North station and CBD South station are assumed to be mined. Mined tunnels would be constructed using road headers.

Stations & Portals

Stations would be constructed utilising cut and cover techniques or mined caverns. Portals connect the existing railway lines at surface and the tunnels. The portals are proposed to be constructed through cut and cover and/or embankment methods. Table 2-2 summarises the proposed construction methods.

Table 2-2: Proposed station & portal construction methods

Location	Construction Method
Western Portal	Cut & Cover
Arden Station	Cut & Cover
Parkville Station	Cut & Cover
CBD North Station	Mined Cavern
CBD South Station	Mined Cavern
Domain Station	Cut & Cover
Eastern Portal	Cut & Cover / Embankment

3 Groundwater Parameters

Groundwater is any water contained in, or occurring in, a geological structure or formation or an artificial landfill (SEPP (Groundwaters of Victoria), 1997). Melbourne Metro is proposed to be constructed at or below the ground water level in a number of locations and would therefore directly interact with groundwater during both the construction phase and, to a lesser extent, once operational.

During construction, groundwater would be encountered across the majority of the project alignment through construction activities comprising:

- TBM tunnelling,
- Mined tunnel and cross passage excavation, and
- Station, shaft and portal structure excavation.

Melbourne Metro would be designed as a tanked structure. Therefore upon commissioning and during operations, all the station and tunnel structures would be expected to have minimal groundwater inflows.

3.1 Groundwater Inflow

3.1.1 Construction

Groundwater inflow occurs when excavation is conducted at or below the water table. Figure 3-1 provides an annotated long section of the alignment demonstrating the extent of the project to be constructed at or below the water table.

Preliminary modelling based on the Melbourne Metro Concept Design has been completed to provide an indication of the estimated groundwater inflow rates at each work site location. The model predicts approximately 380 ML of groundwater inflow would be generated at the site locations during the main works construction period from late 2017 to late 2021. The estimated quantities of groundwater to be generated at the main project site locations, applying typical construction mitigations, are provided in Table 3-1. Inflows have not been considered:

- At site locations where the expected groundwater inflows to construction areas are small, and
- For the TBM tunnel inflows which will be mitigated through construction techniques.

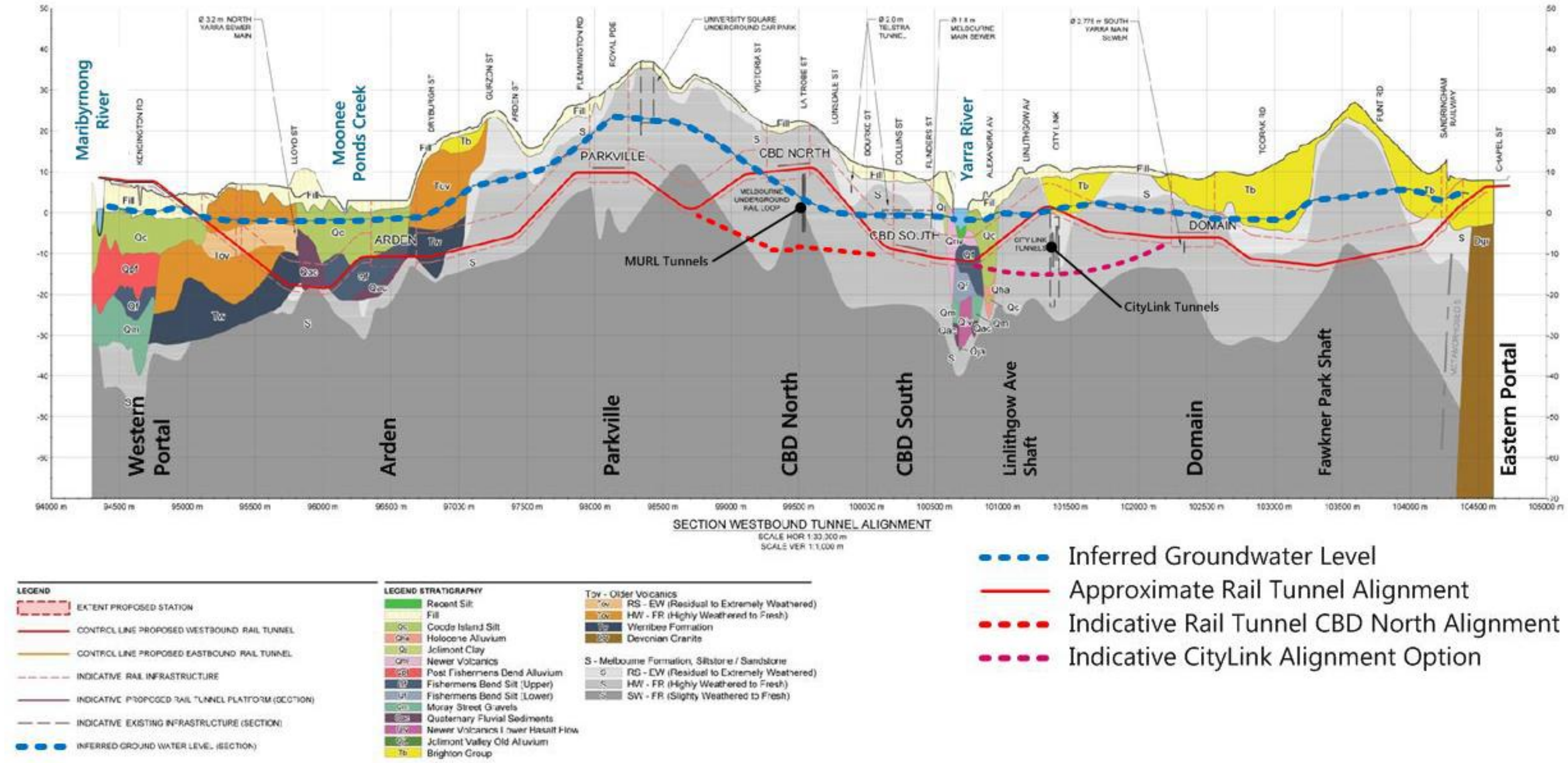

Figure 3-1: MMRP long-section geology and watertable

SOURCE: Adapted from AJM, *Environmental Effects Statement, Chapter 18 Groundwater Figure 18-2 (*18 February 2016)

Figure Notes:

1. This long-section is provided to demonstrate the approximate extent of water table along alignment only. Alignment options known are indicatively sketched on figure above and comprise:
   a. Alignment is proposed to travel underneath MURL with a deeper CBD North Station.
   b. Alignment option to travel underneath CityLink tunnels.

Table 3-1: Estimated groundwater inflow during construction by location

Location	Groundwater Inflow		
	Peak Groundwater Inflow (L/s)	Average Inflow (L/s)	Total Project Groundwater Inflow (ML)
Project Totals			
With Domain Scenario 1T	**6.5**	**2.6**	**383**
With Domain Scenario 2T	**6.5**	**2.4**	**358**
Site Locations:			
Western Portal	0.5	0.2	16
Arden	2.1	1.1	63
Parkville	0.3	0.2	9
CBD North	1.7	0.9	87
CBD South	1.6	1.2	111
Domain			
Domain Scenario 1T	1.7	0.8	45
Domain Scenario 2T	0.8	0.4	20
Eastern Portal	0.5	0.3	17
Intervention Shafts:			
Linlithgow Avenue	0.7	0.4	11
Fawkner Park	0.5	0.3	6
Cross Passages:			
Cross Passage 2	0.9	0.5	8
Cross Passage 3	0.9	0.5	11
Cross Passage 13	0.01	0.01	0.09

Table Notes:

1. Refer Section 1.5 for assumptions & limitations including the groundwater inflow construction mitigations assumed as part of the model.

Lower rate groundwater inflows may also occur during Early Works.

3.1.2 Operations

At completion of construction and once Melbourne Metro is operational, all the completed station and tunnel structures would be tanked structures with minimal groundwater inflows occurring. The inflow rate to these structures would be dependent upon the final design but is expected to be minimal.

3.2 Groundwater Quality Parameters

3.2.1 Total Dissolved Solids (TDS)

The hydrogeological investigations completed to date for the project have included testing for a range of groundwater quality parameters and potential contaminants of concern from groundwater monitoring wells along the alignment.

The key water quality parameter of concern to water authorities and the EPA for groundwater management and disposal is Total Dissolved Solids (TDS), which is a measure of salinity. The concentration of TDS across the Melbourne Metro alignment varies and is generally higher in the western areas of the project. TDS concentrations at key site locations are provided in Table 3-2.

Table 3-2: TDS concentrations at key site locations

Site Location	Average TDS Concentration (mg/L)
Site Locations:	
Western Portal	12,000
Arden	10,200
Parkville	10,400
CBD North	3,300
CBD South	2,900
Domain	4,400
Eastern Portal	5,300
Intervention Shafts:	
Linlithgow Avenue	4,600
Fawkner Park	5,000
Cross Passages:	
Cross Passage 2	44,200
Cross Passage 3	32,500
Cross Passage 13	4,600

Table Notes:

1. Refer Section 1.5 for assumptions & limitations.

The SEPP (Groundwater of Victoria) 1997 designates to protect Victoria's groundwater from contamination and where necessary, improve groundwater quality sufficient to protect existing and potential beneficial uses. The SEPP categorises groundwater into segments that designate a TDS concentration range and the associated protected beneficial uses as shown in Table 3-3.

Table 3-3: SEPP (Groundwaters of Victoria) Protected Beneficial Uses of the Segments

Beneficial Use	Segments (mg/L TDS)				
	A1 0 – 500 mg/L	A2 501 – 1,000 mg/L	B 1,001 – 3,500 mg/L	C 3,501 – 13,000 mg/L	D > 13,000 mg/L
1. Maintenance of ecosystems	✓	✓	✓	✓	✓
2. Potable Water					
Desirable	✓				
Acceptable		✓			
3. Potable mineral water	✓	✓	✓		
4. Agriculture Parks and Gardens	✓	✓			
5. Stock Watering	✓	✓	✓	✓	
6. Industrial water use	✓	✓	✓	✓	✓
7. Primary Contact Recreation (bathing and swimming)	✓	✓	✓	✓	
8. Building and structures	✓	✓	✓	✓	✓

(Source: SEPP (Groundwaters of Victoria) 1997)

The contractor(s) would, through their mitigation and management measures, be required to protect the beneficial reuses at each site location based on the TDS concentrations above. A summary of the segments to protect at the station and portal locations is provided in Table 3-4.

Table 3-4: SEPP (Groundwaters of Victoria) Protected Beneficial Uses of the Segments by Station and Portal Location

Site Location	SEPP (Groundwaters of Victoria) Protected Beneficial Uses of the Segments (TDS)				
	A1 0 – 500 mg/L	A2 501 – 1,000 mg/L	B 1,001 – 3,500 mg/L	C 3,501 – 13,000 mg/L	D > 13,000 mg/L
Western Portal				✓	
Arden				✓	
Parkville				✓	
CBD North			✓	✓	
CBD South			✓	✓	
Domain			✓	✓	
Eastern Portal	✓	✓	✓		

3.2.2 Other Key Water Quality Parameters

There are other key groundwater parameters that may be of importance dependent upon the management method and proposed use or disposal for the groundwater extracted during construction or operation. Parameters of interest to authorities may include:

- Field parameters (such as groundwater level, dissolved oxygen, pH),
- Major ions, TDS, pH, alkalinity,
- Sodium Adsorption Ratio,
- Metals (such as copper, iron, lead),
- Nutrients (such as nitrate and phosphate),
- Petroleum hydrocarbons,
- Other hydrocarbons,
- Chlorinated organics, and/or
- Microorganisms.

Parameters of interest will be designated by the SEPP's requirements and water quality objectives at the point of discharge. The contractor(s) would be required to detail the key parameters to be tested within their CEMP as considered in Section 3.2.3 below.

3.2.3 Sampling & Testing

Groundwater would be sampled, tested, analysed and categorised in accordance with the following EPA guidelines and Australian Standards:

- IWRG701 Sampling & Analysis of Waters Wastewaters, Soils & Wastes 2009.
- EPA Publication 668 Hydrogeological Assessment (Groundwater Quality) Guidelines 2006
- EPA Publication 669 Groundwater Sampling Guidelines 2000
- Australian Standard 4482 Guide to the investigation and sampling of sites with potentially contaminated soil
- Australian Standard 5667 Water Quality – Sampling

Site investigations have been, and continue to be conducted, to categorise groundwater through the collection and testing of representative samples from bores across the Melbourne Metro alignment. This information would enable the Contractor to develop an informed groundwater sampling and testing procedure and program for construction in their CEMP. Testing would occur on both inflows at site locations and in monitoring bores in the vicinity of the project.

During operations, groundwater testing may be required dependent upon the conditions contained within the discharge approval (Trade Waste Agreement) with the appropriate water authority.

4 Groundwater Management

Groundwater for Melbourne Metro would be managed in accordance with the requirements of:

- the *EP Act 1970* (Victoria),
- State Environmental Protection Policies (SEPPs):
  - State Environment Protection Policy (Prevention and Management of Contamination of Land) 2013
  - State Environment Protection Policy (Waters of Victoria) 1998,
  - State Environment Protection Policy (Groundwaters of Victoria) 1997, and
- associated publications and guidelines.

Groundwater inflow will occur into excavations, tunnels, station and portals during construction and to a much reduced extent once Melbourne Metro is operational. Groundwater that flows into excavations and structures would need to be extracted and disposed of appropriately.

The available and preferred management options for the Melbourne Metro groundwater inflow are summarised in Table 4-1. These options are considered in more detail in the following sections.

Table 4-1: Groundwater management options

Preference	Options		Option Detail	Notes
Most Preferable	**Avoidance**	Design	• Design of structures to be tanked with associated watertightness levels. • Design of structures to appropriate standards.	Avoidance to be targeted through design, management & engineering.
		Construction Technique	• Closed face and pressurised TBMs would be used and lining installed immediately behind to create a tanked tunnel effectively mitigating groundwater inflows during and post construction • Grouting and/or freezing of excavation faces in mined tunnels and open excavations. • Use of construction methods such as diaphragm walls and secant piles to limit groundwater inflow during construction	
		Modelling & monitoring regime	• Use of a predictive groundwater model & monitoring regime to monitor, manage and mitigate impact	
	Reuse	Reuse onsite	• Reuse for construction related activities (e.g. dust suppression)	Reuse may require pre-treatment dependent upon receiving location. Reinjection would require a Managed Aquifer Recharge Plan.
		Reuse for aquifer reinjection	• Reinjection of groundwater into aquifers (via groundwater wells)	
↓		Reuse by third-parties for industrial or irrigation purpose	• Irrigation for agricultural and/or recreational purposes • Manufacturing such as concrete aggregate washing	
Least preferable	**Disposal**	Discharge to sewer	• Discharge to sewer subject to required approval from water authorities (such as Trade Waste Agreement)	Discharge to sewer is the approach adopted for the EES. Treatment may be required prior to discharge.
		Discharge to surface water	• Discharge to surface water	This option would require further assessment and third-party approvals.
		Disposal to third-party facility	• Disposal to a certified waste disposal facility	

4.1 Groundwater Inflow into Structures

During construction, groundwater inflow would occur when tunnelling and excavation activities occur at or below the water table. The estimated peak inflow during the main works construction period, based on the Concept Design is approximately 6-7L/s as outlined in Section 3.1.

Operational inflows are expected to be comparatively minimal as the structures will be tanked. Groundwater inflow during operations is expected to be disposed to sewer subject to the appropriate discharge approvals (Trade Waste Agreements) being in place with the relevant Water authorities.

4.1.1 Avoidance

Avoidance of groundwater inflows would comprise a three faceted approach:

- Design,
- Use of appropriate construction techniques, and
- Modelling & monitoring regime.

Structure design & water tightness

Groundwater inflow would be mitigated during the operational phase through design of tanked structures to appropriate water tightness, known as the Haack tightness classification (Haack, A, 1991).

Construction techniques

The use of appropriate construction techniques would provide the primary mitigation method against groundwater inflow during construction. The contractor(s) could utilise methods such as:

- closed face and pressurised TBMs with lining installed immediately behind for tunnels,
- grouting and/or freezing of open excavation faces (i.e. at Cross Passage/Adit Locations), and
- construction methods such as diaphragm walls and secant piles providing lateral restraint to open cut sections as well as limiting groundwater inflow during construction.

Modelling & monitoring regime

For construction, the contractor(s) would be required to develop a predictive groundwater model to:

- inform tunnel design and construction techniques,
- predict ground water inflow rates to construction areas,
- assess potential drawdown and identify trigger levels for implementing additional mitigation measures, and
- assess potential migration of contamination, groundwater levels and potential effect on beneficial uses (refer Section 3.2.1).

The contractor(s) may also need to install additional groundwater monitoring wells. These would be installed, commissioned and managed in accordance with the requirements:

- *Water Act 1989* (Victoria),
- NUDLC Minim Construction Requirements for Water Bores in Australia 2012, and
- EPA Publication 669 Groundwater sampling guidelines.

4.1.2 Reuse

There are three potential options available for reuse of groundwater.

Reuse onsite

Onsite reuse of groundwater for construction related activities may be possible (such as for dust suppression). This reuse would need to meet ecological and human health criteria.

Reuse by third-parties for industrial or irrigation purpose

It may be possible to reuse groundwater for industrial or irrigation purposes. As groundwater quality guidelines for industrial water use are highly specific to the type of process, this would need to be considered for each proposed industrial use. Reuse would need to meet ecological and human health criteria. EPA IWRG 632 Industrial Water Reuse provides further information on the requirements for reuse of industrial water.

Aquifer reinjection

Aquifer reinjection would only be suitable where it would be required to manage drawdown and associated impacts. Reinjection may comprise use of:

- groundwater extracted during construction, or
- other water (such as potable water),

subject to the appropriate approvals and water quality parameters.

Aquifer reinjection with groundwater extracted during construction would require a Managed Aquifer Recharge (MAR) plan to be prepared and approved by the relevant approval authority which may comprise one or more of the EPA, Southern Rural Water, Department of Health & Human Services, Melbourne Water and local Council(s). The EPA would maintain a regulatory interest in this process and would be a key stakeholder during development. EPA Publication 1290 Guidelines for Managed Aquifer Discharge (MAR) – Health & Environmental Risk Management 2009 provides further information on the requirements. The MAR would need to consider the potential effect on beneficial uses (refer Section 3.2.1).

4.1.3 Disposal

Discharge to sewer

At the time of writing this Strategy discharge to sewer is considered the most likely method for disposal given the short term nature and low estimated volumes of groundwater requiring disposal. Discharge to sewer is the approach adopted for the Environmental Effects Statement (EES).

Disposal to sewer would require agreement with Melbourne Water and the relevant water retailer, City West Water or Southeast Water. This agreement would be supported by an assessment of groundwater inflow to construction areas and water quality parameters over time. The retailer would designate the conditions for discharge which may include:

- Permitted hours of discharge (i.e. outside peak sewer times),
- Restrictions during rainfall events,
- Sewer manhole locations to be discharged into, and
- Any requirement to upgrade sewer infrastructure.

Water discharged to sewer from all site locations would be received at the Western Treatment Plant. Melbourne Water, in consultation with the water retailers, would designate a maximum TDS level that can be received the Western Treatment Plant. To meet this level, the contractor(s) may need to consider mitigations such as:

- pre-treatment to lower salinity,
- detention or dilution of groundwater to smooth peak discharge loads, and/or
- program adjustment to offset concurrent excavations at site locations (and hence reduce TDS).

Melbourne Water may also designate permitted levels of other groundwater constituents they can receive. Consultation with Melbourne Water on discharge to sewer is ongoing but it appears a manageable option.

Discharge to surface water

Discharge to surface water could be an option for disposal of groundwater during construction of Melbourne Metro. Assessment of the potential impacts to the receiving surface water would be required in order to obtain approvals from EPA and Melbourne Water.

Consultation with the federal Department of Environment (DoE) would also be required in relation to discharge to the Yarra River and Port Phillip Bay due to the presence of Commonwealth listed threatened species and a Ramsar wetland area. It would also require consideration of the existing determination for Melbourne Metro under *the Environment Protection and Biodiversity Conservation Act 1999 (*Commonwealth) (EPBC Act) and proposed measures for the project outlined in the EPBC Act referral.

If a surface water disposal option was pursued, a contingency sewer discharge would be required in areas where contaminated groundwater could not be separated from groundwater extracted during construction.

Disposal to a third-party facility

Groundwater may be disposed of to an EPA-licensed third-party facility for treatment and/or disposal. The EPA provides a list of licensed disposal locations through their Interaction Portal at https://portal.epa.vic.gov.au/irj/portal

4.1.4 Treatment

The extent of groundwater treatment would be dependent upon the management method adopted. The EPA and/or water authorities would designate permitted levels of groundwater parameters for reuse or disposal. TDS is a key parameter in management of groundwater (as considered in Section 3.2.1).

5 Construction Environment Management Plan (CEMP)

The construction contractor(s) would be required to meet Environmental Performance Requirements defined in the Environment Effect Statement (EES), detailing and implementing work method statements (WMS) for groundwater management within their Construction Environmental Management Plan (CEMP). This would be required to mitigate potential environmental harm and human health effects. Factors which need to be considered include:

- the groundwater inflow rates and its quality over time including further sampling & and testing,
- groundwater disposal requirements including:
  - discharge approvals from appropriate water authorities,
  - minimum water quality standards and treatment to discharge (if required),
  - permitted discharge volumes and rates,
  - discharge locations.
- compliance with the *Occupational Health and Safety Act 2004 (Vic)* and management of occupation health & safety during construction,
- emergency inflow management,
- conformance with Environmental Performance Requirements and their monitoring, and
- persons responsible for implementation and management of the above.

The CEMP would include management measures in accordance with:

- EPA Publication 480 Environmental Guidelines for Major Construction Sites, and
- EPA Publication 668 Construction Techniques for Sediment Pollution Control.

5.1 Performance Monitoring

Regular performance monitoring of groundwater management measures within the CEMP would be conducted by both the Environment Representative of the Contractor(s) and MMRA. The Contractor(s) would hold compliance records which would include as a minimum the following:

- Records of testing and monitoring in relation to groundwater management and associated environmental controls (managed in accordance with the CEMP),
- Records detailing the management and disposal of groundwater at on and off-site locations.

Results and outcomes of inspections, monitoring and auditing would be reported regularly by the Contractor(s). The compliance records would be audited by the MMRA for conformance.

The CEMP would identify the process for identifying, reporting, recording and reviewing non-conformances, which would ensure continual improvement. This document would be periodically reviewed and updated as necessary.

6 References

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