URS

Trackbed Investigation

METROWEST PHASE 1 Factual Report

WESTERN TERRITORY

April 2014

47070043/WT/PL/140569/1

Prepared for:
Network Rail

UNITED KINGDOM & IRELAND

REVISION SCHEDULE					
Rev	**Date**	**Details**	**Prepared by**	**Reviewed by**	**Approved by**
1	April 2014	Factual Report	Jacob Matthews Graduate Engineer	Dave Kite Principal Engineer	Craig Govan Principal Engineer

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The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by URS has not been independently verified by URS, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by URS in providing its services are outlined in the Contract. The work described in this Report was undertaken on the 2nd & 3rd April 2014 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

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Where field investigations are carried out, these have been restricted to a level of detail required to meet the stated objectives of the services. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in issuing this Report.

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1 INTRODUCTION

1.1 Background

Network Rail have commissioned URS (under NR3 Contract) on behalf of North Somerset Council and West of England Councils to produce a feasibility report updating the previously issued "Option Selection Report GRIP Stage 3 Portishead re-opening". As part of this report, Trackbed Investigation has been requested to understand the condition of the trackbed below the redundant track.

This Factual Report contains data appendices and figures showing the details of ABS and Trial Pit samples taken during the site work shifts (2-3 April 2014). This report will be followed by an interpretative report which will provide recommendations in relation to the renewal of the trackbed.

1.2 Site Details

The key information is provided below along with actual investigation mileages completed on site.

REFERENCE DETAILS					
Site Name	**UID**	**ELR**	**Line Name / Track ID**	**Renewal Mileage**	**Issue No. / Date**
MetroWest Phase 1	140569	POD	Reversible	126m 728y to 129m 880y	1 / April 2014

UID – Unique Identification ELR – Engineers Line Reference

SITE INVESTIGATION MILEAGE		
Planned Site Investigation	**Actual Site Investigation**	**Reference Milepost / Feature**
126m 945y to 129m 616y	126m 1043y to 129m 616y	No mileposts present on site, therefore sample locations were recorded using with GPS and scaled from OS Mapping.

2 INVESTIGATION SCOPE

The actual investigation completed is summarised in the table below and the results detailed in Figure 1 and Appendices A-B. Any non-compliance between the required Site Investigation and the actual Site Investigation is justified and mitigated against in Section 3.

SCOPE OF INVESTIGATION		
Activity	**Required**	**Completed**
Drainage Investigation	N	N
Ballast Contamination Sampling	Y	N[1]
Structural Investigation	Y	Y
Trial Pit Investigation	N	N
ABS Investigation	Y	Y
Trial Trench Investigation	N	N
LWD Investigation	N	N
Environmental Noise Notice	N	N

Notes:

1. Samples are currently being tested for ballast contamination classification. Results will be delivered with the Interpretative Report.

3 SITE WORK DEFICIENCY AND MITIGATION

Prior to the investigation, sample positions were scoped by Peter Hillier (URS Associate, Track Design Lead) and agreed by Jacob Matthews (Trackbed Engineer). Sample positions were completed as planned during the site work with the exception of ABS 1, ABS 4, ABS 6, ABS 12 and ABS 21. These samples were moved due to heavy vegetation which made site access difficult in the planned locations.

The following samples were converted from ABS to Deep Trial Pits: ABS 9, ABS 17, ABS 18, ABS 19 & ABS 20.

4 BALLAST WASTE CLASSIFICATION

Samples are currently being tested for ballast contamination classification. Results will be delivered with the Interpretative Report.

5 TRACKBED SAMPLE LOCATIONS

The following table shows the actual locations of the samples completed on site:

TRACKBED SAMPLE LOCATION TABLE							
Type	**No.**	**ELR**	**Position**	**Offset**	**Mile**	**Yard**	**Comments**
ABS	1	POD	Cess	Dn SE	126	1043	
ABS	2	POD	Cess	Dn + 2m	126	1252	
ABS	3	POD	4ft	-	126	1430	Culvert soffit not encountered
ABS	4	POD	Cess	Dn SE	126	1650	
ABS	5	POD	Cess	Dn + 2m	127	61	
ABS	6	POD	Cess	Dn + 1.5m	127	548	
ABS	7	POD	4ft	-	127	760	Culvert soffit not encountered
ABS	8	POD	Cess	Dn + 2m	127	827	
ABS	9	POD	4ft	-	127	915	Sample replaced by DP 9 due to ABS refusal
DP	ABS 9	POD	4ft	-	127	915	Culvert soffit encountered
ABS	10	POD	Cess	Dn + 1m	127	1206	
ABS	11	POD	4ft	-	127	1320	
ABS	12	POD	Cess	Dn SE	127	1350	Relocated due to possible buried services
ABS	13	POD	Cess	Up + 2m	128	45	
ABS	14	POD	4ft	-	128	310	Culvert soffit not encountered
ABS	15	POD	4ft	-	128	370	
ABS	16	POD	4ft	-	128	722	
DP	ABS 17	POD	4ft	-	128	913	Culvert soffit encountered
DP	ABS 18	POD	Cess	Dn + 1.5m	128	923	ABS converted to trial pit due to difficulty with site access
DP	ABS 19	POD	Cess	Dn + 2m	128	1385	ABS converted to trial pit due to difficulty with site access
DP	ABS 20	POD	4ft	-	128	1463	Culvert soffit encountered
ABS	21	POD	Cess	Dn + 1.5m	129	158	
ABS	22	POD	Cess	Dn + 1.5m	129	364	
ABS	23	POD	Cess	Dn + 1.5m	129	563	
ABS	24	POD	6ft	-	129	616	Located in 6ft between POD Up and Down tracks

Notes:

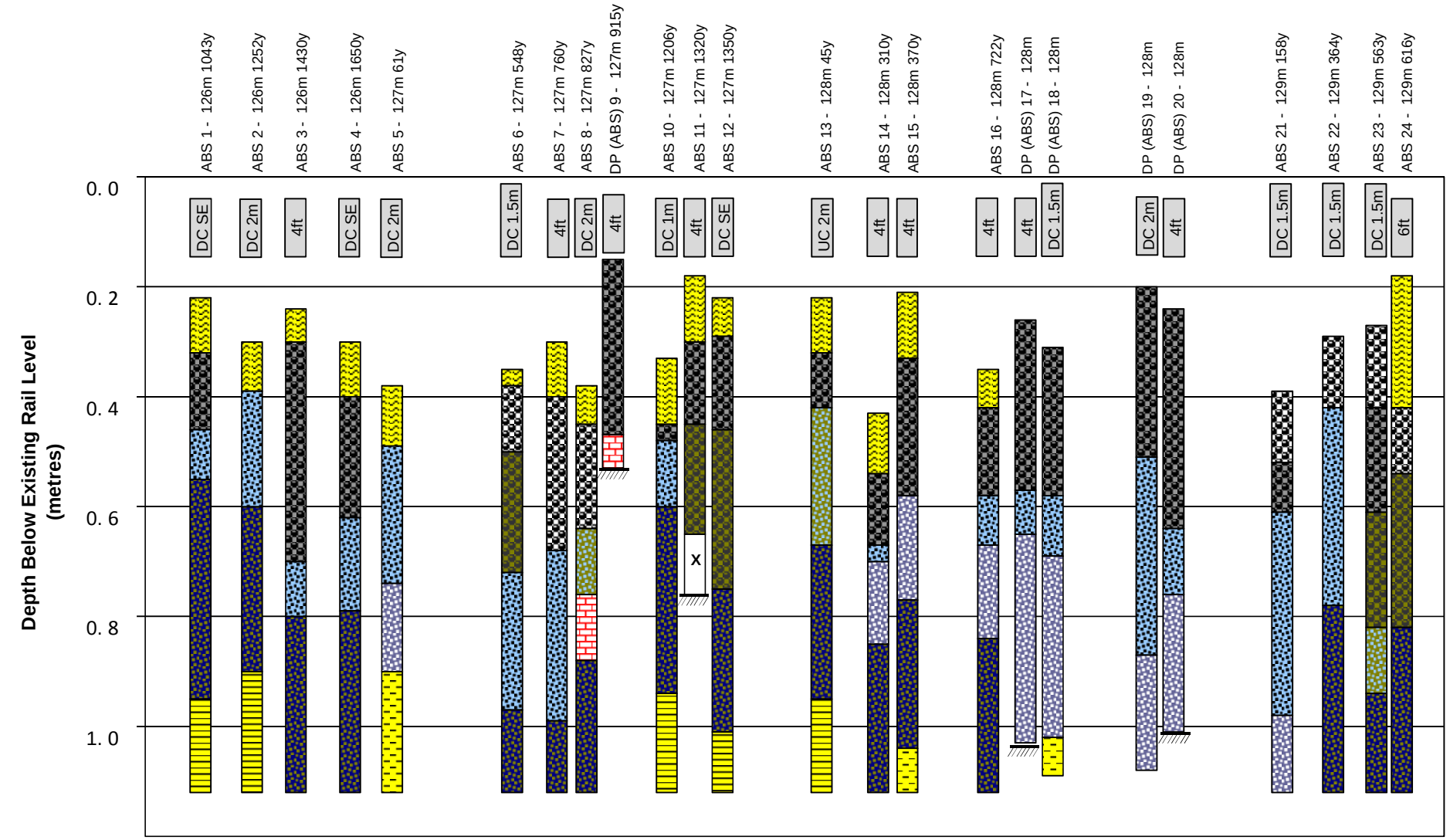
- Offset values are given relative to the Down/Up running rail
- Dn = Downside / Up = Upside / SE = sleeper end

6 TRACKBED RENEWAL RECOMMENDATIONS

Following this Factual Report an Interpretative Report will be provided which will detail recommendations in relation to the renewal of the trackbed.

FIGURE 1A:

LONGITUDINAL SECTION



Grey boxes show the lateral position of the samples relative to the existing redundant track

Abbreviations: DC = Down Cess UC = Up Cess SE = Sleeper End Xm = lateral offset distance of the sample measured from closest running rail in meters

Prepared	AG
Checked	DGK
Job No	47070043
Date	Apr '14

FIGURE 1A

Metrowest Phase 1 - Trackbed Investigation

LONGITUDINAL SECTION

POD - REVERSIBLE - 126m 1043y to 129m 616y

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FIGURE 1B:

LONGITUDINAL SECTION LEGEND KEY

1 BALLAST

a) With no subgrade erosion

1		Clean Ballast
2		Slightly Dirty Ballast
3		Dirty Ballast
4		Very Dirty Ballast (non-cohesive)
5		Very Dirty Ballast (cohesive)
6		Very Dirty Ballast (slurried)

b) With subgrade erosion

7		Slurried Ballast <10% fines
8		Slurried Ballast >10% fines
9		Ballast - Voids filled with silt/fine sand
10		Ballast - Voids filled with soft/firm clay

2 TRACKBED LAYERS / FILL

a) Derived from naturally occurring Sands and Gravels.

11		Fine / Medium Sand (<5%)	D = 0.06 to 0.60mm
12		Coarse Sand (<5%)	D = 0.60 to 2.00mm
13		Sand and Gravel (<5%)	
14		Clayey Sand and/or Gravel (5 to 20%)	
15		Slurried Sand and/or Gravel (5 to 20%)	

b) Quarry Products

16		Stone Dust (<5%)
17		Coarse Crushed Stone Aggregate (<5%)
18		Clayey / Silty Crushed Stone Aggregate (5 to 20%)
19		Slurried Crushed Stone Aggregate

(% refers to clay / silt content)

c) Ash

20		Fine ash (sand sized) (<5%)
21		Coarse ash (gravel sized) (<5%)
22		Clayey / silty Ash (5 to 20%)
23		Slurried Ash

d) Other granular trackbed materials

24		Fine grained, susceptible to erosion (<5%)
25		Coarse Granular Layer (<5%)
26		Clayey / silty Granular Layer (5 to 20%)
27		Slurried Granular Layer
28		Any of 2 a-d in a clay matrix (20 to 50%)

3 SUBGRADE

Use legends from section 2 where appropriate, legend with bold outline indicates natural ground

a) Organic soils, clays and silts

31		Organic Soil	
32		Soft Clay/Silt	Cu < 40kN/m^2
33		Firm Clay/Silt	Cu = 40 to 75kN/m^2
34		Stiff Clay/Silt	Cu = 75 to 150kN/m^2
35		Very Stiff / Hard / Very weak Mudstone Cu > 150kN/m2	

b) Mixed (Fine and Coarse) Soils

36		Unstratified (clayey/silty Coarse Soil OR sandy or gravelly Fine Soil)
37		Interbedded or weathered/weakly cemented fine grained rocks

c) Rock or Rockfill

38		Weak fine grained (mudstone, limestone, chalk, fine sandstone)
39		Moderately strong to hard rock

4 PITCHING LAYERS

29		Clean pitching
30		Slurried Pitching

5 SAMPLE LOSS IN ABS

0x	X	Soil penetrated by ABS, but not recovered
0d	D	Soil displaced by ABS - indicative of very soft soil

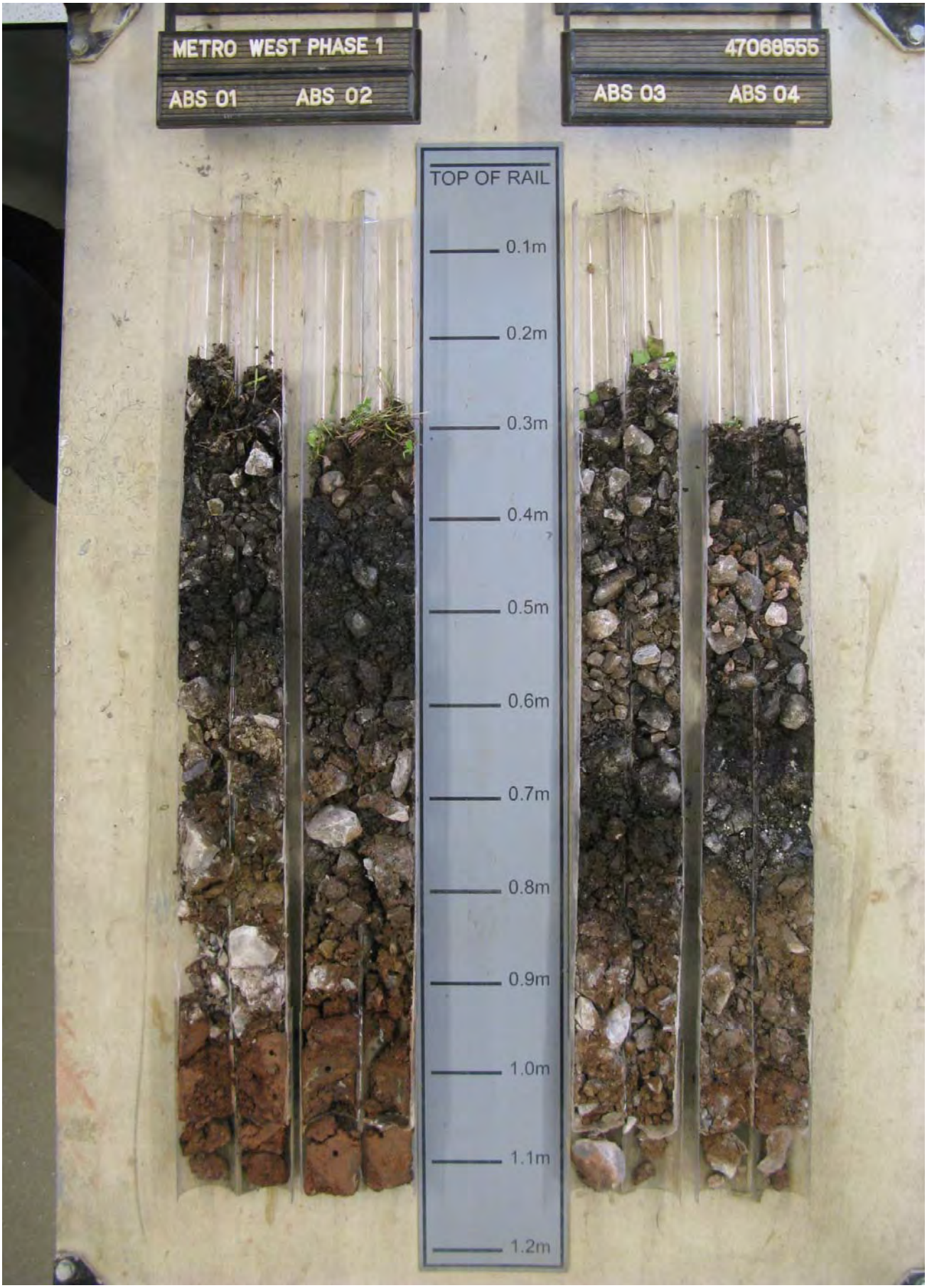
6 ADDITIONAL INFORMATION

g	permeable geotextile separator	**w**	water strike
c	permeable geocomposite	**ws**	water standing
m	reinforcing mesh (geogrid)	**34**	shear strength kN/m^2
p	impermeable membrane (polythene)		
h	impermeable geocomposite		
c-gs	Geosand		
c-tt	Tracktex		
g+m	PW4.0LA / TED4		
hs	evidence of historical slurrying		
e	likely chemical contamination		
L	>10% limestone ballast		

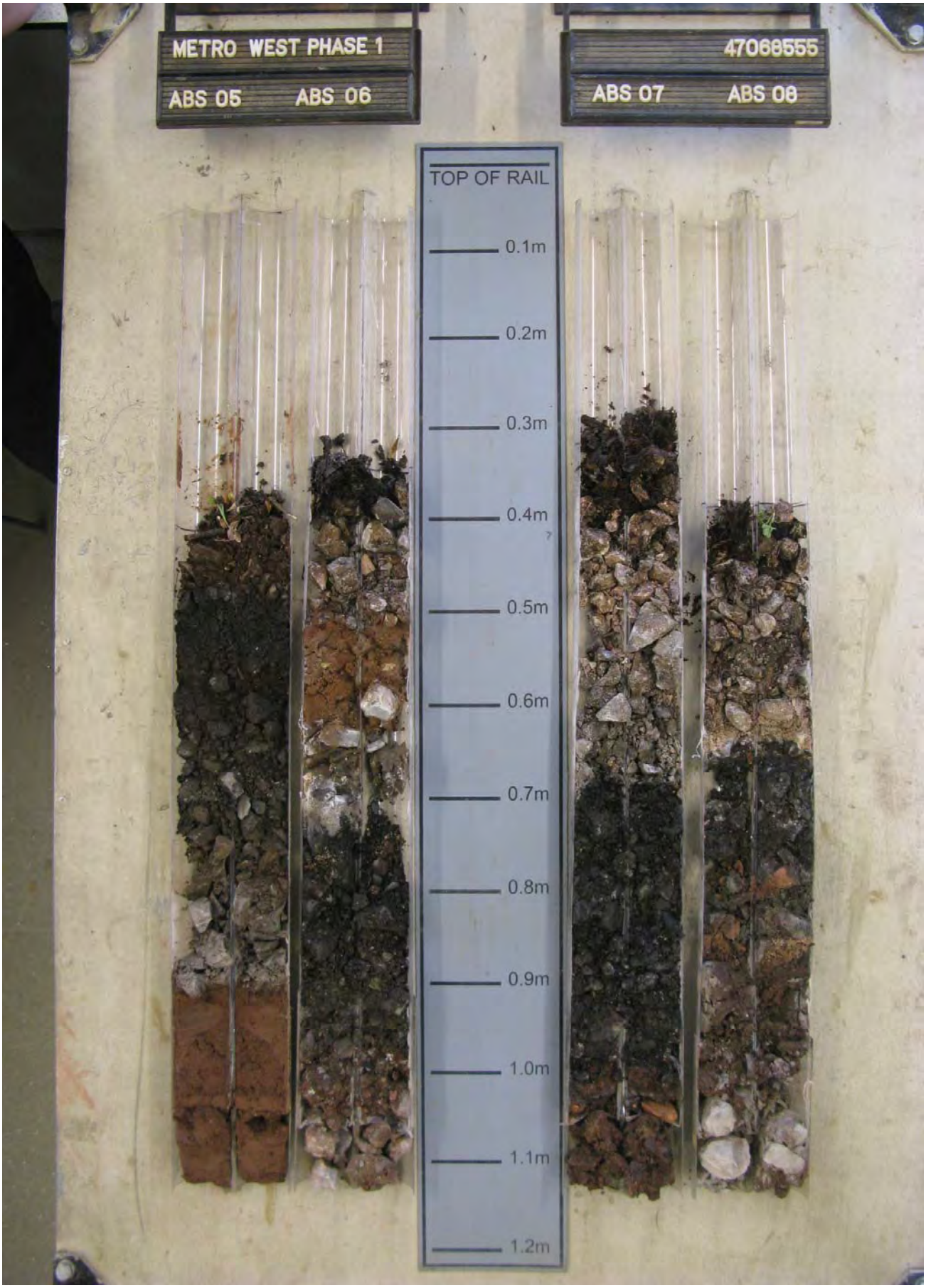
Prepared	AG	FIGURE 1B	URS
Checked	DK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	LONGITUDINAL SECTION LEGEND KEY	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	

APPENDIX A:

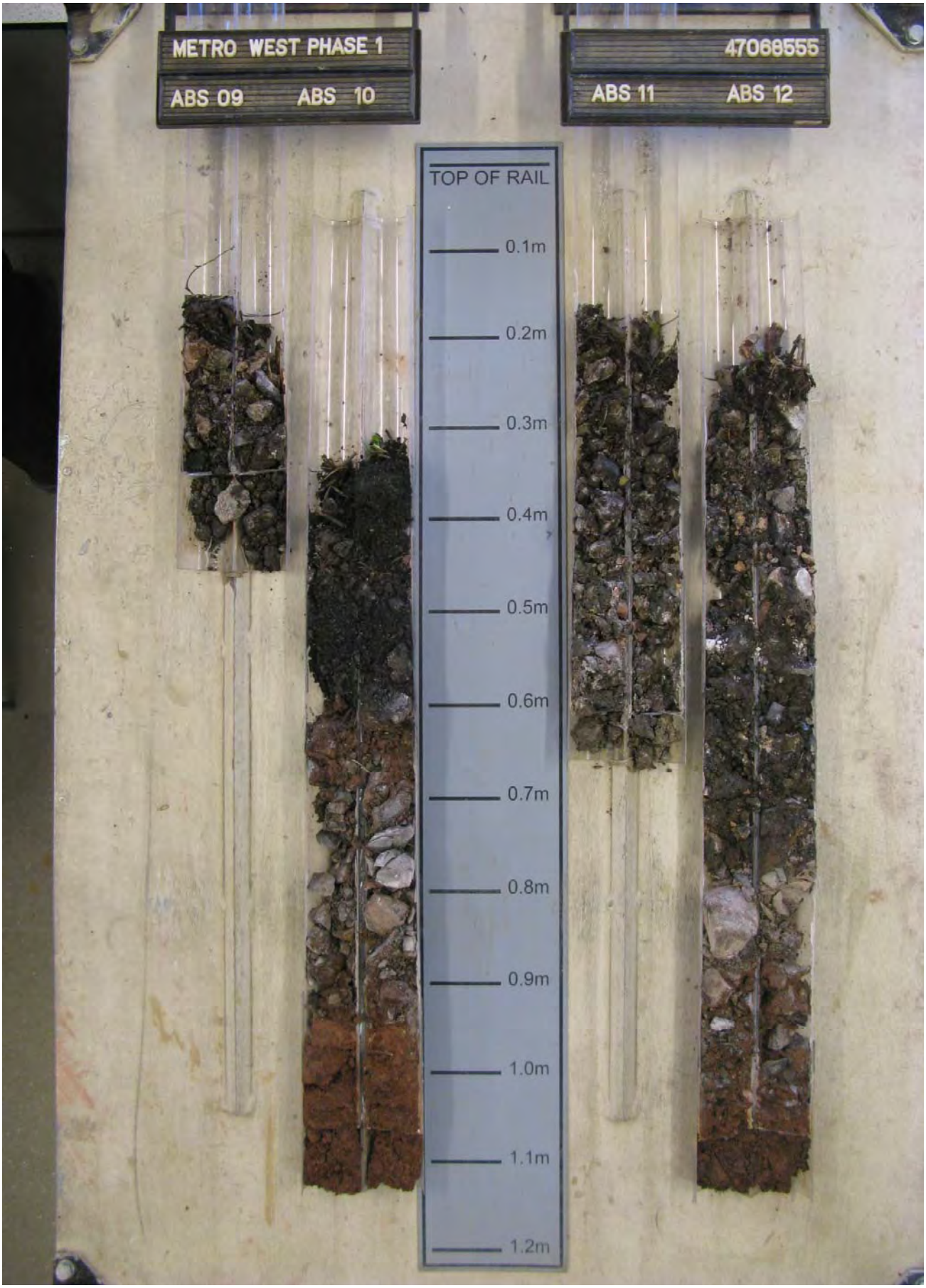
ABS PHOTOGRAPHIC LOGS



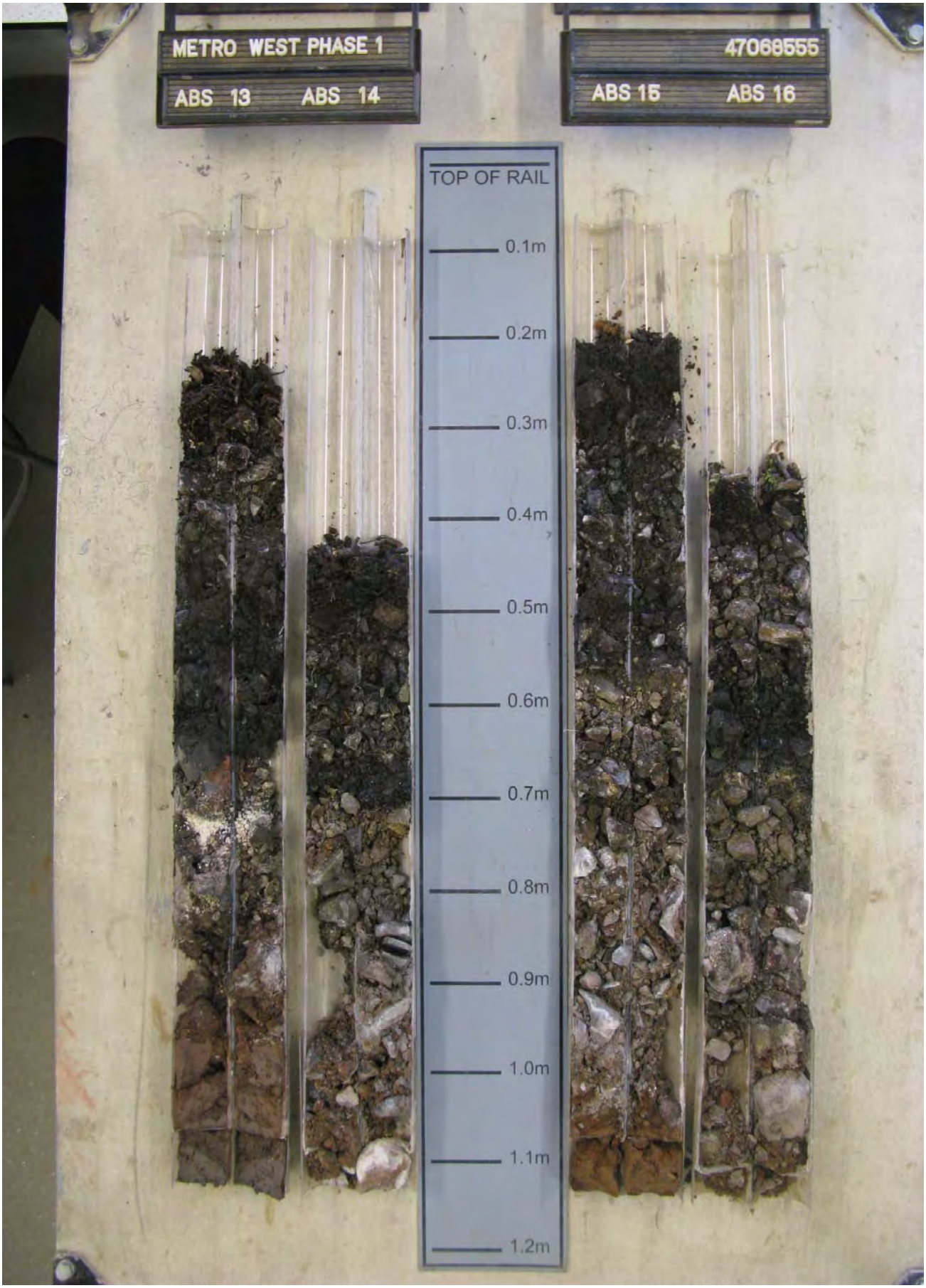
Prepared	AG	APPENDIX A - ABS 1 to ABS 4	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



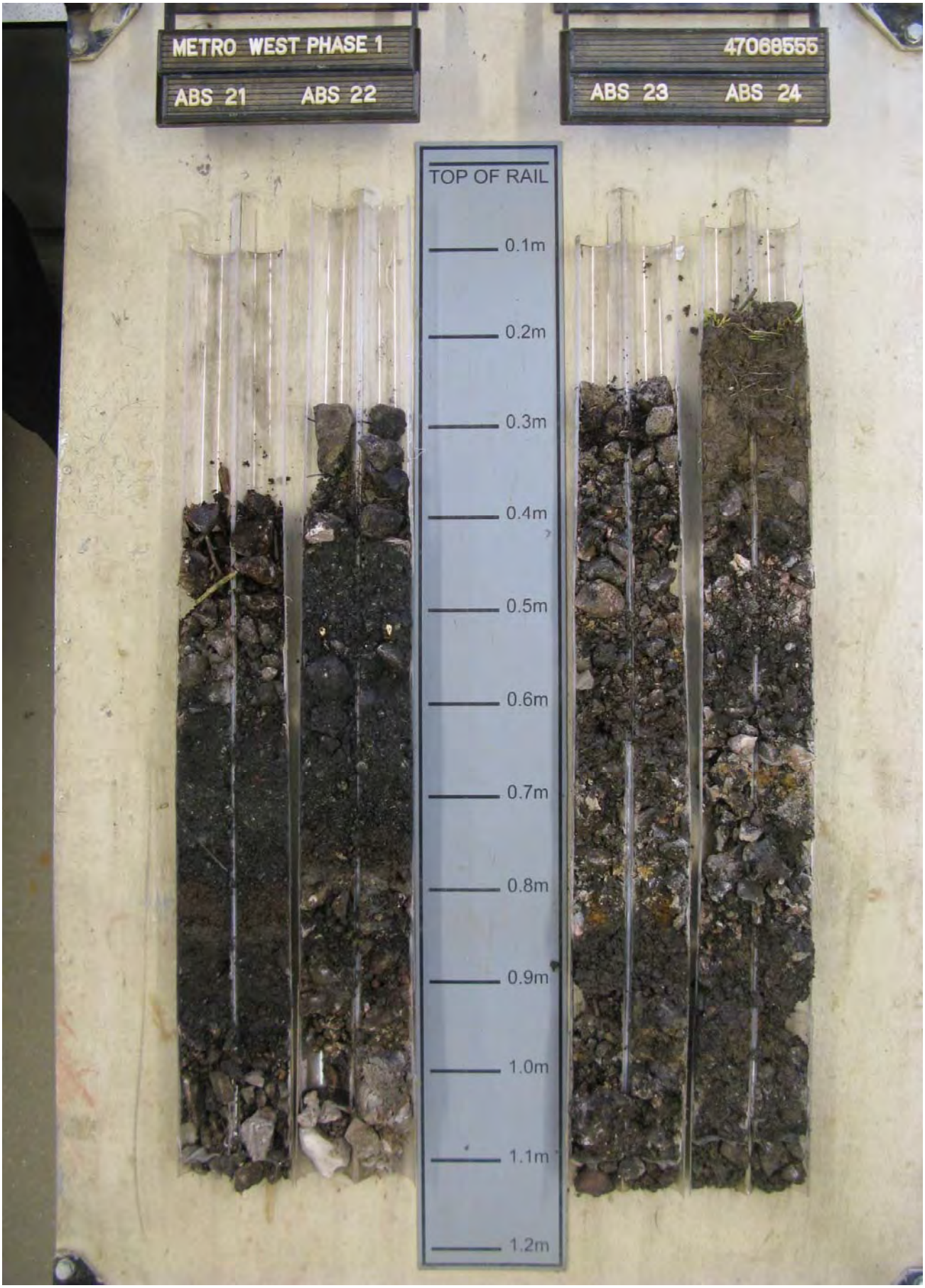
Prepared	AG	APPENDIX A - ABS 5 to ABS 8	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



Prepared	AG	APPENDIX A - ABS 9 to ABS 12	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



Prepared	AG	APPENDIX A - ABS 13 to ABS 16	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



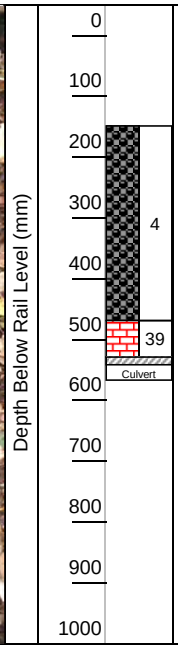
Prepared	AG	APPENDIX A - ABS 21 to ABS 24	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	

APPENDIX B:

TRIAL PIT LOGS

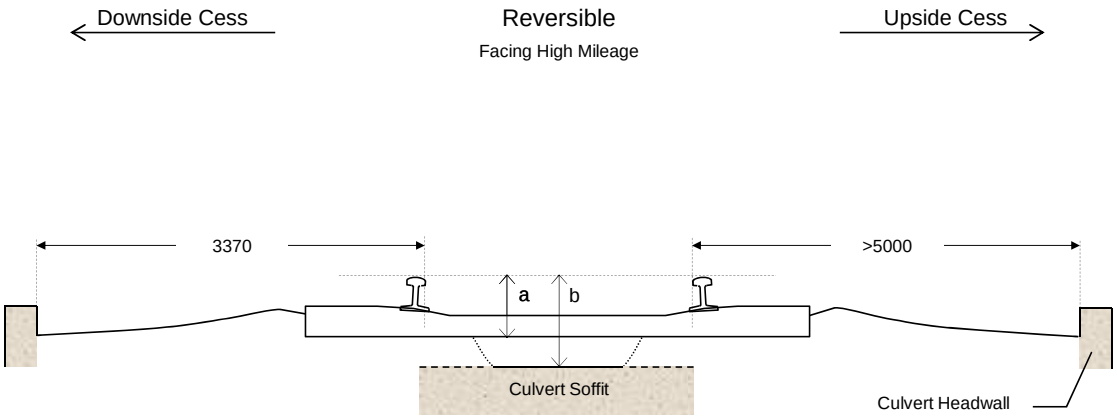
Trial Pit Details			
Pit Type / Number	DP ABS 9	Trial Pit Purpose	Assess clearances to Culvert
Mileage	127m 915y	Reason for termination	Structure encountered
Line	Reversible		
Position	4ft	Structure Reference	Unknown
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Dry	Standing Water	None
Weather During SI	Dry	Slurry Material	None
Date of Inspection	03/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Remarks

Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)



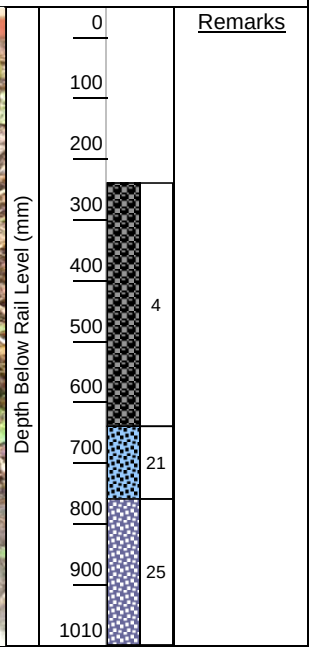
Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values as no mileposts were present on site. ABS converted to DP during the site investigation to confirm cause of shallow refusal. DP refused at a depth of 530mm brl on culvert structure.	a= 300 mm b= 530 mm

Prepared	JWM	APPENDIX B - DP ABS 9 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
Checked	DGK		
Job No	47070043		
Date	Apr '14		

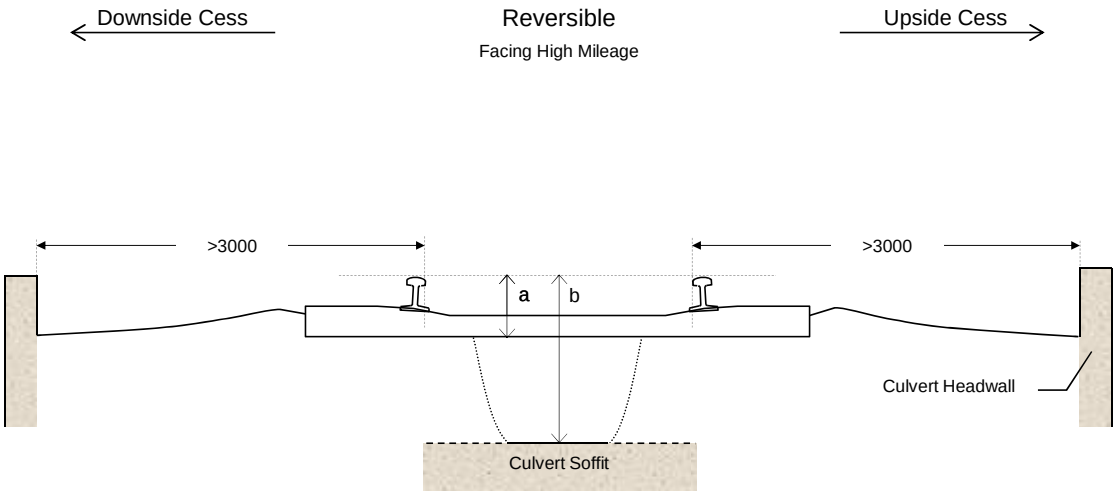
Trial Pit Details

Pit Type / Number	DP ABS 20	Trial Pit Purpose	Assess clearances to Culvert
Mileage	128m 913y	Reason for termination	Design depth achieved
Line	Reversible		
Position	4ft	Structure Reference	Unknown
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Dry	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)



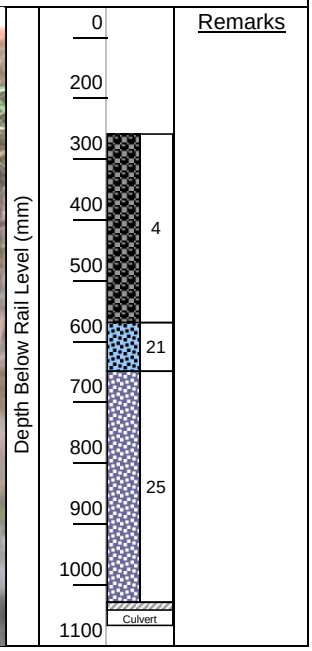
Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 9 converted to DP during site investigation due to track access. DP completed at a depth of 1010mm brl, culvert soffit encountered at base of DP.	a= 300 mm b= 1010 mm

Prepared	JWM	APPENDIX B - DP ABS 20 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
Checked	DGK		
Job No	47070043		
Date	Apr '14		

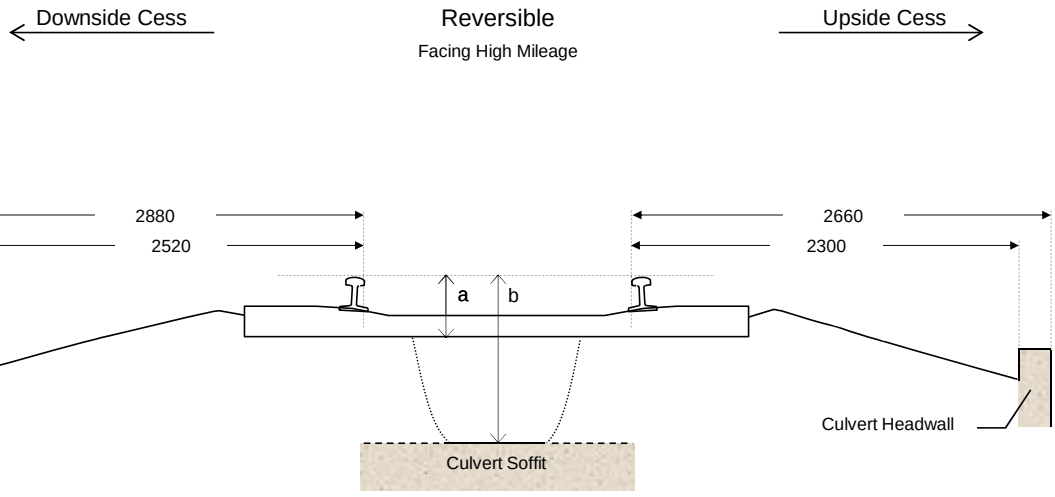
Trial Pit Details

Pit Type / Number	DP ABS 17	Trial Pit Purpose	Assess clearances to Culvert
Mileage	128m 923y	Reason for termination	Structure encountered
Line	Reversible		
Position	4ft	Structure Reference	Unknown
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Wet	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)

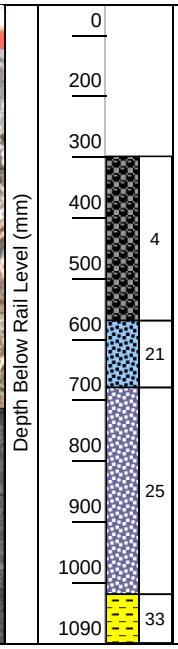


Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 17 converted to DP during site investigation due to track access. DP completed at a depth of 1040mm brl, culvert soffit encountered at base of DP.	a= 330 mm b= 1040 mm

Prepared	JWM	APPENDIX B - DP ABS 17 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
Checked	DGK		
Job No	47070043		
Date	Apr '14		

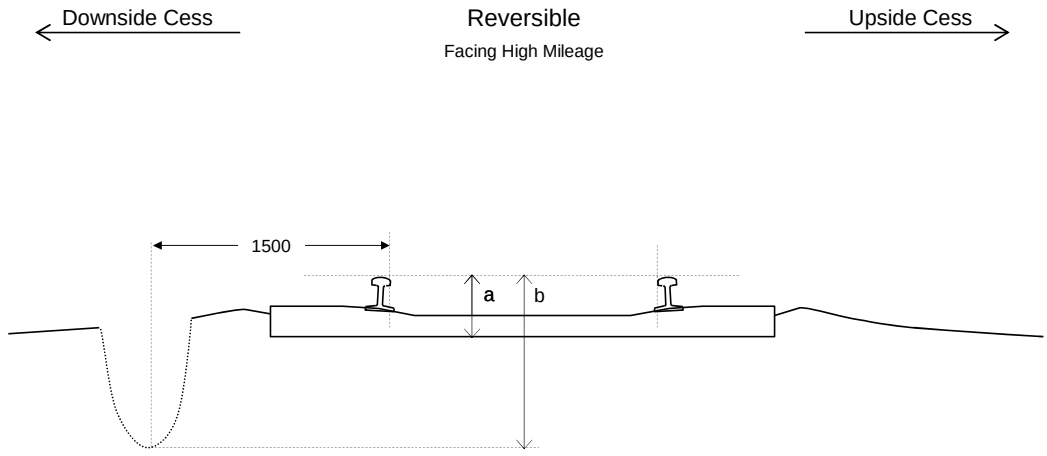
Trial Pit Details			
Pit Type / Number	DP ABS 18	Trial Pit Purpose	ABS Replacement
Mileage	128m 1385y	Reason for termination	Design depth achieved
Line	Reversible		
Position	Cess	Structure Reference	N/A
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Wet	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Remarks

Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)

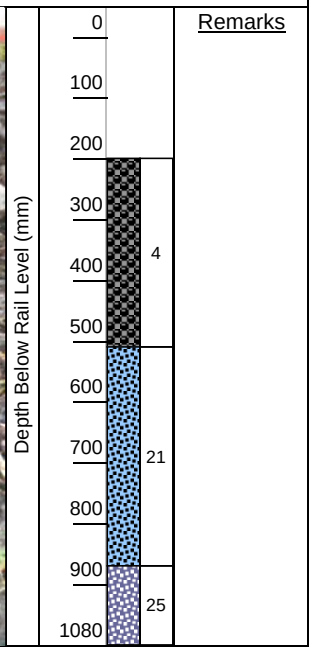


Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 18 converted to DP during site investigation due to track access. DP advanced at a lateral offset of 1500mm from the downside rail and completed at a depth	a= 330 mm b= 1090 mm

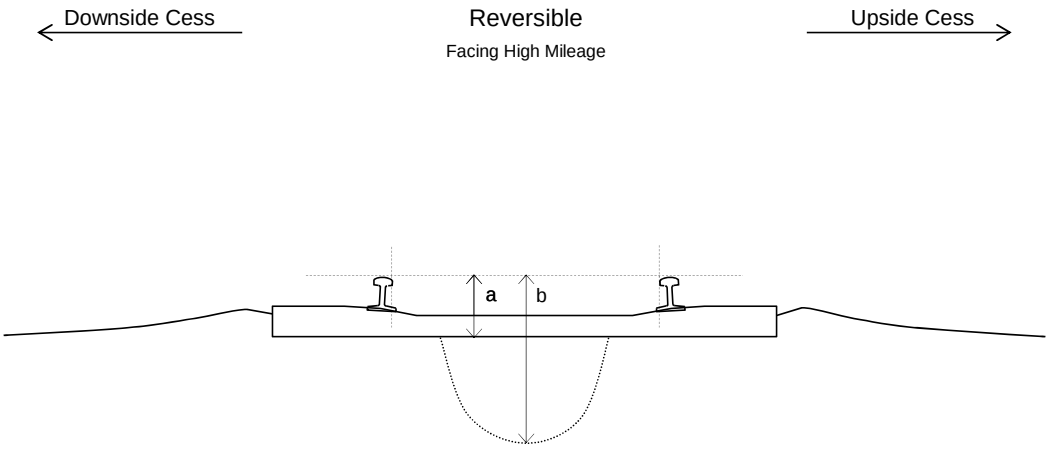
Prepared	JWM	APPENDIX B - DP ABS 18	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	TRIAL PIT LOG	
Date	Apr '14	POD - REVERSIBLE	

Trial Pit Details			
Pit Type / Number	DP ABS 19	Trial Pit Purpose	ABS Replacement
Mileage	128m 1463y	Reason for termination	Design depth achieved
Line	Reversible		
Position	4ft	Structure Reference	N/A
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Dry	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)



Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 19 converted to DP during site investigation due to track access. DP completed at a depth of 1080mm brl.	a= 300 mm b= 1080 mm

Prepared	JWM	APPENDIX B - DP ABS 19 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
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Job No	47070043		
Date	Apr '14		

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Trackbed Investigation

METROWEST PHASE 1 Interpretative Report

WESTERN

April 2014

47070043/WT/PL/140569/2

Prepared for:
Network Rail

UNITED KINGDOM & IRELAND

REVISION SCHEDULE					
Rev	**Date**	**Details**	**Prepared by**	**Reviewed by**	**Approved by**
1	April 2014	Factual Report	Jacob Matthews Graduate Engineer	Dave Kite Principal Engineer	Craig Govan Principal Engineer
2	April 2014	Interpretative Report	Jacob Matthews Graduate Engineer	Dave Kite Principal Engineer	Craig Govan Principal Engineer

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The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by URS has not been independently verified by URS, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by URS in providing its services are outlined in the Contract. The work described in this Report was undertaken on the 2nd & 3rd April 2014 and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

URS disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to URS' attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. URS specifically does not guarantee or warrant any estimate or projections contained in this Report.

Where field investigations are carried out, these have been restricted to a level of detail required to meet the stated objectives of the services. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in issuing this Report.

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1 INTRODUCTION

1.1 Background

Network Rail have commissioned URS (under NR3 Contract) on behalf of North Somerset Council and West of England Councils to produce a feasibility report updating the previously issued "Option Selection Report GRIP Stage 3 Portishead re-opening". As part of this report, Trackbed Investigation has been requested to understand the condition of the trackbed below the redundant track.

This Interpretative Report supersedes and incorporates all data provided in the Factual Report. The report contains appendices and figures with details of ABS and Trial Pit samples taken during the site work shifts (2-3 April 2014) and also photographs from the walkover survey. This report also includes recommendations in relation to the renewal of the trackbed required prior to the reinstatement of the redundant tracks.

1.2 Site Details

The key information is provided below along with actual investigation mileages completed on site.

REFERENCE DETAILS					
Site Name	**UID**	**ELR**	**Line Name / Track ID**	**Renewal Mileage**	**Issue No. / Date**
MetroWest Phase 1	140569	POD	Reversible	126m 728y to 129m 880y	2 / April 2014

Notes: UID – Unique Identification, ELR – Engineers Line Reference

SITE INVESTIGATION MILEAGE		
Planned Site Investigation	**Actual Site Investigation**	**Reference Milepost / Feature**
126m 945y to 129m 616y	126m 1043y to 129m 616y	No mileposts present on site, therefore sample locations were recorded using with GPS and scaled from OS Mapping.

The future planned traffic levels (EMGTPA) have not been provided to URS at this time, although the Client has advised that the Track Category will be no higher than a Category 4.

2 INVESTIGATION SCOPE OF WORK

2.1 Desk Study

Since this site is on track which has been redundant for decades, many of the usual desk study data sources are unavailable (track geometry data, GPR data, OMNICOM, etc.). Desk study has encompassed reviewing geological mapping and aerial photos as well as information from previous reporting (GRIP Stage 3).

2.2 Scope of Site Works

The actual investigation completed is summarised in the table below and the results detailed in Figure 1 and Appendices A-B. Any non-compliance between the required Site Investigation and the actual Site Investigation is justified and mitigated against in Section 2.3.

SCOPE OF INVESTIGATION		
Activity	**Required**	**Completed**
Walkover Survey	Y	Y
Drainage Investigation	N	N
Ballast Contamination Sampling	Y	Y
Structural Investigation	Y	Y
Trial Pit Investigation	N	Y
ABS Investigation	Y	Y
Trial Trench Investigation	N	N
LWD Investigation	N	N
Environmental Noise Notice	N	N

Notes:

1. Trial pits used to replace ABS samples where access constraints existed during site work.

2.3 Site work deficiency and mitigation

Prior to the investigation, sample locations and offset positions were scoped by Peter Hillier (URS Associate, Track Design Lead) and agreed by Jacob Matthews (Trackbed Engineer). Sample positions were completed as planned during the site work with the exception of five samples (ABS 1, 4, 6, 12 & 21). These samples were moved due to heavy vegetation which restricted site access in the planned locations.

The following samples were converted from ABS (1.2m core samples) to Deep Pits (hand excavated trial pits): ABS 9, 17, 18, 19 & 20.

2.4 Trackbed Sample Locations

The following table shows the actual locations of the samples completed on site:

TRACKBED SAMPLE LOCATION TABLE							
Type	**No.**	**ELR**	**Position**	**Offset[1]**	**Mile**	**Yard**	**Comments**
ABS	1	POD	Cess	Down SE	126	1043	
ABS	2	POD	Cess	Down + 2m	126	1252	
ABS	3	POD	4ft	-	126	1430	Culvert soffit not encountered
ABS	4	POD	Cess	Down SE	126	1650	
ABS	5	POD	Cess	Down + 2m	127	61	
ABS	6	POD	Cess	Down + 1.5m	127	548	
ABS	7	POD	4ft	-	127	760	Culvert soffit not encountered
ABS	8	POD	Cess	Down + 2m	127	827	
ABS	9	POD	4ft	-	127	915	Sample replaced by DP 9 due to ABS refusal
DP	ABS 9	POD	4ft	-	127	915	Culvert soffit encountered
ABS	10	POD	Cess	Down + 1m	127	1206	
ABS	11	POD	4ft	-	127	1320	Culvert soffit encountered
ABS	12	POD	Cess	Down SE	127	1350	Relocated due to possible buried services
ABS	13	POD	Cess	Up + 2m	128	45	
ABS	14	POD	4ft	-	128	310	Culvert soffit not encountered
ABS	15	POD	4ft	-	128	370	
ABS	16	POD	4ft	-	128	722	
DP	ABS 17	POD	4ft	-	128	913	Culvert soffit encountered
DP	ABS 18	POD	Cess	Down + 1.5m	128	923	ABS converted to trial pit due to difficulty with site access, culvert soffit encountered
DP	ABS 19	POD	Cess	Down + 2m	128	1385	ABS converted to trial pit due to difficulty with site access
DP	ABS 20	POD	4ft	-	128	1463	Culvert soffit encountered
ABS	21	POD	Cess	Down + 1.5m	129	158	
ABS	22	POD	Cess	Down + 1.5m	129	364	
ABS	23	POD	Cess	Down + 1.5m	129	563	
ABS	24	POD	6ft	-	129	616	Located in 6ft between POD Up and Down tracks

Notes:

1. Offset values are given relative to the nearest running rail on the downside or upside. SE indicates sample taken at sleeper end.

3 INTERPRETATION AND RECOMMENDATIONS

3.1 Site Description

The site relates to approximately 3 miles of redundant track situated between Portbury Dock Junction and Portishead, predominantly single track with a short section of dual track at the Portishead (high mileage) end. The track has been disused for a number of decades and is currently overgrown with heavy vegetation. There are no notable topographical features, the track is situated at grade throughout the site.

3.2 Trackbed

A total of 24 trial pit and ABS samples have been taken to a depth of 1.2m below top of existing rail level through the site. Samples have been spaced regularly through the site, although due to heavy vegetation restricting the access, there are gaps of up to 450 yards between samples in places. Some of the samples have also been positioned to target locations of culverts. All of the samples were planned as ABS (a shallow windowless core sampling technique) although due to access restrictions, hand excavated trial pits have replaced ABS in several locations.

Samples show the upper trackbed has been predominantly covered by 50-100mm of organic soil which has intermixed with the underlying materials which make up the trackbed – mainly degraded ballast, coarse ash and other coarse granular materials. Trackbed materials are contaminated to varying extents by clay.

Below the soil, upper trackbed materials are mainly the aged and degraded original ballast (of igneous and calcareous rock) the thickness of which is variable, but often extending to a depth of 200mm below the existing sleeper base. Coarse ash material is typically underlying the former ballast layer.

At the base of the trackbed, a coarse granular material has often been encountered, which in many cases is described as clayey. This material was also observed to contain possible pitching stone, particularly in the trial pits where larger stones were recovered. This material was historically used to cap clay subgrades to prevent upward migration of the clay into the ballast material above.

3.3 Subgrade

Eight of the 24 samples undertaken encountered a clay subgrade, likely to be the natural geology in this area (which consists of a bedrock geology of Mercia Mudstone Group and a superficial geology of tidal flat deposits, both of which comprise clay and silt materials). Samples show this subgrade to consist of a firm to stiff clay, with the surface of the clay at a depth of 0.9m-1.0m below existing rail level.

3.4 Drainage

There was no lineside drainage visible during the walkover survey. There are thought to be drainage ditches in either Cess through some of the site (particularly towards Portishead) although heavy vegetation prevented identifying their extents.

The drainage characteristics of the current trackbed are not relevant since the track is redundant and will be renewed prior to traffic running.

3.5 Structures

Details of the structures encountered on site are summarised in the table below. Please refer to supporting Figures and Appendices for details of samples taken at structures. Also note that clearances to structures have been measured relative to the position of the existing redundant track, rather than the proposed track position.

STRUCTURES						
Structure Type	**Structure Name / Reference**	**From (m,y)**	**To (m,y)**	**Sample Ref.[1]**	**Minimum Vertical Depth[2] (mm)**	**Minimum Lateral Clearance[3] (mm)**
Concrete Deck Overbridge	M5	126m 1290y	126m 1350y	None	N/A	N/A
Underbridge	Agricultural underpass	126m 1430y		3	1200[4]	N/A
Brick Arch Overbridge	Marsh Lane	127m 60y		None	N/A	N/A
Concrete Deck Overbridge	Royal Portbury Dock Road	127m 513y	127m 540y	None	N/A	N/A
Culvert	N/A	127m 760y		7	1200[4]	N/A
Culvert	N/A	127m 915y		9	530	3370
Culvert	N/A	127m 1320y		11	760	N/A
Brick Arch Overbridge	Station Road	127m 1749y		None	N/A	N/A
Culvert	N/A	128m 310y		14	1200[4]	N/A
Culvert	N/A	128m 923y		17	1040	2300
Brick Arch Overbridge	Sheepway Bridge	128m 1222y		None	N/A	N/A
Culvert	N/A	128m 1463y		20	1010	>3000

Notes:

1. Refer to Figure 1A and Appendix A & B for details of samples.
2. All depths referenced from top of existing rail unless otherwise stated.
3. All lateral clearances referenced from running edge of the associated Cess rail of existing track unless otherwise stated.
4. Samples targeted in 4ft of existing track on structures, however culvert decks not encountered.

3.6 Ballast Contamination Testing

Chemical Testing results are shown in Appendix D. Results should be sent to NDS and Route Delivery Project Manager who will determine the extents of potential site contamination through HazWasteOnline system. The results of this assessment will be communicated by NDS directly to the Route Delivery Project Manager, outside the TBI process.

3.7 Condition Summary and Discussion

The current condition of the railway trackbed through this site is not suitable for the passage of traffic without complete renewal of the trackbed. The former ballast material is degraded, undersized and has been contaminated with fines. Soils and heavy vegetation cover the surface of the trackbed, with frequent shrubs, small and mature trees growing in the 4ft and Cess of the track.

Along with former ballast, ash and other coarse granular materials constitutes the trackbed, which in many places is contaminated by cohesive fines. This clayey material, if not removed, could pose a risk to the stability of the trackbed, as the dynamic loading of train axles combined with high moisture content can cause upward migration of fines. This will potentially lead to wet beds, poor geometry, maintenance issues, requiring a full renewal of the trackbed.

Sampling of the subgrade material has not identified any obvious issues with poor support conditions or variable stiffness, with all of the underlying clay subgrade being identified as stiff or firm. However, this information is typically supplemented with GPR data and/or track geometry data (only available for trafficked sites) which assist with identifying these types of problems. It is feasible that problems of this nature may evolve as the track is opened and trafficked, although there are no current signs from the limited trackbed investigation which has so far taken place.

Of the structures identified on site, two culverts where shown to have soffits at shallow depths below the track. The deck of one of the culverts (127m 915y) was encountered at a depth of 530mm below rail level (230mm below the existing sleeper base). The deck of the second culvert (127m 1320y) was encountered at a depth of 760mm below rail level (460mm below the sleeper base). There were no other shallow decks or narrow lateral clearances at structures to note.

3.8 Design Recommendations

The following table details the recommended trackbed design:

TRACKBED DESIGN – PLAIN LINE

From (m,y)	To (m,y)	Minimum Excavation Width (mm)	Continuous Crossfall Direction / Gradient	Ballast Depth bsb (mm)	Blanket Treatment	Geosynthetic
126m 728y	126m 1760y	3900	Down Cess / 1:30	200	N/A	Robust Separator
126m 1760y	127m 170y	3900	Down Cess / 1:30	250	50mm Sand Blanket	Separator (NP)
127m 170y	127m 1639y	3900	Down Cess / 1:30	200	N/A	Robust Separator
127m 1639y	128m 99y	3900	Down Cess / 1:30	250	50mm Sand Blanket	Separator (NP)
128m 99y	128m 1112y	3900	Down Cess / 1:30	200	N/A	Robust Separator
128m 1112y	128m 1332y	3900	Down Cess / 1:30	250	50mm Sand Blanket	Separator (NP)
128m 1332y	129m 880y	3900	Down Cess / 1:30	200	N/A	Robust Separator

Design Justification:

1. For a track of Category 4 or 5 the minimum ballast thickness below sleeper base is 200mm.
2. A robust separator geotextile is required to underlay the ballast and prevent the possibility of cohesive fines migrating upwards into the new ballast layer.
3. A separator overlying the sand blanket is required to prevent migration of sand particles into the overlying new ballast layer.
4. A sand blanket has been specified in the vicinity of the bridge arch overbridges (where track lowering is likely) to prevent future subgrade erosion through this section.

3.9 Design Commentary

The proposed track category for the site stipulates a minimum ballast thickness of 200mm below the sleeper base. With a typical CWR and concrete sleepered track with standard trackbed crossfall, this would result in ballast extending to a depth of 660mm below the rail level. Since the track levels are not proposed to change (with the exception of close to the brick arch overbridges) it can be assumed that material will be excavated to this depth.

As discussed, much of the lower trackbed materials are contaminated with clay, therefore to mitigate against potential migration of cohesive fines, a robust separator has been specified. This will additionally prevent intermixing of lower trackbed materials with the clean ballast.

The material at the base of dig should have a crossfall to the downside (south side) Cess, which is away from the currently proposed platform and the existing cycle path which are both on the upside (north side) of the track. The crossfall should tie into any drainage provided on this side of the track.

Track lowering will be required in the vicinity of the three brick arch overbridges to allow for the installation of electrification infrastructure, due to the low vertical clearances. At this stage a maximum nominal lowering value of 300mm has been assumed at the bridge centres, with nominal ramp lengths of 200m to either side of the bridge.

Samples which have been taken in the vicinity of bridges are shown in the table below, with an estimation of the maximum dig depth at the sample locations. The max dig depth takes into account a depth of 250mm ballast and 50mm sand blanket.

TRACK LOWERING AT BRICK ARCH OVERBRIDGES				
Sample Ref.	**Structure Ref.**	**Distance from Overbridge (y)**	**Estimate value of track lowering at location (mm)**	**Estimated maximum dig depth at location (mm)**
ABS 4	Marsh Lane	171	44	814
ABS 5	Marsh Lane	0	300	1070
ABS 13	Station Road	56	216	986
ABS 19	Sheepway	163	56	826

The only sample which was taken at an overbridge location was ABS 5, where the material log shows the top of the (firm, very sandy clay) subgrade at 900mm below rail level. The maximum dig at this location (Marsh Lane Overbridge) will extend to a depth of 1070mm, which will disturb the subgrade material. Additionally, the max dig depth at ABS 13 is likely to disturb the subgrade (stiff clay) at this location and likely to be further disturbed closer to Station Road Overbridge where the track lowering will be greater.

It should be noted that although the other samples taken in the vicinity of the brick arch overbridges do not show subgrade material shallower than the max dig depths, a limited number of samples have been taken around the overbridges. It is recommended that further samples are taken to fully understand the subgrade depth local to the bridges, and whether the material will be disturbed. This will allow the limits of blanketing sand to be accurately defined and reduce construction costs and time related to the renewal.

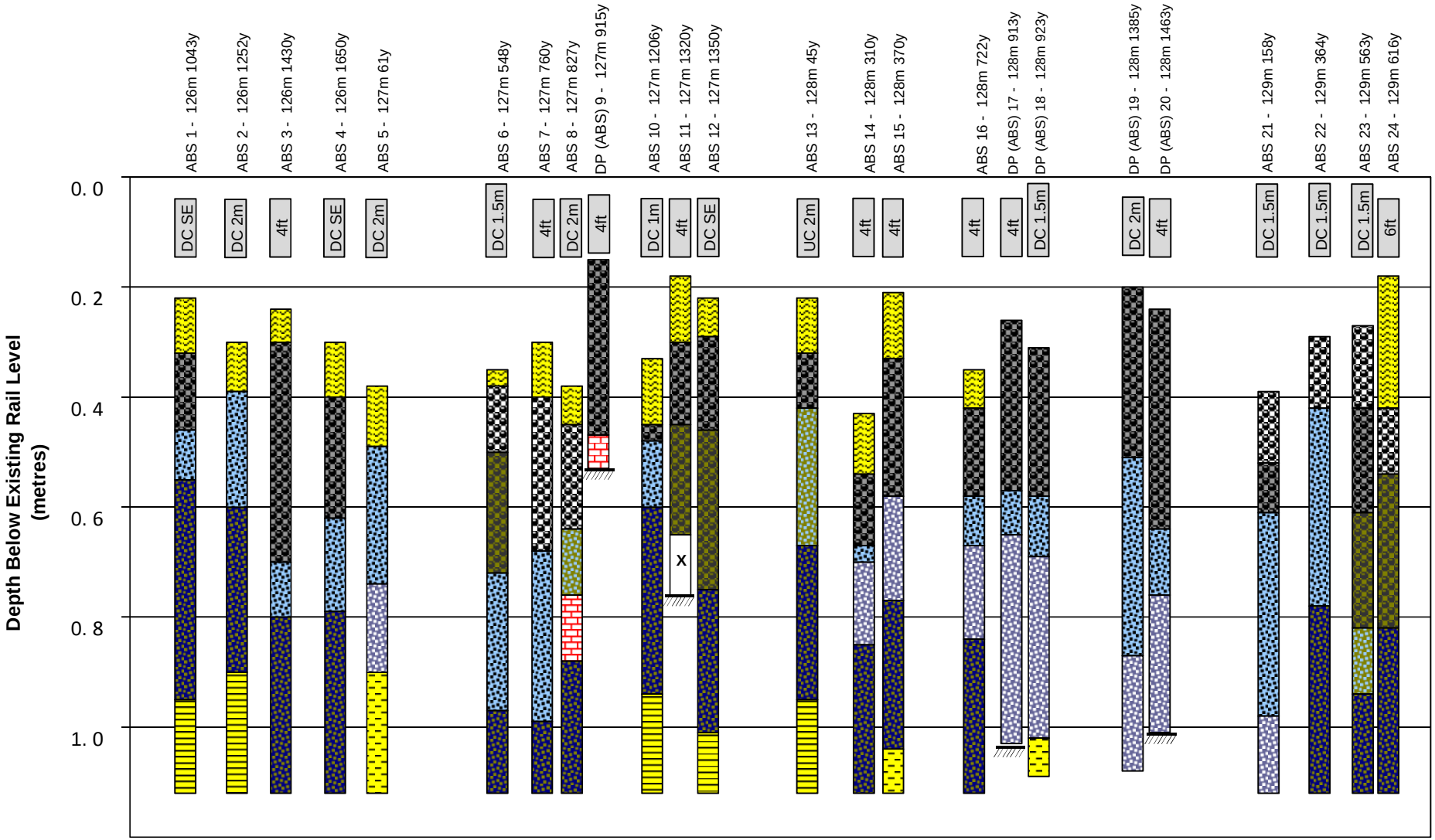
Presently, a precautionary 50mm sand blanket has been recommended 110y either side of each of the brick arch overbridges to prevent upward migration of the clay subgrade and improve drainage characteristics of the trackbed.

3.10 Drainage Recommendations

It is recommended that consideration be given to provision of at least Cess drainage channels to provide a path for effective drainage of water from the trackbed. The drainage characteristics of the site are not fully understood at this stage, although given that this area is historically reclaimed land, effective drainage is likely to be poor to satisfactory, with surcharging of the trackbed likely to be occurring during prolonged wet weather or extreme wet weather events.

FIGURE 1A:

LONGITUDINAL SECTION



Grey boxes show the lateral position of the samples relative to the existing redundant track

Abbreviations: DC = Down Cess UC = Up Cess SE = Sleeper End Xm = lateral offset distance of the sample measured from closest running rail in meters

Prepared	AG
Checked	DGK
Job No	47070043
Date	Apr '14

FIGURE 1A

Metrowest Phase 1 - Trackbed Investigation

LONGITUDINAL SECTION

POD - REVERSIBLE - 126m 1043y to 129m 616y

URS

FIGURE 1B:

LONGITUDINAL SECTION LEGEND KEY

1 BALLAST

a) With no subgrade erosion

1		Clean Ballast
2		Slightly Dirty Ballast
3		Dirty Ballast
4		Very Dirty Ballast (non-cohesive)
5		Very Dirty Ballast (cohesive)
6		Very Dirty Ballast (slurried)

b) With subgrade erosion

7		Slurried Ballast <10% fines
8		Slurried Ballast >10% fines
9		Ballast - Voids filled with silt/fine sand
10		Ballast - Voids filled with soft/firm clay

2 TRACKBED LAYERS / FILL

a) Derived from naturally occurring Sands and Gravels.

11		Fine / Medium Sand (<5%)	D = 0.06 to 0.60mm
12		Coarse Sand (<5%)	D = 0.60 to 2.00mm
13		Sand and Gravel (<5%)	
14		Clayey Sand and/or Gravel (5 to 20%)	
15		Slurried Sand and/or Gravel (5 to 20%)	

b) Quarry Products

16		Stone Dust (<5%)
17		Coarse Crushed Stone Aggregate (<5%)
18		Clayey / Silty Crushed Stone Aggregate (5 to 20%)
19		Slurried Crushed Stone Aggregate

(% refers to clay / silt content)

c) Ash

20		Fine ash (sand sized) (<5%)
21		Coarse ash (gravel sized) (<5%)
22		Clayey / silty Ash (5 to 20%)
23		Slurried Ash

d) Other granular trackbed materials

24		Fine grained, susceptible to erosion (<5%)
25		Coarse Granular Layer (<5%)
26		Clayey / silty Granular Layer (5 to 20%)
27		Slurried Granular Layer
28		Any of 2 a-d in a clay matrix (20 to 50%)

3 SUBGRADE

Use legends from section 2 where appropriate, legend with bold outline indicates natural ground

a) Organic soils, clays and silts

31		Organic Soil	
32		Soft Clay/Silt	Cu < 40kN/m^2
33		Firm Clay/Silt	Cu = 40 to 75kN/m^2
34		Stiff Clay/Silt	Cu = 75 to 150kN/m^2
35		Very Stiff / Hard / Very weak Mudstone Cu > 150kN/m2	

b) Mixed (Fine and Coarse) Soils

36		Unstratified (clayey/silty Coarse Soil OR sandy or gravelly Fine Soil)
37		Interbedded or weathered/weakly cemented fine grained rocks

c) Rock or Rockfill

38		Weak fine grained (mudstone, limestone, chalk, fine sandstone)
39		Moderately strong to hard rock

4 PITCHING LAYERS

29		Clean pitching
30		Slurried Pitching

5 SAMPLE LOSS IN ABS

0x	X	Soil penetrated by ABS, but not recovered
0d	D	Soil displaced by ABS - indicative of very soft soil

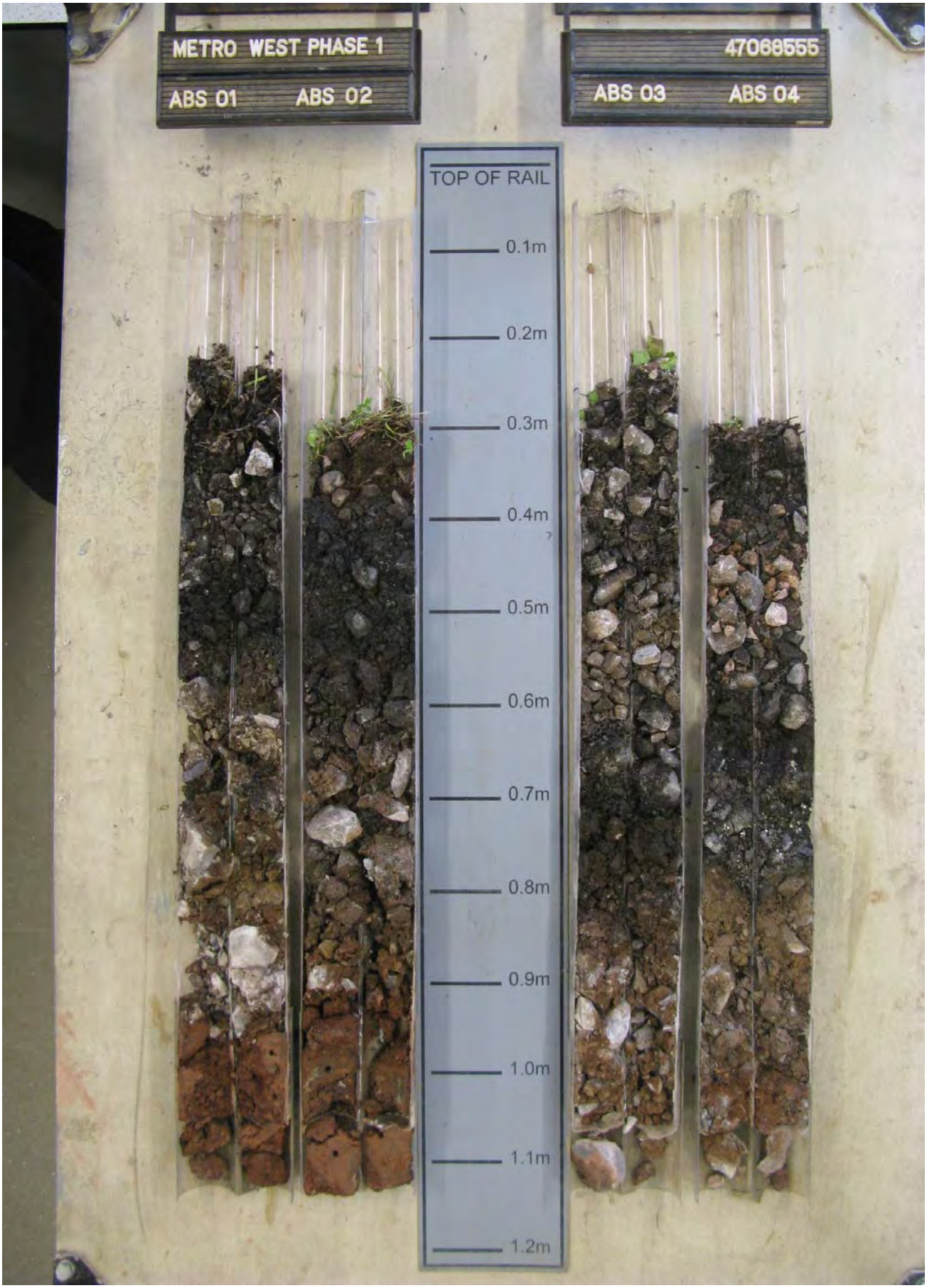
6 ADDITIONAL INFORMATION

g	permeable geotextile separator	**w**	water strike
c	permeable geocomposite	**ws**	water standing
m	reinforcing mesh (geogrid)	**34**	shear strength kN/m^2
p	impermeable membrane (polythene)		
h	impermeable geocomposite		
c-gs	Geosand		
c-tt	Tracktex		
g+m	PW4.0LA / TED4		
hs	evidence of historical slurrying		
e	likely chemical contamination		
L	>10% limestone ballast		

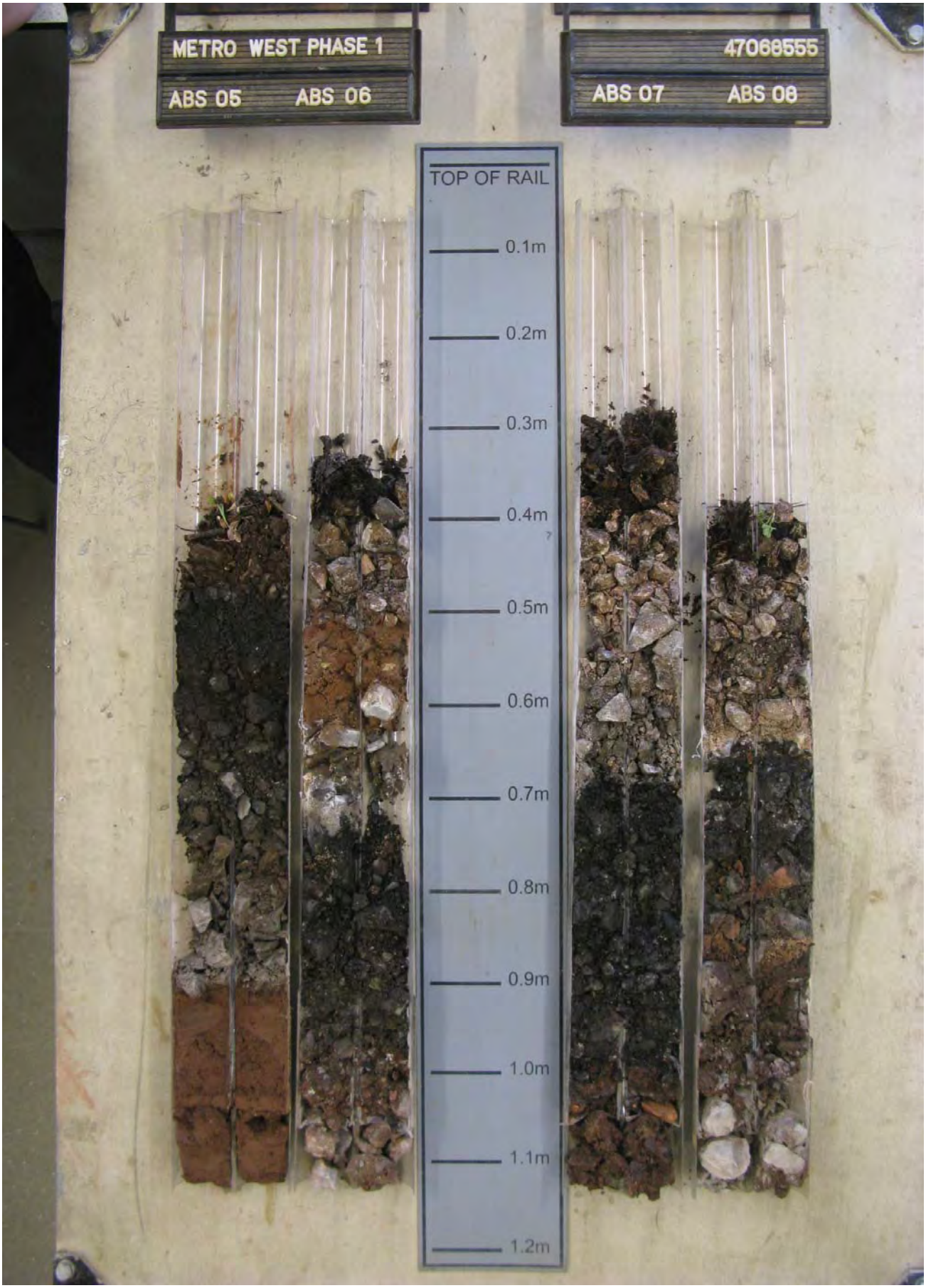
Prepared	AG	FIGURE 1B	URS
Checked	DK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	LONGITUDINAL SECTION LEGEND KEY	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	

APPENDIX A:

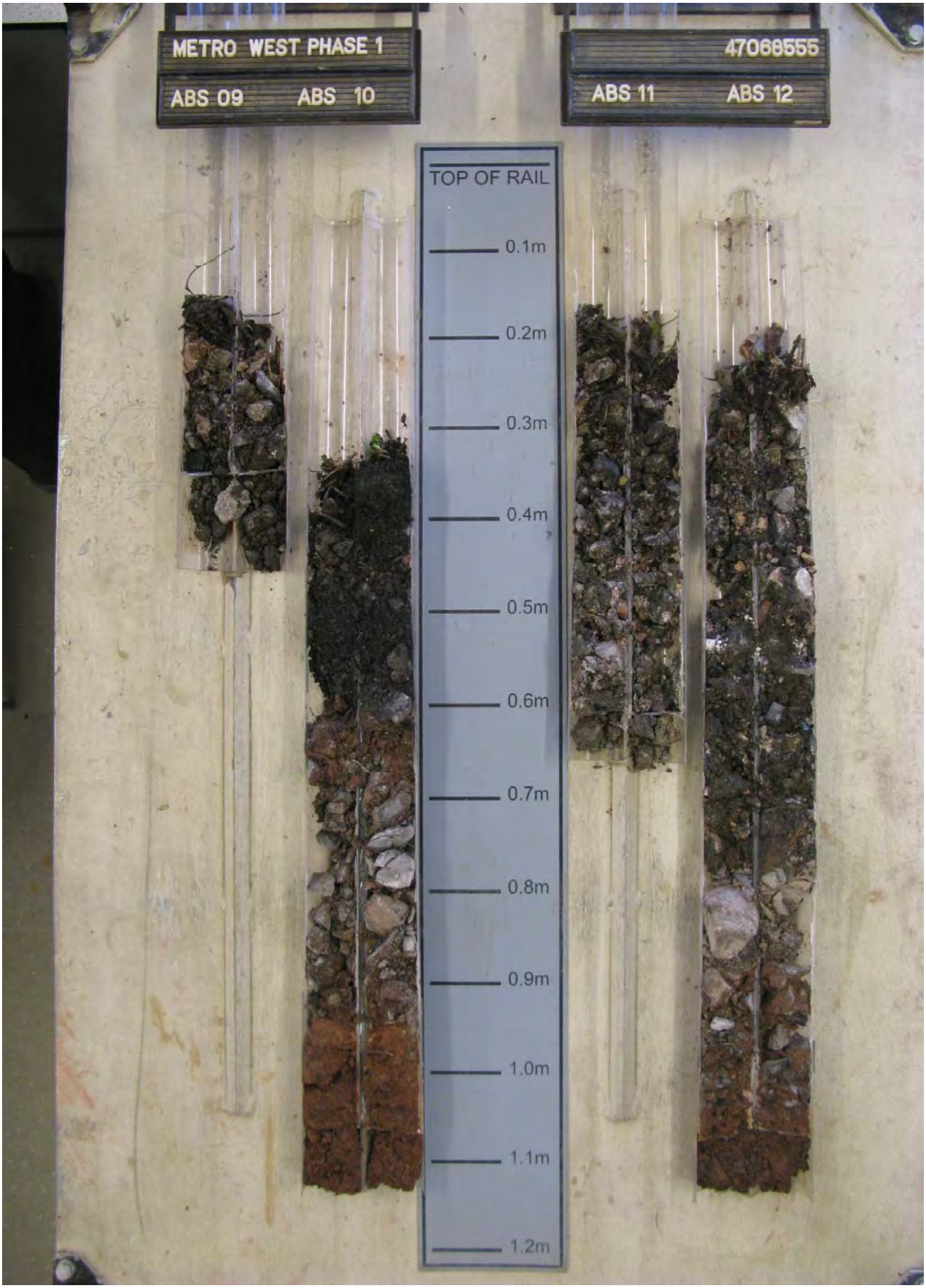
ABS PHOTOGRAPHIC LOGS



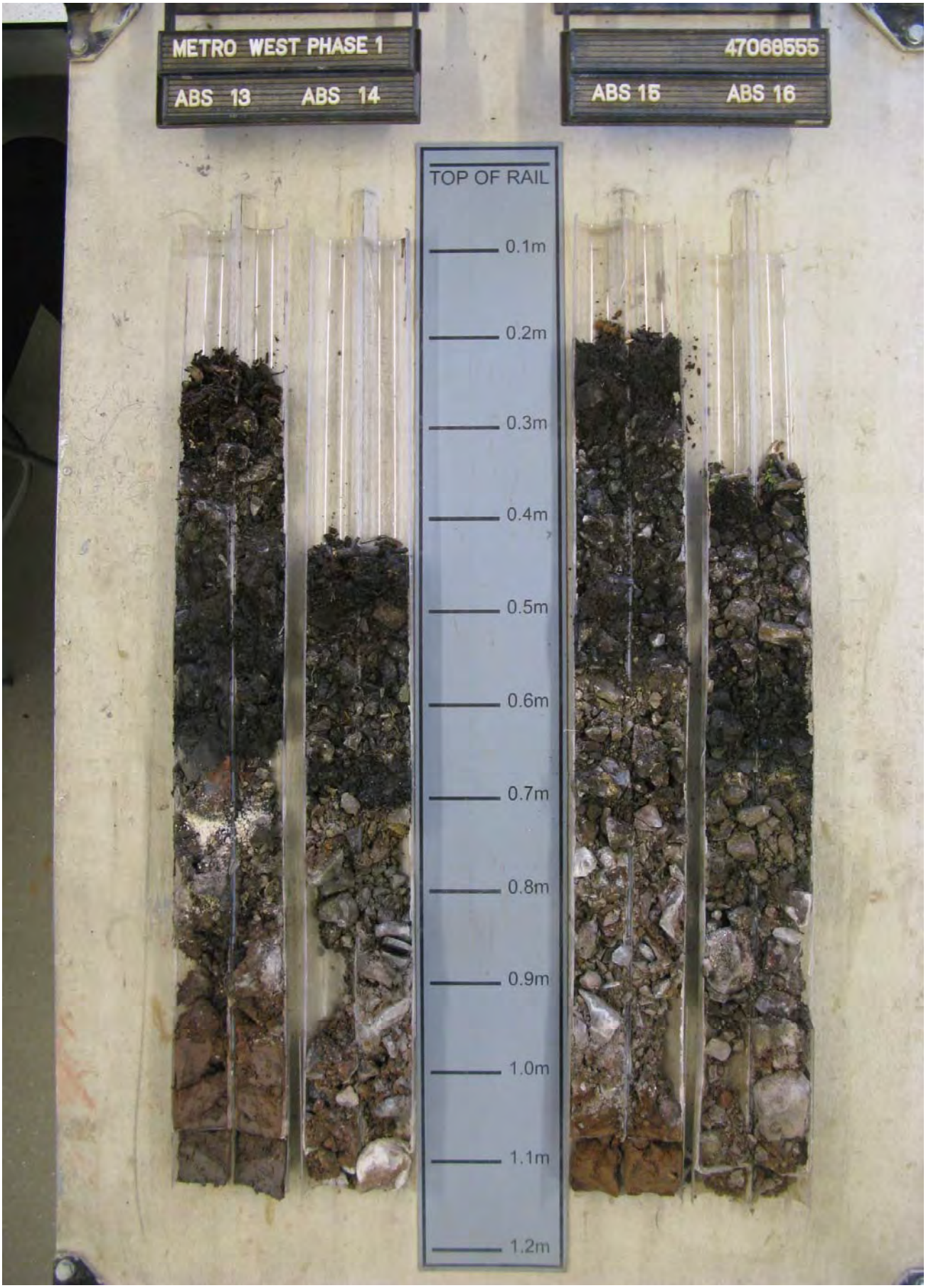
Prepared	AG	APPENDIX A - ABS 1 to ABS 4	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



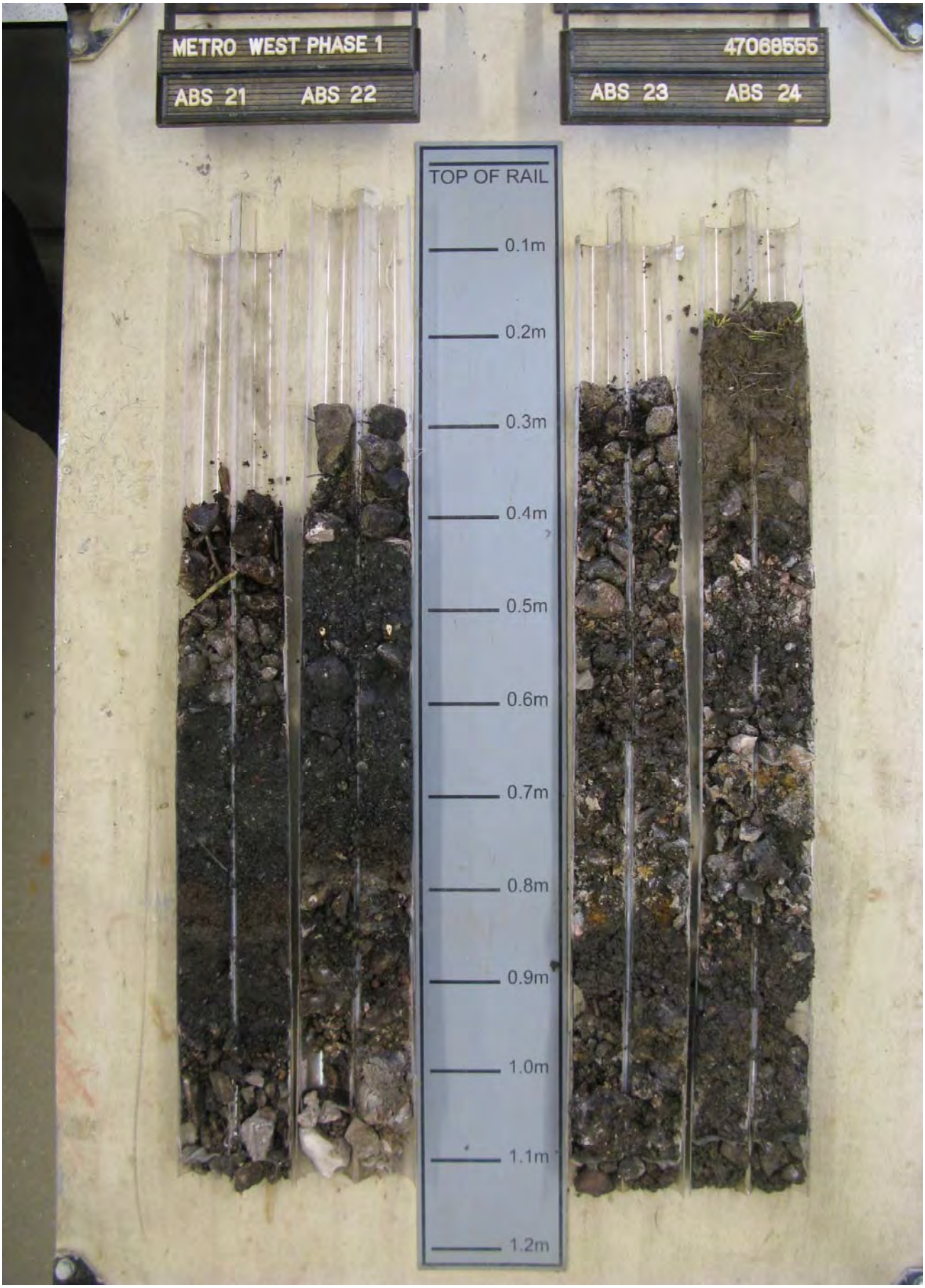
Prepared	AG	APPENDIX A - ABS 5 to ABS 8	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



Prepared	AG	APPENDIX A - ABS 9 to ABS 12	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



Prepared	AG	APPENDIX A - ABS 13 to ABS 16	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	



Prepared	AG	APPENDIX A - ABS 21 to ABS 24	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	ABS PHOTOGRAPHIC LOG	
Date	Apr '14	POD - REVERSIBLE - 126m 1043y to 129m 616y	

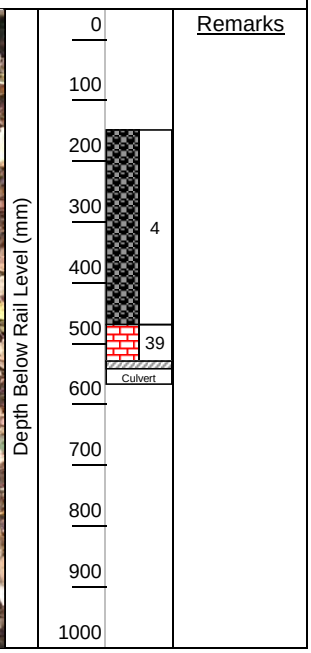
APPENDIX B:

TRIAL PIT LOGS

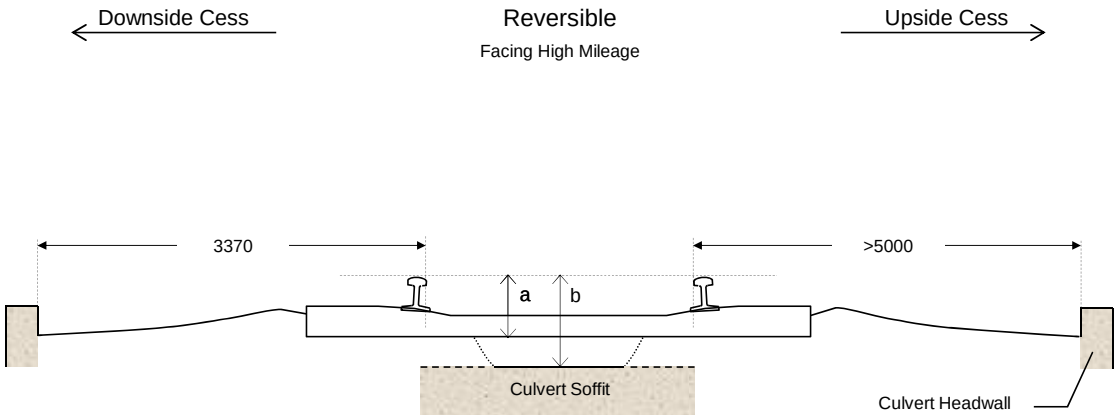
Trial Pit Details

Pit Type / Number	DP ABS 9	Trial Pit Purpose	Assess clearances to Culvert
Mileage	127m 915y	Reason for termination	Structure encountered
Line	Reversible		
Position	4ft	Structure Reference	Unknown
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Dry	Standing Water	None
Weather During SI	Dry	Slurry Material	None
Date of Inspection	03/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)



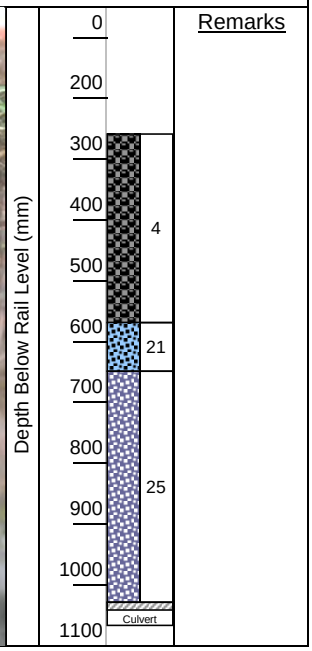
Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values as no mileposts were present on site. ABS converted to DP during the site investigation to confirm cause of shallow refusal. DP refused at a depth of 530mm brl on culvert structure.	a= 300 mm b= 530 mm

Prepared	JWM	APPENDIX B - DP ABS 9 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
Checked	DGK		
Job No	47070043		
Date	Apr '14		

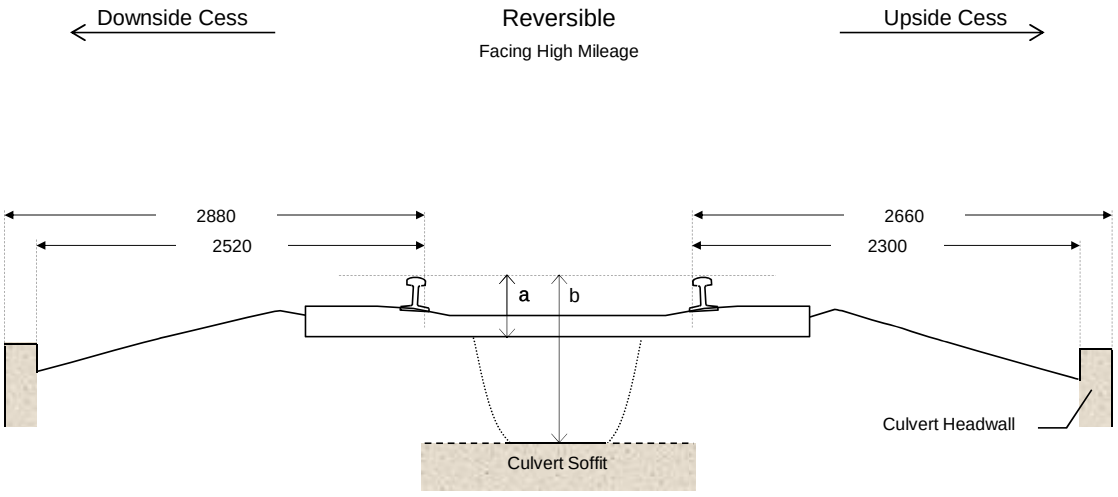
Trial Pit Details

Pit Type / Number	DP ABS 17	Trial Pit Purpose	Assess clearances to Culvert
Mileage	128m 913y	Reason for termination	Structure encountered
Line	Reversible		
Position	4ft	Structure Reference	Unknown
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Wet	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)

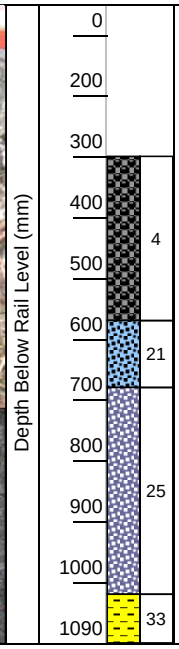


Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 17 converted to DP during site investigation due to track access. DP completed at a depth of 1040mm brl, culvert soffit encountered at base of DP.	a= 330 mm b= 1040 mm

Prepared	JWM	APPENDIX B - DP ABS 17 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
Checked	DGK		
Job No	47070043		
Date	Apr '14		

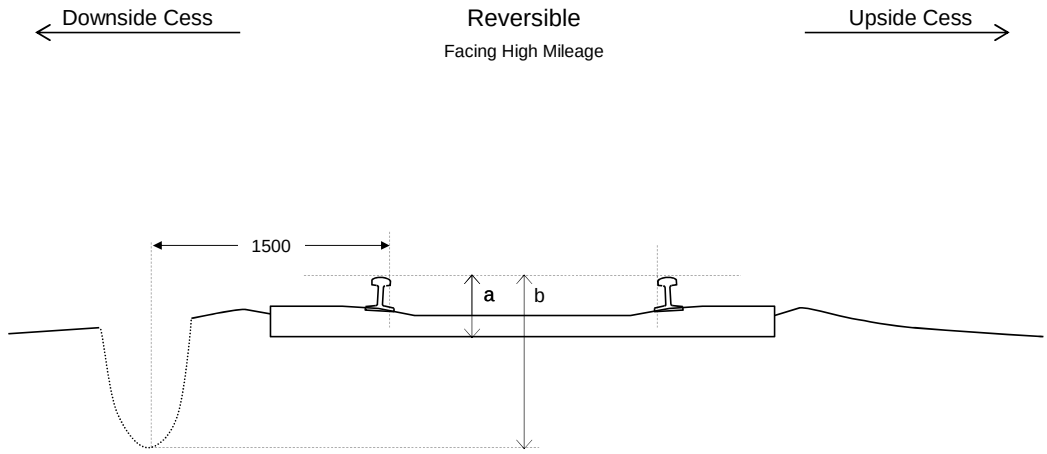
Trial Pit Details			
Pit Type / Number	DP ABS 18	Trial Pit Purpose	ABS Replacement
Mileage	128m 923y	Reason for termination	Design depth achieved
Line	Reversible		
Position	Cess	Structure Reference	N/A
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Wet	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Remarks

Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)

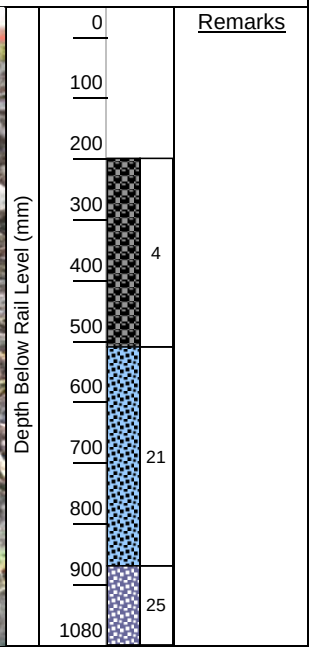


Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 18 converted to DP during site investigation due to track access. DP advanced at a lateral offset of 1500mm from the downside rail and completed at a depth	a= 330 mm b= 1090 mm

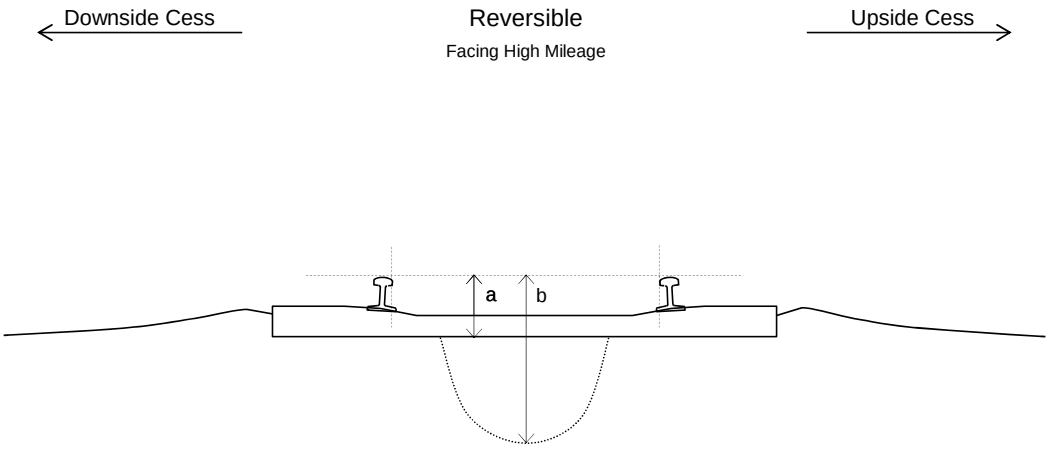
Prepared	JWM	APPENDIX B - DP ABS 18	URS
Checked	DGK	**Metrowest Phase 1 - Trackbed Investigation**	
Job No	47070043	TRIAL PIT LOG	
Date	Apr '14	POD - REVERSIBLE	

Trial Pit Details			
Pit Type / Number	DP ABS 19	Trial Pit Purpose	ABS Replacement
Mileage	128m 1385y	Reason for termination	Design depth achieved
Line	Reversible		
Position	4ft	Structure Reference	N/A
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Dry	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)

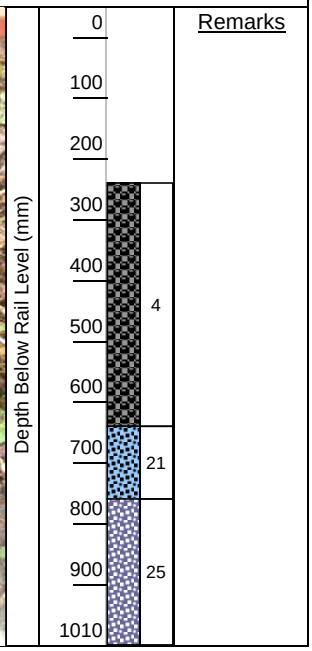


Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 19 converted to DP during site investigation due to track access. DP completed at a depth of 1080mm brl.	a= 300 mm b= 1080 mm

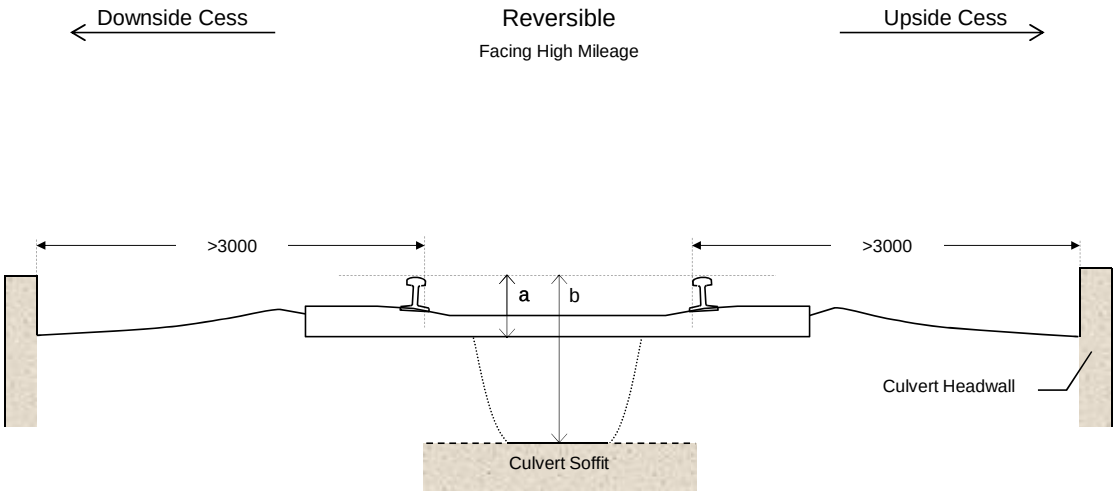
Prepared	JWM	APPENDIX B - DP ABS 19 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
Checked	DGK		
Job No	47070043		
Date	Apr '14		

Trial Pit Details			
Pit Type / Number	DP ABS 20	Trial Pit Purpose	Assess clearances to Culvert
Mileage	128m 1463y	Reason for termination	Design depth achieved
Line	Reversible		
Position	4ft	Structure Reference	Unknown
Rail Type	Flat Bottom JR	**Trackbed conditions encountered (mm below rail level)**	
Sleeper Type	Timber	Wet Material	None
Weather Prior SI	Wet	Standing Water	None
Weather During SI	Dry	Slurry Material	None
Date of Inspection	02/04/2014	Geosynthetics Depth	None
Inspected by	JWM	Geosynthetics Type	N/A

Trial Pit Photo(s) and Material Log



Trial Pit Sketch (with approximate dimensions of excavation and structures in mm)



Notes / Comments	Sketch Dimensions
Sketch not to scale. Mileage and Yardage are approximate values. ABS 9 converted to DP during site investigation due to track access. DP completed at a depth of 1010mm brl, culvert soffit encountered at base of DP.	a= 300 mm b= 1010 mm

Prepared	JWM	APPENDIX B - DP ABS 20 **Metrowest Phase 1 - Trackbed Investigation** TRIAL PIT LOG POD - REVERSIBLE	URS
Checked	DGK		
Job No	47070043		
Date	Apr '14		