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ICP Transport Projects Cost Estimate Review
Expert Witness Report

Sunbury South and Lancefield Road ICP

Reference No. 1700E
Prepared for Best Hooper Lawyers
14 October 2020

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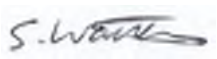
SMEC Company Details

Prepared by:	Stephen Watters		
Address:	Level 20, Tower 4, 727 Collins Street, Melbourne, 3008		
Signature:			
Tel:	03 9869 0896	Mobile:	0427 948 186
Email:	Stephen.watters@smec.com	Website:	www.smec.com

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Appendices

1 Introduction

I have been instructed by Best Hooper Lawyers who act for Moremac in relation to properties at 170 Lancefield Road and 45 Gellies Road, Sunbury. These properties include the land parcels LR-19, LR-23 and LR-24 which are located within the Lancefield Road PSP and are known as the Kingsfield Estate.

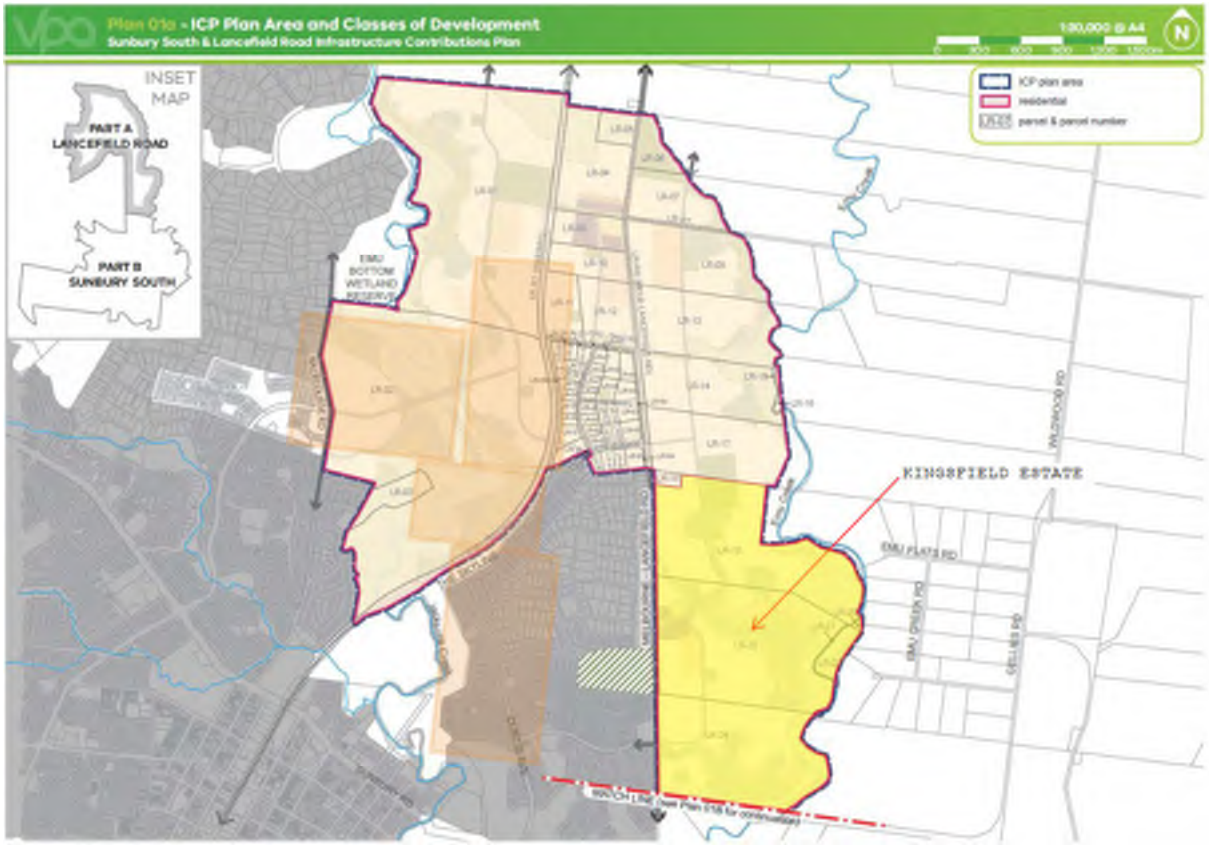


Figure 1: Extract Sunbury South & Lancefield Road ICP, November, 2019 – Plan 01a

This report reviews the Transport Infrastructure costs associated with the ICP projects which Moremac anticipates will be constructed as "works in kind" as part of Kingsfield Estate, as well as bridge costs associated with the northern crossing of Jacksons Creek.

In undertaking my assessment of the costs of delivering ICP Transport Infrastructure associated with Kingsfield Estate, I have:

- Prepared estimates of costs for projects based on construction rates which are being obtained at Kingsfield Estate
- Prepared a comparison of these costs against the cost estimates provided within the November 2019 ICP costs
- Reviewed the bridge design for the northern bridge crossing of Jacksons Creek.

This report outlines the key differences between my estimates and VPA's estimates and recommends changes to the November 2019 ICP costings as appropriate.

2 Expert Witness Statement

2.1 Name and Address

Stephen Watters, Civil Engineer

SMEC Australia, Tower 4, 727 Collins Street, Melbourne, 3008

2.2 Qualifications and Experience

I hold a Bachelor of Engineering (Civil), 1990, University of Melbourne and have 29 years experience as a civil engineer.

My curriculum Vitae is included in Appendix H.

2.3 Area of Expertise to Make the Report

The majority of my civil engineering career has been associated with the delivery of land development projects including associated infrastructure works throughout metropolitan Melbourne.

2.4 Instructions

I have been instructed by Best Hooper Lawyers who act for Moremac in relation to properties at at 170 Lancefield Road and 45 Gellies Road, Sunbury.

I was instructed to review infrastructure costings included in the Sunbury South & Lancefield Road ICP and provide an assessment of these against expected delivery costs. This review is limited to ICP infrastructure projects which Moremac expects to deliver as works in kind as part of development of the above properties, as well as costings associated with the northern bridge crossing of Jacksons Creek.

2.5 Report Preparation

In the preparation of this report I have reviewed the documents identified in section 8 of this report.

2.6 Identity of Other Persons Relied upon in this Report

I was assisted in the preparation of this report by additional members of staff acting under my express instructions as follows:

- Quantity take off and extents plan preparation – Eric Wang and Ka Cong.
- Preliminary road design, drainage design and earthworks quantities – Eric Wang and Ka Cong.

The opinions in this report, however, remain my own.

2.7 Summary of Opinions

My opinions in relation to this matter are provided in section 3 and section 5 of this report.

2.8 Provisional Opinions Not Fully Researched

To the best of my knowledge all matters on which I have made comment in this statement have been appropriately researched or are based on my knowledge and experience. The statement does not contain any provisional opinions that have not been fully researched.

2.9 Matters Outside of My Expertise

To the best of my knowledge, none of the matters on which I have made comment in this statement are outside my area of expertise. To the best of my knowledge the report is complete and does not contain matters which are inaccurate.

2.10 Project History

I have been retained by Moremac on various elements of Kingsfield Estate since 2016. This has included due diligence works associated with the acquisition of the properties, including review of development costs estimates, as well as input into servicing strategies for the project.

2.11 Practice Note Declaration

I have made all the enquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Panel.

I have read the Guide to Expert Evidence and agree to be bound by it.

Stephen Watters

Date: 14th October, 2020

3 Summary of Evidence

3.1 General

The Sunbury South & Lancefield Road ICP includes construction of infrastructure to service the Sunbury South & Lancefield Road PSP area. Kingsfield Estate is located within the Lancefield Road PSP and is being developed by Moremac.

Moremac anticipates that the following transport infrastructure identified in the ICP will be delivered as works in kind by Kingsfield Estate.

- LR-IN-01 – Lancefield Road signalised intersection at Sunningdale Drive
- LR-IN-02 – Lancefield Road signalised intersection at Rolling Meadows Drive

In addition to the above two projects, two other Supplementary projects within the Sunbury South & Lancefield Road ICP that have been identified as being high cost items, and I have been asked to review the ICP cost estimate allowances for the following project:

- LR-BR-01 – Bridge crossing of Jacksons Creek (Northern bridge), and associated road approaches

3.2 Intersection cost comparison

I have prepared independent estimates of costs for the two intersection projects (LR-IN-01 AND LR-IN-02) and identified the key variances to the November 2019 ICP Cost Estimates.

A summary of the SMEC cost estimates compared to the November 2019 ICP cost estimates are provided in the table 1 below:

	LR-IN-01	LR-IN-02
November 2019 ICP estimate	$6,784,805	$7,064,631
SMEC Estimate	$9,057,039	$9,232,078
Difference in cost ($)	$2,272,234	$2,167,447
Difference in cost (%)	33%	31%

Table 1 – Comparison between SMEC Estimate and November 2019 ICP Cost Estimates

The key variances identified are included in tables in Appendix Bces B & C, and include the following:

- Service relocations (both intersections)
- Culverts required under Lancefield Road and Montego Boulevard (LR-IN-01)
- Additional piped drainage required (both intersections)
- Additional pavement required to transition back to existing carriageway (LR-IN-01)
- Additional concrete paths (both intersections)
- Length of Kerb and channel (both intersections)
- Additional guard rail required (both intersections)
- Additional delivery costs required (both intersections)

3.3 Northern Bridge – LR-BD-01

I have reviewed the current estimated cost of the northern bridge in the GHD November 2019 ICP cost report, and also compared this to the previous costs that were available to the PSP panel in 2016/2017.

The scale and cost of the bridge is far greater than any other supplementary item in other PSP areas.

The 2016 estimate of the cost of the bridge was (based on a bridge length of 560m) was $36,051,770 ($24,051,770 construction cost). This compares with the current cost estimate in the ICP of $103,867,741, which is close to three times the cost which informed the PSP panel process.

4 Key Issues impacting Intersection costs

The key issues that have an impact on the cost of the intersections are detailed below.

4.1 Service relocations

The November 2019 ICP costings for IN-LR-01 and IN-LR-02 do not make any allowance for service relocations, however it has been identified that the following services will need to be relocated in order to construct the work:

- High voltage overhead powerline on the east side of Lancefield Road
- Relocation/Protection of Next Gen Fibre Optic cable on the east side of Lancefield Road

The image below shows the 22kV overhead electrical poles and cables which run along the existing fence line on the east side of Lancefield Road and will need to be relocated in order to construct the two intersections.

Fig 1 - 22kV Overhead electrical on east side of Lancefield Road

Based on quotations from Jemena and NextGen, the expected costs to relocate or protect the services at both intersections are:

- LR-IN-01 $740,000
- LR-IN-02 $445,000

4.2 Extent of Interim intersection works - LR-IN-01

4.2.1 Section of Road with no allowance in the ICP

There is currently a funding gap for the section of road works shown between the extents of the Gellies Road intersection (SS-IN-08) and the Sunningdale Avenue intersection (LR-IN-01), as demonstrated in the image below.

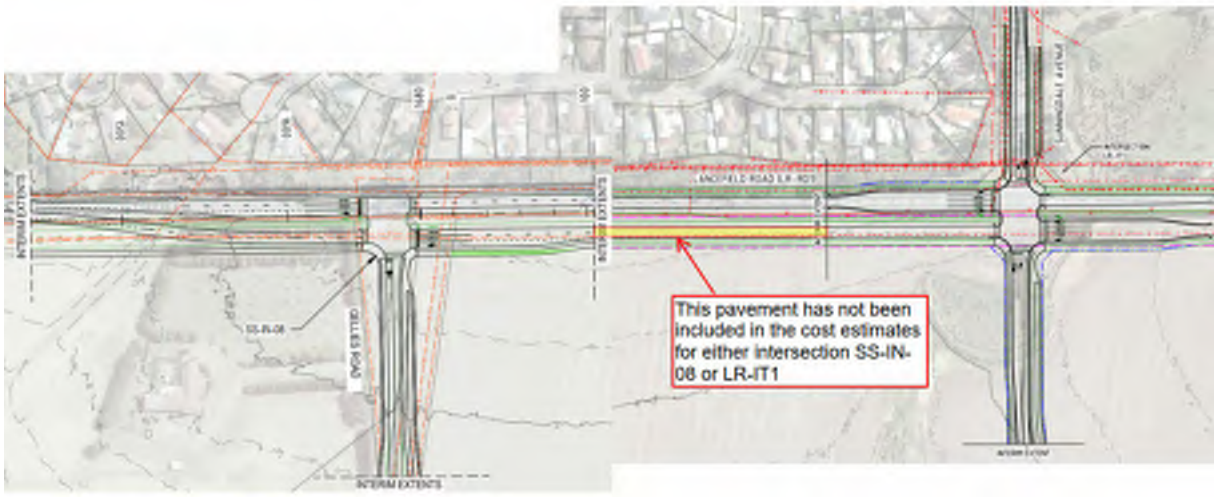


Fig 2 – Combined plan showing SS-IN-08 and LR-IN-01

4.2.2 Transition back to existing carriageway - LR-IN-01

All of the intersections along Lancefield Road have transitions back to the existing carriageway, with the exception of the southern leg of LR-IN-01. Given that the timing of the intersection will be such that LR-IN-01 will be constructed before the Gellies Road intersection will be constructed (as noted in the ICP where LR-IN-01 is indicated to be a short to medium term project, whereas SS-IN-08 is indicated to be a medium to long term project) a transition back to the existing carriageway on the eastern carriageway of Lancefield Road (southern leg) will be required. This will require the extent of the interim intersection for LR-IN-01 to be moved further south as shown in the concept plan below.

Figure 3 - Traffix Group concept plan of LR-IN-01 showing proposed transition on southern leg

4.3 Culverts required at LR-IN-01

The November 2019 ICP costings do not make any allowance for the stormwater drainage crossing of Lancefield Road. Melbourne Water has provided a RORB model that indicates that Q100 flows are in the order of 25.9m^3/s on the west side of Lancefield Road. Whilst the reserve on the west side of Lancefield Road will retard these flows, culverts will need to be provided under the new Lancefield Road carriageway as well as the new east-west connector road (Montego Boulevard).

Fig 4 – Map showing location of overland flow path

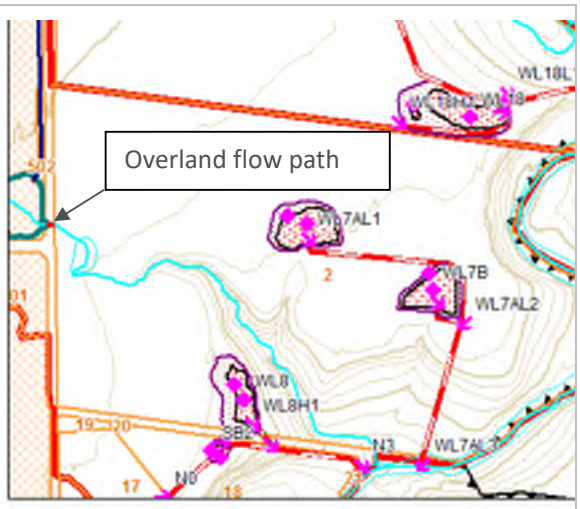


Fig 5 – extract from MW drainage scheme

The existing culverts under Lancefield Road at this location are 4 No. 900mm x 300mm box culverts, so at the very least these size culverts will need to be extended across the new carriageways.

The GHD cost estimate for the intersection makes allowance for minor drainage at the intersection (pipes varying from 300mm diameter up to 500mm diameter) which are not capable of containing these overland flows.

With the inclusion of these culverts, my estimate of drainage costs are $493,000 higher (112% higher) than the November 2019 ICP drainage costs for this intersection, based on extending the culverts with the same dimension culverts as existing.

I recommend that VPA seek confirmation from Melbourne Water in regards to the following:

1. Seek confirmation of the Q50 and Q100 overland flows at the intersection, and the extent that the existing retarding basin on the west side of Lancefield Road can retard the flows.
2. Provide advice in relation to the discharge flow that will need to be accommodated across Lancefield Road (noting that initial advice from the Department of Transport is that the culverts will need to accommodate Q100 flows).

The ICP costing for this intersection should not be finalised before receipt of this information, as if additional large culverts are required at the intersection this will add significant costs.

4.4 Pavement composition

It is not clear what pavement composition has been allowed in the ICP costings. This is an important consideration, as a significant proportion of the intersection costs are related to the pavement construction works.

The GHD costing report includes the following note included under the costing assumptions:

- Road pavement profile has been assumed to be 685mm deep to reflect Hume City Council Trunk Collector Street detail, refer Hume Standard Drawing SD06. Due to the limited geotechnical information, this pavement depth also reflects an insitu subgrade CBR value of 2%

When referencing the Hume City Council Standard Drawing SD06, it clearly states that the standard drawing is only appropriate for trunk collector streets up to an Equivalent Standard Axle (ESA) loading 10^6.

Furthermore, SD 06 states that:

> *Pavement with a Design Traffic Loading greater than 1 x 10^6 ESA's shall be modelled mechanistically to determine the overall thickness and composition of the pavement. A granular unbound pavement with a thin asphalt surfacing (<40mm thick), would not be acceptable in these situations.*

Lancefield Road is an arterial road, which Tonkin & Taylor (T&T) have determined the design traffic loading to be 1.45 x 10^7 ESA, which is clearly a much higher design traffic loading than is appropriate for adoption of SD 06.

Hence we are seeking clarification in relation to the pavement composition that has been adopted for Lancefield Road, and also for the connector roads at each intersection.

The Hume City Council SD 06 can be found as Appendix F, and the T&T pavement design report for Lancefield Road is included as Appendix G.

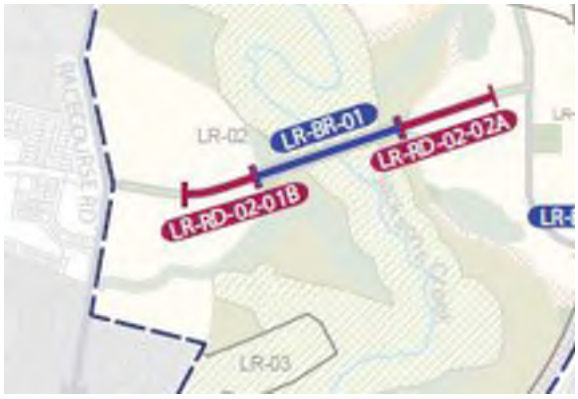
4.4.1 Assumed cut volumes

The ICP cost estimate has made an assumption in relation to the amount of cut at each intersection, which is based on the Council Standard drawing SD 06 indicating a pavement depth of 685mm, which as discussed above is not appropriate for arterial roads. The amount of cut allowed in the cost estimates should be based on an arterial road pavement composition, which T&T have calculated to be 770mm (12% increase in pavement depth will result in cut volumes 12% higher than currently allowed).

5 Northern Bridge – Jacksons Creek

5.1 Northern Bridge

In reviewing the ICP it is apparent that the supplementary levy is extraordinarily high when compared to other published ICPs, to the extent that the supplementary levy at $151,284/ha NDA is higher than the standard transport levy ($123,344/ha NDA). This quantum of supplementary levy is unprecedented in other PSP/ICPs in the outer growth areas of Melbourne. The high cost of the supplementary levy is in large part due to the cost of two bridges which are proposed to cross Jacksons Creek (SS-BR-01 and LR-BR-01), as well as the approach roads associated with the bridges, particularly the two approach road projects (LR-RD-02-01B and LR-RD-02-02A). These projects are shown in the extracts from the ICP below.



LR-BR-01 Bridge project and approach roads

SS-BR-01 Bridge Project

The ICP estimated costs associated with the above two bridge projects are summarised in the table below:

PROJECT	ICP COST
LR-BR-01	$103,867,741
SS-BR-01	$41,735,843
LR-RD-02-01B	$5,796,917
LR-RD-02-02A	$25,033,035

Table 2 – Estimated costs for the Jacksons Road bridges from the November 2019 ICP

The total ICP cost of LR-BR-01 inclusive of the two road approaches is $134,697,693.

5.1.1 Scale, height and bridge length – Bridge LR-BR-01

The scale and cost of the LR-BR-01 bridge appears to be excessive when considering the local connector road status of the road. As detailed in the GHD November 2019 Design and Costing report, the bridge length is 490m long, and the bridge height is 35.5m at the highest point.

It is apparent from the long section that the bridge and approach roads have been designed to span the steep terrain and potentially minimise impacts on the environmental values along the Jacksons Creek corridor.

When compared to other bridge projects in recently completed PSPs, there is no comparison in relation to bridges of similar scale. For example, the Kororoit and Plumpton ICP included three road bridges across Kororoit Creek, which is a substantial waterway not dissimilar to Jacksons Creek. The ICP included the

Hopkins Road bridge which will form one carriageway of the future 6 lane arterial road. The estimated costs for these three bridges varied between $6.3M to $8.6M. This means that the proposed cost of the LR-BR-01 including approach roads is 15.7 times more expensive than the most expensive bridge in the Kororoit and Plumpton ICP.

5.1.2 Northern Bridge – bridge type options

I note from the GHD November 2019 costing report that three alternative bridge designs options were considered – however these options were related to the form of the bridge rather than alternative alignments/ lengths. I further note that VPA has declined to share any alternative bridge alignment/ length options with the panel, so it is not possible for me to comment about the feasibility of other options that may have been considered.

In relation to the three bridge type options that GHD considered (Super-T, Steel Girder Bridge and Concrete Box Girder design), I note that after consultation with VPA, the second most expensive option (Steel Girder Bridge) was chosen, on the basis that this would provide a longer span and hence less impact on the cultural significance of the creek corridor.

Given the very high cost of the northern bridge, I believe that more consideration should be given to the cheaper solution (Super-T construction).

5.1.3 Northern Bridge – Previous cost estimates

The earlier technical reports that VPA commissioned related to the northern bridge and which informed the PSP were undertaken by PB and quantity surveyor Aquenta. The April 2017 Aquenta report indicated that the expected cost of the northern bridge based on a bridge length of 560m was $36,051,770 ($24,051,770 construction cost). This compares with the current cost estimate in the ICP of $103,867,741, which is close to three times the cost which informed the PSP panel process.

5.2 Opinions

It is my opinion that:

- The scale and cost of the northern bridge is not in proportion to the local connector road status of the road network, and is far more expensive than other ICP bridge projects.
- If the panel is satisfied that there remains a strong justification for the inclusion of the northern bridge, I believe that there would be options to design a bridge which is shorter in length and height, and hence would cost considerably less to build. Additionally Super-T construction would likely provide a cheaper alternative than the selected Steel Girder Bridge.

6 Intersection Cost estimates

I have prepared independent cost estimates for ICP intersection projects which are associated with Kingsfield Estate and likely to become Kingsfield works in kind projects. In preparing these estimates:

- I have assessed quantities of works based on intersections layouts and road cross sections as envisaged in the November 2019 ICP. Note that the interim extent of intersection LR-IN-01 has been extended as per the discussion in Section 3 above.
- For LR-IN-02 the quantities have been based on the detailed design plans prepared by SMEC
- For LR-IN-01, I have prepared notional drainage layouts and sizing based on preliminary design considering topography and natural low and high points along and within each project;
- For LR-IN-01, I have prepared preliminary level design to establish earthworks volumes;
- I have applied construction rates from Kingsfield Estate tenders obtained in mid 2020.
- Details of my cost estimates are included in Appendices to this report as follows:
    - Comparison of estimate totals for each project are included in Appendix A;
    - Key variances are summarised in tables included in Appendix B & C;
    - My estimate for LR-IN-01 is included in Appendix D;
    - My estimate for LR-IN-02 is included in Appendix E

Details of the key variances between the November 2019 ICP costings and my cost estimates are explained in the following sections.

7 Cost estimate variances

7.1 General

There are subtle variations in estimated costs of various components of projects as a result of differences in rates applied and in some cases methodology adopted.

In general:

- Siteworks and Earthworks amounts in my estimates are generally lower;
- Pavement amounts in my estimates are higher;
- Concrete areas in my estimates are generally higher;
- Drainage costs in my estimates are higher;
- My estimates include service relocation costs

The key variances between the November 2019 ICP costings and my estimates are outlined in the following sections and summarised in Appendices A, B & C.

7.2 Pavement Areas

There is some differences in measured pavement areas, resulting in increased costs for the two intersections. A comparison of the pavement area quantities measured is shown below, noting that the SMEC quantity for LR-IN-01 is higher due to the extended limit of the interim intersection on the southern leg, as discussed in Section 4.2 above. The difference in area for LR-IN-02 of 2% is considered to be within acceptable margins of error.

PAVEMENT AREA COMPARISON	LR-IN-01	LR-IN-02
	Asphalt Area (m^2)	Asphalt Area (m^2)
November 2019 ICP estimate	11,351	12,837
SMEC Estimate	15,630	13,045
Difference in Area (m^2)	4,279	208
Difference in Area (%)	38%	2%

Table 3 – Comparison of asphalt pavement areas

7.3 Pavement Costs

Whilst the pavement area comparison in Table 3 above shows that the areas measured for LR-IN-01 differ only by 2%, the SMEC estimate is 10% higher in cost than the November 2019 ICP estimate. If the ICP estimate assumes a 685mm depth granular pavement for all pavement areas, this would explain the difference in cost, and I believe that a more realistic pavement composition should be used in ICP estimate.

7.4 Concrete Works

My estimate for both Kerb and Channel length and concrete path areas are both higher than the November 2019 ICP estimates, as shown in the following two tables.

CONCRETE PATH AREA COMPARISON	LR-IN-01	LR-IN-02
	Path Area (m^2)	Path Area (m^2)
November 2019 ICP estimate	1,560	1,620
SMEC Estimate	3,535	1,960
Difference in Area (m^2)	1,975	340
Difference in Area (%)	127%	21%

Table 4 – Comparison of concrete path areas

KERB & CHANNEL COMPARISON	LR-IN-01	LR-IN-02
	Kerb length (m)	Kerb length (m)
November 2019 ICP estimate	1,114	1,039
SMEC Estimate	1,450	2,385
Difference in length (m)	336	1,346
Difference in length (%)	30%	130%

Table 5 – Comparison of kerb lengths

7.5 Drainage Lengths

The drainage pipe lengths measured in both sets of estimates appears to be comparable.

7.6 Drainage size (diameter)

The drainage pipe diameters in the SMEC estimate for LR-IN-02 are considerably larger than the diameters adopted in the November 2019 ICP estimates. The pipe diameters in the SMEC design range from 300mm diameter up to 1050mm diameter, whereas the November 2019 ICP estimates allows for pipe diameters ranging from 300mm diameter up to 525mm diameter. Consequently the estimated cost for drainage in the SMEC estimate is considerably higher.

Additional culvert costs at LR-IN-01 also need to be added to the November 2019 ICP estimates, as discussed in Section 4.3 above.

7.7 Traffic

This item includes traffic signals, and other miscellaneous costs. Whilst the allowance for traffic signals is similar in both estimates, the SMEC estimate makes allowance for guard rail costs along Lancefield Road which will be necessary to protect existing traffic hazards such as electrical poles and culvert endwalls. I believe that these costs need to be added to the ICP cost estimate.

7.8 Miscellaneous

- The SMEC estimate allows for the desludging and filling of a large dam opposite Sunningdale Avenue. The ICP cost estimate should also be adjusted to recognise this cost.
- The SMEC estimate allows for costs associated with Geotechnical investigations and pavement design, which we believe should also be added to the ICP cost estimate.
- The SMEC estimate allows for Non Destructive Digging (NDD) costs which will be necessary to prove the location and level of existing services, which we believe should also be added to the ICP cost estimate.

8 Information Relied Upon

In preparing assessments and my opinions, I have relied upon the following documents

- Lancefield Road Precinct Structure Plan, VPA – June 2018
- Sunbury South and Lancefield Road – Infrastructure Contributions Plan, VPA – November 2019
- Sunbury Sth Lancefield Rd ICP Design and Costings – GHD, November 2019
- Tonkin & Taylor Geotechnical and Investigation and Pavement Design for Kingsfield Residential Estate - August 2019
- Kingsfield Estate tender rates for Stage 1 temporary intersection

9 Conclusion

It is my opinion that:

- The southern extent of the interim intersection LR-IN-01 be extended further south to connect to the existing carriageway of Lancefield Road;

- VPA seek confirmation from Melbourne Water in relation to the required design flows crossing Lancefield Road at LR-IN-01;

- The cost estimate for LR-IN-01 be increased to allow for:
    - Relocation of existing services
    - Additional construction works associated with the intersection moving further south
    - Additional costs associated with the required culverts crossing Lancefield Road and the east west connector road (Montego Boulevard)
    - Additional costs associated with pavement composition
    - Additional costs associated with required guard rail along Lancefield Roads
    - Additional costs associated with additional length of Kerb and Channel and concrete paths
    - Additional costs associated with stormwater drainage at the intersection
    - Additional costs associated with filling an existing dam
    - Additional costs associated with Geotech investigations and proving services

- The cost estimate for LR-IN-02 be increased to allow for:
    - Relocation of existing services
    - Additional costs associated with pavement composition
    - Additional costs associated with required guard rail along Lancefield Roads
    - Additional costs associated with additional length of Kerb and Channel and concrete paths
    - Additional costs associated with stormwater drainage at the intersection
    - Additional costs associated with Geotech investigations and proving services

- Further work be undertaken in relation to alternative alignments/ lengths/ height for the northern bridge crossing of Jacksons Creek (LR-BD-01)

Appendix A Cost Estimates Comparison Summary

	LR-IN-01	LR-IN-02
November 2019 ICP estimate	$6,784,805	$7,064,631
SMEC Estimate	$9,057,039	$9,232,078
Difference in cost ($)	$2,272,234	$2,167,447
Difference in cost (%)	33%	31%

Appendix B LR-IN-01 Cost Estimates Key Variances

LR-IN-01	ICP COSTING	SMEC ESTIMATE	DIFFERENCE	DIFFERENCE (%)
SITEWORKS AND EARTHWORKS	$1,350,778	$1,110,000	-$240,778	-18%
ROAD PAVEMENT	$1,973,003	$2,449,795	$476,792	24%
CONCRETE WORKS	$151,640	$396,850	$245,210	162%
DRAINAGE	$440,877	$933,925	$493,048	112%
TRAFFIC	$567,008	$853,800	$286,792	51%
LANDSCAPE	$26,595	$31,722	$5,127	19%
STREET LIGHTING	$212,500	$210,000	-$2,500	-1%
SERVICES	0	$740,000	$740,000	
MAINTENANCE	$81,000	$81,000	$0	0%
Sub Total	**$4,803,402**	**$6,807,092**	$2,003,690	42%
DELIVERY	**$1,981,403**	**$2,249,947**	$268,543	14%
Totals	**$6,784,805**	**$9,057,039**	$2,272,233	33%

Appendix C LR-IN-02 Cost Estimates Key Variances

LR-IN-02	ICP COSTING	SMEC ESTIMATE	DIFFERENCE	DIFFERENCE (%)
SITEWORKS AND EARTHWORKS	$1,361,916	$1,037,120	-$324,796	-24%
ROAD PAVEMENT	$2,211,454	$2,437,861	$226,407	10%
CONCRETE WORKS	$151,745	$456,155	$304,410	201%
DRAINAGE	$402,441	$1,152,658	$750,217	186%
TRAFFIC	$566,640	$504,850	-$61,790	-11%
LANDSCAPE	$28,313	$43,720	$15,407	54%
STREET LIGHTING	$200,000	$192,600	-$7,400	-4%
SERVICES	$0	$444,917	$444,917	
MAINTENANCE	$81,000	$81,000	$0	0%
Sub Total	**$5,003,509**	**$6,350,882**	$1,347,373	27%
DELIVERY	**$2,063,122**	**$2,881,196**	$818,074	40%
Totals	**$7,066,631**	**$9,232,078**	$2,165,447	31%

Appendix D SMEC Cost Estimate LR-IN-01

KINGSFIELD
LANCEFIELD RD/SUNNINGDALE AVENUE INTERIM SIGNALISED INT - LR-IN-01

Principal:
LANCEFIELD DEVELOPMENT PARTNERS PTY LTD
Suit 11/860 Doncaster Rd
Doncaster East VIC 3109

Consulting Engineers:
SMEC
Collins Square, Tower 4, Level 20, 727 Collins St
Melbourne Vic 3008

CONSTRUCTION OF ROAD AND DRAINAGE
ENGINEERS ESTIMATE
Date of Estimate: 14/10/20

All quantities are solid volumes

Item	Description	Quantity	Unit	Rate	Amount
1	**Siteworks and Earthworks**				
1.1	Siteworks				
1.1.1	Site establishment including provision of access, survey setout, provisi	1	Item	$180,000.00	$180,000.00
1.1.2	Site preparation including disposal of all surface rock, trees and stumps, timber, fences, wire, rubbish, removal of kerb and other existing works and any other materials as specified on the drawings, disposed offsite to a tip to be arranged by the contractor. excluding Tree Removal	1	Item	$85,000.00	$85,000.00
1.2	Bulk Earthworks				
	Payment certification for spread and compact fill items to be approved only upon the presentation of relevant compaction results.				
1.2.2	Cut material	7,000	cu.m	$60.00	$420,000.00
1.2.3	Spread and compact fill onsite	11,500	cu.m	$15.00	$172,500.00
1.2.4	Importation of approved material	4,500	cu.m	$12.00	$54,000.00
1.2.6	Trim and prepare subgrade	18,800	sq.m	$2.00	$37,600.00
	NOTE: All earthwork volumes are calculated from existing surface to bottom of boxing/finished surface (unless otherwise noted on drawings). All quantities are solid volumes				
2	**Demolition Works**				
2.1	Demolition of Existing Pavement, Kerbs, Concrete Box Culvert, Guardrail and Drainage Pit and Pipes	1	Item		
2.2	Tree Removal	1	Item	$40,000.00	$40,000.00
2.3	Topsoil (Rate to include grade and trim to required presentation)				
2.3.1	Load and respread topsoil to naturestrips	15,400	sq.m	$6.00	$92,400.00
3	Pavement works				
3.1	LANCEFIELD ROAD 740mm Pavement				
3.1.1	Asphalt				
3.1.1.1	40mm Size 10 Type V Asphalt (Class 320 binder)	11,850	sq.m	$25.00	$296,250.00
3.1.1.2	75mm Size 20 Type SI Asphalt (Class 320 binder)	11,850	sq.m	$39.50	$468,075.00
3.1.1.3	75mm Size 20 Type SF Asphalt (Class 320 binder)	11,850	sq.m	$39.50	$468,075.00
3.1.2	Crushed rock				
3.1.2.1	20mm nom size Class 3 F.C.R.				
	110mm compacted depth	13,650	sq.m	$11.50	$156,975.00

Item	Description	Quantity	Unit	Rate	Amount
3.1.2.2	20mm nom size Class 3 F.C.R.				
	200mm compacted depth	13,650	sq.m	$20.00	$273,000.00
3.1.2.3	Capping layer				
	240mm compacted depth	14,260	sq.m	$12.00	$171,120.00
3.2	SUNNINGDALE AVE 720mm Pavement				
3.2.1	Asphalt				
3.2.1.1	40mm Size 10 Type V Asphalt (Class 320 binder)	2,075	sq.m	$25.00	$51,875.00
3.2.1.2	75mm Size 20 Type SI Asphalt (Class 320 binder)	2,075	sq.m	$39.50	$81,962.50
3.2.1.3	75mm Size 20 Type SF Asphalt (Class 320 binder)	2,075	sq.m	$39.50	$81,962.50
3.2.2	Crushed rock				
3.2.2.1	20mm nom size Class 3 F.C.R.				
	180mm compacted depth	2,400	sq.m	$18.00	$43,200.00
3.2.2.3	Capping layer				
	200mm compacted depth	2,500	sq.m	$12.00	$30,000.00
3.2.2.4	Construction Layer 150 depth				
	150mm compacted depth	2,500	sq.m	$12.00	$30,000.00
3.3	Montego Boulevard 610 Full Depth				
3.3.1	Asphalt				
3.3.1.1	40mm Size 10 Type V Asphalt (Class 320 binder)	1,705	sq.m	$25.00	$42,625.00
3.3.1.2	75mm Size 20 Type SI Asphalt (Class 320 binder)	1,705	sq.m	$39.50	$67,347.50
3.3.1.3	75mm Size 20 Type SF Asphalt (Class 320 binder)	1,705	sq.m	$39.50	$67,347.50
3.3.2	Crushed rock				
3.3.2.1	20mm nom size Class 3 F.C.R.				
	120mm compacted depth	1,960	sq.m	$12.00	$23,520.00
3.3.2.3	Capping layer				
	150mm compacted depth	2,040	sq.m	$12.00	$24,480.00
3.3.2.4	Construction Layer				
	150mm compacted depth	2,040	sq.m	$12.00	$24,480.00
4	**Concrete works**				
4.1	Kerb and channel (includes laybacks)				
4.1.5	Semi mountable kerb and channel (SM2)	1,450	lin.m.	$50.00	$72,500.00
4.2	100mm diameter subsoil drain (including localised deepening of cappin	2,650	lin.m.	$40.00	$106,000.00
4.2.1	100mm diameter subsoil drain (no fines concrete), required for paveme	50	lin.m.	$35.00	$1,750.00
4.3	Footpaths				
4.3.2	125mm depth concrete including bedding shared path, 2.5m	3,535	sq.m	$60.00	$212,100.00
4.3.4	Tactile pavers	10	no	$450.00	$4,500.00
5	**Drainage**				
5.1	Drainage Pipes				
5.1.1	Class 2 RC - Standard Backfill				
	375mm Dia. 1.5-2.5m deep	645	lin.m	$320.00	$206,400.00
	450mm Dia. 1.5-2.5m deep	15	lin.m	$350.00	$5,250.00
5.1.2	Extra over item 4.1.1 for CR backfill				
	375mm Dia. 1.5-2.5m deep	645	lin.m	$195.00	$125,775.00
5.2	Stormwater Pits				
5.2.1	Side Entry Pits - B2 Kerb and Channel (EDCM 601)				
5.2.1.1	750mm x 1000mm				
	1.5-2.5m deep	15	no.	$4,500.00	$67,500.00
5.2.3	Double Side Entry Pit - B2 Kerb and Channel (EDCM 602)				
5.2.3.1	750mm x 1000mm				

Item	Description	Quantity	Unit	Rate	Amount
	1.5-2.5m deep	4	no.	$8,000.00	$32,000.00
5.5	Connect to existing drainage (install, make good)				
5.5.2	Pit	2	no.	$1,500.00	$3,000.00
5.5.4	Main drain inlet	1	no.	$9,500.00	$9,500.00
5.6	Miscellaneous				
5.6.6	Swale drains (Provisional)	1,100	lin.m	$25.00	$27,500.00
5.6.7	4 No 900x300 Box Culvert Under Lancefield Road	88	m	$1,500.00	$132,000.00
5.6.8	4 No 900x300 Box Culvert Under Montego Boulevard	100	m	$1,350.00	$135,000.00
5.6.9	Alter existing pits or cover levels (pit no)	1	no.	$25,000.00	$25,000.00
5.6.10	Endwalls (incl rock beaching to Council and MW satisfaction as detailed)				
	To Suit Box Culverts and to connect minor drainage pipes. Include earthworks, shaping and rock beaching	3	no.	$25,000.00	$75,000.00
5.6.11	Gross Pollutant Trap (GPT)		no.		
5.6.12	Fill existing Dam/ Desludge and compact to level 1	1	Item	$90,000.00	$90,000.00
7	**Miscellaneous**				
7.2	Signs	1	Item	$12,500.00	$12,500.00
7.3	PSM	2	no.	$650.00	$1,300.00
7.7	Linemarking including RRPM's	1	Item	$75,000.00	$75,000.00
7.9	Guard rail	450	lin.m	$250.00	$112,500.00
7.10	Reinstatement of Title pegs during construction	1	Item	$2,500.00	$2,500.00
7.11	Public Lighting work	1	Item	$210,000.00	$210,000.00
7.25	Elect Pole Relocation	1	Item	$395,000.00	$395,000.00
7.26	Minor Service Relocation	1	Item	$30,000.00	$30,000.00
7.27	NDD Survey	1	Item	$25,000.00	$25,000.00
7.28	E/O civil works to deal with Next Gen cable (Provisional item)	580	lin.m.	$500.00	$290,000.00
7.29	Traffic Signal, including proms, controller and surveillance	1	Item	$300,000.00	$300,000.00
8	**Provisional Quantities**				
8.3	Temporary Security Fencing to be maintained during the construction period **(Provisional Quantity)**	1,900	lin.m	$15.00	$28,500.00
8.4.1	Approved soft rock **(Provisional Quantity)**	500	cu.m	$95.00	$47,500.00
8.4.3	VicRoads 10 year maintenance cost	1	Item	$81,000.00	$81,000.00
				SUB TOTAL	$6,344,370.00
9	**Professional and Authority Fees and Charges - ALLOW**				
9.1	Council Fees - Allow 3.25% of Cost of Works	1	Item	3.25%	$206,192.03
9.2	VicRoads Fees includes Prom | Consent to Works Scope Fees	1	Item		$77,000.00
9.3	Landscaping (hydroseeding) - allow 0.50% of costs of works		Item	0.50%	$31,721.85
9.4	Traffic Management for all works required under the contract including subcontractors works.	1	Item		$350,000.00
9.5	Environmental Management - Allow 0.50% of cost of works	1	Item	0.50%	$31,721.85
9.6	Geotechnical - Allow 1.5% of cost of works	1	Item	1.50%	$95,165.55
9.7	Survey & Design - Allow 5.00% of cost of works	1	Item	5.00%	$317,218.50
9.8	Supervision & Project Management - Allow 9% of cost of works	1	Item	9.00%	$570,993.30
9.9	Contingency - Allow 15% of cost of works	1	Item	15.00%	$951,655.50
				SUB TOTAL	$2,631,668.58
				TOTAL	$8,976,038.58
				Total (rounded)	$8,976,000.00

Appendix E SMEC Cost Estimate LR-IN-02

Kingsfield
ICP Interim Intersection LR-IN-02
Lancefield Road/ Rollingmeadows Drive signalised intersection
Principal:
LANCEFIELD DEVELOPMENT PARTNERS PTY LTD
Suite 11 / 860 Doncaster Road
East Doncaster VIC 3109

Consulting Engineers:
SMEC
Collins Square, Tower 4, Level 20, 727 Collins St
Melbourne Vic 3008

CONSTRUCTION OF ROAD AND DRAINAGE
ENGINEERS ESTIMATE
Date of Estimate: 14/10/20

All quantities are solid volumes

Item	Description	Quantity	Unit	Rate	Amount
1	**Siteworks and Earthworks**				
1.1	Siteworks				
1.1.1	Site establishment including provision of access, survey setout, provision of site and office compounds, insurances and other works as specified.	1	Item	$200,000.00	$200,000.00
1.1.2	Site preparation including disposal of all surface rock, trees and stumps, timber, fences, wire, rubbish, remove culvert, removal of kerb, removing existing gaurdrail, bluestone pitchers, Rolling Meadows Drive entry wall and other existing works and any other materials as specified on the drawings, disposed offsite to a tip to be arranged by the contractor.	1	Item	$85,000.00	$85,000.00
1.2	Bulk Earthworks				
	Payment certification for spread and compact fill items to be approved only upon the presentation of relevant compaction results.				
1.2.1	Strip existing topsoil and stockpile for future use	7,500	sq.m	$1.50	$11,250.00
1.2.2	Cut material (including rock cut and rock disposal)	10,700	cu.m	$55.00	$588,500.00
1.2.3	Spread and compact fill onsite	700	cu.m	$15.00	$10,500.00
1.2.4	Importation of approved material for filling		cu.m		
1.2.3	Trim and prepare subgrade	15,735	sq.m	$2.00	$31,470.00
1.3	Topsoil (Rate to include grade and trim to required presentation)				
1.3.1	Load and respread topsoil to naturestrips	13,900	sq.m	$6.00	$83,400.00
2	**Pavement works**				
2.1	770mm depth Lancefield Road Pavement (Type 10)				
2.1.1	Asphalt				
2.1.1.1	40mm depth of 14mm nom. Size Type V class 320 asphalt	10,450	sq.m	$25.00	$261,250.00
2.1.1.2	75mm depth of 20mm nom. Size Type SI class 320 asphalt	10,450	sq.m	$39.50	$412,775.00
2.1.1.3	75mm depth of 20mm nom. Size Type SF class 320 asphalt	10,450	sq.m	$39.50	$412,775.00
2.1.1.5	Prime	10,450	sq.m	$3.00	$31,350.00
2.1.2	Crushed rock				
2.1.2.1	20mm nom size Class 3 Cement treated crushed rock				
	150mm compacted depth	12,750	sq.m	$20.00	$255,000.00
2.1.2.2	20mm nom size Class 4 F.C.R.				
	150mm compacted depth	12,750	sq.m	$14.00	$178,500.00
2.1.2.3	Capping layer				
	280mm compacted depth	13,500	sq.m	$22.00	$297,000.00
2.3	670mm depth Rhye Street Pavement (Type 6) in Interim Works				
2.3.1	Asphalt				
2.3.1.1	40mm depth of 14mm nom. Size Reconophalt Type H asphalt	**900**	sq.m	$26.00	$23,400.00
2.3.1.2	75mm depth of 20mm nom. Size Type SI asphalt	900	sq.m	$39.50	$35,550.00
2.3.1.2	75mm depth of 20mm nom. Size Type SF asphalt	900	sq.m	$39.50	$35,550.00
2.3.1.4	Prime	900	sq.m.	$3.00	$2,700.00

Item	Description	Quantity	Unit	Rate	Amount
2.3.2	Crushed rock				
2.3.2.1	20mm nom size Class 3 Cement treated crushed rock				
	100mm compacted depth	1,050	sq.m	$14.67	$15,403.50
2.3.2.2	20mm nom size Class 4 F.C.R.				
	130mm compacted depth	1,050	sq.m	$12.50	$13,125.00
2.3.2.3	Capping layer				
	250mm compacted depth	1,100	sq.m	$20.00	$22,000.00
	Stage 4				
2.4	670mm depth Rhye Street Pavement (Type 6) In Stage 4				
2.4.1	Asphalt				
2.4.1.1	40mm depth of 14mm nom. Size Reconophalt Type H asphalt	**845**	sq.m	$26.00	$21,970.00
2.4.1.2	75mm depth of 20mm nom. Size Type SI asphalt	845	sq.m	$39.50	$33,377.50
2.4.1.2	75mm depth of 20mm nom. Size Type SF asphalt	845	sq.m	$39.50	$33,377.50
2.4.1.4	Prime	845	sq.m.	$3.00	$2,535.00
2.4.2	Crushed rock				
2.4.2.1	20mm nom size Class 3 Cement treated crushed rock				
	100mm compacted depth	1,105	sq.m	$14.67	$16,210.35
2.4.2.2	20mm nom size Class 4 F.C.R.				
	130mm compacted depth	1,105	sq.m	$12.50	$13,812.50
2.4.2.4	Capping layer				
	250mm compacted depth	2,100	sq.m	$20.00	$42,000.00
	Semi mountable kerb (SM1)	171	lin.m.	$45.00	$7,695.00
	Semi mountable kerb and channel (b2)	176	lin.m.	$50.00	$8,800.00
	100mm diameter subsoil drain (including localised deepening of capping layer)	347	lin.m.	$40.00	$13,880.00
	Drainage Pipes				
	Class 2 RC - Standard Backfill				
	300mm Dia. 1.5-2.5m deep	15	lin.m	$245.00	$3,675.00
	375mm Dia. 1.5-2.5m deep	58	lin.m	$320.00	$18,560.00
	Extra over item for CR backfill				
	300mm Dia. 1.5-2.5m deep	15	lin.m	$245.00	$3,675.00
	375mm Dia. 1.5-2.5m deep	58	lin.m	$195.00	$11,310.00
	Side Entry Pits - SM2 Kerb and Channel (Vicroads)				
	600mm x 900mm				
	1.5-2.5m deep	5	no.	$4,500.00	$22,500.00
	Footpaths				
	125mm depth concrete including bedding colour concrete	660	sq.m	$120.00	$79,200.00
2.5	600mm depth Rolling Meadows Drive Pavement (Type 5)				
2.5.1	Asphalt				
2.5.1.1	40mm depth of 14mm nom. Size Reconophalt Type H asphalt	850	sq.m	$26.00	$22,100.00
2.5.1.2	75mm depth of 20mm nom. Size Type SI asphalt	850	sq.m	$39.50	$33,575.00
2.5.1.2	75mm depth of 20mm nom. Size Type SF asphalt	850	sq.m	$39.50	$33,575.00
2.5.1.4	Prime	850	sq.m.	$3.00	$2,550.00
2.5.2	Crushed rock				
2.5.2.1	20mm nom size Class 4 F.C.R.				
	150mm compacted depth	950	sq.m	$14.00	$13,300.00
2.5.2.5	Capping layer				
	260mm compacted depth	1,000	sq.m	$20.50	$20,500.00
3	**Concrete works**				
3.1	Kerb and channel (includes laybacks)				
3.1.1	Semi mountable kerb (SM1)	38	lin.m.	$45.00	$1,710.00
3.1.2	Semi mountable kerb and channel (SM3)	1,100	lin.m.	$50.00	$55,000.00
3.1.3	Semi kerb and channel (SM2) - 600mm	900	lin.m.	$50.00	$45,000.00
3.1.5	Traffic island concrete infill	100	sq.m	$80.00	$8,000.00

Item	Description	Quantity	Unit	Rate	Amount
3.2	100mm diameter subsoil drain (including localised deepening of capping layer)	2,038	lin.m.	$40.00	$81,520.00
3.3	100mm diameter subsoil drain (under shoulder)	770	lin.m.	$35.00	$26,950.00
3.3	Footpaths				
3.3.2	125mm depth concrete including bedding bike path, 3m	550	sq.m	$60.00	$33,000.00
3.3.3	125mm depth concrete including bedding colour concrete	750	sq.m	$120.00	$90,000.00
3.3.4	Tactile pavers	12	no.	$450.00	$5,400.00
4	**Drainage**				
4.1	Drainage Pipes				
4.1.1	Class 2 RC - Standard Backfill				
	300mm Dia. <1.5m deep	2	lin.m	$195.00	$390.00
	300mm Dia. 1.5-2.5m deep	3	lin.m	$245.00	$735.00
	375mm Dia. <1.5m deep	42	lin.m	$280.00	$11,760.00
	375mm Dia. 1.5-2.5m deep	116	lin.m	$320.00	$37,120.00
	375mm Dia. 2.5-3.5m deep	23	lin.m	$400.00	$9,200.00
	450mm Dia. 1.5-2.5m deep	207	lin.m	$350.00	$72,450.00
	525mm Dia. 1.5-2.5m deep	74	lin.m	$385.00	$28,490.00
	525mm Dia. 2.5-3.5m deep	44	lin.m	$450.00	$19,800.00
	600mm Dia. 0-1.5m deep	17	lin.m	$435.00	$7,395.00
	600mm Dia. 1.5-2.5m deep	322	lin.m	$480.00	$154,560.00
	675mm Dia. 1.5-2.5m deep	74	lin.m	$550.00	$40,700.00
	1050mm Dia. 1.5-2.5m deep	80	lin.m	$650.00	$52,000.00
	check	***1,004***			
4.1.2	Extra over item 4.1.1 for CR backfill				
	300mm Dia. <1.5m deep	2	lin.m	$80.00	$160.00
	300mm Dia. 1.5-2.5m deep	3	lin.m	$165.00	$495.00
	375mm Dia. <1.5m deep	42	lin.m	$95.00	$3,990.00
	375mm Dia. 1.5-2.5m deep	116	lin.m	$195.00	$22,620.00
	375mm Dia. 2.5-3.5m deep	23	lin.m	$285.00	$6,555.00
	450mm Dia. 1.5-2.5m deep	207	lin.m	$236.27	$48,907.89
	525mm Dia. 1.5-2.5m deep	74	lin.m	$240.00	$17,760.00
	525mm Dia. 2.5-3.5m deep	44	lin.m	$295.00	$12,980.00
	600mm Dia. <1.5m deep	17	lin.m	$300.00	$5,100.00
	600mm Dia. 1.5-2.5m deep	322	lin.m	$380.00	$122,360.00
	675mm Dia. 1.5-2.5m deep	74	lin.m	$480.00	$35,520.00
	1050mm Dia. 1.5-2.5m deep	80	lin.m	$480.00	$38,400.00
	check	*1,004*			
4.1.3	Extra over item 4.1.1 for Class 3 pipe				
	300mm Dia.	5	lin.m	$10.00	$50.00
	375mm Dia.	181	lin.m	$20.00	$3,620.00
	450mm Dia.	207	lin.m	$30.00	$6,210.00
	525mm Dia.	118	lin.m	$40.00	$4,720.00
	600mm Dia.	339	lin.m	$50.00	$16,950.00
	675mm Dia.	74	lin.m	$60.00	$4,440.00
	1050mm Dia. 1.5-2.5m deep	80	lin.m	$100.00	$8,000.00
4.2	Stormwater Pits				
4.2.1	Side Entry Pits - SM2 Kerb and Channel (Vicroads)				
4.2.1.1	750mm x 1000mm				
	1.5-2.5m deep PIT NO 9,10,11,25,32,	5	no.	$4,500.00	$22,500.00
	2.5-3.5m deep PIT NO 31	1	no.	$5,500.00	$5,500.00
4.2.1.2	1000mm x 1000mm (haunched to 750mmx1000mm cast iron cover)				
	1.5-2.5m deep PIT NO 6,7,19,20,21,22,23,24	8	no.	$6,800.00	$54,400.00
4.2.1.4	1000mm x 2000mm (haunched to 750mmx1000mm)				
	1.5-2.5m deep PIT NO 39,40	3	no.	$6,900.00	$20,700.00
4.2.1.5	1500mm x 1500mm (haunched to 750mmx1000mm)				
	1.5-2.5m deep PIT NO 35	1	no.	$8,500.00	$8,500.00
4.2.2	Grated Pits - (Vicroads)				
4.2.2.1	1000mm x 1000mm				
	<1.5m deep PIT NO 3	1	no.	$3,500.00	$3,500.00

Item	Description	Quantity	Unit	Rate	Amount
4.2.2.2	750mm x 1000mm				
	<1.5m deep PIT NO 28,30,34,36	4	no.	$4,000.00	$16,000.00
	1.5-2.5m deep PIT NO 13, 16, 26, 12A	4	no.	$5,000.00	$20,000.00
4.2.3	Junction Pits - (Vicroads)				
4.2.3.1	750mm x 1000mm (Concrete cover)				
	<1.5m deep PIT NO 17	1	no.	$3,000.00	$3,000.00
	1.5-2.5m deep PIT NO 14,15,38	3	no.	$3,500.00	$10,500.00
	2.5-3.5m deep PIT 8	1	no.	$4,000.00	$4,000.00
4.2.3.2	750mm x 1000mm (Cast Iron cover)				
	1.5-2.5m deep PIT NO 12	1	no.	$4,300.00	$4,300.00
4.2.3.3	1000mm x 1000mm (Concrete cover)				
	1.5-2.5m deep PIT NO 2,5	2	no.	$4,000.00	$8,000.00
4.2.3.4	1000mm x 1000mm (Cast iron cover)				
	1.5-2.5m deep PIT NO 4	1	no.	$5,000.00	$5,000.00
4.2.3.5	1000mm x 1500mm (Concrete cover)				
	1.5-2.5m deep PIT NO 37	1	no.	$5,000.00	$5,000.00
4.2.3.6	1000mm x 1500mm (Cact iron cover)				
	1.5-2.5m deep PIT NO 33	1	no.	$5,500.00	$5,500.00
4.2.4	Catch Pit (EDCM 602)	1	no.	$2,000.00	$2,000.00
4.2.5	Connect to existing drainage (install, make good)				
4.2.5.1	Pit	5	no.	$1,500.00	$7,500.00
4.2.5.2	Remove existing pit and extend 300dia drain	1	no.	$8,500.00	$8,500.00
	check	*45*			
4.5	Miscellaneous				
	Modify existing drainage pit cover to finished surface with gatic lid	2	no.	$2,300.00	$4,600.00
4.5.1	Extra over item 4.2.1.4 & 4.2.3.4 construct new pit over existing pipe	4	no.	$2,500.00	$10,000.00
6	**Miscellaneous**				
6.2	Signs				
	Single street sign	5	no.	$500.00	$2,500.00
	R2-3A (L)	5	no.	$300.00	$1,500.00
	R5-35(LR)	7	no.	$300.00	$2,100.00
	R5-36(L)	2	no.	$300.00	$600.00
	G9-15A	6	no.	$300.00	$1,800.00
	R7-4A	2	no.	$300.00	$600.00
	R8-2A	6	no.	$300.00	$1,800.00
	R4-1-80	6	no.	$300.00	$1,800.00
	D4-1-1A (L)	4	no.	$300.00	$1,200.00
	R2-14A(L)	1	no.	$300.00	$300.00
	R2-2A(L)	1	no.	$300.00	$300.00
	G9-78	1	no.	$300.00	$300.00
	Check	46			
6.3	Guard Rail				
6.3.1	Guard rail Ezy guard rail smart TL3	215	lin.m	$250.00	$53,750.00
6.3.2	Guard rail GREAT Ingal ET-SS tangetn end terminal TL-3	5	no.	$4,500.00	$22,500.00
6.3.3	Guard rail trailing terminal vicroads sd 3544	3	no.	$3,500.00	$10,500.00
6.3.4	Concrete maintenance strip	310	sq.m	$85.00	$26,350.00
6.3	Hydromulch table drains	3,000	sq.m	$3.00	$9,000.00
6.4	PSM	3	no.	$650.00	$1,950.00
6.5	Linemarking (inclusive of shared footpath and bikepath)	1	Item	$75,000.00	$75,000.00
6.6	RRPM's		no.		
6.7	Environmental Management in accordance with approved EMP and implementation to the staisfaction of Council/Melbourne Water	1	Item	$95,000.00	$95,000.00

Item	Description	Quantity	Unit	Rate	Amount
6.8	Traffic Management for all works required under the contract including subcontractors works.	1	Item	$350,000.00	$350,000.00
	Service Relocation source file V:_Vault\Projects_Urban\ENG\2640E-Kingsfield\Precinct 2-Central_General\Correspondence\02. Council\200911 OUT LR23 WIK Agreement 1st Submission\				
	LR-IT-02 Service Relocation	1	Item	$444,917.44	$444,917.44
	Traffic signal light poles, pedestal, signal box, service pits	1	Item	$300,000.00	$300,000.00
	Public lighting	1	Item	$192,600.00	$192,600.00
	Provisional Quantities				
	Temporary Security Fencing to be maintained during the construction period	1,800	lin.m	$15.00	$27,000.00
	Excavation of unstable areas below road pavement and allotments, disposal				
	40mm nominal size class 4 FCR **(Provisional Quantity)**	1,000	cu.m	$95.00	$95,000.00
	Approved soft rock **(Provisional Quantity)**	500	cu.m	$90.00	$45,000.00
	Boring under Lancefield Rd **(Provisional Quantity)**				
	375 dia	30	lin.m	$2,350.00	$70,500.00
	Rolling Meadows Drive Pavement surfacing from median to roundabout				
	Asphalt resurfacing Size 7mm 30 mm thick Type N	420	sq.m	$20.00	$8,400.00
	Rotormill and asphalt resurfacing	420	sq.m	$10.00	$4,200.00
	VicRoads 10 year maintenance fees	1	Item	$81,000.00	$81,000.00
				SUB TOTAL	$6,761,161.68
	Professional and Authority Fees and Charges - ALLOW				
	Council Fees - Allow 3.25% of cost of works	1	Item	3.25%	$225,679.67
	VicRoads Fees includes Prom | Consent to Works Scope Fees	1	Item		$92,599.75
	Landscaping (hydroseeding) - Allow 0.50% of costs of works	1	Item	0.50%	$34,719.95
	Geotechnical - Allow 1.5% of cost of works	1	Item	1.50%	$104,159.85
	Survey & Design - Allow 5.00% of cost of works	1	Item	5.00%	$347,199.50
	Supervision & Project Management - Allow 9% of cost of works	1	Item	9.00%	$624,959.09
	Contingency - Allow 15% of cost of works	1	Item	15.00%	$1,041,598.49
				SUB TOTAL	$2,470,916.30
				TOTAL	**$9,232,077.98**
				Total (rounded)	$9,232,000.00

Appendix F Hume City Council SD-06

TRUNK COLLECTOR STREET – (>3000vpd)

ROAD CHARACTERISTICS – TRUNK COLLECTOR STREET

Road Type	Max. VPD	Parking	Kerb & Channel Type	Minimum Width (mm) *
Trunk Collector Street	6000	Parking not permitted	SM2 Type – Refer Std Dwg SD101	7000 2x3.5m Dual Carriageway
Trunk Collector Street with parking	6000	Parking on carriageway	SM2 Type – Refer Std Dwg SD101	11000 2x5.5m Dual Carriageway
Abutting a Reserve	6000		B2 Type – Refer Std Dwg SD101	

* Measured invert to invert.

PAVEMENT COMPOSITION – DESIGN TRAFFIC LOADING

The DTL for roads carrying in excess of 3000vpd must be determined in accordance with Clause 3.1.2, "Pavement Design Guidelines For New Subdivisions – April 2002". Pavements with DTL's less than $1x10^6$ ESA's may be selected from the following tabulation.

PAVEMENT COMPOSITION – TRUNK COLLECTOR STREET – ESA<10^6

Pavement Layer	Pavement Material	Pavement Thickness (mm)							
		Non Expansive Subgrade				Expansive Subgrade **			
		CBR 2%	CBR 3%	CBR 4%	CBR 5%	CBR 2%	CBR 3%	CBR 4%	CBR 5%
Surfacing	Size 14 Type N Asphalt	40	40	40	40	40	40	40	40
Bituminous Prime	Prime or Primerseal								
Base	20mm Class 2 Crushed Rock	160	160	160	160	160	160	160	160
Upper Subbase	20mm Class 3 Crushed Rock	170	170	170	170	170	170	170	170
Lower Subbase	20 or 40mm Class 4 Crushed Rock or Approved Equivalent	315	210	120	55	315	230	230	230
Total		**685**	**580**	**490**	**425**	**685**	**600**	**600**	**600**

** EXPANSIVE SOILS ARE CLASSIFIED AS FOLLOWS:

Liquid Limit	>70%
Plasticity Index	>45
PI x % < 0.425mm	>2200
Potential Swell	>2.5

PAVEMENT COMPOSITION – TRUNK COLLECTOR STREET – ESA>10^6

Pavements with a Design Traffic Loading greater than $1x10^6$ ESA's, shall be modelled mechanistically to determine the overall thickness and composition of the pavement. A granular unbound pavement with a thin asphalt surfacing (<40mm thick), would not be acceptable for these situations.

Amendments			
No.	Detail	Initials	Date

DRAWN : K. GRAHAM
CHECKED : P. TUTTLE
APPROVED : S. PLATER
SCALE :
ISSUE DATE: JUNE 2004

HUME CITY COUNCIL
PO Box 119
1079 Pascoe Vale Road
Broadmeadows
Victoria 3047
Telephone
03) 9205 2200
Facsimile
03) 9309 0109

TYPE :
ROAD CHARACTERISTICS AND PAVEMENT COMPOSITION – TRUNK COLLECTOR STREET

DRAWING NO: SD 06

Appendix G Tonkin & Taylor Geotechnical / Pavement report

REPORT

Tonkin+Taylor

Kingsfield Residential Estate, Sunbury

Geotechnical Investigation and Pavement Design

Prepared for
Lancefield Development Partners P/L
Prepared by
Tonkin & Taylor Pty Ltd
Date
August 2019
Job Number
1010770.R1.v1

Exceptional thinking together
www.tonkintaylor.com.au

Document Control

Title: Kingsfield Residential Estate, Sunbury					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
9 August 2019	1	Final	P. Toro J. Vajna	T. Smith M. Singh	T. Chadwick

Distribution:

Lancefield Development Partners P/L	1 electronic copy
Moremac Property Group	1 electronic copy
Tonkin & Taylor Pty Ltd (FILE)	1 electronic copy

Table of contents

1 Introduction

Tonkin & Taylor Pty Ltd (T+T) has been engaged by Lancefield Development Partners P/L to undertake a Geotechnical Investigation and Pavement Design for the proposed subdivision at Kingsfield Residential Estate, Sunbury. The work has been completed in accordance with our proposal (Ref: 1010770.P1, dated 26 April 2019), which was accepted on 9 May 2019.

In accordance with our proposal, the geotechnical report will include:

- A summary of the ground and groundwater conditions encountered.
- An assessment of construction conditions for water retention structures, including liner requirements, excavation conditions, and temporary batter stability.
- An assessment of the suitability of the excavated soils for use as general fill and also as an impermeable liner, including permeability and dispersion characteristics.
- A discussion on sewer and water main construction, including excavation conditions, pipe embedment requirements, trench backfill, and geotechnical parameters for the design of thrust blocks.
- Recommended options for the flexible pavement structures and compositions for internal subdivision roads and proposed interim and future intersection with Lancefield - Melbourne Road.
- Engineering logs of all boreholes, including coordinates, characteristics of the soil strata encountered on the site and the results of field testing.
- An assessment of design CBR value for the subgrade.
- A site plan showing the locations of all of the boreholes.

Pavement options were developed based on the recommended subgrade CBR values and design traffic loadings derived from traffic volumes supplied by the client and derived from typical published values (e.g. proportion of heavy vehicles, number of axle groups per heavy vehicle and equivalent standard axles pre axle group).

Pavement analysis was undertaken in conformance with the guidance provided by the following documents:

- Austroads Pavement Technology Series Part 2, 2017.
- VicRoads Code of Practice RC500.22.
- VPA (was GAA) Pavement Design Guidelines.

2 Site

2.1 Site Description

The proposed Kingsfield Residential Estate development is approx. 103 ha and located on 178 Lancefield Road, Sunbury. The development is bounded by Emu Creek to the east, Lancefield Road to the west and paddocks to the north and south.

The boundaries of the site are highlighted by a red line as shown within the Figure 2-1 below. A homestead is located opposite the intersection of Rolling Meadows Drive and Lancefield Road with paddocks situated to the north, south and south-eastern sections of the site. The paddocks are relatively flat with gentle downslopes from the northern and eastern boundaries sloping eastwards towards Emu Creek.

The homestead consists of two houses, several outbuildings, medium-sized trees and medium sized shrubs.

Several outbuildings and medium-sized trees are located between the southern and south-western paddocks. The paddocks are currently used as farmland and medium sized shrubs are located on the slopes in the south eastern section of the site.

A gravel and dirt road currently intersects the site running from east to west. Currently water runoff flows down the gully along the northern boundary of the site and feeds into Emu Creek at the south-eastern section of the site.

Two dams are currently present at the site with one in the north near the northern boundary and the other in the southern boundary.

Figure 2-1: Aerial view of the site (source Google Earth)

2.2 Proposed development

We understand that the 103ha site is to be developed into a residential subdivision over 11 stages, to be known as Kingsfield. The development will include a town centre, community facilities, park, 472 mixed commercial and residential lots, primary school, internal subdivisional road network, external Roadworks; Lancefield Road Temporary Intersection Works and future widening of Lancefield Road, arterial roads and road widening works, sediment Basin (SD6) and Wetland (WL18). It is understood that Sediment Basin will be 2 m deep and the Wetland 3 m deep.

2.3 Regional geology and hydrogeology

The geological map of the area[1] shows the site to be underlain by Miocene to Holocene Newer Volcanic Group - basalt flows (Neo), which is characterised by Olivine tholeiite, quartz tholeiite, basanite, basaltic icelandite, hawaiite, mugearite, minor scoria and ash, fluvial sediments: tholeiitic to alkaline; includes sheet flows and valley flows and intercalated gravel, sand, clay. The geological unit is typically characterised by high plasticity stiff clay overlying basalt cobble, boulders or floaters, followed by weathered basalt. This was generally confirmed during our field investigation.

The Visualising Victoria's Groundwater database[2] indicates that groundwater ranges across the site from 20 m - 50 m depth to less than 5 m bgl (below ground level) towards the watercourse. This is shown in Figure 2-2 below.

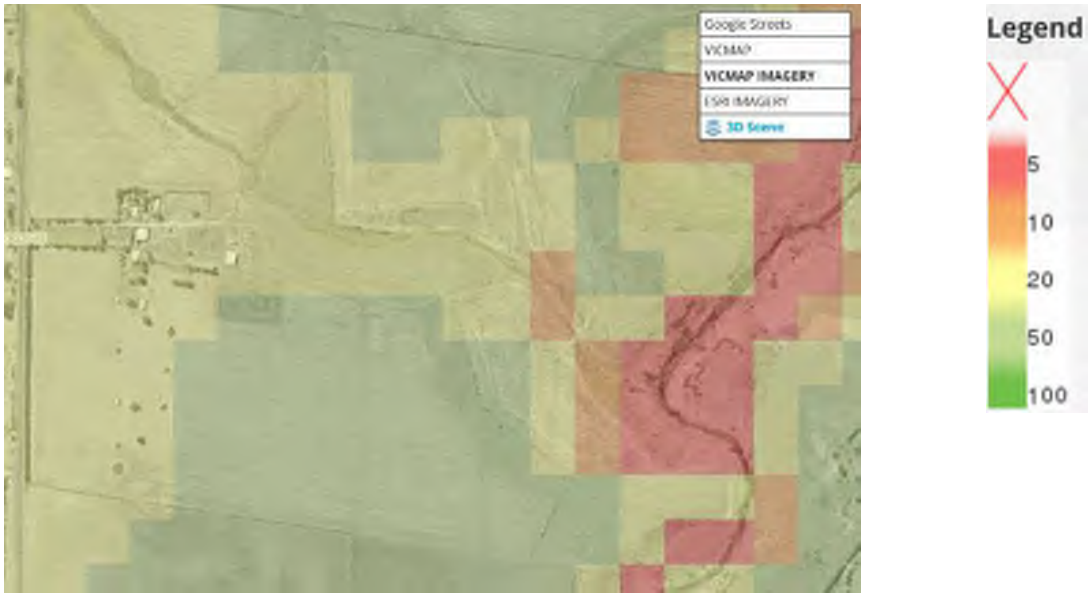


Figure 2-2 Visualising Victoria's Groundwater Mapping Online Tool

[1] Department of Economic Development, Jobs, Transport and Resources (2016) Online 1:250,000 scale geological map (http://er-info.dpi.vic.gov.au/sd_weave/registered.htm). State Government of Victoria.
[2] Federation University of Australia (2015). Visualising Victoria's Groundwater. www.vvg.org.au. Centre for eResearch and Digital Innovation, Federation University Australia.

3 Fieldwork

Fieldwork for the subdivision was carried out on the 30th and 31st of May and the 3rd and 6th of June 2019. The fieldwork for Lancefield Rd was completed between the 1st and 3rd of July 2019.

The fieldwork comprised:

Internal subdivision roads

- Forty two (42) test pits excavated generally to 1.5m bgl. Ten (10) test pits were deepened for the sewer investigation.
- In-situ testing comprising;
  - Dynamic cone penetrometer (DCP) tests up to 1.5 m bgl.

Lancefield Road

- Seven (7) test pits excavated generally up to 1.5m bgl within the proposed future widening (Greenfield).
- Seven (7) test pits excavated generally up to 1.5m bgl within the existing road.
- In-situ testing comprising;
  - Dynamic cone penetrometer (DCP) tests up to 1.5 m bgl.

Sediment Basin (SD6)

- One (1) test pit excavated within the sediment basin area.

Wetland (WL18)

- Three (3) test pits excavated within the wetland area.
- Two (2) test pits excavated at the proposed outlet area.

3.1 General

Test pits were excavated using 1.7 and 4 tonne excavators operated by Fry's Earthmoving. All fieldwork was carried out under the direction and full-time supervision of an experienced T+T geotechnical engineer who was responsible for positioning the test pits, determining the extent of sampling and testing and logging the recovered soils encountered.

The approximate locations of the test pits, shown in Figure 1 in Appendix A, were recorded using a handheld GPS accurate to within approximately 5 m. The engineering logs with an explanation of the terminology used and location coordinates are provided in Appendix B.

Material classification and logging techniques were carried out in accordance with the attached explanatory notes and wherever possible, material classifications have been correlated to the results of laboratory testing. However, it should be noted that field classifications of materials are a subjective opinion of the site engineer and may differ in some respects from an interpretation derived from the laboratory test results.

4 Laboratory testing

Laboratory testing was carried out on representative soil samples and comprised:

Internal subdivisional roads

- Retrieval of disturbed soil samples for laboratory testing, which included:
  - moisture content tests
  - Atterberg limits test
  - particle size distribution tests
  - standard compaction tests
  - 4-day soaked CBR tests

Lancefield Road

- Retrieval of disturbed soil samples for laboratory testing, which included:
  - moisture content tests
  - Atterberg limits tests (subgrade and crushed rock)
  - particle size distribution tests (subgrade and crushed rock)
  - standard compaction tests
  - 4-day soaked CBR tests

Preliminary Sewer Investigation

- Retrieval of disturbed soil samples for
  - Emerson Class Number testing

Sediment Basin (SD6)

- Retrieval of disturbed soil samples for laboratory testing, which included:
  - One (1) sample for particle size distribution, Atterberg Limits, Emerson Class Number and remoulded permeability.

Wetland (WL18)

- Retrieval of disturbed soil samples for laboratory testing, which included:
  - One (1) sample for particle size distribution, Atterberg Limits, Emerson Class Number and remoulded permeability.

Additional testing for reuse of dispersive clay

The treatment process for dispersive clays typically involves the addition of lime or gypsum, which can result in an increase in the permeability of the clay, which may then affect its suitability for use as an impermeable liner. As the Emerson class testing indicated the in-situ clay is dispersive, the following additional work was carried out:

- Obtain a sample of the clay and carry out the following laboratory tests;
  - Two (2) sedimentation tests (after Moyle and Burgess)
  - Two (2) triaxial permeability test on a remoulded stabilised sample of clay, based on the results of the sedimentation tests.

Laboratory testing was undertaken by a NATA approved Chadwick Geotechnics (CG) laboratory.

A summary of the results obtained is shown in the following tables, and NATA laboratory test certificates are provided in Appendix D.

Table 4-1 Summary of laboratory test results – Lancefield Rd Widening

Test Site	Description	Sample depth (m bgl)	Moisture content (%)	Linear Shrinkage (%)	Liquid Limit (%)	Plasticity Index (%)	MDD (t/m³)/OMC (%)	CBR (%)/Swell (%)	Sieve Analysis (%) Passing		
									0.075 mm	0.425 mm	2.36 mm
TP01	Clay (CH)	0.7	25.2	-	-	-	-	-	-	-	-
TP03	Clay (CH)	0.5	22.7	-	-	-	-	-	-	-	-
TP05	Clay (CH)	0.5	33.6	-	-	-	-	-	-	-	-
TP14	Clay (CH)	0.7	31.7	-	-	-	-	-	-	-	-

Table 4-2 Summary of laboratory test results – Existing Lancefield Rd

Test Site	Description	Sample depth (m bgl)	Moisture content (%)	Linear Shrinkage (%)	Liquid Limit (%)	Plasticity Index (%)	MDD (t/m³)/OMC (%)	CBR (%)/Swell (%)	Sieve Analysis (%) Passing		
									0.075 mm	0.425 mm	2.36 mm
PD01	Sandy Gravel (GW)	0.1	4.7	0.0	20	2	-	-	11	24	52
PD01	Clay (CH)	0.65 – 0.8	-	-	-	-	1.57/23.0	2.0/3.5	-	-	-
PD01	Clay (CH)	0.7	33.8	-	-	-	-	-	-	-	-
PD02	Gravelly Clay (GC)	1.0	21.8	18.0	72	54	-	-	40	46	58
PD02	Clay (CH)	0.8	33.1	-	-	-	-	-	-	-	-
PD03	Clay (CH)	0.7	24.4	-	-	-	-	-	-	-	-
PD05	Clay (CH)	0.5	19.3	-	-	-	-	-	-	-	-
PD06	Sandy Gravel (GW)	0.05	3.9	0.0	N/A	NP	-	-	8	23	54
PD06	Clay (CH)	0.5 – 0.6	20.6	10.5	37	23	1.7/18.0	1.5/2.0	81	88	92

Table 4-3 Summary of laboratory test results within subdivision

Test Site	Description	Sample depth (m bgl)	Moisture content (%)	Linear Shrinkage (%)	Liquid Limit (%)	Plasticity Index (%)	MDD (t/m^3)/OMC (%)	CBR (%)/Swell (%)	Sieve Analysis (%) Passing			Emerson Class No.	Permeability (m/sec)
									0.075 mm	0.425 mm	2.36 mm		
TP07	Clay (CH)	0.5 – 0.7	32.4	20.0	90	66	1.41/29.5	2.5/2.5	95	99	100	2	-
TP08	Clay (CH)	0.5	28.1	-	-	-	-	-	-	-	-	-	-
TP09	Clay (CH)	0.3 – 0.5	33.0	16.5	72	53	1.50/27.0	3.5/2.5	91	97	98	-	-
TP10	Clay (CH)	0.5	31.6	-	-	-	-	-	-	-	-	-	-
TP11	Clay (CH)	0.3	34.5	-	-	-	-	-	-	-	-	2	-
TP12	Clay (CH)	0.5 – 0.7	30.2	-	-	-	-	-	-	-	-	-	-
TP13	Clay (CH)	0.5	30.8	-	-	-	-	-	-	-	-	-	-
TP15	Clay (CH)	1.0	30.5	-	-	-	-	-	-	-	-	-	-
TP16	Clay (CH)	0.5 – 0.7	33.7	18.0	73	41	1.28/35.0	-	81	88	94	5	$7x10^{-10}$
TP17	Clay (CH)	0.5 – 0.7	27.2	20.0	80	57	1.53/25.0	2.0/3.5	95	99	100	-	-
TP18	Clay (CH)	0.5	41.9	-	-	-	-	-	-	-	-	-	-
TP19	Clay (CH)	0.2	26.3	-	-	-	-	-	-	-	-	-	-
TP20	Clay (CH)	0.5 – 0.7	29.4	16.0	77	52	1.41/31.0	6.0/1.0	85	89	91	-	-
TP21	Clay (CH)	0.5	33.5	-	-	-	-	-	-	-	-	-	-
TP23	Clay (CH)	0.4	40.1	-	-	-	-	-	-	-	-	-	-
TP24	Clay (CH)	0.6	23.2	-	-	-	-	-	-	-	-	-	-
TP25	Clay (CH)	0.5	30.9	-	-	-	-	-	-	-	-	-	-
TP26	Clay (CH)	0.4 – 0.7	34.8	21.0	92	70	1.38/30.5	3.5/2.0	96	99	100	-	-
TP27	Clay (CH)	0.5	29.7	-	-	-	-	-	-	-	-	-	-

TP28	Clay (CH)	0.5	31.4	-	-	-	-	-	-	-	-	2	-
TP29	Clay (CH)	0.4	38.2	-	-	-	-	-	-	-	-	-	-
TP30	Clay (CH)	1.5	33.3	-	-	-	-	-	-	-	-	-	-
TP31	Clay (CH)	0.5	32.3	-	-	-	-	-	-	-	-	-	-
TP32	Clay (CH)	0.5	32.2	-	-	-	-	-	-	-	-	-	-
TP33	Clay (CH)	0.7	31.9	20.0	83	58	-	-	96	99	100	-	-
TP34	Clay (CH)	0.15 – 0.25	33.1	-	-	-	-	-	-	-	-	-	-
TP35	Clay (CH)	0.5 – 0.7	-	-	-	-	1.35/32.5	3.5/2.0	-	-	-	-	-
TP38	Clay (CH)	0.5 – 0.7	37.6	20.0	80	57	1.42/28.5	-	97	100	100	2	$8x10^{-11}$
TP39	Clay (CH)	0.8	27.3	-	-	-	-	-	-	-	-	-	-
TP40	Clayey Gravel (GC)	1.35	29.3	14.0	58	33	-	-	28	36	47	-	-
TP41	Clay (CH)	0.5	30.2	-	-	-	-	-	-	-	-	-	-
TP42	Clay (CH)	0.7	30.3	-	-	-	-	-	-	-	-	-	-
TP43	Clay (CH)	0.5 – 0.7	29.1	-	-	-	1.48/28.5	4.5/1.5	-	-	-	2	-
TP44	Clay (CH)	0.7	28.5	-	-	-	-	-	-	-	-	-	-
TP45	Clay (CH)	0.5	23.9	-	-	-	-	-	-	-	-	-	-
TP46	Clay (CH)	0.3	31.2	-	-	-	-	-	-	-	-	-	-
TP47	Clay (CH)	1.2	25.6	-	-	-	-	-	-	-	-	-	-
TP48	Clay (CH)	0.5	33.4	-	-	-	-	-	-	-	-	-	-
TP49	Clay (CH)	0.5 – 0.7	27.2	-	-	-	-	-	-	-	-	-	-
TP50	Clay (CH)	0.5	29.8	-	-	-	-	-	-	-	-	-	-
TP51	Clay (CH)	0.5	24.6	-	-	-	-	-	-	-	-	2	-
TP52	Clay (CH)	0.5 – 0.7	30.7	21.5	86	62	1.43/30.5	6.0/1.0	96	98	99	-	-
TP53	Clay (CH)	0.8	36.5	-	-	-	-	-	-	-	-	-	-
TP54	Clay (CH)	0.3	24.5	-	-	-	-	-	-	-	-	-	-
TP55	Clay (CH)	0.5	16.3	-	-	-	-	-	-	-	-	-	-

5 Subsurface Stratigraphy

The following summary of the subsurface stratigraphy is inferred from the available site investigation data, and as such only represents the site conditions at the locations of the field testing. It is possible that conditions at locations between the field tests may be quite different and therefore this summary should only be understood to apply to the test locations. Table 5-1 summarises the subsurface profile across the site.

Table 5-1 Summary of Subsurface Profile

Test Location	SILT (m)	CLAY (m)	Weathered BASALT / Rock floaters (m)	Termination Depth (m)
TP01	0.0 – 0.13	0.13 - TD	Not Encountered	1.5
TP02	0.00 - 0.10	0.10 – 0.90	0.90 - TD	0.90
TP03	0.00 - 0.18	0.18 - 0.95	1.15 - TD	1.15
TP04	0.00 - 0.08	0.08 - 0.80	0.80 - TD	1.50
TP05	0.00 - 0.20	0.20 - 0.70	0.70 - TD	0.85
TP06	0.00 – 0.15	0.15 – 0.65	0.65 - TD	0.90
TP07	0.00 – 0.24	0.24 – 1.10	1.10 - TD	1.65
TP08	0.00 – 0.15	0.15 – 1.50	Not Encountered	1.50
TP09	0.00 – 0.16	0.16 – 0.60	0.60 – TD	1.00
TP10	0.00 – 0.15	0.15 – 0.55	0.55 – TD	1.10
TP11	0.00 – 0.15	0.15 – 0.50	0.50 - TD	0.70
TP12	0.00 – 0.15	0.15 – 1.15	1.15 - TD	1.50
TP13	0.00 – 0.15	0.15 – 0.67	0.67 -TD	1.50
TP14	0.00 – 0.15	0.15 – 1.50	Not Encountered	1.50
TP15	0.00 – 0.10	0.10 – 0.27	0.27 – TD	0.60
TP16	0.00 – 0.20	0.20 – 0.45	0.45 – TD	0.73
TP17	0.00 – 0.10	0.10 – 0.55	0.55 – TD	0.80
TP18	0.00 – 0.15	0.15 – 0.90	0.90 - TD	1.35
TP19	0.00 – 0.25	0.25 – 0.90	0.90 - TD	1.05
TP20	0.00 – 0.25	0.25 – 0.70	0.70 - TD	1.70
TP21	0.00 – 0.15	0.15 – 0.70	0.70 - TD	1.25
TP22	0.00 – 0.35	0.35 – 0.70	0.70 - TD	1.30
TP23	0.00 – 0.15	0.15 – 0.48	0.48 - TD	0.78
TP24	0.00 – 0.15	0.15 – 0.60	0.60 - TD	0.60
TP25	0.00 – 0.20	0.15 – 0.92	0.92 - TD	1.50
TP26	0.00 – 0.15	0.15 – 0.70	0.70 - TD	1.35
TP27	0.00 – 0.15	0.15 – 0.65	0.65 - TD	1.50
TP28	0.00 – 0.20	0.20 – 0.80	0.80 - TD	1.50
TP29	0.00 – 0.25	0.25 – 0.62	0.62 - TD	0.85

Test Location	SILT (m)	CLAY (m)	Weathered BASALT / Rock floaters (m)	Termination Depth (m)
TP30	0.00 – 0.12	0.12 – 1.65	1.65 - TD	2.05
TP31	0.00 – 0.12	0.12 – TD	Not Encountered	1.50
TP32	0.00 – 0.10	0.10 – TD	Not Encountered	1.50
TP33	0.00 – 0.15	0.15 – 0.50	0.50 - TD	1.50
TP34	0.00 – 0.25	0.25 – 0.50	0.50 - TD	0.75
TP35	0.00 – 0.15	0.15 – 0.85	0.85 - TD	1.00
TP36	0.00 – 0.10	0.10 – 0.50	0.50 - TD	1.00
TP37	0.00 – 0.15	0.15 – 0.55	0.55 - TD	1.15
TP38	0.00 – 0.27	0.27 – 1.35	1.35 - TD	2.05
TP39	0.00 – 0.15	0.15 – 0.80	0.80 - TD	1.05
TP40	0.00 – 0.20	0.20 – 0.70	0.70 - TD	1.35
TP41	0.00 – 0.12	0.12 – 0.60	0.60 - TD	0.90
TP42	0.00 – 0.15	0.15 – TD	Not Encountered	1.50
TP43	0.00 – 0.25	0.25 – 1.35	1.35 - TD	1.50
TP44	0.00 – 0.15	0.15 – 0.60	0.60 - TD	1.15
TP45	0.00 – 0.20	0.20 – TD	Not Encountered	1.50
TP46	0.00 – 0.15	0.15 – 0.65	0.65 - TD	1.30
TP47	0.00 – 0.12	0.12 – 1.30	1.30 - TD	1.50
TP48	0.00 – 0.15	0.15 – 1.20	1.20 - TD	1.45
TP49	0.00 – 0.20	0.20 – 0.85	0.85 - TD	0.85
TP50	0.00 – 0.25	0.25 – 1.05	1.05 - TD	1.50
TP51	0.00 – 0.25	0.25 – 1.50	1.50 - TD	1.60
TP52	0.00 – 0.20	0.20 – TD	Not Encountered	1.45
TP53	0.00 – 0.20	0.20 – 0.95	0.95 - TD	1.50
TP54	0.00 – 0.20	0.20 – 0.50	0.50 - TD	0.60
TP55	0.00 – 0.25	0.25 – TD	Not Encountered	1.50

Legend:

TP = termination depth

5.1 Internal subdivision

The soil profile across the site was found to be fairly uniform and consistent with our understanding of the Newer Volcanics Group geology. The subsurface profile within the internal subdivision could be categorised into three main stratigraphic units:

- Unit 1 - SILT
- Unit 2 - CLAY
- Unit 3 - BASALT

5.1.1 Unit 1 – SILT

This unit was encountered across the site generally ranging from 0.1 m and 0.25 m bgl. However, in some locations, silts were encountered up to 0.35 m bgl. The unit was generally described as soft to firm silt with rootlets within the upper 0.05 m-0.1 m.

Penetration resistance as measured by the DCP typically ranged from 1 to 3 blows/100 mm penetration, indicative of soft to stiff soils.

5.1.2 Unit 2 – CLAY

Unit 2 was encountered underlying the Unit 1 silt to depths between 0.1m and the completion depth of the test pits at 1.5 m bgl in some locations. However, this unit was typically found to depths between 0.25 m and 0.5 m bgl.

The clay was generally described as brown/grey, high plasticity, with basalt cobbles and boulders. This unit is considered to be a residual soil derived from the weathering of the underlying basalt. The excavator bucket was unable to continue on several locations due to refusal on basalt rock and/or rock floaters.

Penetration resistance in the clay soils as measured by the DCP typically ranged from 2 blows/100mm penetration to effective refusal (more than 25 blows/100 mm), indicative of firm to hard soils. Atterberg Limits testing recorded Liquid Limits between 58% and 92% and a Plasticity Index between 52% and 70%, indicative of a high plasticity clay.

Laboratory soaked CBR testing recorded CBR values of between 2.0% and 6.0% and swell values between 1.0 and 3.5%, indicating that the clay encountered is highly to very highly reactive, and considered to be expansive as per VicRoads RC500.22.

Seven Emerson Class Number (ECN) tests were carried out across the site. Six tests resulted in an ECN of 2, indicating highly dispersive clays and one test resulted in an ECN of 5, indicating moderately dispersive clay. One permeability test was undertaken within the retarding basin (TP16) and another test on the wetland (TP38); the results were $7x10^{-10}$ m/s and $8x10^{-11}$ m/s, respectively.

5.1.3 Unit 3 – Basalt bedrock and/or boulders

Unit 3 was encountered underlying the Unit 2 to depths between 0.25m and the termination depth of the test pits. However, this unit was typically found to depths between 0.5m and 1m bgl.

This unit was generally recovered as gravel with clay, Gravelly Clay, cobbles and boulders. The excavator bucket was unable to continue on several locations (typically between 0.7m and 1.3m bgl) due to refusal on moderately weathered basalt rock and/or rock floaters.

5.2 Groundwater

Overall, groundwater was not observed during the investigation. However, the test pits were only extended to a shallow depth. Only TP14 showed a wet soft silt layer on the surface, which is considered to be due to the recent rain prior to the fieldwork.

5.3 Lancefield Road Pavement Upgrade

The following section provides a summary of the subsurface stratigraphy that is inferred from the currently available site investigation data and as such only represents the site conditions at the pavement dippings. It is possible that conditions elsewhere on the sites and between dipping locations differ from those described in this report and upon which the following recommendations are based.

The seven (7 No.) pavement dippings (PD01-PD06, & PD14) revealed a predominantly granular pavement with a thin asphalt surfacing. The pavement profile is summarised in the table below.

Table 5-2: Existing Pavement Profile

Layer thickness	PD01	PD02	PD03	PD04	PD05	PD06	PD14
Surfacing (mm)	40	80	130	120	30	30	35
Base (mm)	200 (GW)*	200 (GW)*	220 (GW)	380 (GW)	70 (GW)	70 (GW)	205 (GW)
Sub Base (mm)	360 (GW)	320 (GW)	90 (GW)	-	400 (GM)**	100 (SW)	210 (GM)
Lower Sub Base (mm)	-	150 (GM)	50 (GM)	-	-	70 (Cl)	-
Capping Layer/ Pavement Fill (mm)	-	-	210 (GC)	660 (GW)**	-	130 (SC)	70 (CH)
Total Pavement thickness (mm)	600	750	600	1160	500	400	520
Subgrade	600 - TD	750 - TD	600 - TD	1160-TD	500-TD	400 - TD	520 - TD

*Cement Treated, ** Cobbles and Boulders (possibly Non-Descript Crushed Rock), TD – Termination Depth

The natural subgrade soils were described as high plasticity basaltic Silty Clays which was underlain at shallow depths by bedrock and or basalt boulders.

5.4 Existing Pavement Material analysis

Laboratory testing of the existing base course materials recovered from the pavement dipping's along Lancefield Road was undertaken to compare their grading characteristics with those specified in Section 812 of the VicRoads Specification "Crushed Rock for Base and Sub-base Pavement". A graphical summary of the laboratory test results and the VicRoads grading limits is shown within the following figures.

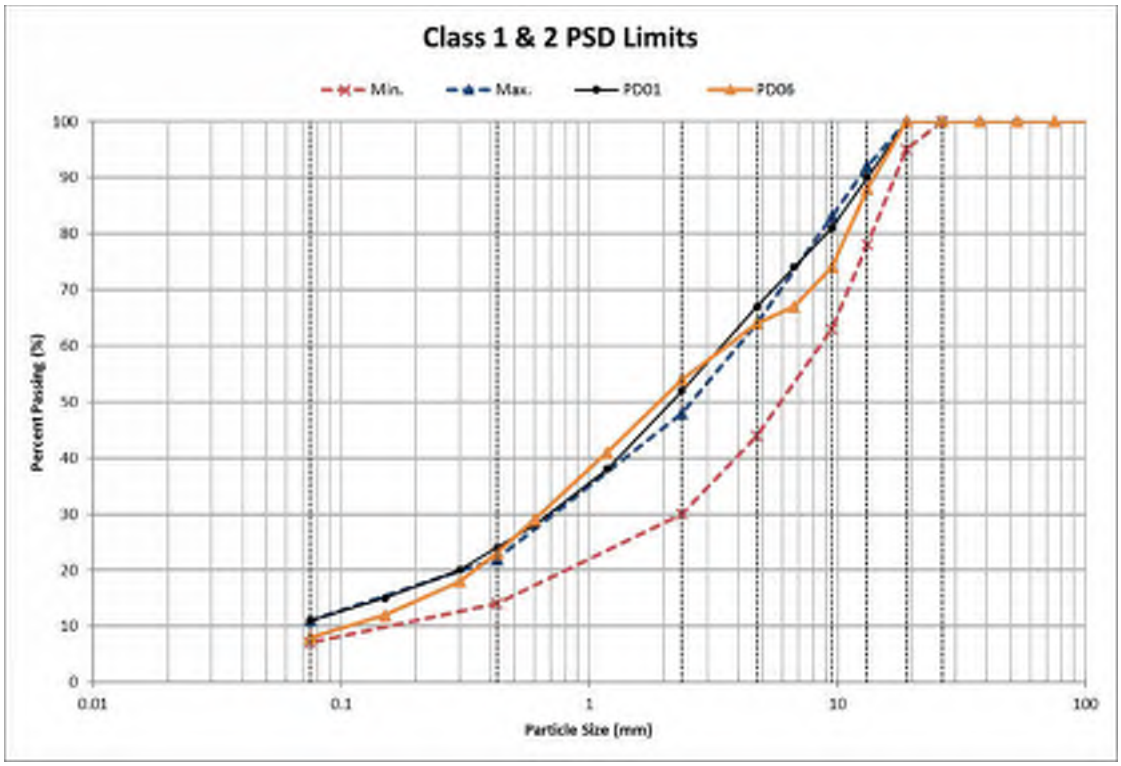


Figure 5-1: Graphical summary of grading analysis – VicRoads 20 mm Class 1 & 2

A comparison of the laboratory results with VicRoads Specification for 20 mm Class 1 & 2 crushed rock show that the samples tested are partially outside the recommended grading limits.

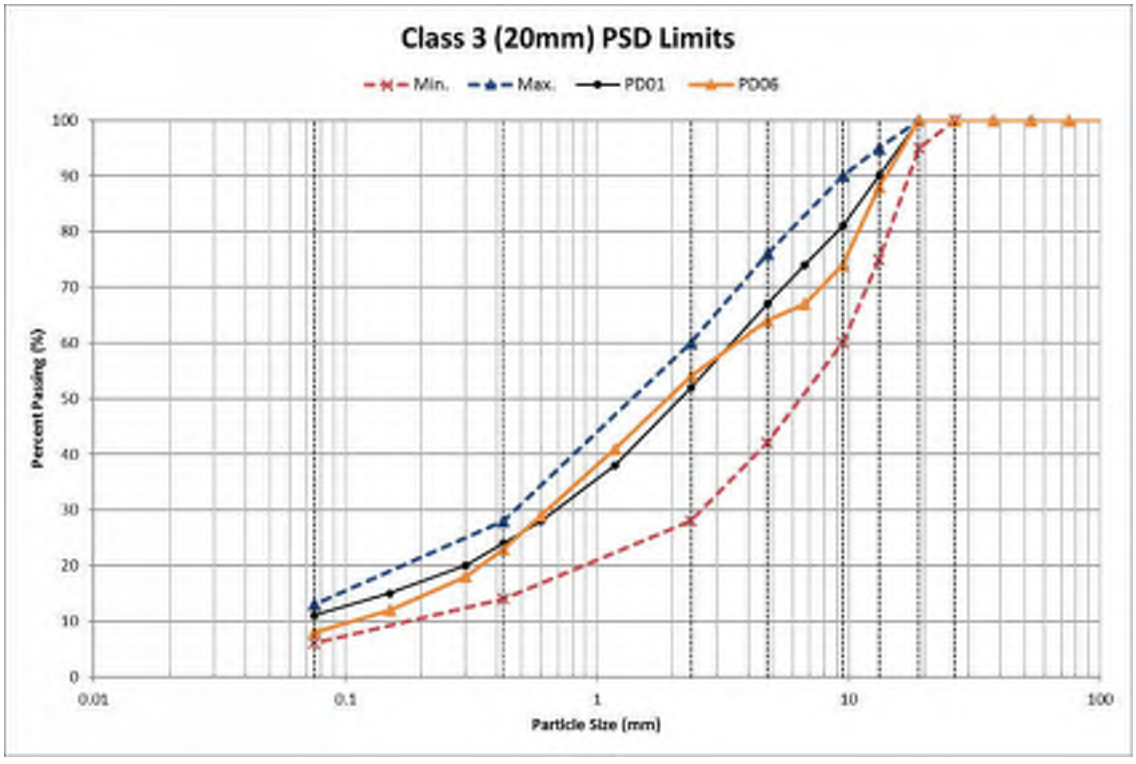


Figure 5-2: Graphical summary of grading analysis – VicRoads 20mm Class 3

A comparison of the laboratory results with VicRoads Specification for 20mm Class 3 crushed rock show that the samples tested are within the recommended grading limits. A comparison of the liquid limit (LL) and Plastic Limit (PI) laboratory test results versus the VicRoads limits for Class 3 crushed rock is provided within the table below. It can be seen that the samples tested met the plasticity limits recommended for Class 3 crushed rock.

Table 5-3 Comparison between VicRoads LL and PI specification limits and measured values

Pavement Dipping No.	Sample Depth (m)	VicRoads Material Type	VicRoads Specification Limits		Test Results	
			LL%	PI%	LL%	PI%
PD01	0.10-0.24 m	20 mm Class 3	<35	<10	20	2
PD06	0.03-0.10 m	20 mm Class 3	<35	<10	N/A	NP

Two tests were carried out on existing pavement materials recovered from Lancefield Road. The samples tested meet the VicRoads requirements for 20 mm Class 3 crushed rock, and may be suitable for reuse as Class 3 crushed rock subbase. It is considered that the material logged as Sandy Gravel (GW) may be suitable for reuse as Class 3 Crushed Rock but further testing of the existing pavement materials should be done during construction to confirm.

6 Pavements design

The following guidelines and codes have been used in the production of the pavement designs:

- Austroads Guide to Pavement Technology Part 2, 2017: Pavement Structural Design (AGPT02-2012).
- Growth Areas Authority (April 2011) Engineering Design and Construction Manual for Residential Subdivisions. Now known as the Victorian Planning Authority);
- Hume City Council guidelines; and
- VicRoads Code of Practice RC500.22.

For the two layer asphalt pavements within the subdivision, the EDCM mandates the use of a crumbed rubber modified binder asphalt for pavements constructed over expansive subgrades. In response to requests from the industry, an alternative pavement composition with the use of asphalt mixes containing standard grade bitumen together with a SAMI (Stress Alleviating Membrane Interlayer) has been provided as per Addendum 1 to Section 11 of the EDCM[3].

The combined thickness of the base course and the asphalt surfacing (or asphalt layers) has been set to 190 mm to match a standard kerb height of 190mm.

6.1 Subgrade design CBR value

Based on the soil plasticity, particle size distribution, linear shrinkage and measured swell values, and our prior experience with similar soils, the clay subgrade is considered to be highly to very highly expansive in nature and a capping layer is required and the pavement needs to satisfy the minimum thickness over expansive subgrade in accordance with Figure 5.1 of VicRoads RC500.22.

It is possible that bedrock will be exposed at or above subgrade level along sections of some roads. If rock is exposed at or above design subgrade level further, advice should be sought in relation to pavement design thickness as an alternative pavement design may be economically viable depending on the length of pavement over which the rock is exposed.

6.1.1 Internal Subdivision Roads

Given the soil profiles encountered and assuming that the new pavements will be constructed to have a finished level at or near the existing surface level, it is most likely that the basaltic clay (Unit 2) will form the subgrade of the internal roads.

The surficial silt (Unit 1) or the topsoil is likely to be removed to the subgrade level of the pavement designs. Pavements should not be founded onto the silt. If the Silt depth is deep, and it requires to be excavated below the design subgrade level, the over excavation should be backfilled up to the design subgrade levels using onsite clay, imported clay or clayey gravel, which has a minimum laboratory soaked CBR value of 2.5% and swell of less than or equal to 2.5%. The backfill should be constructed in layers no more than 200 mm (loose thickness) and compacted to a minimum compaction of 98% of standard maximum dry density.

Taking into consideration the variability of soil profiles encountered, the drainage conditions and the plasticity of the soils together with the field and laboratory soaked CBR values a design CBR value of 2.5% is recommended for the basaltic clay subgrade (Unit 2).

[3] Victorian Planning Authority (October 2015) EDCM Addendum 1. Bitumen Crumb Rubber Asphalt.

6.1.2 Lancefield Road pavement upgrade and future Widening

Two 4-day Soaked CBR tests were carried out along Lancefield Road and they produced results of 1.5% and 2.0%. Therefore, it is considered that a design subgrade CBR of 1.5% should be adopted along Lancefield Road. Furthermore, the existing pavement base and sub base material may be reused as 20 mm Class 3 Crushed Rock, if required.

6.2 Design Traffic Loadings

6.2.1 Design Traffic Volume

6.2.1.1 Traffic volumes for Internal Subdivision Roads

A traffic and transport assessment report was carried out by Cardno (Ref: V181349, dated 11 July 2019) for 170 Lancefield Road. This report was forwarded to Tonkin and Taylor by Moremac Property Group for the purposes of pavement design. The daily traffic volumes along the internal street network have been assessed by Cardno for the road network within the proposed subdivision and are presented within Figure 6-1.

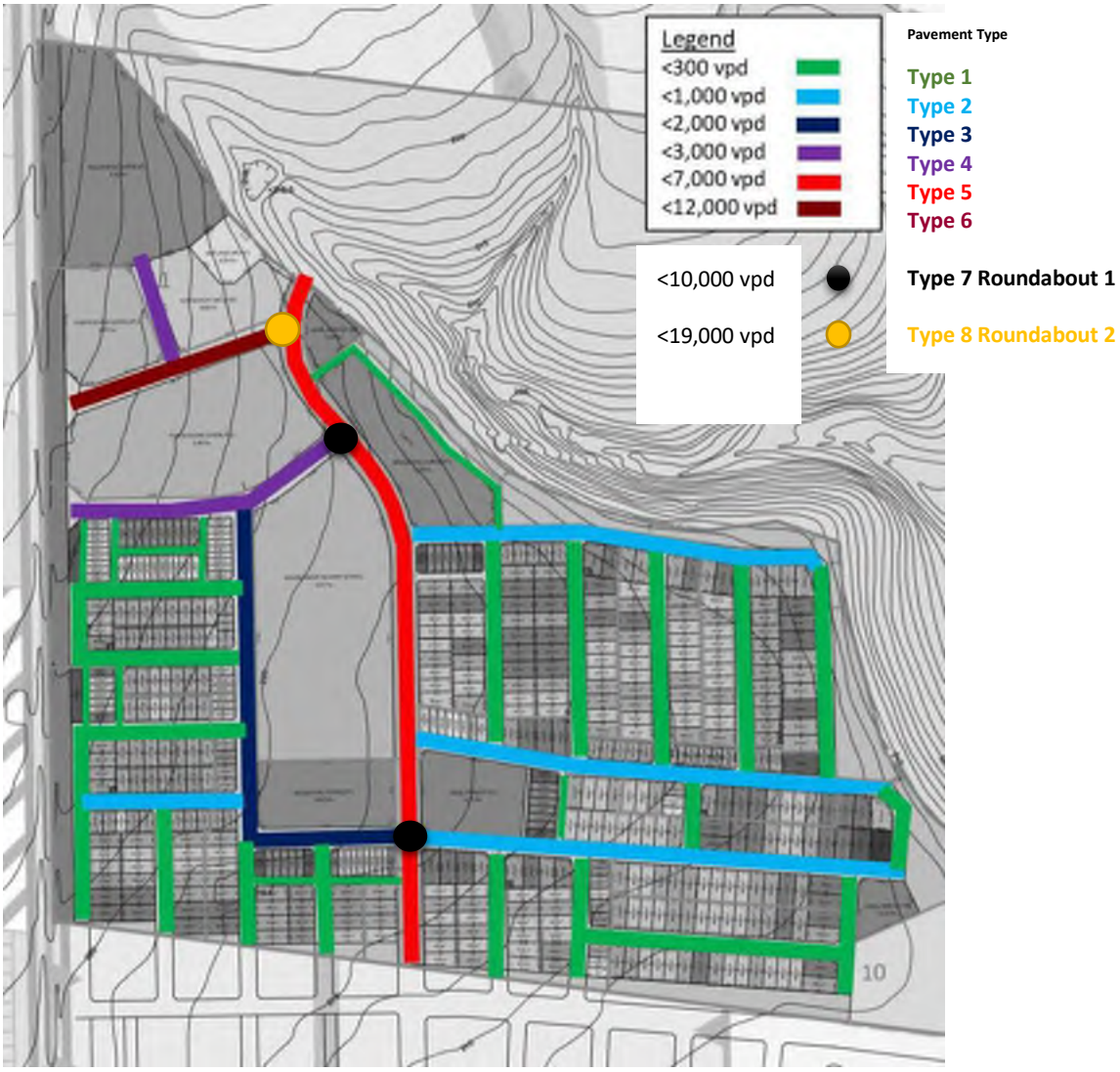


Figure 6-1: Indicative Future Traffic Volumes (source: Figure 5-3 Cardno Traffic and transport assessment)

6.2.1.2 Traffic Volumes for Lancefield Road

The traffic volumes for Lancefield Rd were provided by Cardno via email (Ref: *RE: 1010770 Kingsfield Sunbury*, from Thomas Lawrence to Pablo Toro, dated 22 July 2019). Cardno utilised GTA Consultants modelling for three different scenarios: 25%, 75% and 100% development of the Precinct Structure Planning (PSP). GTA Consultants' traffic volumes north of Lancefield Rd and Rolling Meadows Dr intersection are significantly lower than the volumes provided south of the intersection.

As per comments in Cardno's email, "*Please note that VITM modelling should not be taken as a highly accurate estimate of traffic volumes, this is especially true of local side streets. Accordingly, in the 25 % development scenario where the volume drop north of the intersection but increase past the following intersection I would recommend that the volumes south of the intersection be adopted for the whole intersection.",* the traffic volumes south of the intersection have been used for the whole intersection.

Similarly, for the 75% and 100% development scenarios, the traffic volumes south of the intersection (which are noted to be higher, and generally tend to equate to the sum of the traffic north of the intersection and Rolling Meadows Drive) have been used for the whole intersection. Where this may not be the case, T+T should be sought for advice for the provided pavement designs.

6.2.2 Heavy Vehicle Parameters

6.2.2.1 Internal Subdivision Roads

The design traffic loadings for the 8 pavement areas (6 midblock areas and 2 roundabouts) within the subdivision were calculated using the appropriate methodology provided in Growth Areas Authority (April 2011) Engineering Design and Construction Manual.

6.2.2.2 Lancefield Road

However, for Lancefield Road, traffic loading parameters recommended in VicRoads Codes of Practice RC500.22 (Table B5.09) have been adopted. A growth rate of 3%, 1%, and 0% has been used for the 25%, 75% and 100% development scenarios. Where this may not be the case, T+T should be sought for advice for the provided pavement designs.

The heavy vehicle percentage of 8% has been adopted. This is based on a review of VicRoads published data for vehicle traffic on the subject section of Lancefield Road. Where this may not be the case, T+T should be sought for advice for the provided pavement designs.

6.2.3 Design Traffic Loadings – HVAG's and ESA's

All pavements have been designed for a 20-year design period. If, in the future, more specific traffic information becomes available, the pavement design options will need to be reviewed. A summary of the calculated DTL and adopted design parameters are provided in the following tables.

Table 6-1 Determination of design traffic loadings

Description	Access lane	Access place	Access St 1	Access St 2	Connector	Arterial-LAC
Traffic Load Parameter	**Type 1**	**Type 2**	**Type 3**	**Type 4**	**Type 5**	**Type 6**
Design Period (years)	20	20	20	20	20	20
AADT (Vehicles per day)	300	1,000	2,000	3,000	7,000	12,000
% Heavy Vehicles (HV)	4%	5%	6%	7%	8%	9%
Direction Factor	0.5	0.5	0.5	0.5	0.5	0.5
Lane Distribution Factor	1	1	1	1	1	1
Annual Growth Rate (%)	0.5%	1.0%	1.5%	2.0%	2.5%	3.0%
N_{HVAG}/HV	2.1	2.2	2.25	2.3	2.35	2.4
ESA/HVAG	0.3	0.35	0.4	0.45	0.5	0.55
N_{DT} (HVAG's)	9.65×10^4	4.42×10^5	1.14×10^6	2.14×10^6	6.14×10^6	1.27×10^7
Design Equivalent Standard Axles ESAs	2.89×10^4	1.55×10^5	4.56×10^5	9.64×10^5	3.07×10^6	6.99×10^6
Additional Construction Traffic (%)	5%	4%	3%	3%	-	-
Final Design ESA	**3.04×10^4**	**1.61×10^5**	**4.69×10^5**	**9.93×10^5**	**3.07×10^6**	**6.99×10^6**

ESA: Equivalent Standard Axles where a Standard Axle is a dual-tyred single axle loaded to 8.2 tonne.

Table 6-2 Determination of design traffic loadings

Description	Roundabout 1	Roundabout 2	Lancefield Rd 25% PSP development	Lancefield Rd 75% PSP development	Lancefield Rd 100% PSP development
Traffic Load Parameter	**Type 7**	**Type 8**	**Type 9**	**Type 10**	**Type 10**
Design Period (years)	20	20	20	20	20
AADT (Vehicles per day)	10,000	19,000	18,960	23,500	37,000
% Heavy Vehicles (HV)	8%	9%	8%	8%	8%
Direction Factor	0.5	0.5	0.5	0.5	0.5
Lane Distribution Factor	1	1	1	1	0.65*
Annual Growth Rate (%)	3.0%	3.0%	3.0%	1.0%	0.0%
N_{HVAG}/HV	2.4	2.4	2.6	2.6	2.6
ESA/HVAG	0.55	0.55	0.796	0.796	0.796
N_{DT} (HVAG's)	9.42×10^6	2.01×10^7	1.93×10^7	$1.96E \times 10^7$	1.83×10^7
Final Design ESA	**5.18×10^6**	**1.11×10^7**	**1.54×10^7**	**1.56×10^7**	**1.45×10^7**

*As per Table 7.3 of AGPT02-17, the LDF may be reduced to 0.65 in an urban location where there are 3 through lanes in each direction.

Analysis of the traffic loading for Lancefield Rd revealed that the traffic loading remains relatively similar for the three cases (25%, 75% and 100% development of the PSP) due to the effects of the annual growth rate and the lane distribution factor.

6.3 Design Speed

6.3.1 Internal Subdivision Roads

Intersections and/or roundabouts have been based on a pavement design speed of 10km/h and midblock sections on a pavement design speed of 40km/h (on the basis of a 50km/h posted speed zone).

6.3.2 Lancefield Road

For the 25% scenario, the concept design plans do not show this intersection to be signalised, but rather a midblock pavement with turning lanes. As such, in this instance, the pavement design has been done for a pavement design speed of 80km/h (on the basis of a ≥100km/h posted speed zone).

However, for the 75% and 100% scenario, a signalised intersection is proposed, and such, pavements have been designed on a pavement design speed of 10km/h.

6.4 Intersection Treatment Limits

As per VicRoads RC500.22, it is recommended that the intersection treatments should commence from the start of the turn tapers or at least 80 m from the stop line whichever is the greater and extend for the first 30 m on the departure side of the intersection.

6.5 Pavement structures and compositions within the Subdivision

Table 6-3 Type 1 – Two layer asphalt pavement: Access Ln (CBR: 2.5%, DTL: 3.04 x 10^4 ESA)

Layer	Thickness (mm)	Material
Wearing course	20	Size 7 mm Type L Asphalt (Class 170 binder)
Base Course	30	Size 10 mm Type N Asphalt (Class 170 binder)
Interlayer	-	Size 10 mm SAMI with S18RF Binder
Bonding Layer	-	Bituminous Prime
Base	140	Size 20 mm Class 2 Crushed Rock Compacted to a minimum characteristic density ratio of 98% (Modified) Maximum Dry Density AS1289, 5.2.1
Subbase	120	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	150	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**460**	
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Table 6-4 Type 2 – Two layer asphalt pavement: Access place (CBR: 2.5%, DTL: 1.61 x 10^5 ESA)

Layer	Thickness (mm)	Material
Wearing course	30	Size 10 mm Type N Asphalt (Class 170 binder)
Base Course	30	Size 10 mm Type N Asphalt (Class 170 binder)
Interlayer	-	Size 10 mm SAMI with S18RF Binder
Bonding Layer	-	Bituminous Prime
Base	130	Size 20 mm Class 2 Crushed Rock Compacted to a minimum characteristic density ratio of 98% (Modified) Maximum Dry Density AS1289, 5.2.1
Upper Subbase	100	Size 20 mm Class 3 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Lower Subbase	100	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	160	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**550**	
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Table 6-5 Type 3 – Two layer asphalt pavement: Access St 1 (CBR: 2.5%, DTL: 4.69 x 10^5 ESA)

Layer	Thickness (mm)	Material
Wearing course	30	Size 10 mm Type N Asphalt (Class 170 binder)
Base Course	30	Size 10 mm Type N Asphalt (Class 170 binder)
Interlayer	-	Size 10 mm SAMI with S18RF Binder
Bonding Layer	-	Bituminous Prime
Base	130	Size 20 mm Class 2 Crushed Rock Compacted to a minimum characteristic density ratio of 98% (Modified) Maximum Dry Density AS1289, 5.2.1
Upper Subbase	100	Size 20 mm Class 3 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Lower Subbase	130	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	180	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**600**	
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Table 6-6 Type 4 – Two Layer Asphalt pavement: Access St 2 (CBR: 2.5%, DTL: 9.93 x 10^5 ESA)

Layer	Thickness (mm)	Material
Wearing course	40	Size 14 mm Type N Asphalt (Class 170 binder)
Base Course	40	Size 14 mm Type HP Asphalt (A10E binder)
Interlayer	-	Size 10 mm SAMI with S18RF Binder
Bonding Layer	-	Bituminous Prime
Base	110	Size 20 mm Class 2 Crushed Rock Compacted to a minimum characteristic density ratio of 98% (Modified) Maximum Dry Density AS1289, 5.2.1
Upper Subbase	150	Size 20 mm Class 3 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Lower Subbase	160	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	250	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**750**	
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Table 6-7 Type 5 – Full depth asphalt pavement: Connector (CBR: 2.5%, DTL: 3.07 x 10^6 ESA)

Layer	Thickness (mm)	Material
Wearing course	40	Size 14 mm Type H Asphalt (Class 320 binder)
Intermediate Course	75	Size 20 mm Type SI Asphalt (Class 320 binder)
Base Course	75	Size 20 mm Type SF Asphalt (Class 320 binder)
Subbase	150	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	260	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**600**	**Minimum as per VicRoads RC500.22**
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Table 6-8 Type 6 – Depth strength asphalt pavement: Arterial (CBR: 2.5%, DTL: 6.99 x 10^6 ESA)

Layer	Thickness (mm)	Material
Wearing course	40	Size 14 mm Type H Asphalt (Class 320 binder)
Intermediate Course	75	Size 20 mm Type SI Asphalt (Class 320 binder)
Base Course	75	Size 20 mm Type SF Asphalt (Class 320 binder)
Base	100	Size 20 mm Class 3 Cement Treated Crushed Rock Compacted to a mean density ratio of 96% (Modified) Maximum Dry Density AS1289,5.2.1
Subbase	130	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	250	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**670**	**Minimum as per VicRoads RC500.22**
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Table 6-9 Type 7 – Full depth asphalt pavement: Roundabout 1 (CBR: 2.5%, DTL: 5.18 x 10^6 ESA)

Layer	Thickness (mm)	Material
Wearing course	40	Size 14 mm Type V Asphalt (Class 320 binder)
Intermediate Course	75	Size 20 mm Type SI Asphalt (Class 320 binder)
Base Course	75	Size 20 mm Type SF Asphalt (Class 320 binder)
Base	100	Size 20 mm Class 3 Cement Treated Crushed Rock Compacted to a mean density ratio of 96% (Modified) Maximum Dry Density AS1289,5.2.1
Subbase	100	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	260	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**650**	**Minimum as per VicRoads RC500.22**
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Table 6-10 Type 8 – Depth strength asphalt pavement: roundabout 2 (CBR: 2.5%, DTL: 1.11 x 10^7 ESA)

Layer	Thickness (mm)	Material
Wearing course	40	Size 14 mm Type V Asphalt (Class 320 binder)
Intermediate Course	75	Size 20 mm Type SI Asphalt (Class 320 binder)
Base Course	75	Size 20 mm Type SF Asphalt (Class 320 binder)
Base	130	Size 20 mm Class 3 Cement Treated Crushed Rock Compacted to a mean density ratio of 96% (Modified) Maximum Dry Density AS1289,5.2.1
Subbase	150	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	250	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**720**	**Minimum as per VicRoads RC500.22**
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥2.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

6.6 Pavement structures and compositions for Lancefield Road

Type 9 pavement design provided is for a midblock pavement, for the 25% development scenario.

Table 6-11 Type 9 – Depth strength asphalt pavement (CBR: 1.5%, DTL: 1.54 x 10^7 ESA)

Layer	Thickness (mm)	Material
Wearing course	40	Size 14 mm Type H Asphalt (Class 320 binder)
Intermediate Course	75	Size 20 mm Type SI Asphalt (Class 320 binder)
Base Course	75	Size 20 mm Type SF Asphalt (Class 320 binder)
Base	130	Size 20 mm Class 3 Cement Treated Crushed Rock Compacted to a mean density ratio of 96% (Modified) Maximum Dry Density AS1289,5.2.1
Subbase	150	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	300	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**770**	**Minimum as per VicRoads RC500.22**
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥1.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

Type 10 pavement design provided is for the intersection pavement, for the 75% and 100% development scenario.

Table 6-12 Type 10 – Depth strength asphalt pavement Rd (CBR: 1.5%, DTL: 1.56 x 10^7 ESA)

Layer	Thickness (mm)	Material
Wearing course	40	Size 14 mm Type V Asphalt (Class 320 binder)
Intermediate Course	75	Size 20 mm Type SI Asphalt (Class 320 binder)
Base Course	75	Size 20 mm Type SF Asphalt (Class 320 binder)
Base	150	Size 20 mm Class 3 Cement Treated Crushed Rock Compacted to a mean density ratio of 96% (Modified) Maximum Dry Density AS1289,5.2.1
Subbase	150	Size 20 mm Class 4 Crushed Rock Compacted to a minimum characteristic density ratio of 97% (Modified) Maximum Dry Density AS1289,5.2.1
Capping layer	280	Type A Material (Capping Layer) meeting the following material properties: CBR ≥7%, Swell ≤ 1.5%, Permeability k ≤ 1 x 10-9 m/s. Compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1
Total	**770**	**Minimum as per VicRoads RC500.22**
Subgrade	-	Material as found (CLAY), Minimum in-situ CBR ≥1.5% Top 200 mm compacted to a minimum density ratio of 98% (Standard) Maximum Dry Density AS1289, 5.1.1

CIRCLY 6 has been utilised for the modelling of the internal roads for the subdivision and CIRCLY 7 for Lancefield Rd. CIRCLY output files have been attached as Appendix C.

7 Pavement construction

7.1 Subgrade preparation

7.1.1 Weathered rock

Should rock be exposed above subgrade level or at a depth which is 150mm or less below subgrade level, it should be over-excavated to a depth of at least 150mm below subgrade level. The formation should then be infilled to subgrade level using Class 3 crushed rock.

7.1.2 Effects of weather

Previous experience with soils as described within this report has shown that they are susceptible to severe loss of strength with an increase in moisture content that can occur during wetter times of the year or after heavy rainfall. Therefore significant subgrade improvement may be required if construction is programmed during winter or heavy rainfall occurs during the construction period. Wetting up of clay soils can also create problems with the subgrade meeting proof rolling requirements. Previous experience however, has shown that these materials if carefully treated or controlled can lead to the construction of roads exhibiting good performance.

While it would be preferable for construction to be programmed for the drier months, given the possibility wet weather during construction, the following actions are likely to prove beneficial.

- Shape and compact the formation to maximise surface water runoff and minimise the infiltration of water.
- Replace unsuitably wet materials with a suitable fill (lower subbase material) such as sand, quarry rubble or soft rock to enable construction to proceed.
- After the formation has been prepared, construct the subgrade improvement layer as soon as possible to protect the formation from adverse weather and to provide a platform suitable for construction vehicles.

Note: The suitability of any proposed fill for this purpose will require laboratory testing and/or have sufficient proven performance in practice.

7.1.3 Compaction

The top 200 mm of subgrade soils should be compacted to a minimum dry density ratio of 98% of standard compaction at moisture contents of ±2% of standard optimum moisture content.

It is recommended that a subgrade inspection and testing (through Hilf rapid compaction tests and/or DCP tests) is undertaken at the boxing out stage of after in-situ stabilisation to assess the condition of the subgrade and to assess the need (if any) for further subgrade improvement unless in-situ stabilisation of the subgrade is to be undertaken.

7.1.4 Proof rolling

The subgrade is required to be proof rolled to confirm that the subgrade is a uniform sound surface free of weak areas. Proof rolling should be conducted by a pneumatic-tyred roller loaded to 1.5 t/wheel and with a tyre pressure of 450 kPa. It is recommended that the proof roll be inspected and assessed by a suitably qualified Engineer. Areas where there is visible rutting in excess of 10 mm in depth or where the subgrade "springiness"[4] is observed, the affected area should be marked and the soil in those areas removed and replaced with stronger and/or drier material compacted in accordance with the requirements of Section 7.1.3.

The proof roller should be operated to provide two passes of all areas road formation.

A proof roll carried out on the natural clay subgrade will most likely result in permanent deformation due the low strength of the soil. It is recommended that a proof roll is not undertaken until the capping layer is placed on the natural clay soil. It is also recommended that the proof roll be inspected and assessed by a suitably qualified Engineer.

7.2 Subgrade improvement

7.2.1 Expansive clays

Given the laboratory results obtained on the cohesive subgrade material at this site, the underlying cohesive clay soils are expected to be highly expansive and therefore have the potential to shrink and swell with changes in moisture content.

The Austroads (2017) Guide to Pavement Technology Part 2 provides some advice on controlling the effects of volume changes in moderately expansive soils on pavements. A common technique used to reduce volume change involves the inclusion of a Select Fill capping layer above the expansive soil. This layer minimises the moisture ingress to the expansive soil and provides a minimum depth of cover over the expansive soils so that the effects of any volume change on the pavement are minimised. The inclusion of the capping layer also provides a working platform, allowing construction to proceed in adverse weather conditions.

The construction of the pavements should be completed as expeditiously as possible in order to reduce the period of exposure of the subgrade to:

- Warm to hot and windy weather which are the optimum drying conditions and drying of the expansive subgrade will result in cracking of the subgrade
- Wet weather conditions which will result in a sever loss of subgrade strength

The capping layer should be placed immediately after the formation is excavated and trimmed to the design subgrade level. Proof rolling should be conducted on the surface of the capping layer to avoid extending the time of exposure of the subgrade. The completion of the pavement should proceed immediately following an acceptable proof rolling response.

Further to the above, it is desirable that the subbase layer and the capping layer be extended 1 m beyond the back of kerb and channel to minimise moisture variation in the subgrade at the edge of the pavement.

[4] Springiness is a term to describe movement of the subgrade in areas away from the immediate vicinity of the roller during the proof rolling operation

The minimum depth of pavement over an expansive subgrade is determined in accordance with the VicRoads Code of Practice RC500.22, Figure 5.1. In order for the capping layer to be effective it is essential that the depth of sub-surface drains is above the base of the capping layer.

7.2.2 Select fill material

The select fill capping layer should be placed as soon as possible after the completion of subgrade preparation. In weather conditions which are likely to result in the wetting up or drying out of the subgrade it is recommended that the placement and compaction of the capping layer precede the proof rolling. The select fill capping layer is to comply with VicRoads requirements for capping layer material as stated in Table 6-3 to Table 6-12 and Section 7.4.1 of this report.

Filling should be supervised by a Geotechnical Inspection and Testing Authority appointed by the Principal in accordance with a 'Level 1' inspection and testing regime as detailed in AS3798-2007 Guidelines on Earthworks for Residential and Commercial Developments. The fill should be placed in layers not exceeding 200 mm in loose thickness and compacted to a minimum dry density ratio of 98% Standard Maximum Dry Density.

7.3 Drainage

Providing adequate surface and sub-surface drainage is essential for the proper functioning of a pavement.

To improve the trafficability of the site and to minimise construction delays, adequate drainage of the site during construction should be provided. No pooling of water, either on natural or stripped surfaces within the boxed out areas should be allowed.

7.3.1 Surface drainage

The pavements should be constructed with a minimum cross fall of 3% to ensure drainage of the asphalt surface.

Where catch or table drains are to be provided, careful consideration should be given to minimising the potential for water in the table drain to infiltrate the upper zone of the subgrade. This can be achieved by designing the drains to ensure that the water level remains at least 250 mm below subgrade level. Other factors that should be considered in designing the drains include flow velocity, shape, turn-off (discharge) areas and sediment control. Open drains such as catch drains and table drains should be regularly maintained to remove of any debris or sediment accumulation.

7.3.2 Subsurface drainage

The preferred subsurface drainage system is a 100 mm diameter AGI, installed along both sides of the pavement and installed in accordance with VicRoads[5] Section 702 and include flushing points at the remote end from the outlet pit.

Subsurface drains shall also be required at the interface of existing and new pavements where the new pavement material is likely to trap water within the adjacent existing materials. Subsurface drains should be installed on the high side of the new pavement. If the bottom of the new pavement is located within the subgrade such that it creates a sump, subsurface drainage should also be installed on the low side of the pavement.

[5] VicRoads Standard Specifications for Roadworks and Bridgeworks

7.4 Flexible pavement

7.4.1 Capping layer

Earthworks material to be used as Capping Layer must have following properties;

- soaked CBR of more than 7.0%;
- swell of less than 1.5%;
- liquid limit of less than 50%;
- plasticity index (PI) of less than 25%;
- PI x % less than 0.425 mm sieve of less than 1200; and
- hydraulic conductivity of less than 1 x 10^{-9} m/s measured at OMC ±5%.

Capping layer should be a minimum of 150 mm thick or at least 2.5 times the maximum particle size in the layer. The layer should extend laterally to at least 0.6 m beyond the back of the kerb and channel.

Given the laboratory results obtained on the cohesive subgrade material at this site, the underlying cohesive clay soils are expected to be between moderately and highly expansive and therefore have the potential to shrink and swell with changes in moisture content.

The Austroads (2012) Guide to Pavement Technology Part 2 provides some advice on controlling the effects of volume changes in moderately expansive soils on pavements. A common technique used to reduce volume change involves the inclusion of a capping layer above the expansive soil. This layer minimises the moisture ingress to the expansive soil and provides a minimum depth of cover over the expansive soils so that the effects of any volume change on the pavement are minimised. The inclusion of the capping layer also provides a working platform, allowing construction to proceed in adverse weather conditions.

The construction of the pavements should be completed as expeditiously as possible in order to reduce the period of exposure of the subgrade to:

- warm to hot and windy weather which are the optimum drying conditions and drying of the expansive subgrade will result in cracking of the subgrade.
- wet weather conditions which will result in a sever loss of subgrade strength.

The capping layer should be placed immediately after the formation is excavated and trimmed to the design subgrade level. Proof rolling should be conducted on the surface of the capping layer to avoid extending the time of exposure of the subgrade. The completion of the pavement should proceed immediately following an acceptable proof rolling response.

Further to the above, it is desirable that the subbase layer and the capping layer be extended 1 m beyond the back of kerb and channel to minimise moisture variation in the subgrade at the edge of the pavement.

The minimum depth of pavement over an expansive subgrade is determined in accordance with the VicRoads Code of Practice RC500.22, Figure 5.1. In order for the capping layer to be effective it is essential that the depth of sub-surface drains is above the base of the capping layer.

7.4.2 Granular layers

The base and sub-base crushed rock should comply with VicRoads[6] Section 812 and should be placed and compacted in accordance with VicRoads[6] Section 304 to the minimum density ratios specified in the pavement design tables Table 6-3 to Table 6-12.

The use of recycled crushed concrete complying with VicRoads[6] Sections 820 or 821 may be used in place of Class 3 or Class 4crushed rock in sub-base layers.

The maximum thickness of any pavement base layer shall not exceed 160 mm and the maximum thickness of any sub-base layer shall not exceed 200 mm.

Refer to VicRoads[6] Section 310 for the preparation requirements of unbound granular pavements for sprayed bituminous surfacing or asphalt surfacing.

Each crushed rock should be compacted at or close to optimum moisture content but should be dried back to no more than 70% of optimum moisture content prior to placing the overlying layer. If materials are not subject to dry back, the stiffness's adopted in the pavement design will not be achieved.

Size 40 mm crushed rock within the upper subbase layer of full depth asphalt pavements is not recommended due to difficulties associated with finishing to a smooth surface on which to lay asphalt.

7.4.3 Prime or primerseal

Cutback bitumen or bitumen emulsion prime or a primerseal incorporating a bitumen emulsion binder, is recommended as a treatment prior to the application of new sprayed seals or thin asphalt surfacing over a fine crushed rock base. The main functions of the prime or primerseal are to reduce surface dust, to waterproof the underlying layers, and provide a better bond between the base course and the asphalt.

Cutback bitumen can be used where construction is undertaken provided the cutback can be cured before the final surfacing is placed over the prime. In the summer months curing of the cutback can occur in a matter of hours but in cooler weather may take several days. Where there is insufficient time to cure cutback then an emulsion prime or primerseal is preferred.

A primerseal is also preferred where the pavement is to be subject to traffic including construction traffic prior to laying asphalt.

When the application of the surfacing is delayed, significant construction savings may be realised, especially during the winter months, through the use of primerseal which helps to prevent moisture ingress and possible damage to the pavement. Note that a primerseal should not be trafficked for longer than twelve months.

7.4.4 SAMI

A SAMI (Strain Alleviating Membrane Interlayer) treatment is a sprayed seal with a high application rate of highly polymer or rubber modified binder. A SAMI is normally placed below a new asphalt layer to provide a flexible membrane. This acts to delay the onset of reflective cracking in the new asphalt surfacing as a result of cracks in the underlying pavement layer, which may result from the expansive subgrade. Typically, S18RF, S25E or S45R Polymer Modified Binder (PMB) is used. Design

[6] VicRoads Standard Specifications for Roadworks and Bridgeworks

and application of SAMI, including material requirements, should comply with VicRoads Section 408 and the current Austroads Sprayed Seal Design Method.

Care needs to be taken to ensure that aggregate is not overspread and the SAMI should be swept to remove all loose aggregate prior to the application of a tack coat and placement of asphalt as any loose or surplus aggregate will be detrimental to the bonding between the SAMI and asphalt layers.

7.4.5 Tack coat

Where lower layers of asphalt or primerseals are left exposed for periods longer than 24 hours or are in dusty conditions, then the surface of the asphalt should be tack coated prior to placing the overlying asphalt layer. The tack coat should consist of an application of bitumen emulsion at a rate of 0.1 to 0.2 l/m^2 of residual bitumen.

7.4.6 Asphalt

Asphalt of the types recommended in the pavement design options should be manufactured in accordance with VicRoads[7] Section 407 and should be registered with a 'General' status on the VicRoads Mix Register. Asphalt mixes should be supplied, placed and compacted in accordance with VicRoads[7] Section 407.

The roads should not be opened to traffic prior to completion of the asphalt wearing course where Type N asphalt is utilised in the pavement structure. If the road has to be opened to traffic between the placement of successive layers of asphalt it is recommended that further advice be sought.

The design thicknesses of asphalt layers should make allowance for construction tolerances on the finish surface levels at stipulated in VicRoads Section 407.

7.5 Limitations on planting and removal of vegetation

Swelling and shrinking of the subgrade soils due to variations in moisture content which can lead to pavement cracking and roughness, can be exacerbated by the presence of trees close to the pavement. Along with adequate drainage, restrictions on the planting trees and shrubs play a critical role in ensuring stable moisture conditions are achieved within highly reactive clay sites. Additionally, the planting of large trees can result in root intrusion and disruption to the pavement subgrade.

AS2870[8] considers the potential drying effects on building foundations of existing or proposed trees planted in the vicinity of a structure. Conservatively, without consideration of species, leaf area or site environment, a minimum distance equal to the mature height of a tree or shrub may be used as an estimate of zone of influence of the tree or shrub.

Furthermore, trees removed prior to construction will provide an initially extreme soil moisture condition and as moisture is slowly regained beneath the new construction, swelling movements may be exacerbated in the vicinity of the removed trees. To counteract this extra swelling, deep soaking may be conducted in boreholes across the site, prior to construction. Soaking may be required over a period of six to twelve months and so may not be practical on many sites. When constructing pavements near mature trees, the possibility of death of any of the trees should be considered and the subsequent rebound of the soil in the vicinity of the trees should be taken into account.

[7] VicRoads Standard Specifications for Roadworks and Bridgeworks
[8] As2870-2011 Residential Slabs and Footings

8 Wetland and sediment pond construction

8.1 Excavation conditions

It is understood that Sediment Basin SD6 will be 2 m deep and the Wetland WL18 3 m deep. Test pit 16, which was carried out within the sediment basin, encountered extremely weathered basalt at 0.45 m bgl and excavator refusal on moderately weathered basalt at 0.73 m bgl. Test pits TP 36 to TP 38, which were carried out within the wetland area, encountered extremely weathered basalt between 0.5 m and 1.35 m bgl and excavator refusal on moderately weathered basalt between 1 m and 2 m bgl.

Due to the presence of weathered basalt within the anticipated depths of excavation, the retarding basin and wetland are expected to require a clay liner. Site derived clays could be reused as clay liner if treated with gypsum as described within section 9.1.

The basalt was not penetrated by our test pits. However, based on previous experience with the Newer Volcanics, excavatibility will be a factor of the rock strength and defect spacing. If rocks of few defects and substantial strength are encountered, excavation may prove difficult by conventional methods. The basalt is expected to break on rock defects and over break is likely to occur during excavation in highly fractured rock. Further details regarding excavation conditions are presented within section 10.1 “Excavation conditions”.

8.2 Temporary groundwater control

Groundwater was not observed during the investigation. Based on our assessment of the VVG database, we do not anticipate a high water table at the proposed SD6 and WL18 locations. Due to the cohesive nature of the soils, perched water may develop during periods of rainfall, although this should be controllable with localised sump pumping.

8.3 Liner requirements

It is anticipated that there will be a net flow from the basins into the surrounding soils and rock, therefore in order to maintain the design water level within the basin, and to segregate groundwater from the storm water, Melbourne Water may require construction of an impermeable liner. In any case, the proposed wetland will require a liner to maintain design water levels.

The impermeable liner could be a compacted clay liner, geosynthetic clay liner, or constructed from HDPE. Further advice should be sought from a specialist contractor regarding the suitability of placing geosynthetic clay liner or HDPE over irregular surfaces such as weathered rock.

Permeability testing carried out on samples of the clay indicate that it will achieve the minimum permeability requirements for a clay liner however the clay is highly dispersive, which may result in erosion and possible piping. Therefore it is recommended that either the site won clay is treated to make it non-dispersive or non-dispersive clay is imported. Treatment options for the site won clay are discussed in section 9.1.

8.4 Compacted clay liner construction

It is recommended that the embankment fill should be placed in horizontal layers at a loose thickness of no greater than 200 mm.

It is recommended that a minimum compacted clay liner thickness of 450 mm is adopted, subject to adequate construction control and testing. The liner should be constructed in three equal thickness horizontal layers at a loose thickness of no greater than 200 mm. A fill specification for clay liner can be provided by T+T if required.

8.5 Batter stability in Soil

Permanent cut and fill batters in soil should be no steeper than 3(h):1(v). Some unravelling of the exposed soil is still anticipated and some maintenance of the slopes is likely to be required as construction proceeds. Cut and fill batters should be protected with erosion protection matting, topsoil, and seeding as soon as practicable after construction to minimise the risk of erosion.

Basalt rock batters will be stable at this 1(h):1(v). However, flatter slopes may be required for maintenance or access purposes.

Excavated spoil should be stockpiled at a distance from the top of the excavated face equal to the depth of excavation and the ground around the excavation should be graded to fall away from the excavation to minimise surface water runoff over the unprotected batters.

8.6 ANCOLD Assessment

Melbourne Water may require that the proposed sediment basin and/or wetlands have an assessment in accordance with the guidelines and procedures of the Australian National Committee on Large Dams (ANCOLD). T+T would be pleased to assist Lancefield Development Partners if this type of assessment is required.

9 Reuse of site soils

The majority of the clay soil encountered during the investigation is likely to be suitable for reuse in some form, although some moisture conditioning may be required to produce high quality engineered fill. AS 3798[9] provides the following guidance with respect to unsuitable materials:

> "*Unsuitable materials may include –*
>
> *(a) Organic soils, such as many topsoils, severely root affected subsoils and peat;*
>
> *(b) Materials contaminated through past site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture;*
>
> *(c) Materials containing substances that can be dissolved or leached out in the presence of moisture (e.g. gypsum), or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g. some shales and sandstones), unless these matters are specifically addressed in the design;*
>
> *(d) Silts, or materials that have the deleterious engineering properties of silt;*
>
> *(e) Other materials with properties that are unsuitable for the forming of structural fill; and*
>
> *(f) Fill that contains wood, metal, plastic, boulders or other deleterious material, in sufficient*

[9] AS3798 (2007) Guidelines on earthworks for commercial and residential developments

proportion to affect the required performance of the fill."

The silty soils of Unit 1 are not considered to be suitable for reuse as structural fill. This material should be stockpiled separately from other excavated soils for possible reuse following completion of filling operations as topsoiling (in the top 300mm) on building lots or for other non-structural purposes such as landscaping works elsewhere in the subdivision. The top of the Unit 1 silt affected by rootlets will need to be stockpiled separately.

The clay soils (Unit 2) have been measured to have a maximum dry density of 1.28 to 1.53 t/m^3 and an optimum moisture content of 25.0 to 35.0%. The moisture content of samples of clay were measured between 24.6% and 37.6%, indicating that the clays may require some moisture conditioning to achieve compaction.

The liquid limit results for the clay samples vary between 58% and 92% indicating that the onsite clay is highly reactive. Moisture control and workability may be challenging on this high plasticity clay and in addition, re-use of it in areas of structures will likely lead to very high characteristic surface movements (ys).

9.1 Reuse within Wetlands

The permeability of the remoulded clay (i.e. as a compacted clay liner) was measured to be 7 x 10^{-10} m/s and 8 x 10^{-11} m/s, which is considered suitable and is less than that often required by regulators where they have environmental concerns (permeability ≤ 1x10^{-9} m/s).

However, laboratory testing of the clay soil generally categorised it as Emerson Class 2 which indicates it is dispersive, and therefore will be susceptible to internal erosion and piping. Therefore, the site won clay in its existing condition is not considered to be suitable for use as a compacted clay liner in its current state, and it will be necessary to either treat the clay to reduce its dispersivity or to import non-dispersive clay.

In order to reuse the site won clay as an impermeable liner, it will be necessary to stabilise the clay with lime or gypsum to prevent it being dispersive. To determine what proportion of gypsum would be required to render the clay non-dispersive, two sedimentation tests after Moyle and Burgess were carried out from samples collected from test pit 38 (sample S19DS-05361) and test pit 43 (sample S19DS-05362). The tests indicated that 2% gypsum would be required to render the clay non-dispersive.

The Contractor will need to ensure that it can mix the reagent uniformly and consistently throughout the soil mass, and implement a verification procedure to demonstrate that the recommended mix proportions have been achieved.

Our experience indicates that the stabilisation process increases the permeability of a soil. Therefore, two permeability tests were carried out on remoulded gypsum stabilised samples from test pit 38 (sample S19DS-05361) and test pit 43 (sample S19DS-05362). The stabilised clay with 2% Gypsum achieved a permeability of 5x10^{-11} m/s in test pit 38 (sample S19DS-05361) and 3x10^{-10} m/s in test pit 43 (sample S19DS-05362) when compacted to 98% of standard compaction. It can be seen that the permeability did not significantly increase in this case.

10 Sewer construction

It is understood that the sewer layout and depth have not been confirmed at this stage. A preliminary investigation has been considered at this stage by deepening some of the test locations (which included TP4, TP7, TP10, TP13, TP15, TP24, TP40, TP43, TP49 and TP52). A complementary investigation could be considered when further details about the sewer become available.

10.1 Excavation conditions

The excavator bucket was unable to continue on several locations (typically between 0.7m and 1.3m bgl) due to refusal on moderately weathered basalt rock and/or rock floaters.

Excavation within clay material is likely to be achievable with conventional earthmoving machinery. Excavation of clays with basalt boulders in the clay matrix and extraction of boulders will largely be dependent on the size of the excavator, size of the trench and size of the boulder. Use of hydraulic rock breakers may be required to break down less weathered large boulders within the clay matrix.

It is considered that excavations within the highly weathered basalt will be possible with hard ripping using large plant. However, excavation in moderately weathered or less weathered material may need large excavators equipped with hydraulic breakers or ripping with D9 (or similar) to facilitate the excavation. Actual progress will be dependent on the rock strength and defect spacing and could be challenging if areas of substantial rock strength and wide defect spacing are encountered.

10.2 Groundwater

The Visualising Victoria's Groundwater database[10] indicates that groundwater ranges across the site from 20 m-50 m depth to less than 5 m bgl (below ground level) towards the watercourse. Overall, groundwater was not observed during the investigation however test pits were only extended to a shallow depth. However, perched water table may develop within the upper silt layer overlying the clay during and after a heavy rain fall.

Should a perched water table be encountered during construction, the inflow rates are not expected to be high. It is considered likely that perched water control will be achievable by means of a sump and pump system installed at lowest points of the excavation.

10.3 Batter stability and trench support

Worksafe Victoria recommends that excavations deeper than 1.5 m should be battered, benched or shored to provide a safe working environment. As the anticipated excavation depths exceed 1.5 m, it is recommended that excavations are shored or battered back to reduce the risk of collapse and debris spalling from the excavation sides. The recommended temporary batter slopes are presented in Table 10-1 .

[10] Federation University of Australia (2015). Visualising Victoria's Groundwater. www.vvg.org.au. Centre for eResearch and Digital Innovation, Federation University Australia.

Table 10-1: Recommended temporary batter slopes

Material	Short term (1 – 2 weeks)
Unit 2 - CLAY (firm consistency)	1v:2h, or flatter
Unit 2 - CLAY (Stiff or better consistency) / XW BASALT	1v:1h, or flatter
HW BASALT or better	1v:1h, or flatter

Where excavations are to remain open for a longer period (>2 weeks), it is recommended that further geotechnical advice is sought. Permanent batters are not anticipated at the site. Surcharge loading on the unsupported slope should be eliminated a distance from the crest equal to the height of the temporary cut.

It is recommended that the Contractor should engaged a suitably experienced geotechnical engineer to monitor the slopes to check for signs of instability throughout the construction period. Where any sign of instability is observed, work should cease within the affected area and the advice of a suitably experienced and qualified geotechnical engineer sought.

When excavating trenches it is recommended that the excavated spoil is stockpiled away from the trench walls at a minimum distance equal to the total depth of the trench, i.e. if a trench is 3 m deep then the excavated material should be stockpiled at a minimum distance of 3 m away from the trench walls.

In addition, for the duration of the works the trench should be protected from external water ingress by:

- Shaping the ground surface adjacent to the trench to cause water to flow away from the trench.
- Construction of temporary bunds around the edges of the trench sufficiently remote from the trench so as not to load the trench walls though close enough to minimise water ingress.
- Covering the top of the trench and the upper part of the trench walls with an impermeable membrane (geomembrane).

10.4 Pipe embedment

As the pipes are expected to be within the basalt and groundwater may be encountered, a Type D support in accordance with MRWA standard drawing MRWA-S-202 is considered appropriate for pipe embedment.

10.5 Trench backfilling

Backfilling of the trenches following installation of the sewers within the development should be undertaken in accordance with the requirements of MRWA Specification 4.03-2 for non-trafficable areas. For trafficable areas, the backfill of sewer trenched should be undertaken in accordance with relevant road authority guidelines, its' standard specification and drawings.

The in-situ soil can be used for the backfilling of sewer trenches located in non-trafficable areas. Based on the compaction tests undertaken as part of the investigation, the clay has a maximum dry density between 1.28 to 1.53 t/m^3, with an optimum moisture content between 25.0 to 35.0%. Moisture content tests indicate the soil at the time of the investigation was generally within the range of OMC results obtained through testing. On this basis, significant moisture conditioning of the soil prior to placement is not likely to be required. However, some moisture conditioning during placement is still considered likely.

It is recommended that the backfill material is moisture conditioned prior to placement, to a moisture content between 0% and 3% wet of OMC, as determined by AS 1289.5.1.1 or AS 1289.5.7.1.

There is a risk that large clods of clay may make compaction of the backfill difficult and resulting in permeable backfill susceptible to excessive swell–shrink movements. This risk can be controlled by:

- Careful control of the moisture content of the clay to ensure it is within the recommended limits.
- Breaking up any clods greater than 75 mm in size prior to placement.

It is recommended that the backfill should be placed in horizontal layers at a loose thickness of no greater than 175 mm. The backfill should be compacted in accordance with the requirements of Melbourne Retail Water Agencies 04-03.1 Backfill Specification (MRWA 04.03-1), to a minimum density ratio of 95% (Standard) (AS 1289.5.1.1) in order to minimise the risk of future subsidence.

It should be noted that some subsidence may occur in a compacted clay fill, due to the dissipation of pore pressures induced by the compaction process. In addition, heave or settlement can be expected during the life of the sewer due to seasonal changes in the moisture conditions in the fill.

In order to protect the pipe from damage during construction, a minimum protective cover of 0.3 m and 0.5 m should be placed over the pipe for hand compaction tools and mechanical plant, respectively. The initial backfill layer on the embedment zone may need to be manually compacted to ensure the pipe is not damaged due to excessive force.

The backfill should be placed and compacted evenly around the pipe to avoid eccentric surcharge loading and differential settlement of the pipe.

11 Water main thrust blocks

Pressure mains will require thrust blocks or anchor blocks to transmit the pipe loads to the ground for which the available resistance is a function of the soil properties, and the depth and size of the thrust blocks. It is anticipated that the blocks will be constructed at depths up to 1.5 m bgl and hence the available lateral resistance should consider the lateral earth pressures within the soil at this depth.

Standard drawing MRWA-W-200[11] provides a soil classification table which includes values for allowable horizontal bearing capacities. The values within the table are considered to be acceptable for stiff to hard clay soils subjected to a short term loading regime (i.e. undrained conditions, Cu). This MRWA table is replicated in Table 11-1. In accordance with the recommendations that are provided with such table, an allowable horizontal bearing pressure of 50 kPa is considered appropriate for thrust blocks with a minimum depth to the centre point of the block of 1.0m bgl.

[11] Melbourne Retail Water Agencies (2012) *Water Supply Standard Drawing. MRWS-W-200.*

Table 11-1 Allowable horizontal bearing pressure (extract from MRWA 2012)

SOIL CLASSIFICATION		FIELD IDENTIFICATION TEST	AHBP kPa ▲
CLAY SOILS	VERY SOFT	EASILY PENETRATED 40 mm WITH FIST.	< 50 ★
	SOFT	EASILY PENETRATED 40 mm WITH THUMB.	< 50 ★
	FIRM	MODERATE EFFORT NEEDED TO PENETRATE 30 mm WITH THUMB.	< 50 ★
	STIFF	READILY INDENTED WITH THUMB BUT PENETRATED ONLY WITH GREAT EFFORT.	50
	VERY STIFF	READILY INDENTED WITH THUMBNAIL.	100
	HARD	INDENTED WITH DIFFICULTY BY THUMBNAIL.	200
SANDS	LOOSE CLEAN SAND	TAKES FOOTPRINT MORE THAN 10 mm DEEP.	< 50 ★
	MEDIUM-DENSE CLEAN SAND	TAKES FOOTPRINT 3 mm TO 10 mm DEEP.	50
	DENSE CLEAN SAND OR GRAVEL	TAKES FOOTPRINT LESS THAN 3 mm DEEP.	100
ROCK	BROKEN OR DECOMPOSED ROCK	DIGGABLE. HAMMER BLOW "THUDS". JOINTS (BREAKS IN ROCK) SPACED AT LESS THAN 300 mm APART.	100
	SOUND ROCK	NOT DIGGABLE WITH PICK. HAMMER BLOW "RINGS" JOINTS (BREAK IN ROCK) SPACED MORE THAN 300 mm APART.	200
	UNCOMPACTED FILL REFUSE (TIP)	OBSERVATION AND KNOWLEDGE OF THE SITE HISTORY.	< 50 ★

Where thrust loads are expected to be permanent, then the design of the thrust blocks should consider the drained soil parameters (i.e. c', ϕ', K_p). Additional guidance on the design of thrust blocks can be found in CIRIA Report 128[12]. The passive resistance of the soil can be assessed based on the parameters presented in the following table.

[12] CIRIA (1994) *Guide to the design of thrust blocks for buried pressure pipelines*. Report R128. Construction Industry Research and Information Association, London.

Table 11-2 Preliminary thrust block geotechnical design parameters

Unit	Unit Weight (kN/m^3)	Undrained shear strength, C_u (kPa)	Effective cohesion, c' (kPa)	Effective friction angle, ϕ' (°)	Passive coefficient of lateral earth pressure, K_p
Unit 2 – CLAY (stiff or better)	19.0	75	5	25	2.46
Unit 3 – Highly weathered BASALT	23.0	400	20	35	1.74

The excavation should be inspected by a suitably qualified geotechnical engineer or engineering geologist to confirm that the nature and orientation of discontinuities in the rock are consistent with the recommended values of the thrust block parameters.

12 Applicability

This report has been prepared for the exclusive use of our client Lancefield Development Partners P/L, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on data from discrete investigation locations. The nature and continuity of subsoil away from these locations are inferred but it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Pty Ltd

Report prepared by:

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Pablo Toro

Senior Geotechnical Engineer

Authorised for Tonkin & Taylor Pty Ltd by:

.....

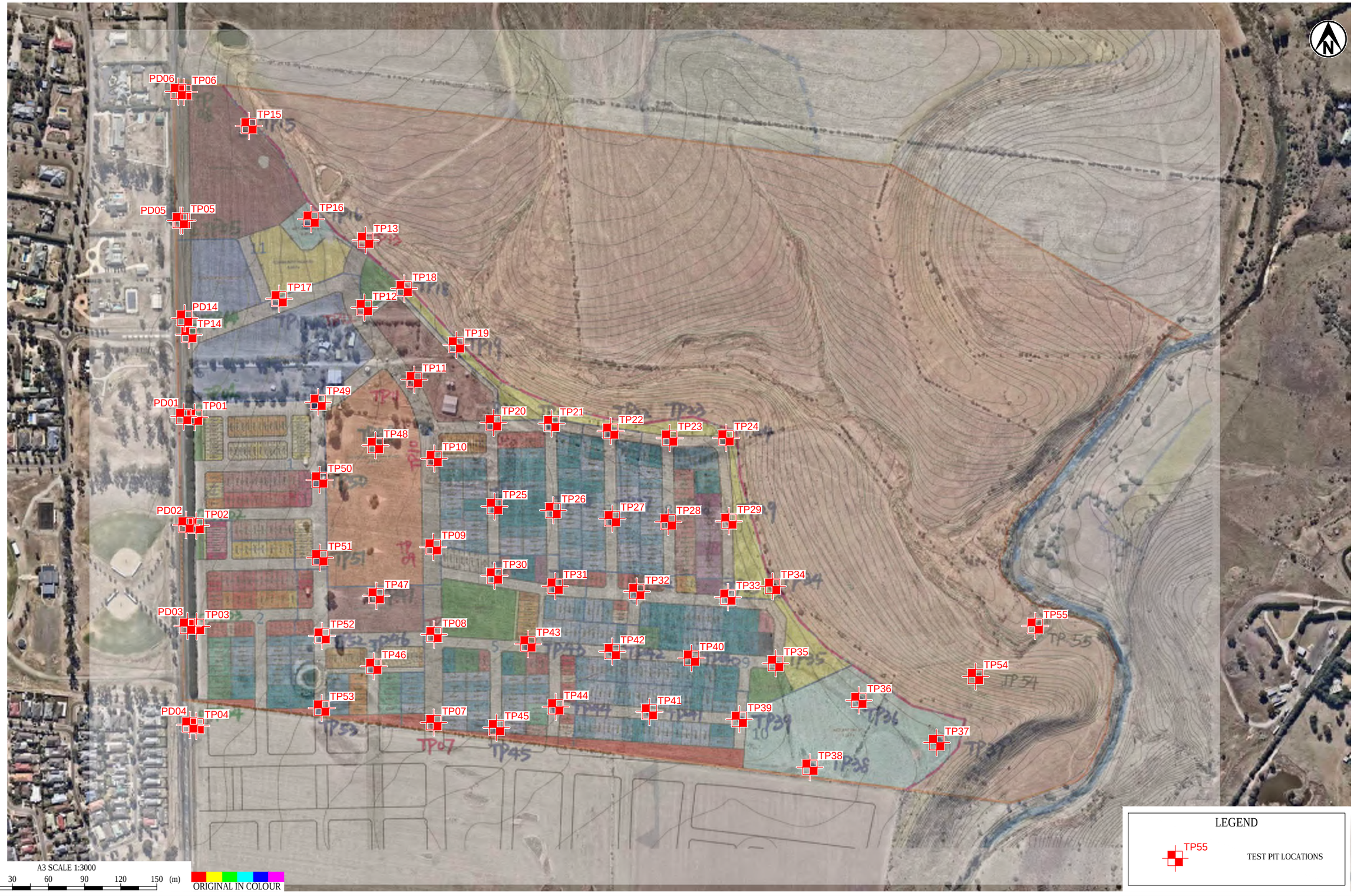
Tim Chadwick

Project Director

14-Aug-19
\\meldc1\corporate\south melbourne\projects\1010770\workingmaterial\reporting\1010770.r1v1.docx

Appendix A: Site plan

P:\1010770\WorkingMaterial\CAD\FIGS\1010770-F1.dwg 2019-Aug-05 2:31:18 PM Plotted By: TIM KELLEY



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. AERIAL PHOTO SOURCED FROM NEARMAP. COPYRIGHT NEARMAP PTY LTD IMAGERY DATE: 19/04/2019.
3. DESIGN PLAN PROVIDED BY SMEC, REFERENCE 30042640U.00, REVISION B, 06/02/2019.

PROJECT No.	1010770	
DESIGNED	XX	Jul.19
DRAWN	SHLI	Jul.19
CHECKED		
APPROVED		DATE

CLIENT LANCEFIELD DEVELOPMENT PARTNERS P/L (C/O MOREMAC PROPERTY GROUP)

PROJECT 170 LANCEFIELD ROAD SUNBURY

TITLE GEOTECHNICAL INVESTIGATION
SITE PLAN

SCALE (A3) 1:5000 FIG No. FIGURE 1 REV 1

Appendix B: Engineering logs

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Engineering log terminology

General

Soil and rock are described in terms of their engineering properties. Descriptions generally follow the "Description and Classification of Soils and Rocks for Geotechnical Purposes" system as given in AS1726 - 2017 Geotechnical Site Investigations.

Water

Water level on date shown

Water inflow

Water outflow

Drilling method/casing

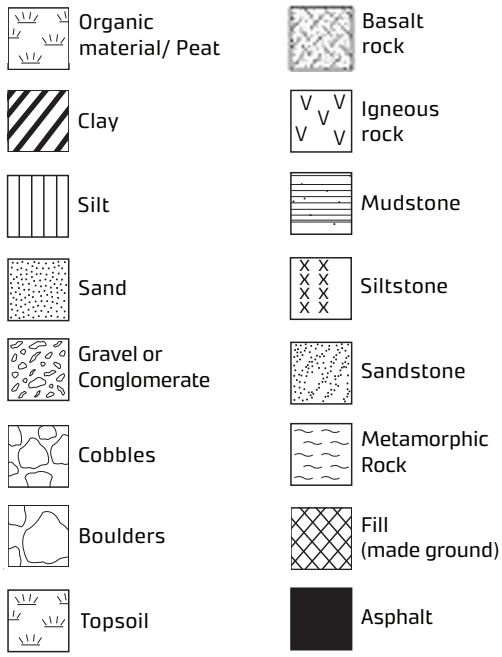
Common types:

SA	Solid auger
HOA	Hollow auger
NQ3	NQ triple tube coring
HQ3	HQ triple tube coring
SCD	Sonic Drilling
WB	Wash boring
AH	Air hammer
HA	Hand Auger
DP	Direct Push
ME	Mechanical Excavation

Graphic logs

The graphic log shows soil and rock types, significant defects and core loss.

Typical material symbols:



Tests

Field test(s) carried out

- **SPT(N):** Standard Penetration Test (uncorrected blow count for 300 mm)
- **DCP:** Dynamic Cone Penetrometer resistance (blows per 100 mm)
- **SV:** Shear Vane, undrained shear strength (kPa)
- **PP:** Pocket Penetrometer, gauge reading (kPa)

Laboratory test(s) carried out:

MC:	Moisture content (%)
LL:	Liquid limit (%)
PI:	Plasticity Index (%)
LS:	Linear shrinkage (%)
CBR:	California Bearing Ratio (%)
Swell:	CBR speciment swell (%) following soaking
PLI:	Point Load Index $Is_{(50)}$ (MPa)
PID:	Photoionization Detector (ppm)
UCS:	Uniaxial Compressive Strength (MPa)

Soil description

Moisture content

D	Dry, non-cohesive and free-running.
M	Moist, soil feels cool, darkened in colour. Soil tends to stick together.
W	Wet, soil feels cool, darkened in colour. Soil tends to stock together, free water forms when handling.

Consistency/ undrained shear strength

		C_u(kPa)
VS	Very soft	<=12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very stiff	100 to 200
H	Hard	> 200

Density index

VL	Very loose
L	Loose
MD	Medium dense
D	Dense
VD	Very dense

Proportional terms definition (Coarse soils)

Fraction	Term	% of soil mass	Example
Major	(UPPER CASE)	Major constituent	GRAVEL
Subordinate	(lower case)	> 12	Sandy
Minor	with ... trace ...	5-12 < 5	with sand trace sand

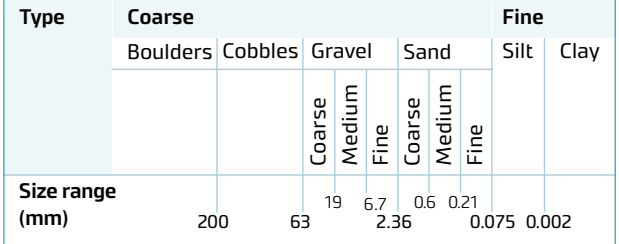
Proportional terms definition (Fine soils)

Fraction	Term	% of soil mass	Example
Major	(UPPER CASE)	Major constituent	CLAY
Subordinate	(lower case)	> 30	Sandy
Minor	with ... trace ...	30-15 < 15	with sand trace sand

Cementing

Uc	Uncemented, Clean grains exhibiting soil properties
Vwk	Very weakly cemented, Cement on some grains, collapsing feel under very light finger pressure
Wk	Weakly cemented: Cement on many grains, collapsing feel under finger pressure, breaks down to individual grains
Mwk	Moderately weakly cemented, Cement on most grains, breaks down to lumps under finger pressure, can crush to individual grains under knife blade
Mo	Moderately cemented, Cement on most grains, can break fragments off by hand and crush to small lumps
We	Well cemented, Practically all grains cemented together, cannot break fragments off by hand, dull sound under hammer
Vwe	Very well cemented, Most primary pores filled with cement, requires firm blow with hammer to break off fragments, rings when struck

Grain size criteria



Tonkin+Taylor

Engineering log terminology

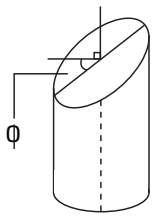
Rock description

Defect coding

Type
Angle (perpendicular to core axis)
Infilling description (as per soil description)

J 60˚, PL, SL, CV, STIFF GREEN CLAY

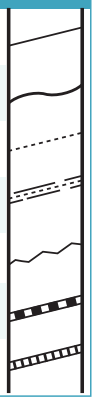
Infilling/coating type
Roughness
Shape



Defect Orientation: for vertical unoriented boreholes defect orientation is measured normal to core axis e.g horizontal = 0˚ (see diagram). For angled boreholes defect orientation is measured relative to core axis e.g parallel to core axis = 0˚.

Type - Signifcant defects

P	Parting
J	Joint
SS	Shear surface
SZ	Sheared seam/zone
CZ	Crushed seam/zone
IF	Infilled seam/zone
XD	Extremely weathered seam



Defect shape

PL	Planar
C	Curved
UN	Undulating
S	Stepped
IR	Irregular

Roughness of defect surface

VR	Very rough
R	Rough
SM	Smooth
PO	Polished
SL	Slickensided

Weathering

RS	Residual Soil
XW	Extremely weathered
DW	Distinctly weathered
HW	Highly weathered
MW	Moderately weathered
SW	Slightly weathered
FR	Fresh

Infillings and coatings

CN	Clean	No visible coating.
ST	Stained	No visible coating but surfaces are discoloured.
CV	Veneer	A visible coating of soil or mineral, too thin to measure, maybe patchy.
CT	Coating	A visible coating up to 1 mm thick.

RQD: Rock Quality Designation

Percentage of core run consisting of sound rock longer than 100 mm per core run.

TCR: Total Core Recovery

Expressed as percentage of the length of the core run recovered.

Field strength

		PLI (MPa)	UCS (MPa)	**Field guide** (50 mm diameter core)
VL	Very low	0.03 to 0.1	0.6 to 2	Crumbles with pick, can be peeled by knife
L	Low	0.1 to 0.3	2 to 6	150 mm piece may be broken by hand
M	Medium	0.3 to 1.0	6 to 20	150 mm piece may be broken by hand with difficulty
H	High	1 to 3	20 to 60	Core breaks after one blow with geological pick
VH	Very high	3 to 10	60 to 200	Core breaks after more than one blow with pick
EH	Extremely high	More than 10	More than 200	Core breaks after many blows with pick

EXCAVATION LOG

INVESTIGATION Id.: **PD01**

SHEET: 1 OF 1

PROJECT:	Kingsfield Estate, Sunbury	LOCATION:	170 Lancefield Road, Sunbury	JOB No.:	1010770.0000
CO-ORDINATES: (UTM55H)	5839258.93 mN 302208.72 mE	EXPOSURE METHOD:	ME	START DATE:	02/07/2019
		EQUIPMENT:	Yanmar Universal VIO17	FINISH DATE:	02/07/2019
R.L.:	219.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.35m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Fill			ASPHALT (40-44 mm). FILL: Sandy GRAVEL, fine to medium grained (19 mm max), subangular to subrounded, pale grey, moist to wet, medium dense to dense. Sand, fine to coarse grained; Well graded. 0.24m: Grey-brown.	M-W	MD-D		0.25 0.50	12	0.10 0.15		*0.04 - 0.24m:* Cement treated
		Newer Volcanic Group		CH	CLAY, high plasticity, brown, moist, firm to stiff.	M	F-St	218	0.75 1.00 1.25	1 13	0.65 0.80	6 4 2 3 2 4 7 7 7	
				CH	BASALT, highly weathered, pale red brown. Recovered as Gravelly CLAY, high plasticity, moist, stiff. Gravel, fine to coarse. 1.5m: END OF INVESTIGATION				1.50 1.75	14	1.48		

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **PD02**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839109.00 mN 302212.00 mE	EXPOSURE METHOD:	ME	START DATE:	02/07/2019
		EQUIPMENT:	Yanmar Universal VIO17	FINISH DATE:	02/07/2019
R.L.:	219.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.35m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Fill			ASPHALT (82 mm).								
					FILL: Sandy GRAVEL, fine to medium grained (19 mm max), subangular to subrounded, pale grey, moist to wet, medium dense to dense. Sand, fine to coarse grained; Well graded.	M-W	MD-D		0.25	15	0.30		*0.08 - 0.28m:* Cement treated
					0.28m: Grey-brown.				0.50	2	0.45		
					0.6m: Dark grey.						0.60		
		Newer Volcanic Group		CH	CLAY, high plasticity, brown, moist, firm to stiff.	M	F-St		0.75	17	0.80	4	
				HW	BASALT, highly weathered, pale red brown. Clayey GRAVEL with cobbles, fine to coarse grained, moist			218	1.00	19	0.85 1.00	7	
				MW-HW	BASALT, moderately to highly weathered. Recovered as cobbles and gravels.						1.05	12	
					1.2m: Refusal on hard strata				1.25			15	
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.2m

EXCAVATION LOG

INVESTIGATION Id.: **PD03**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5838969.00 mN 302214.00 mE	EXPOSURE METHOD:	ME	START DATE:	03/07/2019
		EQUIPMENT:	Yanmar Universal VIO17	FINISH DATE:	03/07/2019
R.L.:	222.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.35m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
EXC		Fill			ASPHALT (130 mm)								
					FILL: Sandy GRAVEL, fine to coarse grained (30 mm max), subangular to subrounded, pale grey, moist to wet, medium dense to dense. Sand, fine to coarse grained; Well graded. 0.35m: Grey-brown. 0.44m: fine to coarse grained (40 mm max), dark grey, angular to subrounded.	M-W	MD-D		0.25	20	0.25		*0.13 - 0.3m:* Cement treated
										20	0.30		
											0.44		*0.44 - 0.61m:* trace 40 mm ballast sized gravel
				CH	FILL: Gravelly CLAY, high plasticity, brown-grey, moist, firm. Gravel, fine to coarse, angular to sub-rounded.	M	F		0.50	3	0.49 0.60	2	
		Newer Volcanic Group		CH	CLAY, high plasticity, brown, moist, stiff.		St	221		22	0.75	1	
									0.75			2	
									1.00			3	
												2	
									1.25			4	
												3	
									1.50			3	
					1.5m: END OF INVESTIGATION							3	
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **PD04**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5838832.21 mN 302217.29 mE	EXPOSURE METHOD:	ME	START DATE:	03/07/2019
		EQUIPMENT:	Yanmar Universal VIO17	FINISH DATE:	03/07/2019
R.L.:	222.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.35m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
EXC	02/07/2019 Perched Water	Fill			ASPHALT (119 mm).								
					FILL: Sandy GRAVEL, fine to coarse grained (40 mm max), subangular to subrounded, grey, moist, medium dense to dense. Sand, fine to coarse grained; Well graded.	M	MD-D		0.25	23	0.20		
					0.5m: fine to coarse grained (100 mm max) pale brown, angular to sub-rounded				0.50		0.25		*0.5 - 1.16m:* with flat angular gravel (ballast)
									0.75	24	0.80		
					1.15m: wet to saturated.			221	1.00		0.85		
		Newer Volcanic Group		CH	CLAY, high plasticity, light brown, moist, firm.		F		1.25	24	1.25	1	
										25	1.38	3	
											1.40	3	
									1.50			5	
					1.52m: END OF INVESTIGATION							4	
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.52m

EXCAVATION LOG

INVESTIGATION Id.: **PD05**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839530.00 mN 302204.00 mE	EXPOSURE METHOD:	ME	START DATE:	01/07/2019
		EQUIPMENT:	Yanmar Universal VIO17	FINISH DATE:	01/07/2019
R.L.:	224.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.35m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
EXC		Fill			ASPHALT (28mm thick). FILL: Sandy GRAVEL, fine to medium grained (40 mm max), subangular to subrounded, pale brown, moist, medium-dense. Sand, fine to coarse grained. 0.1m: red brown, fine to coarse gravel (60 mm max), with sub-rounded to rounded white gravel, trace cobbles.	M	MD		0.25	26	0.30		
		Newer Volcanic Group		CH	CLAY, high plasticity, brown, moist, firm.		F		0.50	27 29	0.35 0.50 0.55 0.65	1 2 4 5	
									0.75				
				MW-HW	0.85m: END OF INVESTIGATION. Refusal on moderately to highly weathered Basalt, red brown, dry.			223	1.00 1.25 1.50 1.75			18	*0.96m:* DCP refusal at 0.96 m

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 0.85m

EXCAVATION LOG

INVESTIGATION Id.: **PD06**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839708.53 mN 302201.12 mE	EXPOSURE METHOD:	ME	START DATE:	01/07/2019
		EQUIPMENT:	Yanmar Universal VIO17	FINISH DATE:	01/07/2019
R.L.:	220.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.35m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
EXC		Fill			ASPHALT (30mm thick).	M	MD-D		0.00	30	0.00		
					FILL: Sandy GRAVEL, fine to coarse grained (40 mm max), subangular to subrounded, grey, moist, medium dense to dense. Sand, fine to coarse grained.		MD		0.10		0.20		
							St			31		8	
					FILL: Gravelly SAND, fine to medium grained, subrounded, pale brown, moist, medium-dense. GRAVEL, medium grained (19 mm max), poorly graded.		MD		0.25		0.25	9	
		Newer Volcanic Group		CH			F		0.50	4	0.50	5	
					FILL: Sandy CLAY, brown, moist, stiff. Sand, fine to medium, black.							3	
					FILL: SAND with clay & gravel, fine to coarse grained (19 mm max), red orange, moist, medium dense. Gravel, fine grained.				0.60		0.60	4	
					CLAY, brown, moist, firm.				0.75	32	0.80	5	
					1.0m: light brown, trace coarse gravel.			219	1.00		0.85	4	
												7	
												11	
												10	
									1.25			20	
												15	
					1.32m: END OF INVESTIGATION. Refusal on highly to moderately weathered basalt, brown.				1.50				*1.37m:* DCP refusal at 1.37 m
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.32m

EXCAVATION LOG

INVESTIGATION Id.: **PD14**

SHEET: 1 OF 1

PROJECT:	Kingsfield Estate, Sunbury	LOCATION:	170 Lancefield Road, Sunbury	JOB No.:	1010770.0000
CO-ORDINATES: (UTM55H)	5839395.00 mN 302210.00 mE	EXPOSURE METHOD:	ME	START DATE:	02/07/2019
		EQUIPMENT:	Yanmar Universal VIO17	FINISH DATE:	02/07/2019
R.L.:	222.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.35m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
EXC		Fill		ASPHALT (36mm thick).	M-W	MD-D	0.25	32	0.20 0.25 0.40		
				FILL: Sandy GRAVEL, fine to medium grained, subangular to subrounded, grey, moist to wet, medium dense to dense. Sand, fine to coarse grained. 0.24m: Grey-brown.				33			
		Newer Volcanic Group	CH	FILL: Gravelly CLAY, high plasticity, light orange, moist, firm to stiff, with sand. Gravel, fine to medium (19 mm max), sub-rounded to sub-angular; sand, medium to coarse.	M	F-St	0.50		0.58 0.45	2	
						F		34 5 35		2	
			MW	CLAY, high plasticity, brown mottled orange brown, firm.			0.75		0.70	7	
				BASALT, moderately weathered, brown-grey. Recovered as boulders and cobbles, dry.							*0.8m:* DCP refusal at 0.8 m
				0.8m: END OF INVESTIGATION. Refusal on moderately weathered basalt.			221 1.00				
							1.25				
							1.50				
							1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.8m

EXCAVATION LOG

INVESTIGATION Id.: **TP01**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839257.97 mN 302224.01 mE	EXPOSURE METHOD: ME		START DATE: 02/07/2019
	EQUIPMENT: Yanmar Universal VIO17		FINISH DATE: 02/07/2019
R.L.: 222.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 02/07/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.05 - 0.1m:* rootlets
				CH	CLAY (CH), high plasticity, brown, dry to moist, stiff to very stiff.	D-M	St-VSt					3	
									0.25			8	
												7	
									0.50	4 Bulk x2	0.50	8	
					0.7m: moist, stiff.						0.60	7	
							St		0.75			6	
												6	*0.85m:* tree roots
					1.0m: stiff to very stiff.			221				4	
							St-VSt		1.00			4	
												4	
									1.25			6	
												5	
												3	
					1.5m: END OF INVESTIGATION				1.50			12	
												5	
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP02**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839108.00 mN 302226.00 mE	EXPOSURE METHOD: ME		START DATE: 02/07/2019
	EQUIPMENT: Yanmar Universal VIO17		FINISH DATE: 02/07/2019
R.L.: 219.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 02/07/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.06m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, dry to moist, firm. 0.3m: Stiff	D-M	St		0.25			1	
												4	*0.37m:* tree rootlets.
					0.65m: dry	D			0.50	38	0.50 0.60	7	
												7	
									0.75			7	
												5	
												6	
					0.9m: Refusal on BASALT, moderately weathered, grey, dry,			218	1.00			7	
												7	
												9	
									1.25			12	*1.19m:* DCP refusal at 1.19 m
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.9m

EXCAVATION LOG

INVESTIGATION Id.: **TP03**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838968.57 mN 302226.75 mE	EXPOSURE METHOD: ME		START DATE: 02/07/2019
	EQUIPMENT: Yanmar Universal VIO17		FINISH DATE: 02/07/2019
R.L.: 219.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 1.8m by 0.35m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 02/07/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, dry to moist, stiff.	D-M	St		0.25			5	
					0.65 - 0.95m: dry, stiff.				0.50			5	
												7	
							St					7	
												12	
									0.75			8	*0.71m:* DCP refusal at 0.71 m
				MW	Gravelly CLAY (CH) with cobbles, low to high strength, moderately weathered, light red/brown, dry	D		218	1.00			25	
					0.9m: Refusal on BASALT, moderately weathered, grey, dry,								
					1.15m: Refusal on hard strata				1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

SKETCH / PHOTO:

EXCAVATION LOG

INVESTIGATION Id.: **TP04**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838831.00 mN 302226.00 mE	EXPOSURE METHOD: ME		START DATE: 02/07/2019
	EQUIPMENT: Yanmar Universal VIO17		FINISH DATE: 02/07/2019
R.L.: 222.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 1.5m by 0.35m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 02/07/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S				0.10	1	*0.0 - 0.1m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, dry to moist, stiff.		F		0.25	DS:0.1m		1	
												2	
									0.50	B:0.5m		3	
					0.8 - 1.4m: Light brown, dry, very stiff						0.60	2	
									0.75			3	
				MW	Gravel, fine to medium, dry, brown	D	VSt	221				2	
									1.00			4	
												3	
									1.25			3	
					1.4 - 1.5m: Friable							4	
												2	
												4	
												25	*1.4m:* DCP refusal at 1.4 m
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP05**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839530.00 mN 302207.00 mE	EXPOSURE METHOD: ME		START DATE: 02/07/2019
	EQUIPMENT: Yanmar Universal VIO17		FINISH DATE: 02/07/2019
R.L.: 224.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 1.8m by 0.35m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 02/07/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.1m:* rootlets *0.0 - 0.7m:* tree roots
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.25			1	
									0.50			1	
												2	
				MW-HW	BASALT, gravel and cobbles, moderately to highly weathered				0.75			2	*0.53m:* DCP refusal at 0.53 m
					0.85m: Refusal on hard strata			223	1.00			5	
									1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 0.85m

EXCAVATION LOG

INVESTIGATION Id.: **TP06**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839708.00 mN 302209.00 mE	EXPOSURE METHOD: ME		START DATE: 01/07/2019
	EQUIPMENT: Yanmar Universal VIO17		FINISH DATE: 01/07/2019
R.L.: 220.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 02/07/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft to firm.	M	S-F		0.25			1	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm.		F		0.50	55	0.50	1	
											0.55	3	
				HW	BASALT, highly weathered, brown, red-brown. Recovered as GRAVEL, with clay, cobbles and boulders, moist. Gravel, fine to coarse.				0.75			3	
												12	
												18	*0.69m:* DCP refusal at 0.69 m
													0.8m: calcareous band.
					0.9m: Refusal on hard strata			219	1.00				
									1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.9m

EXCAVATION LOG

INVESTIGATION Id.: **TP07**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838835.51 mN 302554.93 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 209.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 30/06/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St					10	*0.0 - 0.05m:* Rootlets
				CH	CLAY, high plasticity, moist, firm to stiff.		F-St		0.25			7	
									0.50	1	0.50	4	
												3	
									0.75		0.60	2	
												4	
								208	1.00	2	1.00	3	
												3	
												2	
											1.05	4	*1.01m:* DCP refusal at 1.01 m
				HW	BASALT, highly weathered, light brown. Recovered as Gravelly CLAY, high plasticity, moist. Gravel, fine to coarse grained.				1.25			10	*1.1 - 1.65m:* Occasional ferruginous bands
									1.50				
					1.65m: Refusal on hard strata				1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.65m

EXCAVATION LOG

INVESTIGATION Id.: **TP08**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5838957.28 mN 302555.16 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	215.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 30/06/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, firm to soft.	M	S	214	0.25			1	*0.0 - 0.05m:* Rootlets
				CH	CLAY, high plasticity, light brown, moist, stiff to very stiff.		St-VSt		0.50	3	0.50	1	
									0.75		0.55	3	
									1.00			4	
									1.25	4	1.20	7	
				ML	Clayey SILT, low plasticity, light brown, moist.						1.25	7	
					1.5m: END OF INVESTIGATION				1.50			10	
												10	
									1.75			10	
												10	
												10	
												10	
												17	
												18	
												17	

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP09**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839078.51 mN 302554.12 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	216.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 30/06/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.1m:* Rootlets
				CH	CLAY, high plasticity, light brown, moist, firm to stiff.		F-St		0.25	5	0.30	1	
									0.50		0.50	5	
				XW	BASALT, extremely weathered, red brown. Recovered as Clayey GRAVEL with cobbles, moist. Gravel, fine to coarse grained.				0.75	6	0.70	5	
				HW	BASALT, highly weathered, red brown. Recovered as GRAVEL with cobbles, dry. Gravel, fine to coarse grained.	D		215	1.00		0.75	7	*0.7m:* DCP refusal at 0.47 m
					1m: Refusal on hard strata				1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1m

EXCAVATION LOG

INVESTIGATION Id.: **TP10**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839200.87 mN 302555.45 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 214.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 30/06/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S				0.06	0	*0.0 - 0.1m:* Rootlets
				CH	CLAY, high plasticity, brown, moist, firm to stiff.		F-St		0.25			1	
												1	
												2	
				XW	BASALT, extremely weathered, red brown. Recovered as Gravelly CLAY with cobbles, trace sand, dry. Gravel, fine to coarse grained.	D			0.50	7	0.50	2	
												4	
									0.75			4	
								213				3	
									1.00			4	
					1.1m: Refusal on hard strata							10	
									1.25			10	
												18	*1.28m:* DCP refusal at 1.28 m
									1.50			20	
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.1m

EXCAVATION LOG

INVESTIGATION Id.:
TP11
SHEET: 1 OF 1

PROJECT:	Kingsfield Estate, Sunbury	LOCATION:	170 Lancefield Road, Sunbury	JOB No.:	1010770.0000
CO-ORDINATES: (UTM55H)	5839309.99 mN 302527.80 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	214.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 30/06/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St		0.25	8	0.30	5	*0.0 - 0.1m:* Rootlets
				CH	CLAY, high plasticity, brown, moist, stiff.						0.35	5	
												3	
												7	*0.45m:* DCP refusal at 0.45 m
				HW	BASALT, highly weathered, brown. Recovered as GRAVEL with cobbles, dry. Gravel, fine to coarse grained.	D			0.50			11	
					0.7m: END OF INVESTIGATION. Refusal on highly to moderately weathered rock.			213	0.75 1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 0.7m

EXCAVATION LOG

INVESTIGATION Id.: **TP12**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839409.66 mN 302458.72 mE	EXPOSURE METHOD:	ME	START DATE:	31/05/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	31/05/2019
R.L.:	219.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP (Dynamic Cone Penetrometer)	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 30/06/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St	218	0.25			7	*0.0 - 0.1m:* Rootlets
				CH	CLAY, high plasticity, brown, moist, stiff.				0.50	9	0.50	11	
									0.75		0.70	9	
									1.00			6	
				HW	BASALT, highly weathered, brown. Recovered as Gravelly CLAY with cobbles, moist. Gravel, fine to coarse grained.				1.25			5	
									1.50			7	
					1.5m: END OF INVESTIGATION				1.75			5	
												4	
												3	
												3	
												4	
												3	
												3	
												5	
												10	

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP13**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839502.79 mN 302460.49 mE	EXPOSURE METHOD:	ME	START DATE:	31/05/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	31/05/2019
R.L.:	211.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 30/06/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff, friable, with gravel and cobbles. Gravel, fine to coarse.	M	St	210	0.25	10	0.20	8	*0.0 - 0.1m:* Rootlets
				CH	Gravelly CLAY (CH), high plasticity, brown, moist, stiff.				0.50	11	0.25 0.50 0.55	6 7 8 20	
				HW	BASALT, highly weathered, brown. Recovered as GRAVEL with cobbles, dry. Gravel, fine to coarse grained.	D			0.75 1.00			19 14	*0.65m:* DCP refusal at 0.65 m
					1.5m: END OF INVESTIGATION				1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP14**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839371.97 mN 302215.97 mE	EXPOSURE METHOD: ME		START DATE: 01/07/2019
	EQUIPMENT: Yanmar Universal VIO17		FINISH DATE: 01/07/2019
R.L.: 222.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME	Groundwater Not Encountered 02/07/2019	Newer Volcanic Group		ML	SILT, low plasticity, brown, wet, soft.	W	S					1	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm.	M	F		0.25			1	
									0.50			3	
												4	
									0.75	56	0.70	7	
											0.75	12	
								221	1.00			8	*0.72m:* DCP refusal at 0.72 m
				CH	Gravelly CLAY (CH) and COBBLES, high plasticity, red brown, moist, stiff to very stiff. Gravel, fine to coarse.		St-VSt			57	1.20		
									1.25		1.25		
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP15**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839661.00 mN 302299.00 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 219.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, firm.	M	F		0.25	12	0.10	2	*0.0 - 0.07m:* rootlets
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St				0.15	2	
				XW	GRAVEL, extremely weathered, with cobbles and boulders, dry. Gravel, medium to coarse.	D						10	*0.28m:* DCP refusal at 0.28 m
				HW	0.45m: highly weathered.				0.50				
				HW-MW	0.6m: END OF INVESTIGATION. Refusal on highly to moderately weathered rock.			218	0.75 1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.6m

EXCAVATION LOG

INVESTIGATION Id.: **TP16**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839532.09 mN 302385.08 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 218.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		CH	SILT, high plasticity, brown, moist, firm, with clay?. (North side)	M	F			13	0.15		*0.0 - 0.06m:* rootlets.
				CH	CLAY (CH), high plasticity, orange brown, moist, firm to stiff, with gravel. Gravel, medium to coarse.		F-St		0.25		0.30		
				XW	BASALT, extremely weathered, grey-brown. Recovered as GRAVEL, dry. Gravel, fine to medium.	D			0.50				
					0.73m: END OF INVESTIGATION. Refusal on moderately to highly weathered rock.			217	0.75 1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.73m

EXCAVATION LOG

INVESTIGATION Id.: **TP17**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839421.90 mN 302340.79 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 219.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft to firm.	M	S-F		0.25			2	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.50	14	0.50	5 3 2	
				HW	BASALT, highly weathered. Recovered as CLAY with gravel and cobbles.				0.75		0.70	2	*0.45m:* DCP refusal at 0.45 m
					0.8m: END OF INVESTIGATION. Refusal on slightly to moderately weathered basalt.			218	1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 0.8m

EXCAVATION LOG

INVESTIGATION Id.: **TP18**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839435.96 mN 302513.84 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 215.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St					4	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, light brown mottled orange brown, moist, stiff.				0.25			5	
									0.50	16	0.50	5	
									0.75		0.55	10	*0.43m:* DCP refusal at 0.43 m
				HW	BASALT, highly weathered, Recovered as GRAVEL, with trace clay, lots of cobbles, dry.	D		214	1.00			0	
									1.25				
					1.35m: END OF INVESTIGATION. Refusal on moderately to highly weathered rock.				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.35m

EXCAVATION LOG

INVESTIGATION Id.:
TP19
SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839358.02 mN 302586.23 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 207.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St					3	*0.0 - 0.06m:* rootlets.
				CH	CLAY (CH), high plasticity, red brown, moist, stiff.				0.25	19	0.20 0.25	10 4 6	
				HW	BASALT, highly weathered, red brown. Recovered as GRAVEL, trace clay and cobbles, dry.			206	0.50 0.75 1.00			15	*0.5m:* DCP refusal at 0.5 m
					1.05m: END OF INVESTIGATION. Refusal on moderately to highly weathered rock.				1.25 1.50 1.75				

Hole Depth 1.05m

Scale 1:17

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

EXCAVATION LOG

INVESTIGATION Id.: **TP20**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839250.28 mN 302637.48 mE	EXPOSURE METHOD:	ME	START DATE:	31/05/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	31/05/2019
R.L.:	216.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St					3	*0.0 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, dry, stiff. 0.25m: Moist.	D			0.25			5	
												3	
									0.50	18	0.50	3	
												18	*0.51m:* DCP refusal at 0.51 m
												8	
				HW	BASALT, highly weathered, light red brown. Recovered as gravelly CLAY (CH), high plasticity, dry; gravel, fine to coarse.				0.75		0.70		*0.7 - 1.2m:* Calc pocket
								215	1.00				
									1.25				
									1.50	19	1.60		
				HW	BASALT, light red brown. Recovered as gravelly SAND, dry. Sand and gravel, fine to coarse.						1.65		
					1.7m: END OF INVESTIGATION				1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.7m

EXCAVATION LOG

INVESTIGATION Id.: **TP21**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839249.25 mN 302717.95 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 215.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St	214	0.25			3	*0.0 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, stiff.				0.50	20	0.50	10	
					0.7 - 0.9m: white, gravel.				0.75		0.55	7	
				HW	BASALT. Recovered as GRAVEL, with clay and cobbles, dry. Gravel, fine to medium; clay, high plasticity.	D			1.00			10	
												13	*0.51m:* DCP refusal at 0.51 m
												8	*0.7 - 1.0m:* calcareous
					1.25m: END OF INVESTIGATION				1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.25m

EXCAVATION LOG

INVESTIGATION Id.: **TP22**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839238.76 mN 302799.68 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 213.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft to firm.	M	S-F	212	0.25	TP22	0.35	1 2 3	*0.0 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, stiff.		St		0.50			4 6 5	
				XW	Rubbly BASALT, extremely weathered, red brown. Recovered as clayey GRAVEL, moist, with cobbles.				0.75		0.70	13 10	*0.75m:* DCP refusal at 0.75 m
					1.3m: END OF INVESTIGATION. Refusal on highly to moderately weathered rock.				1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.3m

EXCAVATION LOG

INVESTIGATION Id.: **TP23**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839229.14 mN 302881.33 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 216.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, brown, moist, firm.	M	F		0.25			2	*0.0 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, dark brown, dry, stiff to very stiff. 0.35m: moist.	D	St-VSt					8	
						M				21	0.40	9	*0.3m:* boulders encountered
				HW	BASALT, highly weathered, brown. Recovered as GRAVEL and cobbles. Gravel, fine to coarse.				0.50		0.45	3	*0.41m:* DCP refusal at 0.41 m
									0.75			4	
					0.78m: END OF INVESTIGATION. Refusal on highly to moderately weathered.			215	1.00				
									1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.78m

EXCAVATION LOG

INVESTIGATION Id.: **TP24**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839229.37 mN 302959.38 mE	EXPOSURE METHOD:	ME	START DATE:	30/05/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	30/05/2019
R.L.:	214.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff, with cobbles and boulders.	M	St		0.25			4 8	*0.0 - 0.5m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, very stiff. Basalt cobbles and boulders with depth.		VSt		0.50			4 9 9	
					0.6m: Refusal.			213	0.75 1.00 1.25 1.50 1.75	22	0.60	13 10 12	*0.75m:* DCP refusal at 0.75 m

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 0.6m

EXCAVATION LOG

INVESTIGATION Id.: **TP25**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839134.52 mN 302638.97 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	216.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, stiff.		St		0.25			1	
									0.50	23	0.50	3	
											0.55	6	
									0.75			5	
				XW	BASALT, extremely weathered, yellow brown. Recovered as gravelly CLAY, moist. Gravel, fine to coarse.			215	1.00			6	
												6	
												7	
												14	*1.02m:* DCP refusal at 1.02 m
									1.25			10	
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP26**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839129.04 mN 302720.07 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 217.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, soft to stiff.		S-F		0.25			1	
										24	0.40	3	
									0.50			4	
												5	
									0.75			8	
				HW	BASALT, highly weathered, red-brown. Recovered as GRAVEL, with cobbles and boulders, moist.			216			0.70	5	
									1.00			11	
												15	*0.89m:* DCP refusal at 0.89 m
									1.25				
					1.35m: END OF INVESTIGATION. Refusal on moderately weathered rock.				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.35m

EXCAVATION LOG

INVESTIGATION Id.: **TP27**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839117.62 mN 302801.91 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 217.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					2	*0.0 - 0.07m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, stiff to very stiff.		St-VSt		0.25	25	0.35	2	
									0.50	26		4	
												10	
												8	
				HW	BASALT, highly weathered, red brown. Recovered as GRAVEL, with sand, cobbles, moist. Gravel, fine to coarse; sand, medium to coarse.				0.75		0.70	9	
												10	
								216	1.00			11	
												9	
									1.25			11	
												12	*1.1m:* DCP refusal at 1.1 m
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP28**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839113.15 mN 302879.34 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 217.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.06m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, soft to stiff.		S-F		0.25			1	
									0.50	27	0.50	1	
											0.55	3	
									0.75			3	
				XW	BASALT, extremely weathered, red-brown. Recovered as gravelly CLAY, trace sand and cobbles, moist. Gravel, fine to coarse; sand, coarse.			216				2	
									1.00			3	
									1.25			3	*0.9m:* DCP refusal at 0.9 m
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP29**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839114.07 mN 302963.33 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 218.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, dark brown, moist, stiff, dry clumps.	D-M	St		0.25			3	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, orange brown, moist, stiff, with cobbles.	M			0.50	28	0.40 / 0.45	6 6 3	
				HW	BASALT, highly weathered, pink (light red). Recovered as GRAVEL, with cobbles, moist.				0.75			17 8	*0.51m:* DCP refusal at 0.51 m
					0.85m: END OF INVESTIGATION. Refusal on moderately weathered rock.			217	1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.85m

EXCAVATION LOG

INVESTIGATION Id.: **TP30**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839038.44 mN 302638.88 mE	EXPOSURE METHOD: ME		START DATE: 31/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 31/05/2019
R.L.: 213.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft to firm.	M	S-F					2	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, stiff to very stiff.		St-VSt					4	
												2	
												2	
									0.5	29	0.50	4	
											0.55	3	
					1.0m: pale to light brown.			212				2	
									1.0			4	
												7	
												13	*1.01m:* DCP refusal at 1.01 m
									1.5	30	1.50	8	
				EW	BASALT, extremely weathered, light brown streaked red. Recovered as sandy CLAY, with gravel, cobbles, moist. Sand, fine to coarse; gravel, fine to coarse.						1.55		
								211	2.0	31	2.00		
					2.05m: END OF INVESTIGATION. Refusal on moderately to highly weathered rock.								

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 2.05m

EXCAVATION LOG

INVESTIGATION Id.: **TP31**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839024.22 mN 302722.90 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 206.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.06m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.25			1	
					0.5m: stiff to very stiff.				0.50	32	0.50	3	
							St-VSt				0.55	2	
					0.8m: light brown.				0.75			1	
								205	1.00			3	*0.65m:* DCP refusal at 0.65 m
									1.25			8	
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP32**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839016.80 mN 302835.87 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	214.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	1.2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S	213	0.25			1	*0.0 - 0.05m:* rootlets.
				CL	CLAY, low plasticity, brown, moist, firm to stiff.		F-St		0.50	33	0.50	2	
									0.75		0.55	4	
									1.00	34	0.80	4	
				CL	Clayey SILT, low plasticity, grey-brown, moist.				1.25		0.85	3	
										35	1.30	4	
									1.50		1.35	3	
					1.5m: END OF INVESTIGATION 1.5m: Rock encountered as base of hole (highly weathered), 0.05m recovered as cobbles.				1.75			4	
												4	
												5	
												6	
												6	
												6	
												5	
												6	
												5	

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP33**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839008.96 mN 302961.95 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 211.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft to firm.	M	S-F	210	0.25	36	0.30	1	*0.0 - 0.07m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.50		0.35	2	
				XW	BASALT. extremely weathered,red/brown. Recovered as clayey GRAVEL, with cobbles. Gravel, fine to coarse.				0.75	37	0.70	2	
									1.00		0.75	3	*0.5 - 0.8m:* gravelly clay.
									1.25			9	
					1.5m: END OF INVESTIGATION				1.50			23	*0.7m:* DCP refusal at 0.7 m
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP34**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839024.04 mN 303023.84 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 209.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, firm, with cobbles. 0.2m: dark brown, dry.	M	F		0.25	38	0.15	2 3	*0.05 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, orange-brown, moist, stiff, cobbles.		St		0.50		0.25	3 3 5	
				HW	BASALT, highly weathered, light red. Recovered as GRAVEL, and cobbles, dry. Gravel, fine to coarse.	D			0.75			14	*0.61m:* DCP refusal at 0.61 m
					0.75m: END OF INVESTIGATION. Refusal on moderately weathered rock.			208	1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.75m

EXCAVATION LOG

INVESTIGATION Id.: **TP35**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838917.41 mN 303028.10 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 214.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S		0.25			1	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff, with some (trace) gravel. Gravel, coarse.		F-St		0.50	39	0.50	1 2 4 5	
				MW	BASALT, highly to moderately weathered, Recovered as basalt BOULDERS and COBBLES. Boulders, fine to coarse gravel and clay (CH).			213	0.75		0.70	10 21	*0.7m:* DCP refusal at 0.7 m
					1.0m: END OF INVESTIGATION. Refusal on moderately weathered rock.				1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1m

EXCAVATION LOG

INVESTIGATION Id.: **TP36**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838866.28 mN 303143.24 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 209.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, firm to stiff.	M	F-St	208	0.25				*0.0 - 0.3m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.				0.50				
				EW	BASALT, extremely weathered. Recovered as clayey GRAVEL, with trace sand and cobbles.				0.75				
					1.0m: END OF INVESTIGATION. Refusal on moderately weathered rock.				1.00				
									1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1m

EXCAVATION LOG

INVESTIGATION Id.: **TP37**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838807.75 mN 303250.89 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 213.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, firm to stiff.	M	F-St	212	0.25				*0.0 - 0.15m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.				0.50				
				HW	BASALT, red brown. Recovered as gravelly CLAY, with sand, high plasticity, moist. Gravel, fine to coarse; sand, medium to coarse.				0.75				*0.55m:* calc.
					1.15m: END OF INVESTIGATION. Refusal on slightly to moderately weathered rock.				1.00				
									1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.15m

EXCAVATION LOG

INVESTIGATION Id.: **TP38**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838773.76 mN 303075.46 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 212.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft to firm.	M	S-F						*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.5	42	0.50		
				CH	CLAY, high plasticity, light brown, moist. 1.0m: trace cobbles			211	1.0	40 41			
				XW	BASALT, extremely weathered, red brown. Recovered as SAND, with clay, high plasticity. Sand, fine to coarse.				1.5	43	1.40		
					2.05m: END OF INVESTIGATION. Refusal on moderately weathered rock.			210	2.0				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 2.05m

EXCAVATION LOG

INVESTIGATION Id.: **TP39**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838840.10 mN 302977.74 mE	EXPOSURE METHOD: ME		START DATE: 03/06/2019
	EQUIPMENT: Kubota U173		FINISH DATE: 03/06/2019
R.L.: 212.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, firm.	M	F					2	
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.25			4	
									0.50			2	
												2	
									0.75			2	
												2	
												3	
				XW	BASALT, extremely weathered, red-brown. Recovered as sandy CLAY with gravel and cobbles. Sand, medium to coarse; gravel, fine to coarse; cobbles, extremely weathered.			211	1.00			5	
												6	
												23	
					1.05m: END OF INVESTIGATION. Refusal on highly weathered basalt.				1.25				*1.1m:* DCP refusal at 1.1 m
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.05m

EXCAVATION LOG

INVESTIGATION Id.: **TP40**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838924.64 mN 302911.49 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 211.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.25			1	
									0.50			2	
												2	
												2	
												3	
				HW	BASALT, highly weathered, red brown. Recovered as clayey SAND, with gravel, dry. Sand, fine to coarse; gravel, fine to coarse.	D			0.75			10	*0.68m:* DCP refusal at 0.68 m
								210	1.00				
									1.25		1.35		
					1.35m: END OF INVESTIGATION. Refusal on moderately weathered rock.					46			
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.35m

EXCAVATION LOG

INVESTIGATION Id.: **TP41**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838850.38 mN 302853.29 mE	EXPOSURE METHOD: ME		START DATE: 03/06/2019
	EQUIPMENT: Kubota U173		FINISH DATE: 03/06/2019
R.L.: 204.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St					3	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, soft to firm.		S-F		0.25			2	
												1	
												2	
									0.50	47	0.50	2	
				HW	BASALT, highly weathered, red brown. Recovered as GRAVEL, with cobbles, dry. Gravel, fine to coarse.	D					0.55	2	
									0.75			2	
												3	*0.81m:* DCP refusal at 0.81 m
					0.9m: END OF INVESTIGATION. Refusal on highly weathered rock.			203	1.00			8	
									1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.9m

EXCAVATION LOG

INVESTIGATION Id.: **TP42**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5838933.77 mN 302801.78 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	207.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.05m:* rootlets.
				CH	CLAY, high plasticity, brown, moist, firm to stiff.		F-St		0.25			2	
												2	
									0.50			3	
												4	
									0.75			5	
												9	
					1.0m: light brown, very stiff.							8	
								206	1.00	49	1.00	12	
							VSt				1.05	9	
									1.25			10	
												10	
											1.40	9	
				CH	CLAY, high plasticity, light brown, moist.					50		7	
					1.5m: END OF INVESTIGATION				1.50		1.45	12	
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP43**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838944.29 mN 302685.24 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 212.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, firm.	M	F	211	0.25			2	*0.0 - 0.05m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.50	51	0.50	2	
									0.75		0.60	2	
									1.00			3	
									1.25			3	
					BASALT. Recovered as sandy CLAY, high plasticity, brown, moist, firm to stiff, with gravel.				1.50			3	
					1.5m: END OF INVESTIGATION. Refusal on moderately weathered rock.				1.75			5	
												8	*1.57m:* DCP refusal at 1.57 m

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP44**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838857.22 mN 302723.62 mE	EXPOSURE METHOD: ME		START DATE: 03/06/2019
	EQUIPMENT: Kubota U173		FINISH DATE: 03/06/2019
R.L.: 213.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 1.5m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St	212	0.25	52	0.40	4	*0.0 - 0.05m:* rootlets.
				CH	CLAY, high plasticity, brown, moist, stiff.				0.50	53	0.45	3	
					BASALT, light brown. Recovered as clayey GRAVEL/gravelly CLAY, friable. Gravel, fine to coarse.				0.75	54	0.60	3	
									1.00		0.75	2	
												3	
												4	
												4	
												10	*0.91m:* DCP refusal at 0.91 m
												14	
					1.15m: END OF INVESTIGATION. Refusal on highly weathered rock.				1.25			8	
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.15m

EXCAVATION LOG

INVESTIGATION Id.: **TP45**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5838828.51 mN 302641.67 mE	EXPOSURE METHOD:	ME	START DATE:	03/06/2019
		EQUIPMENT:	Kubota U173	FINISH DATE:	03/06/2019
R.L.:	206.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, dry (under top surface), stiff.	D	St					6	*0.0 - 0.7m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.	M	F-St		0.25			3	
												3	
									0.50	55	0.50	2	
											0.55	2	
									0.75			4	
												3	*0.81m:* DCP refusal at 0.81 m
								205	1.00			4	
				ML	Clayey SILT, low plasticity, grey, moist, stiff to very stiff.		St-VSt					5	
												5	
										56	1.20	7	
									1.25		1.25	20	
												10	
												8	
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP46**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838913.42 mN 302471.78 mE	EXPOSURE METHOD: ME		START DATE: 03/06/2019
	EQUIPMENT: Kubota U173		FINISH DATE: 03/06/2019
R.L.: 213.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		MH	SILT, high plasticity, brown, moist, soft.	M	S	212	0.25	57	0.30	1	*0.0 - 0.5m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, soft to firm.		S-F		0.50		0.35	2	
				XW-MW	BASALT, extremely to moderately weathered. Recovered as clayey GRAVEL, with cobbles, moist. Gravel, fine to coarse.				0.75			2	
									1.00			1	
									1.25		1.30	2	
												2	*0.68m:* DCP refusal at 0.68 m
					1.3m: END OF INVESTIGATION. Refusal on highly weathered rock.				1.50	58			
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.3m

EXCAVATION LOG

INVESTIGATION Id.: **TP47**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839010.79 mN 302475.34 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 218.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.15m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, soft to very soft.		VS-S		0.25			1	
												3	
									0.50			5	
												6	
									0.75			10	
												11	
												12	
									1.00			10	
								217				17	*1.0m:* DCP refusal at 1.0 m
				HW	BASALT, highly weathered, grey-red brown. Recovered as GRAVEL, with cobbles and trace sand, dry. Gravel, fine to coarse; sand, fine to medium.	D			1.25	59	1.20 / 1.25		
					1.5m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP48**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury		LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000	
CO-ORDINATES: (UTM55H)	5839218.97 mN 302474.19 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	217.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft.	M	S					1	*0.0 - 0.05m:* rootlets.
				CH	CLAY, high plasticity, brown, moist, firm to stiff, with trace gravel. Gravel, coarse.		F-St					2	
												3	
												4	
									0.5	60	0.50	5	
											0.55	15	*0.6m:* DCP refusal at 0.6 m
				HW	BASALT, highly weathered, red brown. Recovered as GRAVEL and COBBLES, with clay, moist,			216	1.0				
					1.45m: END OF INVESTIGATION. Refusal on moderately weathered rock.			215	1.5 2.0 2.5				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.45m

EXCAVATION LOG

INVESTIGATION Id.: **TP49**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839278.60 mN 302394.77 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 214.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff,	M	St					5	*0.0 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, stiff to very stiff.		St-VSt		0.25			8	
												7	
									0.50	61	0.50	5	
												3	
												3	
									0.75		0.70	5	*0.7m:* cobbles.
												10	
					0.85m: END OF INVESTIGATION. Refusal on moderately to slightly weathered rock.			213	1.00			10	*0.85m:* DCP refusal at 0.85 m
									1.25				
									1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.85m

EXCAVATION LOG

INVESTIGATION Id.: **TP50**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839171.13 mN 302396.85 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 215.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, soft to firm.	M	S-F					1	*0.0 - 0.2m:* rootlets.
									0.25			2	
				CH	CLAY (CH), high plasticity, brown, moist, stiff.		St					4	
									0.50	62	0.50	4	
											0.55	5	
									0.75			6	
												10	
								214	1.00			10	
												7	
				HW	BASALT, highly weathered, red brown. Recovered as GRAVEL, with sand and cobbles, dry. Gravel, fine to coarse; sand, fine to coarse.	D			1.25			11	
												9	
												9	
												11	*1.41m:* DCP refusal at 1.41 m
					1.5m: END OF INVESTIGATION				1.50			8	
									1.75				

SKETCH / PHOTO:

COMMENTS:

These logs are to be read in conjunction with the full Tonkin & Taylor report

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP51**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5839063.53 mN 302397.21 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 218.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	Clayey SILT, low plasticity, brown, moist, soft to firm.	M	S-F					0	*0.0 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, stiff,		St	217	0.25			0	
									0.50	63	0.50	0	
											0.55	1	*0.5m:* very stiff.
									0.75			1	
												2	
									1.00			4	
												5	
												8	*1.0m:* light brown, boulder at base.
									1.25			8	
				HW	BASALT, highly weathered, red brown. Recovered as GRAVEL, with cobbles and sand, dry. Gravel, fine to coarse; sand, fine to coarse.	D						5	*1.2m:* DCP refusal at 1.2 m
					1.6m: END OF INVESTIGATION				1.50			11	
												14	
									1.75			12	
												13	

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.6m

EXCAVATION LOG

INVESTIGATION Id.: **TP52**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838955.41 mN 302400.21 mE	EXPOSURE METHOD: ME		START DATE: 30/05/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 30/05/2019
R.L.: 215.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St					0	*0.0 - 0.15m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, moist, firm to stiff.		F-St		0.25			6	
									0.50	64	0.50	5	
												3	
									0.75			4	*0.5m:* cobbles and boulder, highly to moderately weathered.
											0.70	2	
												2	
												3	
												3	
					Sandy CLAY, with gravel, stiff, with rubbly basalt. Sand, fine to medium; gravel, fine to coarse.		St	214	1.00			8	*1.01m:* DCP refusal at 1.01 m
												8	
									1.25			10	
					1.45m: END OF INVESTIGATION				1.50				
									1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.45m

EXCAVATION LOG

INVESTIGATION Id.: **TP53**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838855.60 mN 302399.82 mE	EXPOSURE METHOD: ME		START DATE: 03/06/2019
	EQUIPMENT: Kubota U173		FINISH DATE: 03/06/2019
R.L.: 213.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, low plasticity, brown, moist, stiff.	M	St		0.25		0.50	4	*0.0 - 0.2m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, firm to stiff, moist.		F-St		0.50	65	0.55	3	
									0.75	66	0.80	2	
											0.85	2	
				XW	BASALT, extremely weathered, red-brown/brown, grey. Recovered as SAND, moist. Sand, fine to coarse.			212	1.00	67	1.00	3	*1.01m:* DCP refusal at 1.01 m
									1.25		1.40	3	*1.3 - 1.5m:* crumbly soil
					1.5m: END OF INVESTIGATION				1.50			3	
									1.75			5	
												6	

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m

EXCAVATION LOG

INVESTIGATION Id.: **TP54**

SHEET: 1 OF 1

PROJECT: Kingsfield Estate, Sunbury	LOCATION: 170 Lancefield Road, Sunbury		JOB No.: 1010770.0000
CO-ORDINATES: (UTM55H) 5838899.24 mN 303304.69 mE	EXPOSURE METHOD: ME		START DATE: 06/06/2019
	EQUIPMENT: Hitachi Zaxis 38U(3.8 t)		FINISH DATE: 06/06/2019
R.L.: 193.00m	OPERATOR: Frys Earthmoving		LOGGED BY: JVA
DATUM: AHD	DIMENSIONS: 2m by 0.45m		CHECKED BY: PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, red brown, moist, stiff to firm, with cobbles.	M	F-St						*0.0 - 0.25m:* rootlets.
				CH	CLAY (CH), high plasticity, brown, dry, very stiff.	D	VSt		0.25	68	0.30		
				HW	BASALT, highly weathered, grey. Recovered as GRAVEL, with cobbles, moisture. Gravel, fine to coarse.	M			0.50		0.40		
					0.6m: END OF INVESTIGATION. Refusal on moderately to highly weathered basalt.			192	0.75 1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 0.6m

EXCAVATION LOG

INVESTIGATION Id.: **TP55**

SHEET: 1 OF 1

PROJECT:	Kingsfield Estate, Sunbury	LOCATION:	170 Lancefield Road, Sunbury	JOB No.:	1010770.0000
CO-ORDINATES: (UTM55H)	5838969.14 mN 303387.17 mE	EXPOSURE METHOD:	ME	START DATE:	06/06/2019
		EQUIPMENT:	Hitachi Zaxis 38U(3.8 t)	FINISH DATE:	06/06/2019
R.L.:	184.00m	OPERATOR:	Frys Earthmoving	LOGGED BY:	JVA
DATUM:	AHD	DIMENSIONS:	2m by 0.45m	CHECKED BY:	PTO

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
ME		Newer Volcanic Group		ML	SILT, brown, dry, firm to stiff.	D	F-St	183	0.25				*0.0 - 0.3m:* rootlets.
				CH	CLAY, high plasticity, brown, dry, very stiff.		VSt		0.50	69	0.50 0.55		
					1.5m: END OF INVESTIGATION				0.75 1.00 1.25 1.50 1.75				

SKETCH / PHOTO:

COMMENTS:

Hole Depth 1.5m