REPORT

Tonkin+Taylor

PART 1 OF 2

Kinley Development

Geotechnical Framework

Prepared for

Hume Lilydale Pty Ltd & LBJ Corporation Pty Ltd

Prepared by

Tonkin & Taylor Pty Ltd

Date

April 2020

Job Number

1000511.R6.v7

Exceptional thinking together

www.tonkintaylor.com.au

Document Control

Title: Kinley Development					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
Dec 2018	1	Final	D Glover	R Olds	T Chadwick
Sep 2019	2	Final - updated	D Glover	R Olds	T Chadwick
Nov 2019	3	Final – updated	D Glover	R Olds	T Chadwick
Dec 2019	4	Final – Minor update	D Glover	R Olds	T Chadwick
Dec 2019	5	Final – Minor update	D Glover	R Olds	T Chadwick
Apr 2020	6	Final – Precinct changes	D Glover	R Olds	T Chadwick
Apr 2020	7	Final – Minor update	D Glover	R Olds	T Chadwick

Distribution:

Hume Lilydale Pty Ltd & LBJ Corporation Pty Ltd	1 PDF copy
Intrapac Property Pty Ltd	1 PDF copy
Tonkin & Taylor Pty Ltd (FILE)	1 copy

Table of contents

Appendix C :	**Geotechnical assessment of fill compressibility and potential settlement**
Appendix D :	**Geotechnical assessment of past landslides**
Appendix E :	**Geotechnical assessment of quarry rock face stability**
Appendix A :	**Geotechnical assessment of haul road widening**
Appendix B :	**Geotechnical assessment of existing fill beneath quarry haul roads**
Appendix C :	**Preliminary environmental investigation**
Appendix D :	**Preliminary hydrogeological assessment**
Appendix E :	**Quarry base preparation assessment**
Appendix F :	**Treatment of karst features**
Appendix G :	**Geotechnical assessment of sump riser requirements**
Appendix H :	**Precinct 4 quarry pit fill specification**
Appendix I :	**Importation and contamination management plan**
Appendix J :	**Geotechnical monitoring strategy**
Appendix K :	**Performance criteria for handover of assets**
Appendix L :	**DEDJTR geotechnical risk assessment**

1 Background

1.1 Development objectives

The former Lilydale Quarry redevelopment comprises 163 Ha of land proposed for residential, retail, commercial and community uses. The site previously incorporated a limestone quarry and lime production facility which operated since the late-19th century.

The land was purchased by a Joint Venture of Hume Lilydale Pty Ltd and LBJ Developments Pty Ltd from the previous quarry operator (Sibelco) in mid-2017. It is proposed to undertake the redevelopment in Stages which can be summarised as follows;

- Stage 1 is approximately 19 Ha, located on natural ground at the southern end of the site, between Hull Road and the southern edge of the quarry. It abuts existing residential land to the east and the Lilydale commuter railway line to the west. This area has been rezoned for residential purposes and will be developed into residential lots which will involve some cutting and filling consistent with normal residential development.
- Precinct 1 is approximately 44 Ha, located on natural ground east of Mooroolbark Road and west of the railway line. This area was previously used for agricultural grazing purposes. This area will involve mixed use low and medium density residential development which will involve some cutting and filling consistent with normal residential development
- Precinct 2 is approximately 22 Ha and comprises the area north of the quarry and east of the railway line, including the previous lime production and storage facilities, plus offices. This area comprises most of site's heritage assets, including the lime production plant and farming buildings. Uses will include primary medium density residential and potential retail and commercial uses.
- Precinct 3 is approximately 53 Ha, located east of the quarry out to the eastern project boundary which abuts existing residential development and the Box Hill Institute site. This area has been previously used to stockpile overburden (non-limestone) material removed progressively from the quarry during its operations. This overburden has been placed over many years in terraces up to 40m deep. The overburden material will be progressively removed from this area and placed into the quarry as engineered filling, allowing the underlying natural ground to be exposed. Once the overburden is removed this area will be developed predominantly as low and medium density residential.
- Precinct 4 incorporates the former quarry which is up to 120m deep and covers an area of approximately 25 Ha at the surface. It is proposed that the central portion of this area will be developed as a 'neighbourhood centre', with medium density townhouses, commercial and retail facilities, and potentially higher density residential apartments at heights established through development constraints. A new railway station is proposed (but not yet confirmed) towards the western edge of the existing quarry. The northern part of the quarry is planned as public open space which will be transferred to Yarra Ranges Shire Council (Council).

The development will take place sequentially and subject to market influences will take 15 years to complete. The indicative precinct areas are shown in Figure 1 below.

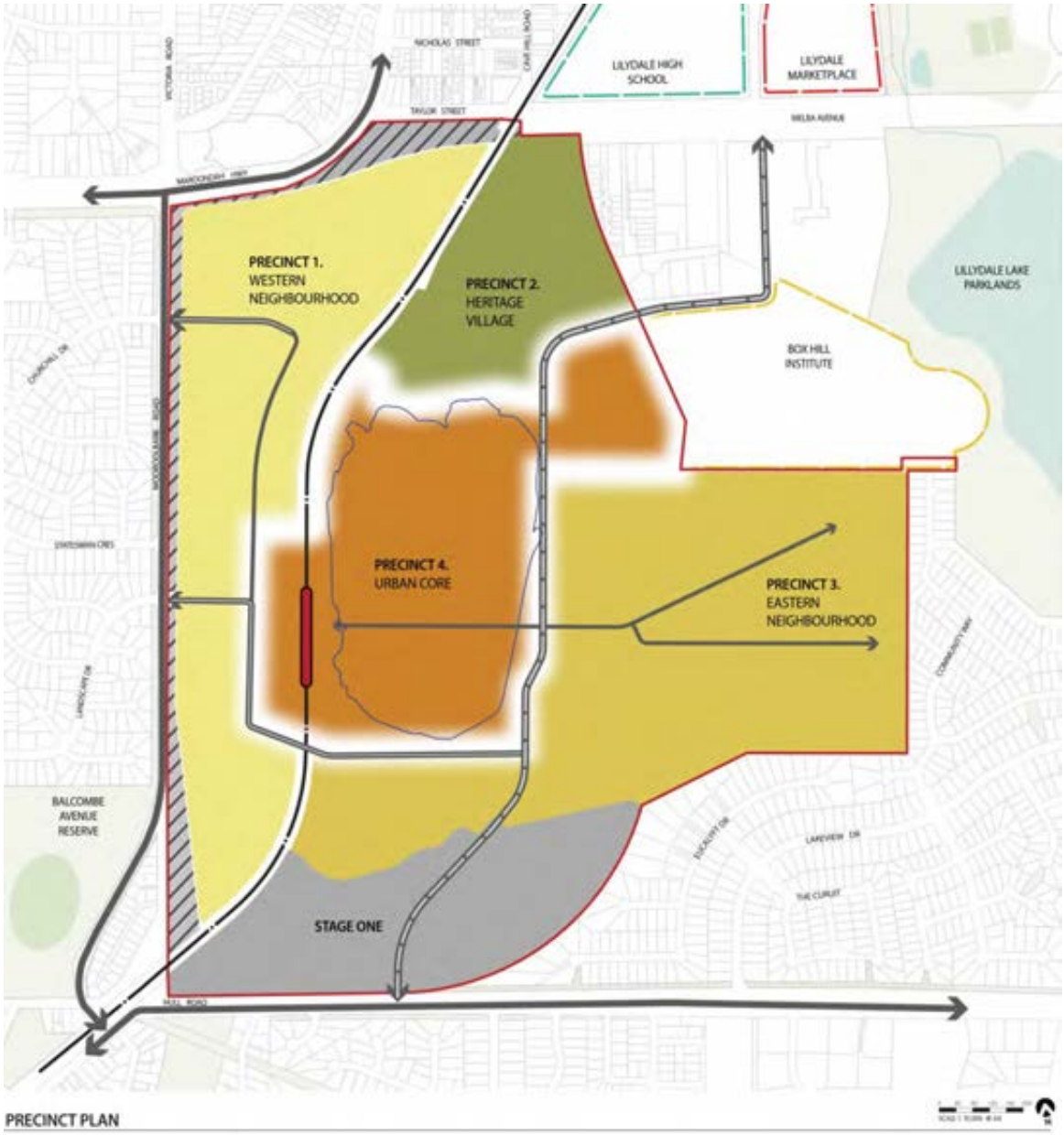


Figure 1.1 Comprehensive Development Plan (CDP) with indicative precinct areas (Source; Intrapac Property Pty Ltd) not to scale.

1.2 Statutory control

A portion of the site to the east of the rail line (Precincts 2, 3 and 4) currently operates under Work Authority WA199 under the supervision of Department of Jobs, Precincts and Regions (DJPR), Earth Resources Regulation (ERR). Stage 1 was excised to facilitate the approved residential development.

Further applications to excise areas from the Work Authority are envisaged as the development progresses until the Work Authority is ultimately extinguished.

Stage 1 is zoned General Residential Zone 1, with a planning permit granted by the Council for the development of approximately 196 lots.

The balance of the site (Precincts 1 through 4) is zoned Special Use Zone (SUZ), with a proposed Planning Scheme Amendment to rezone the site to a Comprehensive Development Zone to facilitate the proposed residential and mixed-use development.

This Geotechnical Framework is provided to:

- describe various survey, assessment and investigation work undertaken;
- describe the intended approach to the filling of the quarry;
- describe the approach to filling specifications, fill process, monitoring, record keeping and reporting; and
- support the Planning Scheme Amendment.

Once the land is rezoned, the backfilling of the quarry is proposed to be managed under a revised work plan under ERR until an agreed point where works transition to being completed under Council planning approval.

1.3 Statutory approvals required

- Planning Scheme Amendment approval for a rezoning to Comprehensive Development Zone including a Comprehensive Development Plan, plus other relevant Overlays, including an Environmental Audit Overlay;
- Resolution of development contributions though a Development Contributions Plan Overlay or a Section 173 Agreement;
- Work plan variation to fill quarry up to RL100 or extinguishment at a lower level;
- Environmental Audits for portions of land under the proposed Environmental Audit Overlay;
- Planning Permit Approvals to complete land forming activities;
- Precinct Plan Approvals for each Precinct consistent with the Comprehensive Development Plan; and
- Planning Permits for subdivisions consistent with Precinct Plans.

1.4 Approved Engineer

Throughout this Geotechnical Framework, various references are made to the role of the *"Approved Engineer"* in relation to preparation of works specification, supervision, monitoring and reporting. At the date of the document, that refers to appropriately qualified officers or employees of Tonkin & Taylor Pty Ltd (T+T).

The Approved Engineer may:

- change from time to time;
- be one or more individual or consulting engineering companies, particularly having regard to any different expertise (eg, geotechnical, environment or civil); and
- be appropriately qualified and experienced, including for geotechnical aspects at Level 1 Supervisor, pursuant to AS 3798 (2007) Guidelines on Earthworks for Commercial and Residential Developments, or any successor standard.

2 Survey

2.1 Initial conditions

The site was surveyed by Reeds Consulting licensed surveyors in 2016. This information is included in Appendix A as a drawing of existing conditions with contours (A1 drawing).

2.2 Planned volumes / quantities

Reeds Consulting has undertaken an estimate of the volume of overburden material in the stockpiles on the south and east side of the quarry. This estimate was conducted by comparing the publicly available Vicmap surface layer with the proposed finished surface layer. A volume of 8.6 million m^3 is estimated to exist within the overburden stockpiles, with an additional 1 million m^3 expected to be obtained through general site earthworks.

The volume of space inside the quarry has been estimated by Reeds to be 10.2 million m^3 if it was to be filled to be completely flat, however this outcome is not being proposed.

2.3 Planned landform

The landform for the filled quarry surface has been designed to allow drainage under gravity from south to north. The planned finished surface level at the southern end of the quarry is approximately RL 140 m. The land then slopes down towards the north at approximately 3%, so that the northern edge of the quarry is approximately RL 120 m.

The highest point of the site, south of the quarry, is RL 155 m, and the site will be graded to continue to fall beyond the northern side of the quarry to approximately RL 100 m, to facilitate drainage to existing flow paths at the north-east of the site.

2.4 Northern escarpment & natural ground levels

The final planned landform leads to the existing quarry batters being retained at the northern faces of the quarry. This design mirrors conditions of Heritage Victoria permit which require a portion of the existing escarpment to be retained for posterity. As the land slopes up to the south, the extent of batter rising above the final landform reduces.

The earthworks design will leave no escarpment at the quarry edge along the east and south; existing natural ground and the filled quarry area will blend together seamlessly at these interfaces.

2.5 Implications for quarry backfill

The bulk earthworks calculations rely on approximately 9 million m^3 of material to fill the quarry to the final designed level. This compares with 9.6 million m^3 of available material on site, which provides a buffer for compaction factors and potentially unsuitable fill.

The landform design retains significant capacity to accommodate more or less fill by raising or lowering the final level across the former quarry area. As an indication of sensitivity, each 1m change in level of the surface comprises approximately 250,000 m^3 of fill material near the top of the pit.

The absolute minimum filling requirements are:

- a reasonable cover over and above the expected rebounded ground water level, anticipated at RL 88m. This will be comfortably achieved with the volumes available; and
- a level of RL 116m or higher at the northern end to retain natural drainage by gravity from the former quarry area.

The project does not intend to import, or require importation of, fill material for quarry filling from external sources.

3 Investigations

3.1 Geotechnical investigations

The site has been the subject of considerable geotechnical investigation since it was purchased. The primary issues being addressed include:

- the nature of the fill material in the spoil stockpiles on site, and its suitability for re-use as engineered fill in the quarry (Appendix B);
- the compressibility of the engineered fill and potential settlement (Appendix C);
- the stability of land in and around past landslides on the property (Appendix D);
- the stability of the rock faces in the quarry (Appendix E);
- the potential widening of haul roads (Appendix F); and
- the assessment of the haul road fill in the quarry (Appendix G).

Reporting of this work has been undertaken progressively and these reports are included in the Appendices listed above.

As the project proceeds and the stockpiles are reduced in height, further investigation will assess remaining materials and confirm their suitability for use as engineered fill. The higher quality material will be identified and retained so that it can be placed in the upper levels of the planned development zone.

In the unlikely event that marginal quality material is found in the stockpiles it will be directed to the part of the fill that will eventually comprise open space.

Material that is potentially unsuitable as engineered fill includes topsoil, silt or organic material. If encountered, this material can be used in landscaping works across the whole site.

T+T has no concerns about the quality or quantity of available fill materials based on its current investigations, and the site area is large enough to absorb a substantial volume of unsuitable material if it is encountered.

3.2 Environmental investigations

Several stages of environmental investigation have been undertaken across the entire site by T+T and others, including assessment of site history, inspection of onsite infrastructure/land use and sampling (soil and groundwater) with laboratory analysis.

The degree of investigation completed to date has been designed to identify the potential for risk of contamination as determined by historical use of the land (i.e. former industrial-use areas, such as the plant and processing area, have been the subject to the most testing), in consideration of the Planning Practice Note PPN30 *Potentially Contaminated Land*.

Results from each investigation have been consistent with previous work (for example areas concluded to have been outside the mining operation - sports oval and paddocks) have not reported soil contamination or waste presence.

Based on the initial investigations, the contaminants of concern, as identified in the 2018 T+T Development Constraints Assessment (Appendix H), and discussion on risk of contamination for various areas of the site are summarised in Table 3.1 below. This information has formed the basis for recommendations relating to the proposed placement of an Environmental Audit Overlay, which is shown in Figure 3.1. At the request of Council, the area of the Environmental Audit Overlay has been expanded from the area recommended in the Development Constraints Assessment to include the quarry pit and stockpiles.

Table 3.1: Contaminants of Potential Concern (COPC) for site areas (from T+T Development Constraints Assessment report)

Site Area	Historical Feature/Activity	COPC	Discussion of risk
Plant Area	Fuelling kilns/storage of fuels	Petroleum hydrocarbons, coke (polycyclic aromatic hydrocarbons (PAHs))	The kilns were operated for over a century and there is a high risk that fuel and ash from burnt fuel is present in this area
	Dumping of ash	PAHs	Ash and elevated PAHs have been identified and the risk of contamination is high
	Uncontrolled demolition of historical buildings/services	Asbestos containing material (ACM)	ACM has been identified in this area and there is a potential that other areas are present
	Electrical substation	PCBs	Even if present, PCB containing oils (such as transformer oil) are likely to have been low in volume and represent a low contamination risk.
Northern Land – Pasture Portion and Pond	Agriculture	Nutrients, bacteria	Potentially an issue at times of intensive use however the nature of these COPC is such that risks decrease significantly with time
	Groundwater storage	None	Groundwater at the site is not impacted and is not likely to cause contamination
Northern Land – Industrial Portion	Dumping of ash	PAHs	Ash and elevated PAHs have been identified and the risk of contamination is high
	Vehicle wash bay	Petroleum hydrocarbons	Residues present in washing fluid may have soaked into land although the mass of contaminant deposited through this process would be low
	Abattoir, cheese and bacon factory, soap manufacture	Aesthetic impacts	Potential for aesthetic impacts from historical waste streams from the various agricultural activities (e.g. odorous soils, buried carcasses). The risk is considered to have decreased significantly with time, however.
Quarry hole	Excavation of lime and overburden	None	Only natural soils remain
Overburden stockpiles	Natural soils excavated as part limestone mining in the quarry	None	See below regarding waste
	Waste disposal/treatment	Petroleum hydrocarbons, PAHs, alkaline materials, buried solid waste	Likely very minor presence relative to the excavated natural soils making up the overburden stockpiles
Western Area	Agriculture (grazing)	None	No evidence of significant use other than for grazing land

Figure 3.1 Extract of T+T drawing 1000511-F3 showing extent of proposed area of Environmental Audit Overlay.

Additional investigation will be ongoing as stockpiled soils are excavated and former operations areas decommissions/demolished. T+T has recommended a detailed site investigation be completed as part of any Environmental Audits completed for portions of land within the EAO. In addition, a Contamination Management Plan (CMP) has been provided prepared for use during the initial quarry hole filling phase to address the potential for any contaminated or waste materials to be present within the stockpiles of soil to be re-used onsite. Further testing will also be conducted on the fill material intended for re use, as required under any site Audit.

3.3 Hydrogeological investigation

The natural groundwater level has been gradually lowered over time as the depth of the quarry increased. The initial groundwater level at the time of the commencement of rehabilitation was at RL 0 m.

When the site operated as a quarry, various hydrogeological studies were undertaken as the pit was deepened and dewatering continued from the quarry floor. As part of the proposed rehabilitation of the quarry prior to selling the land, the previous owner, Sibelco, commissioned groundwater

modelling to establish the expected time frame for the groundwater to return to its natural state and form a lake in the quarry.

As part of planning for the quarry to be backfilled to facilitate residential development, T+T undertook a review of the previous hydrogeological modelling. This review comprised 2D modelling of the recovery of groundwater levels within the quarry once filled. As a result of the document review and the further modelling, the groundwater level in the former quarry area is expected to rebound up to RL 88m. The report on this modelling is included in Appendix I.

4 Implications for development

4.1 Geotechnical

The intended development outside the boundaries of the quarry is that of a conventional subdivision with a potential mix of low and medium density residential, and associated uses. Stage 1 and Precinct 1 are both located in areas of natural terrain and will have earthworks undertaken to create the required landform. Any excess cut material that is not used within the Stage 1 subdivision works is intended to be transferred to the quarry and used as additional fill.

Excess cut material from Precinct 1 may be used in the quarry filling subject to finding a suitable methodology for crossing the railway line. If this is to happen by road, conventional road-registered trucks will need to be used as off-road haul trucks will not be able to travel on public roads. This material will likely comprise high plasticity residual basaltic clay and weathered basalt. Whilst the high plasticity material would not be desirable in the upper 2m of filling where structures are planned, it would be suitable below this depth and in any areas where open space and/or sporting fields are planned. Due to the timing of Precinct 1 it is expected that any excess material from this work could also be placed at considerable depth in the quarry filling.

In Precinct 3, the overburden from the quarrying activities covers the natural ground by depths up to 40m. The vast majority of this material will be placed into the quarry so that development will take place on natural ground, subject to the final design landform. This material was all derived from the natural land that existed at the quarry, which comprised Devonian volcanic and sedimentary rocks. As such this material is considered suitable for engineered filling subject to crushing of boulders to achieve the maximum particle size specified.

If there is more material available from these works than is currently planned for the quarry, then the landform of the quarry area can be adjusted to accommodate the extra material. There is a substantial available volume in the planned landform to accommodate this change if required.

It is estimated that the filling works will take approximately five years to complete. The filling method and production rate has been verified by independent estimators and found to be reasonable. It is possible to accelerate or decelerate the placement rate depending on the fleet of equipment employed. As the fill level rises, the area of filling increases substantially, allowing more compaction equipment to be utilised.

The masterplan for the quarry area envisages moderate scale commercial and residential structures. The filling of the quarry is being undertaken to standards which exceed those normally adopted for residential and commercial development to maximise the likelihood that the planned structures can be safely constructed at the appropriate time after the filling is completed. Development will be subject to acceptable settlement of the foundations being predicted by the settlement monitoring detailed in Section 8 of this report.

Should the settlement monitoring information indicate that the current scale of intended development is not feasible, then the nature of the development will be reviewed and adjusted to suit the predicted settlement, or delayed until the settlement profile is suitable.

Part of the quarry area will be transferred to the Council for roads and open space. The Geotechnical Criteria for these assets will be less stringent than for structures planned in the main development area, except where structures are intended. Discussion with the Council has been conducted and agreement reached on the settlement rate that has to be reached before this land can be transferred to the Council. The details of this are included in section 9.1.

4.2 Environmental

The environmental implications for development vary across the site. A site assessment undertaken by T+T (see Appendix H) in compliance with PPN30 determined that the areas outside the quarrying operation have a low potential for contamination.

Where investigations to date have identified potentially contaminating activities (e.g., industrial use, waste disposal), further environmental assessment works have been recommended, including:

- detailed Site Investigation as part of an Environmental Audit at the plant and processing areas; and
- implementation of a CMP during re-use of stockpiled material for filling the former quarry.

It is envisaged that any issues identified as part of the above should be addressed by removal of contaminated material from site or placement in non-sensitive parts of the site. However, the volume of any contaminated material is not currently known. It is noted that implementation of the CMP to date has identified some minor amounts of solid inert waste (tyres, steel and plastic) and these have been, and would be, removed.

A white granular substance which was thought to be a concentrated dumping of lime has been observed, however chemical testing was conducted which confirmed it to be silica.

Sampling and testing of stockpiled material has not identified any significant contamination, and the CMP has been effective in identifying unsuitable or suspect materials. In addition, the filling process involves returning the original material to its origin which will avoid any unintended soil impacts. Nonetheless, further regular sampling of soils for contamination is recommended, and any contaminated material removed should it be encountered.

4.3 Groundwater

The quarry operation has lowered the groundwater level to just below the base of the quarry. Based on historical reports by others it is estimated the natural groundwater level is approximately RL 88 m. Hence, once the quarry is filled and groundwater pumping ceases, it is expected the groundwater will rise to approximately this level.

As the groundwater rises it will saturate the fill soils used in the quarry. As the fill soils are naturally occurring, having been removed from the site over the past 100 plus years, no adverse impact on groundwater is expected to occur.

The planned level of the final landform across the development ranges from RL 155m to RL 100m, with levels between RL 116m and RL 130m within the former quarry area. Hence there will be at least 12m of cover above the expected final groundwater level across the site. As groundwater rises and saturates the fill, some additional settlement may occur but the effective stress in the fill will reduce. This will take time to occur but once the stresses reduce the settlement rate of the fill should substantially diminish.

As the filling proceeds it will be possible to raise and lower the pump in the sump riser. This will allow the effects of raising and lowering groundwater to be assessed during the filling operation, so that future settlement predictions can be made with increased confidence. Implementation of the

Settlement Monitoring Plan will allow the impacts of the changes to groundwater levels to be assessed against future performance as the filling works continue.

The hydrogeology of the area will be altered and returned to its natural state. Currently the pumped water is transferred to the Olinda Creek which is above the dewatered level in the quarry. Hence there is a gradient for potential flow from the Olinda Creek to the quarry floor. The flow from the Olinda Creek into the groundwater system would be small compared to the inflow of 1 to 2 Ml/day from the groundwater pumping. Once the groundwater level recovers the original natural flow of groundwater into the Creek will resume, but the pumped inflow will cease.

5 Quarry preparation

5.1 Preparation

At the 2017 handover, the quarry was left in an operational state. There were haul roads into the base of the pit and some fill on the quarry floor. Due to the uncontrolled nature of this fill it was removed from the quarry, the oversize rock separated, and the remaining material replaced in a controlled manner. All surfaces that were cleared of uncontrolled fill were and will continue to be inspected by T+T staff prior to placing engineered fill. This includes removal and disposal of any vegetation.

Loose rocks were removed from the quarry walls so that the exposed faces were intact and solid, allowing engineered fill to be compacted against the walls. Where cavities have been observed in the face of the quarry walls, flowable cementitious fill and/or concrete has been used to seal these off from the fill material so that the engineered fill cannot be eroded into the cavities when the water table is allowed to rise. This process will continue if further cavities are encountered as the fill level rises.

Details of the preparation and cavity filling are included in the quarterly project construction reports included in Appendix J.

5.2 Drainage blanket

A drainage blanket has been placed over the entire floor of the quarry to direct water to the sump in the northern end of the pit. The sump riser will be constructed in stages as the fill is placed to allow the submersible pump to operate and control dewatering of the pit. This includes both groundwater seeping into the pit from the floor, and any surface water which may permeate the engineered fill.

The drainage blanket was constructed from boulders in the stockpile that were crushed on site to produce a well graded material with a maximum particle size of 300mm and no particles finer than 50 mm. The blanket has a minimum thickness of 1m but in many places where uncontrolled fill was removed from the floor of the pit, the thickness is much greater.

The material was placed in 500mm loose layers and compacted with a 16t vibrating smooth drum roller. Each layer was proof rolled with 100t fully laden dump trucks. The surface of the blanket was surveyed.

Above the drainage blanket a 300mm thick coarse filter was placed. This material was also sourced from on-site crushing and comprises a material of 50mm maximum particle size and no material finer than 20mm. A Bidim A34 geotextile was then placed above the coarse filter to restrict the migration of fines out of the engineered fill in the event that surface water penetrates the fill.

5.3 Sump riser

The sump riser is a reinforced concrete structure founded on the base of the quarry, with holes in its base to allow water to enter from the drainage layer. It is founded on solid rock at the quarry base and will rise to at least the expected groundwater level of RL 88m, but potentially to the final filled surface.

A 1m wide layer of coarse rock is placed around the sump to allow surface water to drain to the floor and be pumped out. A layer of Bidim A34 is placed between the engineered fill and the drainage material to stop fines being eroded from the engineered fill.

A submersible pump operating within the sump riser will allow the groundwater level to be controlled as filling takes place. It will be possible to raise and lower the pump and to monitor groundwater behaviour as this occurs and will also allow for pump maintenance or replacement if necessary.

There are very high loads imparted to the sump riser as the fill around it settles. These are referred to as downdrag loads. To reduce the magnitude of these loads the external surface of the sump riser is being painted with a 2mm thick layer of bitumen which is then wrapped in heavy duty polythene. The calculations for the design and the design drawings for the sump are included in Appendix K.

5.4 Pit wall stability

Due to the extent of operations and personnel inside the pit, an assessment was made of the safety of the pit walls. The quarry was developed with a series of benches to aid overall wall stability, and also act to catch any minor rockfalls and to control surface water.

Some large features on the east wall of the pit raised concerns regarding the risk to workers operating under this face. An assessment of rockfall risk was undertaken. As a result, the rock faces were hand scaled to remove loose rocks that posed a risk to workers. One large section of the face was protected with rock mesh and monitoring points were installed to allow survey to monitor if any lateral movement is occurring on this face.

The reports regarding rockfall risk are included in Appendix E. Regular surveys for lateral movement are undertaken to ensure any potential faults are captured early so that corrective action can be implemented.

6 Filling process

6.1 General

The backfilling plan for the quarry includes placing fill up to approximately 120m deep. A review of international case studies yielded no relevant examples of projects where development has taken place on such a depth of filling. There are local examples in Victoria where quarries have been backfilled to depths in the order of 30m to 40m and developed for residential purposes.

The estimated settlement cannot be predicted with confidence at this time, due to the uncertainty about the compressibility of the fill. Hence an observational approach to the settlement of the fill will be used, with modifications to the placement methods if needed as the work progresses.

The relevant Australian Standard for Earthworks for Commercial and Residential Development is AS3798. This Standard was first developed in the 1980s to get a consistent approach to such work and to overcome issues with uncontrolled fill on building lots.

AS3798 was not intended to be suitable for placing fill up to 120m deep. Such filling is usually only undertaken in the construction of large dams. To assess the method for undertaking this fill, the

investigation work detailed in section 3.1 was undertaken which led to the following specification being developed.

6.2 Staging

The first stage of quarry development involved filling to RL 40m to satisfy DJPR ERR concerns about over-excavation of batters by the previous quarry operator. In addition to placing filling into the quarry, the first stage included:

- significant preparatory works to remove uncontrolled filling in the quarry floor and old haul road;
- upgrading and building new haul roads;
- placing a drainage blanket over the entire floor of the quarry to direct groundwater to the new sump riser built at the northern end;
- sealing potential caves in the lower walls of the quarry;
- stabilising rock slopes by hand scaling and installing targets to measure movements on the eastern face; and
- the first level of settlement and piezometer installations.

The fill for the first stage has been sourced from the southern and eastern stockpiles.

The second stage of filling will be easier than the first, with material being removed from the eastern stockpile and progressively raising the level of fill in the quarry. Material may also be sourced from the Stage 2 development west of the railway line. This work will fill the quarry up to approximately RL 100 m, including utilising fill that is taken from the stockpiles outside the buffer setback distance from residential areas.

The final stage of fill work will require access to material in the eastern stockpile, however, these are within the required setback distance of the ERR Work Plan, and it is proposed that oversight throughout the final fill stage is solely with the Council for this last phase. The removal of material within the setback distance will be undertaken in compliance with normal subdivisional works requirements and other controls in the geotechnical Section 173 Agreement with Council. This includes areas adjacent to existing residential development. Included in this stage will be lowering of natural ground levels around the outside of the quarry to match the designed final landform.

Since the volume of material available and needed cannot be predicted with precision at this time, there is flexibility to adjust the final landform to match the available material without importing or exporting additional material, to mitigating offsite impacts.

6.3 Engineering filling specification summary

The material for the engineered fill is all being sourced from overburden stockpiles and excess cut material on site. The material has been mostly placed on the eastern side of the quarry in terraced platforms in the order of 40m deep.

This material has been sampled by drilling of boreholes and excavation of test pits. It comprises a mixture of materials removed as part of the overburden stripping and includes very large boulders through to clay fines. Any observed contaminated material, topsoil or organic material will be precluded from the engineered filling.

Laboratory testing was conducted on these materials, and assessment of the behaviour made to assist in preparing a specification for the project. This included an assessment of settlement once the filling is completed. The reports detailing this information are included in Appendix B.

The primary objective of the specification is to achieve economical backfilling of the quarry to a standard which will allow development at some time in the future. Filling is planned to take about five years. During this time settlement monitoring will be undertaken which will assist in estimating future settlement with increased confidence.

Based on the information derived from the investigations, a minimum average dry density ratio of 101% Standard for a day's placement has been adopted, with no test result below 98% Standard. This compares to the requirements of AS3798 (the Australian Standard for Earthworks for Commercial and Residential Development) which require a dry density ratio of 95% Standard for residential development. To achieve this density, initial roller trials adopted 8 passes of a Cat 825 compactor with a loose layer thickness of 400 mm. This has now been demonstrated to achieve and often exceed the minimum density requirements. A maximum particle size of 300mm has been adopted and the moisture content has been maintained at that from the stockpiles, which is generally dry of Standard Optimum Moisture Content, which facilitates achieving higher density.

To compact material close to the walls of the quarry a smaller compactor has been used. This is a 16 t vibrating sheepsfoot roller, and again it has been demonstrated that 8 passes of this roller achieves the specified minimum density. Both rollers are equipped with location sensing equipment which allows their tracking to be recorded over any point in space. This technology can be used to verify that each layer does not exceed the maximum thickness and has at least 8 passes.

At the end of each day's work a flat drum roller is used to seal off the fill material to limit water ingress in the event of rainfall.

All earthworks are and will be conducted under Level 1 supervision; initially this was undertaken by Chadwick Geotechnics Pty Ltd (CG) (Level 1 Supervisor). The Level 1 Supervisor will supervise all stages of the filling process. Testing must occur at a NATA registered laboratory, currently one is established on the site. A geotechnical engineer from the developer appointed engineering firm (initially T+T) will attend site several times each week to track progress and deal with any issues arising.

A standalone specification has been produced separately from this Framework document, and is included in Appendix M.

The specification may be varied from time to time, including varied specification for different parts of the fill work.

Despite the high-density compaction ratio required, some settlement will occur and that monitoring of settlement after completion is the appropriate method that confidence in future settlement predictions can be made. It should be accepted that it may take a significant time after filling is completed before it is established the Precinct 4 area, or relevant parts of it, are suitable for development. There is a small risk that development may never be possible on the filled area, or parts of it. Contingencies for that unlikely prospect have been allowed for in an alternative development form and layout.

6.4 Contamination management

Following environmental assessment of the site, an Importation and Contamination Management Plan has been prepared. This plan is being adopted as part of the backfilling of the quarry. These reports are included in Appendix N.

Additional sampling and testing of onsite stockpiled soils re-used to fill the quarry must also be undertaken.

7 Monitoring

To compare the actual performance of the fill material and groundwater to modelled estimates, monitoring will be undertaken during and after construction of the quarry backfill. This will allow the performance to be compared to the geotechnical and hydrogeological models that have been developed and used to make the estimates of settlement and groundwater rebound.

Monitoring shall be in accordance with an Instrumentation and Monitoring Plan, which sets out requirements for monitoring the settlement performance of the quarry backfill, including monitoring of groundwater to assess the potential impact of rising groundwater levels on the rate of settlement. The instrumentation and monitoring plan should include the following information:

- The type of monitoring instrumentation proposed;
- The location and elevation at which monitoring instrumentation will be installed; and
- The proposed frequency of monitoring during and in the period following the rehabilitation earthworks. The duration for which monitoring will continue following the earthworks should be specified.

Monitoring processes and results shall be reported to Council as provided in Part 7 of this document.

The proposed instrumentation to allow this monitoring to take place is detailed in Appendix O, together with location plans and installation details. As data is collected from this instrumentation, a comparison will be made to the assumed behaviour and will allow estimates to be updated.

Once the quarry filling is completed, a comprehensive surface settlement monitoring network will be set up to allow ongoing survey of the surface settlement. This data will be compared to the estimates from the modelling.

The data will be used to predict long term settlement behaviour of the land. This information will be used to consider development options and associated foundation treatments. Design of buildings will be undertaken with due account of the forecast settlement behaviour and will be required to meet all relevant Australian Standards. Dual certification and/or independent review by suitably qualified engineers will be undertaken.

Land for transfer or vesting to public authorities for open space, road or other purposes will have target Settlement Performance Criteria as a pre-condition to any transfer or vesting.

8 Reporting

8.1 Progress reporting obligations

Weekly construction reports are prepared for the developer which meet the requirements of AS3798. These are consolidated into quarterly reports which summarise the works. These reports will cover the entire development including geotechnical, environmental and hydrogeological matters.

Progress reports should include the following information:

- the extent, depth and volume of fill placed during the reporting period;
- the inspections, sampling and testing carried out by the Geotechnical Engineer over the reporting period;
- the locations and results of the tests performed by the GITA over the reporting period;
- an opinion (statement of compliance) provided by the GITA as to whether the works undertaken over the reporting period comply with the earthworks specification;

- the results of any monitoring undertaken in accordance with the instrumentation and monitoring plan over the reporting period; and
- details and justification for any departures from or updates to the specification and/or instrumentation and monitoring plan over the reporting period.

The quarterly reports will be provided to the Council. These reports are being prepared by the Approved Engineer but they may incorporate the testing work of others, including inspections.

The Completion Report will be provided to Council.

8.2 Completion Report

Within 90 days of the completion of the quarry filling, a completion report should be prepared in accordance with guidance in Section 8.2 of AS3798 (2007) and include the following information:

- the extent, depth and volume of all fill materials placed;
- the inspections, sampling and testing carried out by the Approved Engineer;
- the locations and results of the tests performed by the Approved Engineer;
- an opinion (statement of compliance) provided by the Approved Engineer as to whether the works undertaken comply with the earthworks specification;
- the results of the monitoring undertaken in accordance with the instrumentation and monitoring plan; and
- details and justification for any departures from or updates to the specification and/or instrumentation and monitoring plan.

It is important that the completion report provides a relatively detailed summary of the earthworks undertaken, not only a compilation of compliance tests undertaken.

The earthworks Completion Report will relate only to compliance with the requirements of the earthworks specification and will not provide confirmation that the land is suitable for any development.

For example, the backfill materials may comply with the specified material grading and compaction requirements but not provide a satisfactory founding stratum for multi-storey buildings without further works.

A further Level 1 geotechnical report meeting the requirements of AS 3798 will be provided at the conclusion of the filling works.

9 Land transfer and development approval

9.1 Vesting land to Council

Settlement criteria have been left in the form of target future settlement rate predictions for land intended to vest in Council as Open Space and Road Reserves.

Noting:

- other criteria, as agreed in the Section 173 Agreement, will be applied in determining the acceptance of land for use as Council Open Space and Road Reserves;
- provided the Settlement Performance Criteria are met, these should not form the basis of the Council refusing to accept a transfer or vesting;
- the acceptability of Road Reserves for the infrastructure of agencies other than Council (gas, electricity, sewer, water, waste, communications) is a matter for such agencies; and

- additional considerations including under section 9.2 will apply to parts of Council Open Space and Road Reserves intended to contain buildings or structures; and
- in certain circumstances alternative foundation systems or treatments to a slab may be a viable geotechnical solution.

9.2 Approval process for building assets

A staged approach to approval for Buildings to be constructed on the quarry backfill has been established reflecting the unusual nature of the development. This approach is shown in Appendix O and allows for development to proceed as information is obtained from the ongoing monitoring.

Settlement performance alone may not be sufficient evidence of building capacity of the relevant land.

Design requirements for development of the filled land including buildings and infrastructure such as pavements and underground services should be based on “traditional” targeted geotechnical investigation(s) that demonstrate that the site (including but not limited to the areas where fill has been removed or placed as part of the rehabilitation earthworks) is satisfactory for the proposed development in accordance with prudent engineering design principles. Information to be provided may include but not be limited to the following:

- Details of the proposed development such as building column loads, pavement traffic loads and the ability of buildings and infrastructure to tolerate total and differential settlement.
- Review of the earthworks Completion Report with respect to the proposed development to confirm that the technical specification adopted and earthworks performed are satisfactory.
- The results of settlement monitoring of the placed fill and assessment of the unexpected ongoing total and differential settlement both across the backfill area and between areas of fill and natural ground.
- The results of intrusive investigations (eg, boreholes and test pits) to assess the nature and strength of the subsurface materials over the depth relevant to the design of the building footings, proposed excavations, pavements, etc.
- Assessment of satisfactory footing alternatives for buildings and other structures (if relevant) including assessment of the bearing capacity and shrink-swell behaviour of the proposed fill or natural ground founding materials and the potential impact of ongoing total and differential settlement.
- Confirmation of the site classification in accordance with AS2870 (2011) “Residential Slabs and Footings” (or subsequent revisions), where applicable to the type of development proposed.
- Geotechnical design recommendations for retaining walls, pavements, service trench excavation and service installation, etc.
- Assessment of groundwater levels and the impact of future changes in groundwater levels on the proposed development.
- Assessment of the stability of batter slopes and landslide risk associated with the post-rehabilitation earthworks site conditions.

9.3 Indemnity / landowner acknowledgement

An indemnity is to be provided for Council in relation to any buildings constructed on the filled area by way of the geotechnical section 173 agreement.

10 DJPR

10.1 Current work plan

The quarry is currently undergoing rehabilitation under Work Authority 199, which is administered by ERR. This includes a rehabilitation plan approved for the quarry site which was submitted by the previous site owner, Sibelco, and approved by ERR.

10.2 Proposed work plan variation

A work plan amendment is proposed to ERR to reflect the change in plans for the site since it was sold.

The new work plan will reflect the planned future filling of the site but will include a fall back rehabilitation plan which reflects the currently approved rehabilitation plan objectives. It is intended bonds to ERR will be scaled to cover the fall back scenario in the unlikely event that the developer is unable to complete the current development plan or fulfil the rehabilitation options.

10.3 Set back distances

Under the current work plan for the site as a quarry, the Environment Protection Authority (EPA) recommends a default 250m set back distance between residential development and earthmoving activities unless an alternative distance can be justified. Noise & dust testing, and further design work has been undertaken which supports a request for reduction in the set back distance to 100m so that the transfer of stockpiled material back into the quarry can be affected and the Stage 1 subdivision proceed to registration.

In addition, the Stage 1 Subdivision permit requires a 250 metre setback from earthworks (which may be reduced by agreement of DJPR/ERR and the Council), for future dwellings in Stage 1, and boundary arrangement, requiring consideration in amending the Work Plan. Once the Workplan is extinguished these setbacks no longer apply.

10.4 Stability assessment

After initial discussion with the geotechnical staff of DEDJTR, T+T undertook a geotechnical risk assessment of the proposed rehabilitation plan. This was conducted using the DEDJTR Framework[1] and this assessment is included in Appendix Q.

The standard procedure for this risk assessment is to consider a Geotechnical Reference Zone (GRZ) which is 3 times the depth of the quarry. However, discussions revealed that this is intended only for very preliminary purposes when a quarry is being planned and was not necessary to consider in this case of a well-established quarry. Hence only the risks pertinent to the rehabilitation plan have been assessed.

The risk related to the actual work plan are substantially reduced compared to the rehabilitation plan due to the increased depth of filling and placement of filling against batters in the current quarry.

Both the current work plan and rehabilitation plan show risk levels that are moderate or less in accordance with the DJPR risk methodology.

[1] Risk based work plan using online RRAM Guidelines for Extractive Industries Projects V0.6 August 2016.

11 Applicability

This report has been prepared for the exclusive use of our client Hume Lilydale Pty Ltd & LBJ Corporation Pty Ltd, 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.

We understand and agree that this report will be used by Yarra Ranges Council in undertaking its regulatory functions in connection with the Kinley development.

Tonkin & Taylor Pty Ltd

Report prepared by:	Authorised for Tonkin & Taylor Pty Ltd by:
	
.....	.....
David Glover	Tim Chadwick
Associate Geotechnical Engineer	Project Director

DRG
\\ttgroup.local\corporate\south melbourne\projects\1000511\workingmaterial\geotechnical framework report\1000511.r6v7.docx

Appendix A: Survey data

EXISTING FEATURES PLAN

LILYDALE QUARRY, LILYDALE, VIC 3140

100 0 50 100 150 200

SCALE 1: 3000 SHEET A1

REF 22835 VERSION A DATE 15/11/2018

G:\22835\Office Work\Plans\In Progress\Feature Plans\22835-0-ExistingFeatures-M-A.dgn

LEVEL 6
440 ELIZABETH STREET
MELBOURNE VIC 3000
(03) 8660 3000
SURVEY@REEDSCONSULTING.COM.AU
WWW.REEDSCONSULTING.COM.AU

REEDS CONSULTING

N

MAROONDAH HIGHWAY

TAYLOR ST

LILYDALE HIGHSCHOOL

LILYDALE MARKETPLACE

MELBA AVENUE

BOXHILL INSTITUTE

MOOROOLBARK ROAD

HULL ROAD

MIXED USE COMMERCIAL 1.25ha

PAW

1500m²

2ha

3.2ha

Site Area 44.12ha

2000m²

5200m²

PEDESTRIAN

HERITAGE

2700m²

4.9ha

CIVIC INSTITUTION

POSSIBLE URBAN SCHOOL

Site Area 95.69ha

1600m²

TRANSIT ORIENTATED DEVELOPMENT

FUTURE RAILWAY STATION

1700m²

2.4ha

5400m²

1.3ha

1500m²

PAW

BRIDGE

1275m²

9800m²

APPROVED STAGE 1

LEGEND

	SITE AREA	143.81ha
	QUARRY FILL ZONE	

ENCUMBERED LAND

	RETENTION BASIN & WETLANDS (3.91% OF SA)	6.98ha
	PUBLIC ACQUISITION AREAS	5.66ha
	TOTAL	12.64ha
	% OF SA	8.8%

PUBLIC OPEN SPACE

	MAJOR PARKLAND	4.91ha
	NEIGHBORHOOD PARK	3.44ha
	LOCAL PARK	2.15ha
	CIVIC PLAZA	1.60ha
	RAIL TRAIL	1.38ha
	TOTAL	13.48ha
	% OF GDA	10.3%

ROAD NETWORK

	NORTH SOUTH CONNECTOR	2.99ha
	ROADS	35.39ha
	LANEWAYS	4.06ha
	TOTAL	42.44ha
	% OF GDA	32.4%

DEVELOPABLE	Gross Areas	Av. Density	Est. Yield
CONVENTIONAL RESIDENTIAL	31.09ha	420m²	740
MEDIUM DENSITY	17.67ha	180m²	1052
LARGE LOT	5.91ha	600m²	98
HERITAGE QUARTER	4.84ha	40 dw/ha	193
MIXED USE / COMMERCIAL / RETAIL	1.25ha		
URBAN SCHOOL	1.36ha		
CIVIC INSTITUTION	0.55ha		
TERRACE HOUSE	5.69ha		319
LIVE/WORK	0.32ha		18
APPARTMENTS	2.18ha		610
RETAIL PARKING	1.42ha		
MULTI DECK PARKING	2.02ha		
OFFICE/COMMERCIAL GFA	11,080 m²		
FREESTANDING RETAIL GFA	5,356 m²		
GROUND FLOOR RETAIL GFA	14,091 m²		
TOTAL			3031
AVG. DENSITY			23 dw/ha

REEDS CONSULTING · TORTI GALLAS + PARTNERS · T.C.L · RobertsDay planning·design·place · INTRAPAC PROPERTY · Bayport

robertsday.com.au planning·design·place

WORKING PROGRESS

SIZE A0 1:2000 0 metres 20 40 60 80 100

REV	DESCRIPTION	DDMMYY	DRAWN	APPR'D
M	DESIGN REVISIONS	17.01.18	RF	MJ
L	ENLARGED RB	08.01.18	RF	MJ
K	DESIGN REVISIONS	08.12.17	RF	MJ
J	DESIGN REVISIONS	30.11.17	MJ	MD
I	DESIGN REVISIONS	31.10.17	RF	MJ
G	DESIGN REVISIONS	26.09.17	RF	MJ
F	HERITAGE OVERLAY	31.08.17	RF	EP
E	DESIGN UPDATE	28.08.17	RF	MD

DRAFT CONCEPT PLAN

Lilydale Quarry

Lilydale, VIC

REF NO. **INT LIL** · DRAW NO. **RD1 003** · REV. **M**

Appendix B: Geotechnical investigation of existing stockpiles

REPORT

Tonkin+Taylor

4 Melba Ave, Lilydale

Geotechnical Investigation and Assessment

Prepared for
Bayport Industries Pty Ltd & Intrapac Pty Ltd
Prepared by
Tonkin & Taylor Pty Ltd
Date
June 2016
Job Number
5064.001.R1 DRAFT.vA

Exceptional thinking together
www.tonkintaylor.com.au

Distribution:

Bayport Industries Pty Ltd & Intrapac Pty Ltd	1 pdf copy
Tonkin & Taylor Pty Ltd (FILE)	1 copy

Table of contents

1 Introduction

Tonkin & Taylor Pty Ltd (T+T) has been engaged by Bayport Industries Pty Ltd & Intrapac Pty Ltd (Joint Venture) to undertake an environmental and geotechnical investigation at the former Lilydale Quarry, located at 4 Melba Avenue, Lilydale, and to provide preliminary due diligence phase advice for the proposed acquisition and redevelopment of the site.

The scope of work was detailed in our working letter proposal dated 4 April 2016[1]. This report presents the geotechnical results of the investigation carried out for the Project. The results of the environmental investigation are presented in a separate report.

2 Project understanding

We understand that the Joint Venture has entered into a 90 day due diligence period to consider the acquisition of the site. As part of the process information is required on the environmental condition of the site, and the geotechnical constraints around redevelopment, and placement of overburden material stockpiled on site into the quarry excavation.

A number of existing reports have been made available in a data room, and these have been provided to T+T.

It is understood that the proposed development would consist of mixed use, predominately consisting of single or double storey residential dwellings and some commercial buildings.

For the purposes of defining the site, reference is made to 'Stage 1', which forms the southern portion of the site and for which extensive environmental works (in particular) have already been undertaken (including the issuing of Certificates of Environmental Audit) and Stage 2, being the balance of the site. Within Stage 2, we refer to the following areas previously defined (**Ramsay 2015**):

- The Plant and Processing area, being the main crushing and processing area.
- The Northern Land, encompassing the northern end of the site (east of rail line) and including administration buildings and collection pond.
- The Northern Stockpile, being a smaller overburden disposal area (OBDA) to the northeast of the quarry pit, including a large storage shed.
- The Eastern Stockpile, being the large OBDA to the east of the quarry pit.
- The Southern Stockpile, being a small OBDA to the south of the quarry pit.
- The Western Land, being undeveloped land to the west of the railway line.

Refer to Drawing 2 (Appendix A) for a summary plan delineating the site areas.

2.1 Site location

The former Lilydale Quarry site is located at 4 Melba Avenue, Lilydale. The site incorporates former buffer zones to the west and south and is bisected by the Lilydale railway line. It is bounded by Melba Avenue and Maroondah Highway to the north, Lilydale Lake and the former Swinburne TAFE to the east, Hull Road to the south and Mooroolbark Road to the west (refer Figure 2.1, below). Also refer the site location plan, Drawing 1 (Appendix A). The southern portion of the site (Stage 1) has been approved by local council as a General Residential Zone whilst the balance of the site (Stage 2) is pending approval for a Comprehensive Development Zone.

[1] T+T (4 April 2016) Proposal, *Geotechnical and Environmental investigation 4 Melba Ave, Lilydale.* T+T: 5064.001.P1.

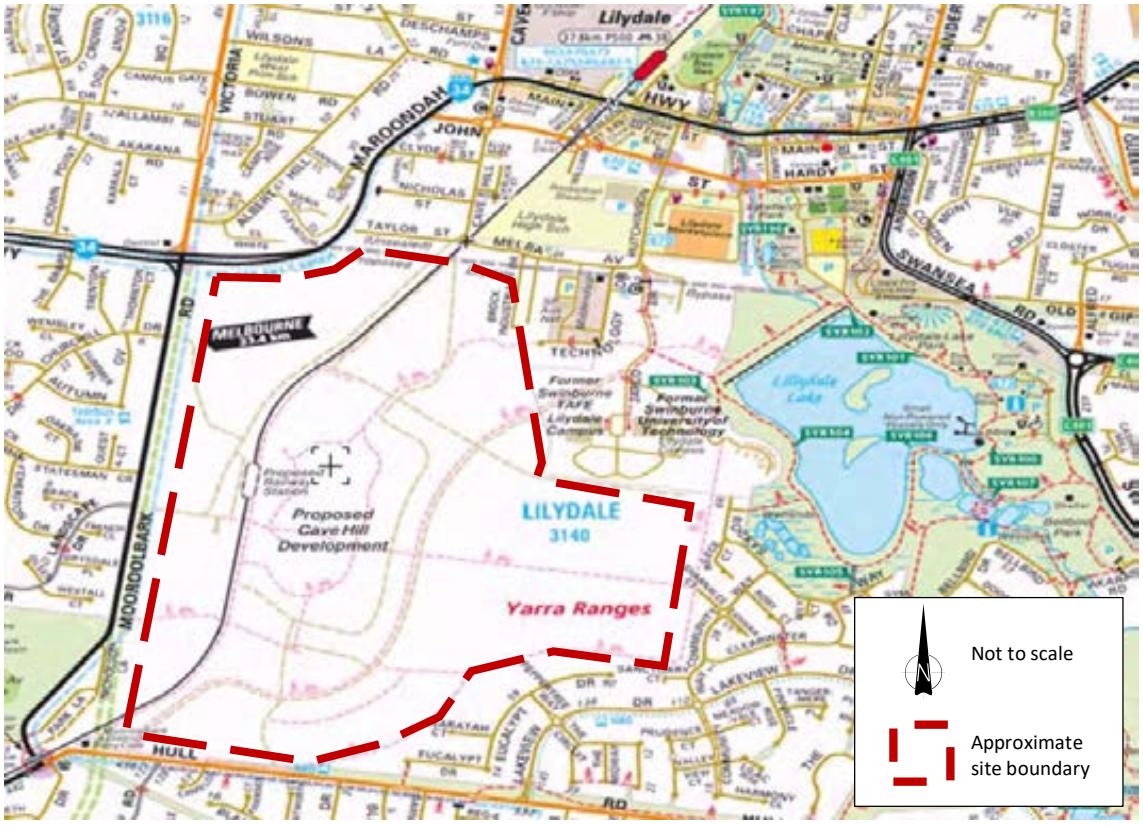


Figure 2.1: Site Location (adapted from Melway, 38 B8)

*Figure 2.2: The Former Lilydale Quarry (**Knight Frank 2015**)*

2.2 Brief

The brief provided to T+T by Joint Venture requested the following:

(a) Review of all existing reports and data bases.

(b) Provide subsurface soil profile for each precinct, including stage 1.

(c) Characterising of overburden material with typical CBR's.

(d) Confirm suitability of overburden material to be placed back into the quarry pit.

(e) Prepare and provide appropriate methodology for placement of material into the quarry pit.

(f) Provide advice on groundwater extraction and groundwater treatment during filling of quarry pit and post completion of the proposed works.

(g) Confirm suitable treatment for slope stability within quarry pit during filling operations (precinct 5).

(h) Confirm suitable treatment for slope stability within erosion overlay zone (precinct 3) for future development.

(i) Provide advice on suitable buffer zones between quarry pit (once filled) and the built development.

2.3 Scope

Based on the brief provided and subsequent discussion between T+T and the Joint Venture the following scope of work was undertaken:

- Review of all existing reports made available to T+T
- Completion of test pits within the Eastern, Northern and Southern Stockpile areas.
- Completion of test pits within the Stage 1 and Western Land areas.
- Logging of test pits and collection of soil samples for laboratory analysis
- Site walkover to assess site-wide slope stability issues.
- Development of options for backfilling of the quarry utilising the material available on site, giving consideration to long term objectives for open space and/or residential use.
- Provision of advice on potential geotechnical constraints associated with the Western Land and the Stage 1 areas.
- Completion of additional boreholes within the Northern and Eastern Stockpiles to confirm the thickness of stockpiles and depth to natural ground.

3 Regional Geology

The site is situated in a complex geological setting with numerous geological units present. The central and eastern portions of the site have been subject to extensive modification by cutting and filling during operation of the quarry. Based on information published by DEDJTR[2] (Figure 3.1) the site comprises:

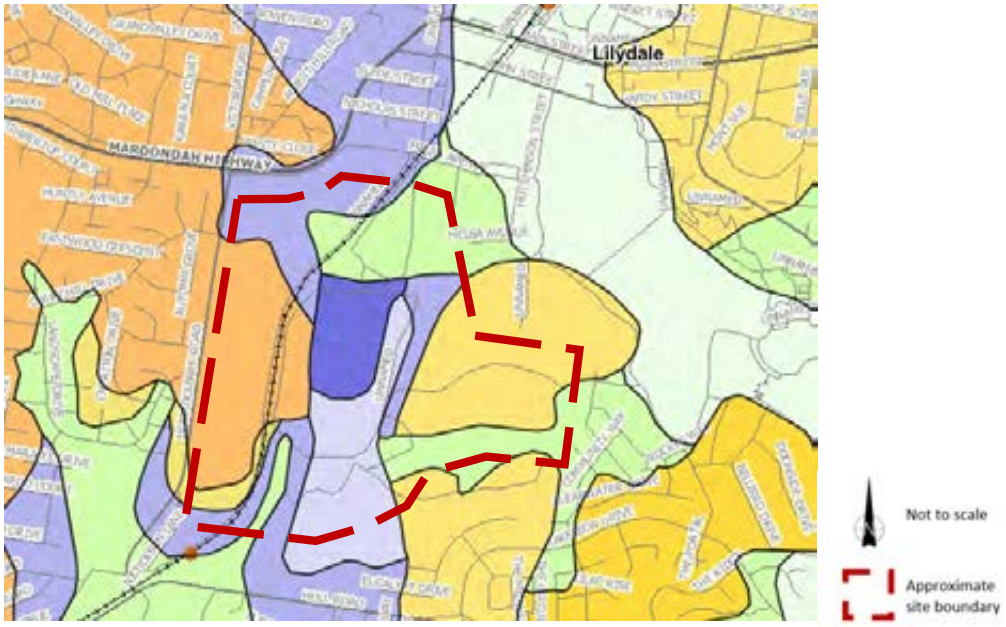


Figure 3.1: Site Geology (after DEDJTR[2])

Table 3.1: Site Geology Legend

Key	Unit name	Age (Youngest)	Brief description
	Alluvium	Quaternary (Holocene)	Gravel, sand, silt. Fluvial.
	Colluvium	Quaternary (Holocene)	Diamictite, gravel, sand, silt, clay, rubble.
	Greensborough Basalt	Tertiary (Miocene)	Basalt. Olivine and titauganite. Older Volcanic Group.
	Sub-basaltic sediments	Tertiary (Miocene)	Conglomerate sandstone. Terrestrial.
	Mount Evelyn Rhyodacite	Devonian (Late)	Rholite to rhyodacite ignimbrite. Multiple flows. Welded.
	Coldstream Rhyolite	Devonian (Late)	Rhyolite lava. Coherent flow-banded to autobrecciated.
	Cave Hill Sandstone	Devonian (Early)	Quartzitic sandstone conglomerate. Quartz sandstone with horizons of sheared rounded quartz pebbles.
	Lilydale Limestone	Devonian (Early)	Limestone, minor dolostone. Well bedded. Bioclastic.
	Humevale Siltstone	Devonian (Early)	Siltstone, laminated sandstone. Massive to thin bedded.

Sub-surface conditions at the site have been documented by **Ramsay 2015** and **Rocktest 2015** and are considered generally consistent with the published geology presented. It is noted that older geological mapping[3] shows the Greensborough Basalt flows extending further to the east beyond the quarry excavation. This was generally confirmed on site with the flows observed to also extend further south into Stage 1. Similarly, the colluvium shown on the DEDJTR map has also previously been interpreted as alluvial material which is consistent with observations on site.

[2] The Department of Economic Development, Jobs, Transport and Resources (Formerly Department of Primary Industries) GeoVic online database, http://www.energyandresources.vic.gov.au/earth-resources/maps-reports-and-data/geovic, accessed 05 May 2016, showing Geological Unit 50K (synthesis from multiple previous mapping sources).
[3] Vandenberg A.H.M. (1997) MELBOURNE SJ 55-5 Edition 2, 1:250 000 Geological Map Series. Geological Survey of Victoria. & Vandenberg, A.H.M. (1981) RINGWOOD No 849, Zone 7, 1:63.360 Geological Map. Geological Survey of Victoria. & Crohn P.W. (1953) Lilydale Limestone Deposit, Mining and Geological Journal Vol 5 No 1. Neal R. Department of Mines, Victoria, pp. 37-41.

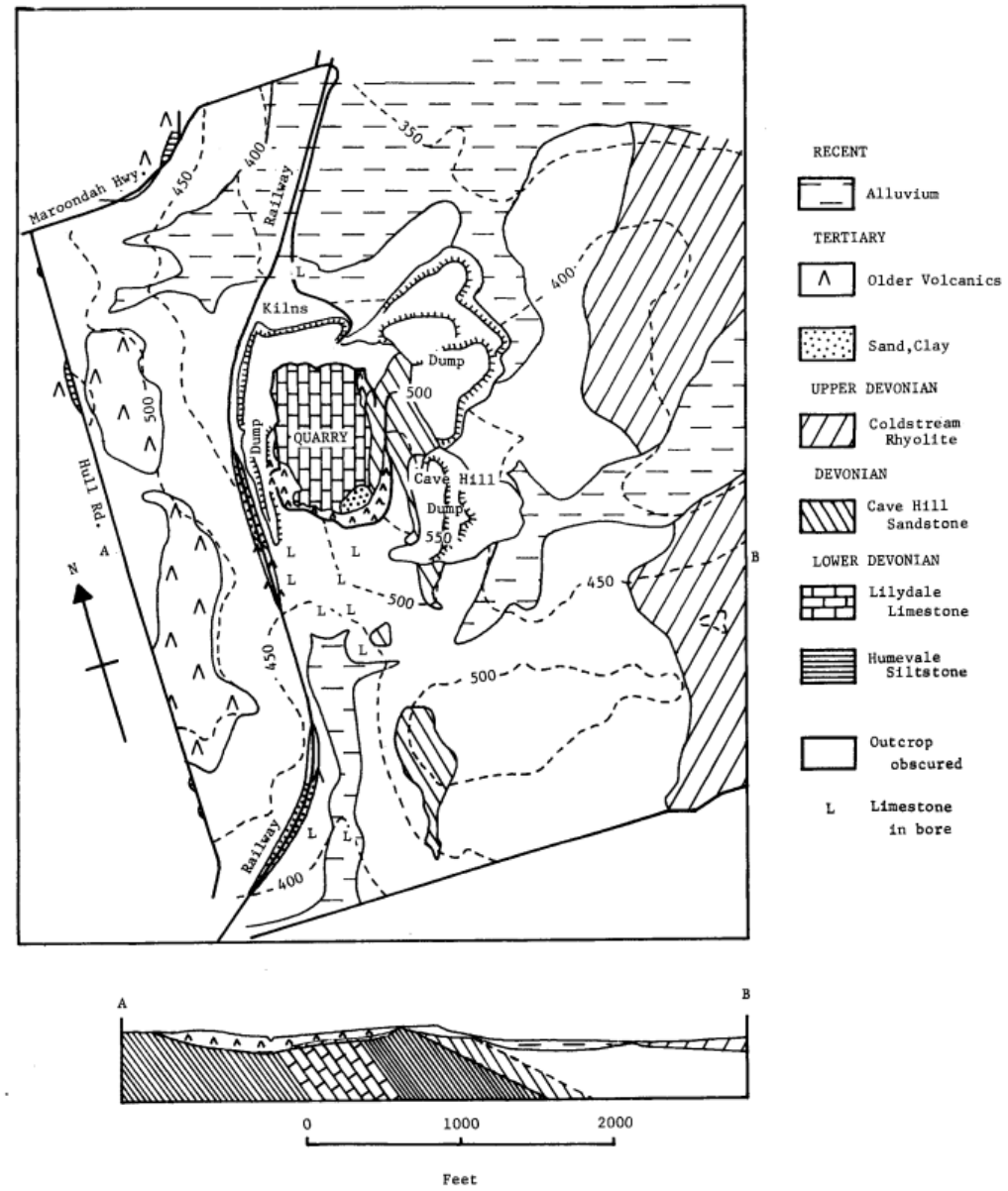


Figure 3.2: Geological outcrop map of Lilydale Quarry (after Crohn 1953) [3]

Clay fill material consistent with disturbed Alluvium, Greensborough Basalt and Coldstream Rhyolite; and sedimentary clay/sand and cobble/boulder fill consistent with Cave Hill Sandstone and Lilydale Limestone; was encountered within the OBDA. Refuse was also observed.

4 Fieldwork

Geotechnical fieldwork was carried out between 13 and 27 April 2016 and 16 to 19 May 2016 and incorporated:

- Site walkover and slope stability assessment by a senior geotechnical engineer.
- 30 test pits within fill:
  - 25 test pits within Eastern Stockpile area (TP01 to TP11, TP12A to TP12D, TP13 to TP22).
  - 3 test pits within the Southern Stockpile area (TP23 to TP25).
  - 2 test pits within the Northern Stockpile area (TP1A to TP1B).
- 17 test pits within natural soils:
  - 9 test pits within the Stage 1 area (TP26 to TP34).
  - 8 test pits within the Western Land area (TP35 to TP42).

A total of 47 test pits were excavated using a 30 t excavator supplied and operated by Bayport Industries Pty Ltd. Test pits were generally excavated to depths of 7 m within fill (the effective reach of the excavator) or until 2 m of natural ground had been encountered. The test pit logs are found in Appendix B. Photographs from the site and test pits can be found in Appendix C.

Test pitting work was carried out under the direction and full time presence of an experienced T+T geotechnical engineer who was responsible for positioning the test locations, determining the extent of sampling and testing and logging the sub-surface conditions encountered. Groundwater levels were recorded in the test pits wherever observed.

Bulk and disturbed samples were collected at regular intervals for laboratory material classification. Vane Shear Tests were performed in the sides of the shallow pits. Test pits were backfilled with material excavated compacted with the bucket in layers and trafficked by the excavator treads. Net excess material was generally generated from the deep test pits. In order to avoid boulder trip hazards and mixing with surficial rootlet impacted material excess spoil was placed into a small stockpile beside each of the test locations rather than spread.

A total of 3 boreholes were excavated using a Hanjin D&B-8D model track mounted drilling rig supplied and operated by Chadwick Geotechnics Pty Ltd. Boreholes were completed to confirm placed overburden thickness at select locations of interest requested by the Joint Venture. Boreholes were advanced using pneumatic downhole hammer and drag bit techniques due to the variable presence of boulders anticipated within the fill.

Test pit and borehole coordinates were recorded with a hand-held GPS device accurate to within approximately 5 m. The approximate locations of the test pits and boreholes are shown on the Test Location Plan (Drawing 2, Appendix A). If more detailed positions of investigation locations are required then these should be undertaken by a qualified surveyor.

5 Laboratory test results

Laboratory testing was conducted at the NATA registered laboratory of our associated company Chadwick Geotechnics in Dandenong South. The testing included:

- Twenty-seven (27) moisture content tests to assess insitu consistency.
- Forty (40) sieve analyses to assess particle size distribution.
- Forty (40) Atterberg Limits tests to assess soil plasticity.
- Seven (7) Emerson Class Number tests to assess soil dispersibility.
- One (1) remoulded permeability test to assess suitability for re-use as a wetland liner.
- Nine (9) 4-day soaked California Bearing Ratio tests to assess pavement subgrade design CBR.

The NATA laboratory test certificates for each of the laboratory tests and summary tables of the field and laboratory test results are included in Appendix D.

A summary of the minimum, maximum and medium of the laboratory test results is presented in Table D.1 to Table 5.2.

Table 5.1: Summary of Atterberg Limits and Grading test results (minimum to maximum (medium))

Area	Moisture Content (%)	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	% Passing 0.075 mm	Emerson Class No.
Eastern Stockpile	7.3 to 47.3 (16.8)	0 to 50 (11)	14 to 76 (30)	0 to 21 (5.5)	8 to 85 (33)	2 to 5 (5)
Stage 1	3.5 to 35.4 (28.8)	30 to 40 (38.5)	63 to 72 (63)	14.5 to 16 (15)	90 to 92 (91)	5
Western Land	11.1 to 36.4 (27)	6 to 38 (26)	23 to 73 (58)	11 to 16.5 (12)	52 to 93 (73)	-

Table 5.2: Summary of CBR and Compaction test results (minimum to maximum (medium))

Area	CBR (%)	Swell (%)	MDD (t/m3)	OMC (%)
Stage 1	2 to 20 (4)	0 to 3 (1)	1.28 to 1.86 (1.47)	13.5 to 38.5 (29)
Western Land	3 to 7 (4)	0 to 1 (0.5)	1.3 to 1.7 (1.49)	18.5 to 37 (31)

6 Geotechnical Considerations

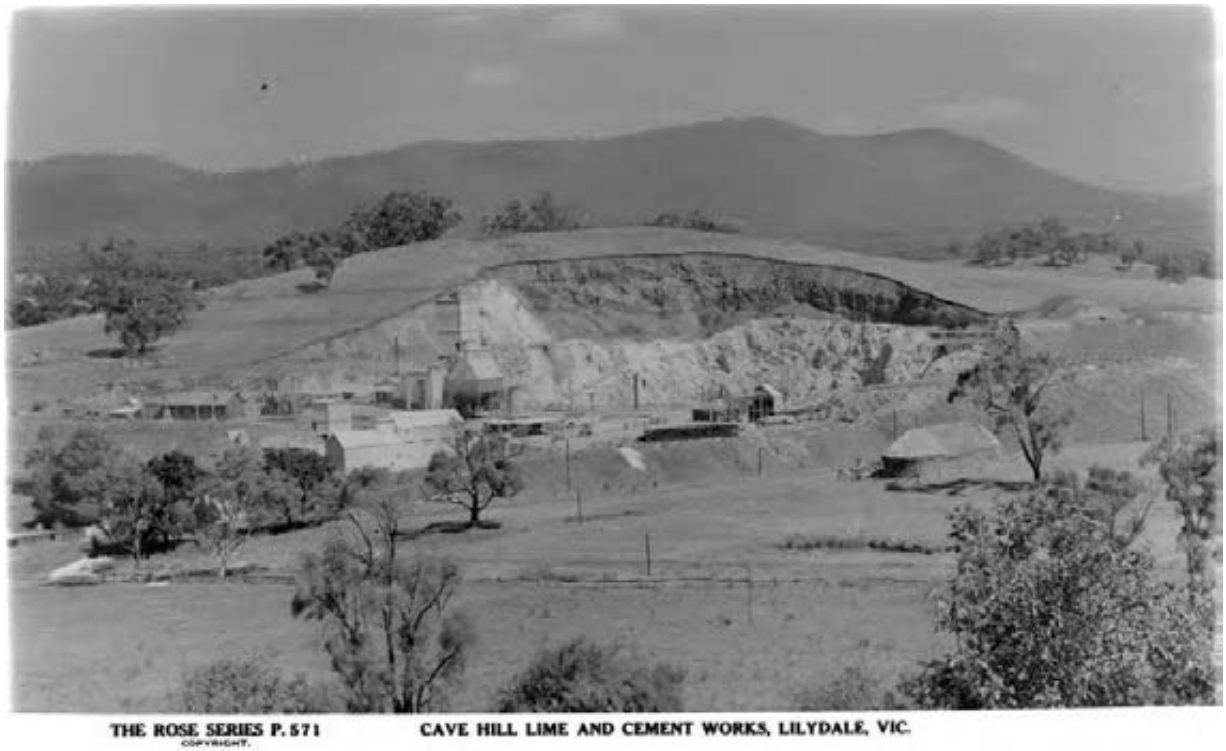
Recommendations and opinions in this report are based on our visual appraisal of the site and point source investigations. The nature and continuity of the subsoils away from the test locations is inferred and it must be appreciated that actual conditions may vary from the assumed model.

6.1 Site conditions

The site consists of the quarry excavation, processing plant and amenities, product and overburden stockpiles and buffer zone. A railway line separates the quarry pit from the western land buffer. The railway line was built in the late 18th century and still operates today. It is currently single track but may be duplicated in the future.

The surface of the site has been greatly influence by the limestone quarrying activities resulting in a large excavation and significant stockpiles across the site. The portion of the site west of the railway has undulating hills and paddocks. The southern section of the site, designated as Stage 1, is covered in hills and tree lined fences. Based on the **Ramsay 2015** Report the western section and Stage 1 are largely unaffected by the quarrying activities and form buffer zones.

Whilst it is difficult to accurately determine the original landscape prior to quarrying commencing in the late 19th century, photographs from the State Library provide an indication. The site was referred to as Cave Hill Lime and Cement works and photograph 6-1 shows what the site looked like in the early to mid 1900's.



Photograph 6-1: Cave Hill Lime and Cement Works, Lilydale (c1920-1954)

It appears that the bulk of Cave Hill was removed to access the limestone.

The construction and expansion of the OBDA has been discussed in detail by others and is summarised briefly in this section. Strata encountered during site investigation works is also briefly described.

Aerial photography available for the site indicates that active OBDA were present immediately to the north east, east and south east of the quarry during the 1950's. These OBDA's had joined by the 1980's. They were partially relocated and began extending significantly further east during the 1990's following expansion of the quarry. During the 2000's the Southern Stockpile is shown to be established and the Eastern Stockpile further expanded. The Southern and Eastern Stockpiles are understood to have been active up until the quarry ceased extraction in 2015.

The survey by Reed Consulting provides a section through the quarry pit. The base on the quarry pit is RL 14 m AHD and the proposed final backfill surface is RL 120 m AHD. The actual backfill surface level will have a fall to the middle and to the north.

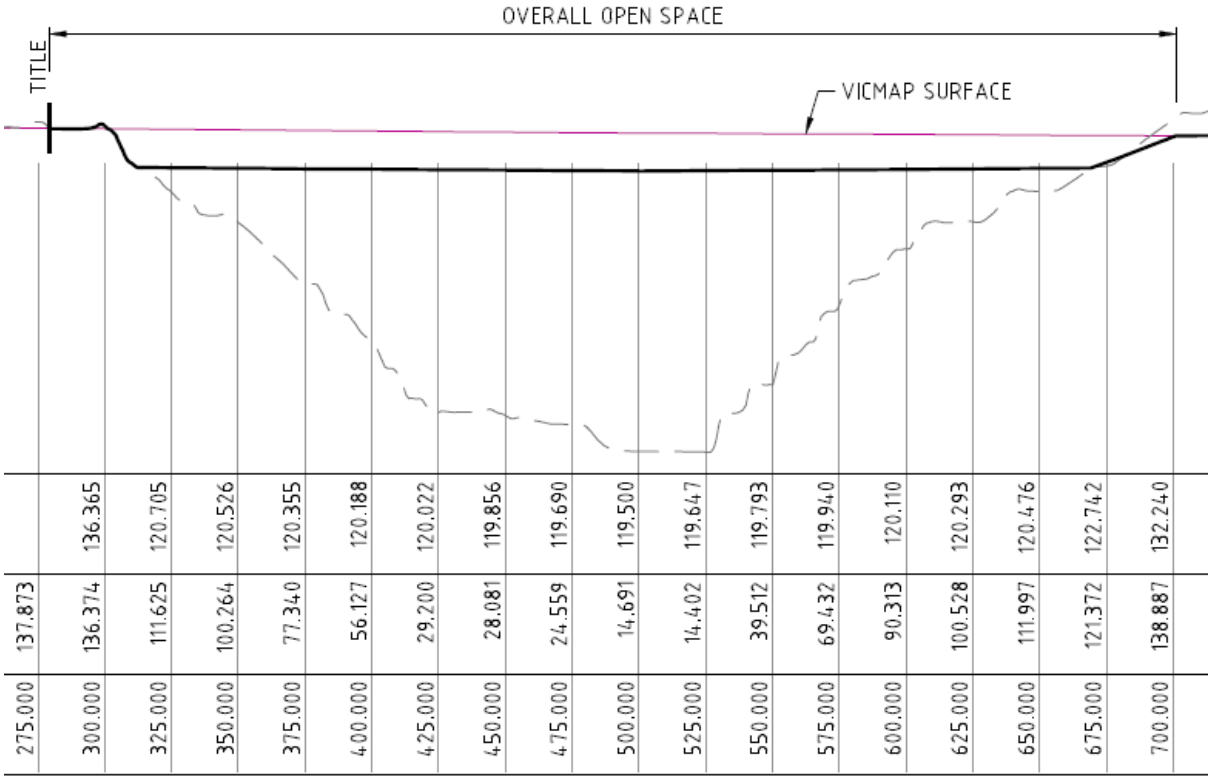


Figure 6.1: Section through quarry pit dated May 2016 (provided by Reeds Consulting)

6.2 Stage 1 area

Stage 1 forms the southern portion of the site adjacent to Hull Road. It has been identified as the first stage of development and has been subjected to an environmental audit. The western extent of the stage adjacent to the rail reserve was recently leased as a Pony Club. Northwest of the Stage 1 area is a vegetated buffer mound and overburden disposal area referred to as the Southern Stockpile. The material is understood to comprise overburden from the quarry pit and a portion has been capped with topsoil and planted. To the north east a smaller fill bund forming an additional visual buffer zone is also present. Between the Stage 1 area and the quarry area is an outcrop of sandstone understood to be of indigenous significance which may form a protected open space viewing area. The material has also previously been referred to as quartzite.

T+T completed nine (9) test pits to 2.0 m bgl within the stage 1 area (TP26 to TP34). The test pits were targeted at obtaining representative samples for geotechnical laboratory testing to assist in future subdivision detailed design, particularly California Bearing Ratio (CBR) testing for pavement subgrades and a permeability test for retarding basin material suitability.

6.2.1 Subsurface conditions

In contrast to GeoVic mapping (Figure 3.1) the area was found to predominantly comprise a clay soil characteristic of residual Coldstream Rhyolite (Dandenong Ranges Igneous Complex). Clay material consistent with residual Greenvale Basalt (Older Volcanic Group) was encountered at the western extent of Stage 1 (TP26 to TP28). Sand and sandstone consistent with the Cave Hill Sandstone formation was encountered in the centre of Stage 1 (TP29 to TP30). Based on existing information (**WSP 2010, Black 2009**) for the site alluvium is also anticipated within the western portion of the Stage 1 area.

Previous test pits and boreholes within the Stage 1 area include (Refer Drawing 3, Appendix A):

- **WSP 2010** TP01 to TP06, BH07 to BH08, TP09 to TP12, BH13, TP14 to TP15, SB01 to SB09.
- **Black 2009** BH11, BH15 to BH18, BH27 to BH62, TP63 to TP76.

The **WSP 2010** test locations were completed as part of an environmental assessment. The **Black 2009** test locations incorporate insitu strength testing and geotechnical laboratory testing. **Black 2009** also completed boreholes within the adjacent visual screen fill bunds to the north. The surface geology model proposed by **Black 2009** is largely concordant with T+T observations.

WSP (2010) identify fill greater than 0.4 m thick within a portion of the former pony club area: SB06 (0.9 m), SBH07 (≥1 m), SB08 (≥2 m). The uncontrolled fill is generally cohesive with inclusions of fiberglass and brick fragments.

6.2.2 Pavement subgrade design CBR values

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 clay soils will form the subgrade over most of the site. Sand is anticipated locally within the central part of the Stage 1 area. Sandstone may also be exposed within the central part as well.

Taking into consideration the variability of soil profiles encountered, the drainage conditions and plasticity of the soils together with the field and laboratory soaked CBR values, design CBR values of 3% and 7% are recommended for the natural clay and sand subgrades, respectively. Refer to Laboratory Test Certificates attached as Appendix D.

Based on the soil profile encountered it is likely that highly weathered sandstone in the form of fractured rock mass or boulders will be exposed at or above subgrade level along sections of some roads, particularly within the central northern section of the site. If rock is exposed at or above design subgrade level[4] a pavement design based on a design CBR of 20% may be economically viable depending on the length of pavement over which rock is exposed.

Based on the variability of field test results and measured swell values, grading and plasticity index results, the clay subgrade is considered to be moderately or highly reactive and the sand/sandstone subgrade only slightly reactive.

Clay inferred to be derived from residual tertiary volcanics observed generally within the stage is considered moderately reactive and will not require a capping layer. Clay inferred to be of alluvial origin, anticipated locally within the western extent of the stage (refer Figure 6.1) is considered highly expansive. Therefore any pavement structures founded on alluviual material should incorporate a capping layer to minimise the effects of ground movement due to moisture variation these clay soils.

[4] Design subgrade level is taken to be above the improved subgrade layer.

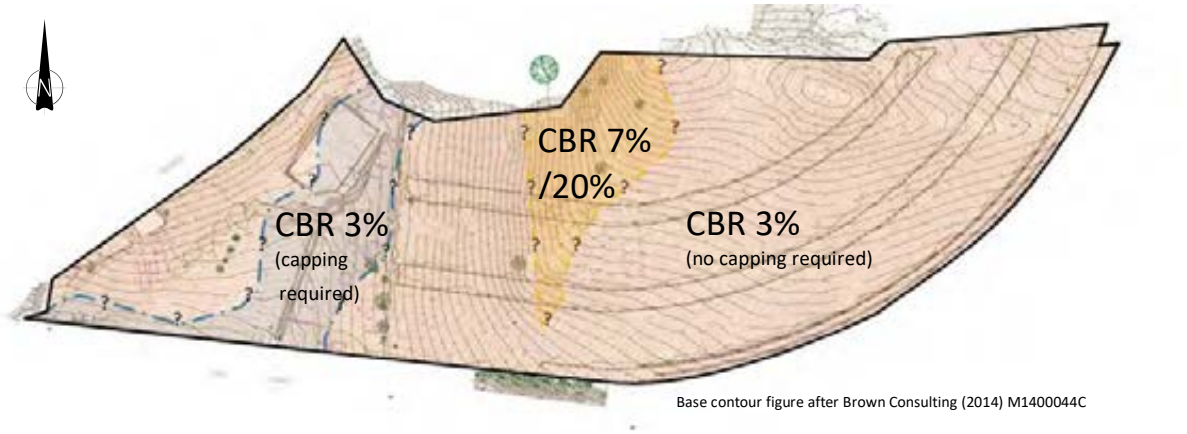


Figure 6.2: Approximate delineation of design CBR values and capping requirements – Stage 1 area

6.2.3 Material reuse

The clay and sand materials encountered on site could be used as structural fill. It is preferable to stockpile materials separately on site (i.e. silt, sand and clay) and when re-used for filling, materials should be placed on like materials (i.e. sand over sand or clay over clay).

The shallow overlying silt (approximately 200 mm), and any pre-existing fill or boulders encountered locally would not be suitable and should be stockpiled separately for possible use in landscaping works elsewhere in the subdivision. Similarly, clay and sand containing organics cannot be used as engineered fill but may be retained for topsoiling (in the top 300 mm) on building lots or for other non-structural purposes such as landscaping.

Clay soil should be placed in layers not exceeding 300 mm in loose thickness and compacted at a moisture content within +/-2% of the optimum moisture content. It is also recommended that the clay filling should be limited to a maximum dry density ratio of 102% to avoid over-compaction, which may result in swelling and softening if subjected to water ingress or increases in moisture content.

Based on the laboratory testing clay soils within Stage 1 have a maximum dry density of 1.28 t/m^3 to 1.54 t/m^3 and optimum moisture contents between 27 % and 38.5 %. In situ moisture contents testing show that the soils are generally close to the optimum moisture content and would require minimal addition or subtraction of water to achieve values near optimum.

Significant re-use of sand at the site is not anticipated due to its localised distribution and the shallow depth at which it was encountered. The sand may be used as engineered fill provided that its moisture content can be controlled to be at or slightly dry of its optimum moisture content. It is anticipated that the material may be difficult to handle if it becomes overly wet. Based on laboratory testing of a single sample of gravelly sand obtained a maximum dry density in the order of 1.86 t/m^3 and an optimum moisture content of 13.5 % may be anticipated.

6.2.4 Wetlands

It is understood that the south west portion of Stage 1 may be redeveloped as a wetland drainage area or retarding basin with batters of 5(H):1(V). It is anticipated that high plasticity clay will be exposed in the base and sides of the basin.

Where a wetland area is to be created there is a requirement to maintain a permanent water level often perched above regional groundwater. Considering the characteristics of the clay it would be expected to have a low permeability and for that reason provide a suitable liner. Remoulded permeability testing of a sample of clay from this area (TP27) confirms that a hydraulic conductivity

of 4 x 10^{-12} m/s may be achieved at 98 % MDD. It is recommended further tests are undertaken to confirm the hydraulic conductivity.

Testing of the clay soils has shown them to generally exhibit only slight dispersion with shaking (Emerson Class Number 5). High plasticity Class 5 soils have a moderate potential for erosion by rain drop impact and high potential for erosion by flowing water. They also have a high potential for environmental harm to receiving waters if disturbed (i.e. will pollute stormwater with turbid run-off). To protect batters from erosion it is recommended that soils that are to be revegetated are covered with a non-dispersive topsoil as soon as possible after construction. In addition it is recommended that slopes no steeper than 4(H):1(V) be adopted to reduce the velocity of surface water run-off across the batters.

6.3 Western Land area

The Western Land area is an undeveloped strip of land to the west of the quarry. It bounded by Mooroolbark Road to the west and the railway reserve (Lilydale Line) to the east. It is understood an easement for a possible future VicRoads 'Healesville Arterial' is present along the western boundary. Disused cattle troughs and a loading area were observed.

T+T completed eight (8) test pits to 2 m bgl within the Western Land area (TP35 to TP42). The test pits targeted obtaining representative samples for geotechnical laboratory testing in order to assist future subdivision detailed design, particularly California Bearing Ratio (CBR) testing.

6.3.1 Subsurface conditions

Subsurface conditions were generally in accordance with published literature. The bulk of the site comprised material typical of Older Volcanic Group geology. Nominally, 0.15 m of silt was underlain by hard medium plasticity basaltic clay to 2 m bgl. Highly weathered basalt was exposed within Test pit TP37 from between 0.7 m and 1.5 m bgl. Material described as claystone which may represent baked clay was encountered below 1.5 m bgl within TP42.

Test pit TP35 at the northern extent of the area encountered clayey sand grading to hard grey-brown sandy clay of medium plasticity. This material is considered representative of the Humevale Siltstone formation. Test pit TP36 within the north of the area encountered high plasticity clay which could be attributed to alluvial deposition.

Previous exploratory investigation locations within the Western Land area are generally consistent with current findings. Test pits and boreholes previously completed include (Refer Drawing 1, Appendix A):

- **Ramsay 2015** BH34 to BH37.
- **Black 2009** BH08 to BH10, BH12 to BH14, BH19 to BH26.
- **WSP 2010** TP16 to TP20.

Ramsay 2015 boreholes identified clay, typically medium to high plasticity, to 1.5 m at four locations across the Western Land corridor. Within the north east (BH34) sandy clay of low plasticity was described. The **WSP 2010** and **Black 2009** test locations were completed within the southern extent of the Western Land area. **WSP 2010** typically describe medium plasticity clay to 1.5 m bgl. Clayey sand is also identified at 0.9 m within TP17. **Black 2009** report high plasticity clay to 2.0 m or 4.5 m at several locations. The investigation also notably identified very stiff or hard medium to high plasticity clay extending to 16.5 m within BH8 (no rock or groundwater observed). Locally, rock fabric was described at 4.35 m (BH12) and silt at 1.8 m (BH20).

6.3.2 Pavement subgrade design CBR values

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 clay soils will form the subgrade over most of the Western Land area. Refer to the attached Site Plan and Test Pit Logs in Appendices A and B respectively. Clay is anticipated to either be residual soil derived from Tertiary volcanics and Devonian mudstone or recent alluvium/colluvium.

Taking into consideration the variability of the soil profiles encountered, the drainage conditions and plasticity of the soils together with laboratory soaked CBR testing, a design CBR value of 4% is recommended for the natural residual clay soils and 3% for alluvium deposit clay soils. Refer Figure 6.3.

The residual clay and alluvial clay subgrades are considered to be moderately and highly reactive, respectively, based on the measured swell values, Atterberg limits and sieve analyses. Refer to the Laboratory Test Certificates attached in Appendix D. A capping layer is recommended for the highly reactive alluvial soil.

Whilst not anticipated, depending on finished levels, it is possible that highly weathered to extremely weathered basalt in the form of fractured rock mass or clayey gravel will be exposed at or above subgrade level, particularly within the local maximums at the site. If rock is exposed at or above design subgrade level[5] further advice should be sought in relation to suitable pavement design subgrade values.

Figure 6.3: Approximate delineation of design CBR value – Western Land

6.3.3 Material reuse

The surficial silty soils are considered to be unsuitable as structural fill and should be excavated and stockpiled separately from the underlying soils. The silt could be used for topsoiling (in the top 300 mm) on building lots or for other non-structural purposes such as landscaping.

The site derived clay or extremely weathered basalt (Greensborough Basalt) and sandy clay (Humevale Siltstone) materials are considered suitable for reuse as structural fill. Based on the compaction tests undertaken as part of the CBR tests, the clay soils have a maximum dry density of 1.30 t/m^3 to 1.49 t/m^3 and optimum moisture contents between 28.5 % and 37 % while the sandy clay has a maximum dry density of 1.70 t/m^3 and an optimum moisture content of 18.5 %.

Based on the in situ moisture contents the soils are generally below optimum moisture content and would require the addition of water to achieve moisture levels close to optimum. Filling should be undertaken under 'Level 1' conditions as detailed in AS3798-2007 Guidelines on Earthworks for

[5] Design subgrade level is taken to be above the improved subgrade layer.

Residential and Commercial Developments and compacted to a minimum dry density ratio of 95% Standard Maximum Dry Density for residential buildings and 98 % Standard Maximum Dry Density for commercial buildings and road formations.

Clay soil should be placed in layers not exceeding 300 mm in loose thickness and compacted at a moisture content within +/-2 % of the optimum moisture content. It is also recommended that the clay filling should be limited to a maximum dry density ratio of 102 % to avoid over-compaction, which may result in swelling and softening if subjected to water ingress or increases in moisture content.

6.4 Plant and Northern Land areas

T+T completed test locations ETP01 to ETP20 and ETP27 to ETP28 within the Plant and Processing and Northern Land areas as part of environmental assessment due diligence. Refer T+T (June 2016) report 5064.002.R01 (5064.v1A). **Ramsay 2015** also previously completed a number of boreholes within this area (Refer Drawing 3, Appendix A).

6.4.1 Subsurface conditions

T+T encountered fill between 0.25 m thick and in excess of 3.3 m in thickness. Where fill was penetrated the natural soils generally comprised variably grey, orange or brown low plasticity clay. Weathered siltstone was also encountered at some locations. Dark moderate plasticity clay consistent with alluvium was encountered at depths of between 0.5 m and 1.3 m bgl within the Plant area immediately north of the quarry.

6.5 Site Classification

A discussion of the anticipated Site Classification applicable to the site for the design of residential slabs and footings is provided below. It is understood that a site classification for individual residential lots is not required at this stage. The site classifications provided below are intended as a likely indication based on prevailing ground conditions. It is recommended that further investigation is carried out within proposed building footprints of individual lots to confirm the classification for individual residential sites as prescribed in AS2870-2011[6].

The effects of changes to the soil profile by additional cutting and filling and the effects of past and future trees should be considered in the selection of ground movement values in design. Cutting or filling will reduce or remove the natural cracked zone that has developed within soils at the site resulting in greater seasonal ground movement, and consequently may result in a higher classification. Where fill is to be constructed to raise site levels, the affected allotments will require re-classification once the depth and type of fill are known and the level of earthwork control has been established.

Taking into consideration the soil profiles encountered during the investigation, the drainage conditions and plasticity of the soils together with the field and laboratory test results, the natural clay soils at the site are considered to generally be highly reactive and have high shrink swell potential. The Site Classification in accordance with AS2870-2011 - Residential Slabs and Footings will vary in as follows:

6.5.1 Stage One area

- **Class P** areas of the stage where:
  - Abnormal soil moisture conditions are likely due to

[6] Standards Australia (2011) *Residential Slabs and Footings,* Standards Australia, Sydney. Section 2.4 – Site Investigation Requirements

- the presence of existing trees (green buffer zones created around boundaries/fence lines). The affected area extends laterally from a stand of trees for a distance equal to twice the design height of the trees.
- the presence of previous building/septic tank (pony club concrete slab area).

– The depth of cohesive fill is greater than 0.4 m due to
- Previous filling identified within the pony hardstand area[7].
- anticipated when the existing pond and drainage channel within the western area of the Stage is infilled (controlled fill may be given an alternative classification).

☑ **Class H2** (anticipated seasonal ground movement >60 mm and ≤75 mm) areas:

– Where very highly reactive alluvial clay soils or colluvium is encountered. Anticipated locally within the western portion of Stage 1.

☑ **Class H1** (anticipated seasonal ground movement >40 mm and ≤60 mm):

– Areas not subject to abnormal moisture conditions and where highly reactive residual rhyolitic clay soils are encountered. Generally anticipated within the Stage 1 area.

☑ **Class M** (anticipated seasonal ground movement >20 mm and ≤40 mm):

– Moderately reactive residual basaltic soil area. Anticipated locally within the western portion of the Stage adjacent to the railway.

– Moderately reactive Cave Hill Sandstone soil area where rock is greater than 0.5 m below ground surface. Anticipated locally within the central north of the Stage.

☑ **Class S** (anticipated seasonal ground movement ≤20 mm):

– Slightly reactive Cave Hill Sandstone area where rock is within 0.5 m of ground surface. Anticipated locally within the central northern portion of the Stage.

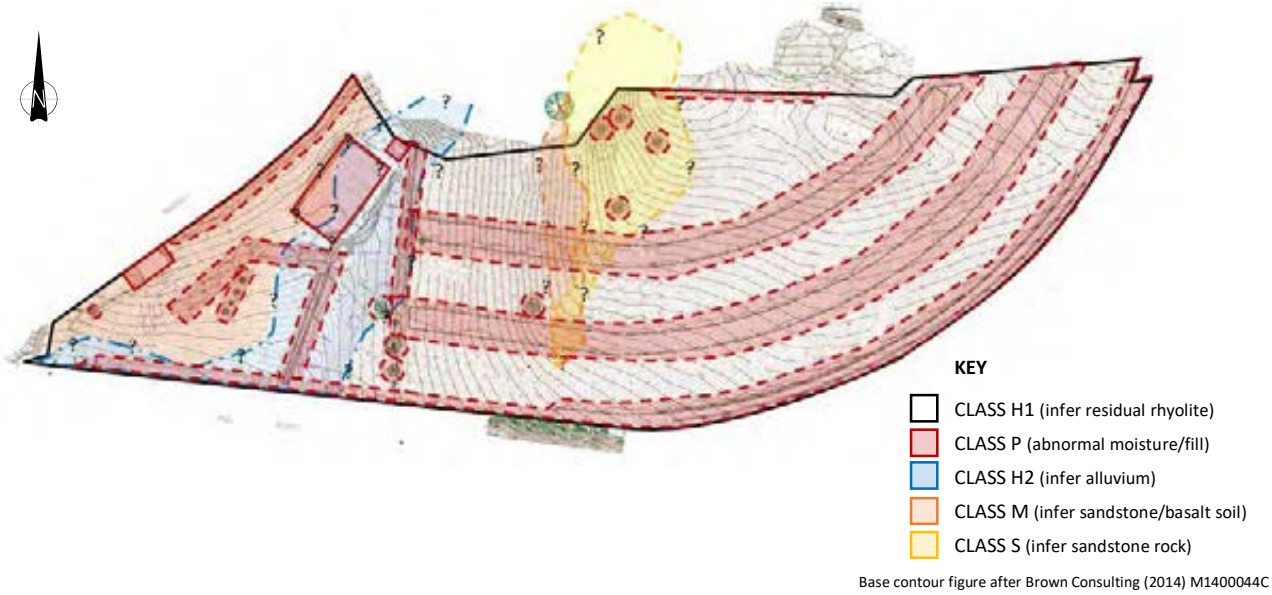


Figure 6.4: Approximate delineation of anticipated seasonal ground movements - Stage 1

6.5.2 Western Land area

☑ **Class M** (anticipated seasonal ground movement >20 mm and ≤40 mm):

[7] WSP (2010) hand auger boreholes and test pits SB6 to SB8 & TP14 referenced within PB (August 2010) Environmental Audit Report – Cavehill Quarry, Hull Road, Lilydale, Victoria. Ref. 2130934A-RPT001.

- Areas not subject to abnormal moisture conditions and where moderately reactive clay soils are encountered (residual basalt and siltstone). Generally anticipated within the Western Land (where other classification conditions described below do not apply).

Class P areas of the stage where:

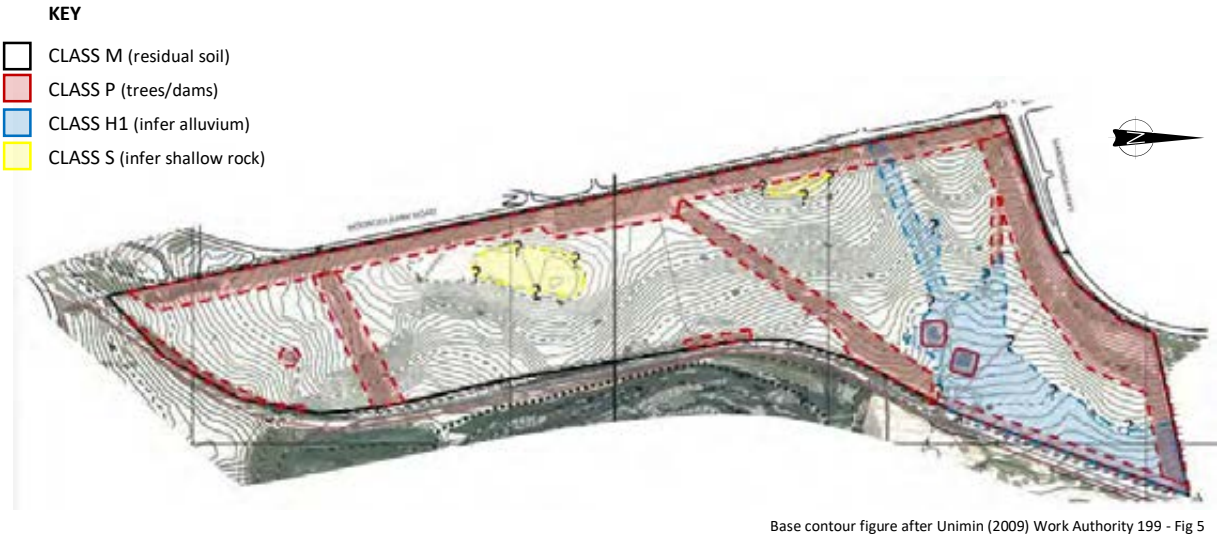
- Abnormal soil moisture conditions are likely due to the presence of existing trees (green buffer zones created around boundaries/fence lines). The affected area extends laterally from a stand of trees for a distance equal to twice the tress design height.
- The depth of cohesive fill is greater than 0.4 m due to filling required for the existing dams and open drainage channels (controlled fill may be given an alternative classification).

Class H1 (anticipated seasonal ground movement >40 mm and ≤60 mm) areas:

- Where highly reactive alluvial clay soils are encountered. Anticipated locally within the northern portion of the Western Land where gullies are present.

Class S (anticipated seasonal ground movement >20 mm and ≤40 mm):

- Slightly reactive areas where it can be shown that basalt is less than 0.6 m below ground surface. Shallow rock was not exposed during the site investigation but may potentially be encountered locally on the rises within the central north and central south areas of the Western Land area.



Base contour figure after Unimin (2009) Work Authority 199 - Fig 5

Figure 6.5: Approximate delineation of anticipated seasonal ground movements – Western Land

6.5.3 Existing trees

On reactive sites trees can cause damage to foundations at substantial distances. The presence of trees on this site means that abnormally dry soil moisture conditions will be present in their vicinity. Removal of the trees will result in a change in existing moisture conditions. If trees are removed from the site, sufficient time, typically a full summer/winter cycle, must elapse prior to the commencement of foundation construction to allow soil to regain normal moisture conditions.

Areas within the lateral reach of the drying influence of the large trees which are to remain on site are subject to abnormal moisture conditions resulting in foundation moisture variations beyond those for normal sites. This drying influence distance may be taken to equal twice the design height of a group of four or more trees within a row, where the design height for a group of trees is 0.9 x the mature height of the tallest tree. For Class H1 and H2 sites individual trees should also be

restricted to a distance of 1 x mature height. For Class M sites individual trees should be restricted to a distance of 0.75 x mature height.

For lots with building footprints within the drying influence distance, the development area is anticipated to have a Site Classification of CLASS P, in accordance with AS2870-2011, and will require specific foundation design. For these sites it is recommended that pier and beam footings be adopted (a strip and stump footing system is not recommended).

6.6 Landslide Risk Management

In addition to the stability of the quarry pit, the natural topography of the site increases the risk of landslides. In general, potential instability across the site can be divided into three areas:

- Landslips within natural slopes
- Landslips in the quarry pit
- Instability of rail embankment

Rocktest 2015 has reviewed instability within the quarry pit and it provides a good summary of the existing conditions. Cardno 2015 identified a number of landslips and potential landslips in the Western and Stage 1 areas. The rail instability is discussed further in Section 6.9.

We identified a number of areas from our walkover of potential instability and a summary of our site observations are in Appendix E. Special site treatment or building foundations will be required for development in areas identified with higher landslide risk. Risk management strategies will need to be developed for areas within the Erosion Management Overlay.

A number of landslide identified in the Cardno 2015 Report are located within the Western Land and a strategy which incorporates surface water flow from west to east will need to be developed to mitigate instability of the rail track and future development.

6.7 Overburden Fill characterisation

It is proposed to utilise the overburden located in OBDA onsite and use this material to backfill the quarry pit. The material is typically the overburden and by-product material from the quarrying and is varied in material type. The site has been delineated into three major overburden areas, namely:

- Northern Stockpile
- Eastern Stockpile
- Southern Stockpile

The existing OBDA naming convention established[8] has been retained for simplicity. The 'Eastern Stockpile' is the largest stockpile encompassing in the order of 35 ha to the east of the quarry. The 'Northern Stockpile' and 'Southern Stockpile' are present immediately north east and south west of the quarry and cover areas of approximately 10 ha and 5 ha, respectively.

A number of test pits and boreholes penetrate into the OBDA and a summary of the materials encountered in each stockpile is discussed below. Refer to Drawing 3 and Drawing 4, Appendix A, for a summary of test locations.

It should be noted that the following overburden characterisation is based on test pits and boreholes by others, and this data has some limitations. The test pits were excavated to depths ranging from

[8] Refer Figure 2, Appendix A. Delineation after Ramsay (September 2015) Preliminary Site Investigation – Cave Hill Limestone Quarry, 4 Melba Avenue, Lilydale Victoria. F2 – Site Plan Showing Site Features and Investigation Areas.

7 m to 10 m due to practical consideration and limit of reach. The boreholes by others were drilled for environmental purposes and they have limited geotechnical information.

6.7.1 Boulders in overburden disposal areas

During test pitting, boulders (particles greater than 0.2 m) were encountered at all test pit locations within the Eastern and Southern Stockpile areas. Boulders were typically observed to be in the range of 0.5m to 1m. Larger boulders, in excess of 1 m size, were observed within TP09 and TP18; and as minor components within TP03, TP14, TP16, and TP24. Refer to Table 6.1 for a summary of oversize particles observed.

Table 6.1: Oversize particles observed

Test Locations	Boulders > 0.2 m size observed	Boulders > 0.5 m size observed:	Boulders > 1.0 m size observed	Boulders > 2.0 m size observed
Eastern Stockpile	TP01 to TP22	TP02, TP04, TP10, TP13, TP19, TP20 and TP21	TP18	TP03, TP09, TP14, TP16
Southern Stockpile	TP23 to TP25		TP24	

Boulders were generally inferred to be of high strength or greater. This is with the exception of a pockets of more highly weathered Cavehill Sandstone Formation sandstone/siltstone boulders within TP07 (recovered as sand) and TP09, TP10 and TP17 (recovered as cobbles).

6.7.2 Unsuitable material in overburden disposal areas

Waste associated with quarry operations was encountered within the Northern Stockpile (TP1A), Eastern stockpile (TP09, TP10, TP11, TP12A, TP12B, TP21) and Southern Stockpile (TP23 and TP25). With the exception of TP1A the waste was in trace proportions and could potentially be sorted during bulk earthworks. A summary of locations, depths and materials observed is provided in Table 6.2.

Table 6.2: Unsuitable refuse inclusions observed

Test location	Depth/s (m bgl)	Material description	Waste description
TP1A	1.2 - 3.1	FILL: WASTE/Clayey GRAVEL	oil filter, large steel chains, steel cables, wires and shavings, rubber mats, hoses, plastic bags, textiles, wood fragments
TP09	2 - 3	FILL: BOULDERS, trace waste	plastic hoses, explosive fuses, textiles, wire
TP10	6	FILL: Clayey/Gravelly SAND, trace waste	single plastic box
TP11	1.5 - 2	FILL: COBBLES with boulders, trace waste	plastic bags
TP12A	0 - 2	FILL: Gravelly COBBLES/BOULDERS, trace waste	single metal sheet
TP12B	0.4 – 1.5	FILL: CLAY, trace waste	clay brick and glass fragments, single copper tube and plastic bag
TP21	4.5	FILL: Clayey SAND with cobbles, trace boulders and waste	two detonator wires

A sample of fill was collected from TP1A for environmental testing. Refer to T+T environmental report dated June 2016[9] for more information on contamination testing.

Organic waste or severely root affected material was observed within test pits at select locations in the eastern stockpile (TP12A, TP12B, TP12D, TP15, TP18 and TP22). A summary of locations, depths and materials observed is provided in Table 6.3. In addition, rootlets associated with ground vegetation were also frequently encountered within surficial fill material.

Table 6.3: Unsuitable organic inclusions observed

Test location	Depth/s (m bgl)	Material description	Organic waste description
TP12A	2.0 - 2.5	FILL: Organic WASTE	silt/mulch with branches/roots
TP12B	1.5 - 2.3	FILL: Organic WASTE	branches
TP12D	0 – 0.55	FILL: Organic WASTE, trace boulders	logs and branches
TP15	2.8	FILL: Clayey SAND with boulders/cobbles/gravel	branches and roots, single log
TP18	3.3 - 4.5	CLAY, with roots/rootlets	Roots and rootlets
TP22	3.0 - 3.2	SILT pockets, with rootlets	rootlets

6.7.3 Perched groundwater in overburden disposal area

Groundwater inflow was observed within four test pits located centrally within the Eastern Stockpile. The test pits were located within approximately 200 m of each another and excavated from a similar relative level (in the order of 145 m AHD). Inflow was also observed during drilling within the northwest of the Eastern Stockpile (BH16-01). Table 6.4 below summarises inflow depths and observations.

Table 6.4: Perched groundwater observed

Test location	Inflow depth (m bgl)	Material description	Comments
TP03	4	FILL: Sandy CLAY/Clayey SAND with gravel	- Moderate inflow between 4.0 m to 4.5 m bgl. - Inflow steady over 15 minutes test pit remained open. - Single boulder >2 m observed at 3.8m.
TP04	5	FILL: Sandy BOULDERS/COBBLES	- Minor rate of inflow observed. - Inflow from a pocket of Gravelly SAND. Pocket 1m size.
TP06	1.5	FILL: Clayey SAND with boulders	- Moderate inflow from a pocket of BOULDERS at 1.5 m bgl. - Unstable test pit (sand collapsing to surface)
TP12A	2.5	FILL: Organic WASTE	- Significant inflow, rapidly slows to minor inflow - Inflow at base of waste layer (interface with clay)
BH16-03	2.5	FILL: COBBLES/BOULDERS	- Significant inflow. Potentially at clayey interface. - Located adjacent to stormwater settling ponds.

[9] T+T (June 2016) Environmental Investigation – Sibelco Quarry, 4 Melba Ave, Lilydale. Ref: 5064.002.R01 (5064.v1A).

6.7.4 Eastern Stockpile

It is understood that the Eastern Stockpile was predominantly constructed from east quarry wall overburden during quarry expansion. It is expected to generally comprise Cave Hill Sandstone derived sediments and rock and to a lesser extent volcanic derived clays and marginal limestone material.

The natural ground surface below the overburden disposal area is understood to dip slightly through to steeply towards the north east. A subsurface drainage blanket incorporating 0.5 m of coarse gravel was installed at the base of the OBDA and seepage flows are pumped from a concrete riser located near the east of the stockpile and directed to settling ponds. The drainage blanket doesn't appear to be persistent across the Eastern Stockpile.

The Eastern Stockpile was constructed as four terraced platforms, each about 7 m to 13 m high with benches about 6 m to 27 m wide. Boreholes completed by **Ramsay 2015** indicate that the total fill thickness typically ranges between 20 m and 40 m thick.

The OBDA batters have been planted and irrigation lines are present to assist in maintaining vegetation. The stockpile is generally shaped to direct surface water towards settling ponds located to the north east and south east of the stockpile. Rock lined channels ('rip rap') have been installed at select locations to reduce runoff scour.

Excavations within the stockpile (test pits TP01 to TP22) typically encountered a predominantly granular material generally categorised as gravelly or cobbly boulders. The majority of the material was described sandstone or siltstone with occasional limestone, consistent with Cavehill Formation overburden and Lilydale Limestone waste. Perched surface water was encountered centrally within the area between 1.5 m and 5 m bgl. A 0.5 m layer of buried organic waste was also encountered centrally within the vicinity of TP12.

Based on visual classification of the fill material observed within the Eastern Stockpile test pits, the materials broadly comprised:

- 35 % predominantly Boulders (Clayey/Gravelly/Cobbly)
- 30 % predominantly Sand (Clayey/Gravelly)
- 15 % predominantly Gravel (Clayey/Sandy)
- 10 % predominantly Cobbles (Sandy/Gravelly)
- 10 % predominantly Clay (Sandy/with boulders)

Waste and organic material was also present (<5 %). Note that these approximations are only stating the proportion of depths over which the predominant particle size was observed, not the actual percentage of particles present over these depths. Visual approximations of particle size distributions within spoil ranged from nominally 60 % boulders, 20 % cobbles, 10 % sand and 10 % gravel through to 40 % gravel, 30 % sand, 20 % cobbles and 10 % clay.

The Eastern Stockpile contains several material stockpiles at surface referred by Sibelco as:

- Salamander.
- NDCR – 100 minus.
- Boral Clay.
- Mineral Waste.

Numerous other boulder stockpiles were also observed at surface. Refer to Drawing 5, Appendix A, and Stockpile Photographs, Appendix C.

The 'Salamander' stockpile material was described in the field is a sandy gravel with clay derived from the Greensborough Basalt Unit. A sample of the stockpile (Stockpile 1) was classified by the lab as silty/gravelly sand. The 'NDCR – 100 minus' (Non-Descript Crushed Rock) was observed to be a cobbly gravel, typically up to 60 mm size. Laboratory grading of a sample (Stockpile 2) confirms 100% particles passing the 75 mm sieve and 20% fines. The 'Boral Clay' is a white clay that appears to be derived from Cavehill Sandstone deposits. Atterberg testing shows the clay (Stockpile 3) to be high plasticity. It is understood that this material was intended for brick production but proved unsuitable. The 'Mineral Waste' dump is understood to comprise a mixture of materials that did not meet requirements for lime products.

6.7.5 Southern Stockpile

The Southern Stockpile is the most recently constructed OBDA and is referred to as a sight screen bund. It is understood to have been constructed without subsurface drainage on a natural surface dipping slightly towards the south. The disposal area has been placed in three platforms, each about 2 m to 9 m high.

The southern face of the OBDA has well-established high density planting used to improve the buffer around the quarry. Similarly to the Eastern Stockpile, the bulk of the OBDA is understood to comprise Cave Hill Sandstone overburden material shifted during quarry expansion. Alternatively, it has also been described as comprising overburden rock and topsoil. It is likely that a topsoil cap was placed over a portion of the bund prior to planting.

The majority of material within the top 7 m of the Southern Stockpile was found to comprise clay or sandy clay (50 %) followed by sandy gravel (40 %). Material encountered is considered consistent with disturbed alluvial and rhyolitic deposits along with material originating from the Cave Hill Sandstone and Lilydale Limestone members. Trace amounts of waste and basalt were observed. A 5 m stockpile of silty material likely to represent topsoil was encountered centrally within the Southern Stockpile (TP25).

6.7.6 Northern Stockpile

The Northern Stockpile contains some of the earliest quarry overburden shifted. It is also the closest dump site to original residences, site offices and the quarry plant. Prior drilling in this area has encountered buried waste including metal and pockets of organic waste.

Whilst it is unclear when placement ceased, the Northern Stockpile does not appear to have significantly changed in size since 1980. The surface has been reshaped in recent decades to store and transfer saleable quarry products. Test pitting (TP1A) identified a 2 m thick layer of refuse at 1.2 m bgl.

The Northern Stockpile contains product stockpiles referred by Sibelco as:

- Aggregate (14/20 mm Screenings)
- Lilydale Toppings (Crushed Rock)
- Scalps QW (40 mm Quarry Waste)
- AgiLime (Agricultural Lime)

It is understood lime kiln stone was temporarily stockpiled from the Sibelco Buchan Quarry following the end of production at Lilydale but this material has since been exhausted.

6.8 Quarry Backfill Options

A number of options are under consideration for the treatment of the quarry pit. The three options currently under consideration are:

1. Option 1 – Mixed residential/recreation use
2. Option 2 – Rapid backfill
3. Option 3 – Do nothing

Below is a summary of each option and some of the key geotechnical risks associated with each option.

6.8.1 Option 1 – Mixed residential/recreation use

This option is to fill the quarry pit up to a nominated level in a manner that would allow for a mix of uses. A portion of the surface would be used as residential development whilst the remainder of the quarry area would be used for recreational use. The final use of the surface would need to be confirmed prior to commencing backfilling of the quarry and a clear demarcation would need to be defined and maintained during backfilling.

It is anticipated that it will take about 3 to 5 years to backfill the quarry to the nominated level. The backfill beneath the proposed residential zone would need to be controlled, whereas the criteria for the backfill beneath the recreational zone could be relaxed. The material used to backfill the quarry should be graded, moisture conditioned and well compacted. The fill would be placed in layers, moisture conditioned and compacted. The thickness of the layers will depend on the compaction equipment and method used and could range from 0.5 m to 2 m thick. Given the larger size of some of the material identified in the stockpiles onsite a 'method spec' approach is recommended.

After completion of the backfilling, some residual settlement of the backfill may be ongoing. Settlement monitoring of the backfill via settlement plates during backfilling and survey pins on the final surface would be required to demonstrate the settlement behaviour and tapering off of the surface settlement to an agreed level. A period of 3 to 5 years after backfilling completion is estimated for the residual settlement to reach an acceptable level.

It should be noted that we have assessed the quality of the material in the stockpile based on limited data. We have referred to deeper sonic boreholes drilled from environmental testing and our test pits. The test pits are typically 7 m to 10 m deep whereas the stockpile can be up 30 m thick. It would be prudent to assume that some of the stockpiled material isn't suitable to be used to backfill beneath the residential zone but may be suitable for use beneath the recreational area. The density of the compacted backfill material will be greater than the current density of material stockpiled and thus some allowance for a compaction factor should be considered as well when calculating volume of material required to backfill the quarry.

The base and walls of the quarry would be need to be prepared with cavities backfilled and uncontrolled fill reworked and compacted if it located in the footprint of the residential zone. The residential area will be influenced by backfill directly beneath the zone as well as backfill within a 2:1 (2 vertical to 1 horizontal) zone.

In summary, some of the key geotechnical risks are:

- Significant volume of stockpile materials may not be suitable.
- Accessing appropriate material throughout the life of the project (i.e. uncertainty of material variability as deeper material in the stockpile is accessed).
- Achievement of settlement within nominated time.
- Long settlement tail to achieve minimal variation for residential housing and road tolerances
- Acceptance of method specification by Council/third party.
- Poor control between open space/residential fill portions, leading to reduce surface area that is acceptable for residential development (i.e. difficulty switching between filling/compaction

standards at variable points midway across the placed layer). Requires detailed surveying to establish a 2:1 line projected from theoretical edge of residential zone down to quarry floor.

The residential sites would be classified as Class P. For the site to be re-classified, a target for long term settlement should be less than 70 mm and if this achieved it may be possible to re-classify the sites.

6.8.2 Option 2 – Rapid backfill

This option is to push material into the quarry with no compaction. This will allow a rapid backfilling of the quarry.

Significant self-weight settlement of the backfill is expected during and after backfilling. The period of time for the self-weight settlement to occur could be significant. To accelerate the self-weight settlement the quarry backfill could be surcharged. The surcharge would be nominally 10 m high and in place for 1 to 2 years.

Of greater concern is the risk of hydroconsolidation settlement due to inundation of uncompacted fill placed dry of Optimum Moisture Content (OMC). It is anticipated that the recovery of the groundwater within the fill and thus inundation of the fill could take several decades. Therefore it could be several decades before the risk of hydroconsolidation settlement is considered low enough to allow use of the site. Some nominal compaction and moisture conditioning of the backfill during the backfilling would assist in mitigating against the risk of hydroconsolidation and creep.

It will be difficult to develop this land for either recreational space or residential. The surface could be vegetated and livestock that can tolerate irregular surfaces, i.e. goats, could be placed on the land. It is recommended that after construction regular inspections of the backfill surface are undertaken to monitor the behaviour of the surface for settlement. Some maintenance will be required to maintain surface.

6.8.3 Option 3 – Leave as is

This option is to not fill the quarry and leave it as is. This is similar to the proposed end use of the site in Works Approval 199 (**Mitchell 2001)**.

If the pumping of groundwater is ceased from the base of the quarry, the water level in the quarry would raise to a level somewhere in the order of RL 100 m AHD. **Geo-Eng 2000** estimate that this would take about 15 years to recover. Further work including the installation of groundwater monitoring bores would be required to calculate the final water levels and time to reach this level.

6.8.4 General considerations

Localised work would be required on the batters above the backfill levels (or long term water level for Option 3) to stabilise old landslides and improve the stability of the batters. The extent and type of work of stability improvement works would also depend on the proposed land use, stormwater management, landscaping and maintenance strategy. Stormwater should be managed to prevent surface water running down batters into the quarry in an uncontrolled manner. In addition, remedial works would be required along the railway corridor to address the creep movement recorded in the extensometers. The remedial works would most likely be a combination of soil nails and earthworks.

Consideration should also be given to structures, roads, and utilities that cross over the backfill and the natural ground. This situation should be minimised and where unavoidable localised solutions will be required to manage the risk of differential settlement.

Sharp changes in the quarry topography may cause significant differential settlement in the backfill surface. Further work is required to assess the impact of the quarry topography and the impact on development.

6.8.5 Estimation of settlement

In designing the earthworks the following should be considered:

- Shrink swell characteristics – limitations should be placed on the plasticity of the fill and the moisture content at which it should be placed.
- Hydroconsolidation settlements – to limit the potential for hydroconsolidation, a relatively high degree of compaction and moisture content close to standard optimum moisture content should be specified in the design.
- Long-term creep settlements – owing to the thickness of the fill, long term settlements due to self-weight of the fill could impact on services and structures.

The plasticity of the stockpiles material vary and depend on the source material. To manage shrink swell behaviour two types of fill are defined:

Type	Criteria	Placement
1	a maximum plasticity index of 20% and maximum percentage passing the 0.075 mm sieve of 20%	Beneath residential zones
2	A maximum plasticity index of 30%	Open space

A relatively high degree of compaction is required to minimise the potential for hydroconsolidation and to minimise long term creep settlements. The stockpiled material onsite has a significant portion of oversized material (>20 mm) and thus typical field density testing will not be suitable for all the earthworks. A methodology specification will need to be developed based on site trials and the equipment used to spread and compact the material.

The backfill will experience a combination of short term settlement and long term settlement (creep). The short term settlement occurs due to the self-weight of the fill as it is placed and for a relatively short period of time once fill has reached full height. The long term settlement occurs over a period of years. In the case of deep fills with light building loads, the creep due to the self-weight of the fill will be the major component of the long-term settlement.

For option 1, we have estimated that the short term settlement of the backfill to be about 1m based on a constrained modulus of 20MPa for the backfill. Deep fill projects in Melbourne (**S. Colls, J. Finlayson and D. Goad 2010**) and Sydney (**Waddell 2012**) have typically experienced short term settlement between 0.5% and 0.8% of the fill height thus suggesting a short term settlement of 1m is conservative. It is expected that the bulk of the short term settlement will occur during filling works and would be complete within several years of reaching the final fill height.

The estimated long term settlement for Option 1 is 0.2 m based on a creep strain rate (per log cycle time) of 0.0011. Likewise for short term settlement, deep fill projects in Melbourne and Sydney have found the actual creep is less than the predicted settlement. Measurement of the fill surface settlement will be required after reaching full fill height to confirm creep settlement.

The short term and long term settlement for Option 2 will be significantly greater than estimated above.

6.8.6 Option 1 Backfill specification

Prior to backfilling the quarry, the following should be undertaken.

- The base of the quarry should be prepared by removing soft material and unsuitable materials.
- The quarry walls should be cleared of loose rocks and any boulders that could potentially fall into the pit.
- A number of landslips observed in the upper batters will need to be stabilised. Further geotechnical investigations are required to assess the appropriate treatment, and we expect the treatment shall be a mixture of 'remove and replace' and soil nailing.

The backfilling of the quarry will consist of a number of zones. The zones are based on future use of the finished surface, stability, backfill material and compactive effort.

The zones are:

- Zone 1 – 2m thick zone across the floor of quarry
- Zone 2A – General Fill A
- Zone 2B – General Fill B
- Zone 3 – Structural Fill - Upper 5m

The material type and compactive effort for each zone is summarised in Table 6.5.

Table 6.5: Compactive effort required

Zone	Material	Max size (m)	Loose Layer thickness (m)	Compaction
1	Rock - Open graded free of gravel or finer grained soil	1	2	None
2A	General Fill A - Well graded mixture of clay, silt, gravel, cobbles and boulders	0.5	0.75	Method Spec. Under constant supervision
2B	General Fill B - Well graded mixture of clay, silt, gravel, cobbles and boulders. Maximum plasticity index of 20%	0.35	0.5	Method Spec. Under constant supervision and compaction testing if appropriate
3	Structural Fill – higher quality	0.1	0.25	Quality Control testing (level 1 supervision and testing)

Site trials shall be undertaken onsite to assess the minimum number of passes required. After each pass of the compacting equipment the compacted surface RL shall be measured. This shall be repeated with passes of the compacting equipment until little change in surface RL is recorded. This shall represent the minimum number of passes. Quality Control testing shall also be carried out for each trial on each material type.

Moisture conditioning of the General Fill and Structural Fill is important, and in general terms, we expect the material to be within ±2% of standard optimum moisture content.

We envisage that assessment of compliance with the specification would largely be based on continuous supervision of the earthworks. The bulk of the earthworks would be undertaken based on a specification developed from onsite earthwork trials. The trials would identify a number of fill types, comprising particular mixes of materials, with corresponding method compaction specifications developed for each fill type. It is likely that two engineers would be onsite during earthworks with one in the quarry observing placement and compaction of earthworks and the

other assisting with sorting and identifying fill material in the existing stockpiles. During the placement and compaction of Zone 2 and 3, a site testing laboratory would need to be established to undertake compliance testing as required. Additional technical staff onsite would or may be required when a site testing laboratory is established.

During the earthworks, regular surveying of the fill placement and fill stockpiles will be required for quality control purposes and checks on compaction factors. This survey could be partially undertaken by earthworks plant fitted with GPS equipment, supplemented with surveyors.

In addition, monitoring of the settlement of the fill is important and will be required to demonstrate that the bulk of the settlement of the backfill has occurred prior to developing this space, or handover to Council. The monitoring of settlement should be undertaken as a combination of settlement monitoring plates (placed in the fill during earthworks), settlement pins installed in the surface, and embankment settlement trials.

6.8.7 Groundwater recovery

The local groundwater has been drawdown to the base of the quarry (RL 0m AHD) and about 2 ML/day is pumped out of the quarry. Perched groundwater was also observed in the Eastern Stockpile and it is understood that subsurface and surface drainage has been constructed to capture and control the perched water in the stockpile. It is anticipated that the perched groundwater in the stockpiles is supplied by rainfall and would become surface water if the stockpiles are removed.

Very little groundwater monitoring data has been provided apart from the **Geo-Eng 2000** report. At the time of the Geo-Eng report the base of the quarry was RL50m AHD, and since this report the quarry has been deepened by a further 50 m. The **Geo-Eng 2000** report recommended a network of groundwater monitoring bores be installed in the Devonian Formations to enable the monitoring of the impact of the quarry groundwater extraction. It is not clear if these bores where installed and monitored as no groundwater monitoring data has been provided.

The **Geo-Eng 2000** report provides a figure (Figure 5) of the drawdown for the quarry at the time of the report, however, it doesn't provide any calculations of drawdown beyond the quarry. Figure 5 appears to be conceptual and only shows drawdown to a distance of 400 m beyond the quarry. We agree with **Geo-Eng 2000** Report that the extent of drawdown would be greater in the north-south direction than the east-west direction, however it is difficult to quantify the difference. Based on our preliminary assessment, we estimate that the extent of drawdown could be of the order of 2 km beyond the quarry.

An assessment of the time it would take for the quarry to fill up with water was undertaken. A number of assumptions have been made in regard to the hydrogeological parameters as little site data is available. Based on the assumed parameters, it is estimated that it would take greater than 50 years to fill the quarry. It is assumed that the final water level is RL 100 m AHD.

If the quarry is filled with compacted soil and rock, then it is estimated that the time it would take for groundwater to recover would be less than filling the quarry void, however, it is expected that is would still take a couple of decades to occur.

It is recommended that groundwater monitoring bores are installed as soon as possible.

6.9 Rail corridor stabilisation

Sebilco have been monitoring 11 extensometers located between the railway and the quarry pit. A plot of the monitoring data from 2014 to 2016 is provided in Figure 6.6 and the location of extensometer are shown on Figure 6.7. In some of the monitoring points a seasonal influence can be seen due the wetting and drying of the deep clays. Monitoring points 6 and 11 appear to be damaged and are not shown in the plot. The monitoring data show minor movement typically in the

order of 2 mm to 5 mm per year and may be associated to soil relaxation rather than instability. It is recommended that the monitoring continues during earthworks and backfilling works. If the movement accelerates then remediate works may be required.

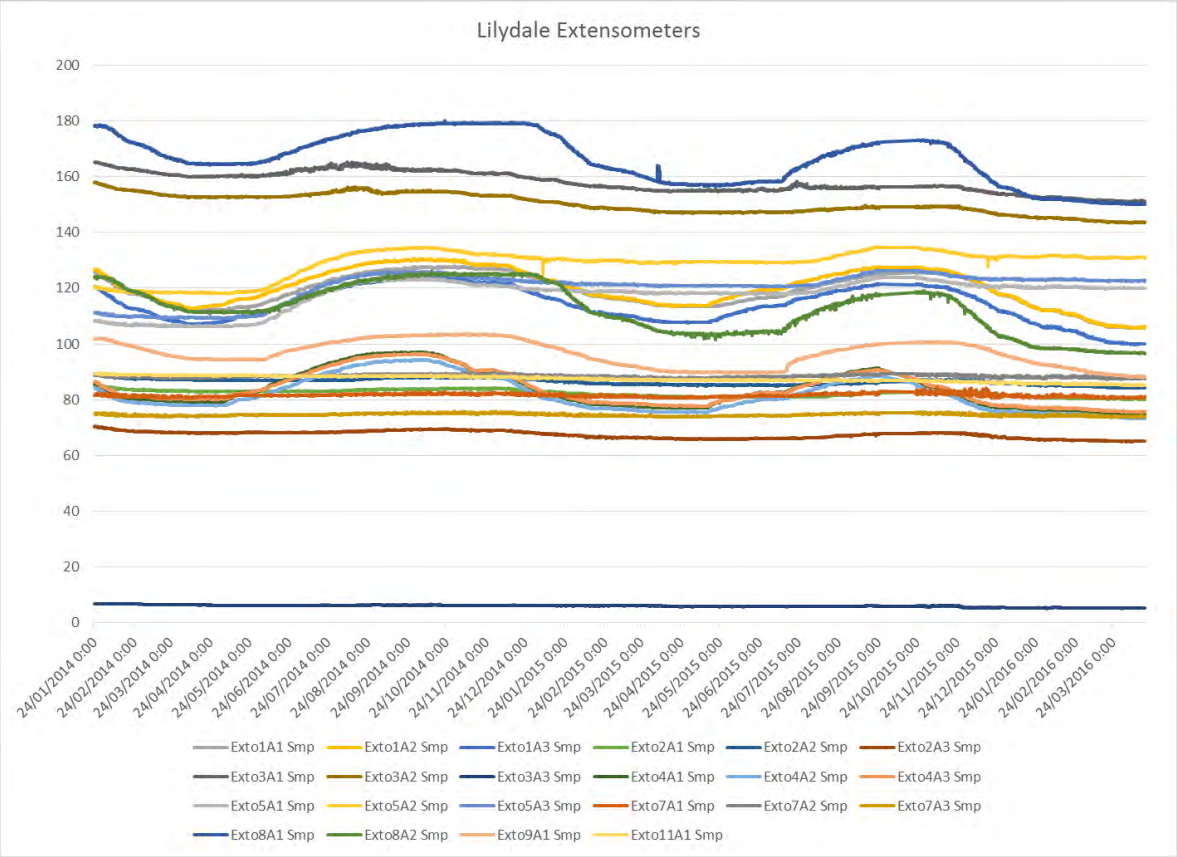


Figure 6.6: Extensometer monitoring data from January 2014 to March 2016 (provided by Sibelco)

Figure 27. Locations of borehole extensometers BX 1 to BX11 behind west wall. Also highlighted are the locations of historically unstable clays.

*Figure 6.7: Location of the extensometers (from **Rocktest 2015**)*

As shown in Figure 6.7, instability in the clays has been observed and it would be prudent to remediate these areas prior to backfilling the quarry pit. Further work is required to delineate the extent of the unstable clays.

7 Additional geotechnical investigations

Separate from the construction supervision, the following geotechnical investigations and assessments are required:

- Installation of groundwater monitoring bores.
- Ongoing monitoring of western slope adjacent to railway.
- Detailed investigations and assessment of 'landslides' west of railway.
- Detailed mapping of quarry batters and floor to identify slope stabilisation measures and treatments for karst formations
- Detailed assessment of the quarry western slope to determine stabilisation measures required to address creep movement recorded in extensometers.
- Investigations and assessment of natural ground below overburden disposal areas (post removal of overburden materials)

8 References

Settlement behaviour of deep engineering fill former basalt quarry, Niddrie, Victoria, VICTORIA, Australian Geomechanics Vol 45 No 1 March 2010 (**S. Colls, J. Finlayson and D. Goad 2010**)

P. Waddell (2013) "Design, prediction and monitoring of deep fill settlement", Proceedings of the Institution of Civil Engineers - Geotechnical Engineering, Volume 166 Issue 4, August 2013, pp. 343-356 (**Waddell 2012**)

Peter J Ramsay & Associates (September 2015) Preliminary Site Investigation – Cave Hill Limestone Quarry, 4 Melba Avenue, Lilydale Victoria (**Ramsay 2015**).

Rocktest (30 July 2015) Lilydale limestone mine: Summary of Geotechnical Characteristics (**Rocktest 2015**).

Cardno Lane Piper (July 2015) Geotechnical Assessment of the Potential for Slope Instability to Affect Residential Development - Lilydale Quarry Site (west), Lilydale. Ref. 215001Report03.2. (**Cardno 2015**)

Knight Frank (2015) Information Memorandum, For the Sale of The Former Lilydale Quarry (**Knight Frank 2015**).

Black Geotechnical (September 2009) Proposed Residential Development – Cavehill Quarry Lilydale – Geotechnical and Slope Stability Investigation. Ref. V1168R3 (**Black 2009**).

David Mitchell Ltd (February 2001) Lilydale Limestone Quarry – Work Authority No. 199 – Updated Work Plan Submitted For Removal Of Depth Restriction Condition (**Mitchell 2001**).

Geo-Eng Australia Pty Ltd (September 2000) Hydrogeological Investigation – Lilydale Limestone Quarry. Ref. 1494/9525A/821 (**Geo-Eng 2000**).

WSP Environmental Australia Pty Ltd, Environmental Site Assessment Unimin Lilydale, Hull Rd, Lilydale Unimin Australia Ltd, March 2010 (**WSP 2010**)

9 Interpretation of recommendations

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

During excavation and construction, the site should be examined by an engineer or engineering geologist competent to judge whether the exposed subsoils are compatible with the inferred conditions on which the report has been based. We would be please to provide this service to you and believe your project would benefit from such continuity. However, it is important that we be contacted if there is any variation in subsoil conditions from those described in the report.

10 Applicability

This report has been prepared for the exclusive use of our client Bayport Industries Pty Ltd & Intrapac Pty Ltd, 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.

Tonkin & Taylor Pty Ltd

Report prepared by:

Report prepared by:

.....	.....
Chris Boyd Senior Engineering Geologist	David Haar Geotechnical Engineer

Authorised for Tonkin & Taylor Pty Ltd by:

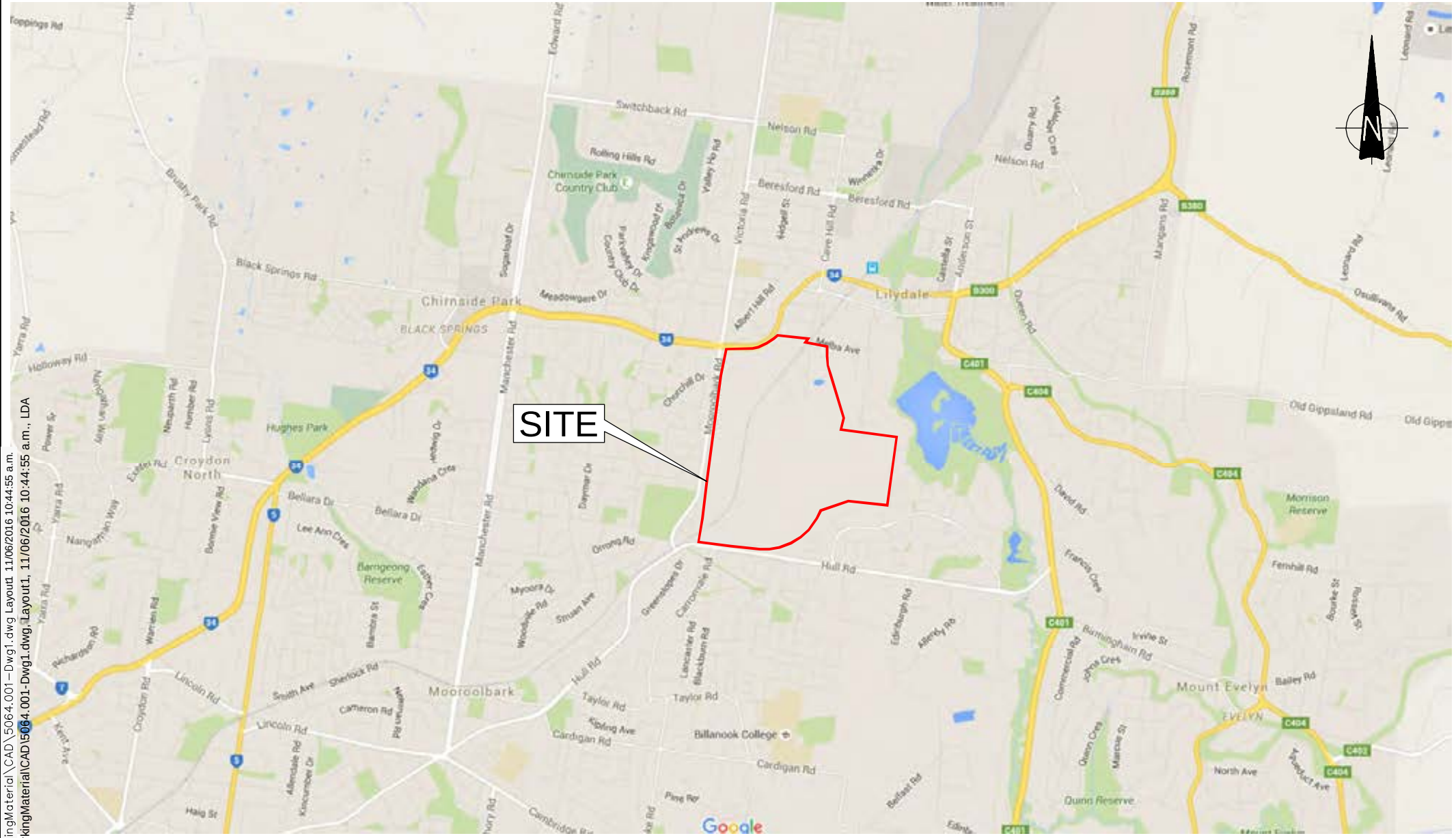
.....

Tim Chadwick
Project Director

c:\users\cb\documents\300 projects\5064\5064.001.r1 draft - input reviewers comments.docx

Appendix A: Figures

- **Test Location Plan**



Aerials sourced from Google Maps data (Copyright: 2016).

SCALE 1: 40,000

0 400 800 1200 1600 2000(m)

Tonkin+Taylor
Tonkin & Taylor Pty Ltd
Kings Technology Park, Ground Floor 95 Coventry St
Southbank, Victoria, 3006
Ph: (03) 9863 8686

DRAWN	LJD	Jun.16
DRAFTING CHECKED		
APPROVED		
CADFILE : \\5064.001–Dwg1.dwg		
SCALES (AT A4 SIZE) AS SHOWN		
PROJECT No. 5064.010		

BAYPORT GROUP

GEOTECHNICAL INVESTIGATION
4 MELBA AVENUE, LILYDALE, VIC
Site Location Plan

FIG. No. Drawing 1

REV. 0

P:\5064\5064.0010\WorkingMaterial\CAD\5064.001–Dwg1.dwg Layout1 11/06/2016 10:44:55 a.m.
P:\5064\5064.0010\WorkingMaterial\CAD\5064.001-Dwg1.dwg, Layout1, 11/06/2016 10:44:55 a.m., LDA

MAROONDAH HWY

MELBA AVE

HULL RD

N

Quarry sump 01

East sump 01

SUMP01

LEGEND

- Site boundary
- Borehole, Testpit, Handauger & Sump location (Peter J Ramsay & Ass., 2015)
- Borehole & Testpit location (Black Pty Ltd, 2009)
- Borehole & Testpit location (WSP Environmental, 2010)
- Environmental Test pit location (T+T, April 2016)

SCALE 1:6000

0 60 120 180 240 300 (m)

Aerials sourced from NearMaps data (Images Copyright: 2016). Imagery Date: February 2016.

Tonkin+Taylor

Tonkin & Taylor Pty Ltd
Kings Technology Park, Ground Floor 95 Coventry St
Southbank, Victoria, 3006
Ph: (03) 9863 8686
www.tonkintaylor.com.au

DRAWN	LJD	Jun.16
DRAFTING CHECKED		
APPROVED		
CADFILE : \\5064.001–Dwg3.dwg		
SCALES (AT A3 SIZE) AS SHOWN		
PROJECT No. 5064.001		

BAYPORT GROUP

GEOTECHNICAL INVESTIGATION
4 MELBA AVENUE, LILYDALE, VIC

Previous Investigations

FIG. No. Drawing 3

REV. 0

MAROONDAH HWY

MELBA AVE

HULL RD

TP35
TP36
TP37
TP38
TP39
TP40
TP41
TP42
TP24
TP23
TP25
TP30
TP28
TP26
TP27
TP29
TP31
TP32
TP33
TP34
TP14
TP15
TP16
TP10
TP11
TP1A
TP1B
TP17
TP18
TP12A
TP12B
TP12C
TP12D
TP19
TP20
TP21
TP22
TP13
TP09
BH 16–01
BH 16–02
BH 16–03
TP04
TP01
TP02
TP03
TP05
TP06
TP07
TP08

N

SCALE 1:6000

0 60 120 180 240 300 (m)

Aerials sourced from NearMaps data (Images Copyright: 2016). Imagery Date: February 2016.

LEGEND

- Site boundary
- Testpit location (T+T, April 2016)
- Borehole location (T+T, May 2016)

Tonkin+Taylor

Tonkin & Taylor Pty Ltd
Kings Technology Park, Ground Floor 95 Coventry St
Southbank, Victoria, 3006
Ph: (03) 9863 8686
www.tonkintaylor.com.au

DRAWN	LJD	Jun.16
DRAFTING CHECKED		
APPROVED		
CADFILE : \\5064.001–Dwg4.dwg		
SCALES (AT A3 SIZE)	AS SHOWN	
PROJECT No.	5064.001	

BAYPORT GROUP

GEOTECHNICAL INVESTIGATION
4 MELBA AVENUE, LILYDALE, VIC

Test Location Plan

FIG. No. Drawing 4

REV. 0

P:\5064\5064.001\WorkingMaterial\CAD\5064.001-Dwg4.dwg Layout1 11/06/2016 10:48:32 a.m.

Appendix B: Engineering Logs

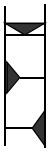
- **Engineering Log Terminology**
- **Borehole Logs No. B16-01 to B16-03**
- **Test Pit Logs No. TP1A to TP1B**
- **Test Pit Logs No. TP01 to TP42**

Tonkin & Taylor
Environmental &
Engineering Consultants

ENGINEERING LOG TERMINOLOGY

DRILLING OR EXCAVATION

WATER



Water level on date shown

Water inflow

Water outflow

CORE RECOVERY

Core recovered expressed as percentage of the length of the core run

METHOD/CASING

Shows drilling method and depth of casing

- SA - Solid Auger
- HA - Hollow Auger
- TR - Terrier
- W - Wash Boring
- NQ3 - NQ triple tube coring

FIELD TEST

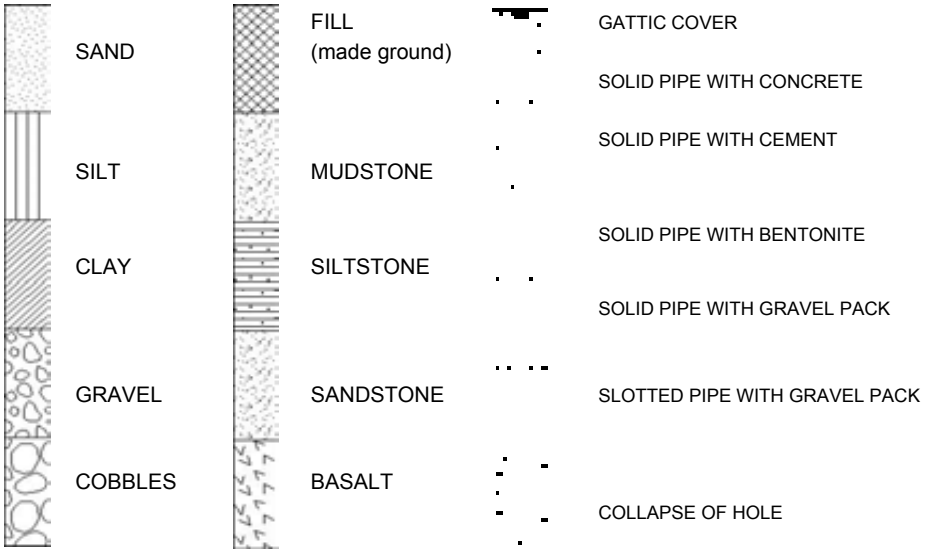
SPT	Standard Penetration Test
U63	Undistirbed Sample 63mm diameter
SV	Undrained Shear Strength as measured by field vane
PP	Twice Undrained Shear Strength as measured by pocket penetrometer
DCP	Dynamic Cone Penetrometer blows per 100mm
Field CBR	Field CBR under exisitng pavement

LABORATORY TEST

U63	Undisturbed Sample - 63mm
DS	Disturbed Sample
MC	Moisture Content % AS 1289.2.1.1
LL	Liquid Limit (%) AS 1289.3.1.2
PI	Plasticity Index AS 1289.3.3.1
LS	Linear Shrinkage (%) AS 1289.3.4.1
PID	Photoionization Detector (ppm)
CBR	California Bearing Ratio AS 1289.6.1.1

GRAPHIC LOG

(The graphic logs shows soil and rock substances, significant defects, and core loss. Soil and rock substances represented clear contrasting symbols consistant for each project.



SOIL DESCRIPTIONS

CLASSIFICATION SYMBOL

Based on USCS Unified Soil Classification Symbol Visual Method field identification. Classification symbols based on the Laboratory Method may differ

Soil and rock desriptions generally follow the "Guide to the Description Identification and Classification of Soils" and the the field guides as given in AS1726 - 1993 Geotechnical Site Investigations. When describing the soils the soils are desribed in terms of the Engineering properties.

MOISTURE CONTENT

D	Dry, look and feels dry
M	Moist, no free water on hand when remoulding
VM	Very Moist
W	Wet, freee water on hand when remoulding

STRENGTH

		Cu (kPa)
VS	Very Soft	<10
S	Soft	10 - 25
F	Firm	25 - 50
St	Stiff	50 - 100
VSt	Very Stiff	100 - 200
H	Hard	>200
Fb	Friable	

DENSITY

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

EASE OF EXCAVATION

E	Easy
M	Moderate
D	Difficult
ER	Effective Refusal

ROCK DESCRIPTIONS

WEATHERING

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

FIELD STRENGTH

		Point Load Index (MPa) - Is(50)	Field Guide (50mm Core)
EL	Extremely Low	< 0.03	Easily remoulded by hand crumbles
VL	Very Low	> 0.03 < 0.1	Crumbles under firm blows with sharp end of pick
L	Low	> 0.1 < 0.3	A 150mm long piece may be broken hand
M	Medium	> 0.3 < 1.0	A 150mm long piece may be broken hand with difficulty
H	High	> 1 < 3	Core breaks after one blow
VH	Very High	> 3 < 10	Core breaks after more than blow
EH	Extremely High	> 10	Core breaks after many blows with pick

Tonkin & Taylor
Environmental & Engineering Consultants

ENGINEERING LOG TERMINOLOGY

ROCK DESCRIPTIONS

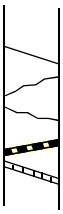
(Continued)

CLASSIFICATION OF ROCK

RQD	Rock Quality Designation	100 x Length of Core in pieces > 100mm / Length of run
	Core Recovery	Recovery of Core per drilling run

DEFECTS

Significant defects may be shown graphically



B	BEDDING
J	JOINT
SZ	SHEARED ZONE
CZ	CRUSHED SEAM / ZONE
IF	INFILLED SEAM / ZONE
XD	EXTREMELY WEATHERED SEAM

CODING

Typical Example:

30.0m, J, 60°, PL, SM, VT, CV, stiff green clay

- Depth of Defect
- Type
- Angle to Core Axis
- Shape
- Roughness
- Apeture
- Infill / Coating Type
- Infill Description (as per soil description)

SHAPE

CODE	TERM
PL	Planar
SC	Slightly Curved
CV	Curved
IR	Irregular
ST	Stepped
WV	Wavy

ROUGHNESS

DESCRIPTION OF JOINT SURFACE	
SL	Slickensided
SM	Smooth
DR	Defined Ridges
ST	Small Steps
R	Rough
VR	Very Rough

APERTURE

SYMBOL	TERM	DESCRIPTION (Seperation)
VT	Very Tight	< 0.1mm
T	Tight	0.1mm - 1.0mm
O	Open	1.0mm - 10.0mm
VO	Very Open	> 10mm

INFILLINGS AND COATINGS

CG	Clay Gouge	Joints have openings between opposing faces of intact rock substance in excess of 1.0mm filled with clay gouge.
CV	Clay Veneers	Joints contain clay coatings whose maximum thickness does not exceed 1mm. Note: Clay described in terms of soil properties
PL	Penetrative Limestone	Joint traces are marked in terms of well defined zones of slightly to moderately weathered ferrugunised rock - substance within the adjacent rock.
FeSt	Limonite Stained	Joint surfaces are stained or coated with limonite, although the rock substance immediately adjacent rock is fresh.
CT SC	Coated	Joints exhibit Coatings other than clay or limonite. Eg. Carbonate (CT) or silica (SC)
CL CS CC	Cemented	Joints are cemented with limonite (CL), silica (CS), or carbonates (CC).
CN	Clean	Joint Surfaces show no trace of clay, limonite, or other coatings.
ST	Stain	No visible sign of infill or coating but surfaces are discoloured by mineral staining.
V	Veneer	A visible coating or infilling of soil or mineral substance but usually unable to be measured (less than 1mm).
C	Coating	A visible coating or infilling of soil or mineral substance, greater than 1mm thick

CEMENTATION CLASSIFICATION

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

BOREHOLE LOG

BOREHOLE NO: ***BH16-01***

SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***18.5.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.5.2016***
LOCATION:	***Northern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90^{o}	**Easting:**	354030	**Surface R.L.:**	
Drill Model:	Hanjin D&B - 8D	**Drill Fluid:**	Air	**Bearing:**		**Northing:**	5818939	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Solid Auger		0 – 1.5		Fill		FILL: Sandy GRAVEL with clay, grey-brown; gravel: fine to coarse grained, angular, limestone, nominally 40mm; sand: fine to coarse grained	M / M	D-VD / D-VD								
Downhole Hammer		1.5 – 3.5		Fill		FILL: Sandy GRAVEL, orange-brown; gravel: fine grained, minor coarse grained, grey, angular, sandstone; sand: fine to coarse grained	M	D-VD							- inferred from hammer return (recovered as fine to medium grained gravel)	
		3.5 – 14		Fill		FILL: Gravelly COBBLES/BOULDERS (inferred), brown and grey, predominantly limestone, minor sandstone - contains pockets of Clayey SAND										
		14 – 16		Fill		FILL: Gravelly CLAY/COBBLES (inferred), brown mottled white-grey and red-orange, medium plasticity; contains limestone, pale grey, basalt, grey, ironstone, red.	M	D-VD								
		16 – 18.4		Fill		- grades to CLAY/GRAVEL (inferred), brown, medium plasticity	M	L							- at 16m, loss of air return, potential void - at 17.5m, slow drill rate, infer loose gravel fill	
		18.4 – 21.0			CI	CLAY, brown mottled grey, minor white and orange-red, medium plasticity	M	St							- at 18.4m, clay, infer natural	
		21.0				**End of BH16-01 at 21.00m**										

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH16-02***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***19.5.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.5.2016***
LOCATION:	***Northern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	354039	**Surface R.L.:**	
Drill Model:	Hanjin D&B - 8D	**Drill Fluid:**	Air	**Bearing:**		**Northing:**	5818736	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Auger						FILL: Sandy GRAVEL, brown and grey, limestone		D-VD								
Downhole Hammer Solid		2				FILL: Sandy GRAVEL/COBBLES (inferred), pale-brown, mottled white, brown, red, sandstone; contains pockets of SAND; sand: fine grained, brown-grey and orange		D-VD								
		4														
		6				FILL: CLAY with gravel/cobbles interbedded with COBBLES/BOULDERS (inferred), brown and grey mottled orange; clay: low to medium plasticity, brown; gravel: limestone, grey, trace basalt		D-VD								
		8						L-MD							- slow rate of drilling, change to clay bit	
		10				- grades to Gravelly CLAY with cobbles (inferred), dark brown; medium to high plasticity, basaltic										
Drag Bit		12				- grades to COBBLES/BOULDERS (inferred), grey, basalt, high strength, moderately weathered		L								
		14						L							- very slow rate of drilling, borehole unstable (collapsing above this depth)	
		16			CI-CH	CLAY, trace gravel (inferred), brown-grey, minor orange mottling, medium to high plasticity; gravel: fine grained, rounded, ironstone nodules, red	M	St-VSt							- extremely slow rate of drilling, no recovery, infer clay - confirm clay	
		18				**End of BH16-02 at 16.90m**										
		20														
		22														
		24														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH16-03***
SHEET: 1 OF 2

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***16.5.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.5.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	354164	**Surface R.L.:**	
Drill Model:	Hanjin D&B - 8D	**Drill Fluid:**	Air	**Bearing:**		**Northing:**	5818574	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Solid Auger		0				FILL: Clayey GRAVEL/COBBLES, pale-brown, basaltic; clay: high plasticity, brown	M	D								
		2				FILL: COBBLES/BOULDERS (inferred), grey, sandstone/limestone	M	D								
		4				- grades to BOULDERS with clay (inferred), grey, sandstone; clay: grey mottled brown and red, sandy	W	D							- contains minor carbonates (very slightly effervescent with HCl)	Inflow
		6					M									
		8														
		10				CLAY/SILTSTONE (inferred), very low to extremely low strength, highly weathered to extremely weathered, grey discoloured brown		VL-EL VL-L	HW-XW						- infer natural - field strength interpretation (approximate only)	
Downhole Hammer/Drag Bit		12														
		14				SILTSTONE (inferred), low strength, highly weathered, grey-brown/yellow-brown		L	HW						- no carbonates detected (non-effervescent with HCl)	
		16				- grades to low to medium strength, highly to moderately weathered		L-M	HW-MW							
		18														
		20				- grades to medium strength, moderately weathered, grey discoloured grey-brown, red-orange staining		M	MW							
		22														
		24														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

BOREHOLE LOG

BOREHOLE NO: ***BH16-03***
SHEET: 2 OF 2

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***16.5.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.5.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Drill Contractor:	CGEO	**Bore Size:**	100mm	**Hole Angle:**	-90°	**Easting:**	354164	**Surface R.L.:**	
Drill Model:	Hanjin D&B - 8D	**Drill Fluid:**	Air	**Bearing:**		**Northing:**	5818574	**Offset:**	

Method	RL (m) / Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Cementation / Weathering	Sample / Test	Tests: DCP	Tests: SV (kPa)	Tests: PP (kPa)	Tests: MC (%)	Field Records / Comments	Water
Downhole Hammer/Drag Bit	26				SILTSTONE (inferred), low strength, highly weathered, grey-brown/yellow-brown *(continued)*		L M-H	HW MW-SW						- no carbonates detected (non-effervescent with HCl)	
	28				- grades to medium to high strength, moderately to slightly weathered, grey interbedded purple-grey										
	30				- interbedded with medium strength, moderately weathered, grey-brown		M	MW							
	32														
	34														
	36														
	38														
	40						M-H	MW-SW							
	42				**End of BH16-03 at 41.40m**										
	44														
	46														
	48														
	50														

This log should be read in conjunction with the T&T Pty Ltd Log Terminology Sheet and the Site Plan

TEST PIT LOG

TESTPIT NO: ***TP1A***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***26.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***26.4.2016***
LOCATION:	***Northern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353940	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818845	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy GRAVEL, grey; gravel: fine to medium grained, limestone	M	VD														- infer 10mm crushed rock product	
		1				FILL: Sandy GRAVEL, dark red-brown; gravel: fine to medium grained, igneous	M	D-VD															
		2				FILL: WASTE/Clayey GRAVEL, grey, some black staining, some sand pockets	M	D														- strong hydrocarbon odour, particularly at 1.5m; waste includes: oil filter, large steel chains, cables; small steel wires, shavings; rubber mats, hoses; HDPE bags; textiles; ligneous fibers/decayed wood fragments	
		3																					
		4			CL-CI	CLAY with sand, trace gravel and cobbles, brown mottled grey, red and yellow-orange, minor green and dark grey; clay: low to medium plasticity; cobbles: purple-red, highly weathered, igneous, contains infilled vesicles	M	VSt-H									35	16	9			- natural? porphyritic fabric - infer extremely weathered rhyolite	
		5																					
		6																					
		7				**End of TP1A at 6.50m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP1B***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***26.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***26.4.2016***
LOCATION:	***Northern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353919	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818579	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Clayey GRAVEL, red-brown and brown, angular	D	MD														- unstable test pit - high ease of excavation	
						FILL: Cobbly BOULDERS with sand and gravel, pale grey and brown; boulders: up to 0.5m size, sub-angular, sandstone, minor limestone	D-M	L-MD	E														
		1																					
		2																					
		3																					
					CL	Sandy CLAY with gravel, trace cobbles and boulders, brown, low to medium plasticity; gravel: fine to coarse grained; boulders: extremely to highly weathered, rhyolitic	D-M	D														- natural?	
		4																					
		5																					
		6																					
		7				**End of TP1B at 6.50m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP01***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***19.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353967	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818513	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy GRAVEL, grey and brown	M	D															
						FILL: Sandy GRAVEL with cobbles and boulders, brown; boulders: limestone, up to 400 mm size	D-M	D-VD														- located in access track to explosives magazine - some carbonates present: limestone boulders noneffervescent or slightly effervescent with dilute HCl - nominally 40% gravel, 30% sand, 20% cobbles, 10% clay (visual approximation only)	
		1				- grades to Sandy GRAVEL with cobbles, trace clay, red-brown; gravel: coarse grained	M																
		2																					
		3				- contains 1 m pocket of CLAY, mottled grey, orange and red, (infer residual rhyolite)																	
		4				FILL: Silty SAND with cobbles, trace of gravel, trace boulders; pale grey mottled brown; sand: fine to coarse grained; clay: medium plasticity; cobbles: rounded limestone/sandstone; gravel: fine to coarse grained	M	D-VD															
		5														13.8							
		6															16	2	1				
		7				**End of TP01 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP02***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***19.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment: Bayport **Trench Length:** 4000m **Trench Bearing:** **Easting:** 354016 **Surface R.L.:**

Model: 29 t **Trench Width:** 1650m Depth above/below existing pavement surface: **Northing:** 5818462 **Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Gravelly BOULDERS with sand and cobbles, grey and brown; boulders up to 0.3m size, limestone	M	D														- carbonates present: non through to violently effervescent reaction of limestone with HCl	
		2				FILL: Sandy COBBLES with gravel, trace boulders, grey; boulders up to 0.5m size, limestone	M	VD															
		3				FILL: CLAY with boulders, mottled dark red brown, grey and pale orange, medium plasticity; boulders up to 0.5m size, limestone	M	VSt															
		4				FILL: Gravelly/Cobbly BOULDERS, trace sand and clay, grey; boulders up to 1m size, limestone, sub-rounded; gravel: coarse grained, sub-rounded	M	VD	D													- difficult excavation - nominally 50% boulders, 20% cobbles, 20% gravel, 10% clayey sand (visual approximation only)	
		7				**End of TP02 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP03***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354160	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818454	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Gravelly COBBLES with boulders, trace of sand and clay, brown; boulders up to 0.5m size, very high strength, rhyolitic	D-M	VD															- difficult ripping, variable material - nominally 60% cobbles, 20% gravel, 5-15% boulders (visual approximation only)	
		1				- at 1.5 m, single large boulder, >2m size																	
						FILL: Gravelly COBBLES with sand, trace of boulders, grey and brown	M	VD															
		2																					
		3				FILL: Gravelly SAND with cobbles and clay, grey, grades to grey, brown and orange-brown, rhyolitic; sand: fine to coarse grained; gravel: fine to coarse grained	M	D-VD															
		4				FILL: Sandy CLAY with gravel, dark brown and brown, porphyritic - at 3.8 m, single large boulder, >2m size	W	MD								32.9							Perched groundwater inflow
		5																					
		6				FILL: Sandy SILT with cobbles, pale grey and pale brown; cobbles: sandstone; silt: low plasticity	M	D-VD															
		7				**End of TP03 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP04***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354154	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818539	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Clayey BOULDERS, brown, boulders up to 0.5m size	D-M	D-VD														- test pit starts 3 m above base of boulder stockpile	
		1																					
		2																					
		3																					
		4				FILL: Sandy BOULDERS/ COBBLES, brown and grey, boulders up to 1m size, limestone and rhyolite - 4.5-5.5m, Gravelly SAND pocket, dark brown/grey, wet	M	D-VD															Perched groundwater inflow
		5																					
		6																					
		7																					
		8				**Refusal of TP04 at 7.50m on on boulder (>2m size)**																	

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP05***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***13.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***13.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354324	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818594	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy COBBLES, brown, cobbles: grey, angular, highly to moderately weathered basalt, high to very high strength, up to 200mm size	M	D															- contains rootlets (grassed swale)	
		1				FILL: Cobbly CLAY with boulders, pale grey mottled pale orange; clay: low to medium plasticity; cobbles/boulders: sandstone	M	VSt-H																
		2				- 2.2m, grades to pale grey, includes siltstone boulders																		
		3																					
		4				FILL: Silty SAND with cobbles, pale grey mottled pale brown; sand: fine to coarse grained; clay: medium plasticity	M	D																
		5																					
		6														9.3							
		7				- 6.5m, grades to with boulders, up to 0.5m nominal size, tabular																		
						End of TP05 at 7.00m																		
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP06***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354270	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818489	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	Tests: FIELD CBR	Tests: PP (kPa)	Tests: SV (kPa)	Tests: MC (%)	Tests: LL (%)	Tests: PI	Tests: LS	Tests: SWELL	Tests: CBR	Field Records / Comments	Water
Excavator		1				FILL: Silty GRAVEL, brown, contains rootlets	D	~~MD-D~~														- unstable test pit	Perched groundwater inflow
						FILL: Clayey SAND with boulders, pale grey mottled brown; sand: fine to coarse grained; clay: medium plasticity; boulders up to 0.6m size	M	MD-D															
		2				- at 1.5m, pocket of BOULDERS	W																
		3					M																
		4																					
		5				FILL: Clayey GRAVEL with sand, dark brown/brown, minor grey; sand: fine to coarse grained; gravel: coarse grained, sub-rounded, dark red-brown, cemented sand/ironstone; clay: low to medium plasticity	M	MD-D									35	16	8				
		6																					
		7				**End of TP06 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP07***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***13.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***13.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354424	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818555	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Clayey GRAVEL with sand, orange-brown; gravel: fine to medium grained, angular	D	MD	E													- cobbly boulders recovered as sand (friable sandstone, minor siltstone) - nominally 50% gravel, 40% sand, 5% cobbles, 5% clay, <2% boulders (visual approximation only)	
							M	MD	E														
							M	MD	M														
		1				FILL: Clayey GRAVEL with cobbles, dark brown; gravel: coarse grained, sub-rounded and angular	M	MD	E														
						FILL: SAND with clay, pale grey, minor red; sand: fine to medium grained, sedimentary																	
		2				FILL: Sandy GRAVEL, trace cobbles and clay, occasional boulder, dark brown; gravel: fine to coarse grained, angular, igneous																	
		3						L-MD															
		4				- 3.6m to 3.8m, pale grey-white pocket, abundant carbonates - grades to brown/dark-brown, increased sand content, contains pocket of cobbles																	
		5																					
		6																					
		7																					
						End of TP07 at 7.00m																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP08***
SHEET: 1 OF 2

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***13.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***13.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354421	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	**Depth above/below existing pavement surface:**		**Northing:**	5818417	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0.0				FILL: Sandy GRAVEL with clay, brown; gravel: fine to coarse grained, clay: medium plasticity	M / M	~~MD~~ / MD															
		0.7				FILL: Gravelly COBBLES/BOULDERS																	
		2.2				FILL: Sandy CLAY/Clayey SAND with cobbles/boulders, pale grey, minor orange-red, low plasticity, boulders highly to extremely weathered siltstone/sandstone	M	MD															
		4.0															25	9	4				
		5.5				- 5.5m to 6.0m, GRAVEL pocket, brown, basaltic																	
		7.0				- boulders grading to highly to extremely weathered mudstone, very low to extremely low strength, friable to clay soil, pale grey																- unstable below 7m, collapsing to surface	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP08***
SHEET: 2 OF 2

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***13.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***13.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354421	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818417	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		9				FILL: Sandy CLAY/Clayey SAND with cobbles/boulders, pale grey, minor orange-red, low plasticity, boulders highly to extremely weathered siltstone/sandstone *(continued)*	M	MD									52	26	10.5				
		10				- 9.5m, contains coarse grained basaltic gravel; clay: high plasticity																	
						End of TP08 at 10.00m																	
		11																					
		12																					
		13																					
		14																					
		15																					
		16																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP09***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***14.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***14.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354471	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818370	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy GRAVEL, brown, contains rootlets	M	D															
						FILL: BOULDERS, recovered as sub-angular COBBLES, white-grey, extremely to highly weathered or moderately weathered (extremely low strength - friable to low to medium plasticity clay or high strength siltstone/sandstone)	D-M	VD														
		1				FILL: BOULDERS with silty sand, pale-brown and grey; boulders generally up to 0.6m size, medium to very high strength, sedimentary; sand: fine to medium grained; silt: low plasticity - 2m to 3m, trace waste: plastic hoses, explosive fuses, textiles, wire	D-M	D-VD														
		2																					
		3																					
		4				- at 4.2m, single large boulder, >2m size																	
		5																					
		6															18	2	1.5				
		7				**End of TP09 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: *TP10*
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***19.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:** 353909	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:** 5818385	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0.0–0.35				FILL: COBBLES, brown, highly weathered, igneous, contains roots and rootlets to 0.35m	D	D															
		0.35–2.0				FILL: COBBLES, pale grey and brown, highly weathered, sedimentary	D	D															
		2.0–4.4				FILL: BOULDERS, recovered as cobbly boulders; boulders: up to 1m size - grades to recovered as Clayey/Sandy GRAVEL/COBBLES with boulders; siltstone/sandstone, minor limestone	D	VD	D							7.3						- hard ripping - nominally 30% gravel, 30% cobbles, 15% sand, 15% clay, 10% boulders (visual approximation only)	
		4.4–6.5				FILL: Sandy CLAY with gravel, pale grey, high carbonate content; clay: low plasticity; sand: fine to medium grained; gravel: fine to coarse grained - at 6m, waste: single plastic box (HDPE)	D	VD															
		6.5				**End of TP10 at 6.50m**																	

Tests (column group heading over DCP to CBR)

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP11***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***18.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353970	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818363	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: COBBLES with BOULDERS, pale grey, limestone, cemented at surface	D	VD	D													- difficult excavation	
		1																					
		2				- 1.5m to 2.0m, grades to with trace waste: contains plastic bags																	
						FILL: Clayey BOULDERS with cobbles, brown, limestone, contains pockets of CLAY, high plasticity, rhyolitic	M	VD									57	25	11.5				
		3																					
		4																					
		5																					
						FILL: Sandy CLAY, with gravel, grey mottled brown and orange; clay: low plasticity; gravel: medium grained, limestone	M	VSt-H									21	7	3				
		6																					
		7				**End of TP11 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP12A***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	364152	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818317	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Gravelly COBBLES/BOULDERS with clay and sand, brown; single piece of waste: scrap metal sheet	M	MD															
		2				FILL: Organic WASTE, dark brown; waste: silt/mulch with branches/roots	W	St														- strong putrescible odour	
		3				FILL: Sandy CLAY, trace cobbles and gravel, pale grey, minor brown; clay: low to medium plasticity; sand: fine to medium grained; cobbles: sandstone	M	St-VSt															Perched groundwater inflow ▶
		5				FILL: Sandy GRAVEL with clay, brown; gravel: coarse grained, sub-rounded, igneous; clay: low plasticity	M-W	D								19.8	27	10	5.5				
		7				**End of TP12A at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP12B***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354136	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818319	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy CLAY, trace cobbles/boulders, brown; clay: medium plasticity; sand: fine to coarse grained	D-M	VSt															- located 10m southwest of TP12A - waste:half clay bricks, glass fragments, copper tube, plastic bag	
						FILL: CLAY, trace waste, dark blue-grey, discoloured green, high plasticity	M	St-VSt								38.4							
		1				FILL: Organic WASTE, dark brown, contains tree branches	M	St-VSt															
		2				FILL: CLAY, dark grey, high plasticity	M	VSt															
						FILL: CLAY, pale white-grey, medium plasticity																	
		3				**End of TP12B at 2.50m**																	
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP12C***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354169	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818323	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Cobbly BOULDERS with sand, brown; boulders: grey, up to 0.5m, rhyolite and sandstone	M	D														- located 20m northeast of TP12A	
		1				FILL: Sandy COBBLES with boulders, orange-brown	M	D														- no organics observed	
		2				- 2.5m, grades to pale-grey																	
		3				- at 2.8m, pocket of CLAY, dark grey mottled orange-yellow, high plasticity, basaltic **End of TP12C at 3.00m**																
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP12D***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354109	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818316	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Organic WASTE, dark brown, logs and branches, trace basalt boulders, fungi growing at surface	M	St														- located 40m southwest of TP12A	
		1				FILL: Clayey COBBLES with boulders, pale grey	D-M	VSt															
		2				FILL: Sandy CLAY with gravel, pale grey, clay: low to medium plasticity; sand: fine to medium grained; gravel: sandstone	M	VSt-H															
		3				**End of TP12D at 3.00m**																	
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP13***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***15.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***15.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354302	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818379	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Cobbly BOULDERS with sandy clay, pale grey, grades to pale brown/orange-brown; boulders: grey, up to 0.5m size, fine grained sedimentary	D-M	D															
		1				FILL: CLAY with boulders, dark brown, low plasticity, porphyritic, igneous	M	St															
		2				FILL: Cobbly BOULDERS with sandy clay, brown/orange-brown; boulders: up to 1m size, fine grained sedimentary; clay: high plasticity	D-M	D									62	35	14.5				
		3				FILL: Clayey SAND with gravel, grey; sand: fine to medium grained; clay: low plasticity; gravel: fine to medium grained, rounded, highly to moderately weathered, sandstone, trace friable	M	MD															
		4																					
		5																					
		6																					
		7				**End of TP13 at 7.00m**											18	5	2				
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP14***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***18.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353739	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818215	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy GRAVEL, grey; gravel: fine to coarse grained, angular, limestone	D	D														- infer crushed rock	
		1				FILL: Clayey COBBLES, grey-brown and red-brown, sandstone	D-M	VD	D													- difficult excavation	
		2				- 1.5m, grades to with boulders, 1m nominal size recovered, infer >2m size from sidewall																	
						Clayey SAND with gravel, trace cobbles, red-brown	D-M	D														- natural?	
		3																					
		4				Clayey GRAVEL with sand, trace cobbles and boulders, grey and brown; gravel: fine to coarse grained, sandstone and limestone; sand: fine to coarse grained	D-M	D															
		5																					
		6																					
		7				**End of TP14 at 6.50m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP15***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***18.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353862	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818295	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy/Cobbly GRAVEL/BOULDERS, brown	D	MD														- note test pit starting level 1.5m above access road (within bund) - nominally 35% boulders, 30% gravel, 20% cobbles, 15% sand (visual approximation only)	
		1																					
		2				FILL: Clayey SAND with boulders/cobbles/gravel, grey and dark brown	M	MD															
		3			SP-SC	- at 2.8m, contains organic waste: single log, some branches/roots Gravelly SAND with clay, pale grey, pale brown mottling, minor orange and pink; sand: fine grained; gravel: sub-angular, highly weathered siltstone, fine to medium grained; clay: low plasticity - grades to grey mottled brown	M	MD-D														- natural? (1.3m below access road level)	
		4																					
		5														17.6							
		6																					
		7																					
		8				**End of TP15 at 8.00m**																	

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP16***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***18.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment: Bayport **Trench Length:** 4000m **Trench Bearing:** **Easting:** 353868 **Surface R.L.:**

Model: 29 t **Trench Width:** 1650m Depth above/below existing pavement surface: **Northing:** 5818241 **Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Gravelly COBBLES with sand, yellow-brown and brown	D	D														- adjacent stockpile of limestone boulders up to 1m size	
		1				FILL: Gravelly SAND with cobbles, yellow-brown; cobbles: dark grey, highly weathered, rhyolitic, vesicular, green infilling	D-M	D															
		2				FILL: Sandy CLAY with gravel, brown, minor grey; clay: medium plasticity; gravel: fine to medium grained, limestone	M	VSt															
		3			GP	Sandy GRAVEL with clay, trace cobbles, occasional boulders, brown; gravel: fine to coarse grained, igneous; sand: fine to coarse grained	M	D									34	14	6			- natural?	
		4																					
		5																					
		6																					
		7				- 6.5m, grades to with large boulders, greater than 1m size																	
						End of TP16 at 7.00m																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP17***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***18.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353986	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818193	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy GRAVEL, grey	D	D															
						FILL: Gravelly BOULDERS/COBBLES, pale brown with grey and orange-brown; boulders: up to 0.5m size, limestone/sandstone	D	VD														- nominally 40% cobbles, 30% boulders (visual approximation only)	
		1																					
		2																					
		3																					
		4				FILL: BOULDERS, recovered as Gravelly COBBLES with boulders and sand, brown	D-M	D-VD															
								VD	D													- difficult excavation	
		5																					
						- grades to brown/orange-brown	M																
		6																					
		7				**End of TP17 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP18***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***18.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***18.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**	**Easting:**	353998	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:	**Northing:**	5818283	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Cobbly BOULDERS with sand and gravel, orange-brown; boulders: up to 1.5m size, predominantly 0.5m size, sedimentary	D	VD														- nominally 60-80% boulders, 20% cobbles, 10% sand, 10% gravel (visual approximation only)	
		2				- 2m, grades to with pockets of CLAY, dark brown, medium plasticity	D-M																
		3			CL-CI	CLAY with organics, dark grey-black, low to medium plasticity; organics: roots/rootlets	M	St									33	11	5.5			- natural?	
		4			SC	Silty SAND with gravel, pale grey, minor orange; sand: fine to medium grained; silt: low plasticity; gravel: coarse, rounded, weakly cemented sand	D	D														- test pit unstable below 4.5m	
		6															18	0	0.5				
		7				**Refusal of TP18 at 6.50m on test pit collapse**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP19***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***14.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***14.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354110	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818247	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		1				FILL: Gravelly/Cobbly SAND with clay, trace boulders, pale brown, mottled grey and orange; sand: fine to coarse grained; gravel: fine to coarse grained, sub-rounded; boulders: up to 1m size, sandstone	D-M	D														- nominally 40% sand, 20-30% cobbles, 20% gravel, 10% clay, 5% boulders (visual approximation only)	
		2																					
		3																					
		4				- 3.5m to 4.5m, pocket of grey Sandy CLAY and dark grey/brown CLAY, high plasticity, basaltic																		
		5				- grades to brown, minor red-brown and grey	M	D															
		6																					
		7				**End of TP19 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: *TP20*
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***14.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***14.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:** 354193	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:** 5818272	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0–0.2				FILL: Clayey GRAVEL with sand, dark brown; gravel: fine to medium grained, angular, siltstone/limestone, dark grey	M	D														- contains rootlets	
		0.2–7.5				FILL: SAND/GRAVEL with boulders and cobbles, trace clay, grey and brown, sedimentary; gravel: coarse grained; sand: fine to coarse grained; boulders: up to 1m size, sandstone	D-M	VD	D (from 3.0m)													- nominally 30-40% sand, 30-40% gravel, 10-30% boulders, 10-20% cobbles (visual approximation only) - difficult excavation (at 3.0m)	
		7.5				**End of TP20 at 7.50m**																	

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP21***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***14.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***14.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354264	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818220	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy CLAY with boulders, brown; boulders: up to 0.5m size, sandstone, moderately weathered, high to very high strength, grey discoloured brown	M	VSt-H															
		1				FILL: Clayey SAND with cobbles, brown, mixed with Sandy CLAY, grey, trace boulders; clay: low to medium plasticity; cobbles: siltstone/sandstone	M	D															
		2				- 2.7m to 3-7m, CLAY pocket, black grey and dark brown mottled dark grey, high plasticity																	
		3																					
		4														*16.6*	*23*	*8*	*3.5*				
		5				- at 4.5m, trace waste: two detonator wires																	
		6				- 6m, grades to with boulders, up to 1m size																	
		7				**End of TP21 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP22***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***14.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***14.4.2016***
LOCATION:	***Eastern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	354418	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818244	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Sandy COBBLES, brown; sand: fine to coarse grained	D-M	D															
		1				FILL: Clayey SAND with cobbles, trace boulders, grey and pale grey; boulders: up to 0.5m size, sandstone, minor siltstone	M	D															
		2																					
		3				- at 3m, SILT pocket, 0.2m, contains rootlets																	
		4				- at 4m, pocket of BOULDERS, sedimentary																	
		5				- at 5m, pocket of Sandy COBBLES, dark brown, cobbles: 150mm size, basaltic	D																
		6					M																
		7														12.8							
		8				**End of TP22 at 7.50m**																	

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP23***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***19.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.4.2016***
LOCATION:	***Southern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353433	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818221	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0				FILL: Cobbly GRAVEL with sand, trace waste, brown - at 0.5m, waste: single plastic bag - at 1.5m, waste: single steel fragment	D	D														- nominally 60% gravel, 10-20% sand, 20-30% cobbles (visual approximation only)	
		3				FILL: Sandy GRAVEL with cobbles/clay, trace boulders, red-brown, grades to grey mottled orange-brown; sandstone/siltstone, minor basalt; boulders up to 0.5m size; clay:medium plasticity - at 5.2m, white-grey pocket (abundant carbonates)	M	D								39.4	30	13	5.5			- test pit unstable below 2.6m - nominally 50% gravel, 20% sand, 15% clay, 10% cobbles, 5% boulders (visual approximation only)	
		7				**End of TP23 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP24***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***19.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.4.2016***
LOCATION:	***Southern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353479	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818258	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		1				FILL: Sandy CLAY, trace boulders, pale grey mottled orange-brown; clay: low to medium plasticity; sand: fine to medium grained; boulders: up to 0.5m size, limestone	D-M	D															
		2																					
		3				FILL: CLAY with gravel, brown/orange-brown, porphyritic; clay: high plasticity; gravel: highly to extremely weathered, igneous	M	D										63	27	15				
		4																					
		5				FILL: Sandy CLAY with gravel and boulders, mottled grey, brown and orange brown; gravel: fine to coarse grained, angular, limestone; boulders: up to 1.5m size, limestone	M	D															
		6																					
		7				**End of TP24 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP25***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***19.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***19.4.2016***
LOCATION:	***Southern Stockpile***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353516	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818191	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		1				FILL: SILT, brown, low plasticity, pockets of dark grey - at 1 m, trace inert waste: plastics and textiles	D	St															- starting level approximately 5 m below top of southern stockpile	
		2				FILL: CLAY, dark grey discoloured blue/green, low to medium plasticity	M	St															
		3														25.8							
		4				FILL: Sandy GRAVEL with clay and cobbles, dark brown; gravel: fine to coarse grained, igneous - at 4 m, trace inert waste: textiles/cotton fabric	D	St															
		5				FILL: Gravelly CLAY with sand, trace boulders and cobbles, pale brown grades to pale grey mottled orange; clay: medium plasticity; boulders up to 0.5 m size, limestone	M	VSt									33	12	6				
		6																					
		7				**End of TP25 at 7.00m**																	
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP26***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353305	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5817982	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	Tests: FIELD CBR	Tests: PP (kPa)	Tests: SV (kPa)	Tests: MC (%)	Tests: LL (%)	Tests: PI	Tests: LS	Tests: SWELL	Tests: CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, brown, low plasticity, contains rootlets	D	St				3											
					CH	CLAY, grey mottled red-orange, minor white (carbonates), high plasticity	D-M	VSt-H				6											
												18											
												36			>210								
		1										25+				25.8	63	38	16	3	2		
							M								>210								
															135								
		2				**End of TP26 at 2.00m**									125								
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP27***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353285	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5817872	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, grey-brown, low plasticity, contains rootlets	D	St															
					CI	CLAY, grey mottled orange-brown, low to medium plasticity, contains rootlets	D	VSt-H															
		1			CH	CLAY, grey mottled orange-brown, high plasticity	M	VSt							>210								
		2															63	40	15				
						End of TP27 at 2.00m									135								
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP28***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353410	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818030	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, trace gravel, brown, low plasticity, contains roots, trace of charcoal; gravel: coarse grained, sandstone/ironstone	D	St															
					CI-CH		M	VSt-H							205								
		1				CLAY with sand, red-brown mottled brown, medium to high plasticity										34.7							
						- grades to mottled grey, red and orange-brown									200								
		2				**End of TP28 at 2.00m**																	
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: *TP29*
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353555	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5817979	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator					SM	Silty SAND, brown; sand: fine to coarse grained	M	MD														- sandstone boulders at surface - contains rabbit burrows	
					GP	Sandy GRAVEL with cobbles, pale brown	D	VD															
		1			SP	Gravelly SAND with cobbles and silt, trace boulders, orange-brown, grades to red; boulders: typically 0.4m, up to 1.5m size, moderately weathered sandstone	M	VD				20+				5				0	20		
		2				**End of TP29 at 2.00m**																	

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP30***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353591	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818081	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	Sandy SILT, brown	D	St															
						BOULDERS, recovered as cobbles with gravel, trace sand, brown and grey; boulders: fine grained sandstone	D	VD														- very hard ripping	
						- 0.4m, grades to SANDSTONE										3.5							
		1				**Refusal of TP30 at 0.80m on Sandstone**																	
		2																					
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP31***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353747	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818089	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, trace gravel, brown, low plasticity; gravel: sandstone, angular	D-M	St															
					CI-CH	CLAY, red-brown, medium to high plasticity	D-M	H							>210								
		1				- white mottling, residual soil grading to extremely weathered rhyolite										30.1				0.5	5		
		2													>210								
						End of TP31 at 2.00m																	
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP32***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353771	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5817879	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, brown, low plasticity	D	St															
					CI-CH	CLAY, brown mottled grey, minor red, medium to high plasticity	D-M	H							>210								
		1				- grades to mottled grey-brown and orange	M								>210	35.4	72	39	15				
		2				**End of TP32 at 2.00m**																	
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP33***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353839	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818060	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	Tests: FIELD CBR	Tests: PP (kPa)	Tests: SV (kPa)	Tests: MC (%)	Tests: LL (%)	Tests: PI	Tests: LS	Tests: SWELL	Tests: CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, brown, low plasticity	D	St														- contains roots and rootlets	
					CI-CH	CLAY, brown-red, medium to high plasticity - grades to grey mottled red and brown	D-M	H							>210								
		1					M									31.1							
						- grades to mottled red, grey and brown, minor yellow and orange-brown, trace gravel, extremely weathered, ferruginous nodules, rounded, dark red-grey									>210								
		2				**End of TP33 at 2.00m**																	
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP34***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***20.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***20.4.2016***
LOCATION:	***Stage 1***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353959	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818109	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, brown, low plasticity	D	St															
					CI-CH	- at 0.2m, trace charcoal fragments CLAY, red-brown mottled brown, medium to high plasticity	D-M	H							>210								
		1														8.1							
															>210								
		2				- grades to mottled orange, red and grey, residual soil grading to extremely weathered rhyolite	D																
						End of TP34 at 2.00m									>210								
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP35***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***26.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***26.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353736	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5819341	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, grey, low plasticity	M	St														- contains roots and rootlets	
					SC	Clayey SAND with pockets of SAND, brown; sand: fine to medium grained	M-W	MD-D							90	20.3							
		1				- grading to Sandy CLAY									210								
					CI	Sandy CLAY, grey-brown; clay: medium plasticity; sand: fine to medium grained	D	H									73	38	15	1	4		
		2				**End of TP35 at 2.00m**									UTP								
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP36***

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***26.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***26.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353543	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5819243	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator					ML	SILT, dark grey, low plasticity	D-M	St														- contains rootlets	
					CH	CLAY, dark grey, high plasticity	D-M	H							*>210*								
		1			CH	CLAY, red-brown and grey, high plasticity - grades to mottled brown, red brown, dark grey, minor yellow-brown, white, orange - grades to red-brown and brown, trace gravel, fine grained ironstone nodules, red, rounded	M	H							*210*	*31.7*	*66*	*33*	*16.5*	*0.5*	*3*		
		2				**End of TP36 at 2.00m**									*>210*								

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP37***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***26.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***26.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353347	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818937	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	Tests: FIELD CBR	Tests: PP (kPa)	Tests: SV (kPa)	Tests: MC (%)	Tests: LL (%)	Tests: PI	Tests: LS	Tests: SWELL	Tests: CBR	Field Records / Comments	Water
Excavator		0			CI-CH	CLAY, dark grey, medium to high plasticity; gravel: medium to coarse grained, 40mm size, rounded and sub-angular, moderately weathered basalt	M	St-VSt							80								- contains rootlets to 0.7m, extremely weathered basalt encountered between 0.45m and 0.7m - highly weathered basalt encountered between 0.7m and 1.5m - spheroidal weathering, some free water within saprolites	
		1				BASALT, extremely low (soil) to medium strength, extremely weathered to highly weathered, pale brown (recovered as friable gravel)	D-M							>210	14.8							
		2				- grades to low to high strength, highly weathered, brown and grey (recovered as gravel, trace cobbles, up to 100mm size)	M-W							UTP								
						End of TP37 at 2.00m																	
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP38***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***27.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***27.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:** 353351	**Surface R.L.:**
Model:	29 t	**Trench Width:**	1650m	**Depth above/below existing pavement surface:**		**Northing:** 5818790	**Offset:**

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator					ML	SILT, brown, low plasticity	M	St														- contains rootlets	
		1			CI	CLAY with sand, trace gravel, grey mottled brown, medium plasticity; sand: fine grained; gravel: coarse grained, slightly weathered basalt	D	H							*UTP*								
							M								*>210*	*11.1*	*46*	*26*	*12*	*0.5*	*4*		
		2				- grades to brown, residual soil grading to extremely weathered basalt																	
		3				**End of TP38 at 2.00m**									*UTP*								
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP39***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***27.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***27.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353420	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818711	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, trace gravel, grey, low plasticity; gravel: coarse grained, well rounded, sandstone/limestone	M	St															
					CH	CLAY, grey, minor brown mottling, high plasticity - grades to orange mottled brown and grey, minor white and red (extremely weathered basalt)	M	H							200 >210	36.4							
		2				**End of TP39 at 2.00m**									>210								
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP40***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***27.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***27.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353305	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818452	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	Tests: FIELD CBR	Tests: PP (kPa)	Tests: SV (kPa)	Tests: MC (%)	Tests: LL (%)	Tests: PI	Tests: LS	Tests: SWELL	Tests: CBR	Field Records / Comments	Water
					ML	SILT, dark grey, low plasticity	M	St															
Excavator		1			CH	CLAY, grey mottled brown, grades to grey-brown, high plasticity	M	H							*135*	*36.3*							
					CL-CI	- grades to grey mottled orange-brown and white-grey, low to medium plasticity, grading to extremely weathered basalt									*185*								
		2													*155*								
						End of TP40 at 2.00m									*>210*								
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP41***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***27.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***27.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353383	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818347	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, brown/red-brown, low plasticity	M	St															
					CH	CLAY with sand, red-brown/red, minor grey mottling, high plasticity	M	H							UTP								
		1														22.2	52	24	11	0	7		
															UTP								
		2																				- polished discontinuity surfaces, possible slickensides	
						End of TP41 at 2.00m									UTP								
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

TEST PIT LOG

TESTPIT NO: ***TP42***
SHEET: 1 OF 1

CLIENT:	***Bayport Industries / Intrapac***	DATE COMMENCED:	***27.4.2016***
PROJECT:	***4 Melba Avenue, Lilydale***	DATE COMPLETED:	***27.4.2016***
LOCATION:	***Western Area***	LOGGED BY:	***DJHH***
JOB NUMBER:	***5064.001***	CHECKED BY:	

Equipment:	Bayport	**Trench Length:**	4000m	**Trench Bearing:**		**Easting:**	353135	**Surface R.L.:**	
Model:	29 t	**Trench Width:**	1650m	Depth above/below existing pavement surface:		**Northing:**	5818093	**Offset:**	

Method	RL (m)	Depth (m)	Geological Unit	Graphic Log	Classification Symbol	Material Description	Moisture Condition	Consistency / Strength	Ease of Excavation	Sample / Test	Sample Type	Tests: DCP (per 100mm)	FIELD CBR	PP (kPa)	SV (kPa)	MC (%)	LL (%)	PI	LS	SWELL	CBR	Field Records / Comments	Water
Excavator		0			ML	SILT, brown, low plasticity	D	St															
					MH	SILT, grey mottled brown/yellow-brown, high plasticity	D	H									23	6	1.5				
					CH	CLAY, grey mottled brown, high plasticity	D-M	H							205								
		1			CH	CLAY with gravel and sand, red mottled grey, high plasticity; gravel: fine grained	M	H							>210	35	63	25	11.5	0	7		
		2				- red mottled grey and orange, grading to extremely to highly weathered CLAYSTONE (recovered as gravelly clay, trace cobbles)									UTP								
						End of TP42 at 2.00m																	
		3																					
		4																					
		5																					
		6																					
		7																					
		8																					

This log should be read in conjunction with the T&T Pty Log Summary Sheet and the Project Plan

Appendix C: Photographs

- **Borehole Photographs (Page 1 to 4)**
- **Stockpile Photographs (Page 1 to 4)**

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au

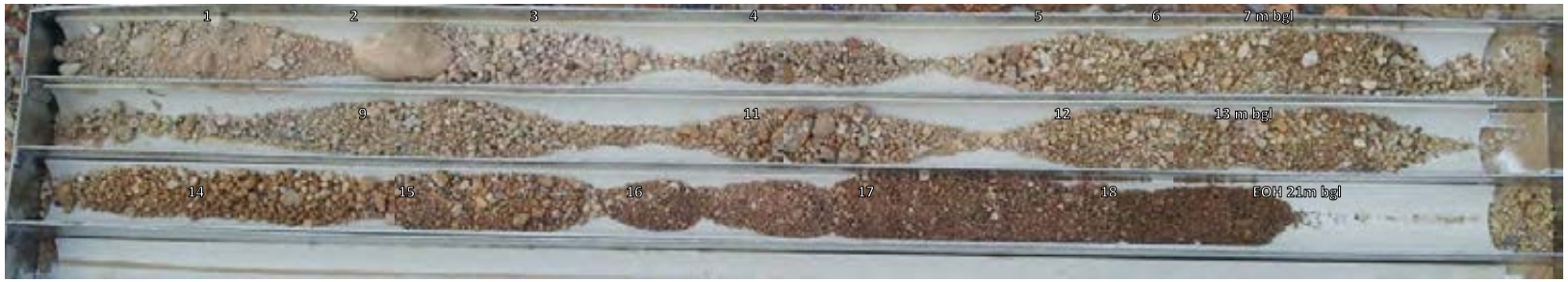
B1 - BH16-01: Borehole Location

B2 - BH16-01: Borehole Location

B3 - BH16-01: Cuttings

(BH16-01)

B4 - BH16-01: Borehole Location (facing south)



B5 - BH16-01: Cuttings

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au

B6 - BH16-02: Borehole Location (facing southwest)

B7 - BH16-02: Borehole Location (facing east)

B8 - BH16-02: Cuttings

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au

B9 - BH16-03: sidewall 5.4 m bgl (downhole camera)

B10 - BH16-03: sidewall 6.6 m bgl (downhole camera)

B11 - BH16-03: downhole 7.2 m bgl (downhole camera)

B12 - BH16-03: sidewall 8.9 m bgl (downhole camera)

B13 - BH16-03: sidewall 9.1 m bgl (downhole camera)

B14 - BH16-03: sidewall 9.1 m bgl (downhole camera)

B15 - BH16-03: downhole camera apparatus

B16 - BH16-03: borehole location

B17 - BH16-03: borehole location

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au

B18 - BH16-03: cuttings

B19 - BH16-03: cuttings detail

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au

S1 - Eastern Stockpile: central overview (facing north)

S2 - 'Mineral Waste' Stockpile (facing west)

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au

S3 - Stockpile 1 ('Salamander'): overview (facing north)


S4 - Stockpile 1: borrow area (facing south)


S5 - Stockpile 1: detail


S6 - Stockpile 1: top of stockpile (facing nort west)

S7 - Stockpile 2 ('NDCR'): Overview (facing north)


S8 - Stockpile 2: borrow area (facing east)

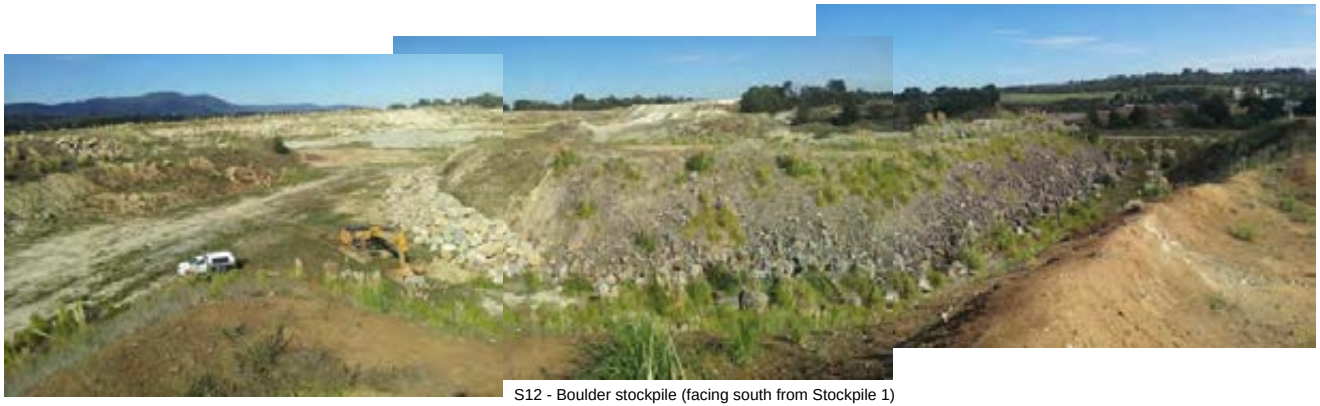
S9 - Stockpile 3 ('Boral Clay'): overview (facing South)


S10 - Stockpile 3: detail


S11 - Stockpile 3 : close detail

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au



S12 - Boulder stockpile (facing south from Stockpile 1)

S13 - Boulder stockpile: detail (facing south)

S14 - Boulder stockpile: detail (facing north)

S15 - Small gravel stockpiles (facing south from Boulder stockpile)

S16 - Small gravel stockpile (south of Stockpile 3)

S17 - Large boulders (south of Stockpile 3)

S18 - Stockpiles on top of Mineral Waste Stockpile

Tonkin & Taylor Pty Ltd
95 Coventry Street
Southbank VIC 3006

Tel : (03) 9863 8686
Fax: (03) 9863 8685
www.tonkintaylor.com.au

S18 - 'Scalps QW' Stockpile (facing north)

S19 - 'Scalps QW' Stockpile (facing east)

S20 - 'Lilydale Toppings' Stockpile (facing north)

S21 - 'Screenings' Stockpile (facing east)

Appendix D: Laboratory Test Results

- **Summary of laboratory test results**
- **Geotechnical laboratory certificates**

Table D.1: Summary of laboratory test results – Eastern Stockpile Area

Test Site	Material Description	Layer Depth (m)	Moisture Content (%)	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	% Passing*			Emerson Class No.
							0.075 mm	0.425 mm	2.36 mm	
TP01	FILL: Sandy GRAVEL FILL: Sandy GRAVEL w/ cobbles, boulders FILL: Clayey SAND w/ cobbles, trace gravel, boulders	0.0 - 0.1 0.1 - 3.5 3.5 - 7.0	13.8	X	X	X	X	X	X	
TP02	FILL: Gravelly BOULDERS w/ sand, cobbles FILL: Sandy COBBLES w/ gravel, trace boulders FILL: CLAY w/ boulders FILL: Gravelly/Cobbly BOULDERS, trace sand, clay	0.0 - 2.0 2.0 - 3.0 3.0 - 4.0 4.0 - 7.0								
TP03	FILL: Gravelly COBBLES w/ boulders, trace sand FILL: Gravelly COBBLES w/ sand, trace boulders FILL: Gravelly SAND w/ cobbles and clay FILL: Sandy CLAY w/ gravel FILL: Sandy SILT w/ cobbles	0.0 - 1.5 1.5 - 3.0 3.0 - 3.7 3.7 - 5.5 5.5 - 7.0	32.9	22 1	49 14	12.0 1.0	57	90	96	
TP04	FILL: Clayey BOULDERS FILL: Sandy BOULDERS/COBBLES	0.0 - 4.0 4.0 - 7.5								
TP05	FILL: Sandy COBBLES w/ rootlets FILL: Cobbly CLAY w/ boulders FILL: Silty SAND w/ cobbles FILL: Silty SAND w/ boulders, cobbles	0.0 - 0.7 0.7 - 3.5 3.5 - 6.5 6.5 - 7.0	9.3	11 0	30 16	4.5 0	44 22	51 47	62 53	
TP06	FILL: Silty GRAVEL w/ rootlets FILL: Clayey SAND w/ boulders FILL: Clayey GRAVEL w/ sand	0.0 - 0.1 0.1 - 4.5 4.5 - 7.0	16.8	16	35	8.0	33	41	50	
TP07	FILL: Clayey GRAVEL w/ sand FILL: Clayey GRAVEL w/ cobbles FILL: Cobbly BOULDERS/ SAND w/ clay FILL: Sandy GRAVEL, trace boulders cobbles, clay	0.0 - 0.15 0.15 - 0.3 0.3 - 0.9 0.9 - 7.0					21 19	30 28	46 43	
TP08	FILL: Sandy GRAVEL w/ clay FILL: Gravelly COBBLES/BOULDERS FILL: SAND/CLAY w/ cobbles, boulders	0.0 - 0.1 0.1 - 2.2 2.2 - 10.0		9 26	25 52	4.0 10.5	40 22	59 26	69 38	
TP09	FILL: Sandy GRAVEL w/ rootlets FILL: BOULDERS FILL: BOULDERS w/ silt, sand	0.0 - 0.2 0.2 - 1.5 1.5 - 7.0		2	18	1.5				
TP10	FILL: COBBLES w/ roots FILL: COBBLES FILL: BOULDERS FILL: Sandy CLAY w/ gravel	0.0 - 0.35 0.35 - 2.0 2.0 - 4.4 4.4 - 6.5	7.3	5	23	1.5	55	82	87	
TP11	FILL: COBBLES w/ BOULDERS FILL: Clayey BOULDERS w/ cobbles, clay pockets FILL: Sandy CLAY w/ gravel	0.0 - 2.0 2.0 - 5.0 5.0 - 7.0	34.8 13.2	25 7	57 21	11.5 3.0	77 43	91 73	96 81	2
TP12A	FILL: Gravelly COBBLES/BOULDERS w/ clay, sand FILL: Organic WASTE FILL: Sandy CLAY, trace cobbles, gravel FILL: Sandy GRAVEL w/ clay	0.0 - 2.0 2.0 - 2.5 2.5 - 5.0 5.0 - 7.0	19.8	17 10	38 27	8.0 5.5	31 26	42 39	62 54	

Test Site	Material Description	Layer Depth (m)	Moisture Content (%)	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	% Passing*			Emerson Class No.
							0.075 mm	0.425 mm	2.36 mm	
TP12B	FILL: Sandy CLAY, trace cobbles/boulders FILL: CLAY, trace waste FILL: Organic WASTE FILL: CLAY	0.0 - 0.4 0.4 - 1.5 1.5 - 2.3 2.0 - 2.5	38.4	50	76	21.0				5
TP12C	FILL: Cobbly BOULDERS w/ sand FILL: Sandy COBBLES w/ boulders	0.0 - 1.0 1.0 - 3.0								
TP12D	FILL: Organic WASTE FILL: Clayey COBBLES w/ boulders FILL: Sandy CLAY w/ gravel	0.0 - 0.55 0.55 - 2.0 2.0 - 3.0								
TP13	FILL: Cobbly BOULDERS w/ sandy clay FILL: CLAY w/ boulders FILL: Cobbly BOULDERS w/ sandy clay FILL: Clayey SAND w/ gravel	0.0 - 1.3 1.3 - 2.5 2.5 - 4.0 4.0 - 7.0		35 5	62 18	14.5 2	46	66	78	
TP14	FILL: Sandy GRAVEL FILL: Clayey COBBLES FILL: Clayey COBBLES w/ boulders Clayey SAND w/ gravel, trace cobbles Gravelly SAND w/ clay, trace cobbles, boulders	0.0 - 0.4 0.4 – 1.5 1.5 - 2.0 2.0 - 4.0 4.0 - 6.5					X	X	X	
TP15	FILL: Sandy/Cobbly GRAVEL/BOULDERS FILL: Clayey SAND w/ boulders/cobbles/gravel Gravelly SAND w/ clay	0.0 - 1.5 1.5 - 2.8 2.8 - 8.0	17.6	10	26	5.5	8	61	67	
TP16	FILL: Gravelly COBBLES w/ sand FILL: Gravelly SAND w/ cobbles FILL: Sandy CLAY w/ gravel Sandy GRAVEL w/ clay, trace cobbles, boulders	0.0 - 0.6 0.6 - 1.5 1.5 - 2.6 2.6 - 7.0	20.7 16.1	14	34	6.0	51 12	70 21	80 40	
TP17	FILL: Sandy GRAVEL FILL: Gravelly BOULDERS/COBBLES FILL: BOULDERS	0.0 - 0.2 0.2 - 3.5 3.5 - 7.0								
TP18	FILL: Cobbly BOULDERS w/ sand and gravel CLAY w/ roots Silty SAND w/ gravel	0.0 - 3.3 3.3 - 4.5 4.5 - 6.5		11 0	33 18	5.5 0.5	45	87	91	
TP19	FILL: Gravelly/Cobbly SAND w/ clay, trace boulders	0.0 - 7.0					34	58	65	
TP20	FILL: Clayey GRAVEL w/ sand, rootlets FILL: SAND/GRAVEL w/ boulders, cobbles, trace clay	0.0 - 0.2 0.2 - 7.5					23	33	37	
TP21	FILL: Sandy CLAY w/ boulders FILL: CLAY/SAND w/ cobbles, trace boulders	0.0 - 1.5 1.5 - 7.0	16.6	X	X	X	X	X	X	
TP22	FILL: Sandy COBBLES FILL: Clayey SAND w/ cobbles, trace boulders	0.0 - 0.5 0.5 - 7.5	12.8				33	60	70	
TP23	FILL: Cobbly GRAVEL w/ sand, trace waste FILL: Sandy GRAVEL w/ cobbles/clay, trace boulders	0.0 - 2.6 2.6 - 7.0	14.4 39.4	13	30	5.5	27 21	46 31	51 52	
TP24	FILL: Sandy CLAY, trace boulders FILL: CLAY, with gravel FILL: Sandy CLAY w/ gravel, boulders	0.0 - 2.4 2.4 - 4.5 4.5 - 7.0	47.3	9 27	27 63	4.0 15.0	85	91	94	
TP25	FILL: SILT FILL: CLAY FILL: Sandy GRAVEL w/ clay, cobbles FILL: Gravelly CLAY w/ sand, trace boulders, cobbles	0.0 - 2.0 2.0 - 3.0 3.0 - 4.0 4.0 - 7.0	25.8 15.3	15 12	44 33	7.0 6.0	51	63	71	5 5

Test Site	Material Description	Layer Depth (m)	Moisture Content (%)	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	% Passing*			Emerson Class No.
							0.075 mm	0.425 mm	2.36 mm	
BH16-03	FILL: Clayey GRAVEL/COBBLES FILL: COBBLES/BOULDERS CLAY SILTSTONE	0.0 – 1.5 1.5 – 10 10 – 13 13 – 41.4								
Stockpile 1	FILL: Sandy GRAVEL w/ clay (Salamander)	-		9	38	4.0	30	44	71	5
Stockpile 2	FILL: GRAVEL (NDCR)	-					20	31	39	
Stockpile 3	FILL: CLAY w/ sand, gravel (Boral Clay)	-		26	51	11.0	57	65	80	5

* Note: Sieve analysis results should be interpreted as indicative only and represent the matrix of the overburden materials.

Table D.2: Summary of laboratory test results – Northern Stockpile Area

Test Site	Material Description	Layer Depth (m)	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	(%) Passing		
						0.075 mm	0.425 mm	2.36 mm
TP1A	FILL: Sandy GRAVEL FILL: Sandy GRAVEL FILL: Clayey GRAVEL/WASTE CLAY w/ sand, trace gravel and cobbles	0.0 – 0.6 0.6 – 1.2 1.2 – 3.1 3.1 – 6.5	16	35	9.0			
TP1B	FILL: Clayey GRAVEL FILL: Cobbly BOULDERS w/ sand, gravel Sandy CLAY w/ gravel, trace cobbles, boulders	0.0 – 0.1 0.1 – 3.5 3.5 – 6.5				52	66	80
BH16-01	FILL: Sandy GRAVEL FILL: Gravelly CLAY/COBBLES/BOULDERS CLAY	0.0 – 1.5 1.5 – 18.4 18.4 - 21						
BH16-02	FILL: Sandy GRAVEL/COBBLES FILL: CLAY/COBBLES/BOULDERS CLAY	0.0 – 5.0 5.0 – 15.8 15.8 – 16.9						

Table D.3: Summary of field and laboratory test results – Stage 1 Area

Test Site	Material Description	Layer Depth (m)	Dynamic Cone Penetrometer Resistance (Blows/100 mm)	Shear Vane (kPa)	Moisture Content (%)	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	CBR (%)/Swell (%)	MDD (t/m^3)/OMC (%)	(%) Passing			Emerson Class No.
											0.075 mm	0.425 mm	2.36 mm	
TP26	SILT w/ rootlets CLAY	0.0 - 0.15 0.15 - 2.0	3-6 18-36	125 >210	25.8 27.5	38	63	16.0	2.0/3.0	1.47/29.0	92	94	97	
TP27	SILT w/ rootlets CLAY w/ rootlets CLAY	0.0 - 0.15 0.15 - 1.0 1.0 - 2.0		>210 135		40	63	15.0		1.54/27.0				5
TP28	SILT w/ roots, trace gravel CLAY w/ sand	0.0 - 0.25 0.25 - 2.0		200 – 205	34.7	30	63	14.5						
TP29	Silty SAND Sandy GRAVEL w/ cobbles Gravelly SAND w/ cobbles, silt, trace boulders	0.0 - 0.2 0.2 - 0.6 0.6 - 2.0	>20	N/A	5.0				20/0.0	1.86/13.5	X	X	X	
TP30	Sandy SILT BOULDERS/ SANDSTONE	0.0 - 0.2 0.2 - 0.8		N/A	3.5									
TP31	SILT, trace gravel CLAY	0.0 - 0.2 0.2 - 2.0		>210	30.1				5.0/0.5	1.28/38.5				
TP32	SILT CLAY	0.0 - 0.15 0.15 - 2.0		>210	35.4	39	72	15.0	3.0/1.5	1.30/35.5	90	93	96	
TP33	SILT w/ roots CLAY	0.0 - 0.2 0.2 - 2.0		>210	31.1									
TP34	SILT CLAY	0.0 - 0.2 0.2 - 2.0		>210	8.1									

Table D.4: Summary of field and laboratory test results – Western Land Area

Test Site	Material Description	Layer Depth (m)	Shear Vane (kPa)	Moisture Content (%)	Plasticity Index (%)	Liquid Limit (%)	Linear Shrinkage (%)	CBR (%)/Swell (%)	MDD (t/m^3)/OMC (%)	(%) Passing		
										0.075 mm	0.425 mm	2.36 mm
TP35	SILT w/ roots Clayey SAND Sandy CLAY	0.0 - 0.2 0.2 - 1.1 1.1 - 2.0	90 - 210 UTP	20.3	38	73	15.0	4.0/1.0	1.70/18.5	52	66	80
TP36	SILT w/ rootlets CLAY	0.0 - 0.2 0.2 - 2.0	210 - >210	31.7	33	66	16.5	3.0/0.5	1.30/37.0	93	95	98
TP37	CLAY w/ rootlets CLAY/BASALT BASALT	0.0 - 0.7 0.7 - 1.5 1.5 - 2.0	80 >210 UTP	14.8								
TP38	SILT w/ rootlets CLAY w/ sand, trace gravel	0.0 - 0.25 0.25 - 2.0	>210 - UTP	11.1	26	46	12.0	4.0/0.5	1.49/28.5	71	73	87
TP39	SILT, trace gravel CLAY	0.0 - 0.25 0.25 - 2.0	200 - >210	36.4								
TP40	SILT CLAY	0.0 - 0.25 0.25 - 2.0	135 - >210	36.3								
TP41	SILT CLAY w/ sand	0.0 - 0.25 0.25 - 2.0	UTP	22.2	24	52	11.0	7/0	1.49/31.0	72	80	93
TP42	SILT CLAY w/ gravel, sand CLAYSTONE	0.0 - 0.5 0.5 - 1.5 1.5 - 2.0	305 - >210 UTP	35.0	X 25	X 63	X 11.5	7/0	1.32/36.5	61	67	80

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900

CHADWICK GEOTECHNICS

MOISTURE CONTENT REPORT

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178 - 1**
Report Date: 10/05/16
Request No: -
Test Method: AS 1289 2.1.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	1605382	1605385	1605389	1605396	1605401	1605402	1605408	1605416	1605419	1605421
ID No.:	1	4	8	15	20	21	27	35	38	40
Lot No.:	-	-	-	-	-	-	-	-	-	-
Date Sampled:	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm
Date Tested:	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016
Material Source:	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Southern Stockpile
Material Description:	FILL: Clayey Sand	FILL: Clay/Sand (wet)	FILL: Clayey Sand	FILL: Clayey/ Sandy Gravel	FILL: Clayey Sand	FILL: Clay	Sandy Clay	FILL: Sandy Clay	FILL: Sand	FILL: Sandy Gravel
To Be Used As:	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis
Sample Location :	TP01 4.0m Below Surface	TP03 4.0m Below Surface	TP05 6.0m Below Surface	TP10 3.0m Below Surface	TP12A 6.0m Below Surface	TP12B 1.0m Below Surface	TP15 4.5m Below Surface	TP21 4.0m Below Surface	TP22 7.0m Below Surface	TP23 5.5m Below Surface
Layer Depth (mm):	-	-	-	-	-	-	-	-	-	-
Test Depth (mm):	-	-	-	-	-	-	-	-	-	-
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled
Moisture Content (%):	**13.8**	**32.9**	**9.3**	**7.3**	**19.8**	**38.4**	**17.6**	**16.6**	**12.8**	**39.4**

Remarks:

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No.: **CG.319.001**
Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900

CHADWICK GEOTECHNICS

MOISTURE CONTENT REPORT

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 1**
Report Date: 10/05/16
Request No: -
Test Method: AS 1289 2.1.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	1605426	1605431	1605434	1605435	1605437	1605438	1605440	1605443	1605444	
ID No.:	45	50	53	54	56	57	59	62	63	
Lot No.:	-	-	-	-	-	-	-	-	-	
Date Sampled:	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	
Date Tested:	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	29/4/2016	
Material Source:	Southern Stockpile	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1	Stage 1	
Material Description:	FILL: Clay	Clay	Sandy Clay	Gravelly Sand	Boulders	Clay	Clay	Clay	Clay	
To Be Used As:	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	
Sample Location :	TP25 2.5m Below Surface	TP26 0.75m Below Surface	TP28 0.75m Below Surface	TP29 0.75m Below Surface	TP30 0.75m Below Surface	TP31 0.75m Below Surface	TP32 0.75m Below Surface	TP33 0.75m Below Surface	TP34 0.75m Below Surface	
Layer Depth (mm):	-	-	-	-	-	-	-	-	-	
Test Depth (mm):	-	-	-	-	-	-	-	-	-	
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	
Moisture Content (%):	**25.8**	**25.8**	**34.7**	**5.0**	**3.5**	**30.1**	**35.4**	**31.1**	**8.1**	

Remarks:

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No.: **CG.319.001**

Issue Date: 19/02/2013

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

CALIFORNIA BEARING RATIO REPORT

Customer: Tonkin + Taylor Pty Ltd
Report Number: **308178 - 2**

Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Report Date: 26/05/16

Project: Lilydale Quarry
CG Request No: -

Location: Lilydale
Test Method: AS 1289.6.1.1

Customer Order No.: 5064.001
Page: 1 of 1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605432**	**1605436**	**1605439**	**1605441**	
ID No.:	51	55	58	60	
Lot No.:	-	-	-	-	
Date Sampled:	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	
Time Sampled:	am/pm	am/pm	am/pm	am/pm	
Date Tested:	6/5/2016	9/5/2016	9/5/2016	18/5/2016	
Material Source:	Stage 1	Stage 1	Stage 1	Stage 1	
Material Description:	Clay	Gravelly Sand	Clay	Clay	
To Be Used As:	Material Analysis	Material Analysis	Material Analysis	Material Analysis	
Sample Location :	TP26 0.8 - 1.0m Below Surface	TP29 0.8 - 1.0m Below Surface	TP31 0.8 - 1.0m Below Surface	TP32 0.8 - 1.0m Below Surface	
Layer Depth (mm):	-	-	-	-	
Test Depth (mm):	-	-	-	-	
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	
MDD (t/m3) AS1289.5.1.1 :	1.47	1.86	1.28	1.30	
OMC (%) AS1289.5.1.1 :	29.0	13.5	38.5	35.5	
Compactive Effort :	Standard	Standard	Standard	Standard	
Nominated % MDD Compaction :	98	98	98	98	
Nominated % OMC Compaction :	100	100	100	100	
Achieved Density Ratio (%) :	97	98	98	99	
Achieved Moisture Ratio (%) :	104	99	101	98	
Test Condition (Soaked/Unsoaked) :	Soaked	Soaked	Soaked	Soaked	
Test Condition Soaking Period (Days) :	4	4	4	4	
Swell (%)	3.0	0.0	0.5	1.5	
Surcharge (kg) :	4.5	4.5	4.5	4.5	
Achieved Dry Density before Soak (t/m^3) :	1.43	1.82	1.25	1.29	
Dry Density after Soak (t/m^3) :	1.40	1.80	1.25	1.25	
Density Ratio after Soak (%) :	95	97	98	96	
Moisture Content AS1289.2.1.1					
Initial Moisture Content (%):	25.6	10.1	30.7	34.9	
Achieved Moisture Content (%) :	30.3	13.5	38.7	34.7	
Moisture Content after Soak (%) :	34.7	15.0	42.0	40.1	
Moisture Content (Top) after Penetration (%) :	37.6	14.4	41.7	36.5	
% retained on 19mm:	0	27	0	0	
CBR Penetration (mm) :	2.5	5.0	2.5	2.5	
CBR Value (%) :	**2.0**	**20**	**5.0**	**3.0**	

Remarks: **All oversize was excluded**

If the specimen was soaked, then an additional 1kg surcharge weight was added at the penetration stage as per AS1289.6.1.1 8(a)

APPROVED SIGNATORY

M Robinson

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

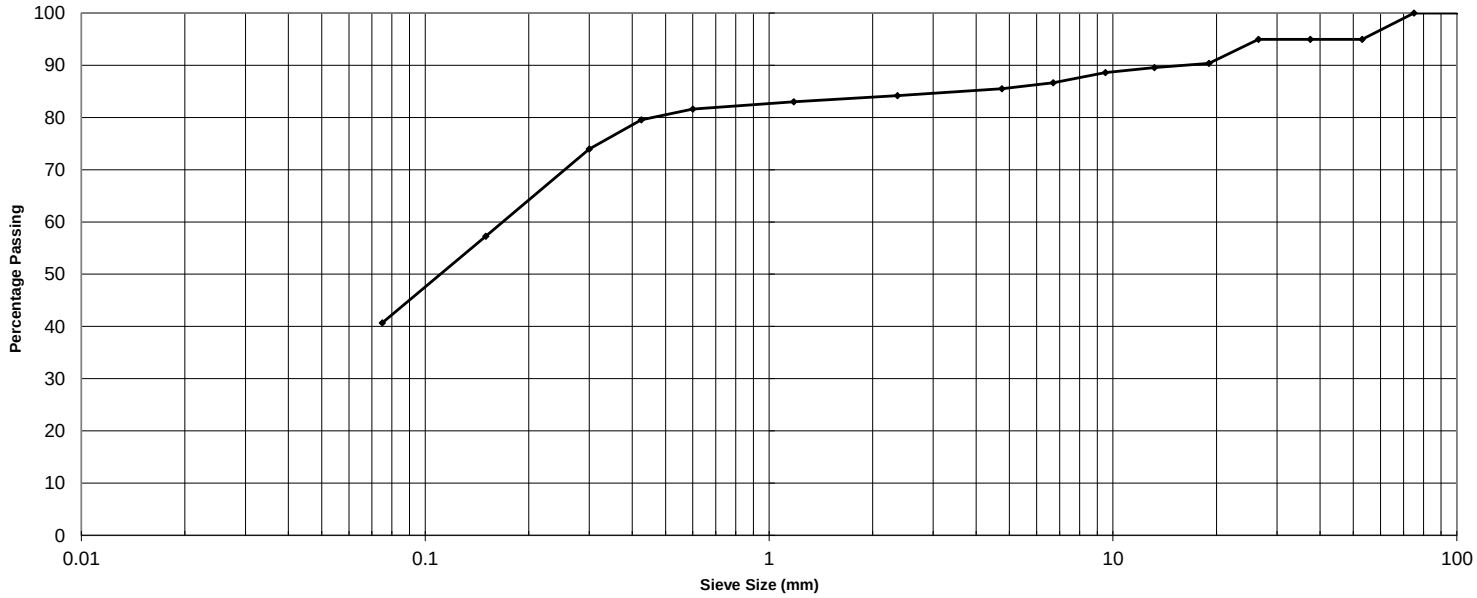
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 09/06/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605383**
ID No.:	2
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	9/06/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clayey Sand
To Be Used As	Material Analysis
Sample Location :	TP01 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	7.4
Liquid Limit (%) AS 1289.3.1.2	16
Plastic Limit (%) AS 1289.3.2.1	14
Plasticity Index AS 1289.3.3.1	2
Linear Shrinkage (%) AS 1289.3.4.1	1.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	159
L.S. x % Passing 0.425mm	80
Ratio of % Passing (0.075/0.425)	0.51

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
		100	95	95	95	90	90	89	87	86	84	83	82	80	74	57	41

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SM Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

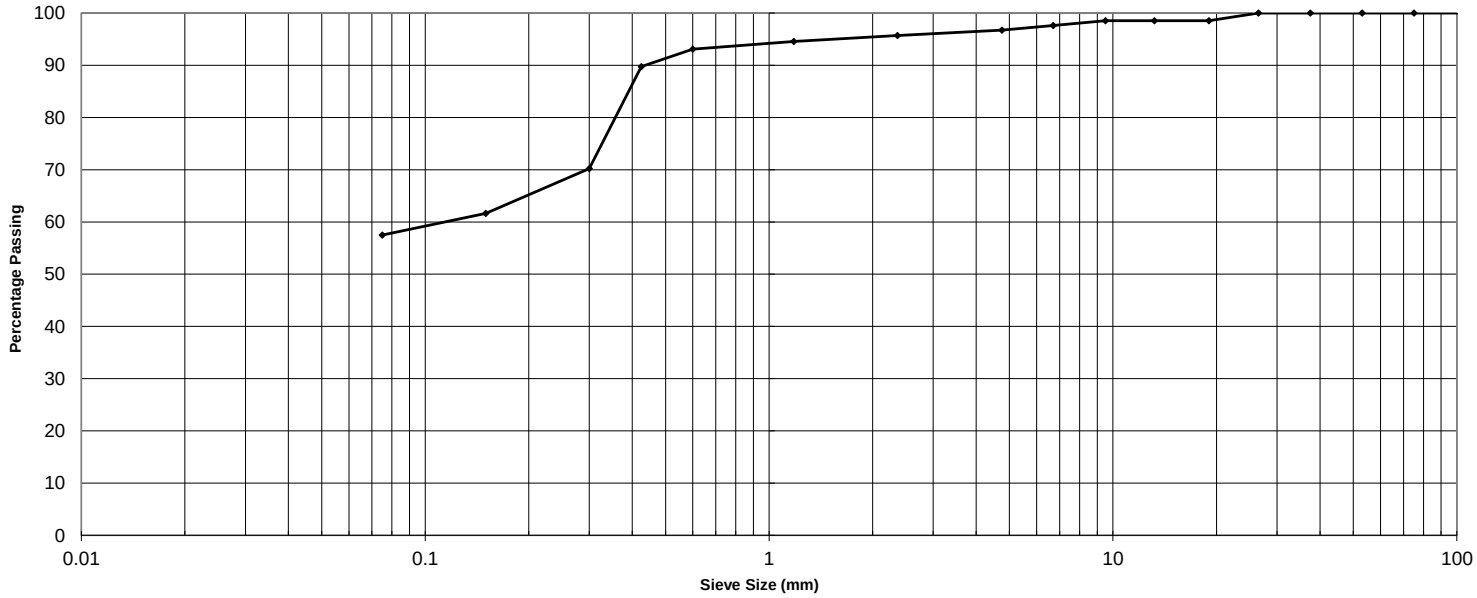
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 06/06/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605386**
ID No.:	5
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	24/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clayey Sand
To Be Used As	Material Analysis
Sample Location :	TP03 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	12.8
Liquid Limit (%) AS 1289.3.1.2	14
Plastic Limit (%) AS 1289.3.2.1	13
Plasticity Index AS 1289.3.3.1	1
Linear Shrinkage (%) AS 1289.3.4.1	1.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	90
L.S. x % Passing 0.425mm	90
Ratio of % Passing (0.075/0.425)	0.64

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	99	99	99	98	97	96	95	93	90	70	62	57

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: ML Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

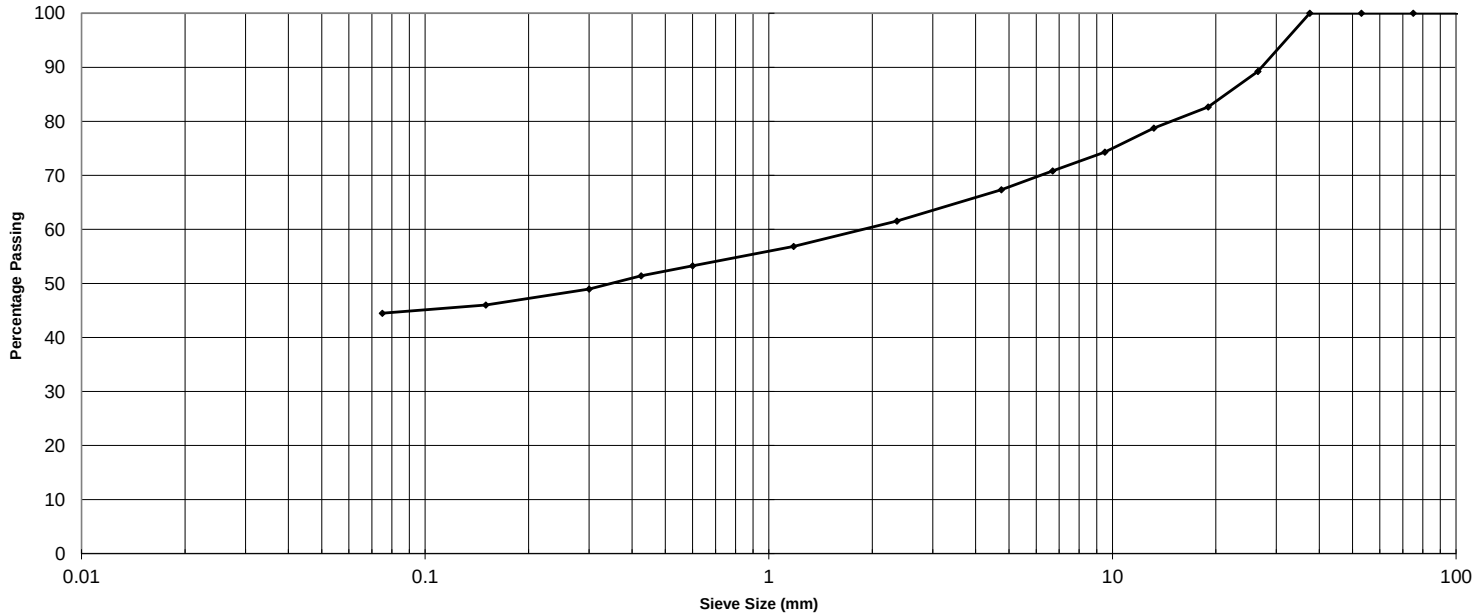
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 3 of 34

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605387**
ID No.:	6
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/5/0216
Material Source:	Eastern Stockpile
Material Type:	FILL: Cobbly Clay
To Be Used As	Material Analysis
Sample Location :	TP05 3.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	15.7
Liquid Limit (%) AS 1289.3.1.2	30
Plastic Limit (%) AS 1289.3.2.1	19
Plasticity Index AS 1289.3.3.1	11
Linear Shrinkage (%) AS 1289.3.4.1	4.5
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	565
L.S. x % Passing 0.425mm	231
Ratio of % Passing (0.075/0.425)	0.87

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	89	83	79	74	71	67	62	57	53	51	49	46	44

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

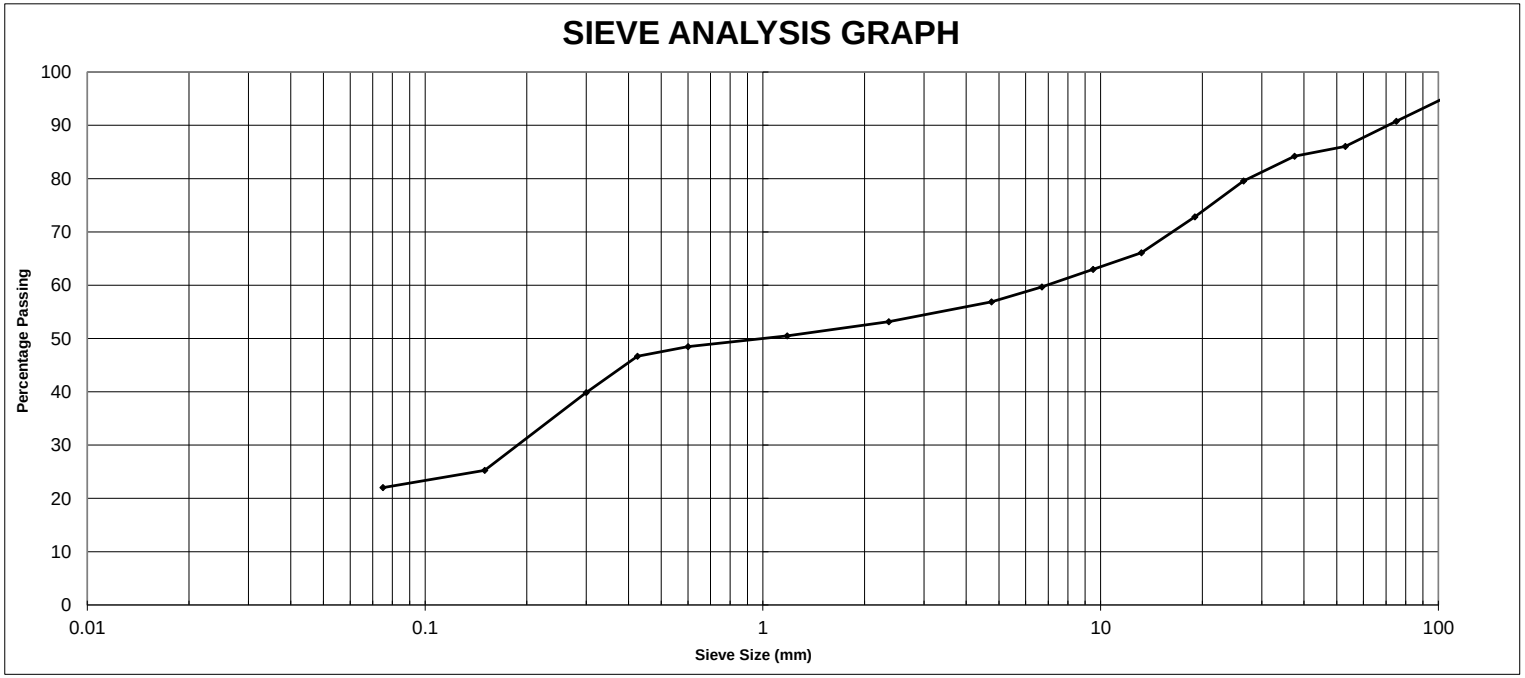
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605388**
ID No.:	7
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	11/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clayey Sand
To Be Used As	Material Analysis
Sample Location :	TP05 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	8.2
Liquid Limit (%) AS 1289.3.1.2	16
Plastic Limit (%) AS 1289.3.2.1	16
Plasticity Index AS 1289.3.3.1	0
Linear Shrinkage (%) AS 1289.3.4.1	0.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	0
L.S. x % Passing 0.425mm	0
Ratio of % Passing (0.075/0.425)	0.47

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
	100	91	86	84	80	73	66	63	60	57	53	50	48	47	40	25	22

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC GM Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

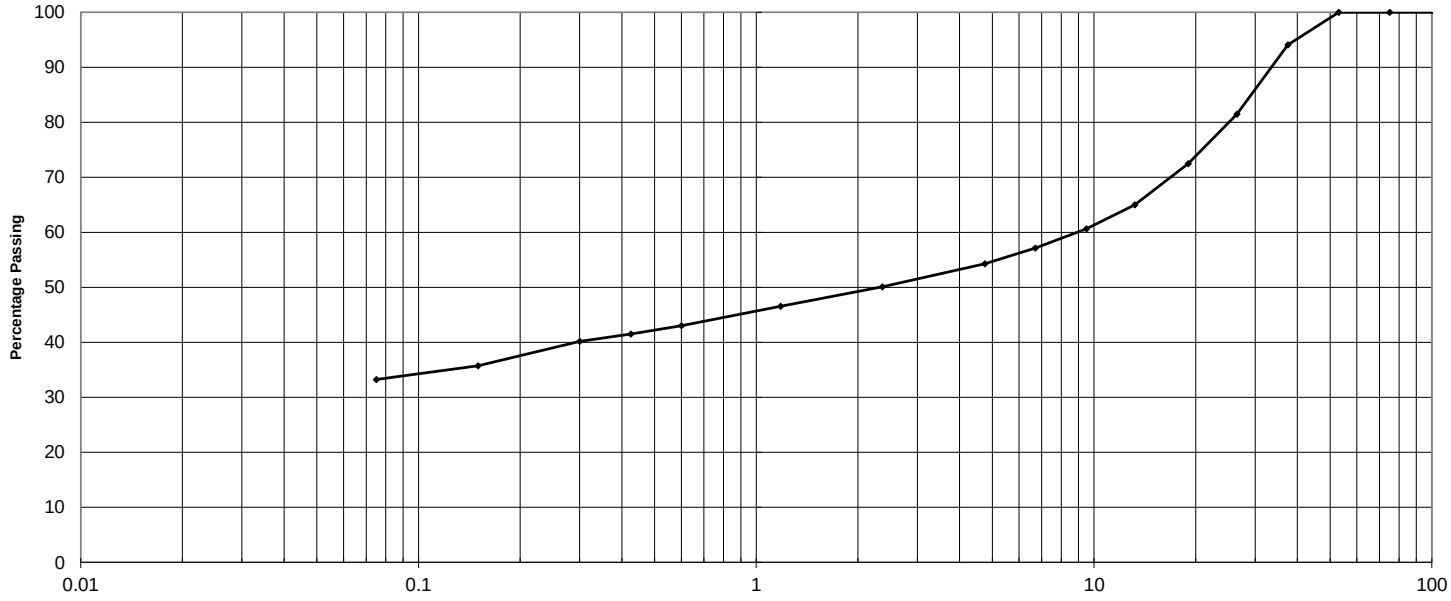
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 5 of 34

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605390**
ID No.:	9
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	5/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clayey Sand/Gravel
To Be Used As	Material Analysis
Sample Location :	TP06 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	16.8
Liquid Limit (%) AS 1289.3.1.2	35
Plastic Limit (%) AS 1289.3.2.1	19
Plasticity Index AS 1289.3.3.1	16
Linear Shrinkage (%) AS 1289.3.4.1	8.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	664
L.S. x % Passing 0.425mm	332
Ratio of % Passing (0.075/0.425)	0.80

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	94	81	72	65	61	57	54	50	47	43	41	40	36	33

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC GC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

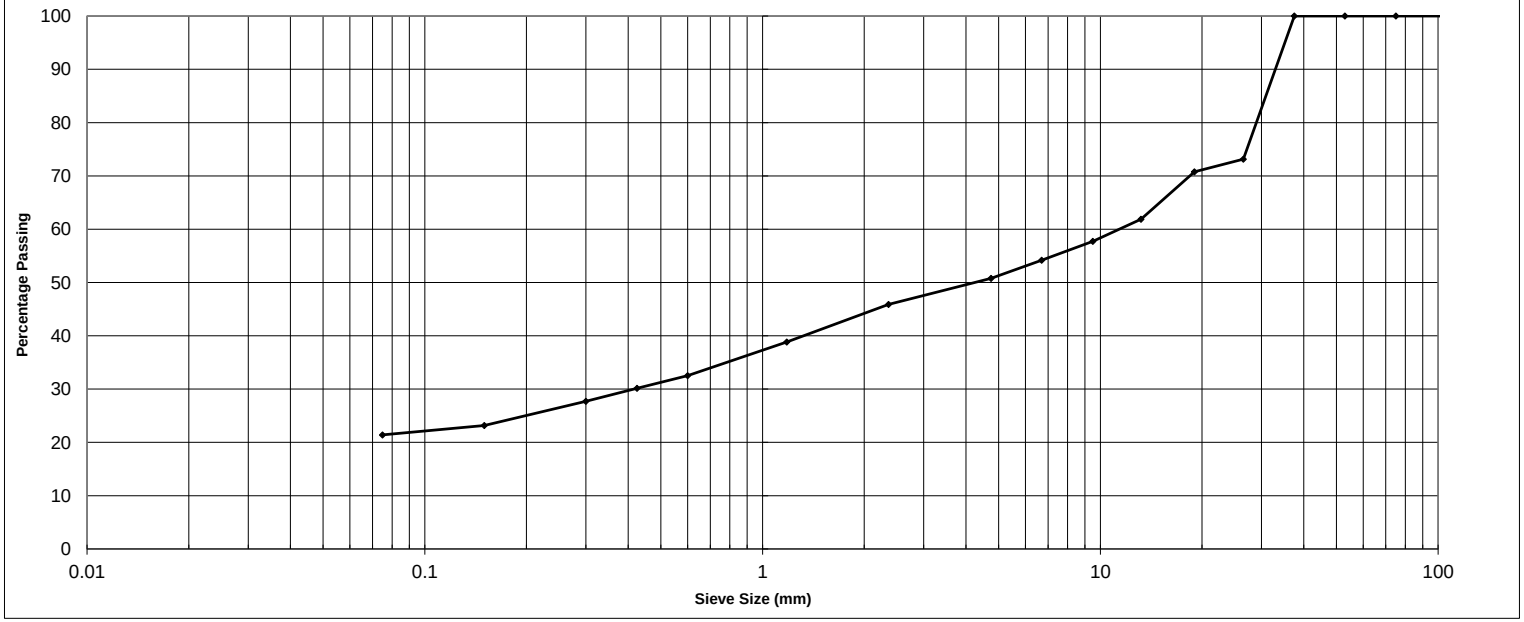
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 6 of 34

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605391**
ID No.:	10
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Gravel
To Be Used As	Material Analysis
Sample Location :	TP07 3.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	15.6
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.71

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	73	71	62	58	54	51	46	39	33	30	28	23	21

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC | Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

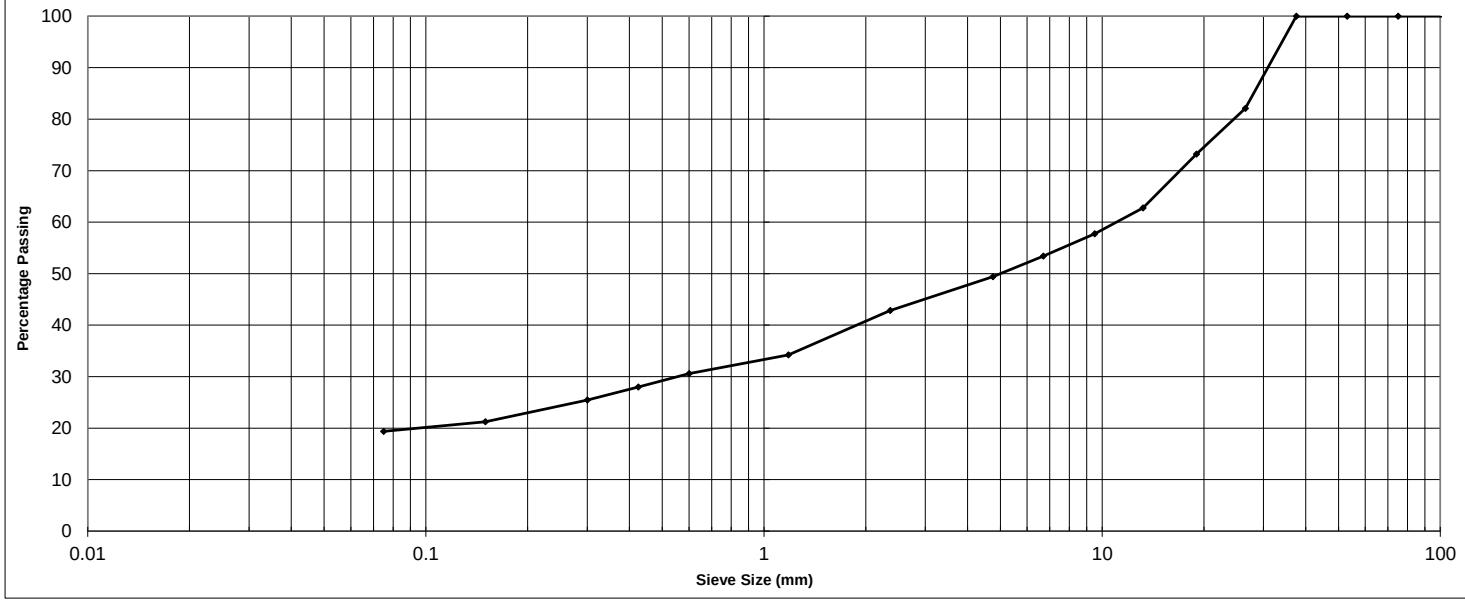
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605392**
ID No.:	11
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Gravel
To Be Used As	Material Analysis
Sample Location :	TP07 6.5m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	9.3
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.69

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	82	73	63	58	53	49	43	34	31	28	25	21	19

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC | Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

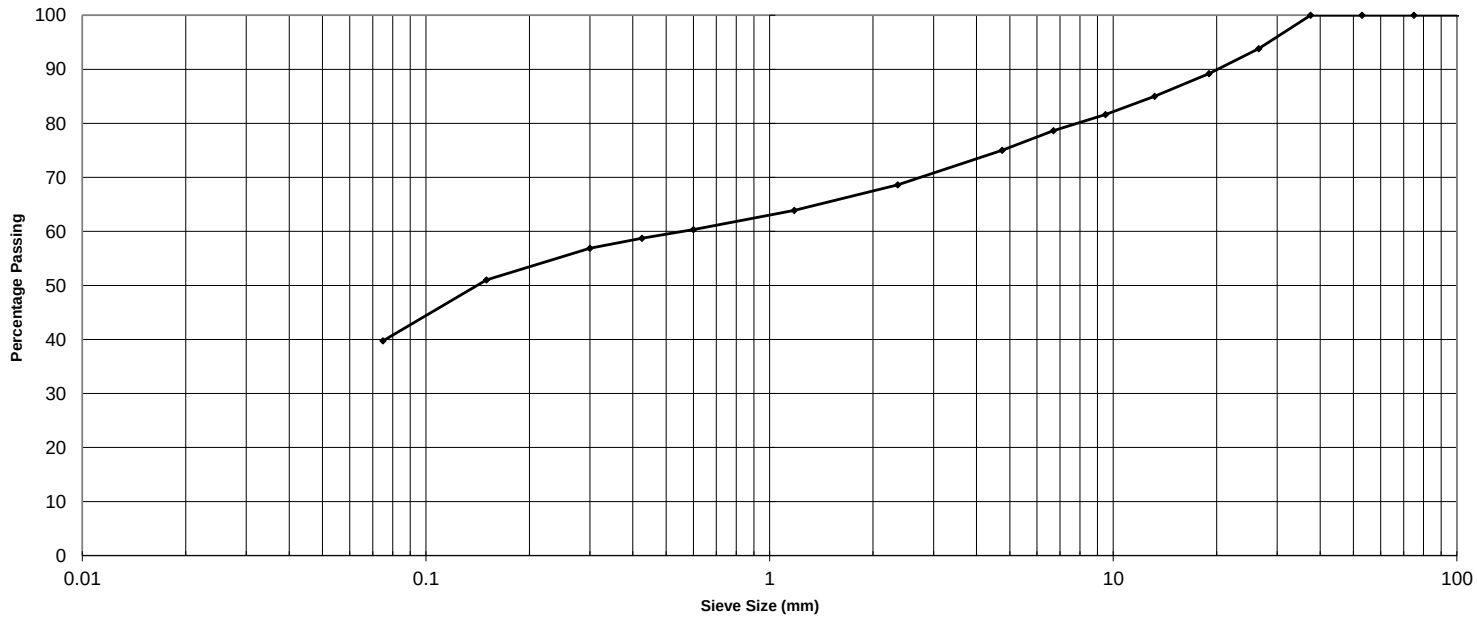
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605393**
ID No.:	12
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	24/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clay/Sand
To Be Used As	Material Analysis
Sample Location :	TP08 4.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	16.7
Liquid Limit (%) AS 1289.3.1.2	25
Plastic Limit (%) AS 1289.3.2.1	16
Plasticity Index AS 1289.3.3.1	9
Linear Shrinkage (%) AS 1289.3.4.1	4.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	529
L.S. x % Passing 0.425mm	235
Ratio of % Passing (0.075/0.425)	0.68

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	94	89	85	82	79	75	69	64	60	59	57	51	40

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

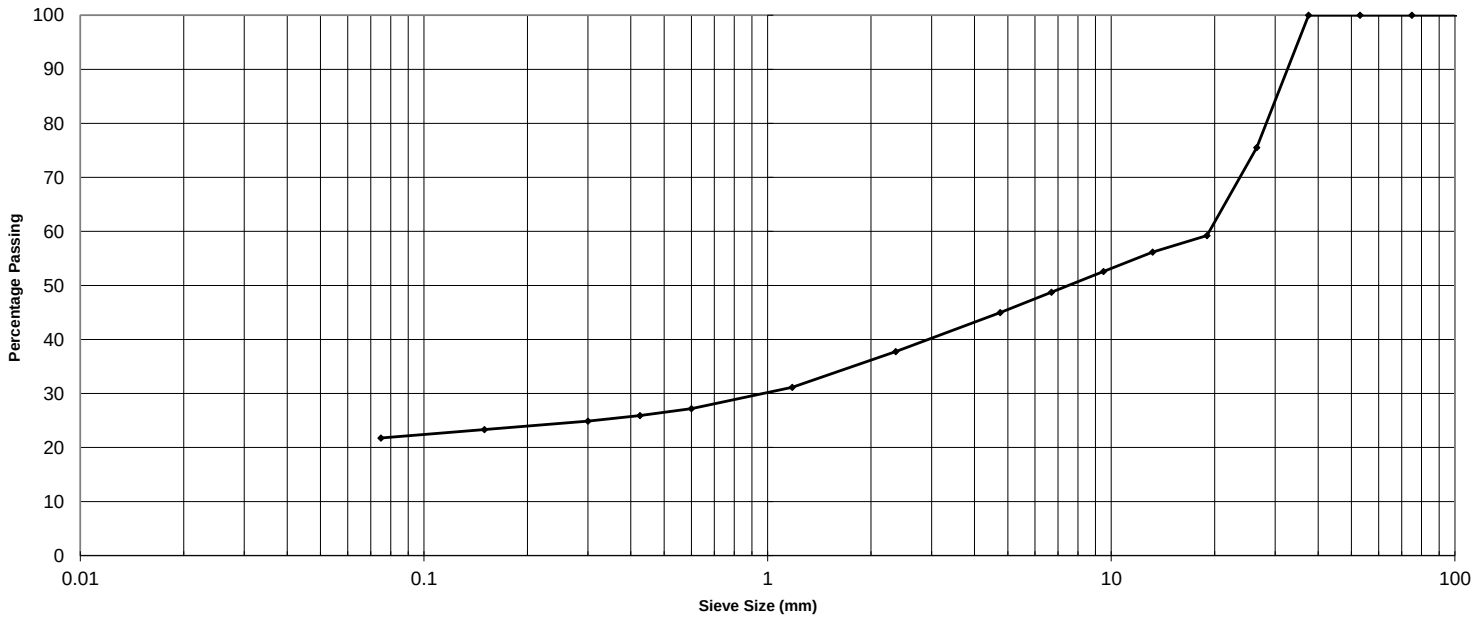
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 13/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605394**
ID No.:	13
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	13/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clay/Sand
To Be Used As	Material Analysis
Sample Location :	TP08 9.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	20.0
Liquid Limit (%) AS 1289.3.1.2	52
Plastic Limit (%) AS 1289.3.2.1	26
Plasticity Index AS 1289.3.3.1	26
Linear Shrinkage (%) AS 1289.3.4.1	10.5
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	674
L.S. x % Passing 0.425mm	272
Ratio of % Passing (0.075/0.425)	0.84

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	76	59	56	53	49	45	38	31	27	26	25	23	22

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

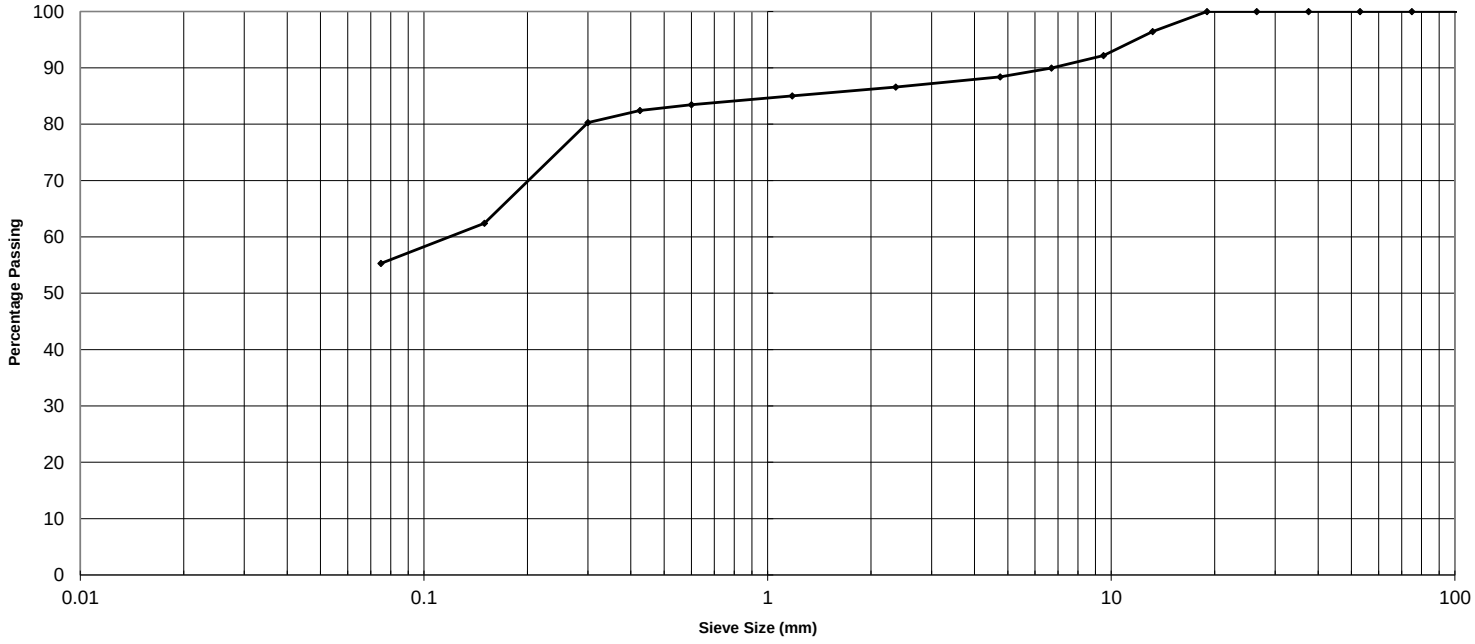
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605397**
ID No.:	16
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	11/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Gravelly/ Clayey Sand
To Be Used As	Material Analysis
Sample Location :	TP10 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	11.2
Liquid Limit (%) AS 1289.3.1.2	23
Plastic Limit (%) AS 1289.3.2.1	18
Plasticity Index AS 1289.3.3.1	5
Linear Shrinkage (%) AS 1289.3.4.1	1.5
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	412
L.S. x % Passing 0.425mm	124
Ratio of % Passing (0.075/0.425)	0.67

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	96	92	90	88	87	85	83	82	80	62	55

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CL-ML Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

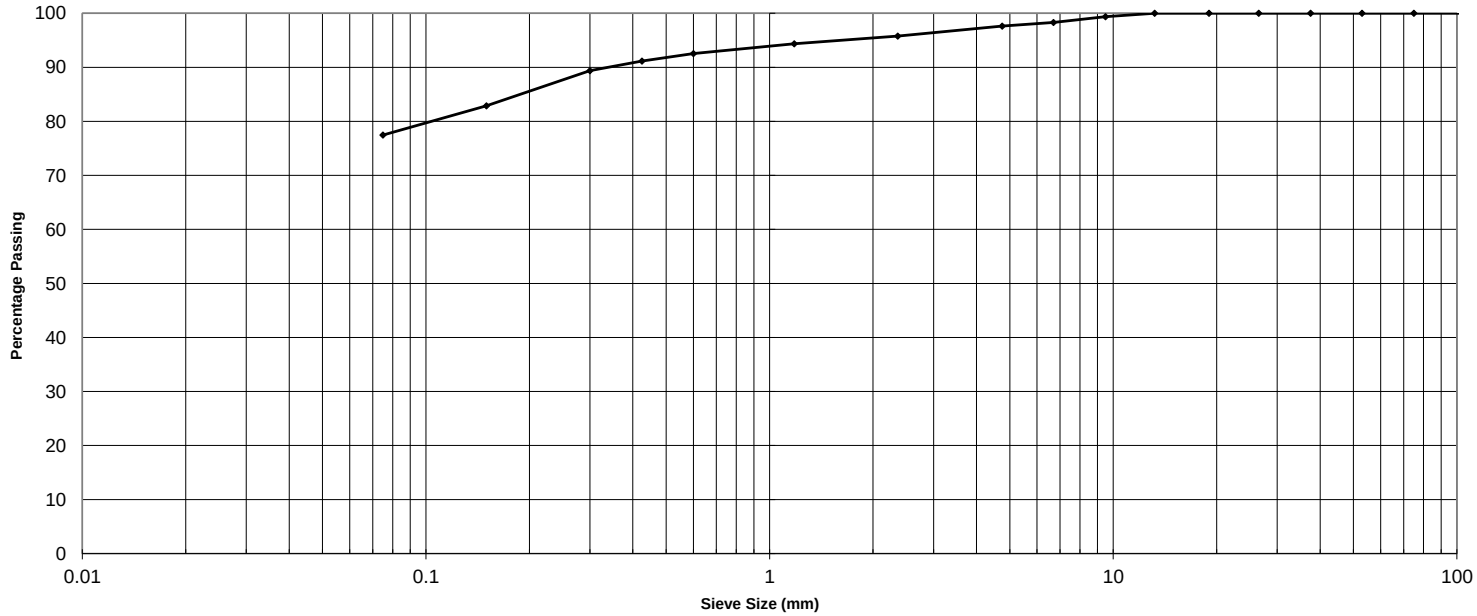
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605398**
ID No.:	17
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	27/04/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Clay
To Be Used As	Material Analysis
Sample Location :	TP11 3.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	34.8
Liquid Limit (%) AS 1289.3.1.2	57
Plastic Limit (%) AS 1289.3.2.1	32
Plasticity Index AS 1289.3.3.1	25
Linear Shrinkage (%) AS 1289.3.4.1	11.5
Cracking, Curling, Crumbling (1,2,3)	1, 2
P.I. x % Passing 0.425mm	2279
L.S. x % Passing 0.425mm	1048
Ratio of % Passing (0.075/0.425)	0.85

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
							100	99	98	98	96	94	93	91	89	83	77

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: MH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

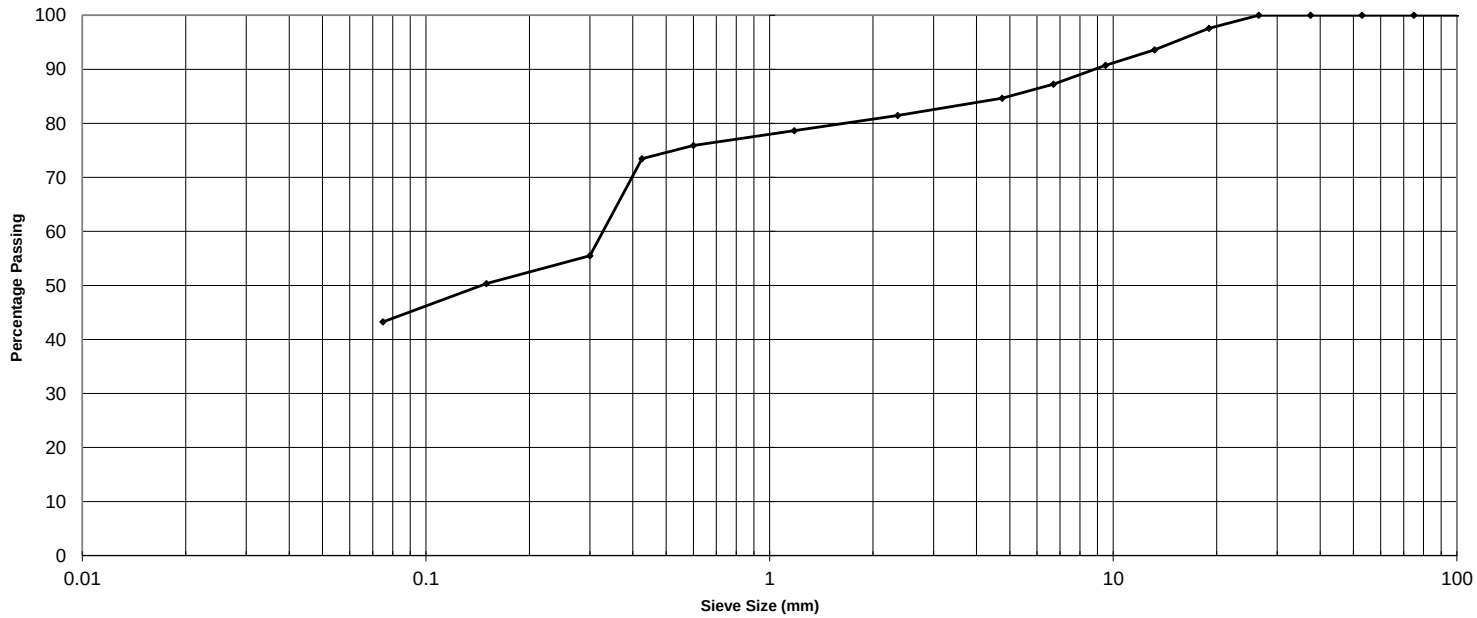
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605399**
ID No.:	18
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	27/04/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Clay
To Be Used As	Material Analysis
Sample Location :	TP11 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	13.2
Liquid Limit (%) AS 1289.3.1.2	21
Plastic Limit (%) AS 1289.3.2.1	14
Plasticity Index AS 1289.3.3.1	7
Linear Shrinkage (%) AS 1289.3.4.1	3.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	514
L.S. x % Passing 0.425mm	220
Ratio of % Passing (0.075/0.425)	0.59

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	98	94	91	87	85	81	79	76	73	55	50	43

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SM-SC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

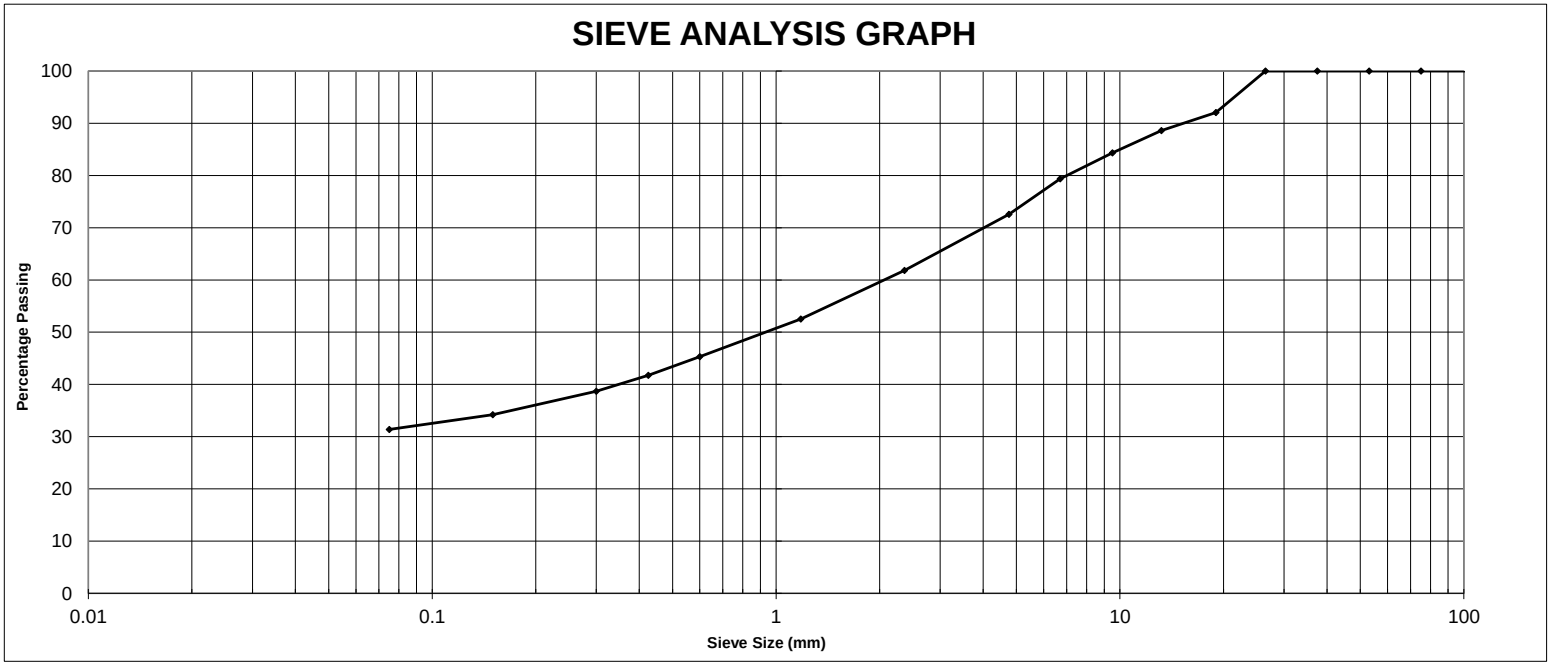
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605400**
ID No.:	19
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Clay
To Be Used As	Material Analysis
Sample Location :	TP12A 3.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	17.4
Liquid Limit (%) AS 1289.3.1.2	38
Plastic Limit (%) AS 1289.3.2.1	21
Plasticity Index AS 1289.3.3.1	17
Linear Shrinkage (%) AS 1289.3.4.1	8.0
Cracking, Curling, Crumbling (1,2,3)	1, 2
P.I. x % Passing 0.425mm	710
L.S. x % Passing 0.425mm	334
Ratio of % Passing (0.075/0.425)	0.75

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	92	89	84	79	73	62	53	45	42	39	34	31

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

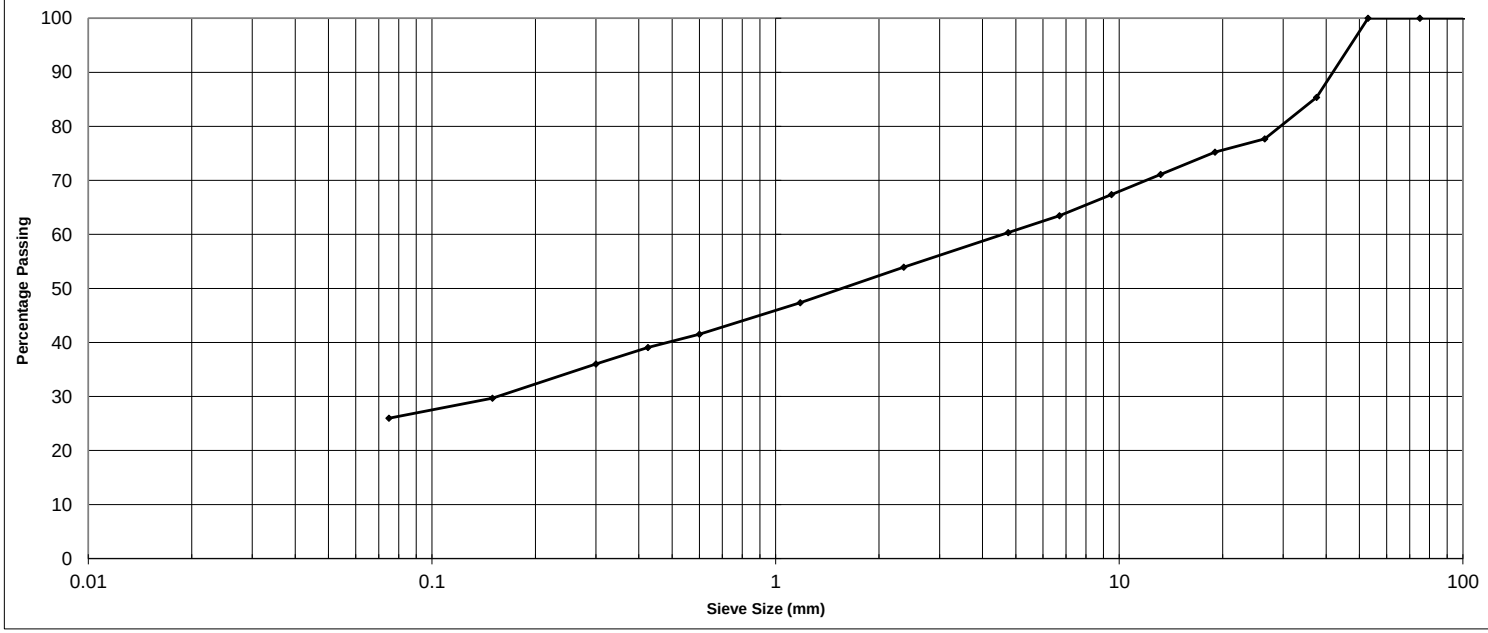
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605401**
ID No.:	20
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	9/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clayey Sand
To Be Used As	Material Analysis
Sample Location :	TP12A 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	19.8
Liquid Limit (%) AS 1289.3.1.2	27
Plastic Limit (%) AS 1289.3.2.1	17
Plasticity Index AS 1289.3.3.1	10
Linear Shrinkage (%) AS 1289.3.4.1	5.5
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	391
L.S. x % Passing 0.425mm	215
Ratio of % Passing (0.075/0.425)	0.67

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	85	78	75	71	67	63	60	54	47	42	39	36	30	26

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

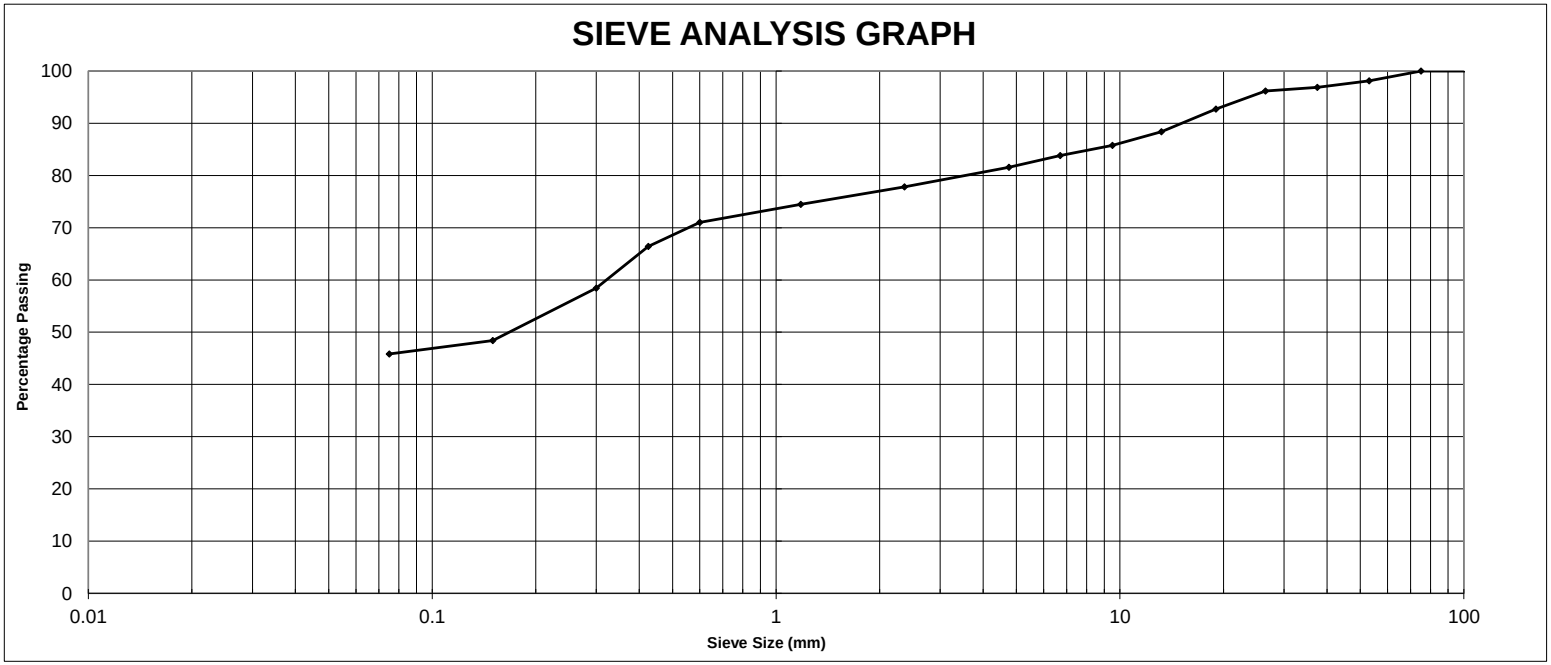
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605404**
ID No.:	23
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	11/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Clayey Sand
To Be Used As	Material Analysis
Sample Location :	TP13 7.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	13.5
Liquid Limit (%) AS 1289.3.1.2	18
Plastic Limit (%) AS 1289.3.2.1	13
Plasticity Index AS 1289.3.3.1	5
Linear Shrinkage (%) AS 1289.3.4.1	2.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	332
L.S. x % Passing 0.425mm	133
Ratio of % Passing (0.075/0.425)	0.69

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
		100	98	97	96	93	88	86	84	82	78	74	71	66	58	48	46

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SM-SC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

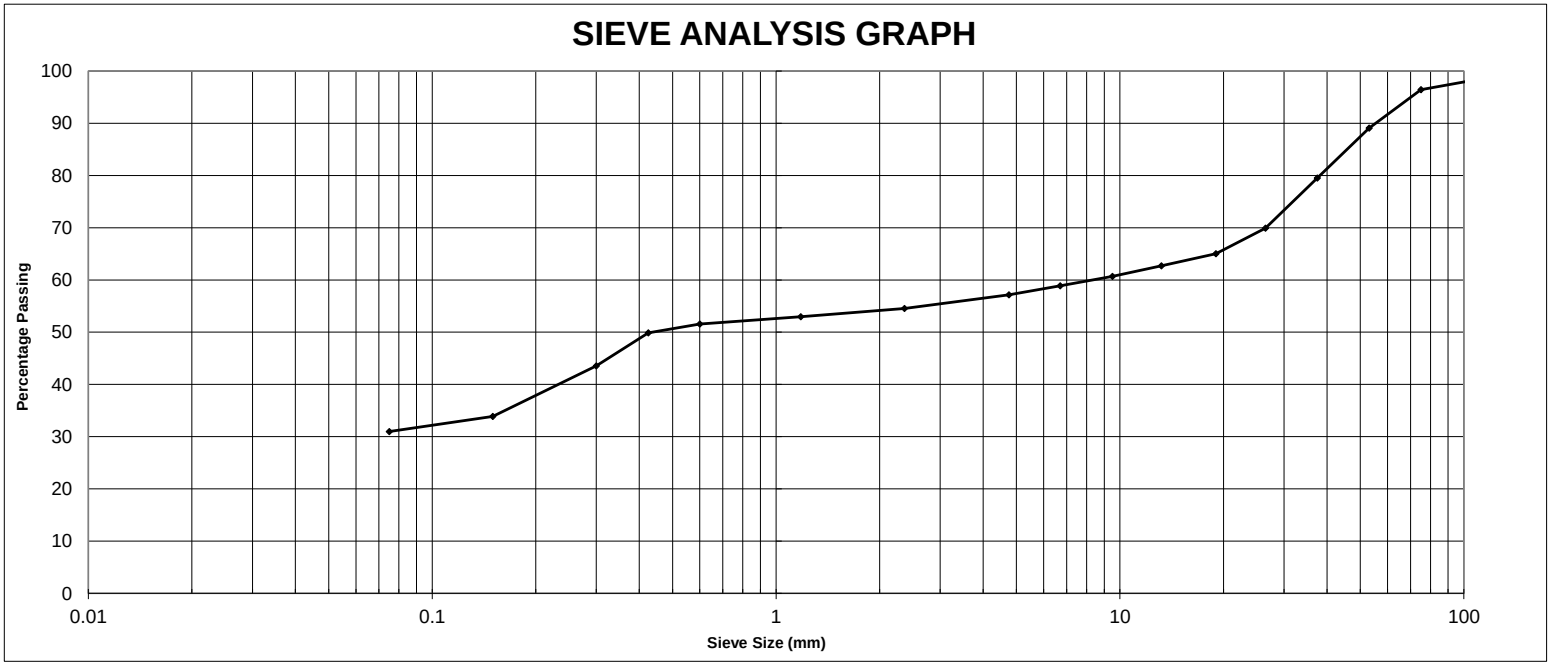
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 09/06/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605405**
ID No.:	24
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	24/05/2016
Material Source:	Eastern Stockpile
Material Type:	Gravelly Sand
To Be Used As	Material Analysis
Sample Location :	TP14 5.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	6.9
Liquid Limit (%) AS 1289.3.1.2	-
Plastic Limit (%) AS 1289.3.2.1	-
Plasticity Index AS 1289.3.3.1	-
Linear Shrinkage (%) AS 1289.3.4.1	-
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	-
L.S. x % Passing 0.425mm	-
Ratio of % Passing (0.075/0.425)	0.62

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
	100	96	89	80	70	65	63	61	59	57	55	53	52	50	44	34	31

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC - Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

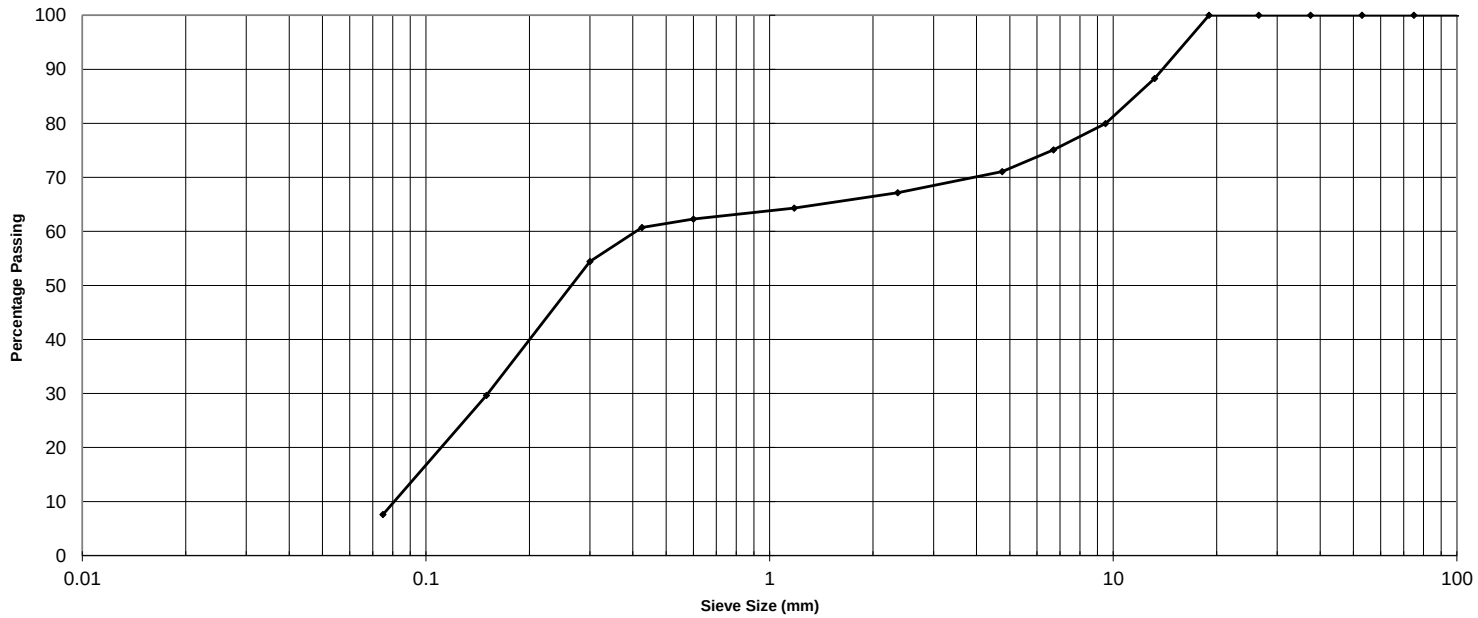
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605407**
ID No.:	26
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	20/05/2016
Material Source:	Eastern Stockpile
Material Type:	Sandy Clay
To Be Used As	Material Analysis
Sample Location :	TP15 4.5m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	16.8
Liquid Limit (%) AS 1289.3.1.2	26
Plastic Limit (%) AS 1289.3.2.1	16
Plasticity Index AS 1289.3.3.1	10
Linear Shrinkage (%) AS 1289.3.4.1	5.5
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	607
L.S. x % Passing 0.425mm	334
Ratio of % Passing (0.075/0.425)	0.13

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	88	80	75	71	67	64	62	61	54	30	8

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SP-SC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

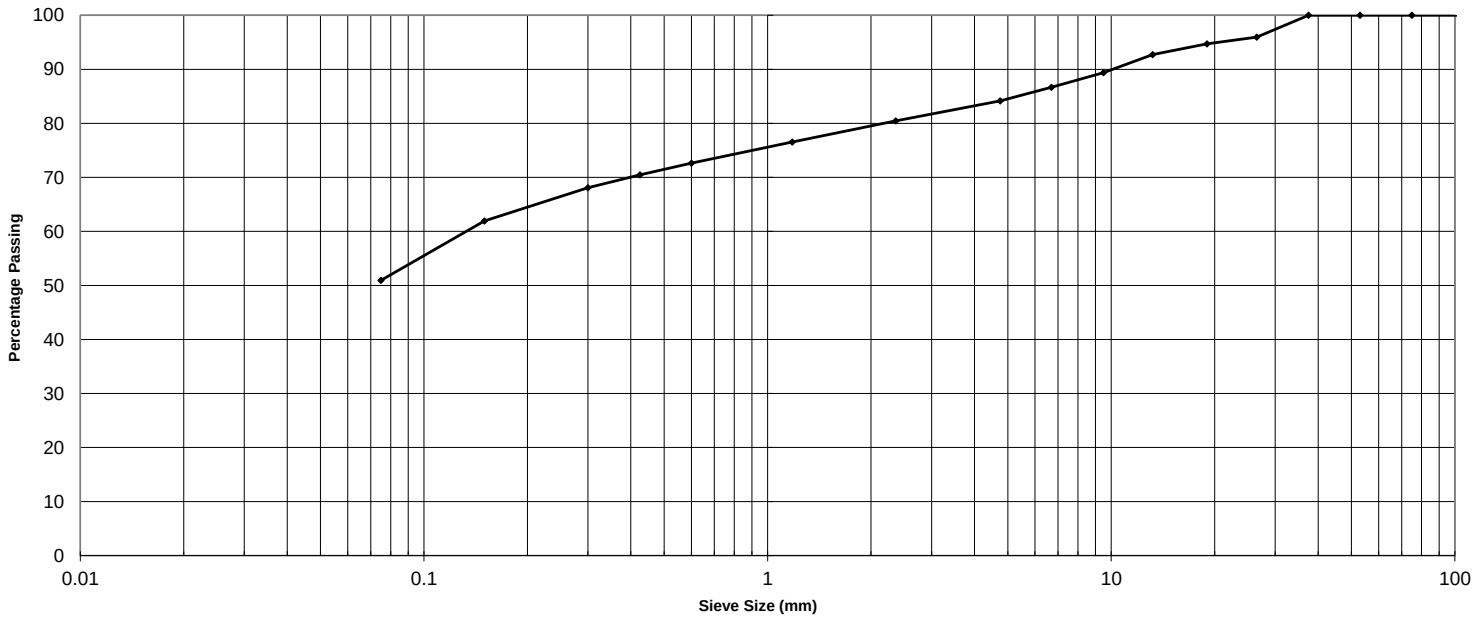
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605409**
ID No.:	28
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	27/04/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Clay
To Be Used As	Material Analysis
Sample Location :	TP16 2.5m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	20.7
Liquid Limit (%) AS 1289.3.1.2	34
Plastic Limit (%) AS 1289.3.2.1	20
Plasticity Index AS 1289.3.3.1	14
Linear Shrinkage (%) AS 1289.3.4.1	6.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	987
L.S. x % Passing 0.425mm	423
Ratio of % Passing (0.075/0.425)	0.72

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	96	95	93	89	87	84	80	77	73	70	68	62	51

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

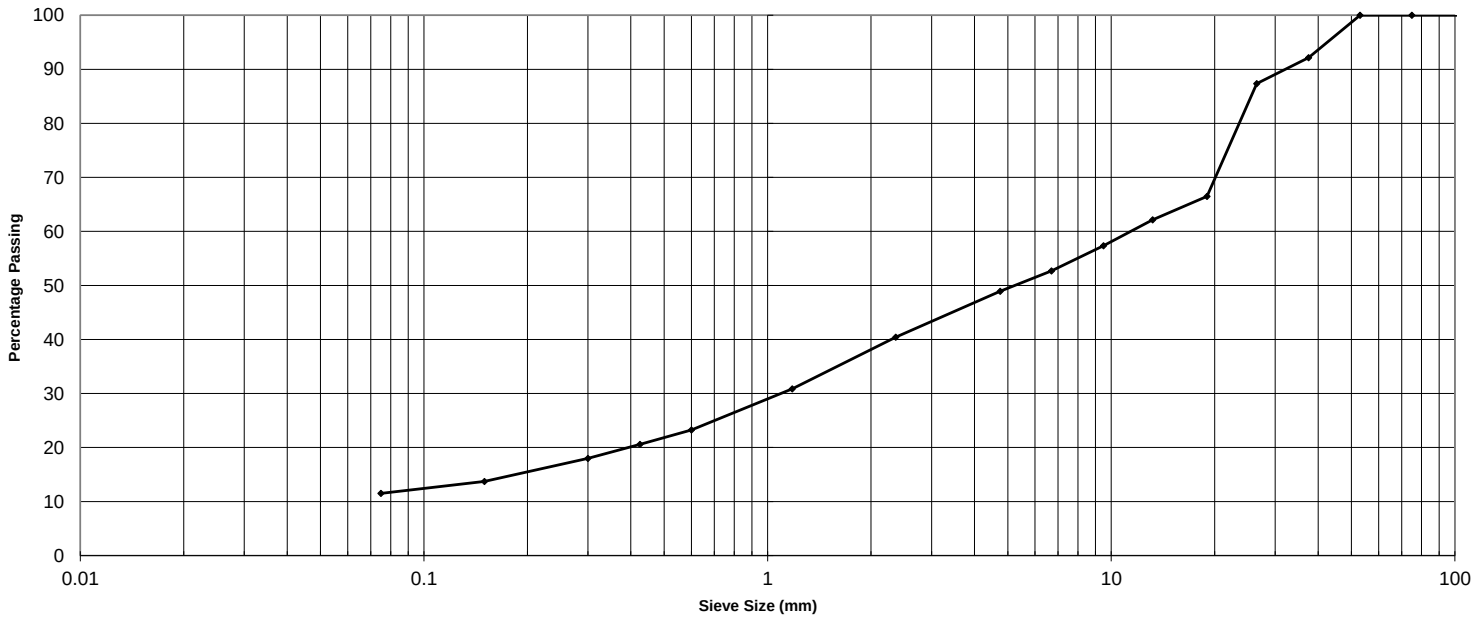
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605410**
ID No.:	29
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	27/4/216
Material Source:	Eastern Stockpile
Material Type:	Sandy Gravel
To Be Used As	Material Analysis
Sample Location :	TP16 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	16.1
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.56

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	92	87	66	62	57	53	49	40	31	23	21	18	14	12

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC

Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

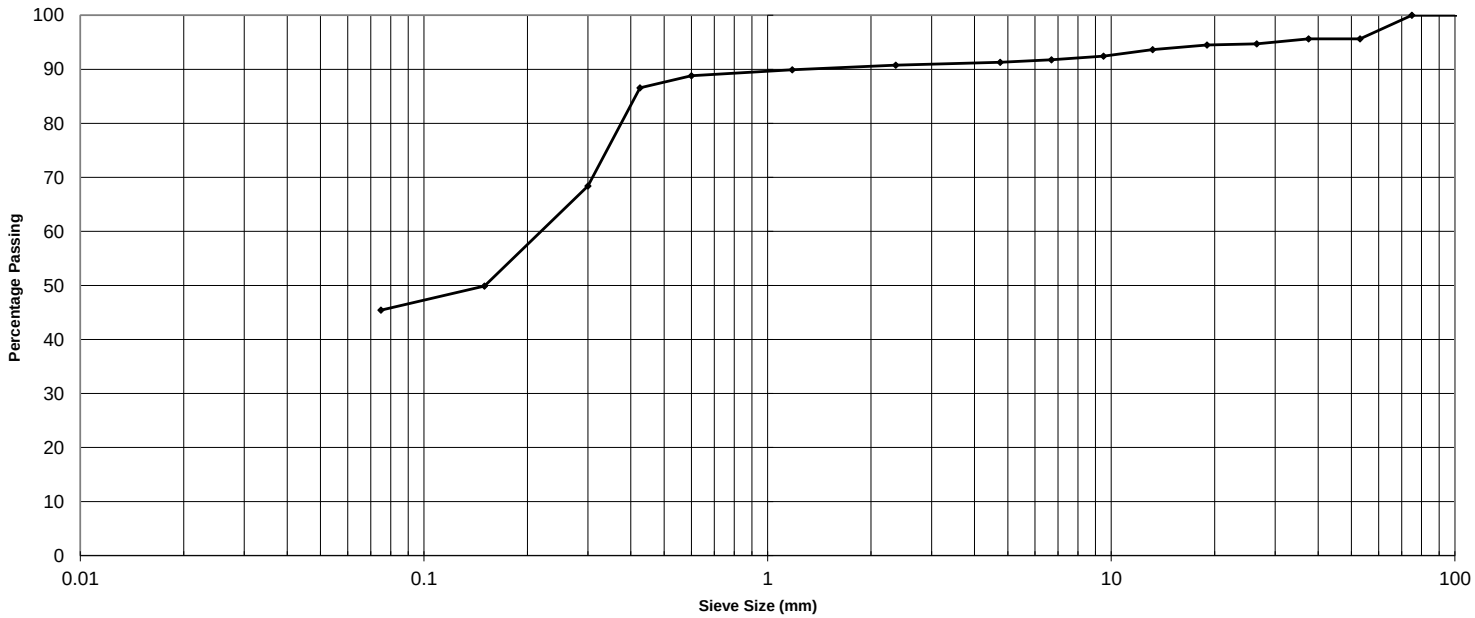
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605413**
ID No.:	32
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Eastern Stockpile
Material Type:	Clayey Sand
To Be Used As	Material Analysis
Sample Location :	TP18 6.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	9.7
Liquid Limit (%) AS 1289.3.1.2	18
Plastic Limit (%) AS 1289.3.2.1	18
Plasticity Index AS 1289.3.3.1	0
Linear Shrinkage (%) AS 1289.3.4.1	0.5
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	0
L.S. x % Passing 0.425mm	43
Ratio of % Passing (0.075/0.425)	0.52

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
		100	96	96	95	94	94	92	92	91	91	90	89	87	68	50	45

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SM Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

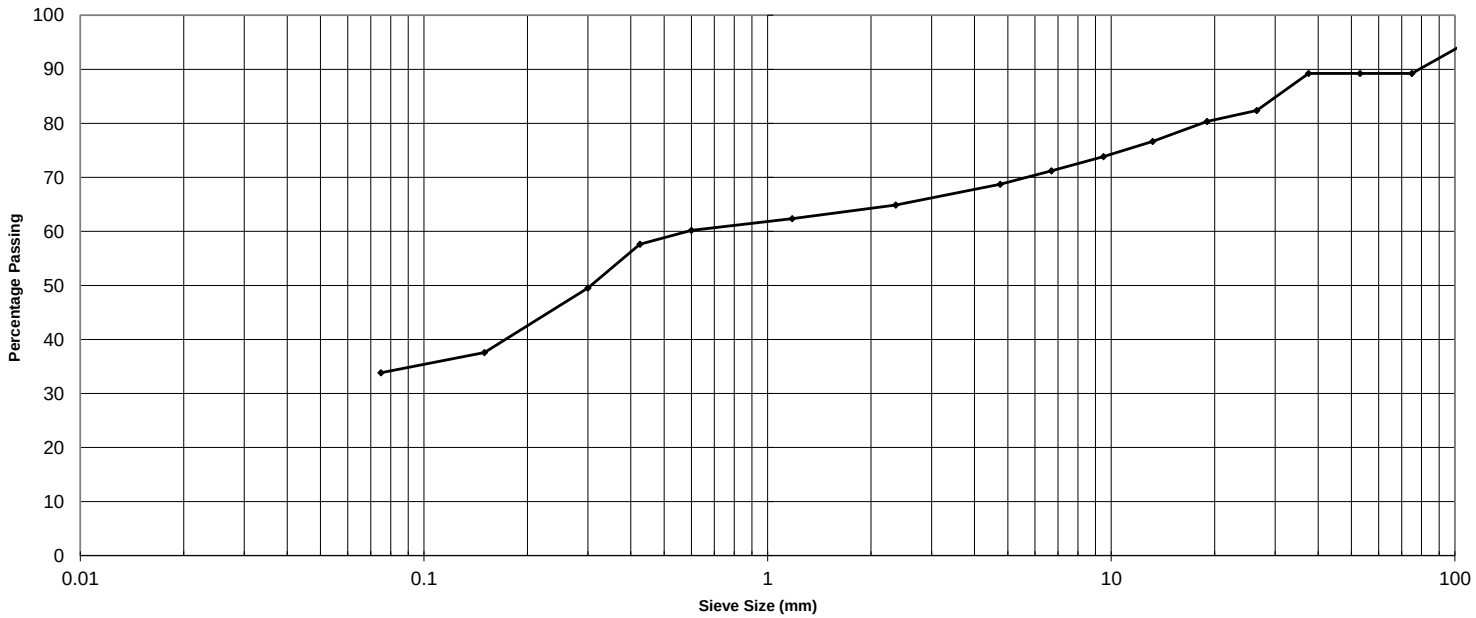
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605414**
ID No.:	33
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Gravelly Sand
To Be Used As	Material Analysis
Sample Location :	TP19 5.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	10.2
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.59

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
	100	89	89	89	82	80	77	74	71	69	65	62	60	58	50	38	34

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC | Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

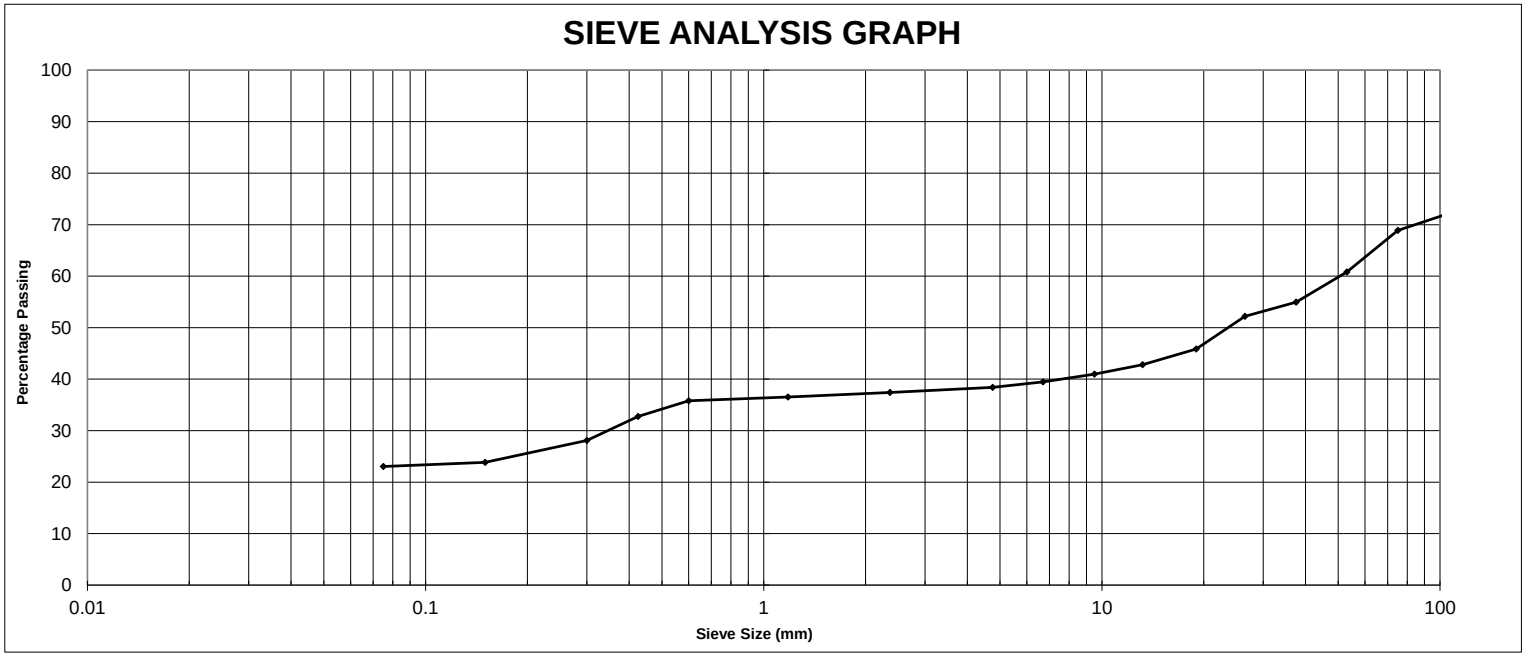
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 22 of 34

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605415**
ID No.:	34
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	10/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Gravel
To Be Used As	Material Analysis
Sample Location :	TP20 2.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	7.1
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.70

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
100	75	69	61	55	52	46	43	41	39	38	37	37	36	33	28	24	23

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

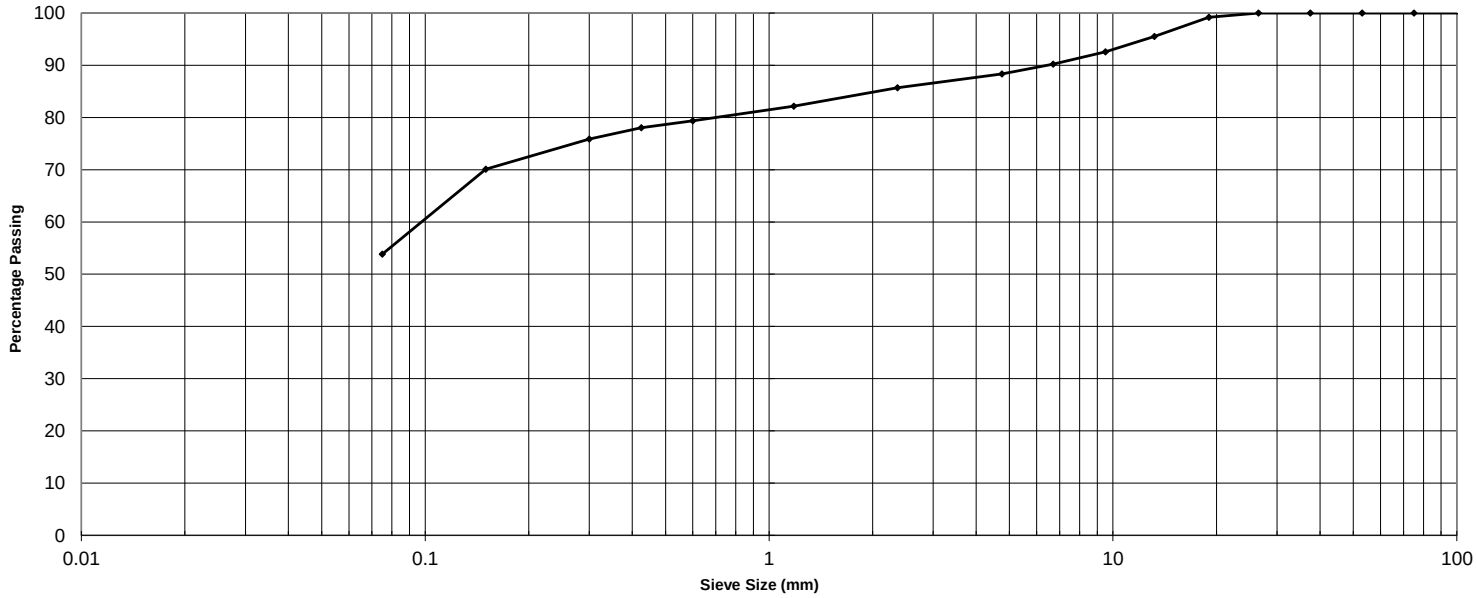
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 09/06/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605416**
ID No.:	35
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	9/06/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sandy Clay
To Be Used As	Material Analysis
Sample Location :	TP21 4.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	4.7
Liquid Limit (%) AS 1289.3.1.2	23
Plastic Limit (%) AS 1289.3.2.1	15
Plasticity Index AS 1289.3.3.1	8
Linear Shrinkage (%) AS 1289.3.4.1	3.5
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	624
L.S. x % Passing 0.425mm	273
Ratio of % Passing (0.075/0.425)	0.69

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	99	96	93	90	88	86	82	79	78	76	70	54

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

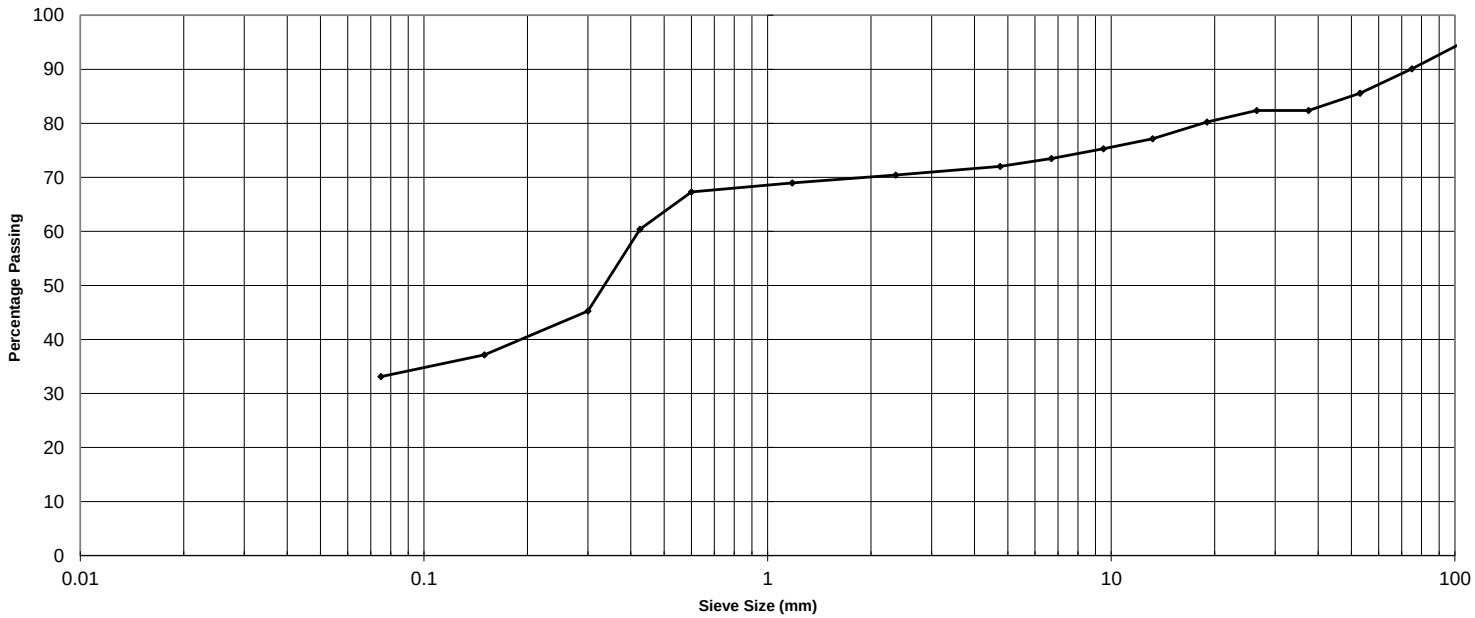
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605418**
ID No.:	37
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	11/05/2016
Material Source:	Eastern Stockpile
Material Type:	FILL: Sand
To Be Used As	Material Analysis
Sample Location :	TP22 7.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	9.0
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.55

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
	100	90	86	82	82	80	77	75	73	72	70	69	67	60	45	37	33

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC | Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

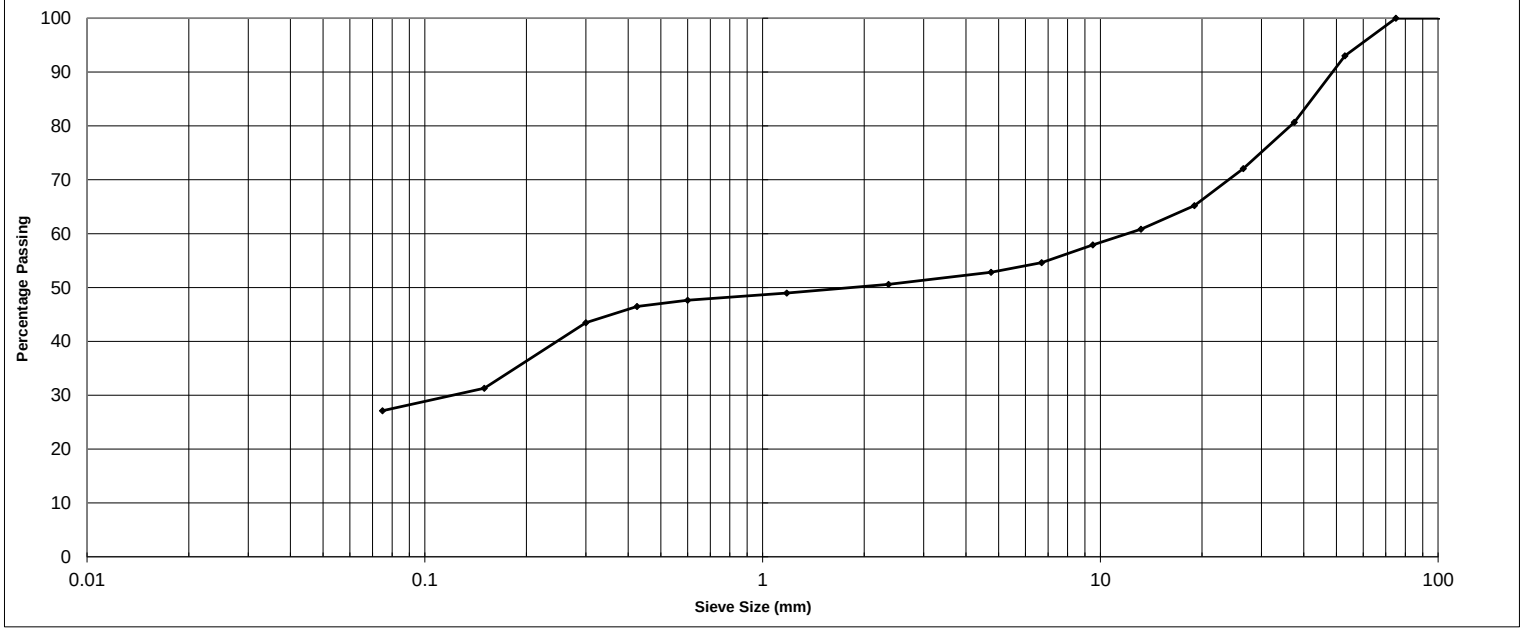
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 25 of 34

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605420**
ID No.:	39
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	3/05/2016
Material Source:	Southern Stockpile
Material Type:	FILL: Sandy Gravel
To Be Used As	Material Analysis
Sample Location :	TP23 3.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	14.4
Liquid Limit (%) AS 1289.3.1.2	30
Plastic Limit (%) AS 1289.3.2.1	17
Plasticity Index AS 1289.3.3.1	13
Linear Shrinkage (%) AS 1289.3.4.1	5.5
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	604
L.S. x % Passing 0.425mm	256
Ratio of % Passing (0.075/0.425)	0.58

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
		100	93	81	72	65	61	58	55	53	51	49	48	46	43	31	27

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

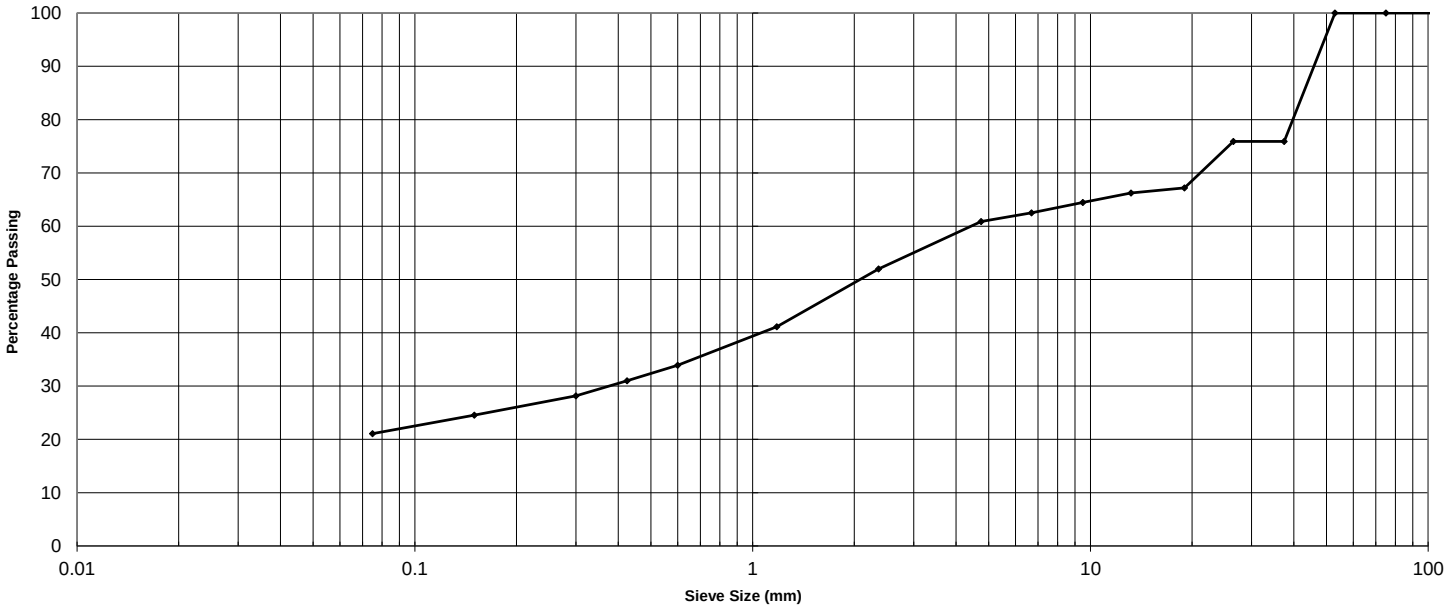
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 26 of 34

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605421**
ID No.:	40
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	9/05/2016
Material Source:	Southern Stockpile
Material Type:	FILL: Sandy Gravel
To Be Used As	Material Analysis
Sample Location :	TP23 5.5m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	39.4
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.68

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	76	76	67	66	64	63	61	52	41	34	31	28	25	21

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

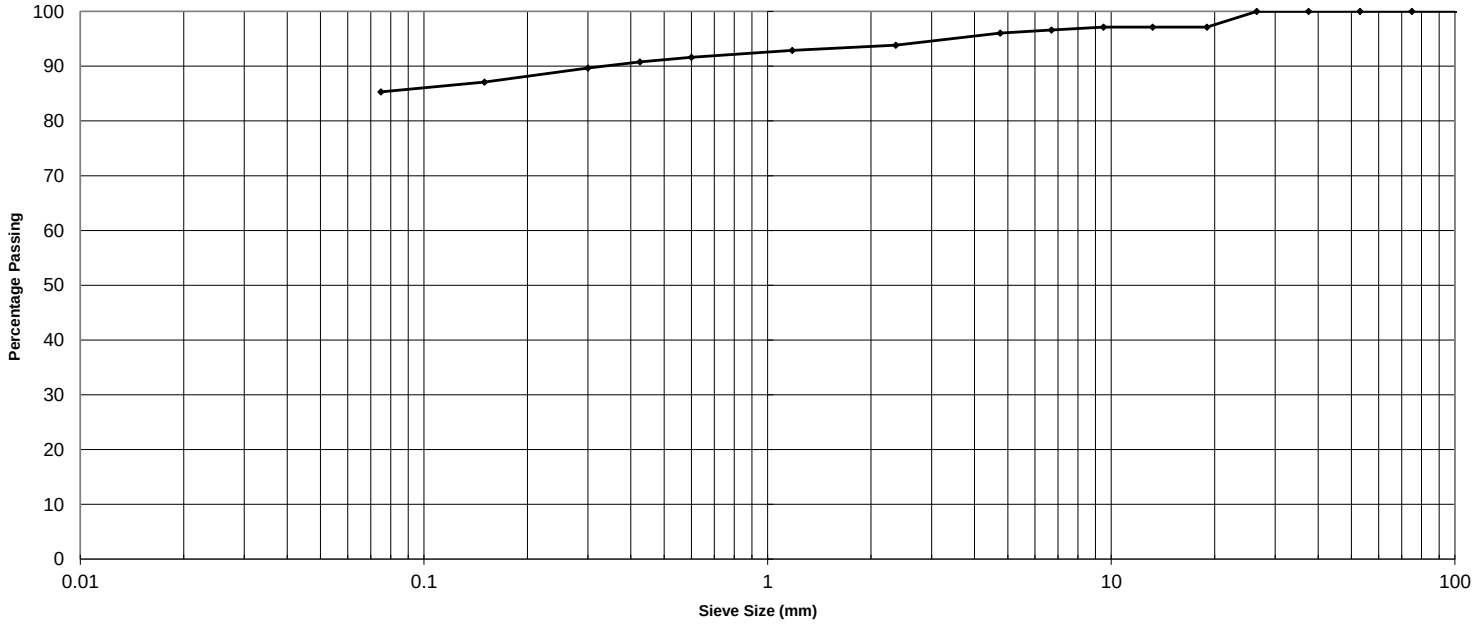
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605423**
ID No.:	42
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	5/05/2016
Material Source:	Southern Stockpile
Material Type:	FILL: Sandy Clay
To Be Used As	Material Analysis
Sample Location :	TP24 3.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	47.3
Liquid Limit (%) AS 1289.3.1.2	63
Plastic Limit (%) AS 1289.3.2.1	36
Plasticity Index AS 1289.3.3.1	27
Linear Shrinkage (%) AS 1289.3.4.1	15.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	2451
L.S. x % Passing 0.425mm	1362
Ratio of % Passing (0.075/0.425)	0.94

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	97	97	97	97	96	94	93	92	91	90	87	85

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: MH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

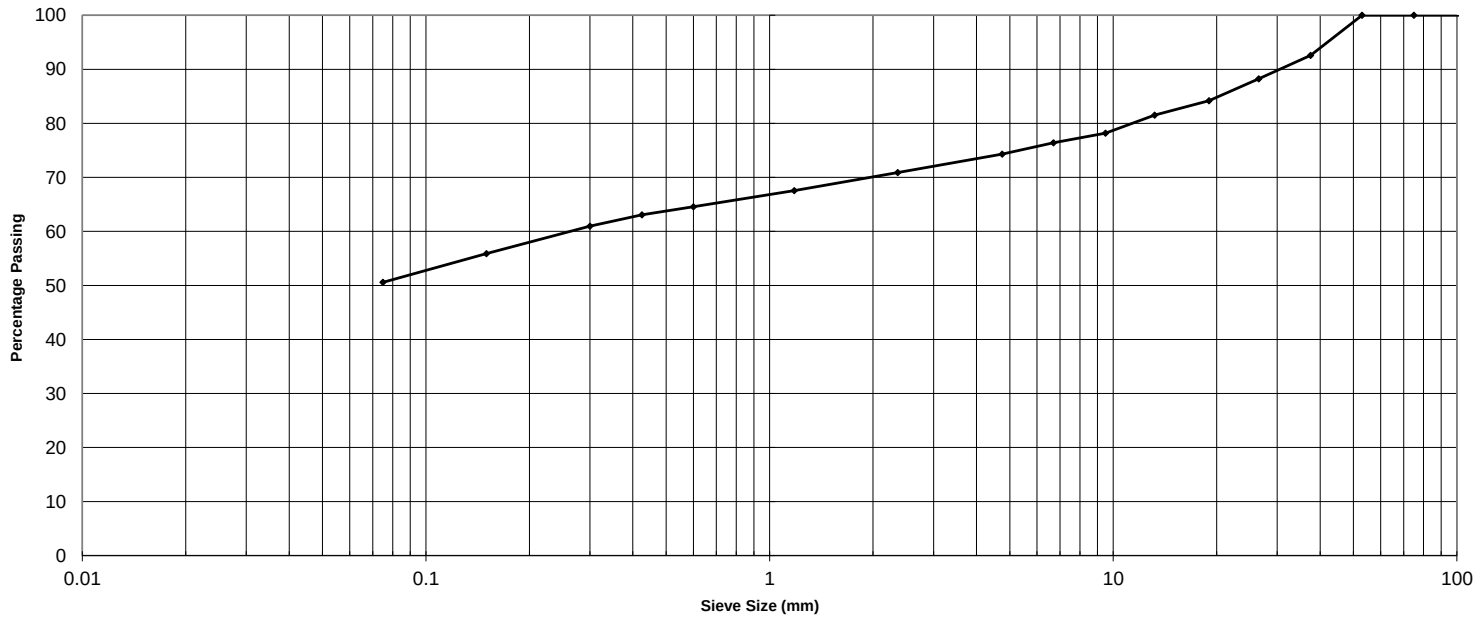
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605427**
ID No.:	46
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	9/05/2016
Material Source:	Southern Stockpile
Material Type:	FILL: Clay/Sand
To Be Used As	Material Analysis
Sample Location :	TP25 5.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	15.3
Liquid Limit (%) AS 1289.3.1.2	33
Plastic Limit (%) AS 1289.3.2.1	21
Plasticity Index AS 1289.3.3.1	12
Linear Shrinkage (%) AS 1289.3.4.1	6.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	757
L.S. x % Passing 0.425mm	378
Ratio of % Passing (0.075/0.425)	0.80

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	93	88	84	82	78	76	74	71	68	65	63	61	56	51

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

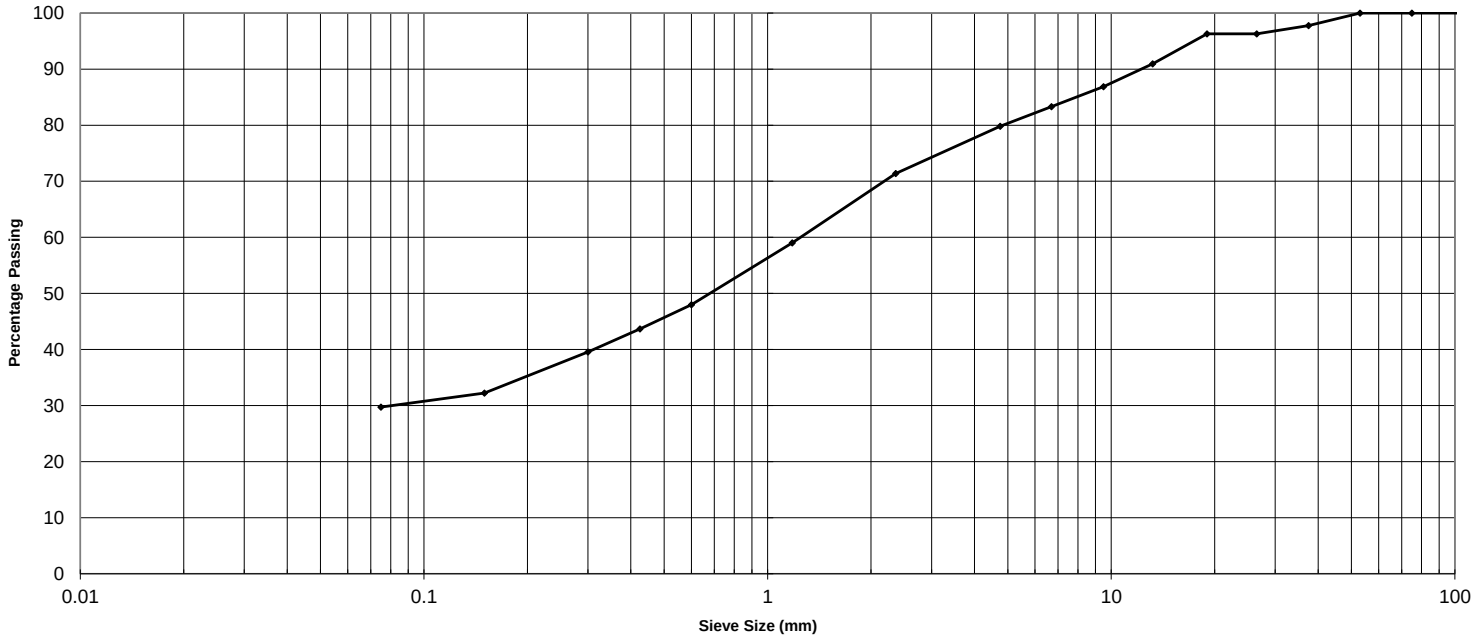
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605428**
ID No.:	47
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	13/05/2016
Material Source:	Salamander
Material Type:	FILL: Sandy Gravel w Clay
To Be Used As	Material Analysis
Sample Location :	Stockpile 1 Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	11.1
Liquid Limit (%) AS 1289.3.1.2	38
Plastic Limit (%) AS 1289.3.2.1	29
Plasticity Index AS 1289.3.3.1	9
Linear Shrinkage (%) AS 1289.3.4.1	4.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	393
L.S. x % Passing 0.425mm	175
Ratio of % Passing (0.075/0.425)	0.68

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	98	96	96	91	87	83	80	71	59	48	44	40	32	30

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SM Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

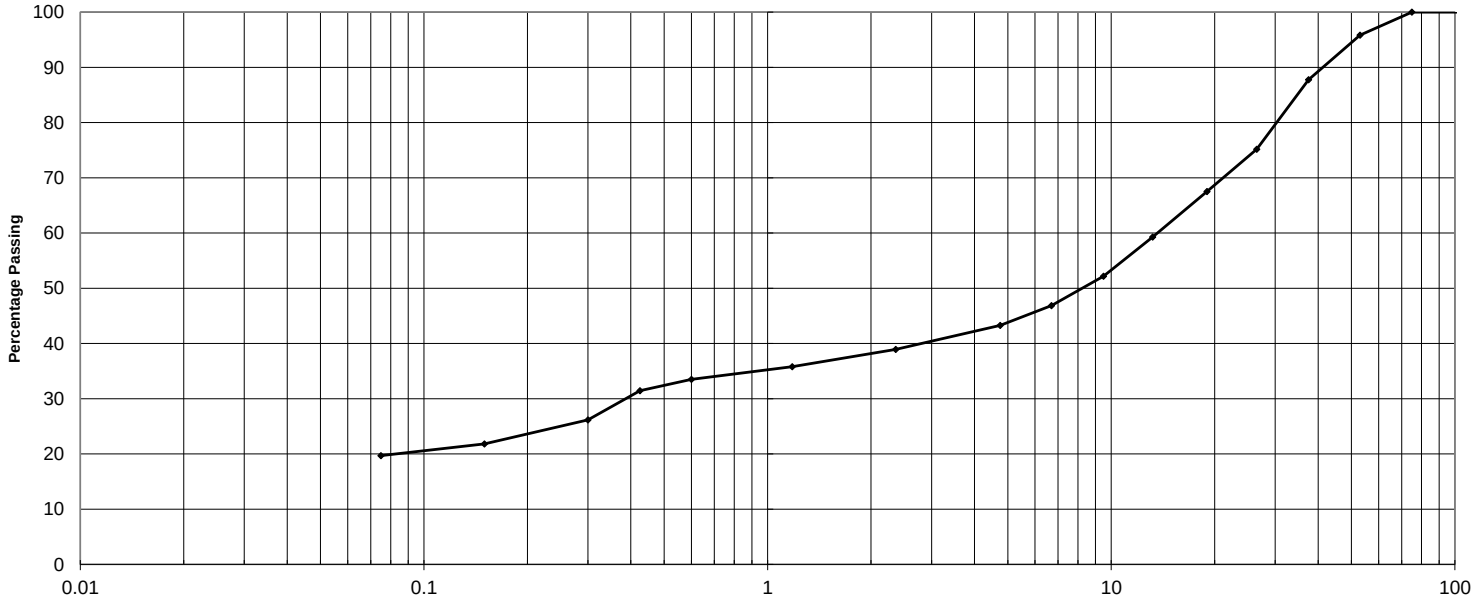
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605429**
ID No.:	48
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	NDCR - 100 minus
Material Type:	FILL: Gravel
To Be Used As	Material Analysis
Sample Location :	Stockpile 2 Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	2.3
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.63

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
		100	96	88	75	68	59	52	47	43	39	36	33	31	26	22	20

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC | Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

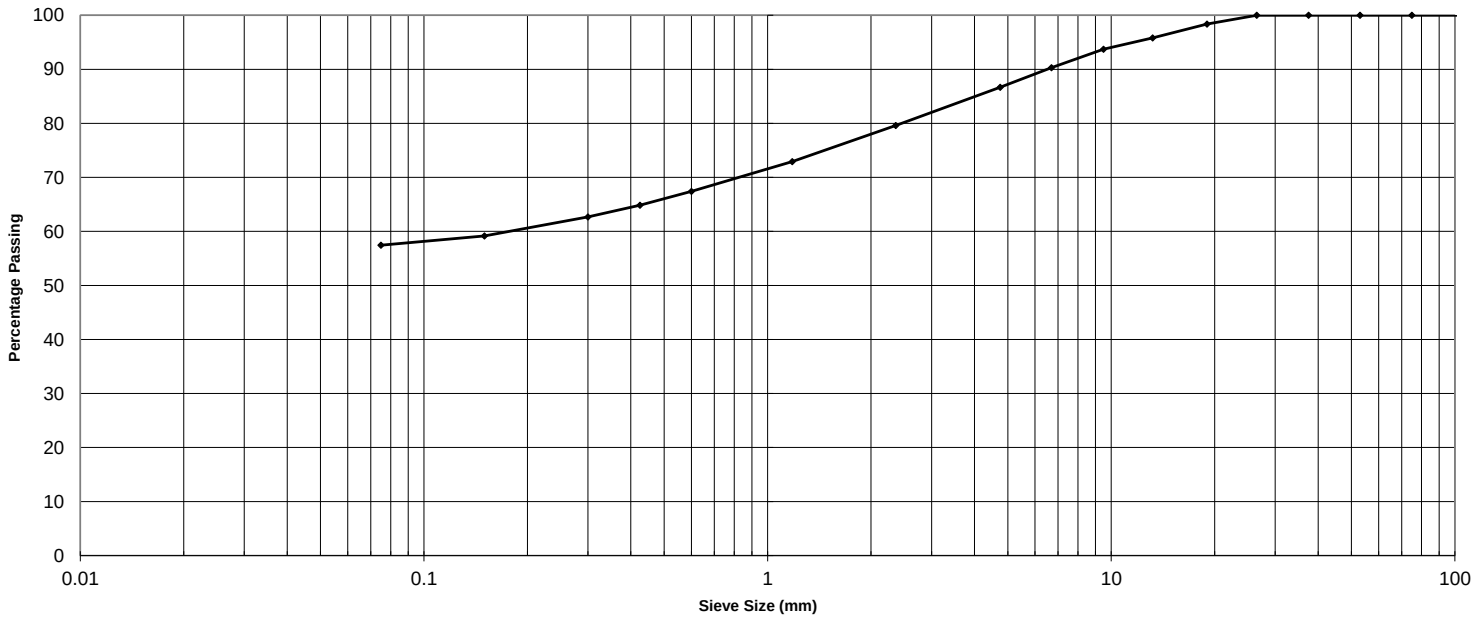
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605430**
ID No.:	49
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Boral Clay
Material Type:	FILL: Clay
To Be Used As	Material Analysis
Sample Location :	Stockpile 3 Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	5.7
Liquid Limit (%) AS 1289.3.1.2	51
Plastic Limit (%) AS 1289.3.2.1	25
Plasticity Index AS 1289.3.3.1	26
Linear Shrinkage (%) AS 1289.3.4.1	11.0
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	1686
L.S. x % Passing 0.425mm	713
Ratio of % Passing (0.075/0.425)	0.89

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	98	96	94	90	87	80	73	67	65	63	59	57

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

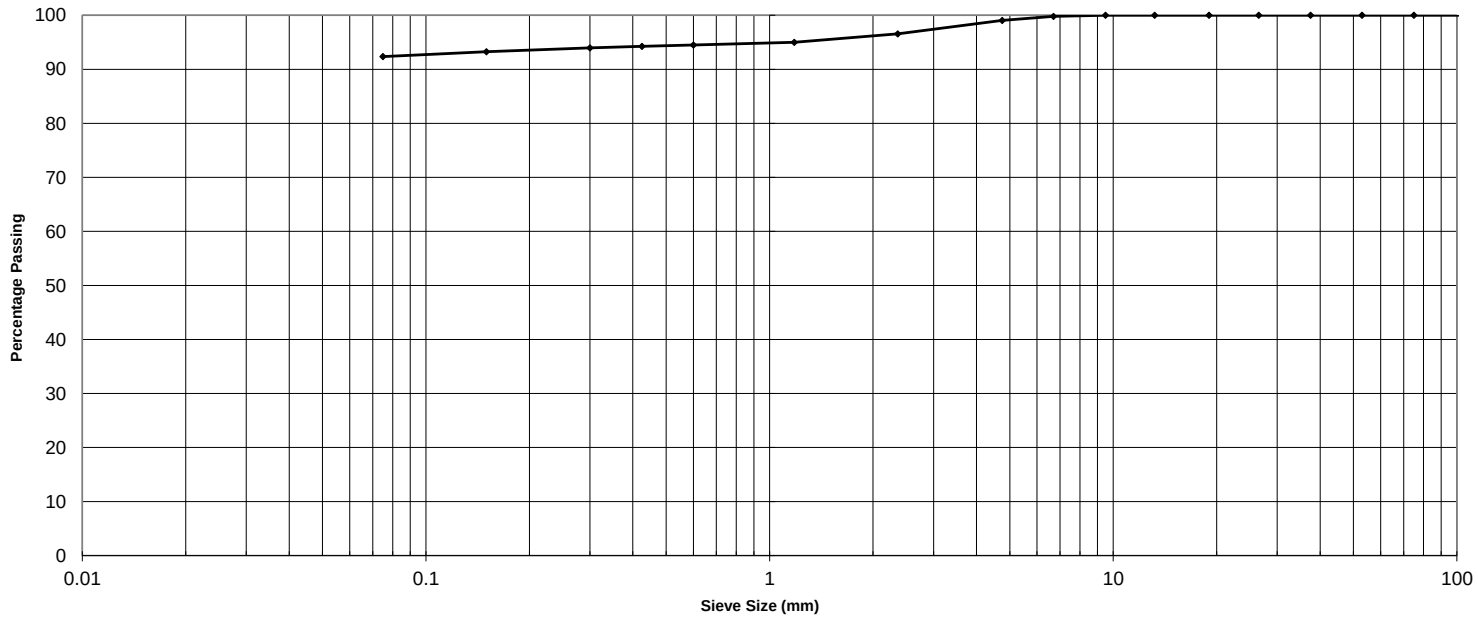
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 10/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605432**
ID No.:	51
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	27/04/2016
Material Source:	Stage 1
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP26 0.8 - 1.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	27.5
Liquid Limit (%) AS 1289.3.1.2	63
Plastic Limit (%) AS 1289.3.2.1	25
Plasticity Index AS 1289.3.3.1	38
Linear Shrinkage (%) AS 1289.3.4.1	16.0
Cracking, Curling, Crumbling (1,2,3)	1, 2
P.I. x % Passing 0.425mm	3582
L.S. x % Passing 0.425mm	1508
Ratio of % Passing (0.075/0.425)	0.98

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
								100	100	99	97	95	94	94	94	93	92

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

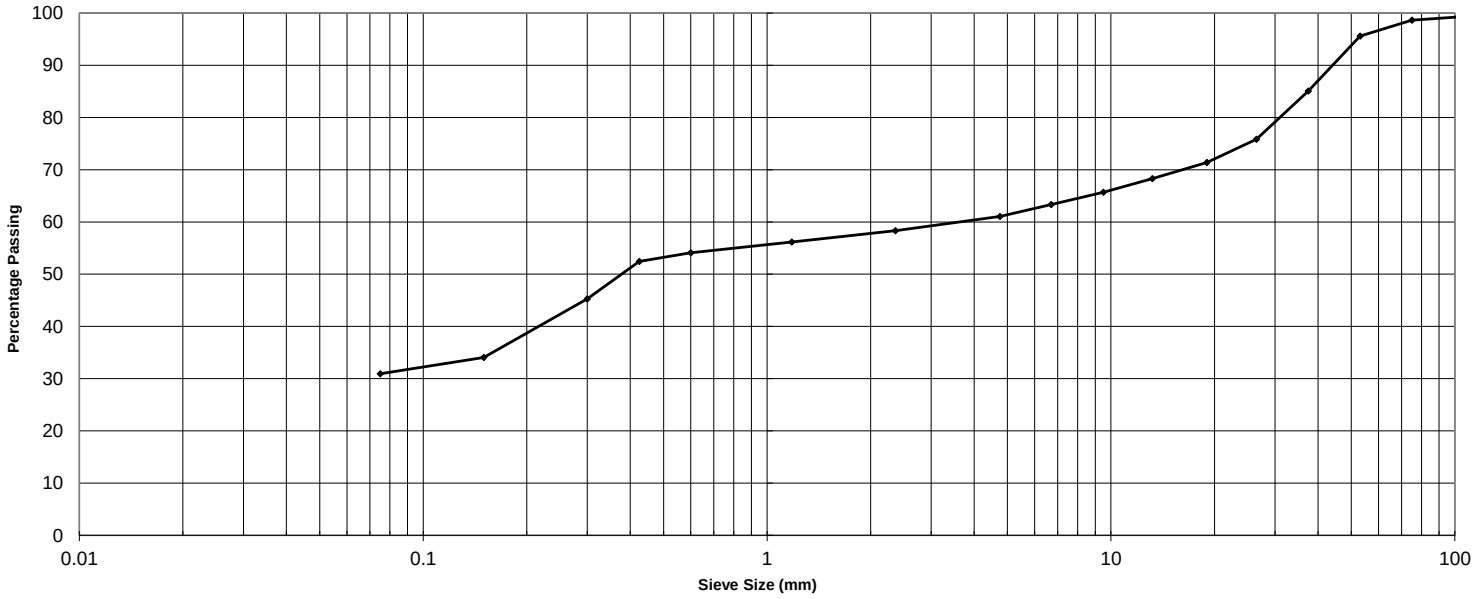
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 09/06/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605436**
ID No.:	55
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	13/05/2016
Material Source:	Stage 1
Material Type:	Gravelly Sand
To Be Used As	Material Analysis
Sample Location :	TP29 0.8 - 1.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	10.1
Liquid Limit (%) AS 1289.3.1.2	-
Plastic Limit (%) AS 1289.3.2.1	-
Plasticity Index AS 1289.3.3.1	-
Linear Shrinkage (%) AS 1289.3.4.1	-
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	-
L.S. x % Passing 0.425mm	-
Ratio of % Passing (0.075/0.425)	0.59

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
	100	99	96	85	76	71	68	66	63	61	58	56	54	52	45	34	31

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC - Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

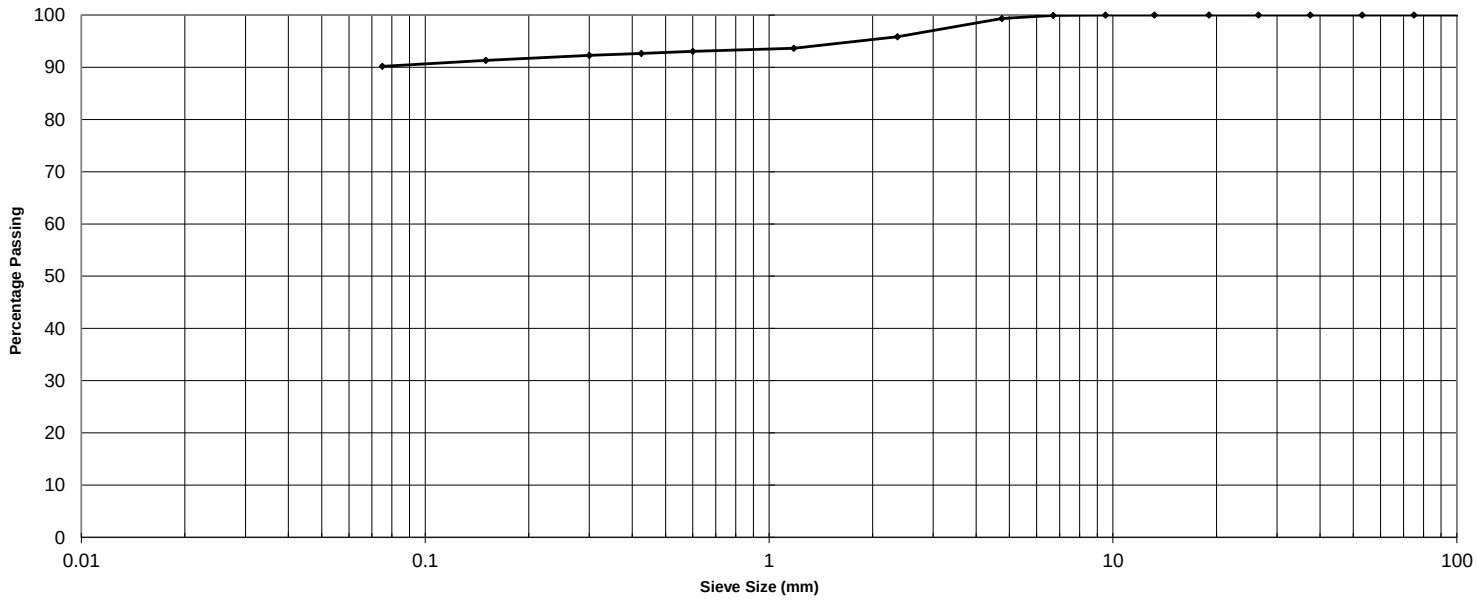
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 3**
Report Date: 05/06/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 34 of 34

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605441**
ID No.:	60
Lot No.:	-
Date Sampled:	15/4 & 20/4/2016
Time Sampled:	am/pm
Date Tested:	5/05/2016
Material Source:	Stage 1
Material Type:	Clay
To Be Used As	Material Analysis
Sample Location :	TP32 0.8 - 1.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	34.9
Liquid Limit (%) AS 1289.3.1.2	72
Plastic Limit (%) AS 1289.3.2.1	33
Plasticity Index AS 1289.3.3.1	39
Linear Shrinkage (%) AS 1289.3.4.1	15.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	3613
L.S. x % Passing 0.425mm	1390
Ratio of % Passing (0.075/0.425)	0.97

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
								100	100	99	96	94	93	93	92	91	90

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC CH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

ATTERBERG LIMITS TEST REPORT

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** -
Report Date: 00/01/00
CT&T Order No: -

Testing performed and reported at our Dandenong South Laboratory

Sample No.:	**1605385**	**1605395**	**1605402**	**1605403**	**1605412**	**1605422**	**1605425**	**1605433**	**1605434**
ID No.:	4	14	21	22	31	41	44	52	53
Lot No.:	-	-	-	-	-	-	-	-	-
Date Sampled:	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm
Date Tested:	3/05/2016	23/05/2016	10/05/2016	13/05/2016	24/05/2016	20/05/2016	2/05/2016	3/05/2016	2/05/2016
Material Source:	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Eastern Stockpile	Southern Stockpile	Southern Stockpile	Stage 1	Stage 1
Material Type:	FILL: Clay/Sand (wet)	FILL: Boulders	FILL: Clay	FILL: Clay	Clay	FILL: Clay	FILL: Silt/Clay	Clay	Sandy Clay
To Be Used As	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis
Sample Location :	TP03 4.0m Below Surface	TP09 6.5m Below Surface	TP12B 1.0m Below Surface	TP13 3.0m Below Surface	TP18 4.0m Below Surface	TP24 1.0m Below Surface	TP25 0.5m Below Surface	TP27 1.8 - 2.0m Below Surface	TP28 0.75m Below Surface
Layer Depth (mm):	-	-	-	-	-	-	-	-	-
Test Depth (mm):	-	-	-	-	-	-	-	-	-
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled
Atterberg Tests									
Liquid Limit Method:	AS1289.3.1.2	AS1289.3.1.2	AS1289.3.1.2	AS1289.3.1.2	AS1289.3.1.2	AS1289.3.1.2	AS1289.3.1.2	AS1289.3.1.2	AS1289.3.1.2
Moisture Content Method:	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1	AS 1289.2.1.1
Preparation:	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved	Dry Sieved
Sample History	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried	Oven Dried
Liquid Limit (%):	**49**	**18**	**76**	**62**	**33**	**27**	**44**	**63**	**63**
Plastic Limit (%) AS 1289.3.2.1:	**27**	**16**	**26**	**27**	**22**	**18**	**29**	**23**	**33**
Plasticity Index AS 1289.3.3.1:	22	2	50	35	11	9	15	40	30
Linear Shrinkage (%) AS1289.3.4.1:	**12.0**	**1.5**	**21.0**	**14.5**	**5.5**	**4.0**	**7.0**	**15.0**	**14.5**
Cracking, Curling, Crumbling (1,2,3):			2	1, 2	1	1	2	1, 2	1, 2

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No.: **CG.301.002**

Form Issue Date: 19/02/2013

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

EMERSON CLASS NUMBER

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **-5**
Report Date: 26/05/16
Request No: -
Test Method: AS 1289.3.8.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605398**	**1605402**	**1605425**	**1605426**	**1605428**
ID No.:	17	21	44	45	47
Lot No.:	-	-	-	-	-
Date Sampled:	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016	15/4 & 20/4/2016
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm
Date Tested:	26/4/2016	10/5/2016	2/5/2016	2/5/2016	23/5/2016
Material Source:	Eastern Stockpile	Eastern Stockpile	Southern Stockpile	Southern Stockpile	Salamander
Material Description:	FILL: Sandy Clay	FILL: Clay	FILL: Silt/Clay	FILL: Clay	FILL: Sandy Gravel w Clay
To Be Used As	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis
Sample Location :	TP11 3.0m Below Surface	TP12B 1.0m Below Surface	TP25 0.5m Below Surface	TP25 2.5m Below Surface	Stockpile 1 Below Surface
Layer Depth (mm):	-	-	-	-	-
Test Depth (mm):	-	-	-	-	-
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled
Distilled Water:	✓	✓	✓	✓	✓
Reservoir Water:					
Water Temperature:	21 º C	20 º C	18 º C	18 º C	20 º C
Air Dried Crumbs:					
Start Time:	11:10:00 AM	8:08:00 AM	9:39:00 AM	9:40:00 AM	8:43:00 AM
Time Dispersion Commences:	11:15:00 AM	-	-	12:00:00 AM	-
Time Dispersion Completed:	2:00:00 PM	-	-	12:00:00 AM	-
Remoulded Material:					
Start Time:		8:32:00 AM	10:05:00 AM	10:10:00 AM	9:30:00 AM
Time Dispersion Commences:					
Time Dispersion Completed:					
Immersion of Air Dried Crumbs:					
Slakes:	✓	✓	✓	✓	✓
Swell:					
Complete Dispersion:					
Partial Dispersion:	✓				
Immersion of Remoulded Material:					
Disperses:					
Calcite or Gypsum:					
Present:					
Vigorous Shaking:					
Disperses:		✓	✓	✓	✓
Flocculates:					
Emerson Class Number:	**2**	**5**	**5**	**5**	**5**

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY
M Robinson

Form No.: **CG.313.001**
Issue Date: 19/02/2013

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

EMERSON CLASS NUMBER

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **-5**
Report Date: 26/05/16
Request No: -
Test Method: AS 1289.3.8.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1605430**	**1605433**			
ID No.:	49	52			
Lot No.:	-	-			
Date Sampled:	15/4 & 20/4/2016	15/4 & 20/4/2016			
Time Sampled:	am/pm	am/pm			
Date Tested:	23/5/2016	2/5/2016			
Material Source:	Boral Clay	Stage 1			
Material Description:	FILL: Clay	Clay			
To Be Used As	Material Analysis	Material Analysis			
Sample Location :	Stockpile 3 Below Surface	TP27 1.8 - 2.0m Below Surface			
Layer Depth (mm):	-	-			
Test Depth (mm):	-	-			
Sampling Procedure:	Client Sampled	Client Sampled			
Distilled Water:	✓	✓			
Reservoir Water:					
Water Temperature:	19 º C	18 º C			
Air Dried Crumbs:					
Start Time:	8:52:00 AM	9:40:00 AM			
Time Dispersion Commences:	-	-			
Time Dispersion Completed:	-	-			
Remoulded Material:					
Start Time:	9:15:00 AM	10:15:00 AM			
Time Dispersion Commences:					
Time Dispersion Completed:					
Immersion of Air Dried Crumbs:					
Slakes:	✓	✓			
Swell:					
Complete Dispersion:					
Partial Dispersion:					
Immersion of Remoulded Material:					
Disperses:					
Calcite or Gypsum:					
Present:					
Vigorous Shaking:					
Disperses:	✓	✓			
Flocculates:					
Emerson Class Number:	**5**	**5**			

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY
M Robinson

Form No.: **CG.313.001**
Issue Date: 19/02/2013

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

COEFFICIENT OF PERMEABILITY

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: 308178 - 6
Report Date: 26/05/2016
Request No: -
Test Method: AS1289.6.7.3
Page: 1 of 1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	1605433			
Date Tested:	11 - 13/05/2016			
ID No:	52			
Sample Location	TP27 1.8 - 2.0m Below Surface			
Sample Source:	Stage 1			
Sample Description:	Clay			
Date Sampled:	15/4 & 20/4/2016			
Sampled By:	Client			
Sampling Procedure:	-			
Sample Type:	Remoulded			
Compaction details				
Maximum Dry Density - MDD (t/m^3) **AS1289 5.1.1**	1.54			
Optimum Moisture Content - OMC (%) **AS1289.5.1.1** :	27.0			
Compactive Effort **AS1289.5.1.1** :	Standard			
Oversize material retained on 19.0mm sieve (%):	0			
Moulding details				
No of layers	3			
Length of specimen	63.9			
Diameter of specimen	64.3			
Length to diameter ratio	~ 1 : 1			
Nominated % Maximum Dry Density Compaction :	98			
Nominated % Moisture Content Compaction :	100			
Initial Dry Density (t/m^3) :	1.51			
Achieved Percentage of Density Ratio (%) :	97.5			
Initial Moisture Content (%) :	21.5			
Moulded Moisture Content (%) :	26.6			
Achieved Percentage of Moisture Ratio (%) :	98.5			
Specimen details after test				
Moisture content (%)	29.5			
Mean effective stress (kPa)	100			
Permeant used	De-aired Water			
Permeability (k) m/sec	**4×10^{-12}**			

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

A.Catton

A.Catton

Form No.: CG.325.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900

CHADWICK GEOTECHNICS

MOISTURE CONTENT REPORT

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 7**
Report Date: 26/05/16
Request No: -
Test Method: AS 1289 2.1.1
Page: 1 of 1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	1606238	1606240	1606242	1606243	1606245	1606246	1606248	1606251		
ID No.:	3	5	7	8	10	11	13	16		
Lot No.:	-	-	-	-	-	-	-	-		
Date Sampled:	26/04/2016	26/04/2016	26/04/2016	27/04/2016	27/04/2016	27/04/2016	27/04/2016	27/04/2016		
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm	am/pm		
Date Tested:	25/5/2016	25/5/2016	25/5/2016	25/5/2016	25/5/2016	25/5/2016	25/5/2016	25/5/2016		
Material Source:	Insitu	Insitu	Insitu	Insitu	Insitu	Insitu	Insitu	Insitu		
Material Description:	Clayey Sand	Clay	Clay/Higly weathered Basalt	Clay	Clay/ Extreamly weather Basalt	Clay	Clay	Clay		
To Be Used As:	-	-	-	-	-	-	-	-		
Sample Location :	TP35 0.5 to 0.8m Below Surface	TP36 0.75m Below Surface	TP37 0.75m Below Surface	TP38 0.75m Below Surface	TP39 0.75m Below Surface	TP40 0.75m Below Surface	TP41 0.75m Below Surface	TP42 0.75m Below Surface		
Layer Depth (mm):	-	-	-	-	-	-	-	-		
Test Depth (mm):	-	-	-	-	-	-	-	-		
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled		
Moisture Content (%):	**20.3**	**31.7**	**14.8**	**11.1**	**36.4**	**36.3**	**22.2**	**35.0**		

Remarks:

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are

APPROVED SIGNATORY

J Lamont

Form No.: **CG.319.001**
Issue Date: 19/02/2013

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900

CHADWICK GEOTECHNICS

CALIFORNIA BEARING RATIO REPORT

Customer: Tonkin + Taylor Pty Ltd
Report Number: **308178 - 8**
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Report Date: 26/05/16
Project: Lilydale Quarry
CG Request No: -
Location: Lilydale
Test Method: AS 1289.6.1.1
Customer Order No.: 5064.001
Page: 1 of 1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1606239**	**1606241**	**1606244**	**1606249**	**1606252**
ID No.:	4	6	9	14	17
Lot No.:	-	-	-	-	-
Date Sampled:	26/04/2016	26/04/2016	27/04/2016	27/04/2016	27/04/2016
Time Sampled:	am/pm	am/pm	am/pm	am/pm	am/pm
Date Tested:	24/5/2016	24/5/2016	23/5/2016	23/5/2016	23/5/2016
Material Source:	Insitu	Insitu	Insitu	Insitu	Insitu
Material Description:	Sandy Clay	Clay	Clay	Clay	Clay
To Be Used As:	-	-	-	-	-
Sample Location :	TP35 1.1 to 1.3m Below Surface	TP36 0.8 to 1.0m Below Surface	TP38 0.8-1.0m Below Surface	TP41 0.75m Below Surface	TP42 0.8-1.0m Below Surface
Layer Depth (mm):	-	-	-	-	-
Test Depth (mm):	-	-	-	-	-
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled
MDD (t/m3) AS1289.5.1.1 :	1.70	1.30	1.49	1.49	1.32
OMC (%) AS1289.5.1.1 :	18.5	37.0	28.5	31.0	36.5
Compactive Effort :	Standard	Standard	Standard	Standard	Standard
Nominated % MDD Compaction :	98	98	98	98	98
Nominated % OMC Compaction :	100	100	100	100	100
Achieved Density Ratio (%) :	99	97	98	99	98
Achieved Moisture Ratio (%) :	96	105	98	97	102
Test Condition (Soaked/Unsoaked) :	Soaked	Soaked	Soaked	Soaked	Soaked
Test Condition Soaking Period (Days) :	4	4	4	4	4
Swell (%)	1.0	0.5	0.5	0.0	0.0
Surcharge (kg) :	4.5	4.5	4.5	4.5	4.5
Achieved Dry Density before Soak (t/m^3) :	1.67	1.26	1.46	1.47	1.29
Dry Density after Soak (t/m^3) :	1.65	1.25	1.45	1.45	1.30
Density Ratio after Soak (%) :	97	96	98	97	98
Moisture Content AS1289.2.1.1					
Initial Moisture Content (%):	12.6	31.4	21.5	22.0	30.7
Achieved Moisture Content (%) :	17.8	39.0	28.1	29.8	37.1
Moisture Content after Soak (%) :	20.2	42.0	32.3	31.5	39.8
Moisture Content (Top) after Penetration (%) :	21.7	42.2	29.7	32.0	38.6
% retained on 19mm:	10	0	0	0	1
CBR Penetration (mm) :	2.5	2.5	2.5	2.5	2.5
CBR Value (%) :	**4.0**	**3.0**	**4.0**	**7**	**7**

Remarks: **All oversize was excluded**

If the specimen was soaked, then an additional 1kg surcharge weight was added at the penetration stage as per AS1289.6.1.1 8(a)

APPROVED SIGNATORY

J Lamont

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

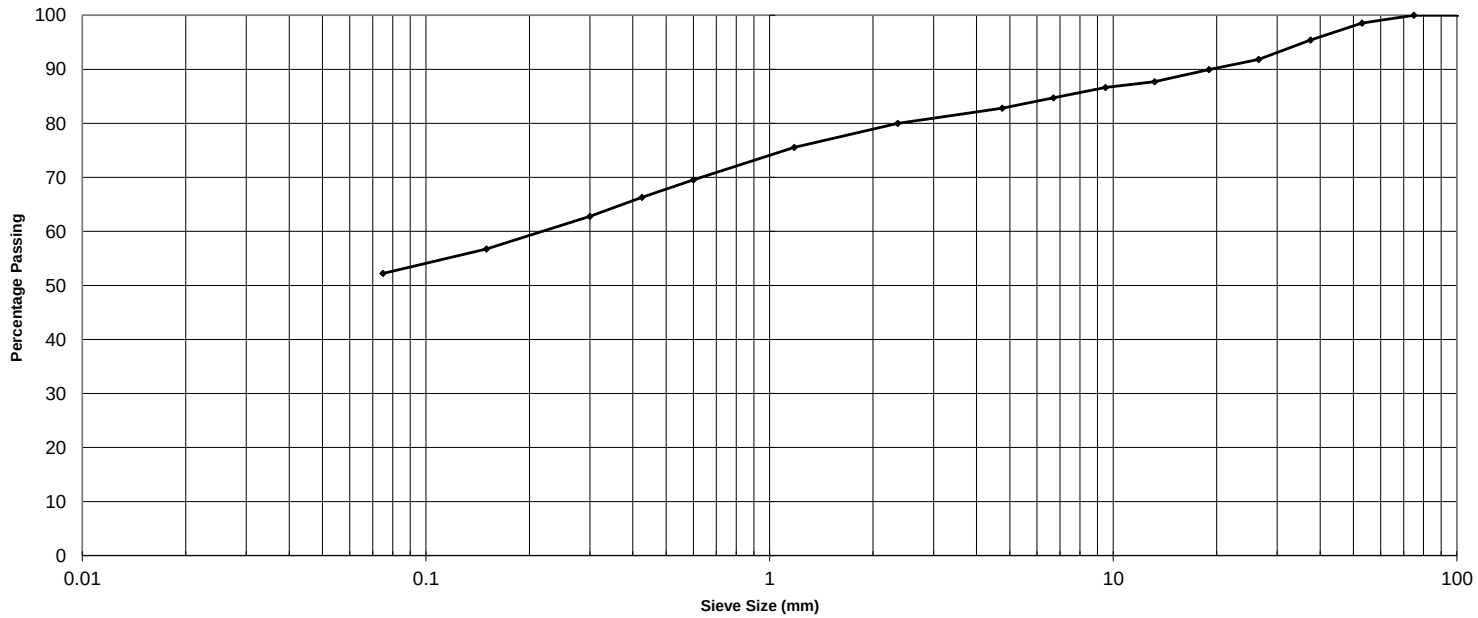
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 9**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1606237**
ID No.:	2
Lot No.:	-
Date Sampled:	26/04/2016
Time Sampled:	am/pm
Date Tested:	20/05/2016
Material Source:	Insitu
Material Type:	Clayey Gravel
To Be Used As	-
Sample Location :	TP1B 4.5 to 5.5m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	30.9
Liquid Limit (%) AS 1289.3.1.2	
Plastic Limit (%) AS 1289.3.2.1	
Plasticity Index AS 1289.3.3.1	
Linear Shrinkage (%) AS 1289.3.4.1	
Cracking, Curling, Crumbling (1,2,3)	
P.I. x % Passing 0.425mm	
L.S. x % Passing 0.425mm	
Ratio of % Passing (0.075/0.425)	0.79

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
		100	99	95	92	90	88	87	85	83	80	76	70	66	63	57	52

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC | Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

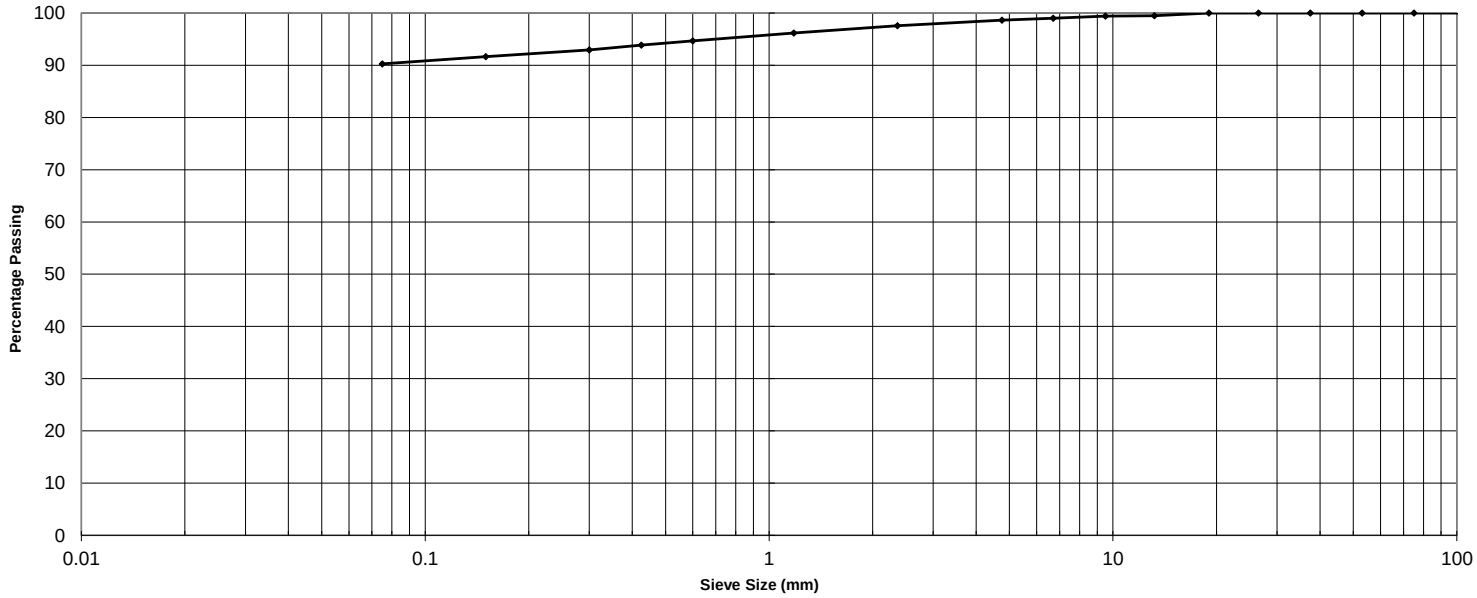
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 9**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1606239**
ID No.:	4
Lot No.:	-
Date Sampled:	26/04/2016
Time Sampled:	am/pm
Date Tested:	20/05/2016
Material Source:	Insitu
Material Type:	Sandy Clay
To Be Used As	-
Sample Location :	TP35 1.1 to 1.3m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	14.1
Liquid Limit (%) AS 1289.3.1.2	73
Plastic Limit (%) AS 1289.3.2.1	35
Plasticity Index AS 1289.3.3.1	38
Linear Shrinkage (%) AS 1289.3.4.1	15.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	3566
L.S. x % Passing 0.425mm	1408
Ratio of % Passing (0.075/0.425)	0.96

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	99	99	99	99	98	96	95	94	93	92	90

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC MH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

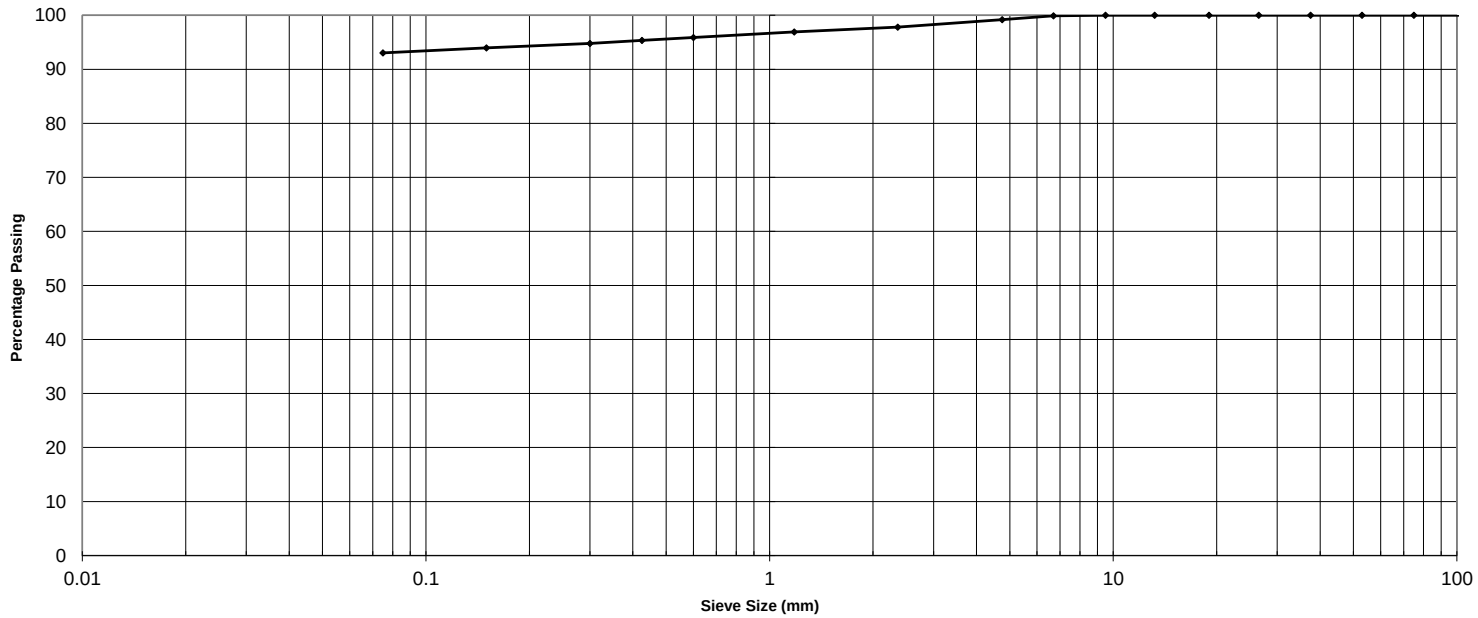
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 9**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1606241**
ID No.:	6
Lot No.:	-
Date Sampled:	26/04/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Insitu
Material Type:	Clay
To Be Used As	-
Sample Location :	TP36 0.8 to 1.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	31.5
Liquid Limit (%) AS 1289.3.1.2	66
Plastic Limit (%) AS 1289.3.2.1	33
Plasticity Index AS 1289.3.3.1	33
Linear Shrinkage (%) AS 1289.3.4.1	16.5
Cracking, Curling, Crumbling (1,2,3)	1, 2
P.I. x % Passing 0.425mm	3146
L.S. x % Passing 0.425mm	1573
Ratio of % Passing (0.075/0.425)	0.98

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
								100	100	99	98	97	96	95	95	94	93

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: MH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

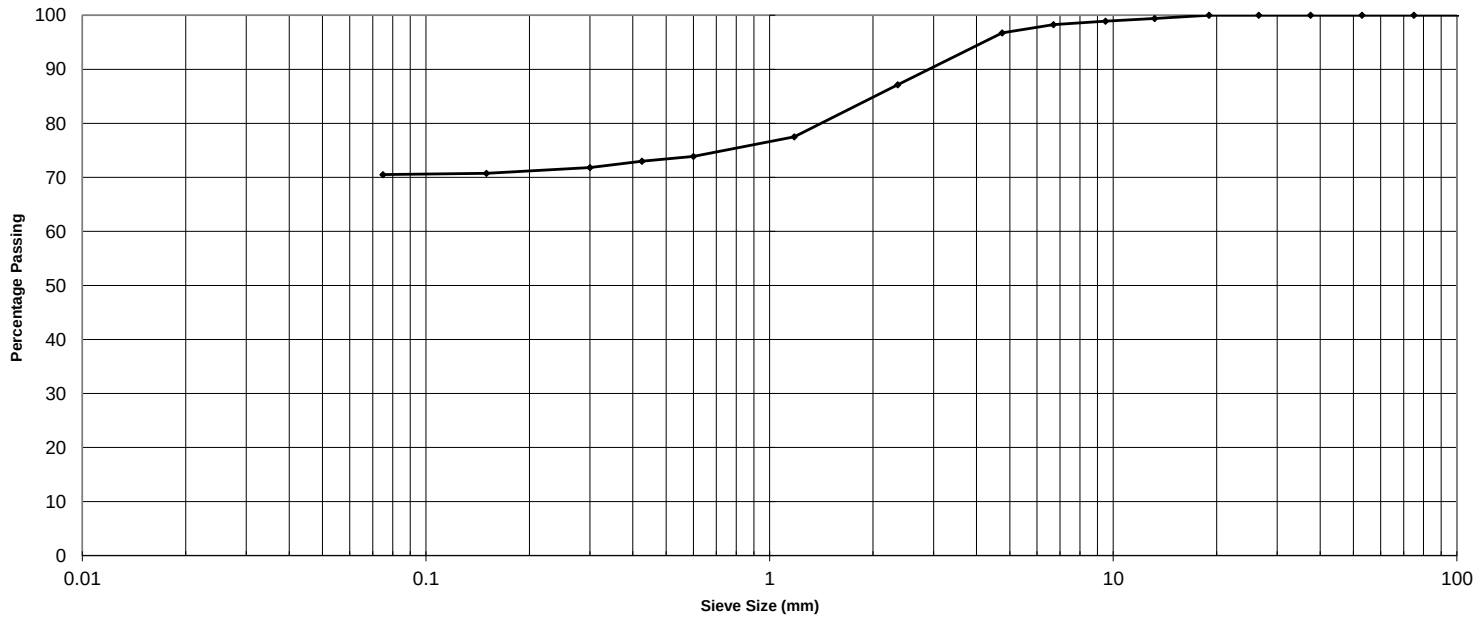
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 9**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1606244**
ID No.:	9
Lot No.:	-
Date Sampled:	27/04/2016
Time Sampled:	am/pm
Date Tested:	18/05/2016
Material Source:	Insitu
Material Type:	Clay
To Be Used As	-
Sample Location :	TP38 0.8-1.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	24.9
Liquid Limit (%) AS 1289.3.1.2	46
Plastic Limit (%) AS 1289.3.2.1	20
Plasticity Index AS 1289.3.3.1	26
Linear Shrinkage (%) AS 1289.3.4.1	12.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	1898
L.S. x % Passing 0.425mm	876
Ratio of % Passing (0.075/0.425)	0.97

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	99	99	98	97	87	78	74	73	72	71	71

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CI Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

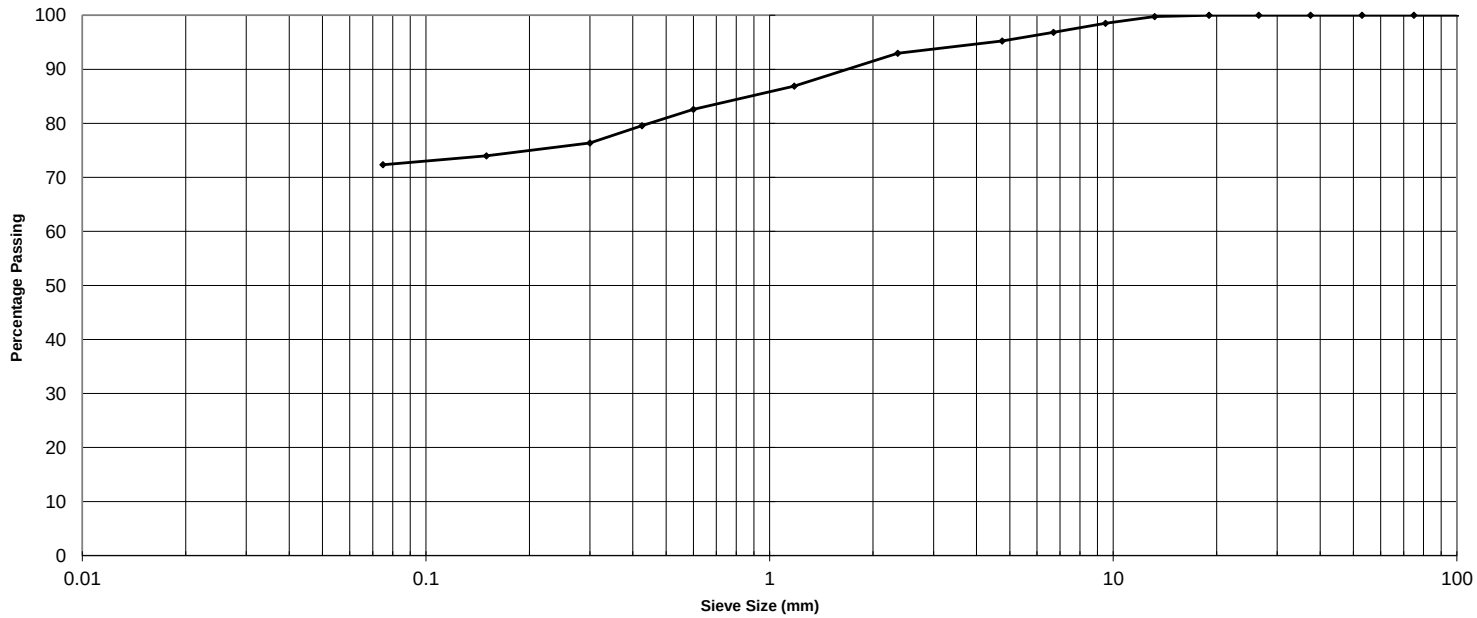
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 9**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 5 of 6

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1606249**
ID No.:	14
Lot No.:	-
Date Sampled:	27/04/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Insitu
Material Type:	Clay
To Be Used As	-
Sample Location :	TP41 0.75m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	22.2
Liquid Limit (%) AS 1289.3.1.2	52
Plastic Limit (%) AS 1289.3.2.1	28
Plasticity Index AS 1289.3.3.1	24
Linear Shrinkage (%) AS 1289.3.4.1	11.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	1910
L.S. x % Passing 0.425mm	875
Ratio of % Passing (0.075/0.425)	0.91

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
						100	100	99	97	95	93	87	83	80	76	74	72

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT

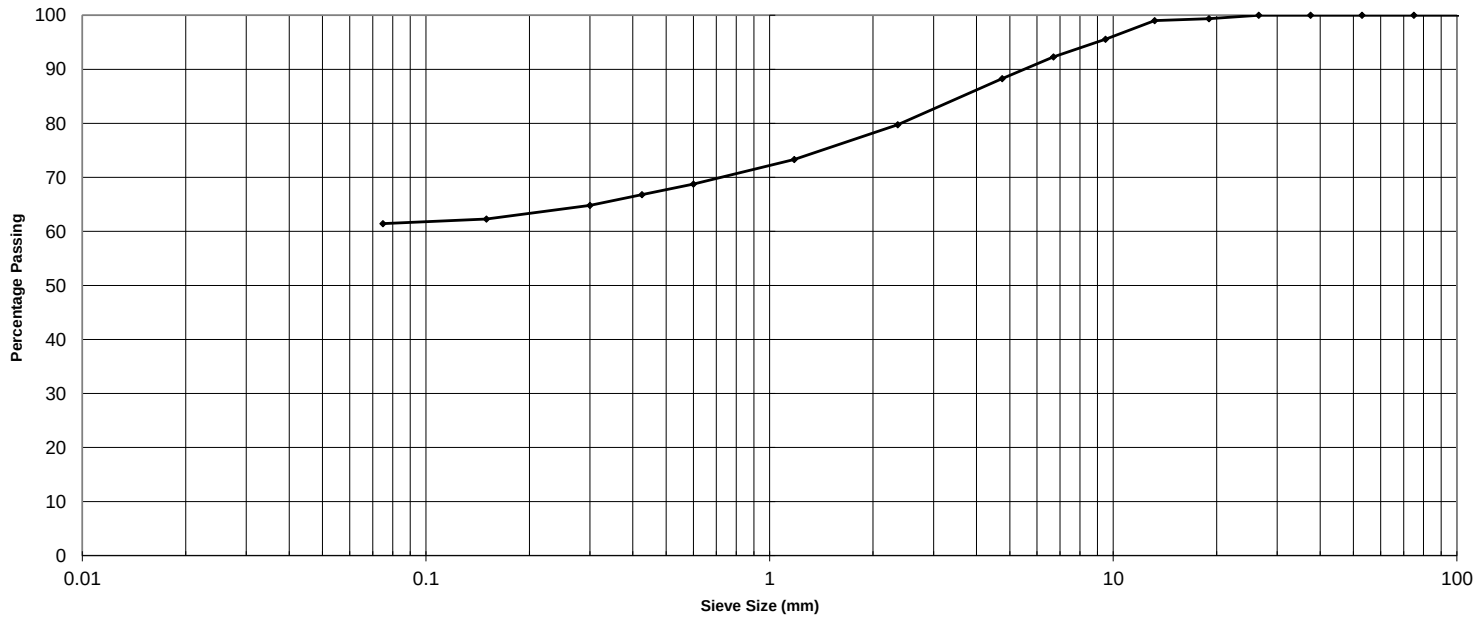
Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 9**
Report Date: 26/05/16
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
Page: 6 of 6

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**1606252**
ID No.:	17
Lot No.:	-
Date Sampled:	27/04/2016
Time Sampled:	am/pm
Date Tested:	23/05/2016
Material Source:	Insitu
Material Type:	Clay
To Be Used As	-
Sample Location :	TP42 0.8-1.0m Below Surface
Layer Depth (mm)	-
Test Depth (mm)	-
Sampling Method	Client Sampled
Moisture Content (%) AS 1289 2.1.1	30.2
Liquid Limit (%) AS 1289.3.1.2	63
Plastic Limit (%) AS 1289.3.2.1	38
Plasticity Index AS 1289.3.3.1	25
Linear Shrinkage (%) AS 1289.3.4.1	11.5
Cracking, Curling, Crumbling (1,2,3)	1, 2
P.I. x % Passing 0.425mm	1670
L.S. x % Passing 0.425mm	768
Ratio of % Passing (0.075/0.425)	0.92

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
					100	99	99	96	92	88	80	73	69	67	65	62	61

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: MH Grading Specification:

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No: CG.329.002

Issue Date: 19/02/2013

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

ATTERBERG LIMITS TEST REPORT

Customer: Tonkin + Taylor Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Southbank VIC 3205
Project: Lilydale Quarry
Location: Lilydale
Customer Order No.: 5064.001

Report Number: **308178** **- 10**
Report Date: 25/05/16
CT&T Order No: -

Testing performed and reported at our Dandenong South Laboratory

Sample No.:	**1606236**	**1606250**								
ID No.:	1	15								
Lot No.:	-	-								
Date Sampled:	26/04/2016	27/04/2016								
Time Sampled:	am/pm	am/pm								
Date Tested:	24/05/2016	26/05/2016								
Material Source:	Insitu	Insitu								
Material Type:	Clay	Siltt/Clay								
To Be Used As	-	-								
Sample Location :	TP1A 6.0m to 6.5m Below Surface	TP42 0.3m Below Surface								
Layer Depth (mm):	-	-								
Test Depth (mm):	-	-								
Sampling Procedure:	Client Sampled	Client Sampled								
Atterberg Tests										
Liquid Limit Method:	AS1289.3.1.2	AS1289.3.1.2								
Moisture Content Method:	AS 1289.2.1.1	AS 1289.2.1.1								
Preparation:	Dry Sieved	Dry Sieved								
Sample History	Oven Dried	Oven Dried								
Liquid Limit (%):	**35**	**23**								
Plastic Limit (%) AS 1289.3.2.1:	**19**	**17**								
Plasticity Index AS 1289.3.3.1:	16	6								
Linear Shrinkage (%) AS1289.3.4.1:	**9.0**	**1.5**								
Cracking, Curling, Crumbling (1,2,3):	2									

Remarks:

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No.: **CG.301.002**

Form Issue Date: 19/02/2013

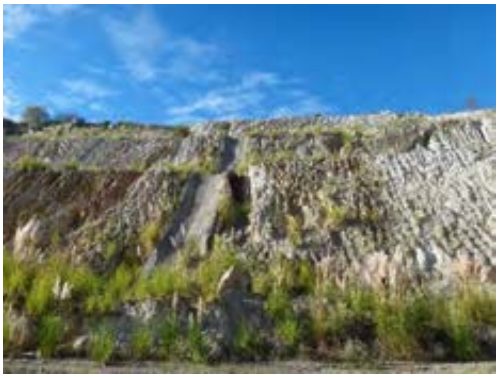
Appendix E: Preliminary Slope Stability Observations

- **Memo – 5064.014.M1**

Tonkin+Taylor

Memo

To:	Project Team	Job No:	5064.014
From:	David Glover	Date:	22 April 2016
Subject:	Lilydale Quarry - Preliminary Slope Stability Observations		

Area	Observation	Development Constraint	
Quarry pit	Benches appear to be stable with only a handful of blocks that have released.	Ongoing monitoring of benches. Exclusion area for pedestrians around toe of benches. A large overhang will need to be removed to allow safe fill placement.	
	Cave Hill Sandstone is erodible, with deep runnels on exposed batters and significant scour around drainage features.	Good earthworks practice to manage areas of erosion during filling works. Some slope trimming may be needed.	
	Some karst within the Lilydale Limestone, with a significant feature in the northwestern corner.	Extent of karst unknown but should be manageable during quarry filling works. Limestone does not appear to extend west beyond the railway.	

Area	Observation	Development Constraint	
	Regression of landslide within fill in southeastern corner.	Flatten slopes and control drainage to prevent further regression. Investigate if water is migrating from beneath the railway.	
	Existing landslides in eastern and northern quarry walls.	Trim slopes and control drainage to prevent regression during filling works.	
	Summary: most features already documented by others and no significant change. Existing karst, rockfall and landslide risk will need a management plan during filling works.		
Southern area	Slopes typically <10° Trees planted to create visual barrier.	Good hillside practice.	
	Area of erosion scarp identified by URS in 2007 now filled over and no longer evident.	Uncontrolled fill will require excavation. Scarp formation inferred to be due to runoff therefore adequate drainage measures will be required.	

Area	Observation	Development Constraint	
	Steeper area with slopes <17° but sandstone appears to be shallow and outcrops in places. Soil creep on steeper slopes.	Current EMO in area of steeper slopes where evidence of soil creep was noted. Depth of soil will require investigating. Deep seated landslide unlikely.	
	Soils eroded where uncontrolled discharge from drainage pipe – unknown source.	Soils will require protection from erosion.	
	Summary: Area covered by EMO likely to be difficult to develop due to steep slopes but unlikely to cause a significant stability issue due to shallow rock. Soil creep will continue and will be difficult to control – ongoing maintenance and visual amenity issue?		
Western area	Soil creep even on shallow slopes.	Limited control – adopt good hillside practice. Deep seated landslide unlikely.	
	Erosion of soils along drainage lines.	Erosion protection required as part of the drainage design.	

Area	Observation	Development Constraint	
	Colluvium filled channels exposed in haul road cutting immediately east of railway – evidence of ancient slope movement.	Variable soil types and potential for low shear strength.	
	Columnar basalt exposed in haul road cutting immediately east of railway.	Variable depth to rock, may affect footing and buried service design.	
	Overlying basaltic clay is reactive with desiccation cracks. Crest of cut slope east of railway shows arcuate marks indicating minor slumping.	Footing design for reactive sites. Shallow batters, adequate drainage measures.	
	Landslides in basaltic clay. Exact geometry unknown – is the toe beneath the embankment or does it extend into the quarry (obscured by fill)? Main slipped mass appears to be stable but minor failures active in back scarp.	Open space. Adequate drainage - no water impounding (retarding basins, wetlands etc). Appears unlikely to affect the railway embankment but needs investigating further.	

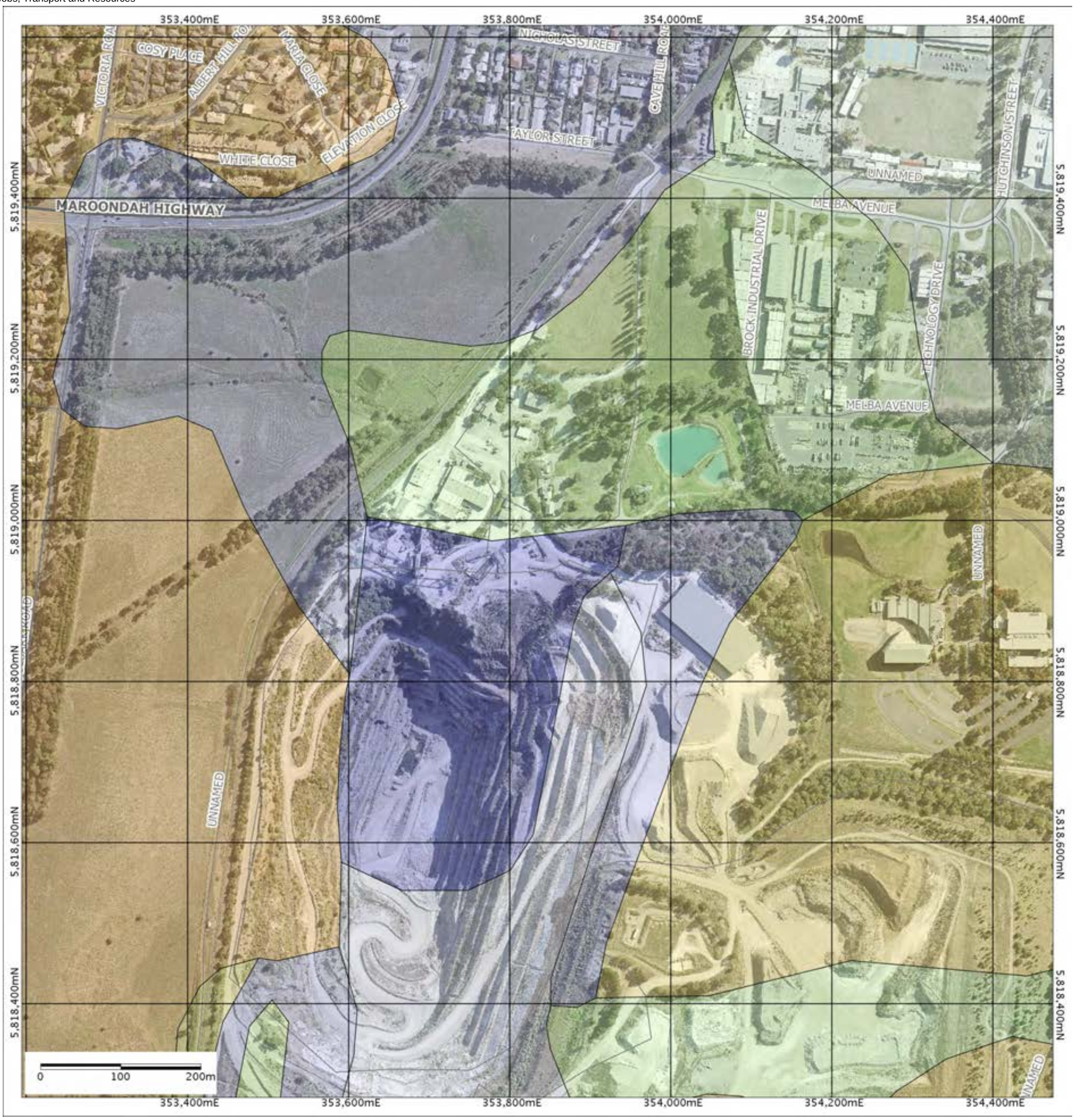
Area	Observation	Development Constraint	
	No culvert beneath railway at low point and within landslide zone. Possible influence on quarry pit landslide, depending on drainage path.	Water should not be allowed to pond against the embankment.	
	Summary: Slopes subject to soil creep with reactive basaltic clay influencing footing design and slope stability. Adequate drainage and good hillside practice should address most issues although further investigation is required in the area of the large landslide.		

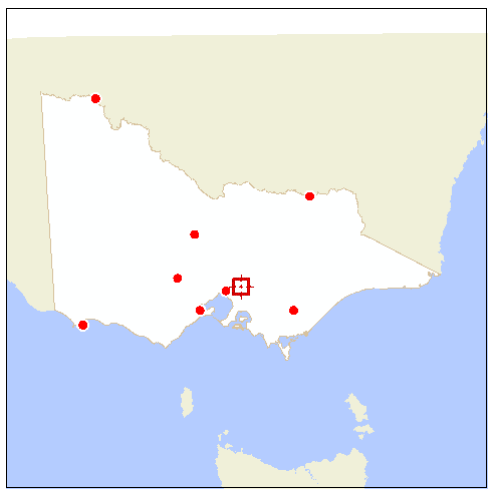
22-Apr-16
p:\5064\5064.0140\workingmaterial\memo.docx

Department of Economic Development,
Jobs, Transport and Resources

Lilydale Geology 1

GN MN





Legend

Towns (25K)

Victoria Boundary

Coastline

Boundary

GSV Shear Displacement Struc

GSV Geological Unit Contact (50K)

Roads (vmtrans)

Freeway

Highway

Main Road

Other

Map Scale: 1:5,000
Projection: MGA 55

Generated from GeoVic 3

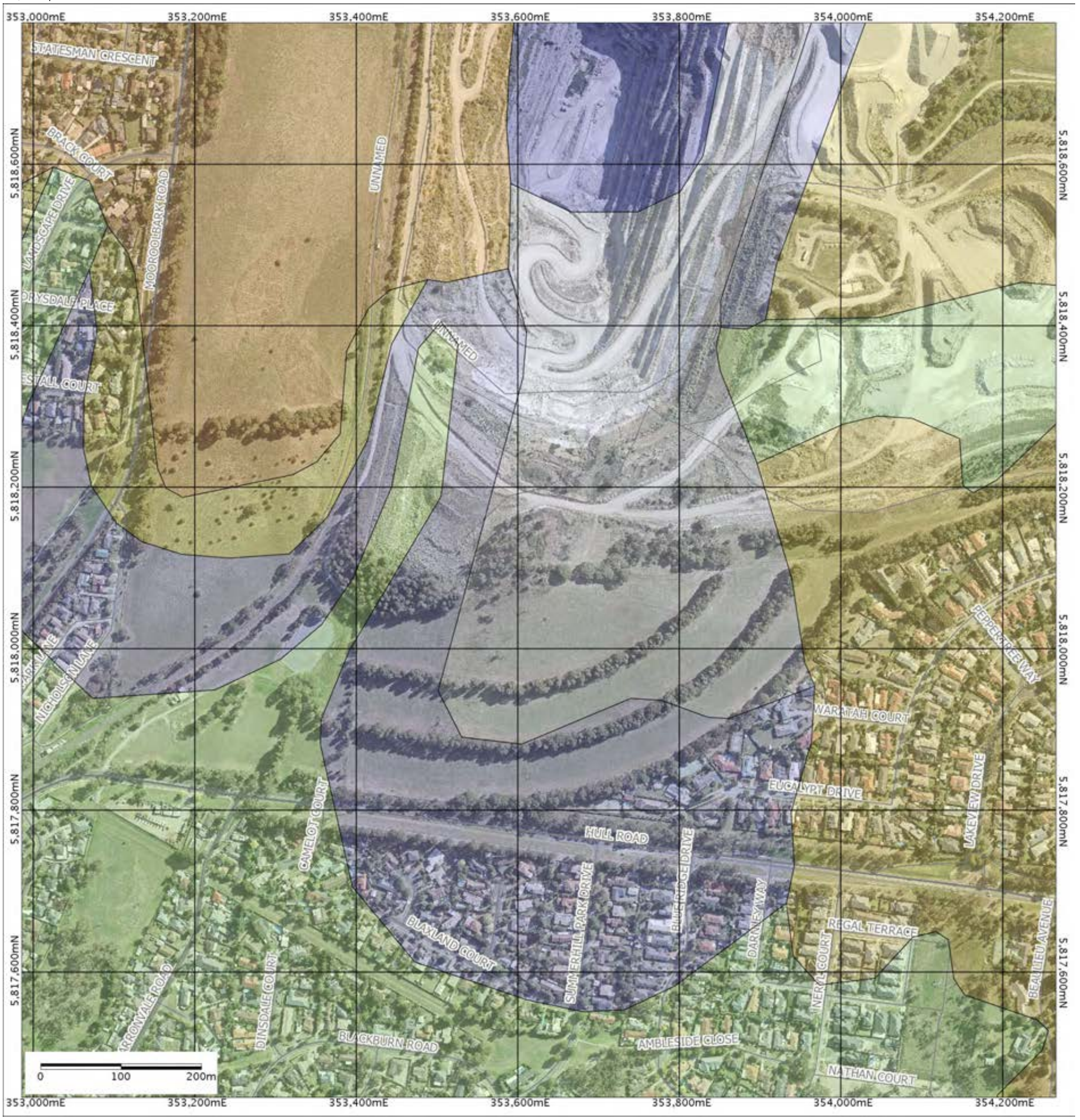
Map Created Fri Apr 22 2016 08:42:29 GMT+1000 (AEST)

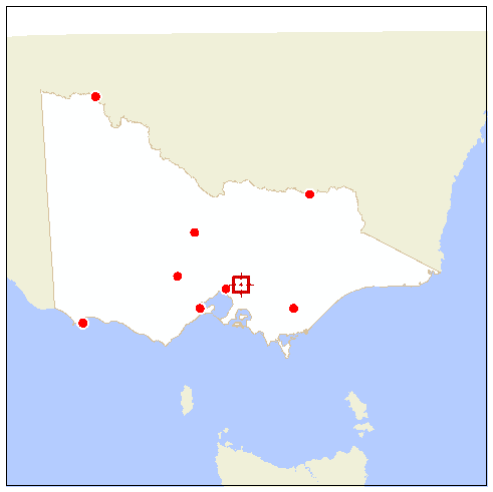
GDA

VICTORIA State Government

Department of Economic Development,
Jobs, Transport and Resources

Lilydale Geology 2





Legend

Towns (25K)

Victoria Boundary

Coastline

Boundary

GSV Shear Displacement Struc

GSV Geological Unit Contact (50K)

Roads (vmtrans)

Freeway

Highway

Main Road

Other

Map Scale: 1:5,000
Projection: MGA 55

Generated from GeoVic 3

Map Created Fri Apr 22 2016 09:12:28 GMT+1000 (AEST)

www.tonkintaylor.com.au

Appendix C: Geotechnical assessment of fill compressibility and potential settlement

REPORT

Tonkin+Taylor

Lilydale Quarry

Geotechnical Assessment of Fill Settlement

Prepared for
Hume Lilydale Pty Ltd & LBJ Corporation Pty Ltd
Prepared by
Tonkin & Taylor Pty Ltd
Date
July 2018
Job Number
1000511.R3.v2

Exceptional thinking together
www.tonkintaylor.com.au

Document Control

Title: Lilydale Quarry					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
June 18	1	Draft	D Glover D Yang	R Olds	T Chadwick
July 18	1	Final	D Glover D Yang	R Olds	T Chadwick
July 2018	2	Final	D Glover D Yang	R Olds	T Chadwick

Distribution:

Hume Lilydale Pty Ltd & LBJ Corporation Pty Ltd	1 pdf copy
Intrapac Property Pty Ltd	1 pdf copy
Tonkin & Taylor Pty Ltd (FILE)	1 copy

Table of contents

1 Introduction

Hume Lilydale Pty Ltd & LBJ Corporation Pty Ltd have engaged Tonkin & Taylor Pty Ltd (T+T) to provide geotechnical advice for the backfilling of Lilydale Quarry.

The general objectives of the quarry filling can be summarised as:

- To remove the existing soil stockpiles from the site so that development of land around the quarry pit can proceed on natural ground.
- To fill the quarry pit to a standard that will limit post construction settlement so that future development on parts of the fill may be able to take place sometime after filling is completed.

The Master Plan for the Lilydale Quarry redevelopment envisages that the former quarry area will encompass both public facilities, such as roads, infrastructure and open space, as well as private development comprising a mix of residential and commercial uses on the filled land.

Land for public facilities such as roads and parks will be assessed against the T+T Fill Performance Criteria[1]. The Fill Performance Criteria have necessarily been agreed upfront so that the developers of the land may undertake the site rehabilitation works with certainty that if the performance requirements are met, this land cannot be excluded from development for public purposes on the question of geotechnical performance.

The agreed Fill Performance Criteria must:

a be demonstrated to be likely to be met prior to Yarra Ranges Council (YRC) granting planning approval for any public roads or open space within the quarry zone; and

b actually be met as a precondition of transferring reserves to YRC for public open space and council roads.

The type and scale of built-form development that can be constructed across the former quarry area will be determined in part by the actual settlement observations in the filled quarry area upon completion. Any applications for residential or commercial development in this zone will be accompanied by suitable geotechnical information describing the use and the ability of the ground and foundation systems to deal with the actual conditions encountered at the time.

Whilst highly unlikely, it also remains possible that despite reasonable efforts to achieve suitable fill performance, the actual measured settlement is excessive, and the land may be left as undeveloped open space for an extended period.

YRC has requested further information on how the fill will be placed and compacted to achieve the requirements of the Fill Performance Criteria report and set the land up for the potential of further built-form development.

This document presents the technical findings of laboratory testing carried out prior to filling being commenced, including a settlement assessment and initial recommendations for placement of the filling. It should be read in conjunction with the T+T Hydrogeological Assessment[2], Development Constraints Assessment[3], and Contamination Management Plan[4].

Regular reports will be provided documenting the actual construction activities and testing on a quarterly basis. The reports will also incorporate settlement monitoring results once it commences.

[1] Tonkin & Taylor Pty Ltd (December 2017) Lilydale Quarry Fill Performance Criteria. Report ref. 1000511.R2.v8.
[2] Tonkin & Taylor Pty Ltd (June 2018) Lilydale Quarry Hydrogeological Assessment. Report ref. 1000511.R4.v1.
[3] Tonkin & Taylor Pty Ltd (January 2018) Development Constraints Assessment, Former Lilydale Quarry. Report ref. 20180115.rko.1000511.R01.
[4] Tonkin & Taylor Pty Ltd (June 2018) Contamination Management Plan – Rehabilitation Works, Former Lilydale Quarry. Report ref. 1000511.rko.20180522.CMP.R01.

Prior to development, the settlement monitoring data will be analysed and the settlement predictions detailed in this report will be updated against actual readings.

2 Background

Up to 110 m thickness of fill is to be placed within the quarry pit. It is important to understand how the fill will behave both during placement and compaction, and also following completion of the earthworks.

Groundwater levels are currently depressed by pumping from a sump in the base of the quarry pit, which has been carried out for many decades. Ultimately, pumping will cease and groundwater levels will be allowed to return to "normal" levels. Current estimates suggest the groundwater will rebound to approximately RL 88 m AHD which is approximately 80m above the existing groundwater level. As groundwater levels rise, the fill will become saturated. The settlement of the fill will therefore most likely consist of three components:

- Settlement due to self-weight compaction.
- Settlement due to wetting.
- Settlement due to long term creep.

The settlement behaviour of the fill can be investigated in a number of ways, such as laboratory tests, field tests, case histories and theoretical predictions. This report discusses and summarizes the key findings from laboratory tests carried out on samples of the stockpiled soils, a review of literature related to case histories of other filled sites and analytical predictions.

A programme of settlement monitoring will be implemented as part of the filling works and the results will be compared with the predicted models to allow updating of settlement predictions as filling proceeds.

3 Existing information

3.1 Literature review

There are numerous reports, papers, and guidance documents on the engineering behaviour of deep fill. This section is not intended to represent a comprehensive review of all relevant documents, but provides a summary of some of the documents reviewed. These include:

i Sowers, G.F. et al (1965) Compressibility of broken rock and the settlement of rockfills. 1965) Compressibility of broken rock and settlement of rockfills. Proceedings of the 6th International Conference on Soil Mechanics and Foundation Engineering, Montreal, Canada, vol. 2, pp. 561 – 565.

ii Brandon et al (1990) Hydrocompression settlement of deep fills. J. Geotech. Engrg. 1990. 116: 1536-1548.

iii Lawton, E.C. et al (1992) Review of wetting-induced collapse in compacted soil. J. Geotech. Engrg. 1992. 118(9): 1376-1394.

iv Charles, J.A. & Watts, K.S. (2001) Building on fill: geotechnical aspects (2nd ed.) BRE.

v Nwabuokei, S.O. & Lovell, C.W. (1986) Compressibility and settlement of compacted fills. Consolidation of soils: testing and evaluation. STP 892. Young, R.N. & Townsend, F.C. (Eds.)

vi Waddell, P.J. & Wong P.K. (2005) Settlement characteristics of deep engineered fills. Australian Geomechanics Vol 40 No 4 December 2005.

vii Colls, S. et al (2010) Settlement behaviour of deep engineered fill former basalt quarry, Niddrie, Victoria. Australian Geomechanics Vol 45 No 1 March 2010.

viii Waddell, P.J. (2012) Design, prediction and monitoring of deep fill settlement. Geotechnical Engineering Vol 166 Issue GE4. ICE Publishing.

The various documents indicate that the behaviour of deep fill subjected to rising groundwater is very complicated and involves partially saturated soil mechanics, and very high effective stresses where typical saturated soil mechanics theory may no longer be applicable. The factors include; reduction in matrix suction, clay content and plasticity of the clay, soil fabric, and moisture content and density during compaction. However, the studies were also consistent in their assessment that lower densities and higher moisture contents typically resulted in higher levels of settlement.

3.2 T+T investigation

The purpose of the testing carried out by T+T was to investigate the settlement behaviour of the stockpiled soils under the expected maximum surcharge pressures (greatest depth of fill) and in response to the recovering groundwater level.

Samples were prepared at compaction levels that would allow comparison with the literature review as well as at higher levels.

A total of five bulk samples were obtained from the areas known as the Eastern Stockpile and Southern Stockpile. The samples were considered to be representative of the majority of soils that were visible within the stockpile areas. Each bulk sample was subjected to classification tests and then sub-sampled, giving a total of twenty three sub-samples. The sub-samples were compacted to densities between 90% and 110% of Standard maximum dry density and 1-dimensional consolidation tests carried out. The consolidation tests were carried out to a maximum applied pressure of 1,600 kPa to represent the likely in situ effective stress conditions that the fill would be subjected to. The load increments were applied with the sample in a dry state, up to the maximum applied pressure. The sample was then inundated with water to model saturation from groundwater.

The test results are presented in Appendix A.

4 Settlement analysis

4.1 Analysis of existing data

The stockpiled soils were generally cohesive and ranged from clay to gravelly clay. As identified in section 3.2 above, a total of twenty three sub-samples (from the five parent samples) were prepared for oedometer tests with a range of moisture contents and dry densities.

The test results were used to assess if there was a trend in compression ratio (CR), preconsolidation pressure (p_c') and collapse compression ratio (CCR) due to water wetting ($CCR = \Delta e_w/(1+e_0)$). The results of this analysis are presented in Table 4.1 below.

Table 4.1: Oedometer test results

Test No.	Soil Type	Initial Moisture Content (%)	Initial Void Ratio (e_0)	Collapse Compression Ratio (%)	Maximum Dry Density (t/m^3)	Initial Unit Weight (t/m^3)	Initial Dry Density (t/m^3)	Compression Ratio	Preconsolidation Pressure (kPa)
1	Clay	18.9	0.700	0	1.75	1.86	1.564	0.109	80
2		17.7	0.416	0.141		2.16	1.835	0.073	170
3		19.9	0.630	0		1.94	1.618	0.115	130
4		17.2	0.396	0.229		2.18	1.86	0.059	65
5		16.0	0.363	0.734		2.22	1.914	-	1600
6	Gravelly Clay	21	0.749	8.29	1.62	1.78	1.471	0.137	520
7		21.6	0.666	6.098		1.88	1.546	0.098	480
8		21.7	0.563	0.448		1.97	1.619	0.156	470
9		19.9	0.49	0.47		2.05	1.71	0.119	500
10		20	0.466	0		2.12	1.767	0.053	820
11		20	0.435	0		2.11	1.758	0.083	560
12		20	0.435	0		2.11	1.758	0.083	510
13	Gravelly Clay	19.2	0.52	0.132	1.657	2.08	1.745	0.046	420
14		19.1	0.514	0		2.08	1.746	0.048	400
15		18.9	0.457	0.686		2.14	1.8	-	1600
16	Clay	21.3	0.547	0.543	1.592	2.01	1.657	-	1600
17		21	0.505	0.439		2.09	1.727	-	1600
18	Silty Clay	25	0.788	11.275	1.572	1.77	1.416	-	1600
19		24.5	0.745	6.831		1.85	1.486	0.061	500
20		25.1	0.652	5.666		1.95	1.559	-	1600
21		23	0.661	6.309		1.83	1.488	0.079	300
22		24.2	0.624	4.926		1.94	1.562	0.046	250
23		24.1	0.567	0.689		2.05	1.652	0.047	250

It is important to understand that the collapse compression ratios due to wetting presented in Table 4.1 are the measured values under a test vertical pressure of 1.6 MPa, and actual values in the field would vary with the applied vertical pressure resulting from different fill depths.

The plots for CR, CCR, and p_c' against initial dry density are presented in Figure 4.1, Figure 4.2 and Figure 4.3, respectively.

Figure 4.1: Plot of Compression Ratio versus Initial Dry Density

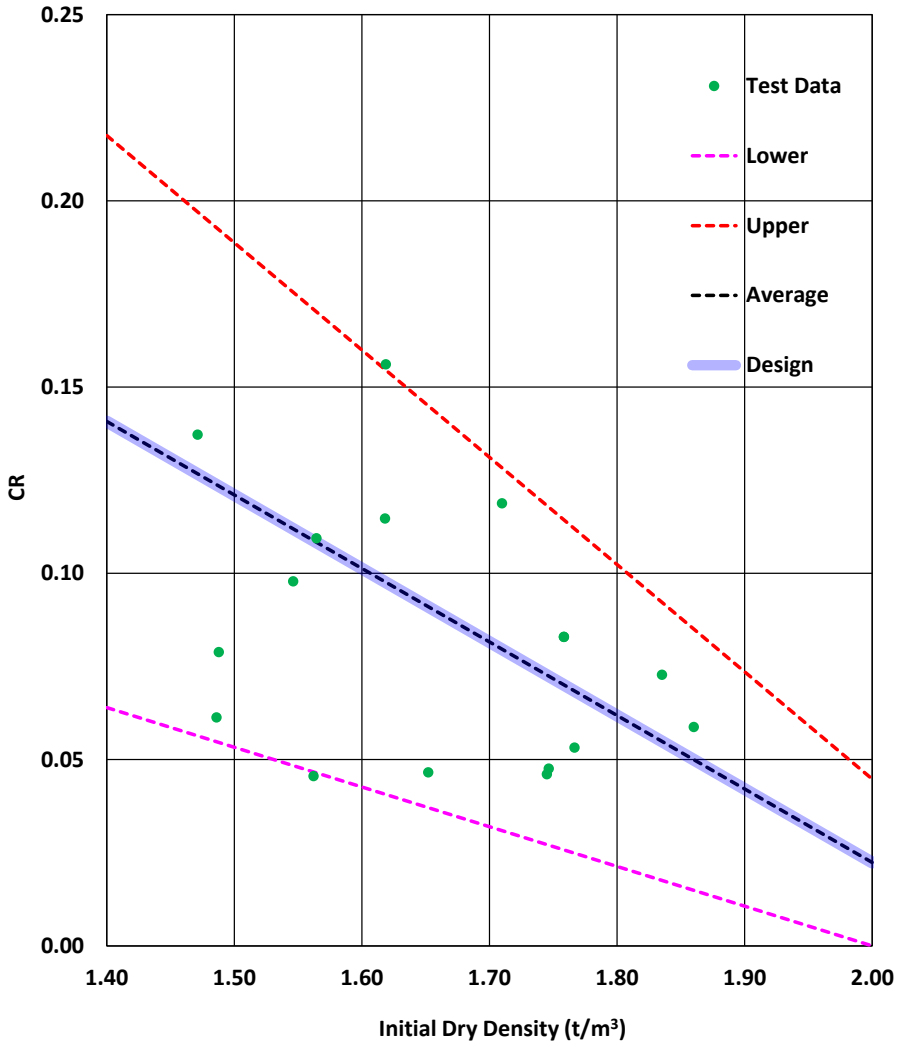


Figure 4.2: Plot of Collapse Compression Ratio versus Initial Dry Density

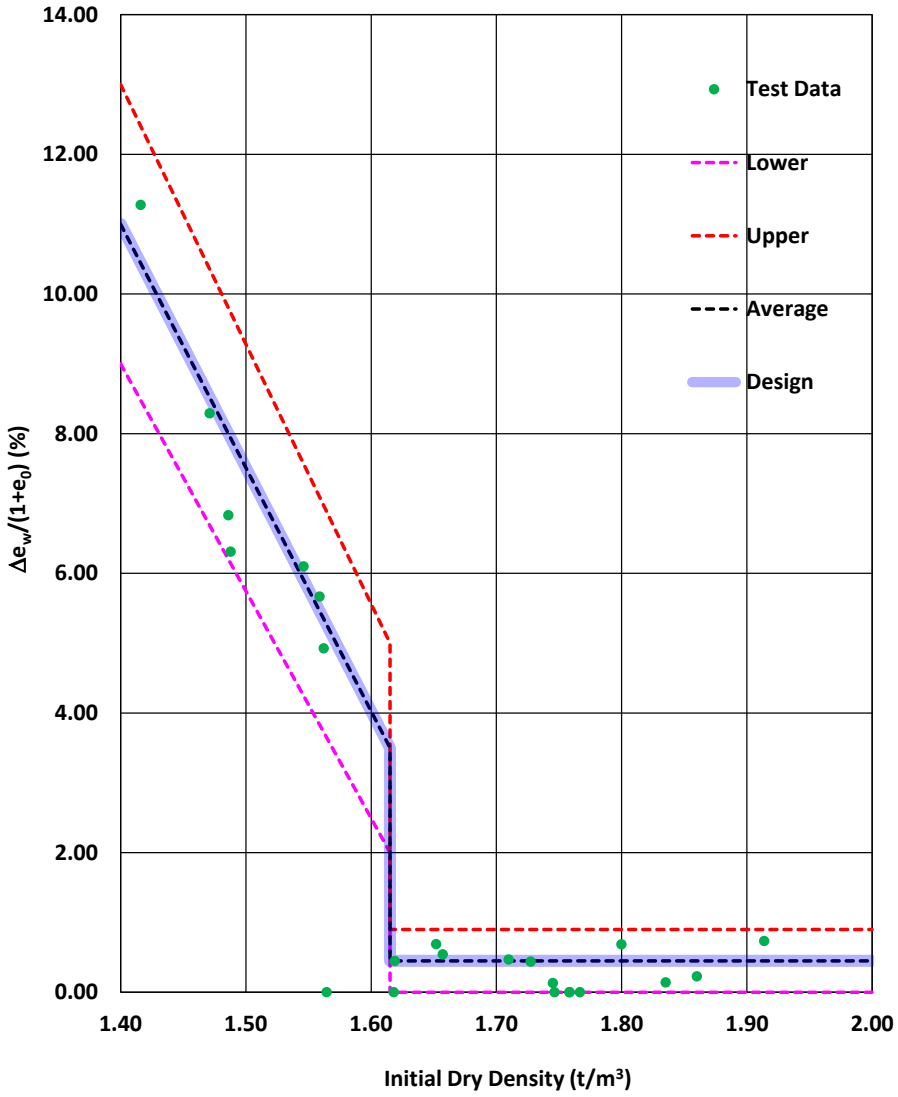
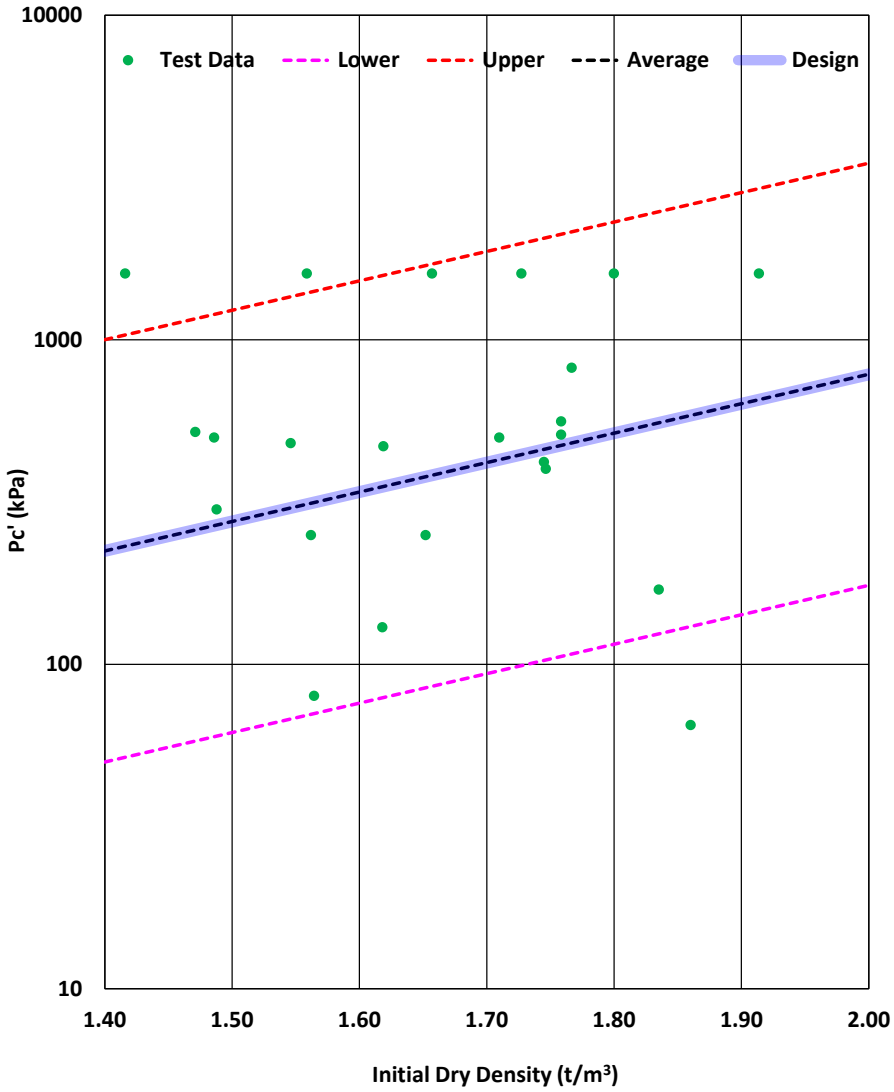


Figure 4.3: Plot of Preconsolidation Pressure versus Initial Dry Density



Significant scatter was observed within the test data, likely due to the natural variability of the soil within the stockpiles. Figure 4.2 shows that the CCR drops significantly to 0.45% when the initial dry density of the fill material is compacted to dry density greater than 1.62 t/m3. From observations, the characteristic of the CCR due to wetting is very much dependent on the initial dry density.

Despite the test data scatter, general trends and relationships are still evident for CR, CCR, and pc'.

$$CR = 0.417 - 0.197\gamma_{d,0} \quad [4.1]$$

$$CCR = 0.598 - 0.349\gamma_{d,0} \quad \text{(where } \gamma_{d,0} \leq 1.62 \text{ t/m}^3\text{)} \quad [4.2a]$$

$$CCR = 0.0045 \quad \text{(where } \gamma_{d,0} > 1.62 \text{ t/m}^3\text{)} \quad [4.2b]$$

$$LOG(p_c') = LOG(12.002) + 0.907\gamma_{d,0} \quad [4.3]$$

Where, $\gamma_{d,0}$ is the initial dry density in t/m^3.

These relationships have been used in the settlement predictions described in the section below. However it needs to be recognised that the samples tested only represent the finer portion of the material taken from stockpiles. The coarse component was removed as the samples are only 19mm in height. The coarser fraction can be expected to reduce the settlement estimates made from the oedometer tests.

4.2 Settlement predictions

4.2.1 General

As discussed above, the settlement of the earth fill in the pit will most likely consist of three components; settlement due to self-weight compaction, settlement due to wetting as groundwater rises, and long term creep settlement. This section assesses the three settlement components during and after filling.

4.2.2 Settlement due to self-weight compaction

Earth fill will deform and settle under the weight of fill placed above, and will settle together with the underlying fill material. This will occur even for well compacted fill, but to a much lesser extent than for poorly compacted fill.

The laboratory tests show the compacted samples to exhibit typical consolidation behaviour, with an inherent pre-consolidation pressure that controls when the sample yields under external applied pressure. This inherent pre-consolidation pressure is dependent on the material type, the compaction energy applied, and the initial moisture content. As the load increments were increased while the samples were “dry”, the samples would still be partially saturated, and voids would contain both air and water before testing. The samples would start to yield once the applied pressure exceeds the pre-consolidation pressure, and significant excessive pore water pressure would also be developed as the applied pressure increases.

It was also observed from the permeability tests that the partially saturated samples were generally of low permeability. In theory, therefore, the dissipation of the excessive pore water pressure should be very slow, however, our observations from the oedometer tests was that the rate of consolidation was much quicker than expected. This abnormal behaviour may be attributed to the following two factors:

1 The presence of the air allows the sample to be compressed quickly.

2 The water within the sample was not free water, but was bonded to the clay mineral structure, and therefore not mobile.

In this assessment, only the total settlement due to self-weight compression has been assessed. Prediction of associated excessive pore water pressure and its dissipation has not been carried out as prediction of excess pore pressure generation in unsaturated soil is very dependent on many factors including recovery of groundwater. But offsetting the impact of any excess pore pressure is the reduction in effective stress created by this pore pressure and the associated rebound or reduction in settlement under lower stress. Due to the complexity of these interactions the net contribution to settlement has been ignored for the purposes of this report.

The test results have been used to calculate the one dimensional consolidation of the fill for a typical section through the quarry pit, considering various fill thicknesses. Both the total settlement due to self-weight compression and the estimated measurable settlement on the site were assessed, and the results are presented in Figures 4.4 and 4.5 respectively. Figure 4.5 shows the expected extensometer profile that could be measured using typical settlement plates, extensometers or horizontal settlement profilers.

Based on the available in situ density testing, the fill materials have been compacted above the Standard maximum dry density, with an average dry density of 2.027 t/m^3 and a standard deviation of 0.158 t/m^3. The average dry density minus one standard derivation (1.869 t/m^3) was adopted for the settlement estimates. Using Equations 4.1 and 4.2 (Section 4.1, above) the compression ratio (CR) and pre-consolidation pressure (p_c’) were estimated to be 0.048 and 595kPa, respectively. The

recompression ratio (CRR) was obtained by adopting a ratio of 0.15 for CRR / CR, giving an estimated value of 0.0072.

From Figures 4.4 and 4.5, the total settlement due to self-weight compaction is estimated to be in the order of 2.2 m, although the majority of this settlement is expected to occur during construction. It is also expected that some differential settlement will occur across the section, particularly where the fill thickness varies significantly over a short distance.

Figure 4.4: Plot of ground profile and total settlement versus horizontal distance.

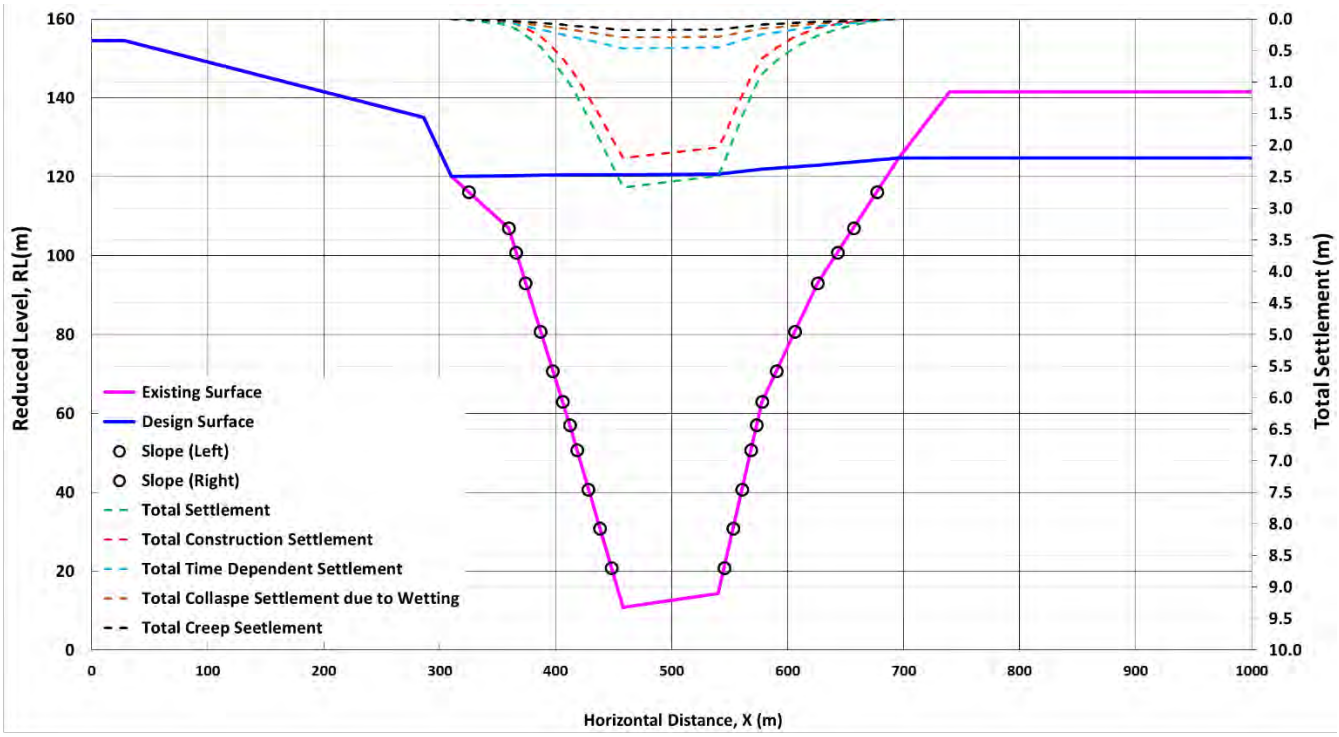
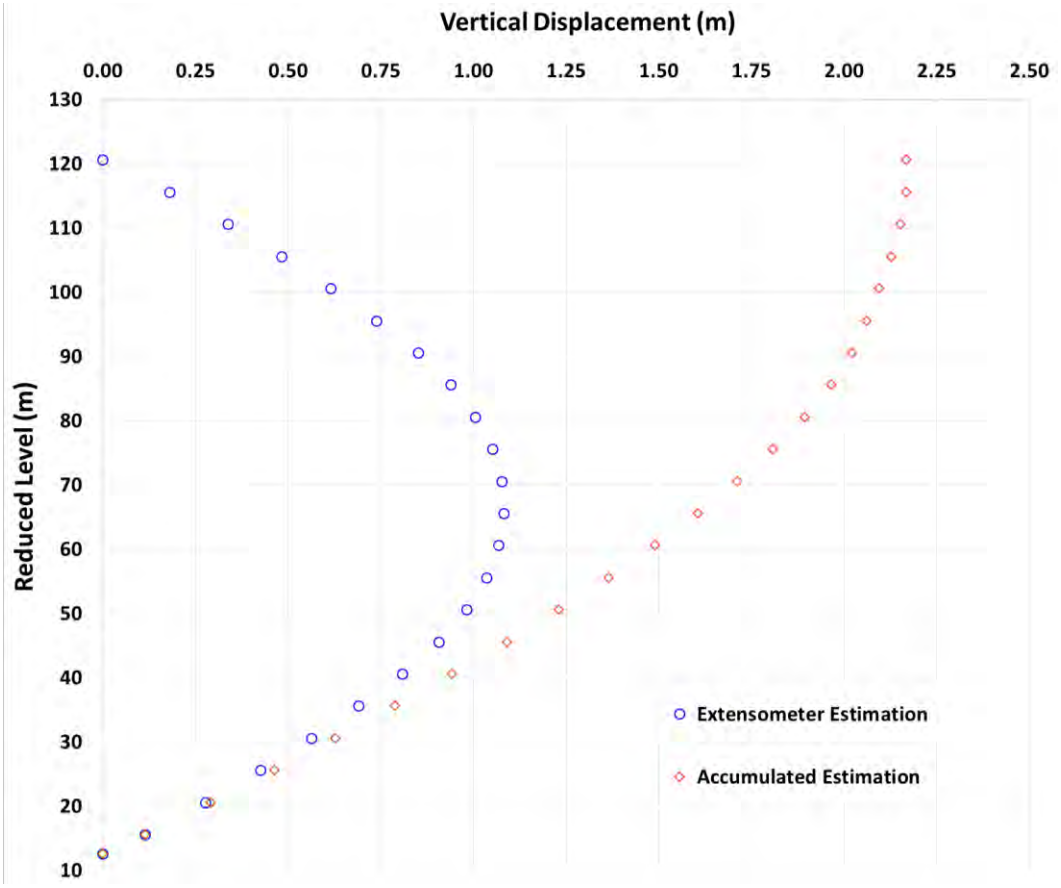


Figure 4.5: Plot of vertical displacement versus reduced level at end of construction.



4.2.3 Settlement due to wetting from groundwater rebound

Once pumping ceases, groundwater is expected to rise slowly to approximately 88 m AHD. As a result, the fill within the pit will eventually become fully saturated. The time for the fill to achieve full saturation is dependent predominantly on the permeability of the compacted material, the presence of drainage paths, and the time taken for groundwater to recharge outside the pit walls.

The total collapse settlement due to wetting is a function of the collapse compression ratio, thickness of fill, and heave, and can be estimated from:

$$Collapse\ settlement = CCR \times Fill\ Thickness - Heave$$

The estimated maximum total collapse settlement due to wetting is estimated to be approximately 0.3 m. The settlement will occur as the groundwater level rises, which has been estimated to take in the order of twenty years.

4.2.4 Settlement from long term creep

Creep settlement of fill is likely to occur even in granular soils. Creep settlement would occur after completion of filling, and can be estimated from:

$$Creep\ settlement = c_{\propto e} \times Fill\ Thickness \times LOG\left({}^{(t_2 + t_1)}/_{t_1}\right)$$

Where; t_2 is the design life, t_1 is the time between completion of filling and commencement of construction, and $c_{\alpha e}$=3% of CR.

Assuming creep commences at the end of construction, it is estimated that approximately 0.5m of settlement will occur over the next 50 years.

4.2.5 Total settlement

Based on the assumption that creep and collapse due to groundwater commence at the end of construction, it is estimated that settlement in the order of 0.8 m will occur over the next 50 years. Depending on the design settlement for the facilities to be built and the method of construction, a delay is likely to be required after filling to allow for some of this settlement to take place.

If it assumed that construction is delayed for 5 years after filling, the modelling estimates that design settlement of approximately 300 mm will occur over a 50 year design life. This will be a mixture of creep and groundwater induced settlement. The actual delay time will be determined based on actual performance of the settlement as measured and the design settlement criteria which are required to be met for the asset types to be constructed in different parts of the filled area.

The maximum combined settlement for the 50 years post commencement of filling is therefore estimated to be in the order of 3 m (2.2 m + 0.8 m). The settlement estimates presented here are preliminary and subject to verification by field measurements. Back analysis should be carried out using in situ field measurements to revise key design parameters. A further review of the settlement predictions will be undertaken as settlement is measured during construction, to allow calibration of the model and improved confidence in settlement estimates.

As the current estimates are based on limited laboratory data, the settlement estimates within this report should only be used as a guide for the magnitudes expected both during and following the filling works.

4.2.6 Design of structures

If the masterplan development is to proceed then structures and the supporting services will need to be designed to accommodate the predicted total and differential settlement. For the reasons outlined in this report it is premature to confidently predict what this design will require and how long it will take for settlement to reach acceptable levels prior to construction.

However assuming that settlement monitoring provides confidence that the development can proceed, a variety of concepts will be considered in designing structures to accommodate the predicted settlement. These concepts could include one or more of the following;

- Surcharging of the fill in areas of proposed development
- Use of basements to unload the fill under structures
- Stiffened raft foundations to reduce differential settlement in the structures
- Piling to quarry benches at the quarry perimeter
- Flexible service connections to accommodate differential movements

Such designs will be undertaken to meet all appropriate design and construction standards for the structures proposed.

The settlement monitoring of the fill will be crucial in gaining confidence in future settlement predictions. Settlement will be measured at different levels in the filling using a variety of methods and at the finished surface. Results will be gathered at a regular frequency so that reliable data is available to analyse and from which to make predictions.

5 Recommendations for fill placement

Based on the assessment undertaken it is evident that the compressibility of the fill and hence its long term settlement behaviour can be strongly influenced by the density of the filling. Therefore it is recommended that for the initial placement of filling, the following specification be adopted. This should be reviewed as construction progresses.

- No boulders greater than 300 mm.
- Fill to be placed in maximum 400 mm loose layers
- Fill to be compacted using a combination of Cat 825 compactor, Bomag vibrating pad foot roller, and Bomag vibrating flat drum roller. Passes to be determined based on a site trial, but currently set at a minimum of 8 passes of the Cat 825 compactor.
- Dry Density Ratio of the fill to be targeted at 105% Standard with average dry density ratio of the compacted fill to be no less than 101% Standard and no individual test results less than 98% Standard.
- The material should be placed dry of Standard optimum Moisture Content to assist in maximising density. If density fails due to moisture then material must be dried before recompacting.

6 Conclusions

The settlement behaviour of deep fill is complex and dependent on a number of variables. Broadly speaking, the settlement can be separated into three main components; self-weight compaction, wetting induced settlement, and creep settlement.

Much of the settlement resulting from self-weight compaction is likely to occur during the filling works, while the wetting induced settlement and creep settlement are time dependent. Preliminary estimates indicate the settlement from self-weight compaction could be in the order of 2.2 m, and the time dependent settlement could be up to 0.8 m over 50 years, giving a total settlement in the order of 3 m.

The modelling suggests that if construction of assets is delayed for 5 years post filling, settlement of approximately 300 mm could occur over the subsequent 50-year design life. This is indicative only and will vary based on actual performance of the fill, the assets being developed on the fill, the delay time between completing the filling and constructing assets on the fill, and any other actions taken to mitigate the effects of settlement on the assets.

The estimates are preliminary and based on a limited number of laboratory tests. It is recommended that back analysis is carried out using data from in situ field measurements, and the prediction models updated and refined based on actual settlement values. By the time construction is complete the model will be updated using actual settlement and pore pressure measurement data. This will provide more confidence in settlement predictions for design of assets.

7 Applicability

This report has been prepared for the exclusive use of our client Hume Lilydale Pty Ltd & LBJ Corporation Pty Ltd, 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.

Tonkin & Taylor Pty Ltd

Report prepared by:	Authorised for Tonkin & Taylor Pty Ltd by:
.....	.....
David Glover	Tim Chadwick
Senior Geotechnical Engineer	Project Director

DYA / DRG

\\meldc1\corporate\south melbourne\projects\1000511\workingmaterial\stockpile sampling\1000511.r3v2.docx

Appendix A: NATA test reports

CHADWICK GEOTECHNICS

Dandenong South
ACN 143 009 330
25 Metcalf Street
DANDENONG SOUTH, VIC 3175

Ph: + 61 3 8796 7900
Fax: +61 3 9706 9431

Report No: MDD:S17DS-04895
Issue No: 1

Maximum Dry Density Report

Client: Tonkin & Taylor (Aus) Pty Limited
Address: Ground Floor
SOUTH MELBOURNE VIC 3006
Project: Lilydale Quarry Prelim Testing
Project No.: 1004145
Order No.: **CG Request No.:**
TRN: **Lot No.:**

Accredited for compliance with ISO/IEC 17025 – Testing

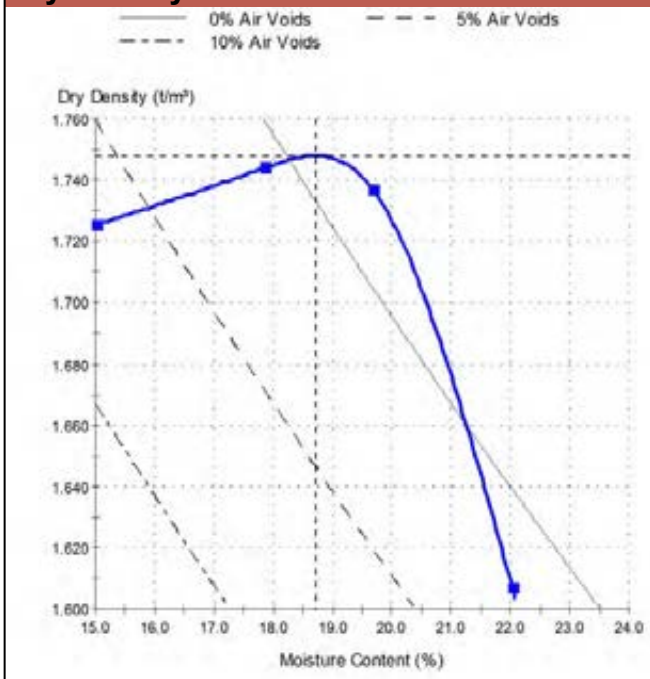
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: J. Lamont
(Melbourne Lab Supervisor)
12712 Date of Issue: 14/11/2017

Sample Details

Location: Infer Cavehill Formation Overburden TP17-01 0.1-0.4
Sample ID: S17DS-04895 **Date Sampled:** 8/08/2017
Sampling Method: AS1289.1.2.1 Clause 6.5.3
Source: Onsite **Material:** General Fill
Specification: AS Grading
Location: TP17-01 , 0.0-0.4, As Received
Tested By: M. Longfield **Date Tested:** 17/08/2017

Dry Density - Moisture Content Relationship



Test Results

AS 1289.5.1.1
Standard MDD (t/m³): 1.75
Standard OMC (%): 18.5

Date/Time Cure Start: 12/ 08/ 2017 00:00
Date/Time Cure End: 17/ 08/ 2017 00:00

Comments

Chadwick Geotechnics

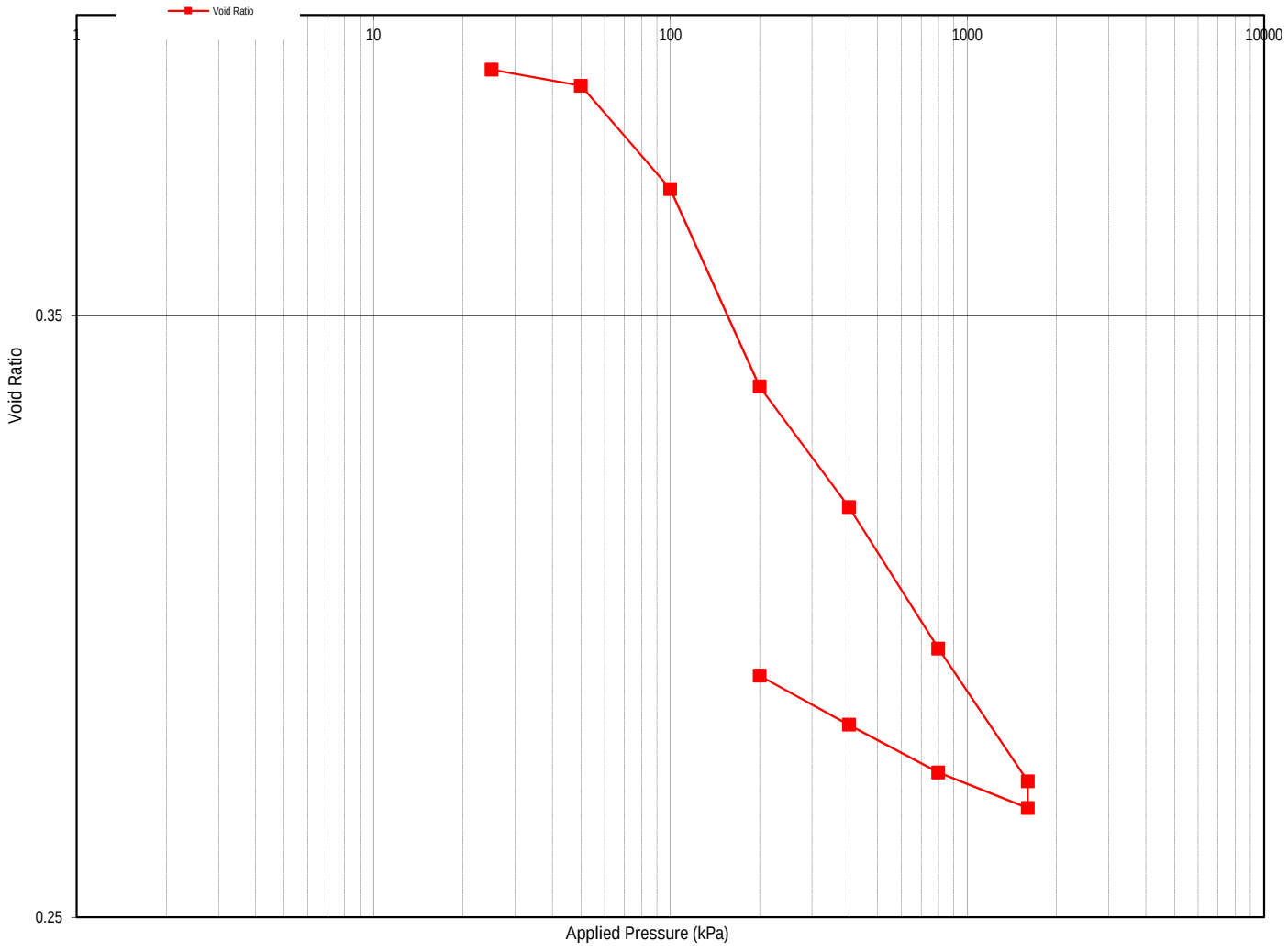
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04897
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	16/11/2017
		Report Date:	30/11/2017
Client Id.:	TP17-01	**Depth (m):**	0.0 - 0.4m
Description:	Clay		



Wet Density (t/m^3):	2.18	Initial Moisture (%):	17.2	Test Condition:	Inundated on 1600 KPa
Particle Density (t/m^3):	2.62	Final Moisture (%):	16.2	Initial Voids Ratio:	0.396
Remarks:	Remoulded at 95% OMC and 110% SMDD			Initial Degree of Saturation (%):	114.3

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04897
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	16/11/2017
		Report Date:	30/11/2017
Client Id.:	TP17-01	**Depth (m):**	0.0 - 0.4m
Description:	Clay		

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	3.90	-	0.153	0.70	0.4
2	25-50	0.009	11.82	-	0.077	0.73	0.6
3	50-100	0.057	0.02	-	0.247	11.10	1.8
4	100-200	0.109	0.01	-	0.239	19.01	4.2
5	200-400	0.067	0.01	-	0.075	6.75	5.6
6	400-800	0.078	0.01	-	0.045	9.75	7.3
7	800-1600	0.073	0.05	-	0.021	6.11	8.9
8	1600-1600	-	0.37	-	-	0.94	9.2
9	1600-800	0.020	-	-	0.006	-	8.7
10	800-400	0.026	-	-	0.016	-	8.2
11	400-200	0.027	-	-	0.032	-	7.6

Remarks: MDD: 1.75 t/m3, OMC: 18.7%, DR: 106%, MR: 92%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

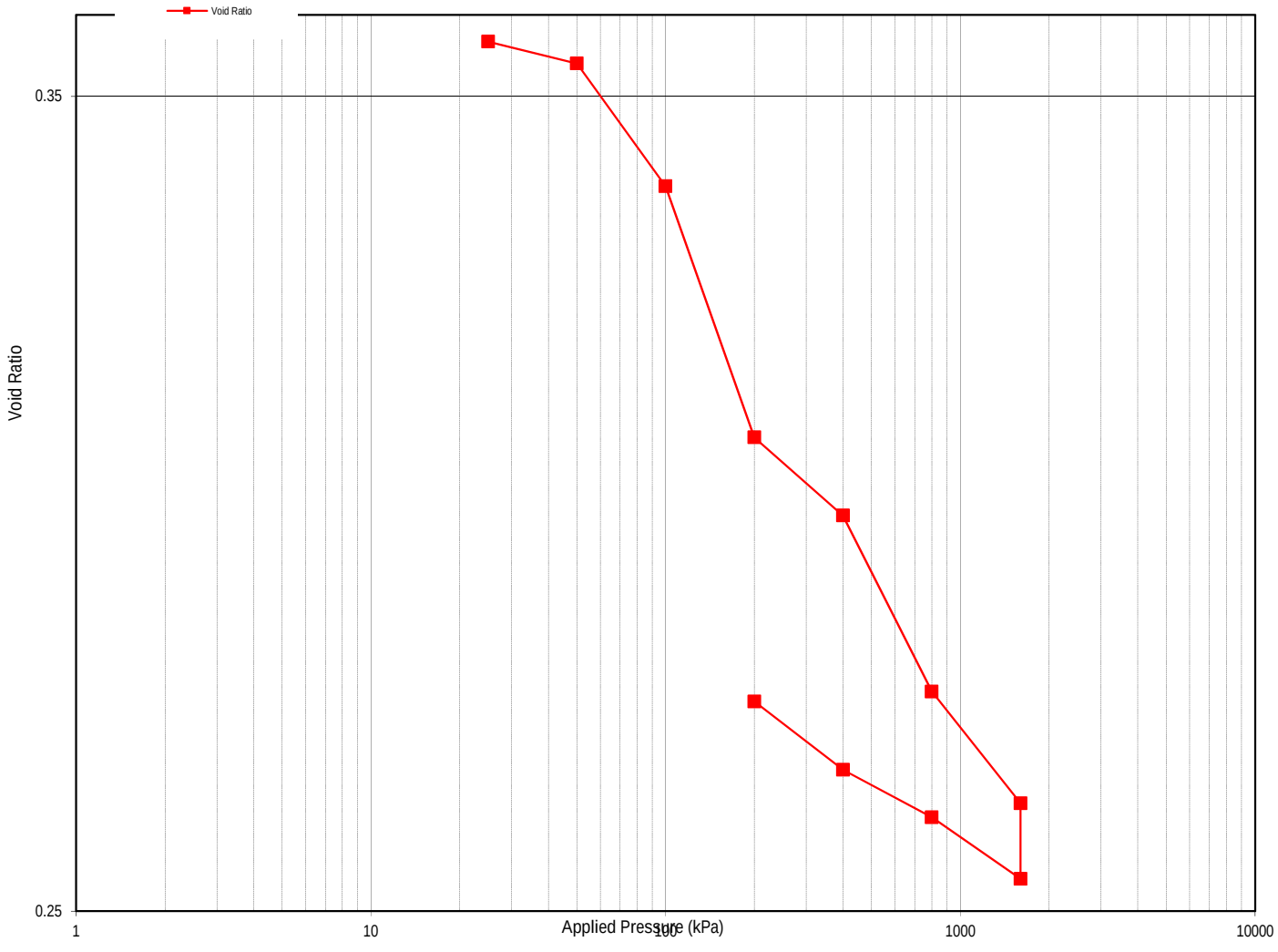
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04898
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	16/11/2017
		Report Date:	30/11/2017
Client Id.:	TP 17-01	**Depth (m):**	0.0 - 0.4m
Description:	Clay		



Wet Density (t/m^3):	2.22	Initial Moisture (%):	16.0	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.62	Final Moisture (%):	15.9	Initial Voids Ratio:	0.363
Remarks:	Remoulded at 90% OMC and 110% SMDD			Initial Degree of Saturation (%):	131.8

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04898
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	16/11/2017
		Report Date:	30/11/2017
Client Id.:	TP 17-01	**Depth (m):**	0.0 - 0.4m
Description:	Clay		

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	18.62	-	0.187	0.00	0.5
2	25-50	0.009	7.95	-	0.079	0.28	0.7
3	50-100	0.050	0.02	-	0.223	22.19	1.8
4	100-200	0.102	0.01	-	0.230	23.29	4.0
5	200-400	0.032	0.13	-	0.037	3.47	4.7
6	400-800	0.072	0.01	-	0.042	7.89	6.3
7	800-1600	0.046	0.03	-	0.013	4.58	7.3
8	1600-1600	-	0.35	-	-	0.52	8.0
9	1600-800	0.025	-	-	0.008	-	7.4
10	800-400	0.019	-	-	0.012	-	7.0
11	400-200	0.028	-	-	0.033	-	6.4

Remarks: MDD: 1.75t/m3, OMC: 18.7%, DR: 109, MR: 86%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

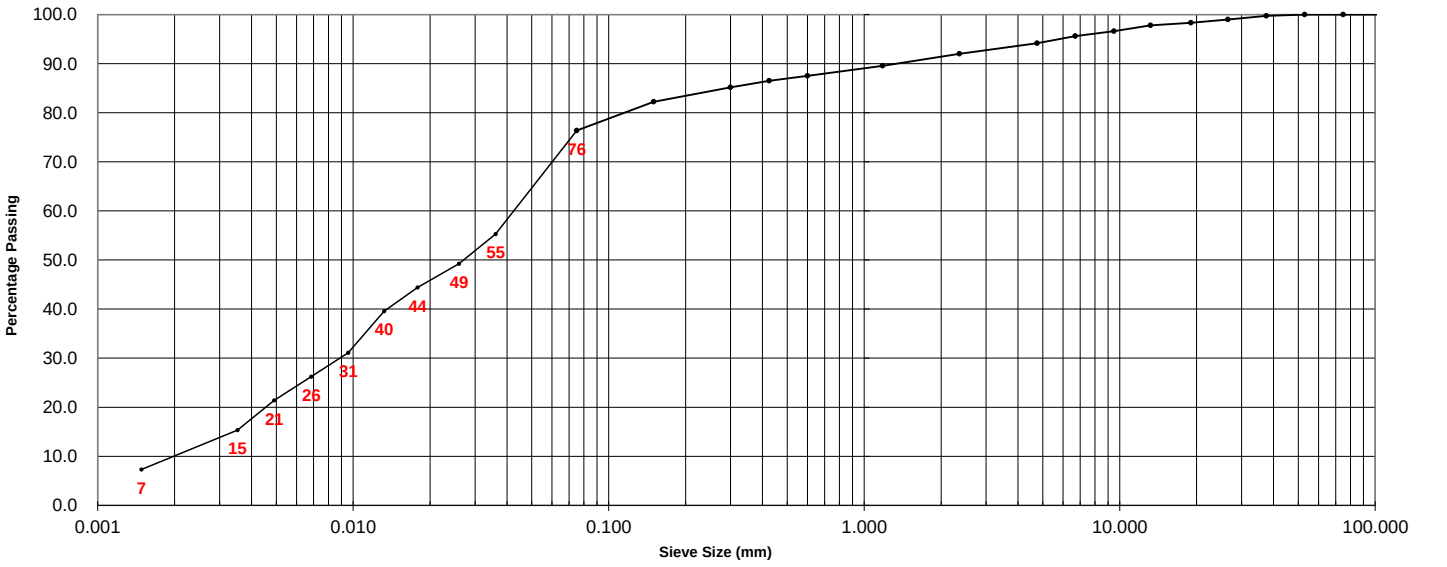
Customer: Tonkin & Taylor (Aus) Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Sth Melbourne VIC 3006
Project: Lilydale Quarry Prelim Testing
Location: Lilydale
Customer Order No.: 1004145

Report Number: **W17DS01364**
Report Date: 11/09/2017
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**S17DS-04895**
ID No.:	1
Lot No:	-
Date Sampled:	8/08/2017
Time Sampled:	-
Date Tested:	22/08/2017
Material Source:	Site Derived
Material Type:	Fill:Clay
To Be Used As	-
Sample Location	TP17-01 0-0.4m
	-
	-
Sampling Method	AS1289.1.2.1.6.2
Moisture Content (%) AS 1289 2.1.1	23.0
Liquid Limit (%) AS 1289.3.1.2	33
Plastic Limit (%) AS 1289.3.2.1	18
Plasticity Index AS 1289.3.3.1	15
Linear Shrinkage (%) AS 1289.3.4.1	6.5
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	1298
L.S. x % Passing 0.425mm	562
Ratio of % Passing (0.075/0.425)	0.88

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	100	99	98	98	97	96	94	92	90	88	87	85	82	76

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CL Grading Specification:

Remarks:
-**Dispersion Method:** mechanical **Hydrometer:** grams per litre
-Average Particle Density of **2.62g/cm^3** in accordance with AS1289.3.5.1

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: **CG.349.001**

Issue Date: 19/02/2013

Chadwick Geotechnics

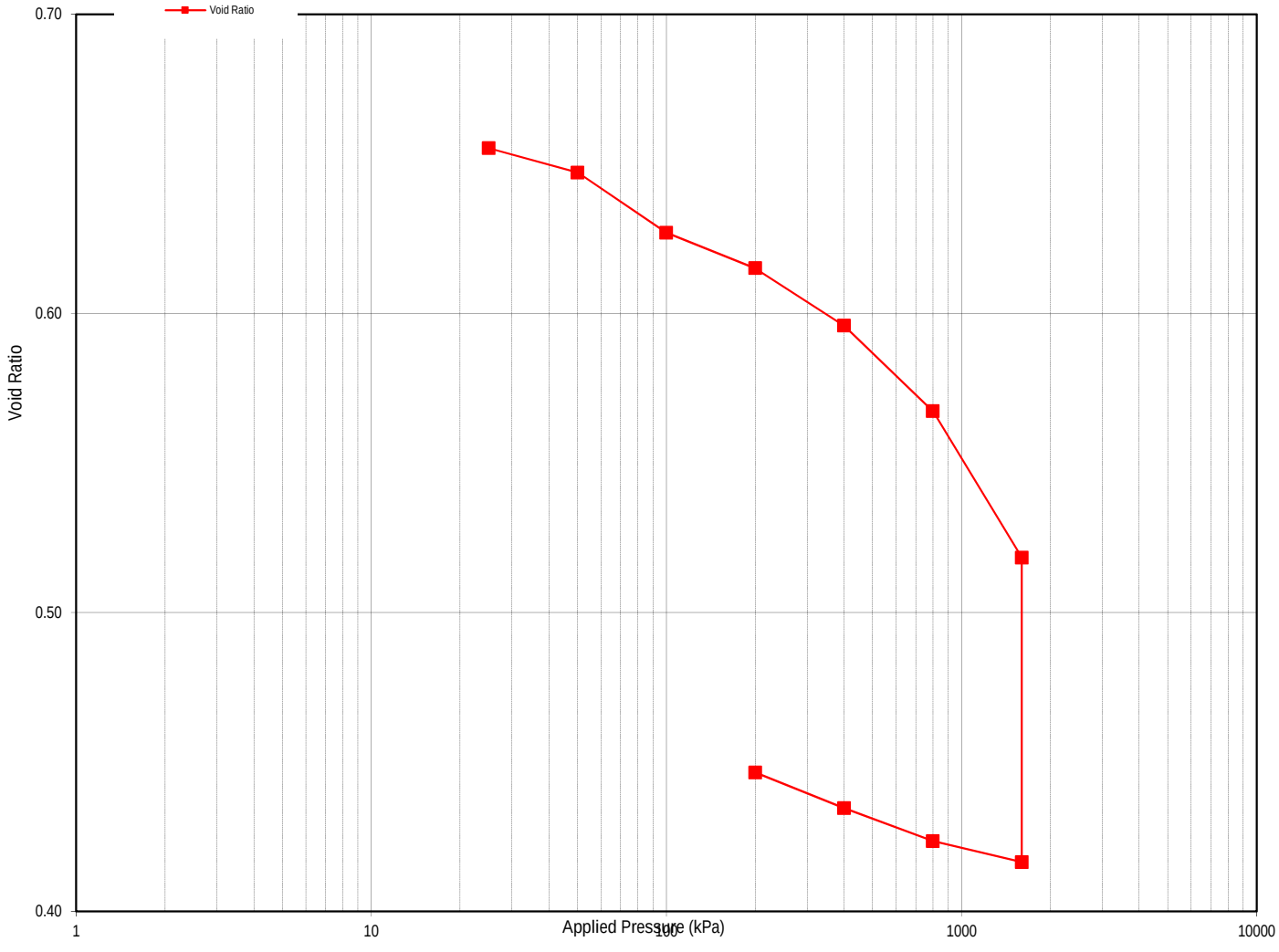
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3208	**Sample No:**	S17DS-04904
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	25/10/2017
		Report Date:	10/11/2017
Client Id.:	TP17-03	**Depth (m):**	0 - 0.5
Description:	Gravelly Clay		



Wet Density (t/m^3):	1.88	Initial Moisture (%):	21.6	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.58	Final Moisture (%):	22.4	Initial Voids Ratio:	0.666
Remarks:	Remoulded at OMC and 95% SMDD			Initial Degree of Saturation (%):	89.3

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3208	**Sample No:**	S17DS-04904
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	25/10/2017
		Report Date:	10/11/2017
Client Id.:	TP17-03	**Depth (m):**	0 - 0.5

Description: Gravelly Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	0.03	-	0.269	3.61	0.7
2	25-50	0.027	0.02	-	0.197	3.77	1.2
3	50-100	0.067	0.00	-	0.244	11.69	2.4
4	100-200	0.039	0.03	-	0.073	4.59	3.1
5	200-400	0.064	0.05	-	0.059	2.94	4.2
6	400-800	0.095	0.08	-	0.045	5.52	6.0
7	800-1600	0.163	0.09	-	0.039	8.13	8.9
8	1600-1600	-	0.67	-	-	3.31	15.0
9	1600-800	0.023	-	-	0.006	-	14.6
10	800-400	0.037	-	-	0.019	-	13.9
11	400-200	0.039	-	-	0.041	-	13.2

Remarks: MDD: 1.62 t/m3, OMC: 22.0% / DR: 95.6%, MR: 98.1%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

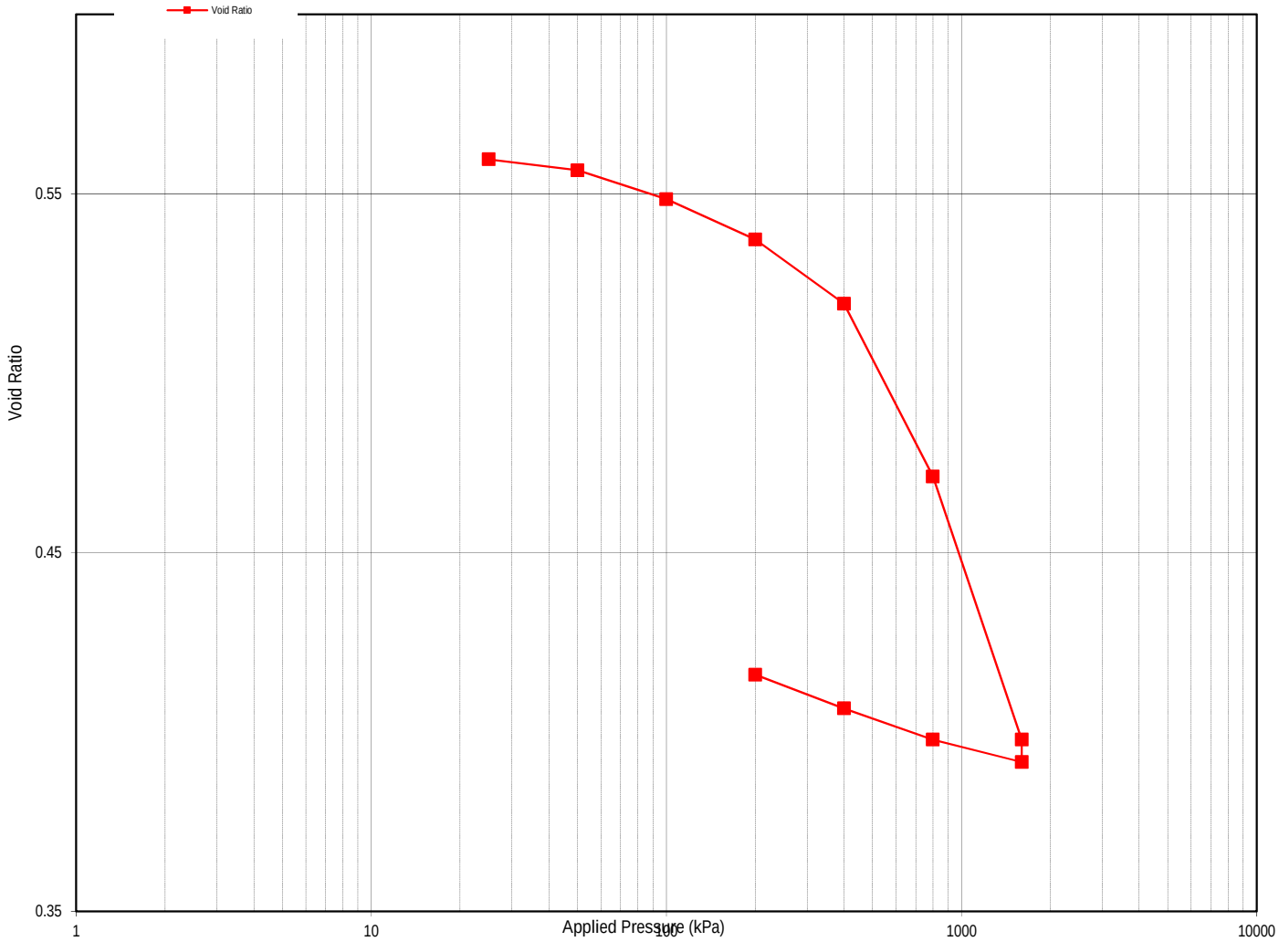
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04905
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	3/11/2017
		Report Date:	17/11/2017
Client Id.:	TP17-03	**Depth (m):**	0.0 - 0.5m
Description:	Gravelly Clay		



Wet Density (t/m^3):	1.97	Initial Moisture (%):	21.7	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.58	Final Moisture (%):	20.7	Initial Voids Ratio:	0.563
Remarks:	Remoulded OMC and 100% SMDD			Initial Degree of Saturation (%):	98.3

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04905
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	3/11/2017
		Report Date:	17/11/2017
Client Id.:	TP17-03	**Depth (m):**	0.0 - 0.5m

Description: Gravelly Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	151.68	-	0.093	0.22	0.2
2	25-50	0.010	2.32	-	0.078	0.00	0.4
3	50-100	0.027	2.39	-	0.103	0.00	0.9
4	100-200	0.037	4.20	-	0.073	0.00	1.7
5	200-400	0.059	7.00	-	0.058	0.50	2.8
6	400-800	0.160	7.18	-	0.079	1.76	5.9
7	800-1600	0.244	6.34	-	0.062	2.31	10.6
8	1600-1600	-	1.98	-	-	0.00	11.0
9	1600-800	0.021	-	-	0.006	-	10.6
10	800-400	0.029	-	-	0.016	-	10.0
11	400-200	0.031	-	-	0.033	-	9.4

Remarks: MDD: 1.62 t/m^3, OMC: 22.0%, DR: 100.0%, MR: 98.6%

Approved Signatory: TDelpachitra

Chadwick Geotechnics

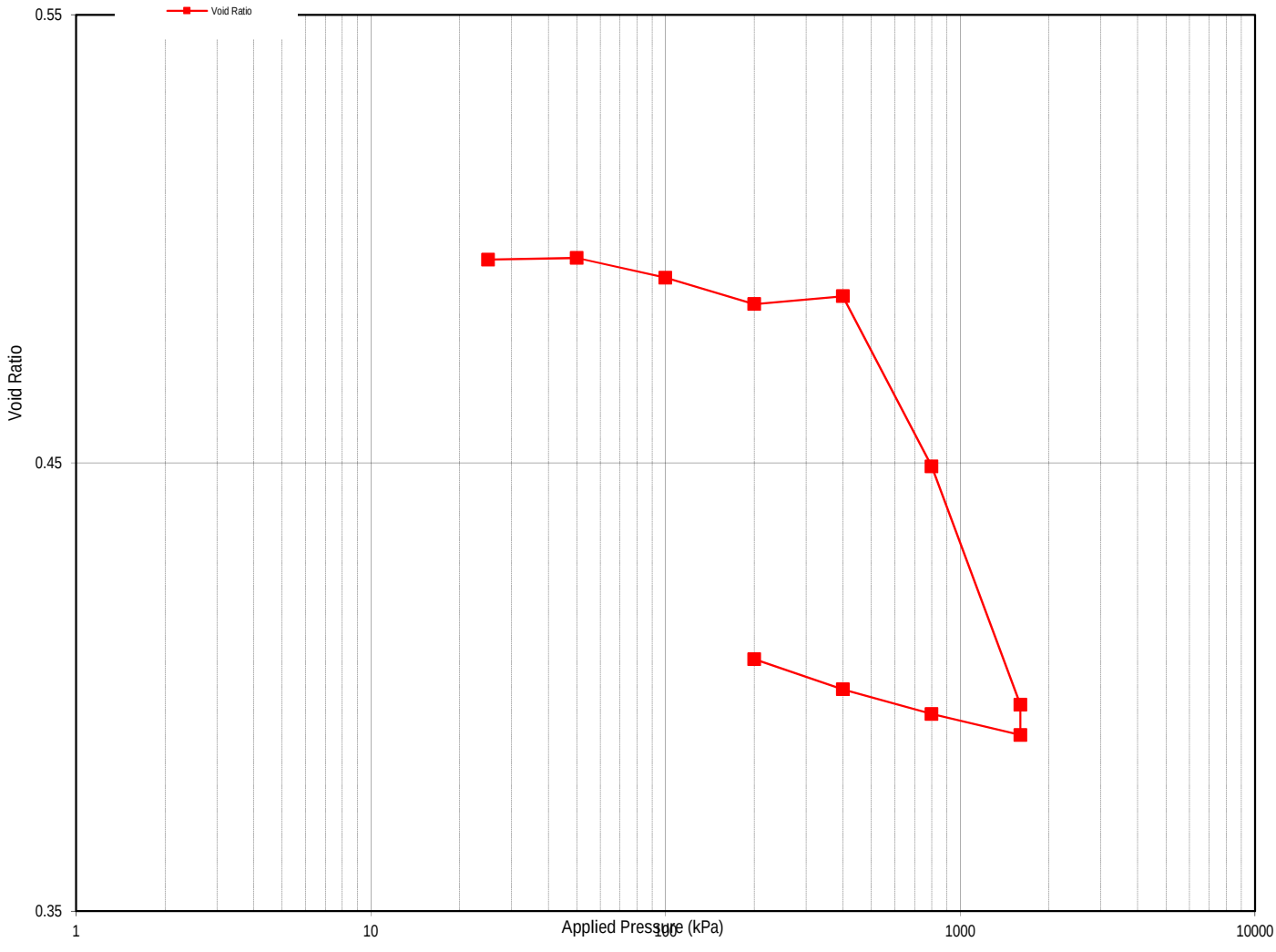
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04906
Project:	Lilydale Quarry	**Test Date:**	6/11/2017
		Report Date:	23/11/2017
Client Id.:	TP17-03	**Depth (m):**	0.0 - 0.5m
Description:	Gravelly Clay		



Wet Density (t/m^3):	2.05	Initial Moisture (%):	19.9	Test Condition:	Inundated on 1600 KPa
Particle Density (t/m^3):	2.58	Final Moisture (%):	20.4	Initial Voids Ratio:	0.490
Remarks:	Remoulded at 95% OMC and 105% SMDD			Initial Degree of Saturation (%):	111.2

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04906
Project:	Lilydale Quarry	**Test Date:**	6/11/2017
		Report Date:	23/11/2017
Client Id.:	TP17-03	**Depth (m):**	0.0 - 0.5m
Description:	Gravelly Clay		

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	30.45	-	-0.135	0.00	-0.3
2	25-50	-0.001	9.63	-	-0.010	0.00	-0.4
3	50-100	0.015	8.43	-	0.059	0.28	-0.1
4	100-200	0.020	33.55	-	0.040	0.73	0.3
5	200-400	-0.006	6.87	-	-0.006	0.36	0.2
6	400-800	0.126	8.59	-	0.064	0.72	2.8
7	800-1600	0.177	9.98	-	0.046	2.70	6.3
8	1600-1600	-	0.03	-	-	0.71	6.8
9	1600-800	0.015	-	-	0.004	-	6.5
10	800-400	0.018	-	-	0.010	-	6.1
11	400-200	0.022	-	-	0.024	-	5.6

Remarks: MDD: 1.62 t/m3, OMC: 22.0%, DR: 105.6% MR: 90.5%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

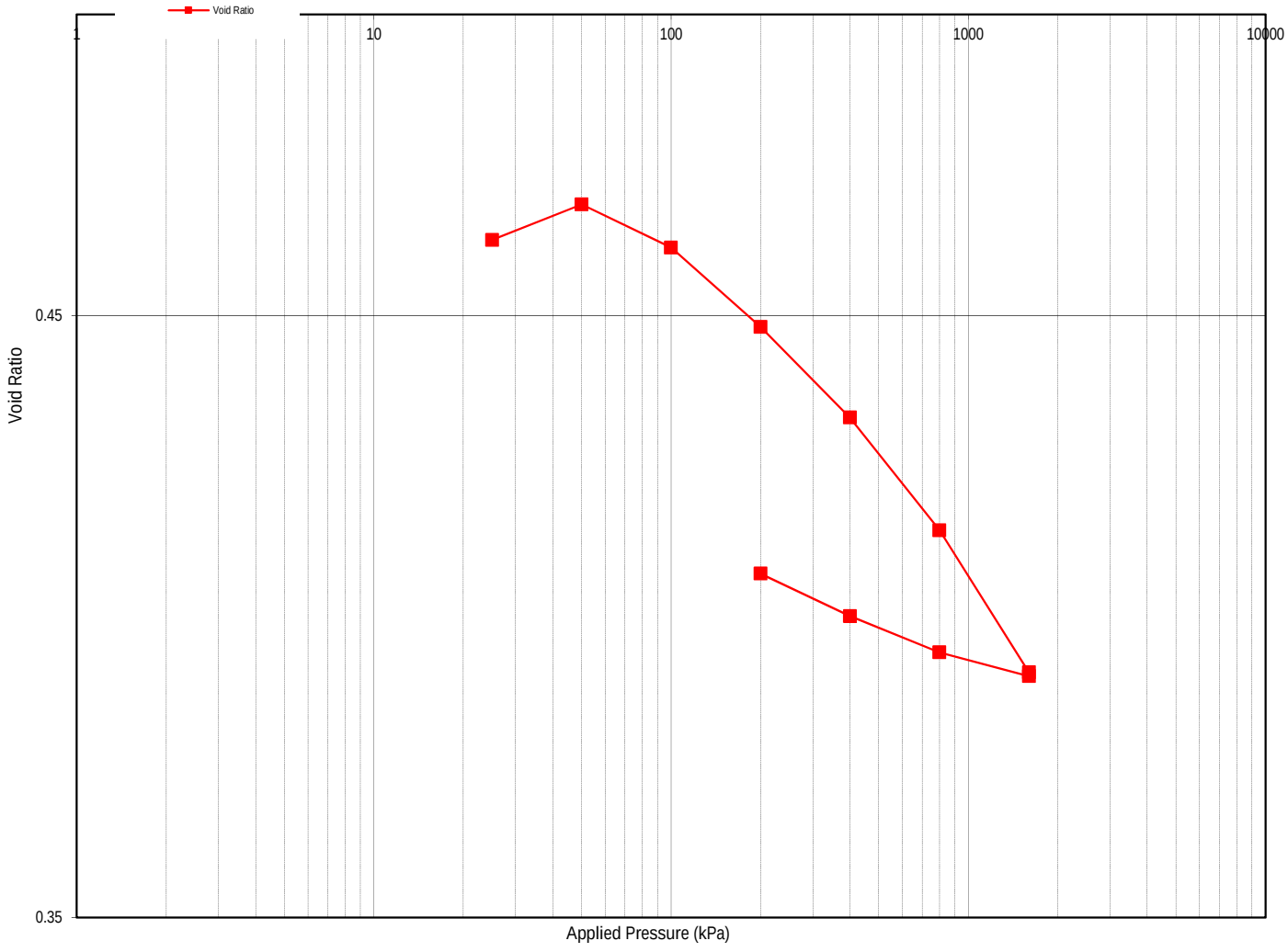
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04907
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	6/11/2017
		Report Date:	17/11/2017
Client Id.:	TP17 - 03	**Depth (m):**	0.0 - 0.5m
Description:	Gravelly Clay		



Wet Density (t/m^3):	2.12	Initial Moisture (%):	20.0	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	0.00	Final Moisture (%):	20.8	Initial Voids Ratio:	0.466
Remarks:	Remoulded at 95% OMC and 110% SMDD			Initial Degree of Saturation (%):	116.9

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04907
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	6/11/2017
		Report Date:	17/11/2017
Client Id.:	TP17 - 03	**Depth (m):**	0.0 - 0.5m

Description: Gravelly Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	76.27	-	0.104	0.00	0.3
2	25-50	-0.020	1.61	-	-0.161	0.00	-0.1
3	50-100	0.024	76.36	-	0.098	0.00	0.3
4	100-200	0.044	2.70	-	0.090	0.80	1.2
5	200-400	0.050	2.94	-	0.052	0.63	2.3
6	400-800	0.062	3.54	-	0.033	0.99	3.5
7	800-1600	0.078	0.00	-	0.021	68.15	5.2
8	1600-1600	-	-	-	-	-	5.2
9	1600-800	0.013	-	-	0.004	-	4.9
10	800-400	0.020	-	-	0.011	-	4.5
11	400-200	0.023	-	-	0.025	-	4.0

Remarks: MDD: 1.62 t/m3, OMC: 22.0, DR: 109.3%, MR: 91%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

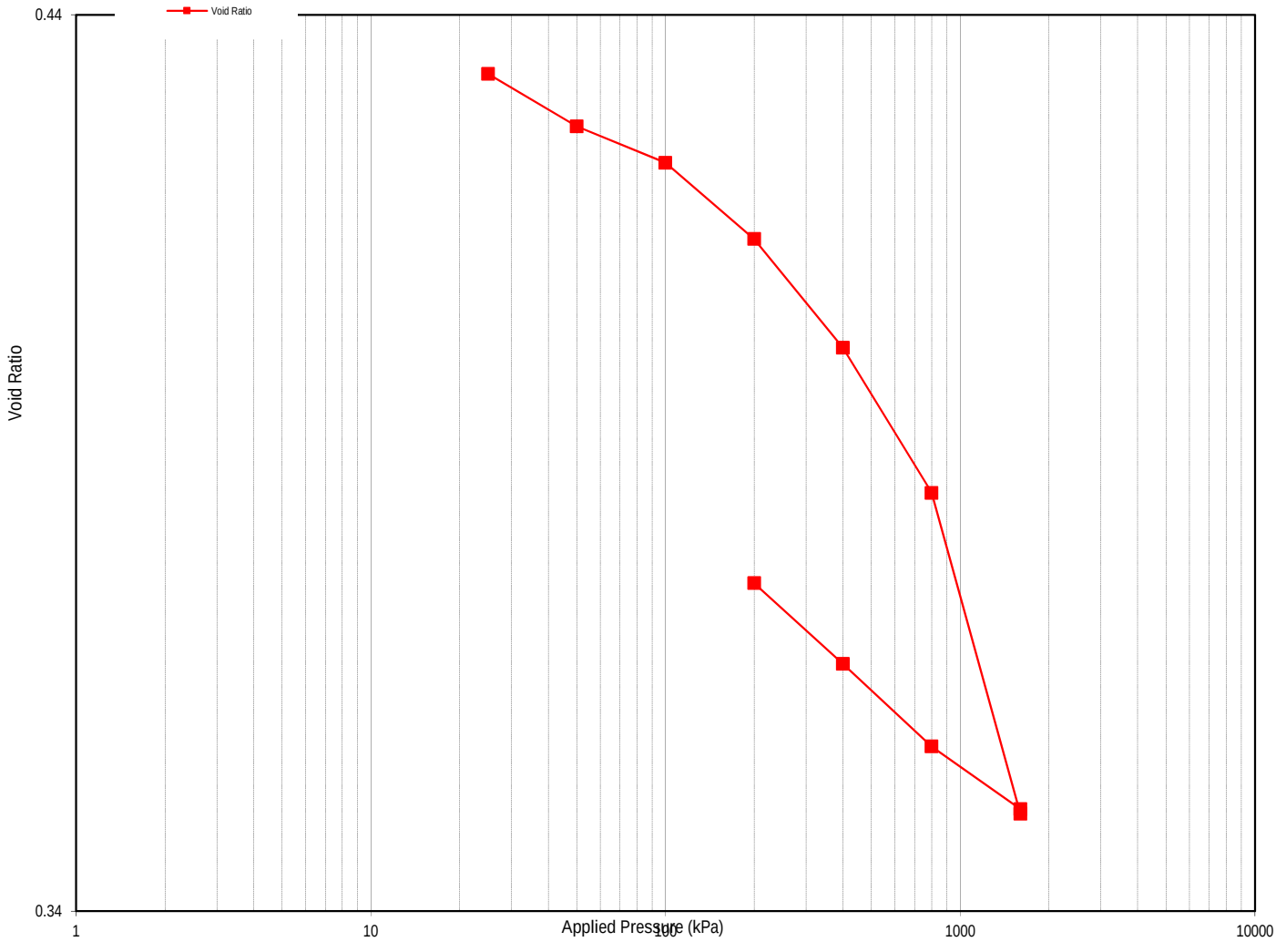
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04908
Project:	Lilydale Quarry	**Test Date:**	6/11/2017
		Report Date:	23/11/2017
Client Id.:	TP17-03	**Depth (m):**	0.0 - 0.5m
Description:	Gravelly Clay		



Wet Density (t/m^3):	2.11	Initial Moisture (%):	20.0	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.58	Final Moisture (%):	19.3	Initial Voids Ratio:	0.435
Remarks:	Remoulded at 90% OMC and 110% SMDD			Initial Degree of Saturation (%):	112.8

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04908
Project:	Lilydale Quarry	**Test Date:**	6/11/2017
		Report Date:	23/11/2017
Client Id.:	TP17-03	**Depth (m):**	0.0 - 0.5m

Description: Gravelly Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	51.07	-	0.058	0.00	0.1
2	25-50	0.019	37.97	-	0.163	0.00	0.6
3	50-100	0.014	34.16	-	0.057	0.21	0.8
4	100-200	0.028	2.28	-	0.060	0.36	1.4
5	200-400	0.040	8.35	-	0.043	1.00	2.3
6	400-800	0.054	6.30	-	0.029	0.99	3.4
7	800-1600	0.119	0.01	-	0.032	22.08	5.9
8	1600-1600	-	-	-	-	-	5.9
9	1600-800	0.023	-	-	0.006	-	5.4
10	800-400	0.031	-	-	0.017	-	4.7
11	400-200	0.030	-	-	0.033	-	4.1

Remarks: MDD: 1.62 t/m^3, OMC: 22.0, DR: 110%, MR: 91%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

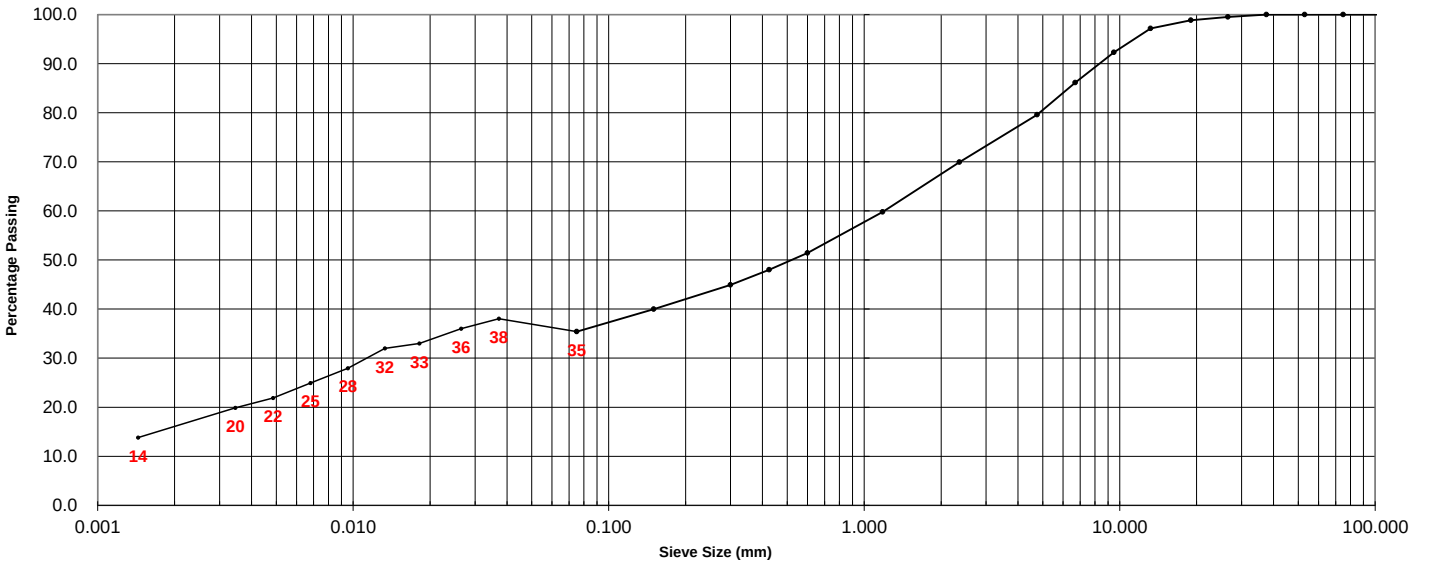
Customer: Tonkin & Taylor (Aus) Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Sth Melbourne VIC 3006
Project: Lilydale Quarry Prelim Testing
Location: Lilydale
Customer Order No.: 1004145

Report Number: **W17DS01365**
Report Date: 11/09/2017
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**S17DS-04902**
ID No.:	1
Lot No:	-
Date Sampled:	8/08/2017
Time Sampled:	-
Date Tested:	30/08/2017
Material Source:	Site Derived
Material Type:	Gravelly Clay
To Be Used As	-
Sample Location	TP17-03 0-0.5m
	-
	-
Sampling Method	AS1289.1.2.1.6.2
Moisture Content (%) AS 1289 2.1.1	21.8
Liquid Limit (%) AS 1289.3.1.2	52
Plastic Limit (%) AS 1289.3.2.1	27
Plasticity Index AS 1289.3.3.1	25
Linear Shrinkage (%) AS 1289.3.4.1	12.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	1200
L.S. x % Passing 0.425mm	576
Ratio of % Passing (0.075/0.425)	0.74

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	100	99	97	92	86	80	70	60	51	48	45	40	35

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: SC Grading Specification:

Remarks:
-**Dispersion Method:** mechanical **Hydrometer:** grams per litre
-Average Particle Density of **2.59g/cm^3** in accordance with AS1289.3.5.1

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: **CG.349.001**

Issue Date: 19/02/2013

CHADWICK GEOTECHNICS

Dandenong South
ACN 143 009 330
25 Metcalf Street
DANDENONG SOUTH, VIC 3175

Ph: + 61 3 8796 7900
Fax: +61 3 9706 9431

Report No: MDD:S17DS-04902
Issue No: 1

Maximum Dry Density Report

Client: Tonkin & Taylor (Aus) Pty Limited
Address: Ground Floor
SOUTH MELBOURNE VIC 3006
Project: Lilydale Quarry Prelim Testing
Project No.: 1004145
Order No.: **CG Request No.:**
TRN: **Lot No.:**

Accredited for compliance with ISO/IEC 17025 – Testing

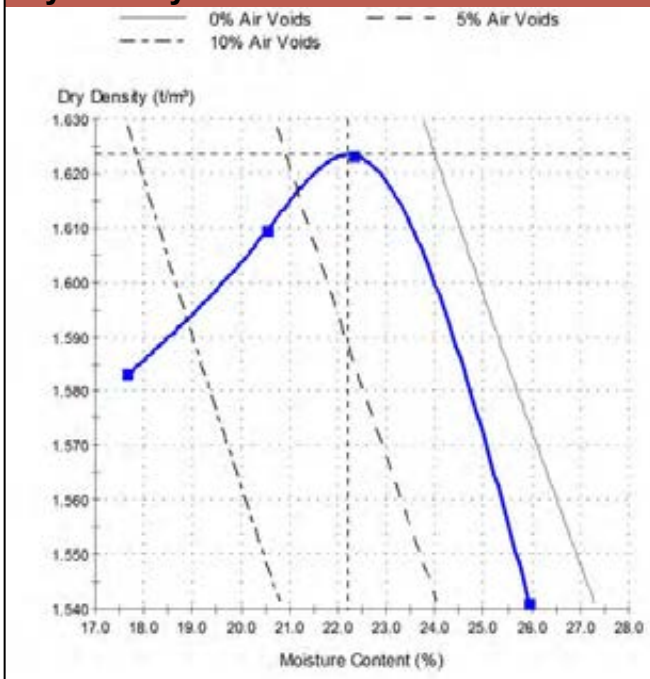
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: J. Lamont
(Melbourne Lab Supervisor)
12712 Date of Issue: 14/11/2017

Sample Details

Location: Infer Cavehill Formation Overburden TP17-03
Sample ID: S17DS-04902 **Date Sampled:** 8/08/2017
Sampling Method: AS1289.1.2.1 Clause 6.5.3
Source: Onsite **Material:** General Fill
Specification: AS Hydrometer
Location: TP17-03, 0-0.5m, As Received
Tested By: D. McMahon **Date Tested:** 25/08/2017

Dry Density - Moisture Content Relationship



Test Results

AS 1289.5.1.1

Standard MDD (t/m³): 1.62
Standard OMC (%): 22.0

Date/Time Cure Start: 22/ 08/ 2017 11:30
Date/Time Cure End: 25/ 08/ 2017 10:15

Comments

Chadwick Geotechnics

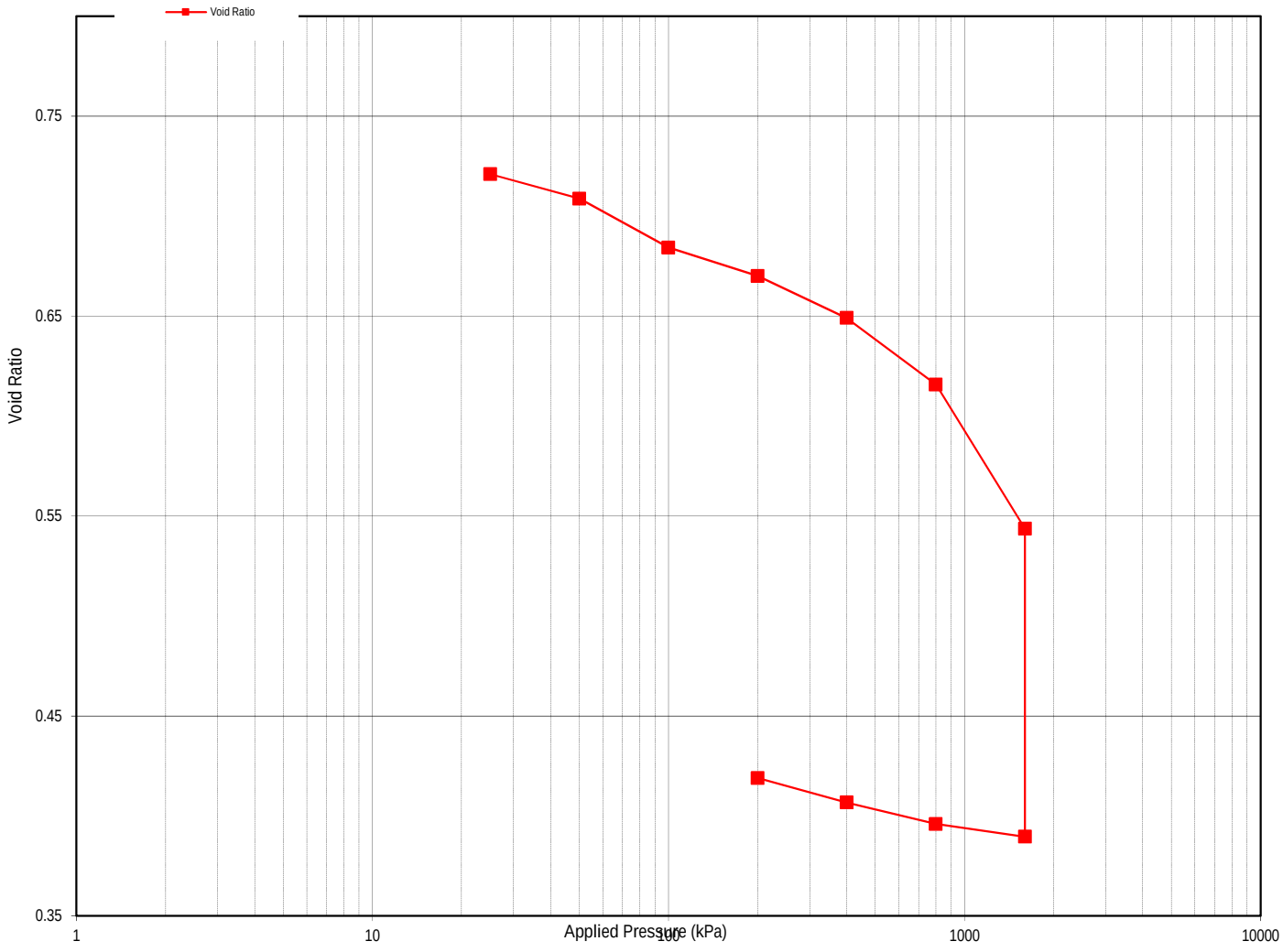
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St. South Melbourne, VIC 3208	**Sample No:**	S17DS-04903
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	25/10/2017
		Report Date:	10/11/2017
Client Id.:	TP17-03	**Depth (m):**	0 - 0.5
Description:	Gravelly Clay		



Wet Density (t/m^3):	1.78	Initial Moisture (%):	21.0	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.58	Final Moisture (%):	22.6	Initial Voids Ratio:	0.749
Remarks:	Remoulded at OMC and 90% SMDD			Initial Degree of Saturation (%):	77.8

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St. South Melbourne, VIC 3208	**Sample No:**	S17DS-04903
Project:	Lilydale Quarry Preliminary Testing	**Test Date:**	25/10/2017
		Report Date:	10/11/2017
Client Id.:	TP17-03	**Depth (m):**	0 - 0.5

Description: Gravelly Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	0.05	-	0.636	3.63	1.6
2	25-50	0.041	0.01	-	0.286	3.82	2.3
3	50-100	0.081	0.00	-	0.286	14.21	3.7
4	100-200	0.047	0.02	-	0.084	4.88	4.5
5	200-400	0.070	0.04	-	0.063	4.97	5.7
6	400-800	0.111	0.09	-	0.050	5.31	7.6
7	800-1600	0.240	0.29	-	0.056	7.07	11.7
8	1600-1600	-	4.65	-	-	4.17	20.5
9	1600-800	0.021	-	-	0.006	-	20.2
10	800-400	0.036	-	-	0.019	-	19.6
11	400-200	0.041	-	-	0.043	-	18.9

Remarks: MDD: 1.62 t/m^3, OMC:22.0 / DR: 90.7%, MR: 95.5%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

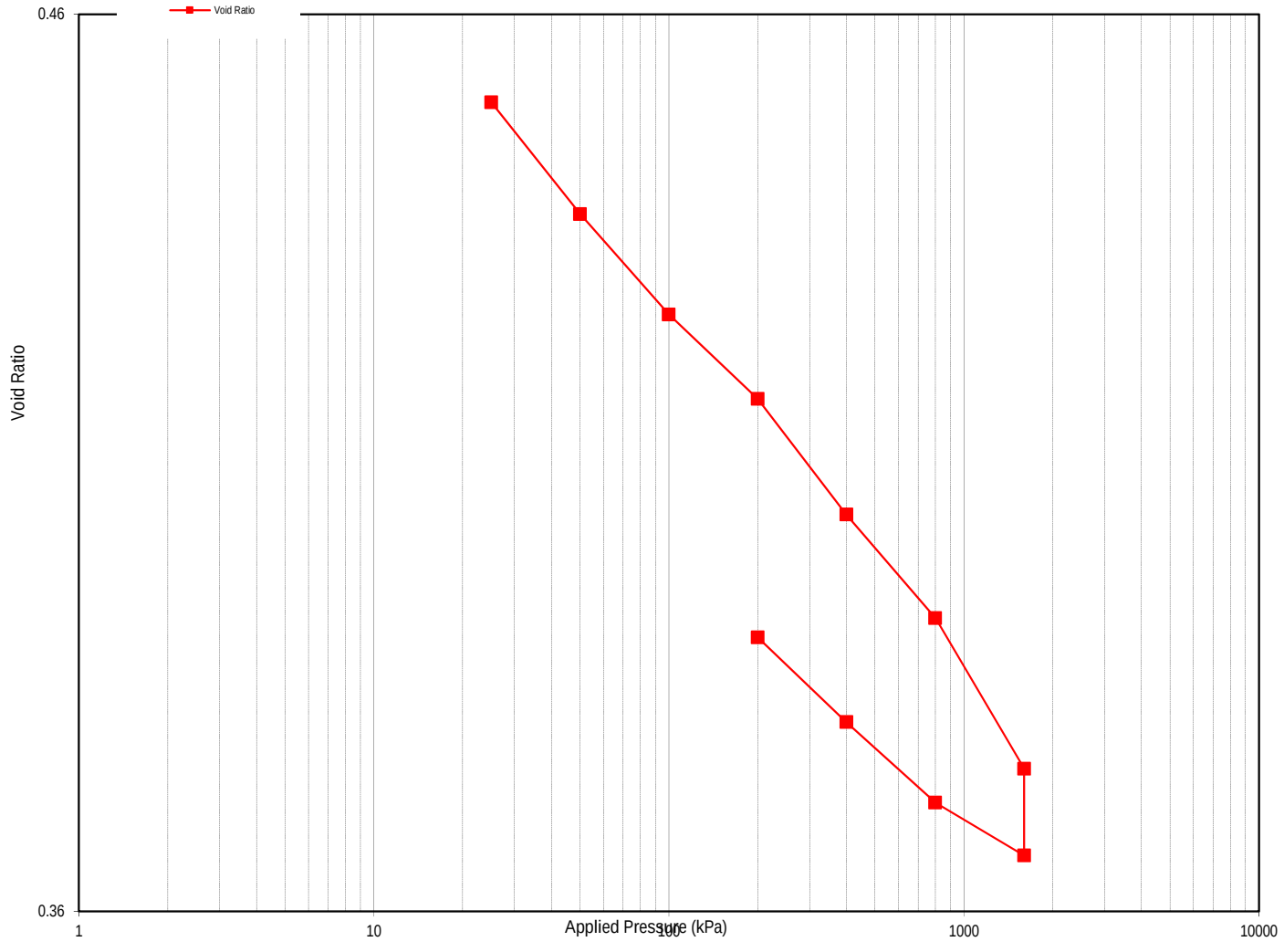
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04912
Project:	Lilydale Quarry	**Test Date:**	29/11/2017
		Report Date:	14/12/2017
Client Id.:	TP17 - 04	**Depth (m):**	0.0 - 0.3m
Description:	Gravelly Clay		



Wet Density (t/m^3):	2.14	Initial Moisture (%):	18.9	Test Condition:	Inundated on 1600 KPa
Particle Density (t/m^3):	2.65	Final Moisture (%):	18.4	Initial Voids Ratio:	0.457
Remarks:	Remouded at 90% OMC and 110% SMDD			Initial Degree of Saturation (%):	103.0

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04912
Project:	Lilydale Quarry	**Test Date:**	29/11/2017
		Report Date:	14/12/2017
Client Id.:	TP17 - 04	**Depth (m):**	0.0 - 0.3m
Description:	Gravelly Clay		

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	5.35	-	0.198	1.08	0.5
2	25-50	0.041	0.03	-	0.344	6.51	1.4
3	50-100	0.037	0.02	-	0.156	6.60	2.1
4	100-200	0.031	0.02	-	0.066	4.22	2.8
5	200-400	0.043	0.01	-	0.045	9.00	3.6
6	400-800	0.038	0.02	-	0.021	5.38	4.4
7	800-1600	0.056	0.04	-	0.015	4.61	5.6
8	1600-1600	-	0.13	-	-	0.60	6.3
9	1600-800	0.020	-	-	0.005	-	5.9
10	800-400	0.030	-	-	0.016	-	5.2
11	400-200	0.031	-	-	0.034	-	4.6

Remarks: MDD: 1.66 t/m3, OMC: 22.0%, DR: 108.5%, MR: 86%

Approved Signatory:

T Delpachitra

CHADWICK GEOTECHNICS

Dandenong South
ACN 143 009 330
25 Metcalf Street
DANDENONG SOUTH, VIC 3175

Ph: + 61 3 8796 7900
Fax: +61 3 9706 9431

Report No: MDD:S17DS-04909
Issue No: 1

Maximum Dry Density Report

Client: Tonkin & Taylor (Aus) Pty Limited
Address: Ground Floor
SOUTH MELBOURNE VIC 3006
Project: Lilydale Quarry Prelim Testing
Project No.: 1004145
Order No.: **CG Request No.:**
TRN: **Lot No.:**

Accredited for compliance with ISO/IEC 17025 – Testing

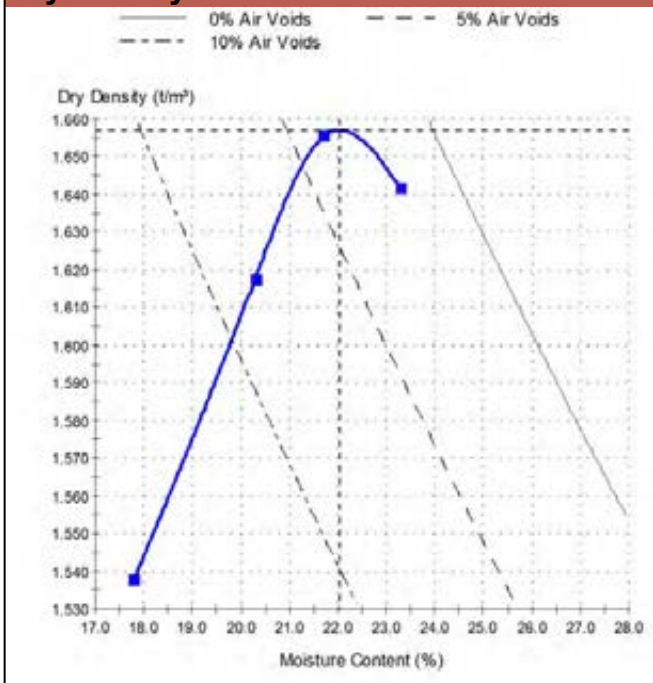
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: J. Lamont
(Melbourne Lab Supervisor)
12712 Date of Issue: 14/11/2017

Sample Details

Location: Infer Older Volcanics Overburden TP17-04 0-0.3m
Sample ID: S17DS-04909 **Date Sampled:** 8/08/2017
Sampling Method: AS1289.1.2.1 Clause 6.5.3
Source: Onsite **Material:** General Fill
Specification: AS Hydrometer
Location: TP17-04, 0-0.3, As Received
Tested By: D. McMahon **Date Tested:** 21/08/2017

Dry Density - Moisture Content Relationship



Test Results

AS 1289.5.1.1

Standard MDD (t/m³):	**1.66**
Standard OMC (%):	**22.0**
Retained Sieve 19mm (%):	11
Date/Time Cure Start:	17/ 08/ 2017 14:00
Date/Time Cure End:	21/ 08/ 2017 14:30

Comments

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

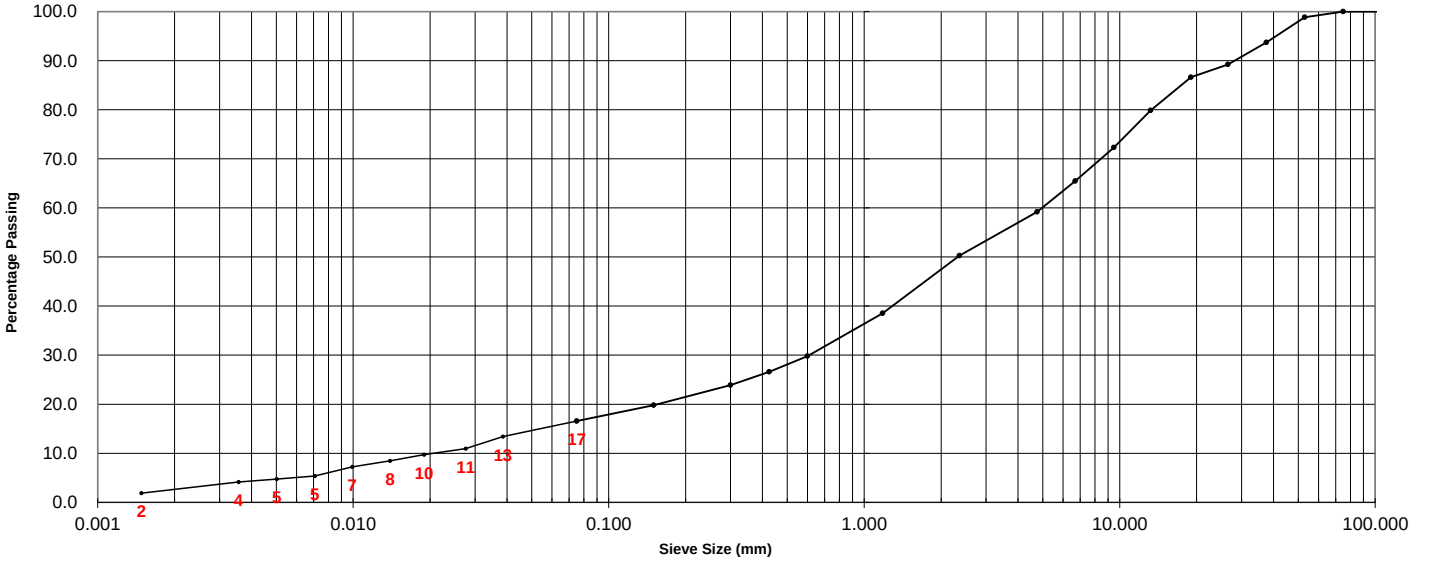
Customer: Tonkin & Taylor (Aus) Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Sth Melbourne VIC 3006
Project: Lilydale Quarry Prelim Testing
Location: Lilydale
Customer Order No.: 1004145

Report Number: **W17DS01366**
Report Date: 11/09/2017
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**S17DS-04909**
ID No.:	1
Lot No:	-
Date Sampled:	8/08/2017
Time Sampled:	-
Date Tested:	22/08/2017
Material Source:	Site Derived
Material Type:	Clayey Gravel
To Be Used As	-
Sample Location	TP17-04 0-0.3m
	-
	-
Sampling Method	AS1289.1.2.1.6.2
Moisture Content (%) AS 1289 2.1.1	26.0
Liquid Limit (%) AS 1289.3.1.2	38
Plastic Limit (%) AS 1289.3.2.1	31
Plasticity Index AS 1289.3.3.1	7
Linear Shrinkage (%) AS 1289.3.4.1	5.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	186
L.S. x % Passing 0.425mm	133
Ratio of % Passing (0.075/0.425)	0.62

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
		100	99	94	89	87	80	72	65	59	50	39	30	27	24	20	17

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GM Grading Specification:

Remarks:
-**Dispersion Method:** mechanical **Hydrometer:** grams per litre
-Average Particle Density of **2.65g/cm^3** in accordance with AS1289.3.5.1

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: **CG.349.001**

Issue Date: 19/02/2013

Chadwick Geotechnics

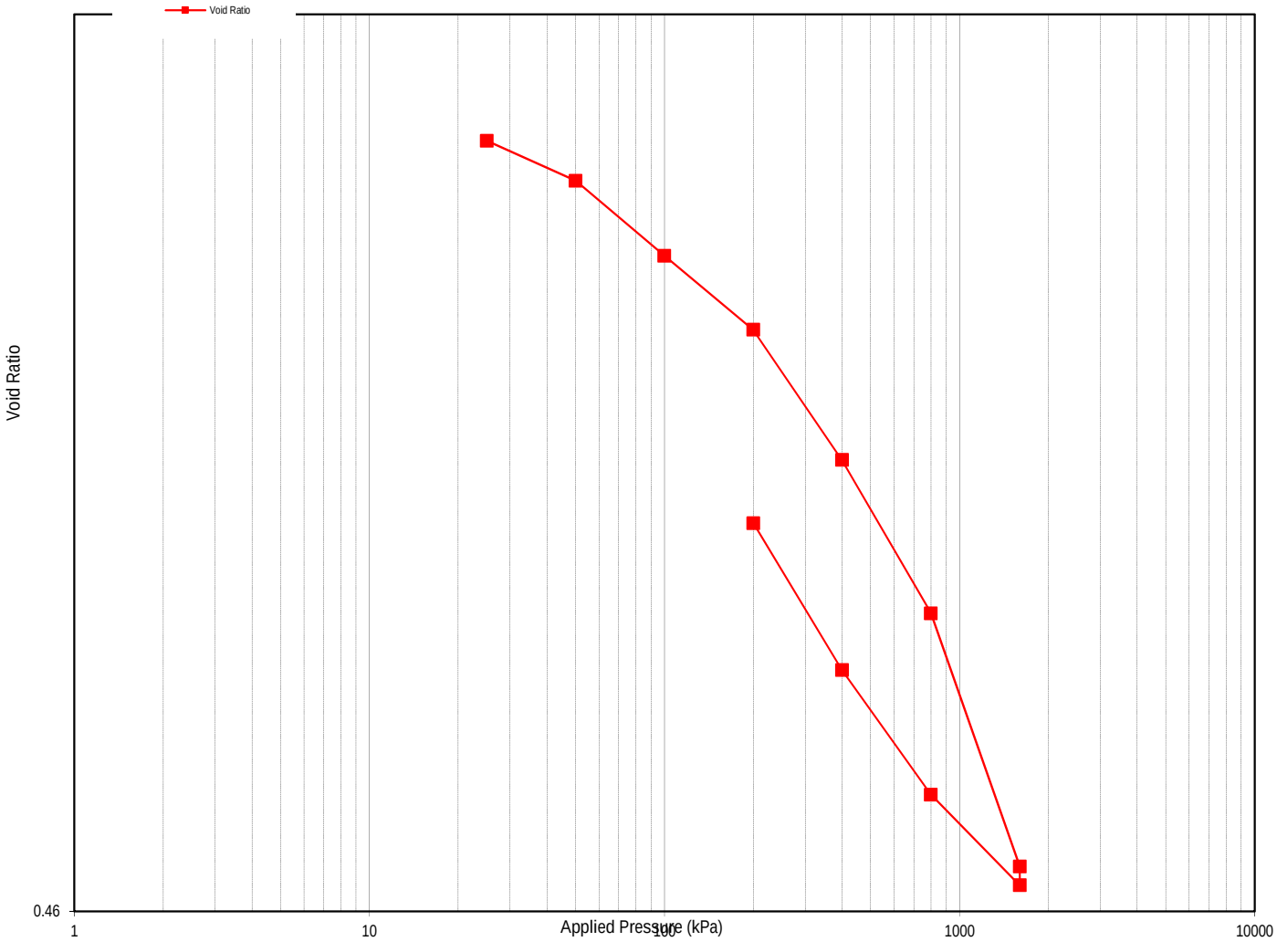
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04910
Project:	Lilydale Quarry	**Test Date:**	29/11/2017
		Report Date:	12/12/2017
Client Id.:	TP17 - 04	**Depth (m):**	0.0 - 0.3m
Description:	Gravelly Clay		



Wet Density (t/m^3):	2.08	Initial Moisture (%):	19.2	Test Condition:	Inundated on 1600 KPa
Particle Density (t/m^3):	2.65	Final Moisture (%):	22.2	Initial Voids Ratio:	0.520
Remarks:	Remouded at 95% OMC and 105% SMDD			Initial Degree of Saturation (%):	98.1

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04910
Project:	Lilydale Quarry	**Test Date:**	29/11/2017
		Report Date:	12/12/2017
Client Id.:	TP17 - 04	**Depth (m):**	0.0 - 0.3m
Description:	Gravelly Clay		

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	1.49	-	0.005	0.73	0.0
2	25-50	0.011	0.03	-	0.088	3.69	0.2
3	50-100	0.021	0.03	-	0.083	4.05	0.6
4	100-200	0.021	0.03	-	0.041	3.56	1.1
5	200-400	0.036	0.01	-	0.036	5.89	1.8
6	400-800	0.043	0.06	-	0.021	3.45	2.6
7	800-1600	0.070	0.04	-	0.018	4.85	4.0
8	1600-1600	-	-	-	-	-	4.1
9	1600-800	0.025	-	-	0.007	-	3.6
10	800-400	0.035	-	-	0.018	-	2.9
11	400-200	0.041	-	-	0.042	-	2.1

Remarks: MDD: 1.66 t/m3, OMC: 22.0%, DR: 105.1%, MR: 87.3%

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

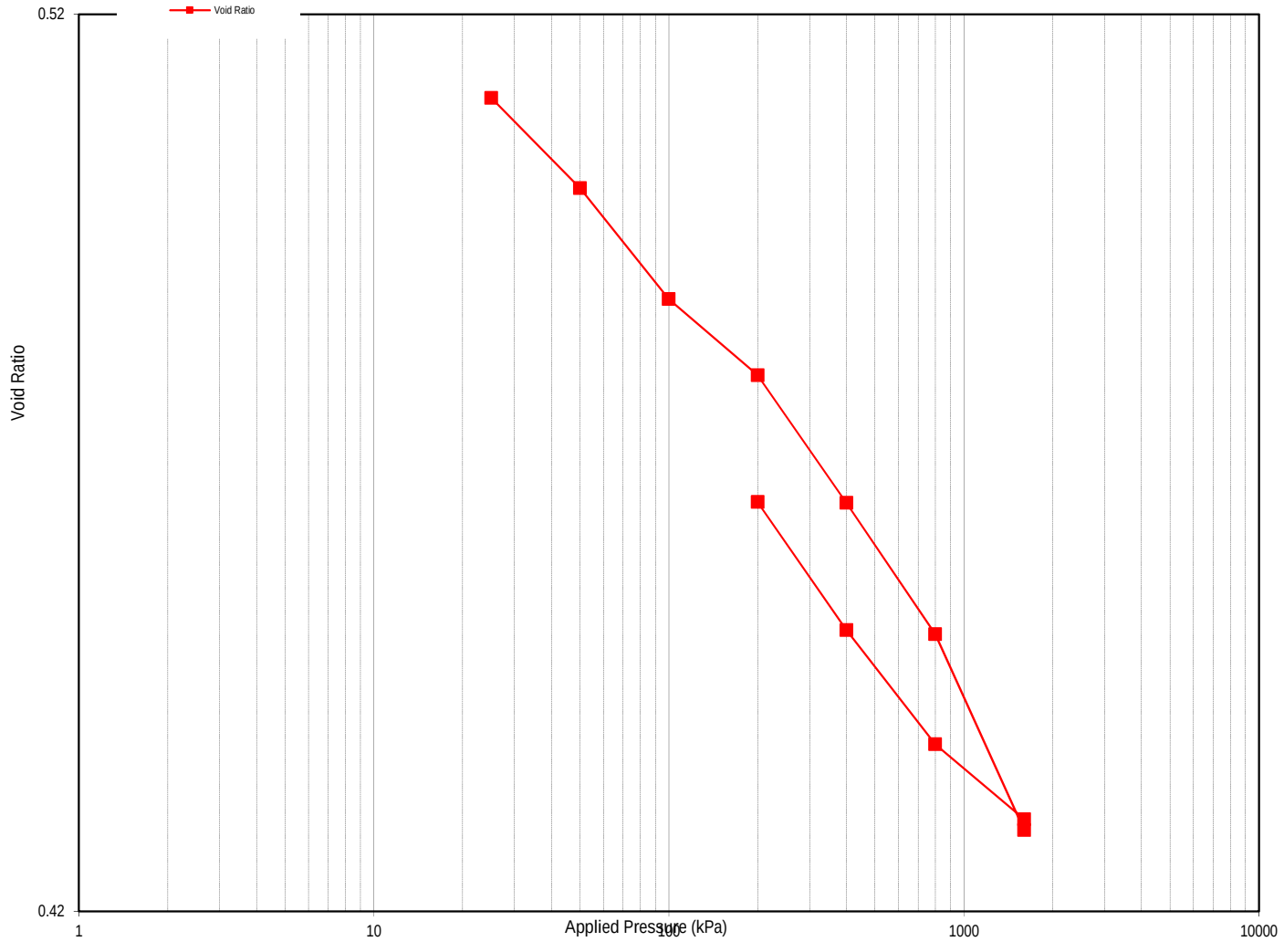
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04911
Project:	Lilydale Quarry	**Test Date:**	29/11/2017
		Report Date:	12/12/2017
Client Id.:	TP17 - 04	**Depth (m):**	0.0 - 0.3m
Description:	Gravelly Clay		



Wet Density (t/m^3):	2.08	Initial Moisture (%):	19.1	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.65	Final Moisture (%):	21.8	Initial Voids Ratio:	0.514
Remarks:	Remouded at 95% OMC and 110%MDD			Initial Degree of Saturation (%):	98.7

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04911
Project:	Lilydale Quarry	**Test Date:**	29/11/2017
		Report Date:	12/12/2017
Client Id.:	TP17 - 04	**Depth (m):**	0.0 - 0.3m
Description:	Gravelly Clay		

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	2.84	-	0.097	0.60	0.2
2	25-50	0.033	0.03	-	0.267	4.63	0.9
3	50-100	0.041	0.02	-	0.165	5.71	1.7
4	100-200	0.028	0.03	-	0.057	4.51	2.3
5	200-400	0.047	0.02	-	0.048	5.38	3.2
6	400-800	0.049	0.04	-	0.025	4.07	4.2
7	800-1600	0.072	0.06	-	0.019	5.05	5.6
8	1600-1600	-	-	-	-	-	5.6
9	1600-800	0.028	-	-	0.007	-	5.0
10	800-400	0.042	-	-	0.022	-	4.2
11	400-200	0.047	-	-	0.049	-	3.2

Remarks: MDD: 1.66 t/m3, OMC: 22.0, DR: 105.7%, MR: 86.8%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

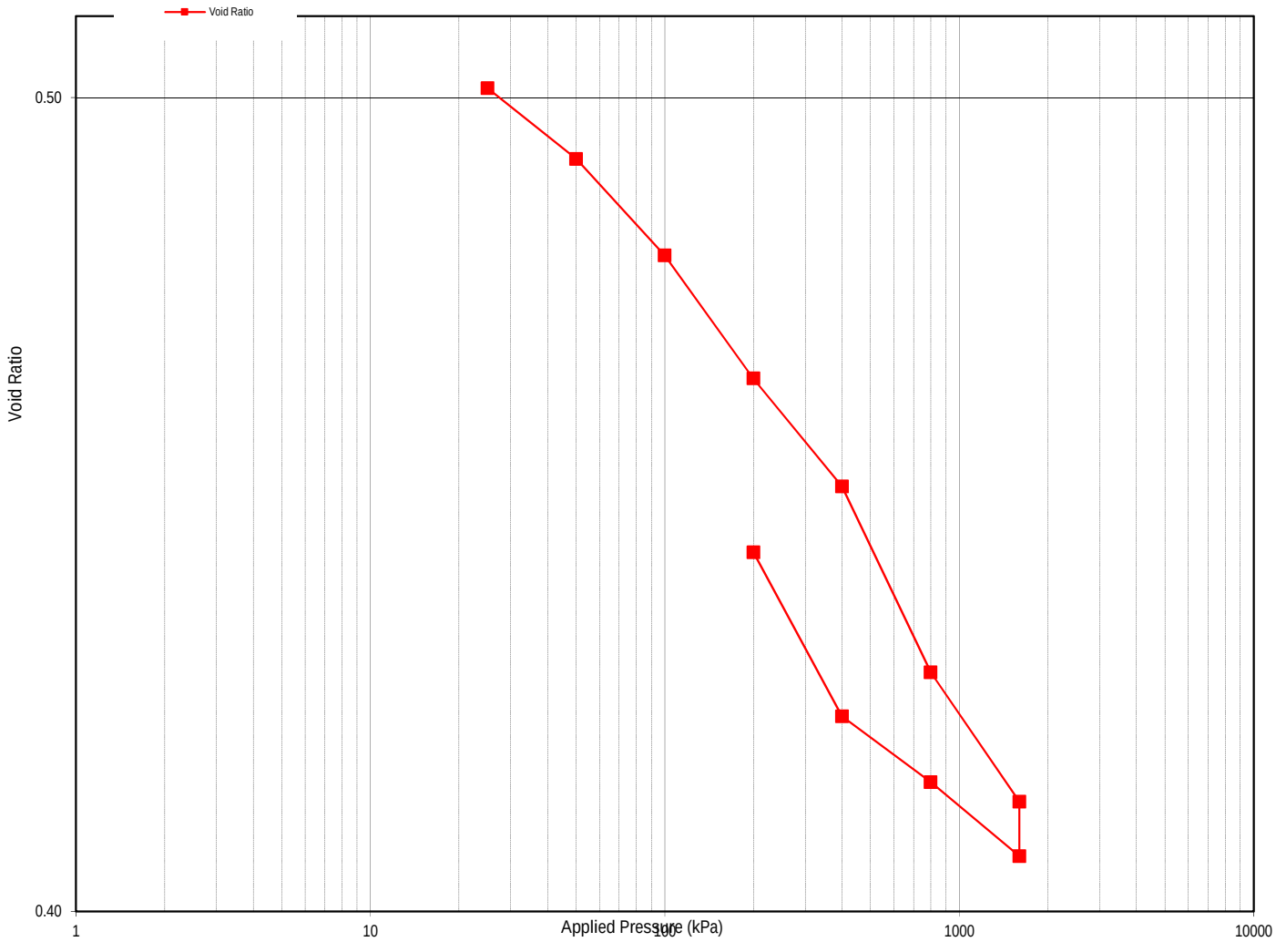
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04921
Project:	Lilydale Quarry	**Test Date:**	9/11/2017
		Report Date:	24/11/2017
Client Id.:	TP17 - 05	**Depth (m):**	3.0 - 3.5
Description:	Clay		



Wet Density (t/m^3):	2.09	Initial Moisture (%):	21.0	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.65	Final Moisture (%):	28.7	Initial Voids Ratio:	0.505
Remarks:	Remoulded at 95% OMC and 110% SMDD			Initial Degree of Saturation (%):	117.0

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04921
Project:	Lilydale Quarry	**Test Date:**	9/11/2017
		Report Date:	24/11/2017
Client Id.:	TP17 - 05	**Depth (m):**	3.0 - 3.5
Description:	Clay		

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	4.93	-	0.115	0.00	0.3
2	25-50	0.029	0.03	-	0.232	3.96	0.9
3	50-100	0.039	0.03	-	0.159	3.61	1.7
4	100-200	0.050	0.01	-	0.102	7.73	2.7
5	200-400	0.044	0.04	-	0.045	4.25	3.5
6	400-800	0.076	0.02	-	0.039	5.72	5.1
7	800-1600	0.053	0.66	-	0.014	3.49	6.1
8	1600-1600	-	-	-	-	-	6.6
9	1600-800	0.030	-	-	0.008	-	5.9
10	800-400	0.027	-	-	0.014	-	5.4
11	400-200	0.067	-	-	0.071	-	4.1

Remarks: MDD: 1.59 t/m3, OMC: 23.0%, DR: 109%, MR: 91%

Approved Signatory:

T Delpachitra

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

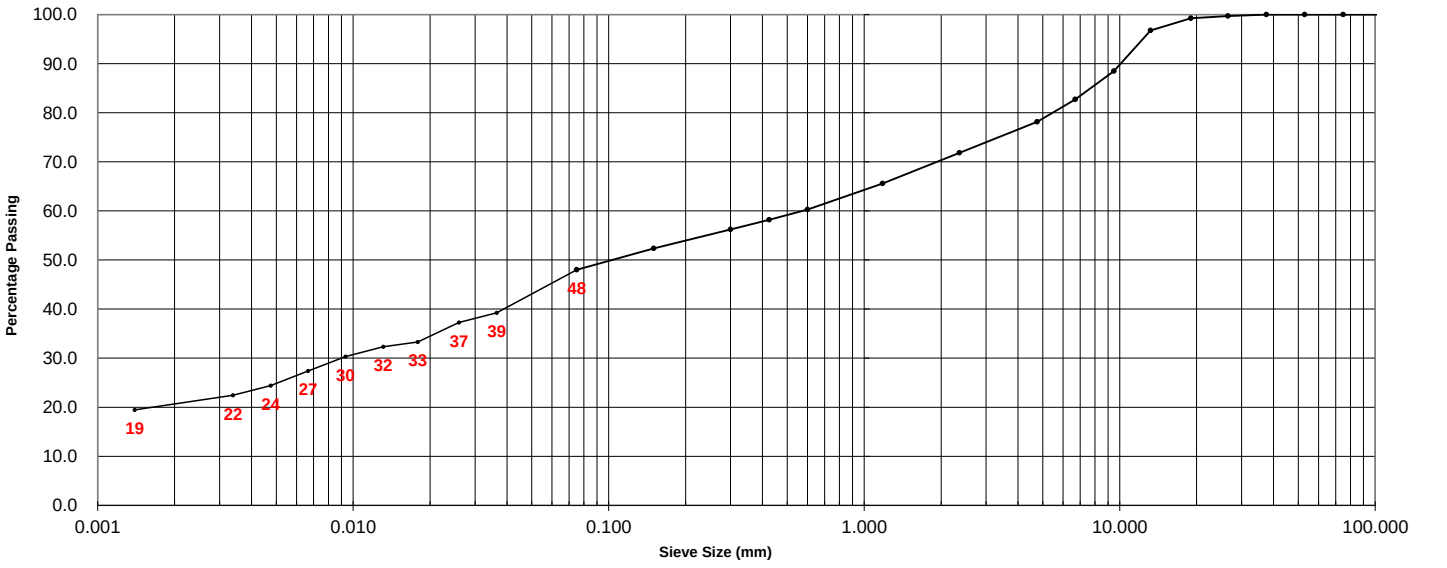
Customer: Tonkin & Taylor (Aus) Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Sth Melbourne VIC 3006
Project: Lilydale Quarry Prelim Testing
Location: Lilydale
Customer Order No.: 1004145

Report Number: **W17DS01367**
Report Date: 11/09/2017
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**S17DS-04916**
ID No.:	1
Lot No:	-
Date Sampled:	8/08/2017
Time Sampled:	-
Date Tested:	10/09/2017
Material Source:	Site Derived
Material Type:	Fill:Clay
To Be Used As	-
Sample Location	TP17-05 3-3.5m
	-
	-
Sampling Method	AS1289.1.2.1.6.2
Moisture Content (%) AS 1289 2.1.1	26.1
Liquid Limit (%) AS 1289.3.1.2	42
Plastic Limit (%) AS 1289.3.2.1	28
Plasticity Index AS 1289.3.3.1	14
Linear Shrinkage (%) AS 1289.3.4.1	6.0
Cracking, Curling, Crumbling (1,2,3)	1
P.I. x % Passing 0.425mm	815
L.S. x % Passing 0.425mm	349
Ratio of % Passing (0.075/0.425)	0.82

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
				100	100	99	97	88	83	78	72	66	60	58	56	52	48

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: GM Grading Specification:

Remarks:
-**Dispersion Method:** mechanical **Hydrometer:** grams per litre
-Average Particle Density of **2.65g/cm^3** in accordance with AS1289.3.5.1

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: **CG.349.001**

Issue Date: 19/02/2013

CHADWICK GEOTECHNICS

Dandenong South
ACN 143 009 330
25 Metcalf Street
DANDENONG SOUTH, VIC 3175

Ph: + 61 3 8796 7900
Fax: +61 3 9706 9431

Report No: MDD:S17DS-04916
Issue No: 1

Maximum Dry Density Report

Client: Tonkin & Taylor (Aus) Pty Limited
Address: Ground Floor
SOUTH MELBOURNE VIC 3006
Project: Lilydale Quarry Prelim Testing
Project No.: 1004145
Order No.: **CG Request No.:**
TRN: **Lot No.:**

Accredited for compliance with ISO/IEC 17025 – Testing

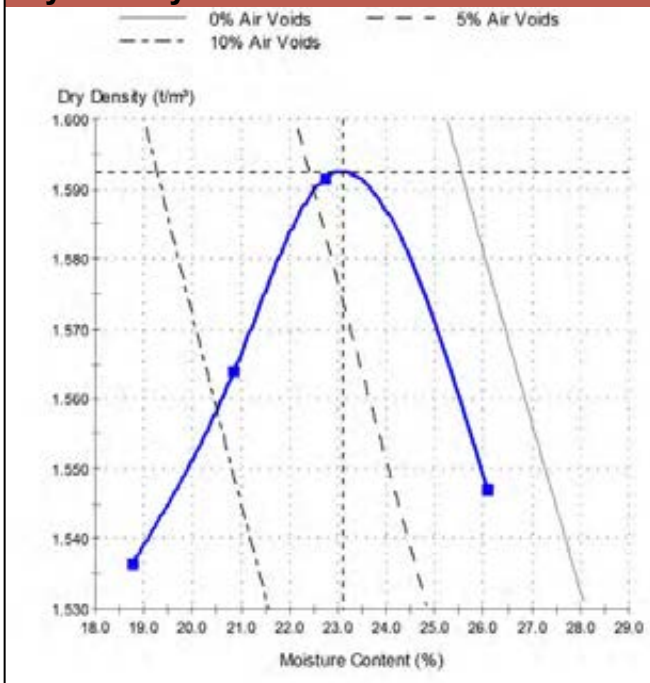
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: J. Lamont
(Melbourne Lab Supervisor)
12712 Date of Issue: 14/11/2017

Sample Details

Location: Infer Cavehill Formation Overburden TP17-05 3-3.5m
Sample ID: S17DS-04916 **Date Sampled:** 8/08/2017
Sampling Method: AS1289.1.2.1 Clause 6.5.3
Source: Onsite **Material:** General Fill
Specification: AS Hydrometer
Location: TP17-05, 3-3.5m, As Received
Tested By: P. Doherty **Date Tested:** 25/08/2017

Dry Density - Moisture Content Relationship



Test Results

AS 1289.5.1.1
Standard MDD (t/m³): 1.59
Standard OMC (%): 23.0

Date/Time Cure Start: 22/ 08/ 2017 15:00
Date/Time Cure End: 25/ 08/ 2017 14:00

Comments

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

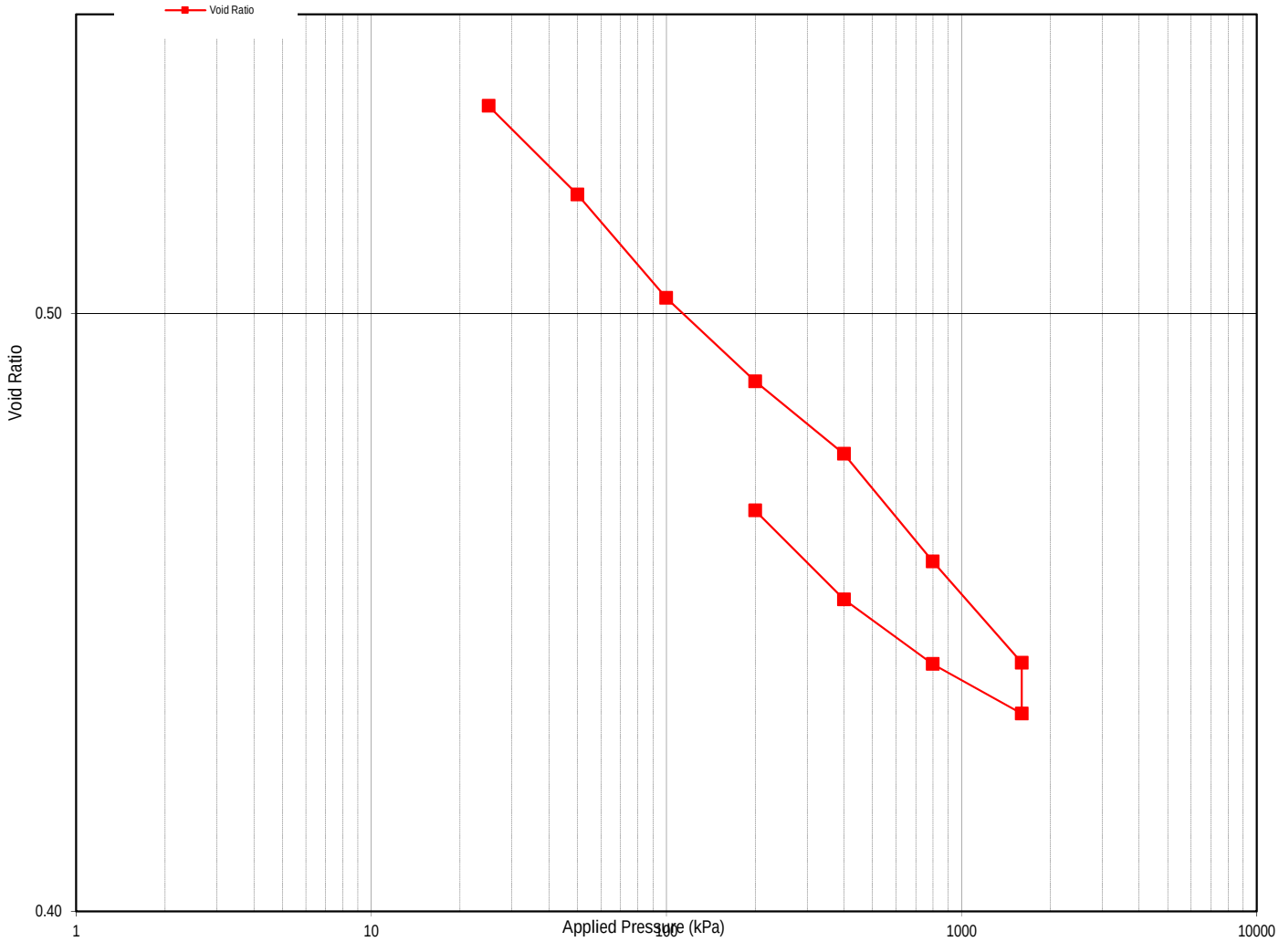
Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04920
Project:	Lilydale Quarry	**Test Date:**	9/11/2017
		Report Date:	24/11/2017
Client Id.:	TP17-05	**Depth (m):**	3.0 - 3.5

Description: Clay



Wet Density (t/m^3):	2.01	Initial Moisture (%):	21.3	Test Condition:	Inundated on 1600 KPa
Particle Density (t/m^3):	2.65	Final Moisture (%):	29.5	Initial Voids Ratio:	0.547
Remarks:	Remoulded at 95% OMC and 105% SMDD			Initial Degree of Saturation (%):	99.3

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor Pty Ltd	**Report No.:**	1004145
Address:	95 Conventry Street, South Melbourne, VIC	**Sample No:**	S17DS-04920
Project:	Lilydale Quarry	**Test Date:**	9/11/2017
		Report Date:	24/11/2017
Client Id.:	TP17-05	**Depth (m):**	3.0 - 3.5

Description: Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	189.83	-	0.308	0.48	0.8
2	25-50	0.049	0.03	-	0.387	3.98	1.7
3	50-100	0.057	0.03	-	0.227	3.00	2.8
4	100-200	0.046	0.01	-	0.093	5.29	3.7
5	200-400	0.040	0.05	-	0.041	2.50	4.5
6	400-800	0.060	0.05	-	0.030	4.67	5.7
7	800-1600	0.056	0.40	-	0.014	3.18	6.8
8	1600-1600	-	0.15	-	-	1.38	7.3
9	1600-800	0.028	-	-	0.007	-	6.8
10	800-400	0.036	-	-	0.019	-	6.1
11	400-200	0.049	-	-	0.051	-	5.1

Remarks: MDD: 1.59 t/m3, OMC: 23.0%, DR: 104.4%, MR: 92.6%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

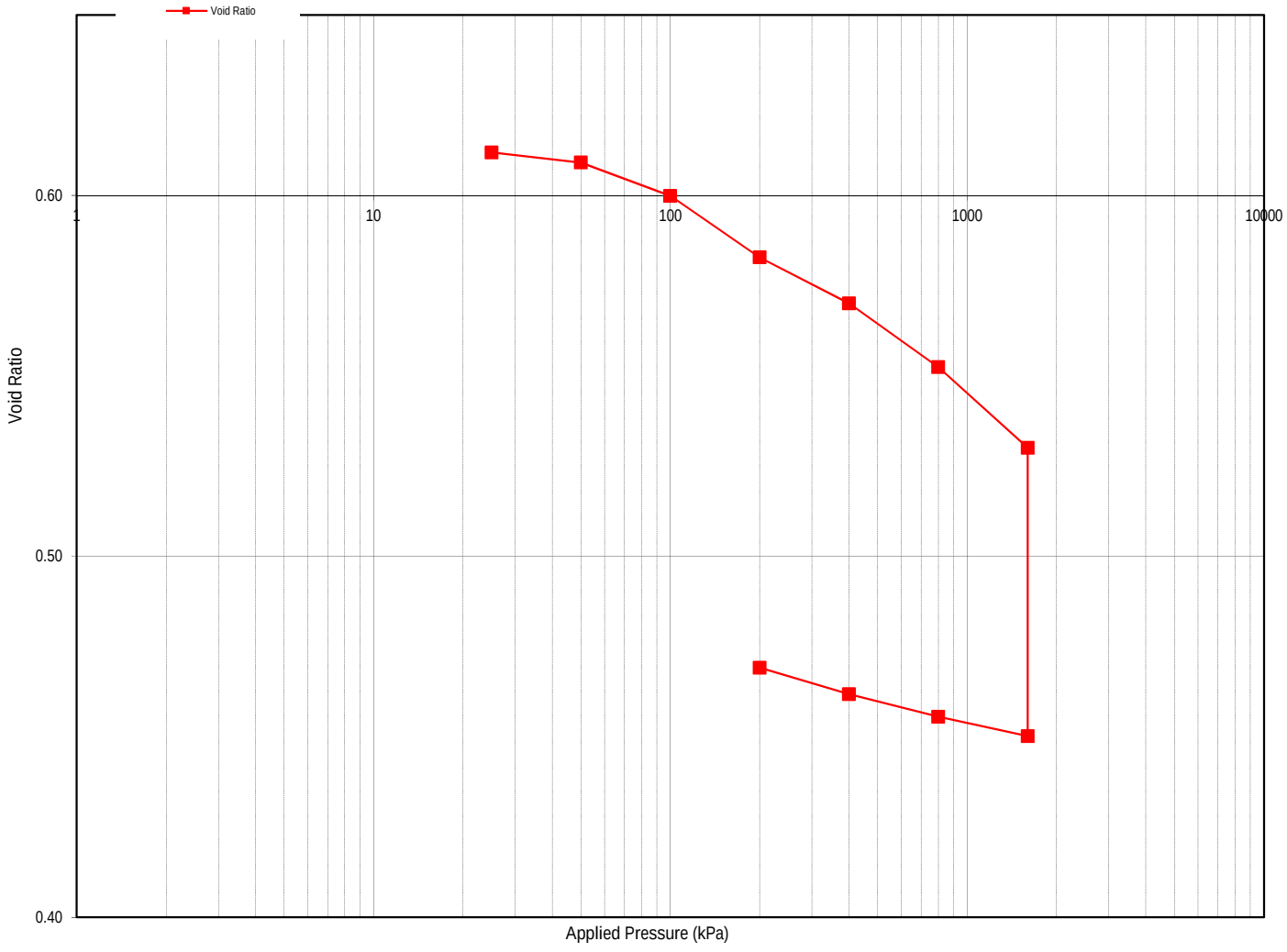
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3205	**Sample No:**	S17DS-04928
Project:	Lilydale Quarry	**Test Date:**	5/10/2017
		Report Date:	20/10/2017
Client Id.:	TP - 17	**Depth (m):**	0 - 0.3m
Description:	Caly with silt		



Wet Density (t/m^3):	1.94	Initial Moisture (%):	24.2	Test Condition:	Inundated on 1600 KPa
Particle Density (t/m^3):	2.59	Final Moisture (%):	26.0	Initial Voids Ratio:	0.624
Remarks:	Moulded at 95% OMC and 100% SMDD			Initial Degree of Saturation (%):	80.5

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

Tharun Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3205	**Sample No:**	S17DS-04928
Project:	Lilydale Quarry	**Test Date:**	5/10/2017
		Report Date:	20/10/2017
Client Id.:	TP - 17	**Depth (m):**	0 - 0.3m

Description: Caly with silt

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	0.15	-	0.294	0.94	0.7
2	25-50	0.009	0.01	-	0.070	2.71	0.9
3	50-100	0.031	0.02	-	0.115	5.49	1.5
4	100-200	0.057	0.01	-	0.106	5.78	2.5
5	200-400	0.042	0.03	-	0.040	6.20	3.3
6	400-800	0.059	0.02	-	0.028	9.79	4.4
7	800-1600	0.074	0.03	-	0.018	10.49	5.8
8	1600-1600	-	0.27	-	-	2.88	10.7
9	1600-800	0.018	-	-	0.005	-	10.4
10	800-400	0.021	-	-	0.011	-	10.0
11	400-200	0.024	-	-	0.025	-	9.5

Remarks: MDD: 1.57 t/3, OMC: 25%, MR: 96.8%, DR: 99.4%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Tharun Delpachitra

Chadwick Geotechnics

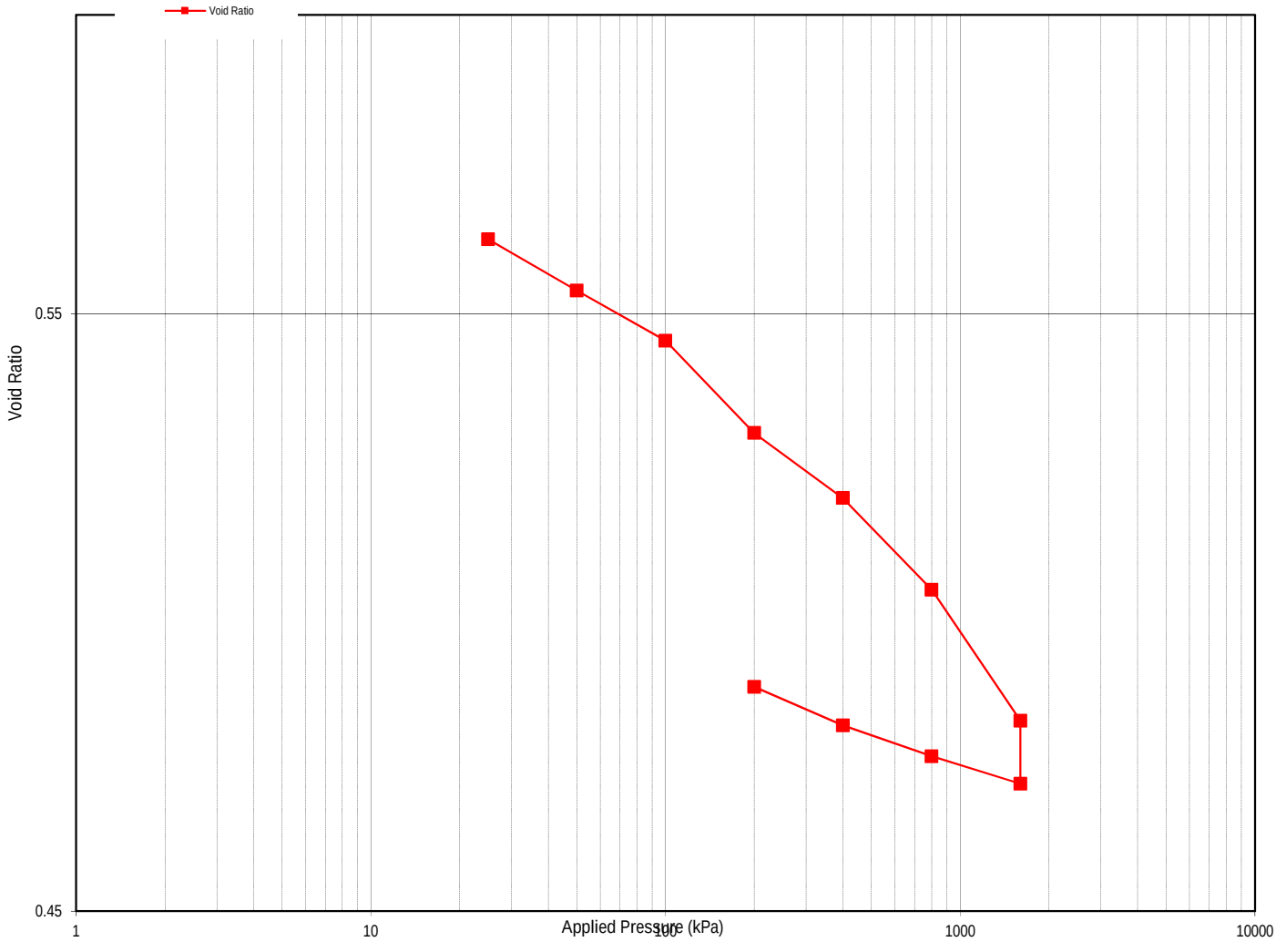
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3205	**Sample No:**	S17DS-04929
Project:	Lilydale Quarry	**Test Date:**	5/10/2017
		Report Date:	20/10/2017
Client Id.:	TP17-06	**Depth (m):**	0 - 0.3m
Description:	Caly with silt		



Wet Density (t/m^3):	2.05	Initial Moisture (%):	24.1	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.59	Final Moisture (%):	25.7	Initial Voids Ratio:	0.567
Remarks:	Remoulded at 95% OMC and			Initial Degree of Saturation (%):	97.1

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

Tharun Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3205	**Sample No:**	S17DS-04929
Project:	Lilydale Quarry	**Test Date:**	5/10/2017
		Report Date:	20/10/2017
Client Id.:	TP17-06	**Depth (m):**	0 - 0.3m

Description: Caly with silt

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	0.76	-	0.109	0.00	0.3
2	25-50	0.029	0.01	-	0.220	2.84	0.8
3	50-100	0.028	0.02	-	0.108	2.75	1.4
4	100-200	0.051	0.00	-	0.100	8.66	2.3
5	200-400	0.036	0.02	-	0.036	6.20	3.0
6	400-800	0.051	0.03	-	0.025	6.51	4.0
7	800-1600	0.073	0.02	-	0.018	6.42	5.4
8	1600-1600	-	0.20	-	-	0.65	6.1
9	1600-800	0.015	-	-	0.004	-	5.8
10	800-400	0.017	-	-	0.009	-	5.5
11	400-200	0.021	-	-	0.022	-	5.1

Remarks: MDD: 1.57 t/m^3, OMC: 25%, MR: 96.4 and DR: 105.1%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Tharun Delpachitra

Head Office
25 Metcalf Street
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

QUALITY OF MATERIALS REPORT with HYDROMETER

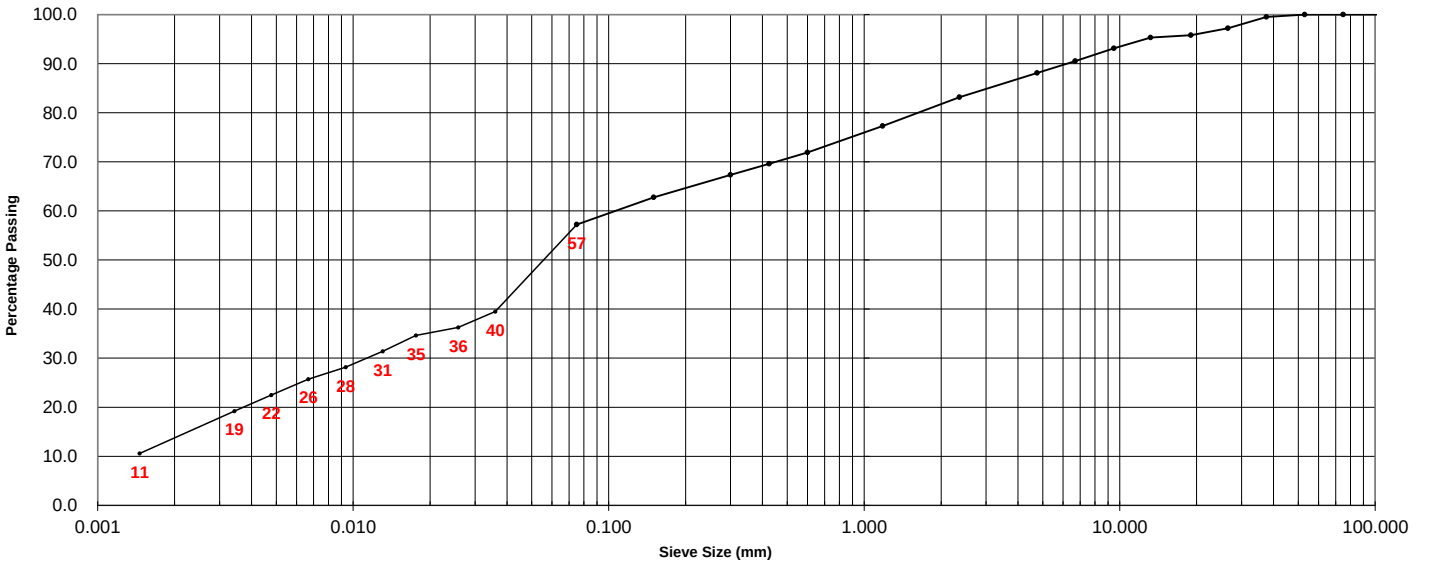
Customer: Tonkin & Taylor (Aus) Pty Ltd
Customer Address: Ground Floor, 95 Coventry Street, Sth Melbourne VIC 3006
Project: Lilydale Quarry Prelim Testing
Location: Lilydale
Customer Order No.: 1004145

Report Number: **W17DS01368**
Report Date: 11/09/2017
Request No: -
Sieve Analysis Test Method: AS 1289.3.6.1
AS1289 3.6.3

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	**S17DS-04923**
ID No.:	1
Lot No:	-
Date Sampled:	8/08/2017
Time Sampled:	-
Date Tested:	22/08/2017
Material Source:	Site Derived
Material Type:	Fill:Clay w Silt
To Be Used As	-
Sample Location	TP17-06 0-0.3m
	-
	-
Sampling Method	AS1289.1.2.1.6.2
Moisture Content (%) AS 1289 2.1.1	28.6
Liquid Limit (%) AS 1289.3.1.2	41
Plastic Limit (%) AS 1289.3.2.1	24
Plasticity Index AS 1289.3.3.1	17
Linear Shrinkage (%) AS 1289.3.4.1	8.0
Cracking, Curling, Crumbling (1,2,3)	2
P.I. x % Passing 0.425mm	1183
L.S. x % Passing 0.425mm	557
Ratio of % Passing (0.075/0.425)	0.82

SIEVE ANALYSIS GRAPH



300mm	150mm	75.00mm	53.00mm	37.50mm	26.50mm	19.00mm	13.2mm	9.50mm	6.70mm	4.75mm	2.36mm	1.18mm	0.600mm	0.425mm	0.300mm	0.150mm	0.075mm
			100	100	97	96	95	93	91	88	83	77	72	70	67	63	57

Soil Classification in accordance with Unified Soil Classification Laboratory Identification Procedure AS1726 Table A1 (1993) - Appendix A, Section A

USC: CI Grading Specification:

Remarks:
-**Dispersion Method:** mechanical **Hydrometer:** grams per litre
-Average Particle Density of **2.60g/cm^3** in accordance with AS1289.3.5.1

ilac-MRA NATA

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

J Lamont

Form No: **CG.349.001**

Issue Date: 19/02/2013

CHADWICK GEOTECHNICS

Dandenong South
ACN 143 009 330
25 Metcalf Street
DANDENONG SOUTH, VIC 3175

Ph: + 61 3 8796 7900
Fax: +61 3 9706 9431

Report No: MDD:S17DS-04923
Issue No: 1

Maximum Dry Density Report

Client: Tonkin & Taylor (Aus) Pty Limited
Address: Ground Floor
SOUTH MELBOURNE VIC 3006
Project: Lilydale Quarry Prelim Testing
Project No.: 1004145
Order No.: **CG Request No.:**
TRN: **Lot No.:**

Accredited for compliance with ISO/IEC 17025 – Testing

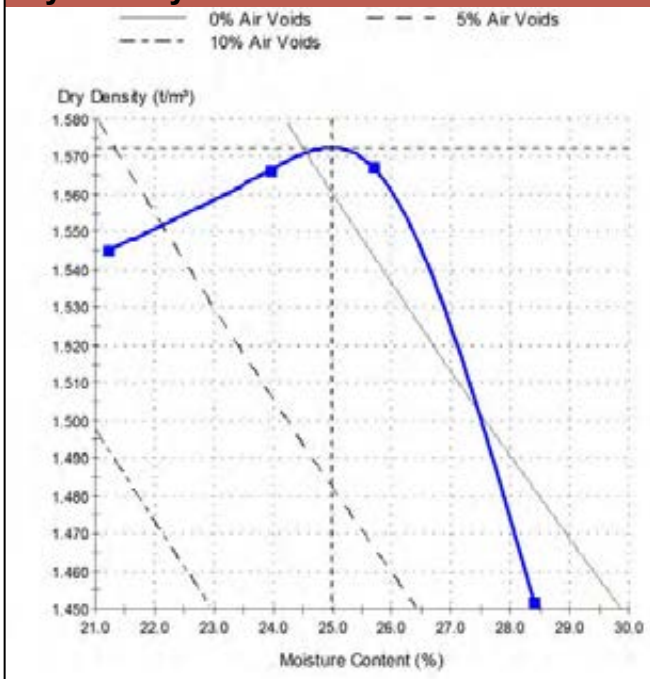
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: J. Lamont
(Melbourne Lab Supervisor)
12712 Date of Issue: 26/10/2017

Sample Details

Location: Infer Upper Cavehill/Topsoil TP17-06 0-0.3m
Sample ID: S17DS-04923 **Date Sampled:** 8/08/2017
Sampling Method: AS1289.1.2.1 Clause 6.5.3
Source: Onsite **Material:** General Fill
Specification: AS Grading
Location: TP17-06, 0-0.3m, As Received
Tested By: T. Hong **Date Tested:** 22/08/2017

Dry Density - Moisture Content Relationship



Test Results

AS 1289.5.1.1

Standard MDD (t/m³):	**1.57**
Standard OMC (%):	**25.0**
Retained Sieve 19mm (%):	3
Date/Time Cure Start:	16/ 08/ 2017 10:00
Date/Time Cure End:	22/ 08/ 2017 15:00

Comments

Chadwick Geotechnics

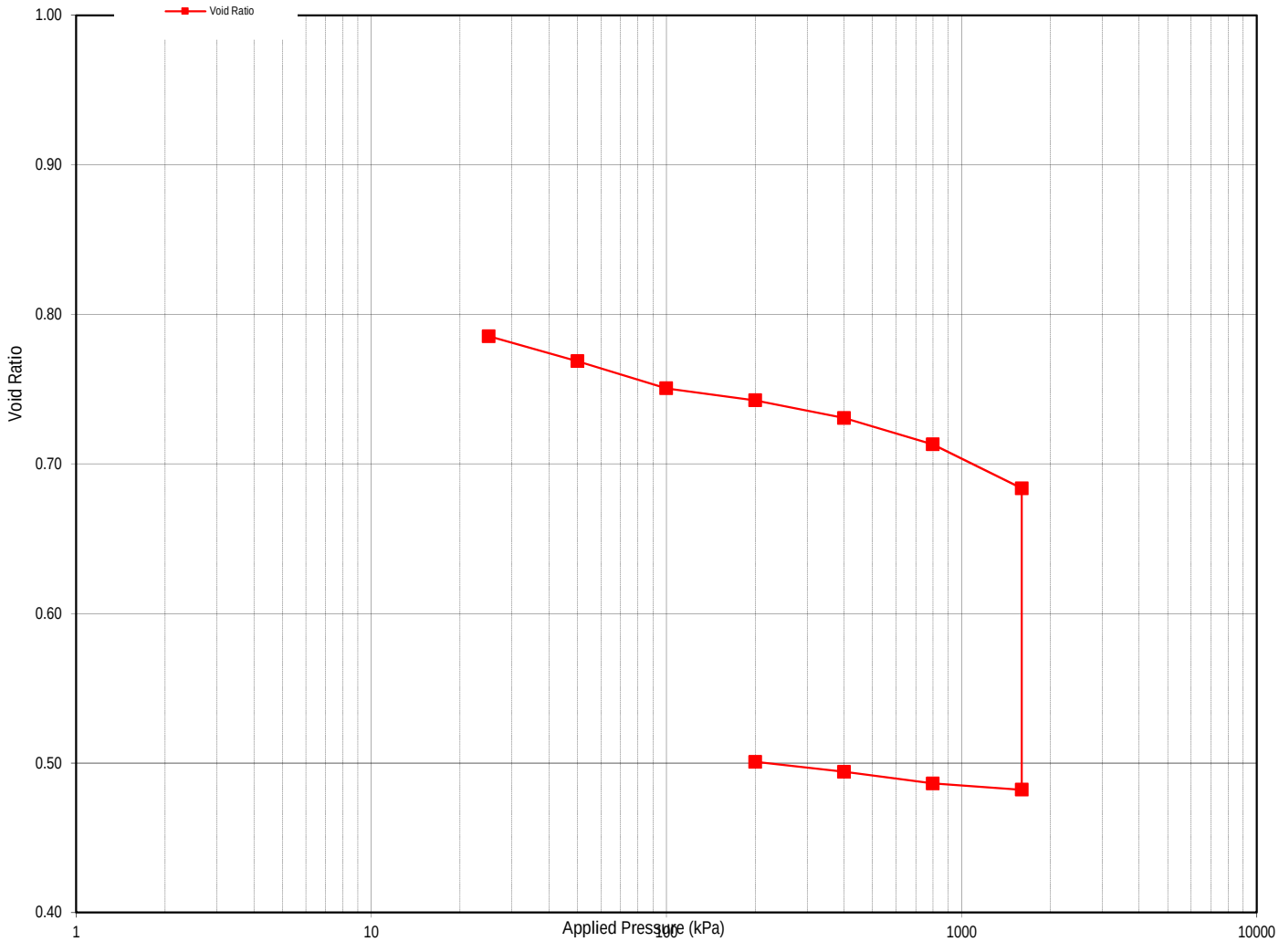
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	Ground Floor, 95 Coventry Street, South Melbourne, Vic	**Sample No:**	S17DS-04924
Project:	Lilydale Quarry PrelimTesting	**Test Date:**	18/09/2017
		Report Date:	12/10/2017
Client Id.:	TP17-06	**Depth (m):**	0.0 - 0.30m
Description:	Silty Clay		



Wet Density (t/m^3):	1.77	Initial Moisture (%):	25.0	Test Condition:	Inundated at 1600 Kpa
Particle Density (t/m^3):	2.60	Final Moisture (%):	21.7	Initial Voids Ratio:	0.788
Remarks:	Remoulded sample: 90% Compaction @ OMC (Amended on 12/10/2017)			Initial Degree of Saturation (%):	75.6

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	Ground Floor, 95 Coventry Street, South Melbourne, Vic	**Sample No:**	S17DS-04924
Project:	Lilydale Quarry PrelimTesting	**Test Date:**	18/09/2017
		Report Date:	12/10/2017
Client Id.:	TP17-06	**Depth (m):**	0.0 - 0.30m

Description: Silty Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	18.54	-	0.067	0.00	0.2
2	25-50	0.055	0.01	-	0.374	6.08	1.1
3	50-100	0.060	0.01	-	0.205	18.97	2.1
4	100-200	0.027	0.02	-	0.046	6.32	2.6
5	200-400	0.039	0.03	-	0.034	6.10	3.2
6	400-800	0.059	0.03	-	0.026	6.89	4.2
7	800-1600	0.098	0.05	-	0.021	8.36	5.9
8	1600-1600	-	0.82	-	-	1.35	17.1
9	1600-800	0.014	-	-	0.004	-	16.9
10	800-400	0.026	-	-	0.013	-	16.5
11	400-200	0.022	-	-	0.022	-	16.1

Remarks: MDD :1.57 t/m^3, OMC: 25.0% / Dry Density: 1.41 t/m^3, DR: 90.0%, MR: 100%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

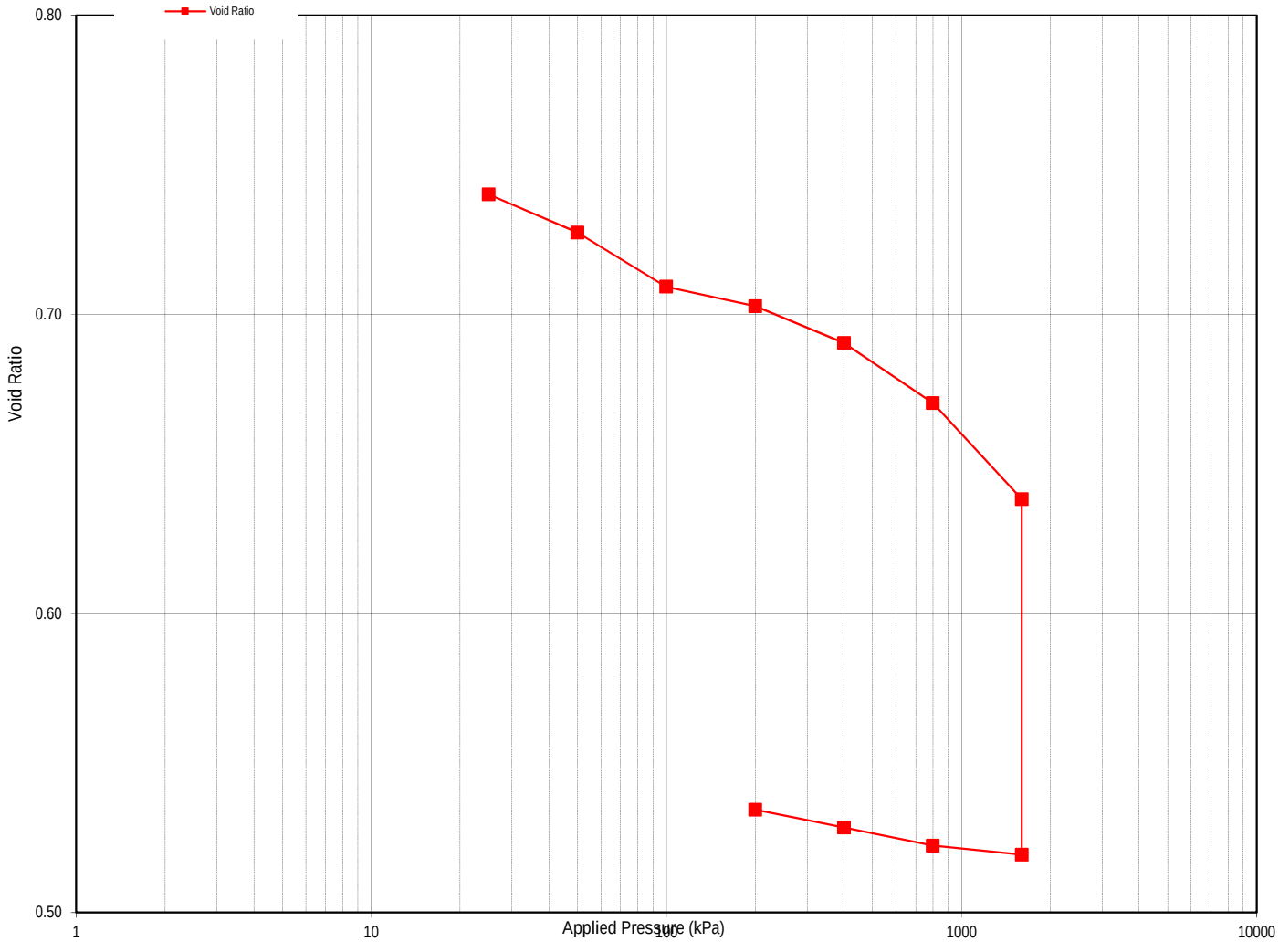
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty Ltd	**Report No.:**	1004145
Address:	Ground Floor, 95 Coventry Street, South Melbourne, Vic	**Sample No:**	S17DS-04925
Project:	Lilydale Quarry PrelimTesting	**Test Date:**	20/09/2017
		Report Date:	4/10/2017
Client Id.:	TP17-06	**Depth (m):**	0.0 - 0.30m
Description:	Silty Clay		



Wet Density (t/m^3):	1.85	Initial Moisture (%):	24.5	Test Condition:	Inundated at 1600 Kpa
Particle Density (t/m^3):	2.65	Final Moisture (%):	22.6	Initial Voids Ratio:	0.745
Remarks:	Remoulded sample: 95% Compaction @ OMC (Amended on 12/10/2017)			Initial Degree of Saturation (%):	95.5

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	Ground Floor, 95 Coventry Street, South Melbourne, Vic	**Sample No:**	S17DS-04925
Project:	Lilydale Quarry PrelimTesting	**Test Date:**	20/09/2017
		Report Date:	4/10/2017
Client Id.:	TP17-06	**Depth (m):**	0.0 - 0.30m

Description: Silty Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	4.67	-	0.105	0.00	0.3
2	25-50	0.043	0.01	-	0.294	11.76	1.0
3	50-100	0.060	0.01	-	0.209	9.90	2.0
4	100-200	0.022	0.03	-	0.038	4.65	2.4
5	200-400	0.041	0.04	-	0.036	6.10	3.1
6	400-800	0.067	0.03	-	0.030	3.45	4.3
7	800-1600	0.107	0.04	-	0.024	10.27	6.1
8	1600-1600	-	0.21	-	-	1.06	12.9
9	1600-800	0.010	-	-	0.002	-	12.7
10	800-400	0.020	-	-	0.010	-	12.4
11	400-200	0.020	-	-	0.019	-	12.1

Remarks: MDD :1.57 t/m3, OMC: 25.0% / Dry Density: 1.49t/m3, DR: 94.8%, MR: 98.0%

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

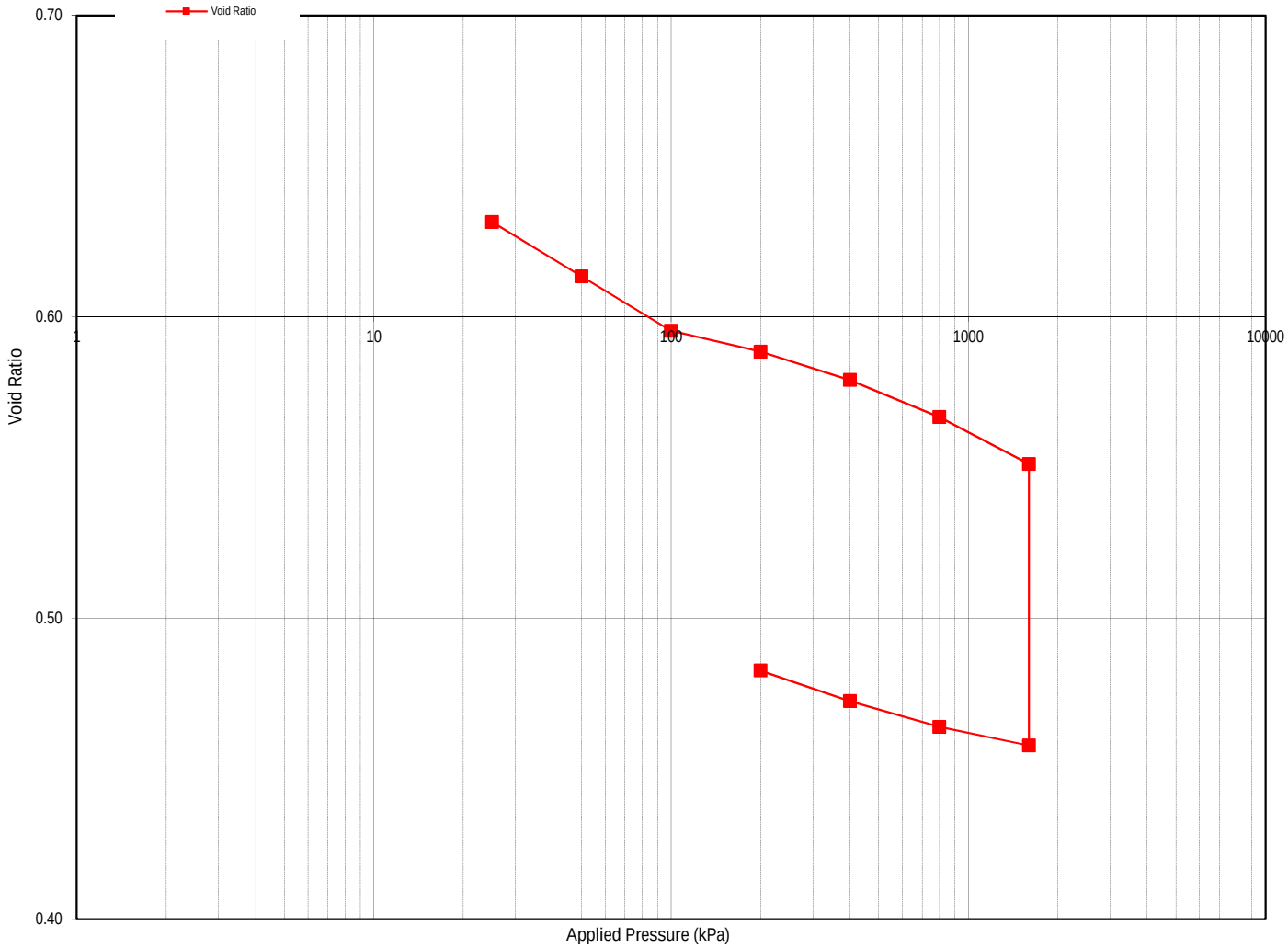
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	Ground Floor, 95 Coventry Street, South Melbourne, Vic	**Sample No:**	S17DS-04926
Project:	Lilydale Quarry PrelimTesting	**Test Date:**	18/09/2017
		Report Date:	4/10/2017
Client Id.:	TP17-06	**Depth (m):**	0.0 - 0.30m
Description:	Silty Clay		



Wet Density (t/m^3):	1.95	Initial Moisture (%):	25.1	Test Condition:	Inundated at 1600 KPa
Particle Density (t/m^3):	2.60	Final Moisture (%):	21.5	Initial Voids Ratio:	0.652
Remarks:	Remoulded sample: 100% Compaction @ OMC (Amended on 12/10/2017)			Initial Degree of Saturation (%):	105.5

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

T Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor (Aus) Pty	**Report No.:**	1004145
Address:	Ground Floor, 95 Coventry Street, South Melbourne, Vic	**Sample No:**	S17DS-04926
Project:	Lilydale Quarry PrelimTesting	**Test Date:**	18/09/2017
		Report Date:	4/10/2017
Client Id.:	TP17-06	**Depth (m):**	0.0 - 0.30m

Description: Silty Clay

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	3.54	-	0.506	0.00	1.3
2	25-50	0.060	0.01	-	0.443	10.13	2.4
3	50-100	0.060	0.01	-	0.224	19.77	3.5
4	100-200	0.023	0.01	-	0.043	6.40	3.9
5	200-400	0.031	0.02	-	0.030	6.17	4.4
6	400-800	0.041	0.02	-	0.019	6.69	5.2
7	800-1600	0.052	0.03	-	0.012	6.59	6.1
8	1600-1600	-	0.19	-	-	1.34	11.8
9	1600-800	0.021	-	-	0.005	-	11.4
10	800-400	0.028	-	-	0.015	-	10.9
11	400-200	0.034	-	-	0.034	-	10.3

Remarks: MDD :1.57 t/m3, OMC: 25.0% / Dry Density: 1.41 t/m3, DR: 99.4%, MR: 100.2

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

T Delpachitra

Chadwick Geotechnics

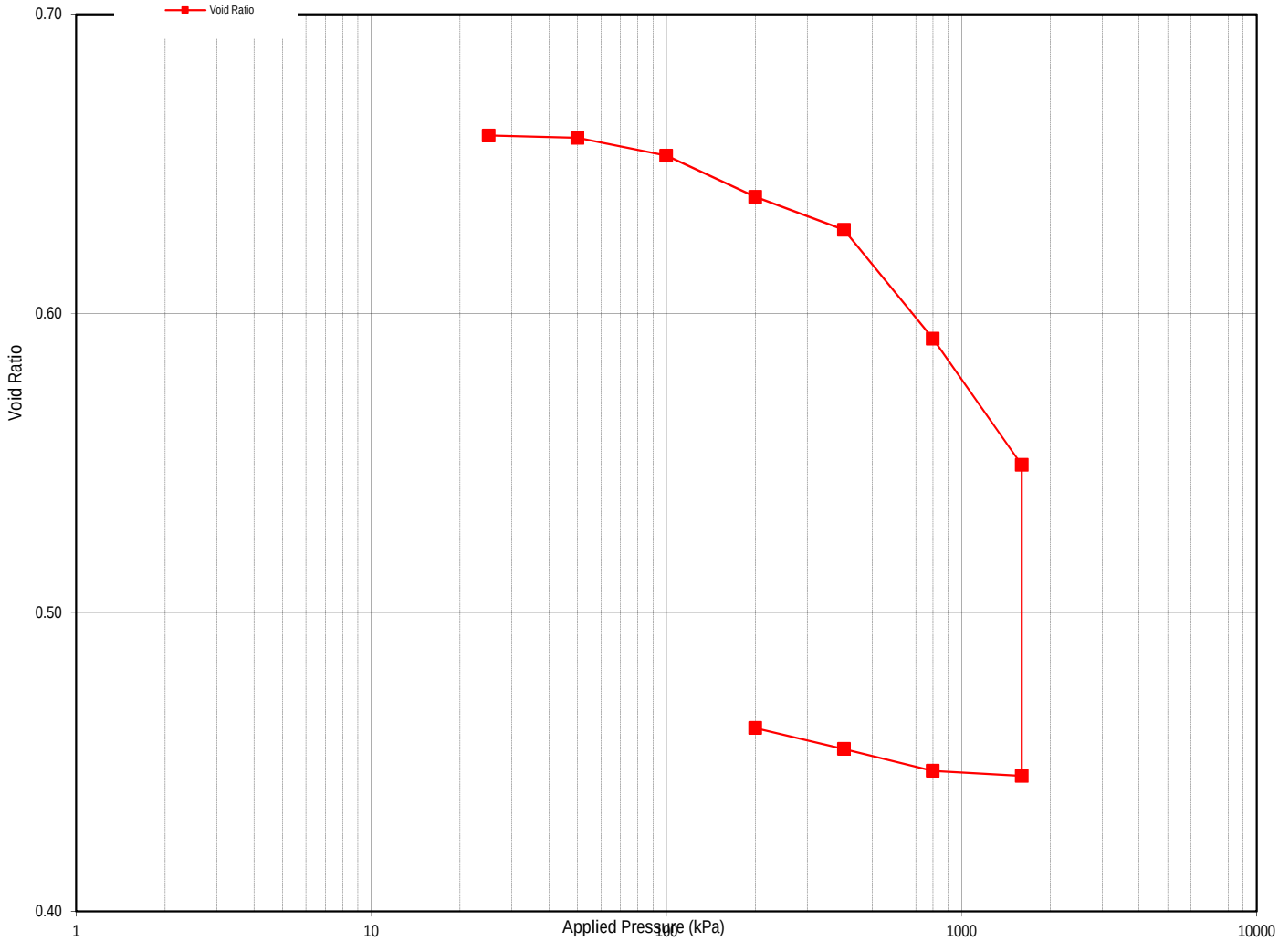
Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3205	**Sample No:**	S17DS-04927
Project:	Llilydale Quarry	**Test Date:**	5/10/2017
		Report Date:	23/10/2017
Client Id.:	TP 17	**Depth (m):**	0 - 0.3m
Description:	Clay with Silt		



Wet Density (t/m^3):	1.83	Initial Moisture (%):	23.0	Test Condition:	Inundated on 1600 Kpa
Particle Density (t/m^3):	2.59	Final Moisture (%):	24.0	Initial Voids Ratio:	0.661
Remarks:	Remoulded 95% OMC and 95% SMDD			Initial Degree of Saturation (%):	100.1

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Laboratory Accreditation Number 12719

Tharun Delpachitra

Chadwick Geotechnics

Head Office
25 Metcalf Street
Dandenong South VIC 3175

Tel: (03) 8796 7900
Fax: (03) 8796 7944

OEDOMETER TEST REPORT

Test Method: AS1289.6.6.1, 3.5.1

Client:	Tonkin & Taylor	**Report No.:**	1004145
Address:	95 Conventry St, South Melbourne, VIC 3205	**Sample No:**	S17DS-04927
Project:	Llilydale Quarry	**Test Date:**	5/10/2017
		Report Date:	23/10/2017
Client Id.:	TP 17	**Depth (m):**	0 - 0.3m

Description: Clay with Silt

TEST RESULTS

Stage	Load (kPa)	Cc	Cv (m^2/yr) t_{50}	Cv (m^2/yr) t_{90}	Mv ($kPa^{-1}x10^{-3}$)	C_a x 10^{-3}	% Consolidation
1	0-25	-	0.13	-	0.049	1.53	0.1
2	25-50	0.003	1.08	-	0.018	0.00	0.2
3	50-100	0.020	0.01	-	0.072	0.98	0.5
4	100-200	0.046	0.01	-	0.083	8.18	1.4
5	200-400	0.037	0.02	-	0.034	10.42	2.0
6	400-800	0.121	0.02	-	0.056	9.56	4.2
7	800-1600	0.140	0.07	-	0.033	11.08	6.8
8	1600-1600	-	0.51	-	-	4.54	13.0
9	1600-800	0.006	-	-	0.001	-	12.9
10	800-400	0.024	-	-	0.013	-	12.5
11	400-200	0.023	-	-	0.024	-	12.0

Remarks: MDD: 1.57 t/m3, OMC: 25%, DR: 94.9%, MR: 92%

NATA

Accredited for compliance with ISO/IEC 17025.
The results of tests, calibrations and/or measurements included in this document are traceable to Australian national standards.

Approved Signatory:

Tharun Delpachitra

www.tonkintaylor.com.au