APPENDIX H -
CONCEPT DESIGN AND FILLING STRATEGY

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CONCEPT DESIGN AND FILLING STRATEGY

Luddenham Quarry
275 Adams Road
Luddenham, NSW

Prepared for
CFT No.13 Pty Ltd & KLF Holdings Pty Ltd
Level 5, 2 Grosvenor Street
Bondi Junction NSW 2022

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InSitu Advisory

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1 INTRODUCTION

InSitu Advisory Pty Ltd (InSitu Advisory) was commissioned by CFT No.13 Pty. Limited (CFT) and KLF Holdings Pty Ltd to undertake a Concept Design and Filling Strategy (CDFS) at the Adams Road Quarry, 275 Adams Road, Luddenham, NSW 2745 (see Figure 1).

CFT No 13 Pty Ltd, a member of Coombes Property Group (CPG), has recently acquired the property at 275 Adams Road, Luddenham NSW (Lot 3 in DP 623799, 'the site') within the Liverpool City Council municipality. The site is host to an existing shale/clay quarry.

CPG owns, develops, and manages a national portfolio of office, retail, entertainment, land, and other assets. The company's business model is to retain long-term ownership and control of all its assets. CPG has the following staged vision to the long-term development of the site:

- Stage 1 Quarry Reactivation: **Solving a problem**. CPG intends to responsibly avoid the sterilisation of the remaining natural resource by completing the extraction of shale which is important to the local construction industry as raw material used by brick manufacturers in Western Sydney. Following the completion of approved extraction activities, the void prepared for rehabilitation.

- Stage 2 Advanced Resource Recovery Centre (ARRC) and Quarry Rehabilitation: **A smart way to fill the void**: CPG in partnership with KLF Holdings Pty Ltd (KLF) and in collaboration between the circular economy industry and the material science research sector, intends to establish a technology-led approach to resource recovery, management, and reuse of Western Sydney's construction waste, and repurposing those materials that cannot be recovered for use to rehabilitate the void. This will provide a sustainable and economically viable method of rehabilitating the void for development.

- Stage 3 High Value Employment Generating Development: **Transform the land to deliver high value agribusiness jobs**. CPG intends to develop the rehabilitated site into a sustainable and high-tech agribusiness hub supporting food production, processing, freight transport, warehousing, and distribution, whilst continuing to invest in the resource recovery R&D initiatives. This will deliver the vision of a technology-led agribusiness precinct as part of the Aerotropolis that balances its valuable assets including proximity to the future Western Sydney Airport (WSA) and Outer Sydney Orbital.

This CDFS aims to address the comments from the Department Planning, Industry and Environment (DPIE) and government agencies in respect to an Environmental Impact Statement (EIS) application to establish the ARRC prepared by EMM Consulting Pty Ltd.

It is noted that infilling of the quarry void does not form part of the ARRC application. Infilling of the void will be the subject of a future modification application of the existing quarry consent. This CDFS, therefore, provides high level information to DPIE and government agencies to demonstrate the feasibility of infilling the void with the material and as per the methodology described herein.

The main considerations that this CDFS addresses are as follows:

- *The wildlife assessment submitted as part of AIA refers to the Western Sydney Airport EIS and that Western Sydney Airport EIS did not identify the Proposed Development site as a risk. When the Western Sydney Airport EIS was prepared a waste management facility was not proposed for the site and therefore it is not relevant that the Western Sydney Airport EIS did not identify the site as an area of concern. (Western Sydney Airport);*

- *This Department is concerned about the consultant's claim that quarries are "low risk", given International Civil Aviation Organisation wildlife management guidance identifies quarries and waste facilities as key potential off-airport attractants. (Department of Infrastructure, Transport, Regional Development and Communications);*

- *The application states "This ARRC application seeks approval to transfer non-recyclable residues to the void. It does not seek approval for the placement of this material, which will be subject to a separate approval." WSA seeks clarification regarding the Applicant's intent on how it proposes to manage and dispose of waste that is not recycled. (Western Sydney Airport);*

- *The EIS states that it is the intent of the facility to receive garden waste, wood waste and vegetative waste, but does not provide detail of how this waste is to be managed or disposed of. These types of waste are organic waste and if disposed of in the quarry void would likely result in the generation of land fill gas as the waste breaks down. This would require management of land fill gas and may give rise for the need for flaring or plumes to manage land fill gases. Management of any land fill gas (e.g. flaring) needs to be assessed as it can create a hazard to Airport operations. In addition, wildlife hazards associated with landfilling will need to be assessed. Further information and clarification on this matter is required. (Western Sydney Airport); AND*

- *Importantly, it remains unclear from the documents provided what is ultimately proposed for the development site and what are the timings of the various stages of development and operations over the medium to long term. … The Department would like more information on the Proponent's long-term plans for the site to better consider the potential impacts on the Airport (Department of Infrastructure, Transport, Regional Development and Communications).*

This CDFS is based upon a review of existing documents (previous project reports and NSW EPA Environmental Guidelines: Solid Waste Landfills, Second Edition 2016) and site inspection observations made by InSitu Advisory. A preliminary landfill voidspace assessment has previously been estimated to determine the likely waste void space achieved post quarrying adhering to the requirements of the NSW EPA Environmental Guidelines 2016 (Landfill Guidelines).

The landfill concept design presented within this CDFS assumes that the quarry will be extracted to its full extent as approved by Development Approval No. 315-7-2003 issued by the Minister for Infrastructure, Planning and Natural Resources on 23 May 2004 and as subsequently modified (assuming other aspects of the Landfill Guidelines are also adhered to). It has been assumed that Modification 5 will be approved and that the quarry will extract up to 300,000 tonnes per annum (t/pa) until 31 December 2024.

2 SITE DETAILS

2.1 Location

The Adams Road Quarry is located approximately 65km west of the Sydney CBD and locally some 350 metres to the south east of the intersection between Adams Road and Elizabeth Drive in the suburb of Luddenham, NSW (see Figure 1).

2.2 The Site

The site is a dormant quarry that was previously worked to produce clay, shale and structural clay used for the manufacture of bricks and pavers. Interbedded sandstone was also quarried with the clay/shale but is typically not used in the brick manufacturing process.

The site is an irregular shaped parcel with an area of 19.09 Ha, comprising one single lot (Lot 3). The site comprises a single open pit which is bordered to the east and south by Commonwealth land, to the north by open farming land and a residential dwelling, and to the west to quarry related buildings and open stockpiles. The eastern boundary of the subject property is demarcated by Oaky Creek.

The separate landholdings of Lot 281 DP 571171 and Lot 1 DP 838361 are located to the north and south of the property respectively. The Commonwealth land is currently being prepared for the construction of the Western Sydney Airport. The site sits independent of any land set aside for this airport.

2.3 Geology and Hydrogeology

2.3.1 Geology

The Penrith 1:100,000 series geological sheet shows that the site is underlain by the Bringelly and Ashfield Shales of the Wianamatta Group and Hawkesbury Sandstone. Quaternary alluvial sediments are also located within the vicinity.

The Bringelly Shale is a low permeability geological unit that hosts a number of landfills in the vicinity due to its ability to provide a natural geological barrier to compliment engineered landfill containment barriers protecting the groundwater. Nearby waste management facilities within the Bringelly Shale include SUEZ - Elizabeth Drive, Brandown - Elizabeth Drive, Bingo - Orchard Hills and Hi-Quality – Kemps Central.

2.3.2 Hydrogeology

The Luddenham Quarry Modification Report DA 315-7-2003 MOD5, dated August 2020, prepared by EMM Consulting Pty Ltd presents the findings of a qualitative groundwater assessment. The assessment states *the most recent groundwater standing water levels (SWLs) measured in the bores were in May 2017. These ranged from 58.36 m AHD (bore BSM1) in the south-west to 46.83 m AHD to the north-east (bore BSM3), with the inferred groundwater flow direction to the north-east mirroring the prevailing topography. Quarrying activities have disrupted natural groundwater flow, with some local groundwater flows likely to be towards the pit. Groundwater quality measured at this time indicated that groundwater was near neutral, saline (total dissolved solids (TDS) of approximately 18,000 mg/L), and with elevated total nitrogen concentrations. Relatively low concentrations of metals were also reported for the bores sampled, less than the relevant guideline values.*

Any landfill detailed design will likely need to consider groundwater ingress and its effect on the engineered containment system proposed. Hydraulic uplift pressures in some instances can disrupt and damage an engineered barrier unless mitigating design measures are installed.

3 LANDFILL CONCEPTUAL DESIGN

3.1 Required Design Considerations

The Protection of the Environment Operations Act 1997 prescribes the waste classification system in NSW. The Act defines six waste classes:

- general solid waste (putrescible)
- general solid waste (non-putrescible)
- restricted solid waste

- special waste
- hazardous waste
- liquid waste

Inert Waste Class 2 would now sit within the general solid waste (non-putrescible) classification.

The original environmental impact statement for the quarry (Douglas Nicolaisen & Associates Pty Ltd, 2003, Environmental Impact Statement – Proposed Clay/Shale Extraction Operation – Lot 3 - 272 Adams Road Luddenham NSW, prepared for Badger Mining Company Pty Limited) describes the backfill and rehabilitation of the void using materials that satisfy the criteria for Class 2 inert waste.

The EPA's Waste Classification Guidelines (NSW EPA, 2014) provide further guidance on how to classify waste for disposal.

3.2 Base and Sidewall Containment Engineering

3.2.1 Design Requirements

The Landfill Guidelines state that the base and walls of solid waste landfill cells should be lined with a durable material of very low permeability to form a barrier between the waste and the groundwater, soil and substrata.

For General Solid Waste (non-putrescible) Landfills (Inert Waste Class 2) the primary barrier system should include the following components, from bottom to top:

- a compacted sub-base 200 millimetres thick to provide a firm, stable, smooth surface of high bearing strength on which to install the liner;
- a compacted clay liner at least 1000 millimetres thick, with an in situ hydraulic conductivity of less than 1×10^{-9} metres/second; for landfills receiving more than 20,000 tonnes of waste per year, the liner should include a geomembrane over the compacted clay; the base liner should have gradients of greater than 1% longitudinally and 3% in transverse directions;
- a leachate collection layer comprising a 300 millimetres thick gravel drainage layer including collection pipework, which slopes to a sump or other extraction point from which leachate can be conveyed from the cell; the pipes should be at least 150 millimetres in internal diameter, be placed on the floor at intervals of not more than 25 metres (running the length of the cell), and be laid at gradients of at least 1% longitudinally into the sump and 3% in transverse directions.

As an alternative to compacted clay, a geosynthetic clay liner (GCL) may be used, provided it is used in composite with an overlying geomembrane liner.

A protection or cushion geotextile should be used to protect geomembranes from damage by construction equipment and overlying materials.

A separation geotextile should be placed above the drainage layer to reduce the ingress of fines from the overlying waste.

A geonet drainage geocomposite may be used for side wall drainage to a groundwater collection sump should groundwater seepages be noticed after final excavation.

3.2.2 Concept Design

The concept design for the proposed landfill is presented within Figures 2-4 adopting the requirements outlined within the Landfill Guidelines. Figure 3 shows a concept excavation surface that has side slopes and basal levels in accordance with the DA consent for the extent of clay/shale extraction. The basal liner would either be a minimum 1000mm of compacted clay/shale with an overlying 2mm high-density polyethylene (HDPE) liner (and protection geotextile), or a GCL alternative to the 1000mm of clay shale. The GCL would still need to have an overlying HDPE and protection geotextile (see design option within Figure 2).

Bringelly clay/shale has been proven to be suitable for use in landfill leachate barriers (subject to meeting design, construction and testing requirements) as shown in nearby facilities including Brandown, and SUEZ both on Elizabeth Drive, Kemps Creek.

In order to collect and manage accumulated leachate from the base of the landfill, a minimum 300mm aggregate drainage layer would be installed above the protection geotextile. Within the leachate drainage aggregate would need to be a connected network of minimum 150mm internal diameter slotted pipes placed across the landfill floor at typically 25m spacing. The leachate pipework would fall to a lowered sump whereby a side wall extraction riser would be placed that was extended in lifts to the surface, whereby leachate could be extracted and managed.

Due to the steep sided nature of the quarry walls (approx. 70 degrees once extracted to defined limits), the concept design presented allows for progressive construction of the side walls upon the completed landfill basal area. It is not possible to construct a compacted clay/shale wall from the base of the proposed landfill to the final surface for wall stability and safety in construction reasons.

Similar to other nearby steep sided landfills within the Bringelly Shale, the side wall engineering should be built in lifts of approximately 3m in height. The clay/shale barrier would typically be some 3m in width to allow construction plant to traverse along, this being subsequently trimmed back to the required minimum thickness of 1m. With the wall constructed under Construction Quality Assurance (CQA) supervision, in accordance with the Landfill Guidelines, the overlying 2mm HDPE liner needs to be installed. Overlying the HDPE will be a non-woven needle punched protection geotextile.

With EPA approval of the CQA Validation report, waste would be emplaced to the level of the engineered side walls to provide a supporting buttress to the engineered walls and to provide a safe working platform for the construction of subsequent side wall lifts. Side wall construction-waste emplaced should continue until the top of the landfill walls are reached. A concept filling plan and tipping cross sections are presented in Figures 6 and 7 respectively.

3.3 Landfill Gas Consideration

The waste type proposed is general solid non–putrescible waste and, as such, is not anticipated to produce significant amounts of landfill gas. Therefore, a formal gas collection and treatment system is not currently proposed. However, should future environmental monitoring at the site suggest that landfill gas emissions are near permissible levels, a number of engineering controls, such as the inclusion of a landfill gas collection and treatment system, will be assessed and implemented as necessary and in consultation with NSW EPA.

3.4 Capping and Rehabilitation

3.4.1 Design Requirements

The final capping of general and restricted solid waste landfills should comprise, from bottom to top:

- a seal-bearing surface consisting of a properly designed and engineered layer of material at least 300 millimetres thick to support the sealing layer; the material should meet recognised specifications for engineered materials, such as QA Specification 3071: Selected Material for Formation (NSW Roads and Maritime Services, December 2011), as amended from time to time;
- a sealing layer, comprising a compacted clay layer at least 600 millimetres thick, with an in situ saturated hydraulic conductivity of less than 1 x 10^{-9} metres/second; and
- a revegetation layer at least 1000 millimetres thick and comprising clean soils and vegetation with root systems that will not penetrate into lower layers; the upper 200 millimetres should be a topsoil layer, which can include compost to help with vegetation establishment and growth.

Alternatives may be proposed to the designs and specifications, these are detailed within the Landfill Guidelines.

Waste disposal to land will allow (subject to Development Consent and NSW EPA EPL conditions) waste to not only be emplaced back to original ground level, but will allow for a domed landform to facilitate adequate stormwater management infrastructure. NSW EPA Guidelines, Section 9.1 states 'to facilitate runoff and minimise ponding of water, the cap should have a gradient of greater than 5% to defined drainage points. However, to reduce the risk of erosion, steep caps (greater than 20%) should be avoided. A 20% slope angle equates to a 1(V):5(H).

3.4.2 Concept Design

The proposed capping concept design is in accordance with the Landfill Guidelines utilising a composite capping system comprising a Geosynthetic Clay Liner and overlying Liner Low Density Geomembrane (LLDPE). To protect the composite capping barrier, a protection geotextile is to be placed above the LLDPE (see Figure 2).

As with the basal engineering requirements, Bringelly clay/shale has been proven to be suitable for use in landfill engineering barriers (subject to meeting design, construction and testing requirements), providing a robust, low permeability layer appropriate for landfill capping applications.

Although the Landfill Guidelines allow side slope gradients to be <20%, the completed landfill surface needs to support further industrial development requiring a flatter topographical landform. The concept design proposed shows a slightly domed landform over the deepest section of the quarry/landfill to represent and acknowledge the settlement of the waste anticipated, allowing the domed surface to typically settle to a near level surface in respect to the surrounding land.

The detailed design would need to calculate the actual settlement rates expected to produce a final pre-settlement waste surface. Settlement would typically be driven by a number of factors including waste moisture content, waste composition, degree of compaction, waste depth etc. The proposed concept landform pre-settlement waste landform is presented as Figure 5.

Rehabilitation soils to a typical depth of minimum 1,000mm shall be placed over the protection geotextile. The soil profile will be typically 900mm subsoil and an overlying minimum 100mm of topsoil. A components of the concept design layers are presented within Figure 2. Due to the proposed future development over the site, the detailed capping design of the emplaced fill may consider additional VENM (additional 2m) over and above the minimum 1m to allow for unimpeded foundation design and construction.

Revegetation would typically include grasses and shallow rooted shrubs as required. Deep rooted plants and trees should be avoided that have roots that extend down to the composite capping barrier having the potential to damage or penetrate the engineered layers.

4 FILLING STRATEGY

Waste emplacement within the landfill would commence on receiving all necessary approvals and consents, including that for the CQA Validation report.

Due to engineering side walls constraints, waste will be emplaced in a series of lifts to provide support to the engineered side walls. The concept filling strategy utilises an entry point into the landfill in the south-eastern corner, directly off of the existing eastern side site access road.

A detailed design may consider dividing up the base of the landfill into a number of sub-cells to satisfy the requirements of a water balance assessment, as long as leachate was managed and extracted from the sub-cells appropriately.

Although the surface area of the landfill base is approximately 52,000m^2 (based on Figure 4), that active tipping face should be kept as small as possible, in accordance with section 6.1 of the Landfill Guidelines. The Landfill Guidelines under 'Operating practices for odour control' states that operators should '*keep the active face as small as practicable. Ideally, the area of the tipping face should be no more than 600 square metres (i.e. 30 x 20 metres) where health and safety considerations allow*'.

Waste should be placed in discrete layers (typically 1m to 2m in thickness) to allow for adequate compaction of the waste and to remove cavities or voids within the waste mass. Compaction trials should be undertaken to ascertain the most appropriate waste lift thickness that is suited to the compaction plant used. Suitable waste compaction allows for a more efficient use of the waste void space, reduces subsequent waste settlement, better controls litter and odour release etc.

In accordance with the Landfill Guidelines, Section 8, emplaced waste will be covered regularly during operations with a suitable material to minimise odour, dust, litter, the presence of scavengers and vermin, the risk of fire, rainwater infiltration into the waste (and therefore the amount of leachate generated) and the emission of any landfill gas. Covering of waste will include:

- Daily cover – typically virgin excavated natural material (VENM) in the form of soil with a minimum depth of 150mm.
- Intermediate cover – being a more substantial cover than daily cover used to close off a cell that will not receive additional lifts of waste for some time or will not be finally capped for some time. The intermediate soil layer would typically be a minimum 300mm of VENM and have a minimum impermeability requirement.

- Alternate daily cover material – which may include (subject to EPA approval) inert waste materials (e.g. crushed building waste and glass), waste-derived organic materials, and speciality manufactured covers (e.g. plastic sheets, tarps, foams and fabricated metal landfill lids).

A concept filling plan and tipping cross sections are presented in Figures 6 and 7 respectively. The landfill entry access ramp is progressively shortened as the waste lifts rise within the landfill until it is removed. The access ramp will need to be moved laterally as the waste lifts increase in order to engineer the side wall behind the access ramp for each lift. The access ramp length in respect to waste lift height is indicated within Figure 6.

Mobile plant and equipment used for waste placement and compaction within the cell would normally include the following:

- Waste compactor – a heavy wheeled compactor with four pad-foot 'spiked' steel wheels designed to break up waste and providing compaction. Compactors vary in machine weight depending on make and model, but a typical example would be a 40 tonne CAT826K https://www.cat.com/en_AU/products/new/equipment/compactors/landfill-compactors.html or a 32 tonne Tana H320 https://tana.fi/products/tana-h320/

- Tracked bulldozer - to push waste into layers to allow greater efficiency to the waste compactor and for general trimming of the waste surface and placement of cover soils.

- Articulated dump truck/s - to transport the residual waste from the ARRC to the landfill working area, and to transport cover soils from any cover soil stockpile to the working area.

- Tracked excavator or front wheeled loader – used to load residual waste at the ARRC into the articulated dump trucks and to load VENM for waste covering.

In order to achieve a shallow **pre-settlement** 'domed' final landform, the conceptual top of waste contours are presented within Figure 5. The final landform (**post settlement**) is required to be flat to allow for proposed warehouse construction. Rate of settlement is dependent on degree of compaction afforded to the emplaced waste, moisture content of the waste, waste type etc. Adequate compaction of a residual waste derived from a C&D recycling stream, together with a capping design that incorporates approximately 3m of covering VENM and shallow capping slopes will provide a geotechnically stable landform (subject to appropriate loading calculations and warehouse foundation design etc). Waste settlement calculations would need to be undertaken to ascertain when the majority of waste settlement would likely take place. It is anticipated that the settlement would be in excess of 12 months. Waste settlement can be accelerated operationally through regular leachate extraction, reduced waste layer thickness, and continual compaction. Additional engineering measures can be considered (subject to trials and approvals) to accelerate compaction, these include measures such as dynamic compaction. Dynamic compaction is a method that is used to increase the density of the soil which involves dropping a heavy weight repeatedly on the ground at regularly spaced intervals usually by a crane or similar.

5 ADDRESSING DPIE CONSIDERATIONS

The following DPIE considerations are responded to under each specific point, as follows:

- *The wildlife assessment submitted as part of AIA refers to the Western Sydney Airport EIS and that Western Sydney Airport EIS did not identify the Proposed Development site as a risk. When the Western Sydney Airport EIS was prepared a waste management facility was not proposed for the site and therefore it is not relevant that the Western Sydney Airport EIS did not identify the site as an area of concern. (Western Sydney Airport);*

    - Landfill facilities that dispose of general solid waste (non-putrescible) waste, specifically construction and demolition residual wastes, with good operational practices do not normally attract wildlife, specifically birds or scavengers due to the nature of the waste handled at the facility. Unlike putrescible waste facilities that do attract these pests due to food scraps and other organics being present. The waste entering the site is initially dropped off in an enclosed shed facility which is processed to recover recyclables and resources such as timber, steel, crushed a concrete/brick etc. Residual waste would be transferred to the landfill voidspace where it would be deposited, spread, compacted and covered in soil in accordance with an approved Landfill Environmental Management Plan (LEMP) and in accordance with the Landfill Guidelines and a NSW EPA EPL.

- *This Department is concerned about the consultant's claim that quarries are "low risk", given International Civil Aviation Organisation wildlife management guidance identifies quarries and waste facilities as key potential off-airport attractants. (Department of Infrastructure, Transport, Regional Development and Communications);*

    - As detailed above, some landfills can be attractants for wildlife, but this statement would depend on the waste authorised for disposal. Disposal of construction and demolition residue with little or no organic content would not typically attract pests and vermin.

- *The application states "This ARRC application seeks approval to transfer non-recyclable residues to the void. It does not seek approval for the placement of this material, which will be subject to a separate approval." WSA seeks clarification regarding the Applicant's intent on how it proposes to manage and dispose of waste that is not recycled. (Western Sydney Airport);*

    - A separate application will made to infill the quarry with non-recyclable material and imported material for cover and direct infill. However, it is noted that no recyclable residual waste will leave the resource recovery facility via the internal access roads to the landfill void. Waste will be deposited from the vehicle onto the landfill active tipping face. Waste shall be spread to a thickness determined in the NSW EPA EPL and compacted. Daily cover shall be applied to the required thickness, using EPA approved materials in accordance with the Landfill Guidelines, approved LEMP and EPL.

- *The EIS states that it is the intent of the facility to receive garden waste, wood waste and vegetative waste, but does not provide detail of how this waste is to be managed or disposed of. These types of waste are organic waste and if disposed of in the quarry void would likely result in the generation of land fill gas as the waste breaks down. This would require management of land fill gas and may give rise for the need for flaring or plumes to manage land fill gases. Management of any land fill gas (e.g. flaring) needs to be assessed as it can create a hazard to Airport operations. In addition, wildlife hazards associated with landfilling will need to be assessed. Further information and clarification on this matter is required. (Western Sydney Airport);*

    - The landfilling of organic wastes is not encouraged due to the decomposition of the organic matter, the generation of landfill gas and the likelihood of differential settlement of the waste mass as a result. The garden waste, wood waste and vegetative waste will be chipped, mulched and converted to compost for subsequent rehabilitation use or for resale (subject to testing, quality standards and markets). The Landfill Guidelines allow for '*waste-derived organic materials'* to be used as an alternate daily cover material (Section 8.3), although significant volumes are not anticipated to be used for this manner.

- *Importantly, it remains unclear from the documents provided what is ultimately proposed for the development site and what are the timings of the various stages of development and operations over the medium to long term. … The Department would like more information on the Proponent's long-term plans for the site to better consider the potential impacts on the Airport (Department of Infrastructure, Transport, Regional Development and Communications).*

    - We understand that the timing for the resource recovery facility construction and the development of the landfill is still being considered by the site owners, however it is anticipated the fill could take up to 15 years depending on market conditions.

6 CONCLUSIONS AND RECOMMENDATIONS

Rehabilitation of the void by infilling the quarry with inert wastes (non-recyclable material and imported cover material) would be a commercially viable method of site rehabilitation, subject to the necessary approvals.

An engineered containment liner typically comprising 1,000mm of compacted clay with an overlying HDPE liner and protection geotextile would be required. Management of leachate would need to be undertaken by the installation of a 300mm aggregate leachate drainage blanket and collection/extraction pipework. Engineered side walls would be required to be constructed in a series of lifts of typical 3m height for wall stability and construction health and safety considerations

Waste would be placed in a series of lifts immediately after each engineered side wall has been constructed, with each waste surface providing a platform for subsequent engineered lifts to be constructed.

Emplacement of general solid waste (non-putrescible) waste would minimise the attraction of vermin, pests etc detrimental to any neighbouring airport, also good operation practices would minimise the generation and transport of litter, odour and dust etc.

7 CLOSE

This report has been prepared by InSitu Advisory Pty Ltd with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

InSitu Advisory Pty Ltd disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

8 REFERENCES

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NSW Government Department of Planning and Environment, Development Consent, File No. P91/02045, DA 315-7-2003) 23 May 2004, modified 13 May 2015.

FIGURES

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InSitu Advisory

LUDDENHAM QUARRY
SITE LOCATION PLAN

0 50 100 150 200 m

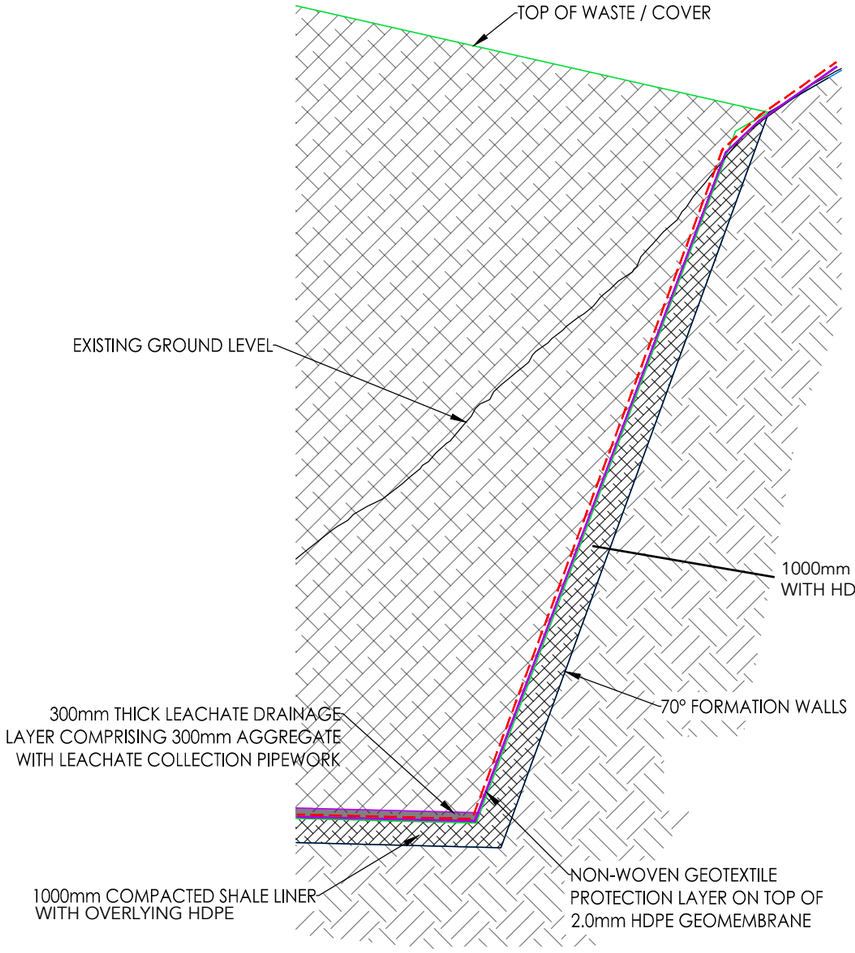
Scale: 1:5,000

GDA 1994 MGA Zone 56

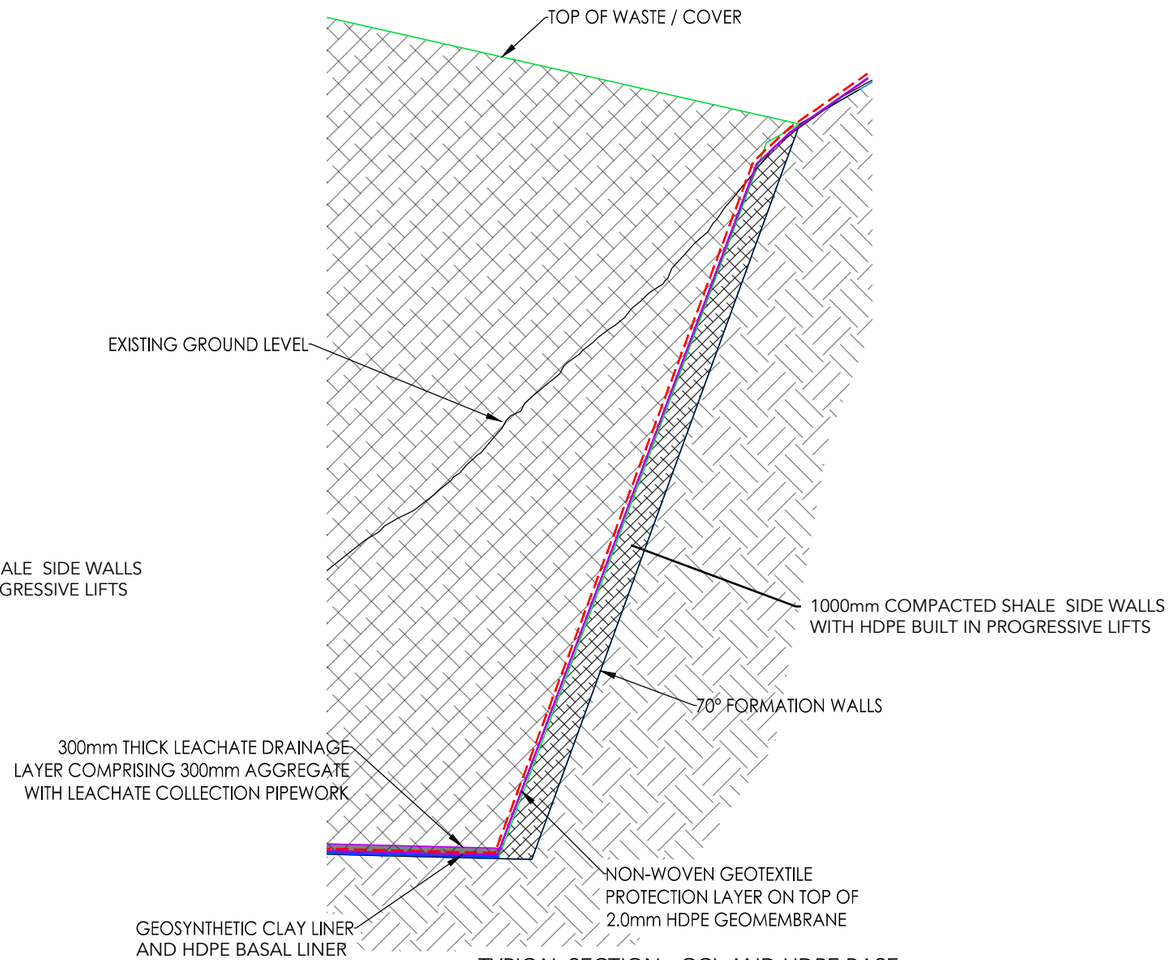
Date: 15.11.2020

Sheet Size : A4

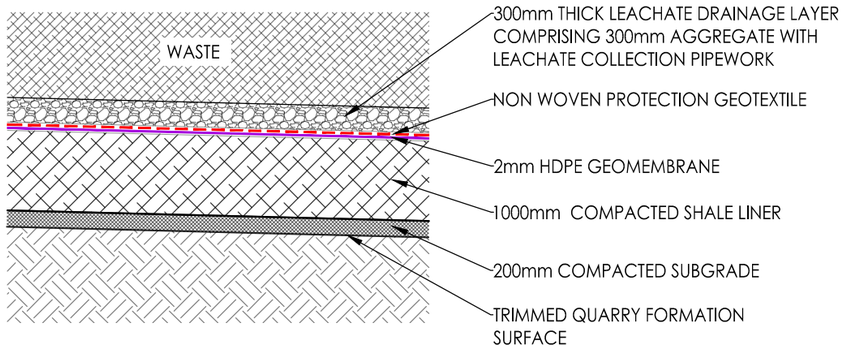
FIGURE 1



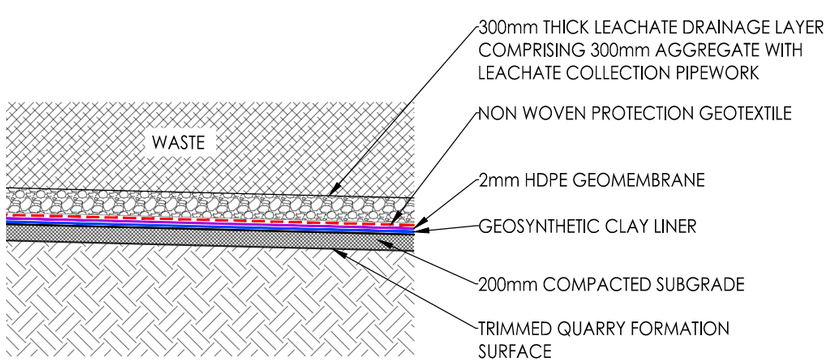
TYPICAL SECTION - COMPACTED SHALE/HDPE BASE
SCALE 1:250



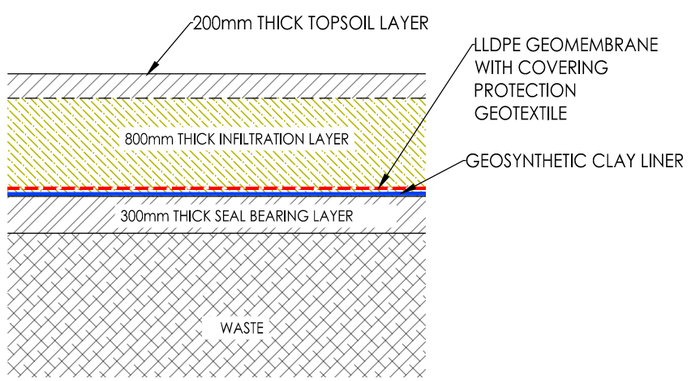
TYPICAL SECTION - GCL AND HDPE BASE
SCALE 1:250



TYPICAL BASAL LINER - COMPACTED CLAY/SHALE
SCALE 1:75



TYPICAL BASAL LINER - GCL & HDPE
SCALE 1:75



TYPICAL SECTION THROUGH CAPPING LAYERS
SCALE 1:50

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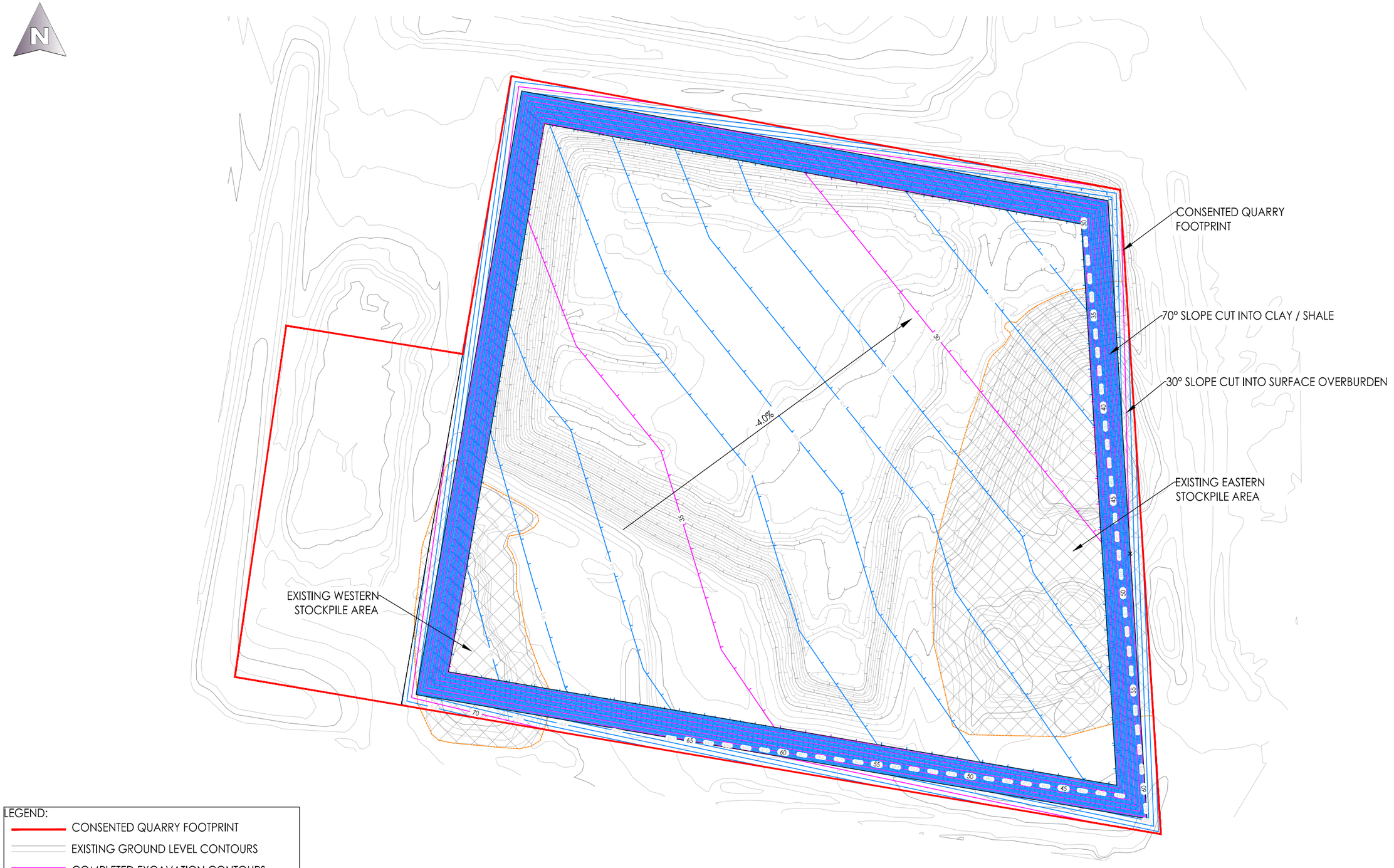
CLIENT: **CFT No.13 PTY LTD**

SITE: **LUDDENHAM QUARRY**

TITLE: **TYPICAL CONSTRUCTION DETAILS**

DATE: **16.11.2020** SCALE: **1:1,500** PAPERSIZE: **A3** DWG: **FIGURE 2**



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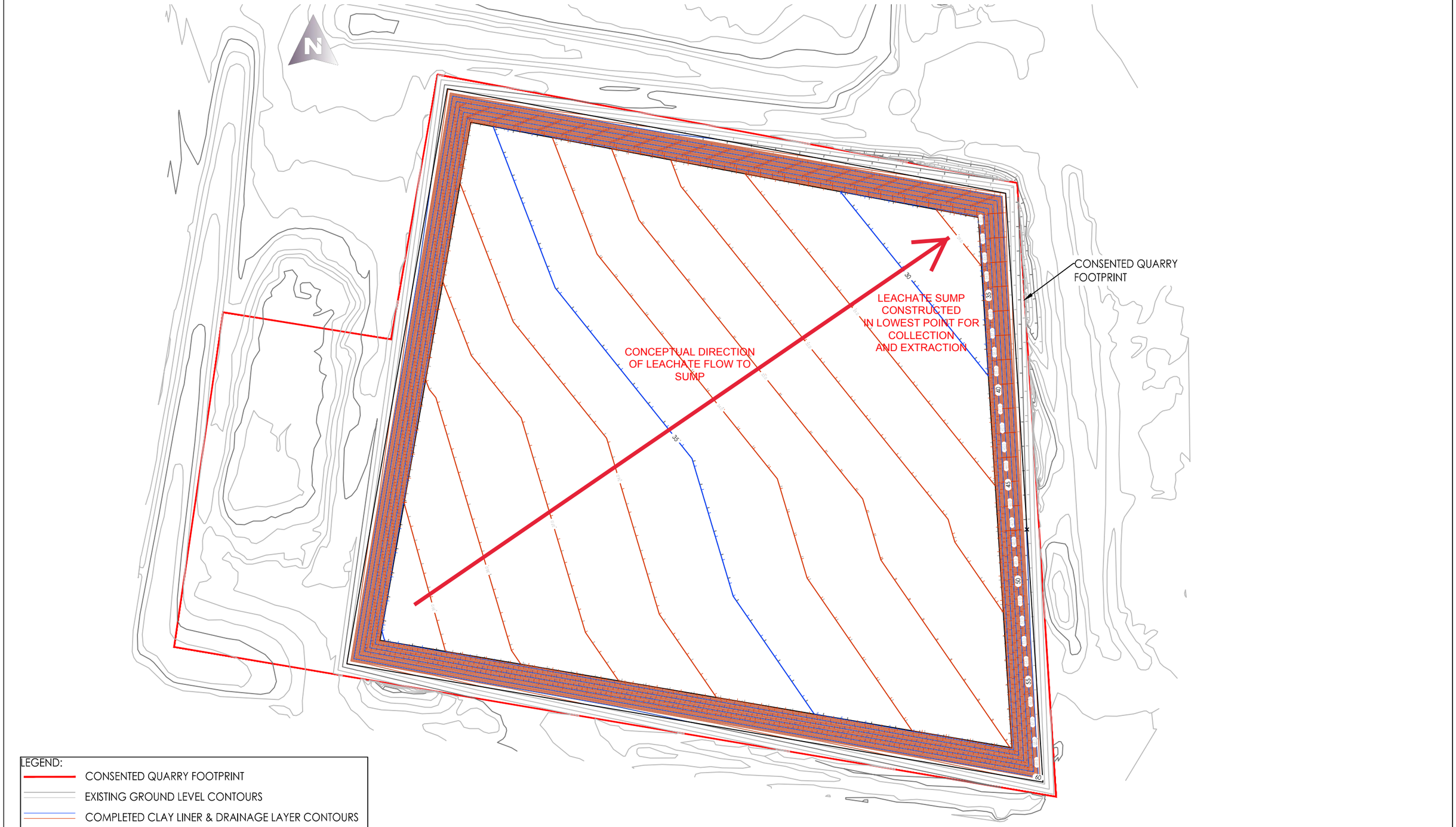
CLIENT: **CFT No.13 PTY LTD**

SITE: **LUDDENHAM QUARRY**

TITLE: **CONCEPTUAL EXCAVATED LANDFILL PROFILE**

DATE: **16.11.2020** SCALE: **1:1,500** PAPERSIZE: **A3** DWG: **FIGURE 3**



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CLIENT: **CFT No.13 PTY LTD**

SITE: **LUDDENHAM QUARRY**

TITLE: **CONCEPTUAL TOP OF ENGINEERING SURFACE**

DATE: **16.11.2020** SCALE: **1:1,500** PAPERSIZE: **A3** DWG: **FIGURE 4**

LEGEND:
- CONSENTED QUARRY FOOTPRINT
- COMPLETED LANDFILL CONTOURS
- PROPOSED RESTORATION PROFILE

0 15m 30m 60m 90m

SCALE 1:1,500

CONCEPTUAL FINAL WASTE PROFILE SHOWING SHALLOW DOMING TO ALLOW FOR INITIAL STORM WATER MANAGEMENT AND SUBSEQUENT WASTE SETTLEMENT TO LEVEL GROUND

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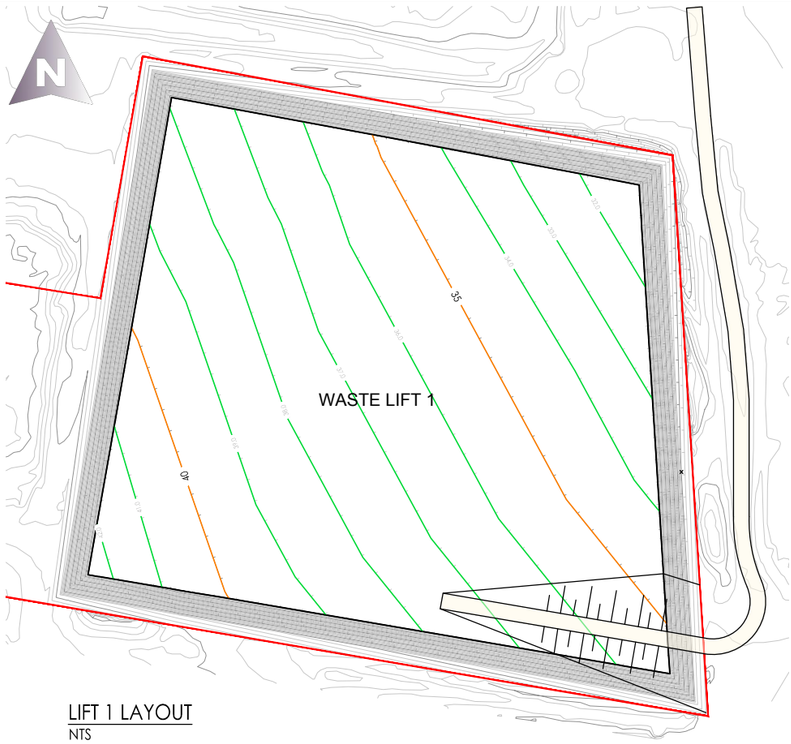
CLIENT: **CFT No.13 PTY LTD**

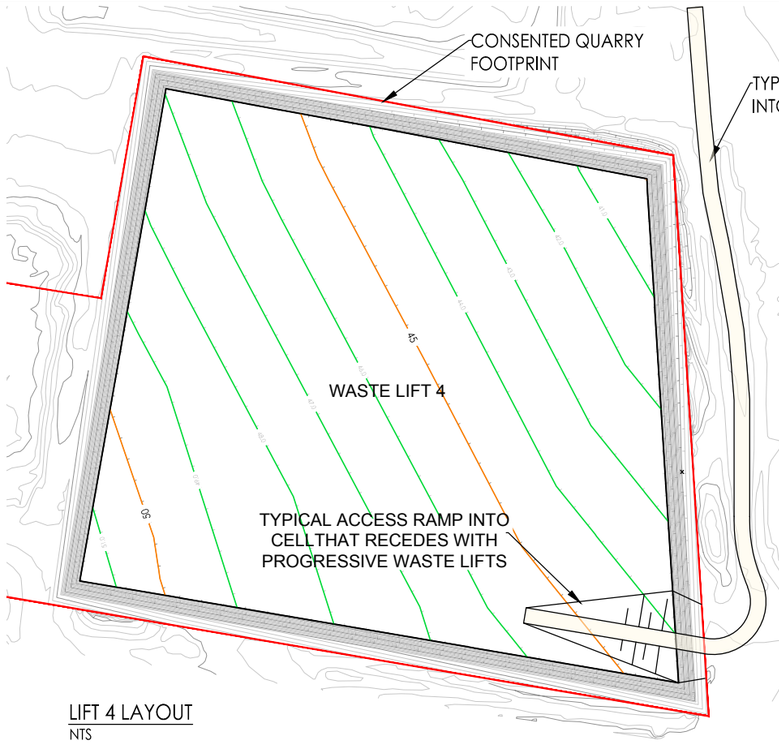
SITE: **LUDDENHAM QUARRY**

TITLE: **CONCEPTUAL FINAL WASTE PROFILE**

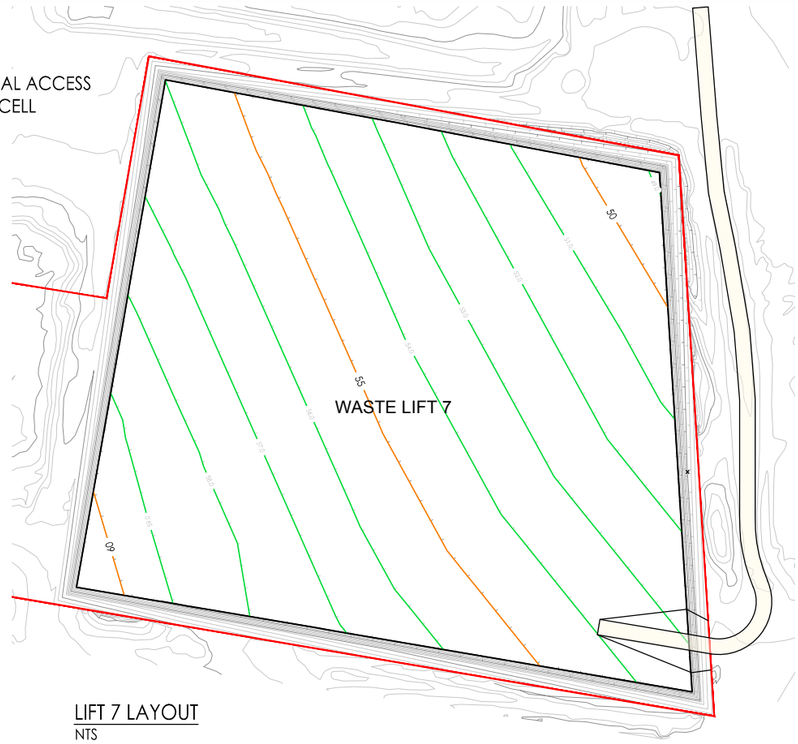
DATE: **15.11.2020** SCALE: **1:1,500** PAPERSIZE: **A3** DWG: **FIGURE 5**



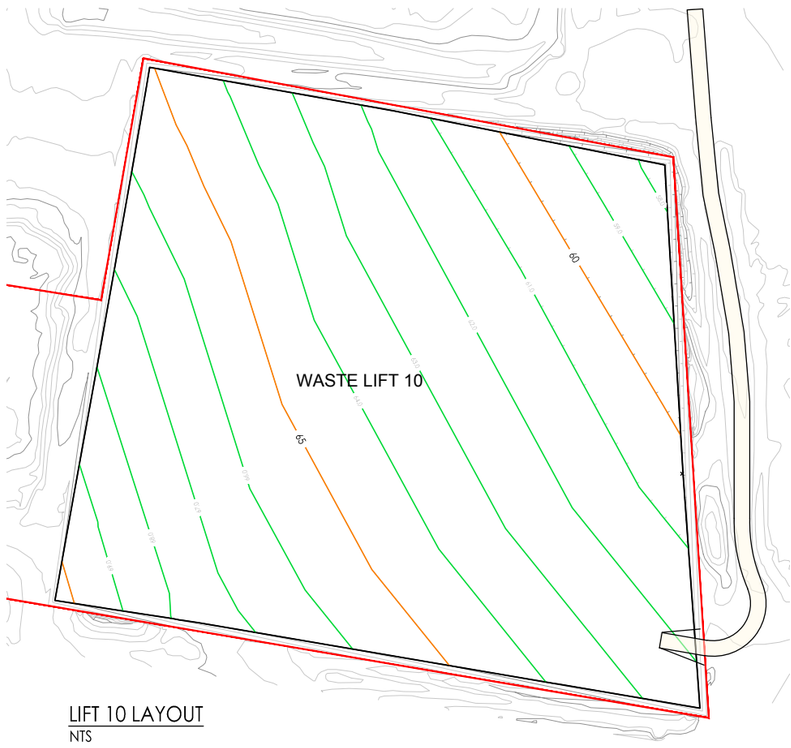
LIFT 1 LAYOUT
NTS



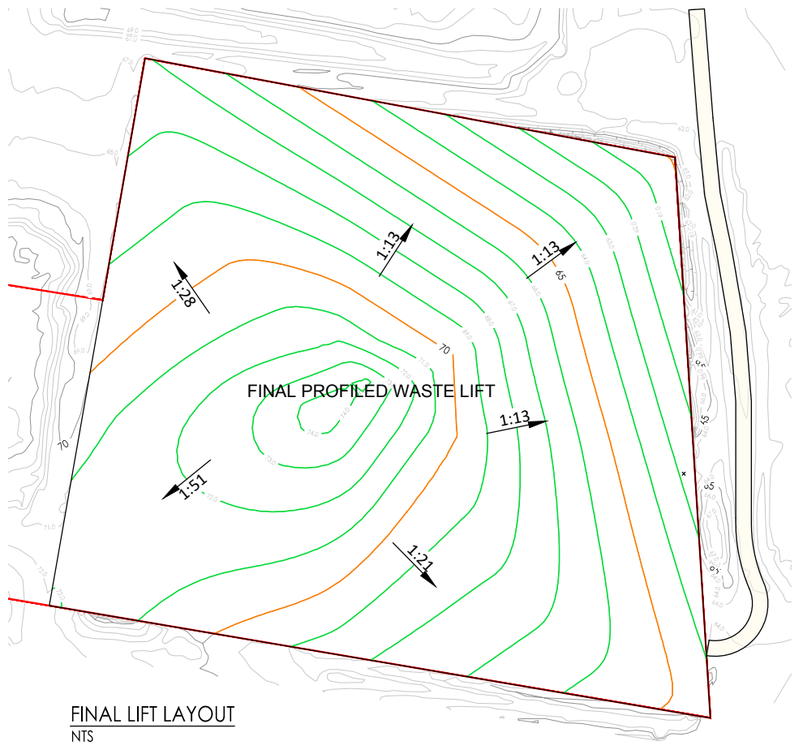
LIFT 4 LAYOUT
NTS



LIFT 7 LAYOUT
NTS



LIFT 10 LAYOUT
NTS



FINAL LIFT LAYOUT
NTS

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LEGEND:
- CONSENTED QUARRY FOOTPRINT
- EXISTING GROUND LEVEL CONTOURS
- COMPLETED CLAY LINER & DRAINAGE LAYER CONTOURS

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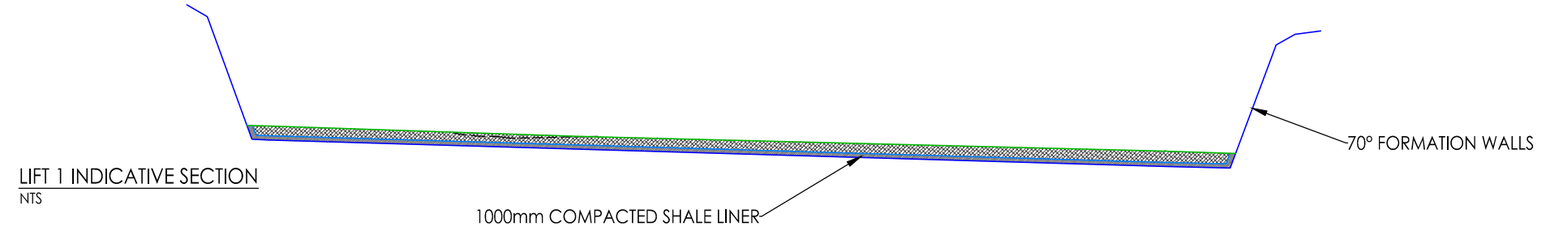
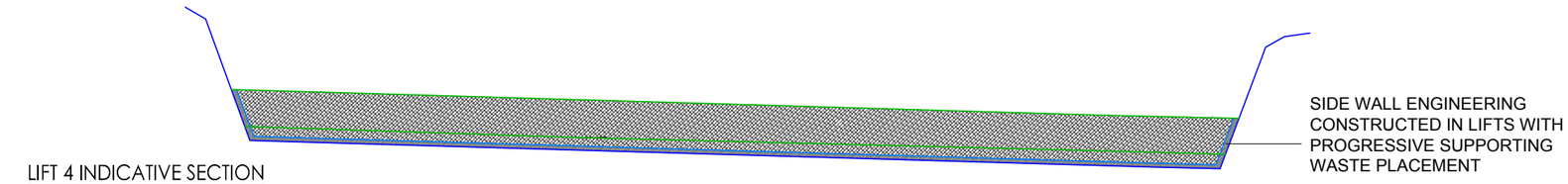
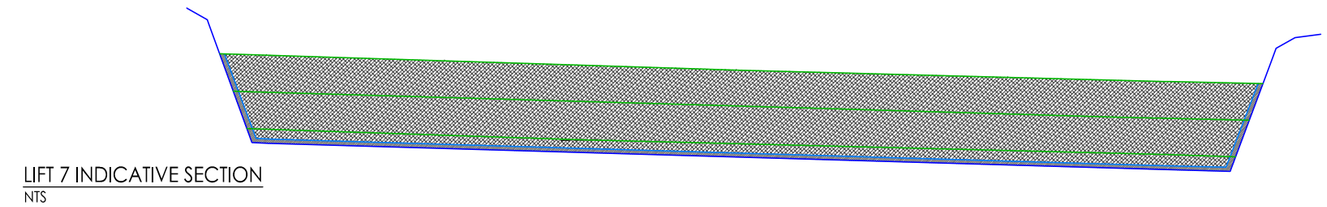
SITE: **LUDDENHAM QUARRY**
TITLE: **CONCEPTUAL STAGED TIPPING PLAN**
DATE: **15.11.2020** SCALE: **1:1,500** PAPERSIZE: **A3** DWG: **FIGURE 6**



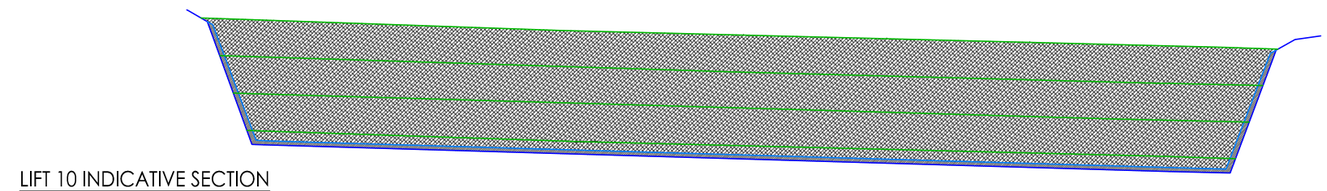
LIFT 1 INDICATIVE SECTION
NTS



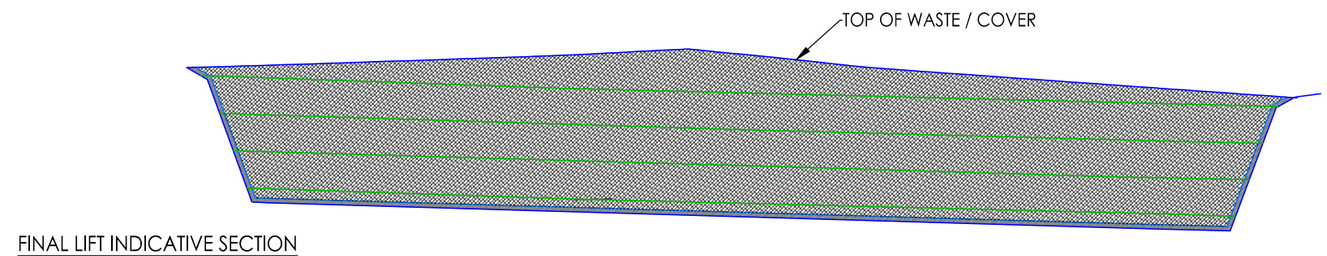
LIFT 4 INDICATIVE SECTION
NTS



LIFT 7 INDICATIVE SECTION
NTS



LIFT 10 INDICATIVE SECTION
NTS



FINAL LIFT INDICATIVE SECTION
NTS

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LEGEND:

EXISTING GROUND LEVEL CONTOURS

COMPLETED CLAY LINER & DRAINAGE LAYER CONTOURS

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SITE: **LUDDENHAM QUARRY**

TITLE: **INDICATIVE TIPPING SECTIONS**

DATE: **16.11.2020** SCALE: **1:1,500** PAPERSIZE: **A3** DWG: **FIGURE 7**

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