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Report on Acid Sulfate Soils Desktop Study Review and Preliminary ASS Management Plan

Proposed Commercial Development
383 Kent Street, Sydney

Prepared for
Charter Hall Holdings Pty Ltd

Project 217267.02
December 2023

Document History

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		08 December 2023
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Table of Contents

Report on Acid Sulfate Soils Desktop Study Review and Preliminary ASS Management Plan

Proposed Commercial Development

383 Kent Street, Sydney

1. Introduction

This report was conducted for a proposed commercial development located at 383 Kent Street, Sydney (herein after referred to as “the site”). The site location and layout is shown in Drawing 1, Appendix B. The study and management plan was commissioned in an email dated 18 September 2023 by Tracy Hoven of Touchstone Partners Pty Ltd and was conducted in general accordance with Douglas Partners' (DP) proposal 217267.02.P.001.Rev0 dated 20 September 2023.

This report has been prepared giving due consideration to Section 9.1 Local Planning Direction 4.5 from the Council of the City of Sydney and comprises a desktop review of relevant, nearby DP projects and the preparation of a preliminary acid sulfate soil management plan (ASSMP). The report assesses the likelihood of acid sulfate soils (ASS) at the site. It is noted from the proposal 217267.02.P.001.Rev0 that the site is classified as Class 1 and Class 2 Acid Sulfate Soils from the Sydney Local Environment Plan 2012 ASS Maps. If not properly managed ASS can pose environmental risks when disturbed by construction activities such as excavation, piling and dewatering.

The following guidelines were consulted in the preparation of this report:

- EPA Waste Classification Guidelines (2014) (EPA, 2014) Part 4: Acid Sulfate Soils.
- National Acid Sulfate Soils Guidance (2018). National Acid Sulfate Soils Sampling and Identification Methods manual.
- Queensland Acid Sulfate Soil Technical Manual Soil Management Guidelines v4.0 (2014).
- Acid Sulfate Soils Assessment Guidelines, NSW Acid Sulfate Soils Management Advisory Committee (August 1998).

The purpose of this preliminary ASSMP is to minimise the risk of adverse effects of exposing ASS to the environment and to:

- Outline the procedure to identify ASS at the site, as described in Section 6;
- Outline the procedures for the appropriate management/mitigation of potential environmental impacts that may result from the disturbance of ASS (if ASS is encountered);
- Outline the procedures for the on-site treatment of ASS (if ASS found);
- Provide a monitoring program for validating the effectiveness of the management process; and
- Provide emergency response procedures for potential environmental threats which could occur during ASS management (if ASS found).

2. Proposed Development

It is understood that the proposed development involves the demolition of the existing building and public car park as well as the construction of a new 42-storey office tower with up to 73,000 m^2 of gross floor area and a two-level basement, covering the full extent of the development footprint. The first level of basement comprises approximately seventy car park spaces as shown in drawing “Basement 1 Carparking” (dated 16/02/2023) and the second level of basement comprises a loading dock, with 28 loading bays and shared retail space as shown in drawing “Sussex St GL- Shared Loading/ retail” (dated 1/12/23). These drawings and other architectural drawings provided are attached in Appendix A. There will also be a new through-site link connecting Kent and Sussex St and will feature public art installations.

It is noted an existing basement level is present on the eastern portion of the site. Dewatering may also be required when constructing the two-level basement.

3. Acid Sulfate Soils Background

ASS are naturally occurring sediments that contain iron sulphides, primarily pyrite, commonly deposited in estuarine environments. The occurrence of ASS is associated with areas or regions that have previously been or are currently estuarine environments. Due to changes in sea level or geomorphologic changes to coastal systems, these sediments are often overlain by terrestrial sediments. Fill can also overlay ASS.

When ASS are exposed to air (e.g., due to bulk excavation or dewatering), the oxygen reacts with iron sulphides in the sediment, producing sulphuric acid. This acid can be produced in large quantities and is highly mobile in water. The sulphuric acid can drain into waterways causing severe short and long term socio-economic and environmental impacts, including damage to man-made structures and natural ecosystems.

ASS can either be classified as “*actual acid sulphate soils*” (AASS) which are soils that have already reacted with oxygen to produce acid, or “*potential acid sulphate soils*” (PASS). PASS are soils containing iron sulphide that have not been exposed to oxygen (e.g., soils below the water table). PASS therefore have not produced sulphuric acid but have the potential to do so if exposure to oxygen occurs.

The NSW Environment Protection Authority (EPA) *Waste Classification Guidelines* (2014) (EPA, 2014) Part 4 (Acid Sulfate Soils) defines PASS as soils that:

- Meet the definition of ‘virgin excavated natural material’ (VENM) under the Protection of the Environment Operations Act 1997, even though they contain sulfidic ores or soils.

Jarosite is an acidic, pale-yellow iron hydroxysulfate mineral and occurs as a by-product of the ASS oxidation process. As such, the presence of jarosite is an indicator of AASS.

Table 2.1 of the National Acid Sulfate Soils Guidance 2018 describes indicators where ASS materials are generally found. Indicators where ASS are generally found include but are not limited to:

- Shallow estuarine or marine deposits;
- Areas known to contain peat or build-up of organic matter;

- Highest known water table is three metres from the surface;
- Land with elevation less than five metres relative to the Australian Height Datum (AHD);
- The presence of jarosite; and
- Detection of sulphurous odours.

4. Site Information

Site Address	383 Kent Street, Sydney, refer to Drawing 1, Appendix B
Legal Description	Lot 1 Deposited Plan 778342
Approximate Area	3,600 m^2
Zoning	Zone B8 Metropolitan Centre
Local Council Area	The Council of The City of Sydney
Current Use	Commercial
Topography	The site slopes steeply to the west and sits at reduced level (RL) 18 m relative to the AHD along its eastern boundary to RL 10 m AHD along its western boundary. Little vegetation is observed at this site.
Soil Landscape	Reference to the Sydney 1:100 000 Soil Landscape Series Sheet indicates that the site is underlain by a landscape group known as the Gymea soil landscape. The Gymea soil landscape is an erosional soil landscape and is characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone, with local relief of 20 m to 80 m and slope gradients of 10% to 25%. The Gymea soil landscape typically contains localised steep slopes, high soil erosion, rock outcrops and shallow highly permeable soil. It consists of predominantly yellow sandy soils, including podzolic soils. Podzolic soils are acidic soils containing a mixture of sand, silt and clay subsoils. This soil landscape is likely to have an increasing clay content with depth.
Geology	Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is underlain by Hawkesbury Sandstone, symbol Rh, of Triassic age, which typically comprises medium to coarse-grained quartz sandstone with minor shale and laminite lenses. This geological unit is not considered 'geologically recent'. It is noted that beyond the western edge of the site boundary, there are Quarternary sediments, symbol Qha, which contain silty to peaty quartz sand, silt and clay. An extract of the Sydney 1:100 000 Geology Sheet is shown below in Figure 1. The site locality is indicated in a dashed, blue outline in Figure 1.

Surface Water	The closest surface water body is Cockle Bay Wharf located approximately 250 metres west of the site. It is expected that stormwater drains will flow west towards Cockle Bay Wharf.
Groundwater	Reference to the groundwater bore register data from WaterNSW indicates that three registered groundwater monitoring bores are located within 500 m of the site. These are labelled GW109085, GW109086 and GW109087. No information on groundwater levels was provided during a search of these groundwater bores. A search of the DP database identified a groundwater well for Project No. 72924.00, located on the northwestern corner of King St / Pitt St approximately 400 m west from site. Groundwater levels were reported as being at approximately RL 12 m AHD. Another investigation located approximately 750 m south of the site (Project No. 207999.00), installed three groundwater wells. Two of the wells recorded groundwater levels at RL 2.5 m AHD and RL 4.5 m AHD, which were measured after installation on 27/9/2022. The third groundwater well was dry.

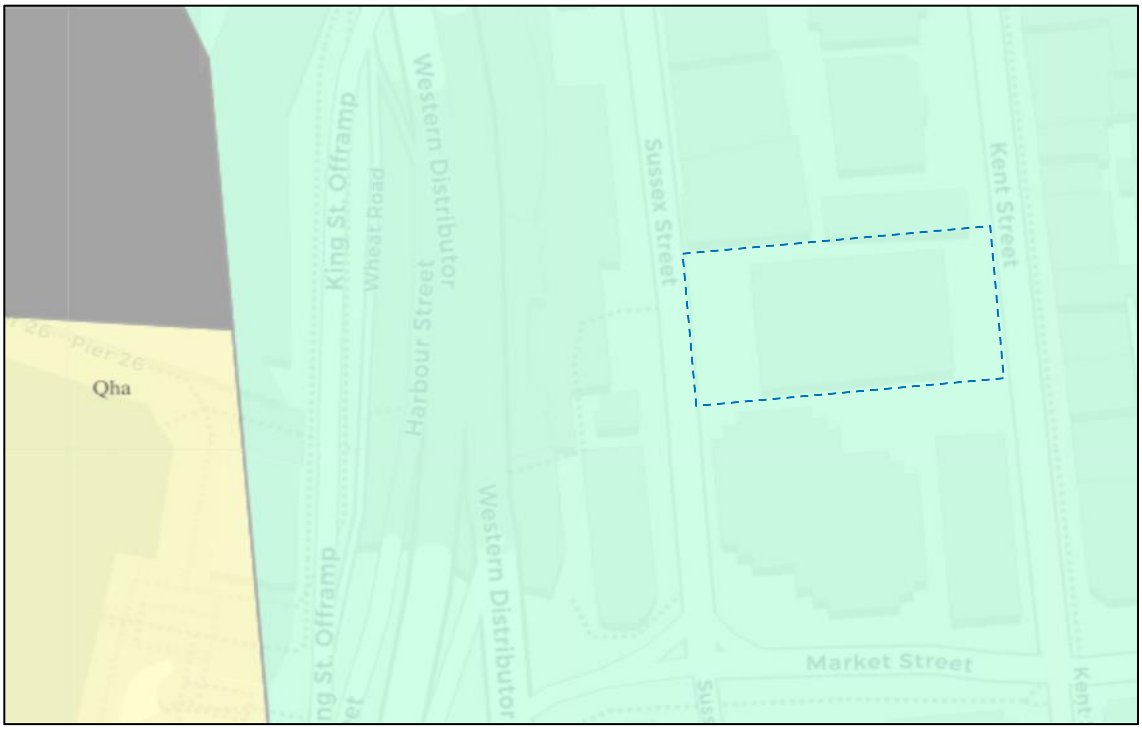


Figure 1: Extract of Sydney 1:100 000 Geology Sheet (site locality shown as dashed line)

The Australian Soil Resource Information System (ASRIS) ASS risk map (2014) for the site is shown below in Figure 2. The site locality is indicated in a blue dashed outline.

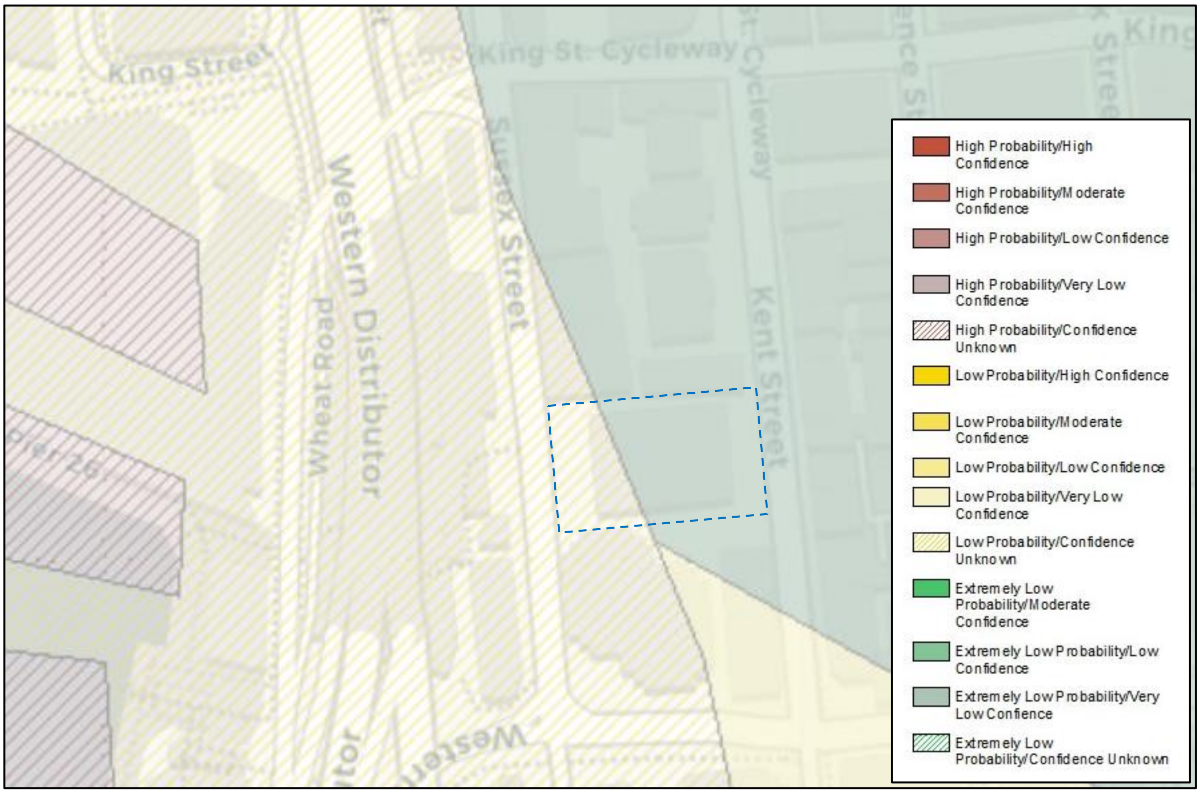


Figure 2: Extract of ASRIS ASS Map 2014 (site locality shown as dashed line)

Figure 2 shows that the green eastern portion of the site is mapped as having an extremely low risk of ASS but of very low confidence whereas the yellow western portion is mapped as a low risk but of unknown confidence levels.

The NSW Department of Environment and Climate Change 1:25 000 ASS risk map (1998) is shown in Figure 3. The site locality is indicated in a blue dashed outline. Figure 3 shows that the western portion of is mapped as disturbed terrain, indicating that a soil investigation is needed to establish whether ASS exists at the site or not.

Figure 3: Extract of NSW Acid Sulfate Soil Risk Map 1998 (site locality shown as dashed line)

5. Previous Investigations

DP has conducted the following investigations deemed relevant for this project:

- DP Report: 211320.01.R.012.Rev0, dated 31 July 2023
- DP Report: 207999.00.R.002.Rev1, dated 22 May 2023 and DP Report: 207999.01.R.001.Rev3

5.1 DP Report: 211320.01.R.012.Rev0

This Detailed Site Investigation (Contamination) Report was prepared by Douglas Partners Pty Ltd for a site located in Union Street, Pyrmont. The investigation comprised of a desktop review of the NSW Department of Environment and Climate Change 1:25 000 Acid Sulfate Soil Risk Maps and Sydney Local Environmental Plan 2012 ASS maps, and intrusive sampling at thirteen (13) borehole locations. ASS maps shown in the Sydney Local Environmental Plan 2012 depict that the northern portion of the site is in Class 1 ASS and the southern portion is in Class 5 ASS. ASS risk maps published by the NSW Department of Environment and Climate Change for this site show that the northern portion was located in disturbed terrain and the southern portion of this site as having a low occurrence of ASS. The desktop review concluded that there was a low probability of ASS occurring at this site but should be confirmed by field observations, pH screening and laboratory analysis.

Field observations also indicated that this site had a low risk of ASS. One sample (BH4/3.2-3.5) returned pH results potentially indicative of ASS. Laboratory analysis for the chromium reducible sulphur full suite was conducted on this sample and found that the recorded chromium reducible sulphur and net acidity recorded below laboratory practical quantitation limit and assessment criteria. These results indicate that the sample BH4/3.2-3.5 m did not contain ASS. This was consistent with field observations indicating that the risk of ASS was low.

5.2 DP Report: 207999.00.R.002.Rev1 and DP Report: 207999.01.R.001.Rev3

The geotechnical investigation report 207999.00.R.002.Rev1 was prepared by Douglas Partners Pty Ltd for a site located in Sussex Street, Sydney. The field work for this investigation included the drilling of three boreholes (identified as BH1 to BH3), which were each converted into groundwater monitoring wells.

The general sequence of materials encountered included concrete (ranging from 120 mm to 200 mm thick) overlying a mixture of clay / sand fill, overlying typically very stiff residual clay, overlying sandstone bedrock. The residual clay unit was encountered to a thickness of 300 mm at BH3. No marine or estuarine sediments were encountered at these borehole locations.

The PSI investigation report, 207999.01.R.001.Rev3 identified that there was no known occurrence of ASS and that the encountered soil profile was unlikely to contain ASS because the area did not contain alluvial or estuarine sediments.

6. Proposed Works for ASS Assessment

These proposed works will identify if ASS are present at the site. It was developed in accordance with the National Acid Sulfate Soils Guidance (2018) and consists of:

- Four boreholes will be extended to a minimum depth of 1.0 m below the proposed excavation level or top of bedrock. The boreholes will be drilled post-demolition of the existing structures. Indicative borehole locations are provided in Drawing 1, Appendix B, with three boreholes targeting the western portion of the site.
- Collection of soil samples from either surface or below the level of the concrete slab, and then at 0.5 metre intervals, changes in strata or apparent signs of PASS, including sulphuric odours.
- DP will store all samples in air-tight zip lock bags in an esky on ice. Within 24 hours the samples are either frozen or delivered to the NATA accredited laboratory.
- All samples will be subjected to field screening for field pH and pH_{fox} (oxidised pH). These tests will be performed by a NATA-accredited laboratory.
- Selected / representative samples that exceed the field screening criteria will be analysed for chromium reducible sulfur test.
- The minimum quality assurance and quality control (QA / QC) procedures will include:
  - Collection of one field duplicate for every 20 investigative samples (QC); and
  - Use of standardised field sampling forms, methods and Chains of Custody (QA).

7. Management Options

If the proposed works described in Section 6 confirms the presence of ASS management strategies will need implementing. These strategies are detailed in this section of this report. ASSMAC (1998) provides the following potential management options:

- Non-excavation or minimal earthworks;
- On-site treatment, followed by off-site disposal;
- On-site treatment, followed by on-site re-use;
- Off-site treatment and disposal;
- On-site reburial without treatment (PASS only);
- Off-site reburial without treatment (PASS only); and
- Separation of ASS fines.

Based on the proposed development, DP considers on-site treatment followed by off-site disposal is the most appropriate option. Contingency options, including off-site treatment and disposal and off-site disposal as PASS are discussed in Appendix D.

In addition, if a formal ASSMP is required as part of the proposed development, the following procedures must be included:

- An ASS investigation report (to be completed following demolition of existing site buildings);
- Treating soils according to their existing acidity plus potential acidity with an appropriate amount of neutralising agent (ag lime);
- Laboratory tests to verify that the ASS have been properly treated and that neutralising material has been thoroughly mixed throughout the soil;
- Substantial bunding of the site using non-ASS material to divert site run-on and collect all site runoff during earthworks which is in contact with any identified PASS. Any material suspected to be ASS can be appropriately stored on site (e.g., skip bins);
- Monitoring the pH of any pools of water collected within bunding or sealed areas;
- All leachate from treatment pads and / or discharge water from excavations should be contained and must meet acceptable standards of pH, metal content (particularly iron and aluminium) and turbidity prior to release;
- Preventing infiltration from passing through ASS to groundwater using impermeable materials. Otherwise, apply an extra layer of neutralising material to intercept and neutralise leachate from ASS;
- Development of an environmental management plan (EMP) that meets the requirements of the City of Sydney; and
- On completion of works, provide documentation of ASS management activities to the site / project manager in the form of a simple closure report, including information on the final placement / use of disturbed soil.

7.1 On-site Treatment and Off-site Disposal

The general process for the on-site treatment and off-site disposal of ASS is as follows:

1. Prepare a treatment pad as described in Section 7.3.
2. Transport ASS material requiring treatment to the treatment pad.

   If ASS are not present then no further action is required unless other signs of ASS are noted during excavation such as sulphurous odours or iron staining from leachate. If ASS is present, continue to step three.
3. Manage ASS during stockpiling and treatment to minimise dust and leachate generation (e.g., by covering, or lightly conditioning with water). If wet weather prevails, stop works and cover the stockpiled material with plastic sheeting to reduce the formation of leachate. Possible treatment options for leachate are provided in Appendix C;
4. Spread the ASS material onto the guard layer in layers of up to 0.3 metre thick, leaving a 1 metre flat area between the toe of the spread soil and the containment bund or drain. When spreading the first soil layer, care should be taken not to churn up the lime guard layer;
5. Let the ASS dry to facilitate lime mixing (if too wet, then adequate mixing of lime cannot be achieved). The use of rotary plough equipment (e.g., auger bucket) may be appropriate for cohesive soils, where adequate mixing is difficult to achieve;
6. Apply ag lime to the stockpiled soil (refer to Section 7.2 for liming rates and Section 7.4 for explanation of ag lime) over each spread layer and harrow / mix thoroughly prior to spreading the next layer;
7. The results of verification testing, described in Section 7.5, should confirm that the ASS has been adequately neutralised in each layer prior to placement of the next layer to be treated. If verification sampling indicates that additional neutralisation is required, add additional lime (at an appropriate liming rate) and mix as described above;
8. Continue the spreading / liming / harrowing / verification cycle until excavation is finished; and
9. When verification testing, described in Section 7.5, indicates that lime neutralisation is complete, then the soil may be removed from the treatment area and disposed off-site in accordance with a waste classification.

   Note: If significant volumes of PASS or soil with sulphidic ores are present on the site then we would suggest that the client consider applying for a specific exemption (similar to the excavated natural material [ENM] exemption) for treated PASS or natural soils with sulphidic ores generated from the site. In some instances, the EPA has granted specific exemptions for treated PASS under agreements similar to the ENM Exemption (and where a specific receiving site can be named in the specific exemption). This would significantly reduce disposal cost for such material.

7.2 Liming Rate

Following the results of the proposed works described in Section 6 the following table is to be completed to provide the liming rates. The liming rate calculation is described in Appendix C.

Table 1: Indicative Liming Rate

Material	Net Acidity (%S)	'Ag' Lime Application Rate for Treatment	
		Guard Layers (kg/m^2) per metre of height	Stockpiled Soil[a] (kg/tonne)
To be confirmed	To be determined	5[b]	To be determined

a – adopt 95% upper confidence limit of test results in calculation.
b – Note if the highest detected sum of existing and potential acidity is more than 1.0% S-equivalent, this rate will be at least 10 kilograms of fine ag lime per m^2

7.3 Neutralisation Pads and Treatment of Soils

The key features of the treatment area and design considerations are summarised below and shown in Figure 4 below:

- **Treatment pad area** - The treatment pad should be of an appropriate area for the volume of soil to be treated / stored, and should be prepared on relatively level or gently sloping ground to minimise the risk of potential instability issues, with a fall to the local drainage sump;
- **Pad location** - The pad should be located as far as practical from any potential ecological receptors (such as drainage lines) which enter the stormwater system;
- **Lining** - An approved compacted clay layer (at least two layers to a combined compacted thickness of 0.5 m) or an approved geosynthetic liner (such as HDPE sheeting) should be used to line the pad. Where the subgrade soils comprise low permeability clay, no geosynthetic lining will be required;
- **Guard Layer** - A guard layer of fine agricultural lime ('ag lime'), as described in Section 7.4, should be applied over the clay subgrade or lining to neutralise downward seepage. This guard layer of lime should be applied at a rate appropriate to the soil to be treated (refer to Table 1 above) for each 1.0 m height of stockpiled soil;
    - The guard layer should be re-applied following removal of treated soils prior to addition of untreated ASS; and
    - NOTE: if the stockpiled soils on the treatment pad are expected to be greater than 3.0 m in height, it is recommended that the guard layer be applied as a base guard layer, with interim guard layers through the height of the stockpile.
- **Bunding** - The treatment pad should be bunded to contain and collect potential leachate runoff within the treatment pad area and to prevent surface water from entering the treatment pad. The inner bund slopes should be lined to prevent leachate seeping into the ground surface and sized such as to prevent overflow of untreated leachate onto the site.

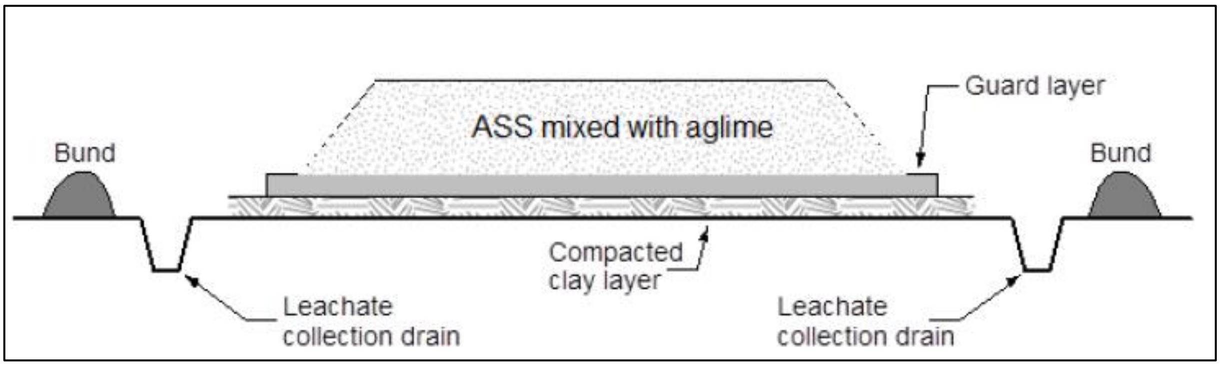


Figure 4: Schematic cross-section of a treatment pad

Alternatively, for smaller batches of soil it may be preferrable to store and treat soils within a sealed container e.g., skip bin. The method for developing this alternate treatment pad is provided below:

- **Bin size** - The bin should be of an appropriate volume for the soil to be treated / stored. Care should be taken to not overfill a container which may cause leachate, run-off or soils to overflow from the bin;
- **Lining** - Approved geosynthetic liner (such as HDPE sheeting) should be used to line the bin;
- **Cover** - The bin should be covered when not actively used to prevent potential accumulation of water from rain;
- **Guard layer** - A guard layer of fine agricultural lime ('ag lime') should be applied over the base lining. This guard layer of lime should be applied at a rate appropriate to the soil to be treated (refer to Table 1 above) for every 1.0 m height of stockpiled soil; The guard layer should be re-applied following removal of treated soils prior to addition of untreated ASS; and
- **Leachate and water** - Any excess leachate or water collected within the bin will be managed in accordance with the requirements presented in Appendix C.

7.4 Neutralising Materials

Agricultural lime, commonly known as ag lime, is the preferred neutralisation material for the management of ASS, as this material is usually the cheapest and most readily available product for acid neutralisation. Furthermore, ag lime is slightly alkaline (pH of 8.5 to 9), non-corrosive, of low solubility and does not present handling problems.

Ag lime comprises calcium carbonate ($CaCO_3$), typically made from limestone that has been finely ground and sieved to a fine powder. Ag lime with the following properties is the preferred neutralising agent:

- Purity of at least 95% or better (i.e., NV > 95, where NV is the neutralising value, a term used to rate the neutralising power of different forms of materials relative to pure, fine calcium carbonate which is designated NV = 100); and
- Fine (at least <1 mm) and dry, as texture and moisture can decrease the effective NV.

Ag lime requires no special handling, however, it would be advisable to cover any ag lime stockpiles with a tarpaulin both to minimise wind erosion and wetting, as the material is more difficult to spread when wet.

It is noted that ag lime is not suitable for the neutralisation of leachate because it has a low solubility in water. The most suitable neutralising agent for leachate and retained drainage water is slaked lime or quicklime (calcium hydroxide) because of its very quick reaction and high solubility.

Calcium hydroxide is made by treating burnt lime (calcium oxide) with water (slaking) and comes as a fine white powder. It has a typical NV of about 135. A calcium hydroxide solution can be produced by stirring calcium oxide into water, in a container of sufficient volume (for example, a plastic 200 litre drum). The slurry should be allowed to settle, and the clear solution (which will be caustic, with a pH of approximately 12.5 to 13) can be pumped or sprayed into the standing water in small amounts, with some agitation and monitoring. Due to its very strong alkalinity (pH or about 12.5 to 13), slaked lime or quicklime should not be allowed to come into contact with skin or be inhaled. This procedure should be continued until the pH is adjusted to acceptable levels. Adequate care should be taken not to "*overshoot*" the desired pH with calcium hydroxide. Quicklime is very reactive, and relatively corrosive (due to its caustic nature). When quicklime is mixed with water, the resulting reaction generates heat. Therefore, if utilised, the material should be added in increments to a large amount of water to control the reaction.

Application of slaked lime is discussed in greater detail in Appendix C.

7.5 Verification Testing of Treated Soil

Verification testing of the ASS and drainage water (if present) is required to be conducted after the addition of ag lime to test whether mixing has been adequate, and to reduce the risk of acidic water being returned to watercourses. This testing consists of a field test (pH_F and pH_{Fox} screening) and laboratory analysis using the Chromium Reducible Sulfur (SCr) method and / or the Suspension Peroxide Oxidation Combined Acidity and Sulfur (SPOCAS) method at the frequency given below:

- One sample per soil type OR one sample per 500 m^3 of treated material. Adopt which ever has the greatest frequency; and
- At least one sample per 200 mm to 300 mm of the deep soil treatment layer.

Potential sulfidic acidity is measured using either the SPOCAS or SCr Method. The SCr method is recommended for all soil materials. However, the SPOCAS method is not recommended for soil materials with organic matter containing greater than 0.6% organic carbon, as the organic matter in many soil materials with organic carbon contents greater than 0.6% can produce false positive identifications when using the SPOCAS method. The sulfur from organic matter, even at these relatively low concentrations, can be erroneously included in the SPOCAS determination at levels that exceed action criteria. Furthermore, if SPOCAS is used to quantify the potential sulfidic acidity of soil materials, it is recommended at least 15% of samples are also analysed by the SCr method to allow for the verification of the SPOCAS values.

In addition, the pH of all ponded drainage water around the confines of the treatment bunds (or pooled within skip bins) should be measured daily and results assessed against the criteria provided in Table 2.

The soil and water contained within the bunded treatment area or bins should not be removed until the target values presented in Table 2 below have been achieved.

Treatment of deeper soil layers should not commence until the existing surface layer has been validated and removed.

Table 2: Target Levels of Neutralised Soil and Water

Test	Component	Target Level
Monitoring of water	pH	6.5 < pH < 8.5
	Turbidity	To comply with either values established in consultation with the Authority or less than local background levels (baseline monitoring required).
	Aluminium (Al) and Iron (Fe)	Establish local water quality data prior to site disturbance and ensure that these values are not exceeded.
	Dissolved Oxygen	To comply with either values established in consultation with the Authority or less than local background levels (baseline monitoring required).
Field Screening of Soil	pH_f	6.5 < pHF ≤ 8.5
Acid based accounting of soil (Chromium suite test method)	Net acidity (using appropriate fine factor)	Zero or negative
	pH_{KCL}	pHKCL ≥ 6.5
	Total Actual Acidity (TAA)	Zero

It should be noted that laboratory tests may require up to five days turnaround, possibly longer, and hence sufficient time should be allowed in the treatment programme for such verification testing. Only appropriately skilled staff should collect and test verification samples. In addition to normal regular supervision of the soil management process, it is suggested that formal regular inspections be conducted.

8. Contingency Plan and Emergency Response Procedures

When the proposed primary management option of on-site treatment and off-site disposal is not possible, it is then necessary to adopt a contingency. Appendix D details the contingency plan for off-site treatment and disposal and off-site disposal of PASS. Construction activities which may cause potential environmental threats and preliminary contingency and emergency response procedures are summarised in Table 3 below. The preliminary contingency and emergency response procedures outlined in Table 3 will require updating pending the results of the intrusive investigation described in Section 6.

Table 3: Contingency and Emergency Response Procedure

Construction Activity	Potential Environmental Threat	Preliminary Contingency and / or Emergency Response
Bulk Excavation	Flooding of open excavation causing or leading to potential acid leachate once the excavation is drained	• Inform site foreman and project manager or environmental officer; • Determine pH of groundwater / floodwater in excavation; • Correct groundwater / floodwater pH to bring pH in range of 6.5 to 8.5; • Drain pit to tanks / basins for water quality assessment prior to discharge.
Stockpiling and neutralisation	Stockpile washes or slips outside bunded lime pad	• Inform site foreman and project manager or environmental officer; • Estimate volume of material breeching bund; • Conduct pH monitoring of adjacent surface water (if potentially impacted), and establish an alternative monitoring / management approach if potential impacts are detected; • Move breeched soil into a bunded limed pad; • Over-excavate contaminated area to 0.2 m depth, apply and mix lime at rate as for guard layers (10 kg ag lime per m^2 of surface).
	Breach in stockpile containment bund	• Inform site foreman and project manager or environmental officer; • Fix breach in bund; • Conduct pH monitoring of adjacent surface water (if potentially impacted) and establish an alternative monitoring / management approach if potential impacts are detected.

Construction Activity	Potential Environmental Threat	Preliminary Contingency and / or Emergency Response
Dewatering	A pH decrease by 0.5 to 1 unit below background	• Inform site foreman and project manager or environmental officer; • Perform pH monitoring every second day; • Conduct groundwater assessment of metals (aluminium, arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc and iron); • Establish the cause of the pH drop; • Implement measures to prevent further decrease in pH. This may include change to dewatering procedure.
	A pH decrease by more than 1 pH unit below background	• As per pH drop of 0.5 to 1; plus • Assess the need for corrective measures to increase pH to previous level.

It is required that an incident report is completed for all construction incidents which pose an environmental threat, not just limited to ASS. The report must detail:

- The cause of the incident; and
- Implementation of additional control measures; and
- How to reduce the likelihood of the incident reoccurring, including by modifying work procedures.

9. Reporting

The contractor must maintain a record of ASS treatment. The ASS treatment record should include the following details:

- Date of works involving ASS;
- Location / area and depth of excavated ASS material and location of treatment pads;
- Time of excavation;
- Neutralisation process completed;
- Liming material and rate utilised;
- Results of field and analytical testing and comparison to acceptance criteria;
- Disposal location;
- Tonnages and disposal / transfer dockets (if applicable);
- Results of water monitoring; and
- Water discharge records.

These records should be provided to DP if requested and upon completion of works.

A record should also be maintained confirming contingency measures and additional treatment if undertaken. A final report should be issued upon completion of the works presenting the monitoring regime and results and confirming that adverse environmental impact has not occurred during the works.

10. Conclusion

This report included a desktop review of relevant DP reports, databases and reference material as well as the development of a preliminary ASSMP.

The preliminary ASSMP will be formalised, after conducting the intrusive soil sampling outlined in Section 6 and will allow adoption of appropriate management procedures to mitigate the potential environmental risks associated with ASS.

11. References

ASRIS. (2014). ASRIS - Australian Soil Resource Information System. http://www.asris.csiro.au. Accessed November 14 October 2023

Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines*. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government.

NSW EPA. (2014). *Waste Classification Guidelines, Part 4: Acid Sulfate Soils.* NSW Environment Protection Authority.

Stone, Y., Ahern, C. R., & Blunden, B. (1998). *Acid Sulfate Soil Manual.* Acid Sulfate Soil Management Committee (ASSMAC).

Sullivan, L., Ward, N., Toppler, N., & Lancaster, G. (2018). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Identification and Laboratory Methods Manual.* Canberra ACT CC BY 4.0: Department of Agriculture and Water Resources.

Sullivan, L., Ward, N., Toppler, N., & Lancaster, G. (2018). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual.* Canberra ACT CC BY 4.0: Department of Agriculture and Water Resources.

12. Limitations

Douglas Partners (DP) has prepared this report for this project at 383 Kent Street, Sydney in accordance with DP's proposal dated 20/09/2023 and acceptance received from Tracy Hoven dated 25/09/2023. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Touchstone Partners Pty Ltd and Charter Hall Holdings Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences.

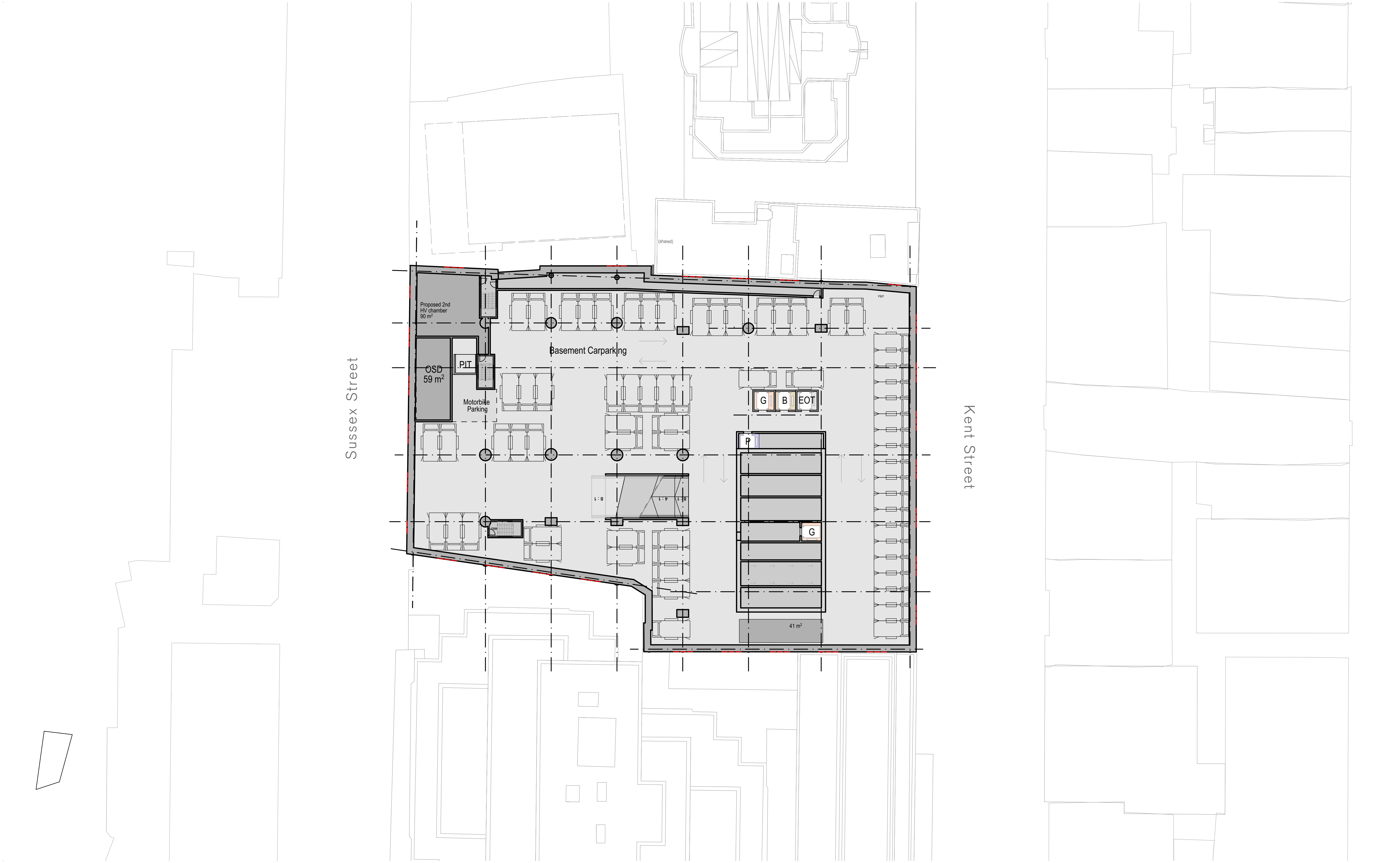
This report must be read in conjunction with all of the attached, including notes in Appendix E, and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

Architectural Drawings



fjmt

Basement 1 - Carparking

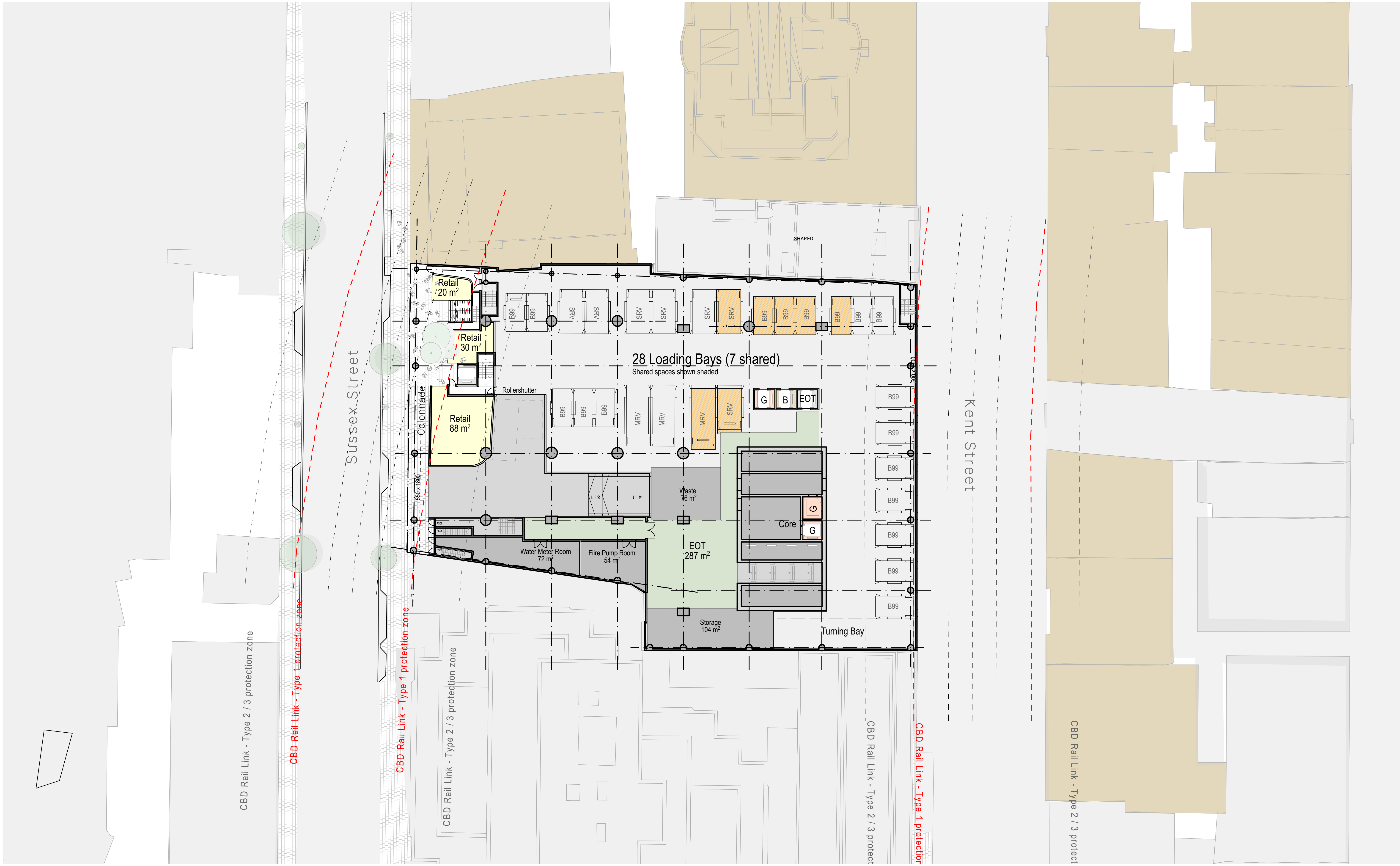
Charter Hall - 383 Kent Street

0 5 10 20m

1:500 @ A3

<16/02/2023>

Issued for Approval



fjmt

Sussex St GL - Shared Loading/ retail

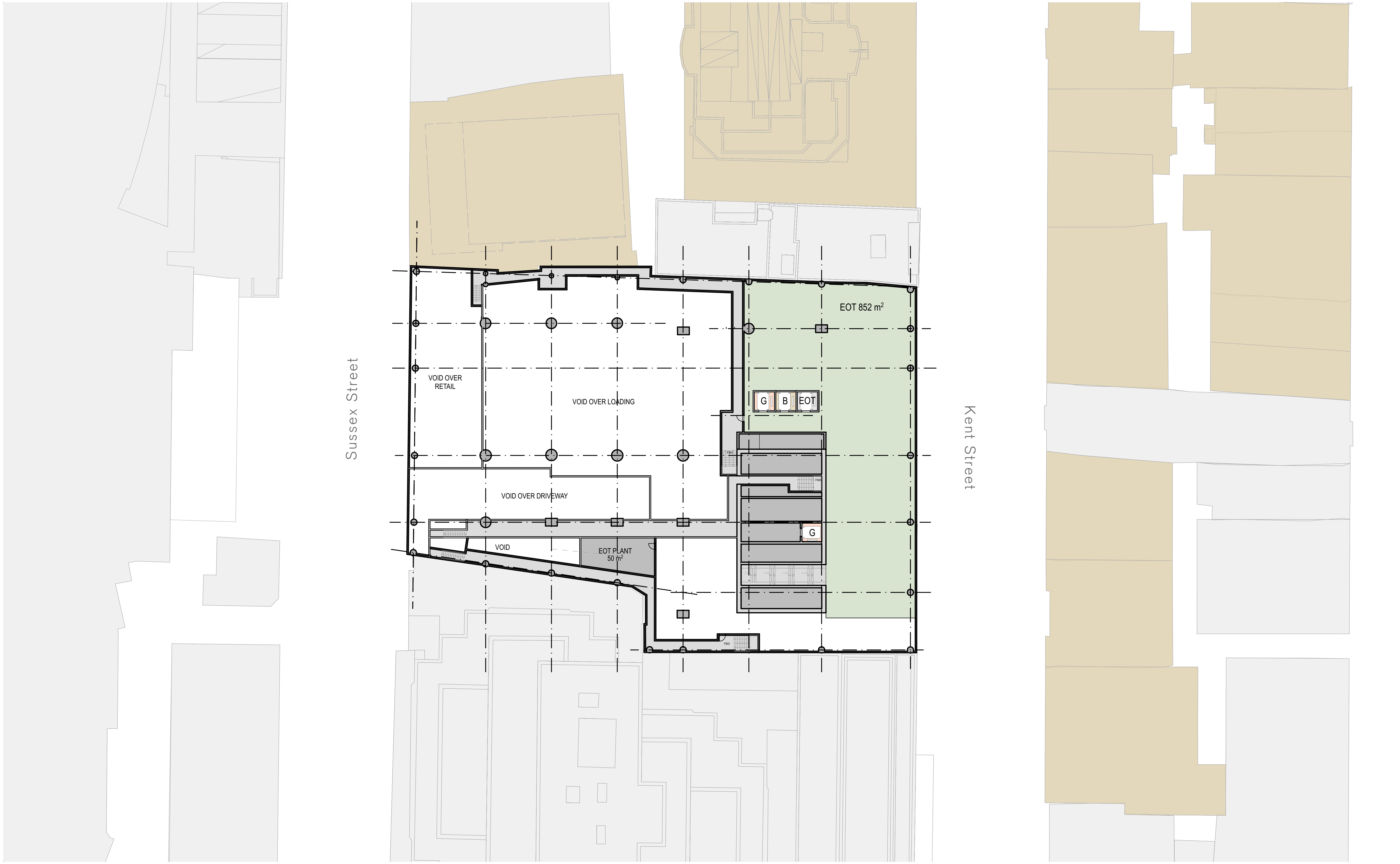
Charter Hall - 383 Kent Street

0 5 10 20m

1:500 @ A3

1/12/23

Issued for Approval



fjmt

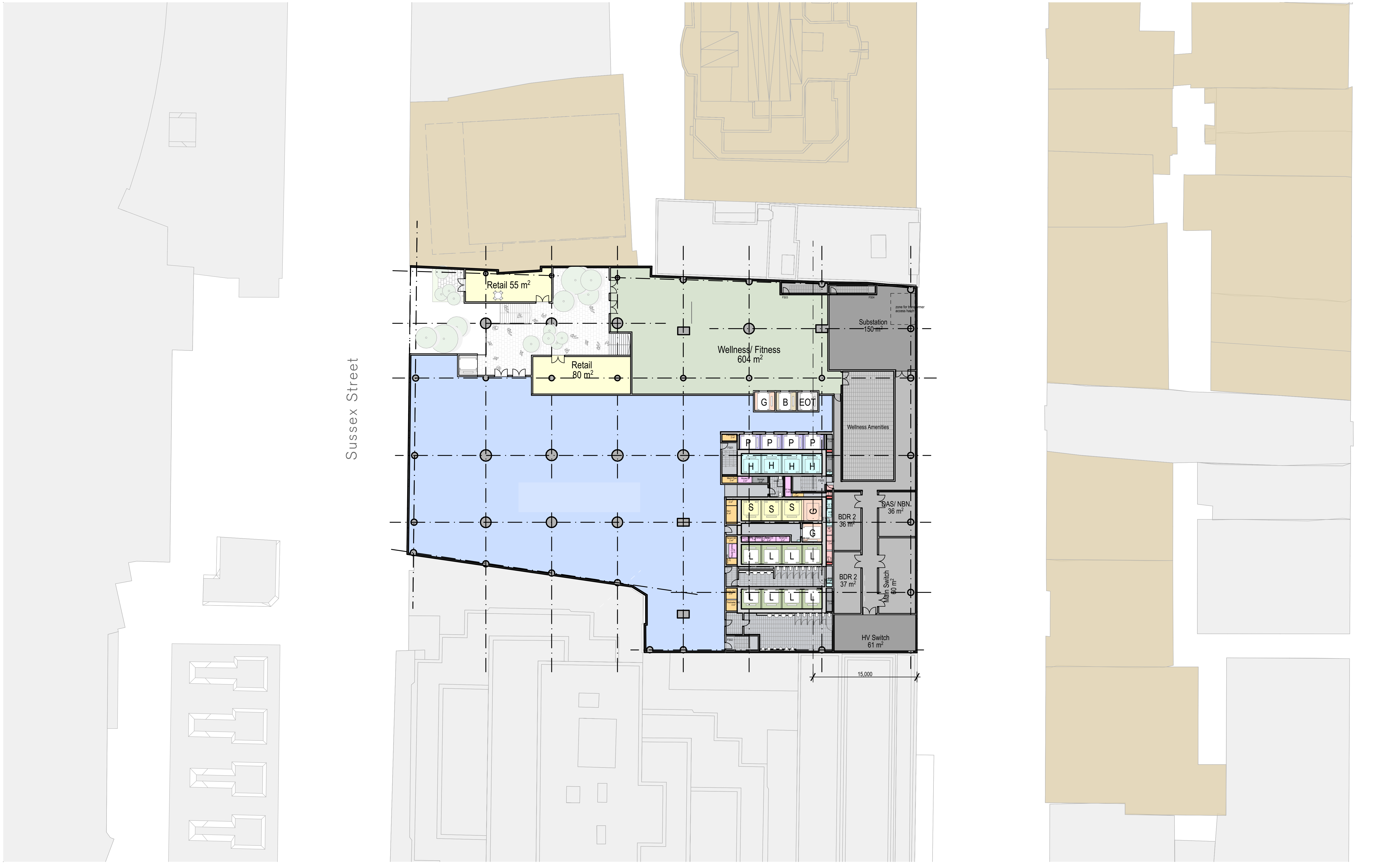
Sussex St Mezzanine - EOT

1:500 @ A3

1/12/23

Charter Hall - 383 Kent Street

Issued for Approval

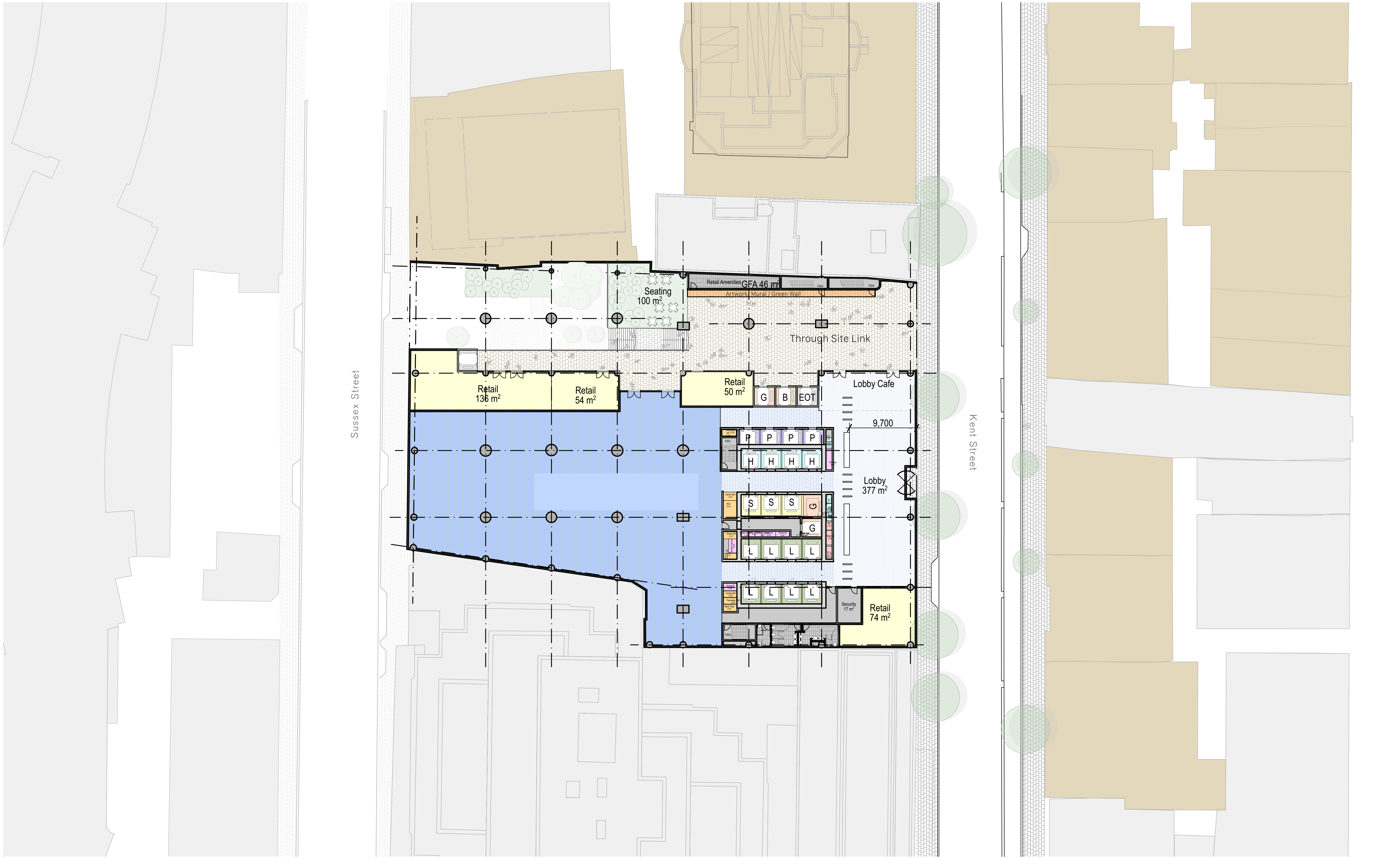


0 5 10 20m

Lower GL - Commercial/ EOT/ Plant

1:500 @ A3

1/12/23



fjmt

0 5 10 20m

1:500 @ A3

1/12/23

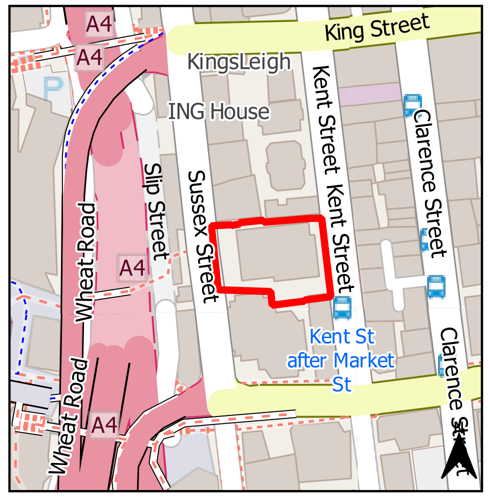
Kent St GL - Lobby/ Retail/ Commercial

Charter Hall - 383 Kent Street

Issued for Approval

Appendix B

Drawing



Site Location

Legend

Site Boundary

Proposed Test Locations

NOTE:
1. Drawing adapted from aerial imagery from MetroMap dated 01.02.2020
2. Test locations are indicative only

0 10 20 30 40 50 m

Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Chater Hall Holdings Pty Ltd		TITLE:	**Proposed Test Location Plan**
OFFICE: Sydney	DRAWN BY: AN		**Acid Sulfate Soil Investigation**
SCALE: 1:500 @A3	DATE: 12.October.2023		**383 Kent Street, Sydney, NSW, 2000**

Project:	217267.02
DRAWING No:	1
REVISION:	0

Appendix C

Acid Sulfate Soils Treatment

Appendix C
Acid Sulfate Soils Treatment
383 Kent Street, Sydney

C1.0 Introduction

This appendix outlines:

- Acid sulfate soil treatment verification criteria;
- Equations for net acidity;
- Liming rate calculations; and
- Water and groundwater management.

C2.0 Verification of Treatment

The following section provides the equations and methods of verifying that the neutralisation treatment has been successful / completed.

Net Acidity

Net Acidity is the quantitative measure of the acidity hazard of ASS. It is determined from an Acid Base Accounting (ABA) approach using one of the equations below. Equations C1 and C2 are used to determine the net acidity prior to treatment of ASS / PASS and therefore if acid sulfate soil treatment and / or a management plan is required. Equation C3 is used to establish that the neutralisation treatment has been successful:

Equation C1 - when the effectiveness of a soil's measured Acid Neutralising Capacity has been corroborated by other data demonstrating the soil does not experience acidification during complete oxidation under field conditions, or

Equation C2 - when the effectiveness of a soil's measured Acid Neutralising Capacity has not been corroborated by other data, or

Equation C3 - when the effectiveness of a management approach involving the addition of liming materials is being verified post treatment via calculation of the Verification Net Acidity.

Equation C1 Net Acidity whereby acid neutralising capacity (ANC) has been corroborated by other data

Net Acidity = potential sulfidic acidity + actual acidity + retained acidity - Acid Neutralising Capacity.

Net Acidity = Scr + S-TAA at pH 6.5 + SNAS - s-ANCBT.

Equation C2 Net Acidity whereby ANC has not been corroborated by other data

Net Acidity = potential sulfidic acidity + actual acidity + retained acidity.

Net Acidity = Scr + S-TAA at pH 6.5 + SNAS.

Equation C3 Verification Net Acidity

Verification Net Acidity = potential sulfidic acidity + actual acidity + retained acidity – (post neutralised Acid Neutralising Capacity - pre neutralised Acid Neutralising Capacity).

Verification Net Acidity = Scr + S-TAA at pH 6.5 + SNAS - (ANCBT of treated material - ANCBT of untreated material).

C3.0 Liming Rates

The required liming rate can be calculated from one of the following formulas.

Equation C4:

Neutralising Material Required (kg $CaCO_3$/tonne soil) = (Net acidity (mol H+/t) / 19.98) x FOS x 100/ENV.

Equation C5:

Neutralising Material Required (kg $CaCO_3/m^3$ soil) = D (tonne/m^3) x (Net acidity (mol H+/t) / 19.98) x FOS x 100/ENV.

Where:

- Net acidity (mol H+/t) is derived using the 95% UCL of the Net Acidity (%S). This can be determined pending laboratory results after an intrusive investigation is conducted; 19.98 converts to kg $CaCO_3$/tonne.
- FOS (factor of safety) = a minimum value of 1.5 needs to be adopted, although values of up to 2 can be suitable;
- ENV = Effective Neutralising Value (e.g., Approx. 98% for fine (0.3 mm grain size) ag lime with an NV of 98%).
- D = bulk density, site specific results can be used, or the bulk densities can be determined from laboratory results after an intrusive investigation is undertaken.

Notes:

- The ENV is calculated based on the molecular weight, particle size and purity of the neutralising agent and should be assessed for proposed materials in accordance with National Acid Sulfate Soils Guidance (2018).
- Natural net acidity must not be used.

An initial liming rate based on the laboratory result calculation (excluding ANC) is considered appropriate based on it including a safety factor of 1.5 and the use of ag lime with an NV of at least 98% and a grain size of less than 0.5 mm.

The liming rate to be calculated from the analytical results should therefore be considered as a "starting point", and pH monitoring should be conducted during treatment to assess the progress of the neutralisation and need for additional mixing and / or addition of ag lime. Soil will only be considered to have been successfully treated when all soil has been verified in accordance with Section 7.5.

C4.0 Disposal as PASS

Further guidance for the disposal of untreated soil as PASS (as a contingency strategy) is provided in Appendix D.

C5.0 Water and Groundwater Management

Water is the main mechanism by which acid and metals from oxidised ASS are mobilised and transported. Careful management of water is therefore paramount to effective management of potential adverse impacts from ASS. Management is required to provide control of treated waters for discharge and provide some margin for unattended weekend or holiday periods as well as heavy rain periods.

The below sections provide potential strategies for management, assessment and disposal of water leaching from ASS.

In general, risks associated with dewatering in areas underlain by ASS include:

- Acidification of in-situ soils drained within the dewatering cone of depression and difficulties associated with neutralising these in situ soils (this can also impact the possible PASS classification of some soils);
- Acidification of groundwater remaining within the dewatering cone of depression after the system has re-flooded;
- Iron, aluminium and heavy metal contamination of groundwater arising from mobilisation of these compounds under low pH conditions; and
- Acidification and contamination of surface water bodies which receive groundwater.

C5.1 Water Assessment for Disposal

All water which has potentially come into contact with ASS requires assessment (and if necessary, treatment). The minimum recommended monitoring is provided in Table C1, below.

Table C1: Suggested Water Monitoring Frequencies and Target Levels for Disposal to Stormwater

<table>
<tr><th>Test</th><th>Frequency</th><th>Target Level for Disposal to Stormwater</th></tr>
<tr><td>pH</td><td rowspan="3">Water detention basin / tank:
• During storage / treatment as required to allow timely treatment;
• Less than 24 hours prior to any planned discharge;
• Daily during discharge period.
• For unplanned discharges (i.e., due to rain), within five days of the cessation of the rainfall event
• Treatment Plant:
• During storage / treatment as required to allow timely treatment; and
• Daily during discharge period.</td><td>• pH 6.5 to 8.5</td></tr>
<tr><td>Total Suspended Solids (TSS)</td><td>• ≤50 mg/L or equivalent turbidity measure (in NTU) where a statistical correlation between the TSS and turbidity has been determined</td></tr>
<tr><td>Oil and Grease</td><td>• None observable</td></tr>
<tr><td>Iron (total and soluble)</td><td>• Weekly checks during discharge period; and
• Laboratory analysis immediately prior to disposal; and
• As required based on visual observations; and
• Visual assessment of discolouration:
• Daily during discharge</td><td>• No obvious sign of iron staining/ settlement
• ≤0.3 mg/L filterable iron
• ≤0.8 µg/L filterable Aluminium @ < pH 6.5
• ≤55 µg/L filterable Aluminium @ > pH 6.5</td></tr>
<tr><td>Potential contaminants
PAH, TRH, BTEX and metals (aluminium, arsenic, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, zinc)]</td><td>Laboratory analysis:
• One round of testing before first disposal of ASS impacted water;
• If first round of testing exceeds target levels then further testing prior to disposal is required</td><td>ANZG (2018) Trigger Levels for 95% Level of Protection for marine ecosystems if no licence conditions are available</td></tr>
</table>

Notes: PAH Polycyclic aromatic hydrocarbons
BTEX Benzene, toluene, ethylbenzene, xylenes
TRH Total recoverable hydrocarbons

C5.2 Treatment

It is noted that ag lime is generally not suitable for the treatment of leachate due to its low solubility in water. As stated in the report, slaked lime is the most suitable neutralising agent for leachate.

The amount of neutralising agent required to be added to the leachate can be calculated from the equation below:

Equation C6:

$$\textit{Alkali Material Required (kg)} = \frac{M_{Alkali} \times 10^{-pH initial}}{2 \times 10^{3}} \times V$$

Where: M_{Alkali} = *molecular weight of alkali material (g/mole) (molecular weight of slaked lime ($Ca(OH)_2$) = 74 g/mole.)*
pH initial = initial pH of leachate
V = volume of leachate (litres)

As a guide, the approximate quantities of slaked lime required to neutralise acidic water are provided in Table C2.

Table C2: Approximate Liming Rates for Water (based on slaked lime (kg of $Ca(OH)_2$))

Water pH	Volume		
	10 m^3	50 m^3	100 m^3
2	3.7	18.5	37
3	0.37	1.85	3.7
4	0.037	0.185	0.37
5	0.0037	0.0185	0.037
6	0.00037	0.00185	0.0037

C6.0 References

ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality;

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality;

NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013);

Acid Sulfate Soils Management Advisory Committee (ASSMAC) Acid Sulfate Soils Management Guidelines (1998) (ASSMAC, 1998);

Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government (Dear et al 2014);

NSW Environment Protection Authority (EPA) Waste Classification Guidelines (2014) (EPA, 2014);

NHMRC (2018) Australian Drinking Water Guidelines 6 2011 (v3.5 updated August 2018);

Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0 (Sullivan et al 2018a); and

Sullivan, L., Ward, N., Toppler, N., & Lancaster, G. (2018). *National Acid Sulfate Soils Guidance: National Acid Sulfate Soils Identification and Laboratory Methods Manual.* Canberra ACT CC BY 4.0: Department of Agriculture and Water Resources. (Sullivan et al 2018b).

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Appendix D

Contingency Options to On-Site Treatment and Off-Site Disposal

Appendix D

Contingency Options to On-Site Treatment and Off-Site Disposal

383 Kent Street, Sydney

D1.0 Introduction

This Appendix provides the contingency options to the selected ASS management option of on-site treatment and off-site disposal. The contingency options discussed in this appendix are off-site treatment and disposal and off-site disposal as PASS.

D2.0 Off-Site Treatment and Disposal

Where on site treatment of PASS is not possible and / or practical then off-site treatment at a facility appropriately licenced to accept and treat such soil can be considered. The below general procedure and works should be followed for off-site treatment:

- Loading the soil onto trucks. Note if the soils are wet, they will be heavier than soils as normally transported at field moisture. This should be taken into consideration when loading trucks to ensure that trucks are not overloaded;
- Transport must be conducted in a sealed truck which prevents water leaking from the truck during transport;
- Completion of site records of the above and all information required by the treatment facility, and provision of copies of these records to the treatment facility;
- Transporting of soil to the treatment facility;
- Once the ASS have been accepted by the treatment facility, the facility will treat and manage it in accordance with the National Acid Sulfate Soil Guidance (2018) and their site specific Environment Protection License (EPL) conditions, subject to the verification procedures documented herein. The liming rate will be based on the liming rate presented in this report or based on results that supersede those presented herein;
- Verification of the treatment of the ASS and classification of the soil by an Environmental Consultant; and
- Transport of the treated, classified ASS to the final receiving site / disposal facility.

D3.0 Off-Site Disposal as PASS

D3.1 PASS Criteria

For the purposes of this ASSMP, potential acid sulfate soils (PASS) are defined in accordance with the NSW Environment Protection Authority (EPA) Waste Classification Guidelines (2014) (EPA, 2014) Part 4 (Acid Sulfate Soils). which states that "*Potential ASS may be disposed of in water below the permanent water table, provided:*

- *The soils meet the definition of VENM in all aspects other than the presence of sulfidic soils or ores;*
- *The pH of soils in their undisturbed state is pH 5.5 or more;*
- *The soil has not dried out or undergone any oxidation of its sulfidic minerals;*
- *Soil is received at the disposal point within 16 hours of excavation, and kept wet at all times between excavation and reburial at the disposal point;*
- *Appropriate records are provided to the receiving site with every truck load confirming that it meets the above criteria; and*
- *The receiving site meets its obligations under EPA (2014) and its Licence conditions."*

D3.2 Disposal as PASS

The following works will be conducted by appropriately trained staff:

- Agreement with the receiving site on acceptance times for trucks, and allowable time lapse between excavation and acceptance by receiving site;
- Soils will be kept wet at all times, and should be sprayed with water if required to keep them wet;
- Recording of the excavation date, time and source chainage of the excavated soil;
- Inspection of the excavated soil for moisture content, material texture/ signs of contamination concern, such as anthropogenic odours, staining or inclusions by all personnel involved in the management / handling of the spoil;
- If signs of anthropogenic impact or fill are observed, the soil will not be pre-classified as PASS, and the soil will need to be segregated for further assessment;
- Measuring the pH in at least one sample per 50 m^3, or a minimum of 10 per shift, using a calibrated pH meter in accordance with Department of Agriculture and Water Resources' National Acid Sulfate Soils Guidance – National acid sulfate soils sampling and identification methods manual, June 2018:
    - NOTE: If the pH is less than or equal to 6.5, the soil will not be classified as PASS, and the soil will be segregated for further assessment and treatment.
- Loading the soil into trucks and ensuring the soil is moist enough to prevent it drying out during transport. Note: due to the soils being wet, they will be heavier than soils as normally transported at field moisture. This should be taken into consideration when loading trucks to ensure that the trucks are not overloaded;
- Soil should be loaded and transported as soon as possible to minimise the risk of oxidisation, which prevents it from being classified as PASS;

- Transport must be conducted in a sealed truck which prevents water leaking from the truck during transport;
- Completion of site records of the above;
- Completion of records of all information required by the receiving site, and provision of copies of these records to the receiving site, including copies sent with the truck driver for the load being carried;
- Transporting of soil meeting the PASS requirements to the receiving site within 16 hours of excavation (or earlier if required by the receiving site);
- Once the PASS have been accepted by the receiving site they are required to manage it in accordance with the their EPL conditions. It is not the role of this document to discuss management of soil once they have been accepted by the receiving site; and
- Any soil which is rejected by receiving will be transported back to the site and managed in accordance with the formalised ASSMP.

D4.0 References

ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality;

Acid Sulfate Soils Management Advisory Committee (ASSMAC) Acid Sulfate Soils Management Guidelines (1998) (ASSMAC, 1998);

NSW Environment Protection Authority (EPA) Waste Classification Guidelines (2014) (EPA, 2014); and

Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0 (Sullivan *et a*l 2018a).

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Appendix E

About this Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.