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PRELIMINARY DRAINAGE STRATEGY REPORT

SCRAP HANDLING FACILITY
TREMORFA
CARDIFF

CLIENT:

Celsa Manufacturing (UK) Limited
Building 58 Castle Works
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Cardiff
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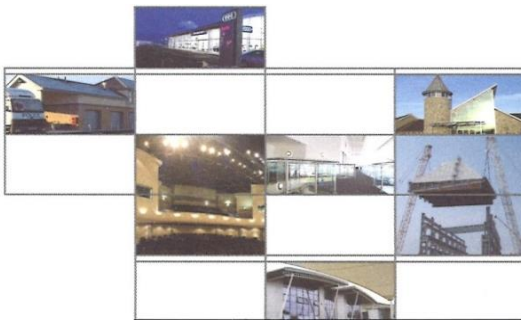

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CONTENTS

Issue 1 – First Issue

Issue 2 – Update front sheet to add correct report ref.no.

Issue 3 – Add new Section 6 and renumber subsequent sections; Add Appendix D and renumber subsequent appendices; update cross-references; update re. minor typographical errors, section numbering, pagination.

1.0 INTRODUCTION

1.1 BACKGROUND

Celsa Manufacturing (UK) Ltd ('Celsa') are the largest manufacturer of steel reinforcement in the United Kingdom and one of the largest producers of other long-steel products.

Celsa's Cardiff facility produces circa 1.2 million tonnes of recycled steel per annum, all from recycled scrap metal.

The proposed development comprises the following: -

- Installation of two new weighbridges
- Installation of a new scrap metal shredder
- Construction of a new amenity block
- Construction of associated car parking
- Construction of hardstanding and roads.

1.2 SuDS LEGISLATION

Schedule 3 of the Floods and Water Management Act 2010 (FWMA 2010) was enacted in Wales in January 2019 and as a result, all proposed new developments with a construction area of more than 100 m^2 are required to incorporate (SuDS) in accordance with Welsh Government's SuDS Statutory Guidance. This guidance includes a requirement for the SuDS design to be approved by the local SuDS Approving Body (SAB) before construction works begin.

1.3 REFERENCES

Our proposed drainage strategy has been developed in accordance with and with reference to the following:-

- CIRIA SuDS Manual C753 published in 2015
- Sewers for Adoption 7th Edition by WRc plc
- Geotechnical Site Investigation Report by TFW Group (ref. Appendix A)
- Flood Consequences Assessment Report ref. JBAU-XX-XX-RP-Z-0001-S3-P01 by JBA Consulting dated June 2022.
- Guidance Note 16 Fire Prevention & Mitigation Plan Guidance – Waste Management dated August 2017 by Natural Resources Wales

1.4 DESIGNERS

Designed by: - Karl Jones BSc Civil Engineering (Hons) MSc

Checked by: - Kevin Tobin MSc DIC CEng MICE

Approved by: - Kevin Tobin MSc DIC CEng MICE

2.0 EXISTING SITE

2.1 SITE LOCATION

The proposed development site is located to the south of Rover Way, adjacent to Celsa's existing steelmaking facility in Tremorfa, Cardiff.

The existing site comprises approximately 15 hectares of previously-developed (brownfield) land; the site is split into two separate operations (i.e. slag processing and scrap handling). What area is the proposed shredder development site is 3.95 Ha

Figure 1 – Site Location Plan (Site Denoted in red line)

2.2 SITE GEOLOGY

2.2.1 In the past, various site investigation works have been undertaken across the Celsa site and in connection with a variety of different construction projects; additional site investigation works are currently being undertaken by TFW Group Ltd.

The various previous site investigations carried out across the site have indicated the ground profile to comprise the following: -

- Dense to very dense made ground (0.0 m – 8.0 m)
- Very soft silty clay with bands of peat (8.0 m – 22.0 m)
- Extremely soft mudstone (22.0 m - 23.5 m)

TFW Group Ltd have advised that their current site investigation work indicates that the infiltration rates within the made ground are between 1.11 x 10^{-4} m/s to 7.39 x 10^{-5} m/s i.e. the

proposed development site appears to have a very good soakaway potential (TFW Group Ltd Infiltration Rate Data appended - Ref. Appendix A).

2.3 SITE FLOOD RISK

2.3.1 JBA Consulting have been commissioned by Celsa to prepare a Flood Consequence Assessment (FCA) in accordance with Welsh Government ('WG') guidance on development and flood risk, as set out in Welsh Assembly Government Technical Advice Note 15 dated 2004.

2.3.2 The FCA (i.e. Flood Consequence Assessment report ref. JBAU-XX-XX-RP-Z-0001-S3-C01 dated May 2022 by JBA Consulting) concludes that the vast majority of the proposed development site is located in Flood Zone B with only a very limited portion falling within Flood Zone C2.

The FCA recommends that in order to manage the risk of tidal flooding, ground levels should be raised above the 2097 0.5% AEP flood level of 8.64 m AOD.

The FCA also concludes that due to the implementation of the Cardiff coastal defence, the proposed development site is expected to be flood free for the 0.5% and 0.1% AEP events with climate change allowances for the 75 year lifetime of the development, irrespective of the proposed flood mitigation.

2.4 EXISTING DRAINAGE INFRASTRUCTURE

2.4.1 FOUL DRAINAGE

The proposed development site is not currently served by a dedicated foul sewerage system, however, a 2400 mm diameter concrete combined adopted sewer ('the Combined Adopted Sewer') crosses the site in a north-easterly to south-westerly direction, running parallel to and within its southern boundary (Ref. DCWW Plan ref. 321525,176305 dated 10th March 2022 – copy appended, ref. Appendix B).

The Combined Adopted Sewer takes all surface water and sewerage from the various residential and industrial units north of the proposed development and drains it to the Dwr Cymru sewerage treatment plant located adjacent to Celsa's Minerals Site on Tide Fields Road.

There is a number of non-adoptable foul drains that located within the entrance of the site.

2.4.2 SURFACE WATER DRAINAGE

The proposed development site is not currently served by a dedicated surface water sewer.

The nearest surface water sewers are 2 no. adopted DCWW sewers (1 no. of 475 mm diameter and 1 no. of 685 mm diameter) located just to the north-east of Celsa's site entrance in Rover Way. These 2 no. sewers both drain into a DCWW pumping station located to the north of the site and ultimately into the 2400 mm Combined Adopted Sewer.

3.0 PROPOSED FOUL DRAINAGE

Due to the limited amount of foul (sewage) water that will be generated by the new welfare facilities it is proposed that this will be drained to an existing foul sewer located just north of the amenity block.

4.0 PROPOSED SURFACE WATER DRAINAGE

4.1 SuDS STANDARDS

4.1.1 DESIGN GUIDANCE OVERVIEW

Welsh Government's 2019 Sustainable Urban Drainage Systems (SuDS) Statutory Guidance requires that all new developments where the construction area exceeds 100 m^2 are required to incorporate SuDS complying with six standards numbered S1 to S6, as follows: -

- S1 – Runoff destination
- S2 – Hydraulic control
- S3 – Water quality
- S4 – Amenity
- S5 – Biodiversity
- S6 – Construction, operation and maintenance

The overall proposed surface water drainage layout is illustrated on Drawing No. 21.121 C04 Rev B (Proposed Drainage Layout) by James & Nicholas LLP (copy appended - ref. Appendix C).

It should be noted that the proposed development site is currently surfaced with hardcore, with no dedicated drainage system.

Given the large scale of the proposed development, the site has been split into 3 no. sub-catchment surface water drainage areas, as follows: -

- Area 1 – Shear and Shredder Yard Area

  This area includes the processing plant (shear and shredder) and associated yard areas for the processing of scrap metal.

  It is proposed that the yard is to be served by 2 no. separate proprietary infiltration-based drainage systems.

- Area 2 – West Entrance and Internal Circulation

  It is proposed that the Tide Fields Road entrance will be the main point of access for scrap deliveries, with internal circulation being achieved via a new concrete road layout.

  It is proposed that drainage to the area immediately adjacent to the Tide Fields Road entrance will be achieved via a local soakaway or to existing mains and that drainage to the internal circulation roads will be via an infiltration-based proprietary drainage system.

- Area 3 – East Entrance & Car Park

  This area comprises the main car park along with the existing East Entrance (off Rover Way).

  It is proposed that drainage to this area will be via a close-to-surface drainage system, drained into an infiltration basin.

Please refer to Section 4.0 'Surface Water Drainage Design' (below) for further details of the proposed surface water drainage design.

Each of the Welsh Government SuDS standards has been addressed within the proposed designs, as described in Sections 3.2 to 3.6, below.

4.1.2 S1 – RUNOFF DESTINATION

4.1.2.1 Priority Level 1 – Collection of rainwater for use

There would potentially be an opportunity to collect rainwater for re-use, however Celsa have advised that re-use is not feasible for the following reasons:-

- Collected rainwater cannot be stored for use in the event of a fire on site because this is not permitted under the NRW permit for the site (due to the potential for contaminants being present in the collected rainwater.)

- Although collected rainwater could potentially be re-used in the shredder plant, the rainwater would need to be cleaned and filtered prior to any re-use to ensure no foreign objects were present (as these could cause costly damage to key components of plant) and to remove contamination. The cost of cleaning/filtering are such that re-use is not economically viable. In addition, the amount of water required for day-to-day operations varies considerably from one day to another and therefore storage of the excess would be required, albeit the maximum volume requiring storage would be difficult/impossible to determine.

4.1.2.2 Priority Level 2 – Surface water runoff infiltrated to ground

The results of infiltration testing indicate that the site has very good soakaway potential. It is therefore proposed that all surface water will be collected, treated then drained away via infiltration into the ground. This will mimic the exact drainage conditions that already occur across the entirety of the site.

4.1.2.3 Priority Level 3 – Surface water runoff discharged to watercourse

The proposed development site is situated approximately 250.0 m to the west of the Severn Estuary.

It is not considered likely to be viable to collect all surface water and discharge it into the Severn Estuary due to various factors including: -

- There is no existing available discharge point.
- The high pollution indices associated with the proposed operations at the development site, mean that it will be difficult/impossible to ensure the water quality is sufficiently high prior to discharge into the Estuary (which is environmentally sensitive).

- Coastal defence works are due to be carried out in the vicinity in 2022 – 2024 by Cardiff Council meaning that discharge of surface water into the Estuary will not be possible until these works have been completed, i.e. discharge into the Estuary will not be viable for this project.

4.1.2.4 Priority Level 4 – Surface water runoff discharge to surface water drain or highway drain

The proposed development site is located directly off Rover Way, where there is a dedicated highway drain, however Cardiff Council have advised that this drain is already continually blocked, experiencing surcharges and in need of regular maintenance to rectify the ongoing issues and that consequently it would not be possible for surface water run-off from the proposed development to discharge into this drain.

There are also 2 no. DCWW surface water sewers (of 475 mm and 685 mm diameter) located within in Rover Way, however the manholes are located approximately 90 m away from the main site. Connection to these manholes would therefore be very costly as well as logistically difficult (including causing disruption to highway traffic (temporary signaling). In addition the required discharge rate would be at the Qbar rate (33.18l/s), which would potentially be rejected by DCWW.

4.1.2.5 Priority Level 5 – Surface water runoff discharge to combined sewer

The only known sewer that runs through the site is the 2400 mm diameter Combined Adopted Sewer that runs from the DCWW pumping station located to the north of the site to the DCWW waste treatment plant located in Tide Fields Road. This sewer is a major DCWW asset that is located approximately 6.0 m – 8.0 m below ground level. Connection to this sewer is not considered practical as this would require major civil works with associated very high costs.

4.1.3 S2 – HYDRAULIC CONTROL

4.1.3.1 Hydraulic control of surface water runoff will be achieved utilising generally-accepted methods, primarily infiltration and attenuation.

4.1.3.2 The underlying soil profile of the site appears to present a very good opportunity for infiltration and this should prevent runoff from occurring following a ‘first flush’ 5 mm rainfall event. It is proposed that the natural infiltration processes will be encouraged by the use of filter strips with proprietary filter media that will be located alongside the length of the internal roads and the scrap processing area. An infiltration basin will provide drainage to the amenity block.

4.1.3.3 Preliminary hydraulic calculations have been undertaken to determine the required sizing of the proposed filter strips and proposed infiltration rate. Soakaways and storage capacity will be sized to ensure they have sufficient volume to store a 1 in 100-year return period storm + 40% climate change.

4.1.3.4 Site levels will be designed so that the exceedance routes will direct surface water runoff towards the low-lying areas of the site. This should ensure that surface water will remain on site in the event of any failure of the local drainage system and/or any storms in excess of those considered within the calculations.

4.1.4 S3 – WATER QUALITY

4.1.4.1 Surface water quality for site runoff will be managed through the construction of new SuDS features.

4.1.4.2 A water quality risk assessment has been carried out using the SuDS manual mitigation indices in accordance with Chapter 26 of the CIRIA C753 SuDS Manual (CIRIA, 2015).

Under this assessment the proposed development (i.e. development of a new industrial site where chemicals are delivered and stored) is shown to present high pollution hazard risks (see Figure 2, below).

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Figure 2 – CIRIA 2015 SuDS Pollution Hazard Levels Indices

4.1.4.3 It can be seen from Figure 2 that the pollution indices are as follows:-

- Total Suspended Solids (TSS) – 0.8
- Metals – 0.8
- Hydrocarbons – 0.9

It is proposed to mitigate the potential pollution hazards with proprietary filter mediums for the filter strips and grass/planting for the infiltration basin. The mitigation strategy and design is discussed in further detail in Section 5.0, below.

4.1.5 S4 & S5 – AMENITY AND BIODIVERSITY

4.1.5.1 The proposed new SuDS features will be designed in accordance with CIRIA 2015 to maximize the multiple benefits of SuDS including amenity and biodiversity.

4.1.5.2 Designing for amenity is considered a particular priority. The proposed green features (i.e. the proposed infiltration basin) will provide an amenity benefit to employees because of the proposed inclusion of seating areas around the landscaped areas, which will enable employees to comfortably access and enjoy these areas.

4.1.5.3 The proposed infiltration basin will each provide an opportunity to maximise biodiversity benefits. To achieve this, it is proposed that they will each be planted with local plant species. This should help to attract local wildlife and provide a continuation of habitat.

4.1.6 S6 – CONSTRUCTION, OPERATION AND MAINTENANCE

4.1.6.1 All surface water drainage systems will be designed taking account of health and safety considerations during the construction, long-term operation and maintenance of the system.

4.1.6.2 The existing site drainage is limited to the Combined Adopted Sewer (the DCWW combined sewer running along the southern boundary of the site) It is proposed that a 12.0m easement zone, either side of the centreline of the pipe will be retained as per DCWW adopted sewer policy . Prior to any detailed design being undertaken, a location survey of the Combined Adopted Sewer will be undertaken to ensure that no encroachment on the combined sewer occurs and it is intended that works to the existing system will be kept to a minimum. A site drainage plan will be kept on site during the construction stage showing the location of the drainage features.

4.1.6.3 Construction works will be undertaken in accordance with all statutory approvals (including Natural Resources Wales if applicable) and all works will adhere to Pollution Prevention Guidelines.

All hazardous substances (including liquids and solids) will be stored within impermeable, bunded areas, to remove the risk of migration to groundwater or a nearby watercourse. The measures proposed will assist in avoiding or minimising the potential for contaminants and suspended solids to migrate to surface and groundwater, reduce localised flood risk, and protect water quality and the ecosystems the water resources support.

The following list shows measures that will be put in place during the construction phase: -

- The handling, use and storage of hazardous materials will to be undertaken in line with the EA procedures will be put in place.

- Adequately bunded and secure areas with impervious walls and floor will be provided for the temporary storage of fuel, oil and chemicals on site during construction; drip trays will be in place to collect leaks from diesel pumps / standing plant; oil interceptor(s) will be fitted to all temporary discharge points and for discharge from any temporary oil storage / refuelling areas; suitable spill kits will be available on site; restrictions will be in place on use of unnecessary machinery near to adjacent water courses.

- No runoff from development areas will be discharged into controlled waters unless specific approval has been obtained in advance from NRW.

- The early re-seeding of cleared land will be undertaken, where practicable, to minimise exposed land and the entrainment of sediment by overland flow. Construction plant / materials will be stored on hardstanding surfaces where possible; if this is not possible, the contractor will ensure any compacted topsoil is loosened as soon as possible following completion of the works;

- Where possible, the attenuation pond/infiltration basin/other drainage features within each identified drainage catchment will be constructed first and used to attenuate and store run-off from the site during construction to prevent possible contamination of the surface and ground waters.

- If site drainage is required (including surface runoff and dewatering effluents) it will be discharged to sewers where reasonably practicable. Site drainage will meet the requirements for effluent and flood risk standards required by the sewerage undertaker.

- The relevant sections of BS6031:2009 Code of Practice for Earthworks will be followed and reference should be made to SuDS best practice during construction.

- During construction, protection measures to control the risk of pollution to surface water will be adopted, as necessary.

- The adoption of appropriate pollution prevention measures and good construction practices should ensure that any oils, hydrocarbons or hazardous materials stored on site will not leak onto the ground surface and thereby ensure that surface water bodies and associated ecosystems in the vicinity of the site are protected.

4.1.6.4 All below-ground drainage will be constructed in accordance with Sewers for Adoption 7th Edition, to ensure compliance with best practice.

4.1.6.5 The maintenance for all on-site drainage infrastructure will be the responsibility of the client. Details of the maintenance activities for the constructed drainage infrastructure will be passed to the client as part of an Operation and Maintenance Manual upon completion of the construction works. A full maintenance schedule for each drainage element can be seen in section 7.0 (below).

4.2 SURFACE WATER DRAINAGE DESIGN

The overall proposed surface water drainage layout is illustrated on Drawing No. 21.121 C04 Rev B (Proposed Drainage Layout) by James & Nicholas LLP (copy appended, ref. Appendix C).

4.2.1 GREENFIELD DISCHARGE RATE

4.2.1.1 Although the site is classified as brownfield all proposed discharge rates from the site will be considered as greenfield run off.

4.2.1.2 CIRIA 2015 provides a methodology of calculating the mean annual flood for areas less than 25 km^2 ($Q_{BAR(rural)}$) as follows: -

$$Q_{BAR(rural)} = 0.00108\ AREA^{0.89} \times SAAR^{1.17} \times SOIL^{2.17}$$

- AREA = the area of the catchment in km^2
- SAAR = standard average annual rainfall for the period 1941 to 1970 in mm
- SOIL = soil index (which is a value found from the Wallingford procedure to estimate the proportion of runoff from the catchment surface)

The Institute of Hydrology's 1993 Flood Studies Report (FSR) provides 'UK and Ireland Growth Rate Factors' for various different flood return periods (ranging from 1 to 500 years) for nine defined Hydrometric Areas (numbered 1 to 9) each of which covers a particular region of the country.

The FSR also notes that where the site area is below 50 ha, the formula should be applied for 50 ha and then the result should be factored based on the ratio of the actual site area to the applied site area (50 ha)

4.2.1.3 The site at Celsa is shown to be located in Hydrometric Area 9 and the hydrological values for the Q_{BAR} calculation for the site at Celsa are as shown in Figure 6, below:

SAAR	1125 mm
SOIL	0.47
Hydrometric Area	9

Figure 3 – Site Hydrological Characteristics

4.2.1.4 The site area is 3.95 ha, i.e. less than 50 ha. The Q_{BAR} calculation methodology therefore requires that the calculation is carried out for a 50 ha area and then factored down (by actual site area / 50 ha, i.e. by 3.95 ha / 50.0 ha).

For a notional 50 ha (=0.25 km^2) site area $Q_{BAR(rural)}$ is calculated as follows: -

$Q_{BAR(rural)} = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times SOIL^{2.17}$

$Q_{BAR(rural)} = 0.00108 \times 0.5^{0.89} \times 1125^{1.17} \times 0.47^{2.17}$

$Q_{BAR(rural)} = 0.00108 \times 0.54 \times 3714.06 \times 0.194$

$Q_{BAR(rural)} = 0.420\ m^3/s$ for 50 ha site

$Q_{BAR(rural)} = 420$ l/s for 50 ha site

The above equates to $Q_{BAR(rural)}$ of 420 / 50 = 8.4 litres per second per hectare

This is then factored for the actual total 3.95 ha site area as follows: -

Total allowable Q_{BAR} = 8.4 l/s/ha x 3.95 ha = 33.18l/s for the site as a whole

4.2.1.5 The FSR Growth Rate Factors (as per Table 24.2 in CIRIA 2015 – see Figure 7, below) are then applied to the total Q_{BAR} rate to determine the allowable discharge for the 1 in 1 year, 1 in 30-year and 1 in 100-year return periods.

TABLE 24.2 UK and Ireland growth curve factors (after NERC, 1993)

Hydrometric area	Return period								
	1[1]	2	5	10	25	30[2]	50	100	500
1	0.85	0.90	1.20	1.45	1.81	1.99	2.12	2.48	3.25
2	0.87	0.91	1.11	1.42	1.81	1.99	2.17	2.63	3.45
3	0.86	0.94	1.25	1.45	1.70	1.75	1.90	2.08	2.73
9	0.88	0.93	1.21	1.42	1.71	1.80	1.94	2.18	2.86
10	0.87	0.93	1.19	1.38	1.64	1.70	1.85	2.08	2.73
4	0.83	0.89	1.23	1.49	1.87	1.99	2.20	2.57	3.62
5	0.87	0.89	1.29	1.65	2.25	2.55	2.83	3.56	5.02
6/7	0.85	0.88	1.28	1.62	2.14	2.40	2.62	3.19	4.49
8	0.78	0.88	1.23	1.49	1.84	1.98	2.12	2.42	3.41
Ireland	0.83[2]	0.95	1.20	1.37	1.60	1.65	1.77	1.96	2.40

Notes

1 1 year return period growth curve factors are taken from NERC (1977)

2 30 year (and 1 year for Ireland) return period growth curve factors are interpolated estimates

Figure 4 – Table 24.2, CIRIA 2015

The relevant allowable discharge rates for the three return periods are therefore calculated as the following for the Celsa site (Hydrometric Area 9): -

1 in 1 year return

Total allowable Q_{BAR} for the site (ref. 4.1.3, above) = 33.18 l / s
FSR_{1yr} = 0.88
$Q_{BAR(rural)1\ yr}$ = 0.88 x 33.18 l/s = 29.20l/s

1 in 30-year return

Total allowable Q_{BAR} for the site (ref, 4.1.3, above) = 33.18 l / s
FSR_{30yr} = 1.80
$Q_{BAR(rural)30yr}$ = 1.80 x 33.18 l/s = 59.72l/s

1 in 100-year return

Total allowable Q_{BAR} for the site (ref, 4.1.3, above) = 33.18 l / s
FSR_{100yr} = 2.18
$Q_{BAR(rural)100yr}$ = 2.18 x 33.18 l/s = 72.33l/s

4.2.2 INFILTRATION DISCHARGE RATES

4.2.2.1 Infiltration testing has been completed by TFW Group Ltd (ref. Appendix A).

The infiltration rate has been calculated by taking the average across trial pits 1, 2 and 4 as follows: -

Trial Pit 1 (TP1) Rates
Test 1 – 5.66 x 10^{-5} ms^{-1}
Test 2 – 4.21 x 10^{-5} ms^{-1}
Test 3 – 3.96 x 10^{-5} ms^{-1}
Average Rate for TP1 = 4.61 x 10^{-5} ms^{-1}

Trial Pit 2 (TP2) Rates
Test 1 – 6.56 x 10^{-5} ms^{-1}
Test 2 – 7.39 x 10^{-5} ms^{-1}
Test 3 – 4.19 x 10^{-5} ms^{-1}
Average Rate for TP2 = 6.05 x 10^{-5} ms^{-1}

Trial Pit 4 (TP4) Rates
Test 1 – 1.17 x 10^{-4} ms^{-1}
Test 2 – 1.11 x 10^{-4} ms^{-1}
Test 3 – 1.11 x 10^{-4} ms^{-1}
Average Rate for TP4 = 1.13 x 10^{-4} ms^{-1}

Average infiltration rate = 7.32 x 10^{-5} ms^{-1} or 0.26m/hr.

This rate will be applied for the detailed calculations of the SuDS elements.

4.2.3 AREA 1 (SHEAR AND SHREDDER YARD AREA) DRAINAGE DESIGN

This area comprises of the operational plant and yard areas for scrap metal storage. The area will comprise of concrete hardstanding with an area of 20453m2 (i.e. 2.04 ha). It is proposed that the hardstanding will fall in two directions (North and South), where the surface water will drain to a proprietary filter strip at the northern and southern boundaries.

All design elements will be designed for the following parameters:

- 1 in 1 year storm + 40%CC
- 1 in 30-year storm + 40%CC
- 1 in 100-year storm + 40%CC
- Cv Ratio of 0.95 for both summer and winter events (as requested by Cardiff Council)
- Rainfall data from FEH point data to the site location

4.2.3.1 Northern Boundary Filter Strip

It is proposed that the northern boundary filter strip will have a length of 196.0m, width of 0.5m and a depth of 1.25m which will drain into a 2.0 m wide by 1.0 m deep cellular soakaway which will sit beneath the filter strip. The total hardstanding which is to be drained is 9648 m^2. The filter strip will be a complex structure made up with the following layers: -

Layer 1 - 500 mm wide by 500 mm thick of 20/40 mm clean stone

Layer 2 – 500 mm wide by 250 mm thick of SDS Aqua-Xchange filter media

Layer 3 – 500 mm wide by 250 mm thick of 20/40 mm clean stone

Layer 4 – 500 mm wide by 250 mm thick of SDS Aqua-Xchange filter media

Layer 5 – 2000 mm wide by 1000 mm thick of SDS Geolight attenuation crates (or similar approved)

It is proposed that each layer will be separated with a layer of Terram 1000 geotextile membrane with an impermeable membrane that will wrap around the side of the filter strip, this will ensure surface water will infiltrate into the cellular soakaway.

The proposed filter strip will be constructed to fall at the same gradient of the new concrete hardstanding, with the steepest gradient of 1:142 achieved. This will ensure that the interception mechanism of the filter strip is achieved to ensure the cleansing of the 1:1 year storm is achieved. This will ensure that the interception mechanism of the filter strip is achieved to ensure the cleansing of the 1:1 year storm is achieved.

Based on the design parameters above, the storm flood levels are: -

- 1 in 1 year storm – 488 mm
- 1 in 30-year storm – 1156 mm
- 1 in 100-year storm – 1601 mm

Detailed calculations are appended (ref. Appendix E)

4.2.3.2 Southern Boundary Filter Strip

It is proposed that the southern boundary filter strip will have a length of 142.0m, width of 0.5m and a depth of 1.25m, this will drain 10,805m^2 of hardstanding. The proposed filter strip will be of the same construction as the northern filter strip however the cellular soakaway will be 2.25m in width.

The proposed filter strip will be constructed to fall at the same gradient of the new concrete hardstanding, with the steepest gradient of 1:242 achieved. This will ensure that the interception mechanism of the filter strip is achieved to ensure the cleansing of the 1:1 year storm is achieved.

Based on the design parameters above, the storm flood levels are: -

- 1 in 1 year storm – 770 mm
- 1 in 30-year storm – 1622 mm
- 1 in 100-year storm – 2146 mm

Detailed calculations are appended (ref. Appendix F)

4.2.4 AREA 2 (WEST ENTRANCE & INTERNAL CIRCULATION) DRAINAGE DESIGN

4.2.4.1 Filter Strip

The proposed road will fall at a cross-fall going south-to-north. It is proposed that a filter strip will be installed along its perimeter to collect the surface water. The proposed filter strip will stop short at the Harsco operational area, where a traditional drainage system will be implement to pick the remaining surface water.

The proposed filter strip will be 388.0m in length, 0.5m in width and 1.25m deep, draining into a 0.75m wide by 1.0m deep cellular soakaway which will sit underneath the filter strip.

The steepest gradient of 1:128 will be achieved, to ensure interception will occur.

The total amount of hardstanding to be drained is 7790m^2.

The filter strip will be a complex structure made up with the following layers: -

Layer 1 – 500mm wide by 500mm thick of 20/40 mm clean stone

Layer 2 – 500mm wide by 250mm thick of SDS Aqua-Xchange filter media

Layer 3 – 500mm wide by 250mm thick of 20/40 mm clean stone

Layer 4 – 500mm wide by 250mm thick of SDS Aqua-Xchange filter media

Layer 5 – 750mm wide by 1000mm thick of SDS Geolight attenuation crates (or similar approved)

It is proposed that each layer will be separated with a layer of Terram 1000 geotextile membrane with an impermeable membrane that will wrap around the side of the filter strip, this will ensure surface water will infiltrate into the cellular soakaway. Detailed calculations are appended (ref. Appendix G)

4.2.4.2 Harsco Operational Area

It is proposed that the Harsco operational area, will be drained via gullies on the northern edge on the road via a full retention separator into an existing surface water drain located within the Harsco compound. The area drained is 2997 m^2

4.2.5 AREA 3 (EAST ENTRANCE AND CAR PARK) DRAINAGE DESIGN

It is proposed that the existing main entrance off Rover Way and the proposed new car park will be drained using close-to-surface ACO drainage which will then drain into an SPEL Stormceptor The proposed SPEL Stormceptor will maximize the removal of coarse sediment, debris and free-floating hydrocarbons before it is discharged into an infiltration basin. The infiltration basin will be grassed and planted to ensure the surface water will receive a two-stage treatment process before being infiltrated into the ground.
Based on the design parameters the basin will require to be the following size:-

Cover Area = 185.0m^2

Base Area = 66.0m^2

Depth = 800 mm

This will give the following storm flood levels:-

1 in 1 year storm – 324mm

1 in 30-year storm – 577mm

1 in 100-year storm – 718mm

Detailed calculations are appended (ref. Appendix H)

5.0 SURFACE WATER POLLUTION MITIGATION STRATEGY

The proposed development will include the storage and processing of scrap metals which will be transported to and from site using HGV's. All operational work will be undertaken in the shredder/shear yard area.

5.1 FILTER STRIP MITIGATION STRATEGY

As noted in section 3.4.3, the pollution indices for the site are at highest value stipulated in CIRIA C753, as follows: -

- Total Suspended Solids (TSS) – 0.8
- Metals – 0.8
- Hydrocarbons – 0.9

It is therefore critical that the SuDS components selected are suitable to ensure that all surface water is captured and treated sufficiently before being infiltrated into the ground.

Currently the site isn't surfaced, therefore all surface water from the shear processing infiltrates directly into the ground, therefore all surfacing within the yard is to be concreted. Ensuring that all water can be captured before being allowed to infiltrate.

It is proposed to use a proprietary multi-layered filter strip all along the northern and southern edges of the yard. The SDS Aqua-Xchange is an enhanced engineered filter media that use ionic exchange and filtration to remove soluble and soil pollutants such as copper and zinc.

Device	Total suspended solids mitigation index	Total metals mitigation index	Soluble metals mitigation index[1]	Hydrocarbons[3]
Aqua-swirl™ vortex grit separator	0.8 (0.5 on trunk roads and motorways where the suspended solids level is very high)	0.5[4]	The Aquaswirl™ is not designed to remove soluble pollutants	0.7[3]
Aqua-filter™ stormwater filtration unit	0.8	0.8	0.6	0.7[3]
Aqua-swirl™ and Aqua-filter™ in sequence	1.2[2]	0.9	0.6	1.0[2,3]
Aqua-Xchange™	0.8 when installed as a layer in a filter drain	0.9	1.0	0.6 when installed as a layer in a filter drain

Figure 5 – SDS Product Mitigation Indices for Stormwater Treatment Devices

Figure 5 shows the pollution mitigation indices for the SDS Aqua-Xchange, giving the following values:-

Total Suspended Solids (TSS) – 0.8 when installed as a layer in a filter drain

Total Metal Mitigation – 0.9

Soluble Metal Mitigation – 1.0

Hydrocarbons – 0.6 when installed as a layer in the filter media.

Using one layer of Aqua-Xchange will therefore not be sufficient to satisfy the hydrocarbon index.

CIRIA C753 states when an individual component is insufficient and two or more components in series will be required then following formula applies:-

Total SuDS Mitigation Index = Mitigation Index + 0.5 (Mitigation Index)

It is therefore proposed to use two layers of SDS Aqua-Xchange which will be separated with a 250 mm clean stone layer. This will therefore give the filter strips the following pollution mitigation indices and satisfy all of the CIRIA criteria, as follows:-

Total Suspended Solids (TSS) – 0.8 + 0.4 = 1.2

Total Metal Mitigation – 0.9 + 0.45 = 1.35

Soluble Metal Mitigation – 1.0 + 0.5 = 1.5

Hydrocarbons – 0.6 + 0.3 = 0.9

5.2 INFILTRATION BASIN MITIGATION STRATEGY

The proposed infiltration basin will be designed as a bioretention system that will be grassed and planted to ensure the cleansing properties are achieved whilst providing an amenity space for the proposed new amenity block.

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater

Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates[1]	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.6[4]	0.5	0.6
A soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.4[4]	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential[2] of at least 300 mm in depth[3]	0.8[4]	0.8	0.8
Proprietary treatment systems[5, 6]	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

Figure 6 – CIRIA Table 26.4

CIRIA C753, table 26.4 (ref. Figure 6, above) stipulates that for infiltration a bio retention system underlain with soil with good attenuation potential achieves the following pollution indices:-

Total Suspended Solids (TSS) – 0.8

Total Metal Mitigation – 0.8

Hydrocarbons – 0.8

It is proposed that an SPEL Stormceptor ESR20/C1 Swill be installed upstream from the infiltration basin to remove coarse sediment, debris and free-floating hydrocarbons from the surface water before it is discharged into the infiltration basin. Using the values from Figure 7 (below) the stormceptor l and infiltration basin will give the following values:-

Total Suspended Solids (TSS) – 0.8 + 0.8 = 1.6

Total Metal Mitigation – 0.8 + 0.6 = 1.4

Hydrocarbons – 0.8 + 0.9 = 1.7

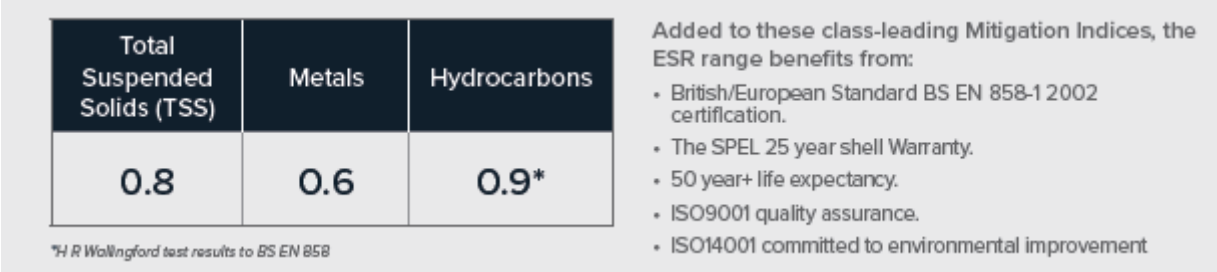


Figure 7 – SPEL ESR Product Mitigation Indices for Stormwater Treatment Devices

6.0 EMERGENCY FLOODING CONTAINMENT (FIREWATER)

National Resources Wales' Guidance Note 16 (Fire Prevention & Mitigation Plan Guidance – Waste Management) dated August 2017 requires that a strategy must be in place to allow for containment of firewater, in the event that a fire breaks out within the processing areas of a site. NRW were consulted and they confirmed that the proposed development site should allow for containment of a minimum volume of 900,000 litres (900 m^3) of firewater to be contained, having been discharged at a maximum flow rate of 5,000 l/min.

In order to achieve this, it is proposed that the processing areas of the site (i.e. shear, shredder and associated yard areas) will be provided with a drainage system that can be isolated if/when necessary to ensure that the required volume of firewater can be contained within the site and then sampled prior to disposal off site or via the existing drainage system.

It is proposed that this will be achieved by constructing concrete bund walls (each with a U-shaped drainage channel located to its rear) in the areas where firewater containment needs to be provided for.

Under normal circumstances, the surface water will discharge via controlled discharge points located at circa 20m c/c within the bund wall into the channel located to the rear of the wall. The water will then run the length of the channel and drain via a network of pipes cast into the rear wall of the channel so that water is distributed as evenly as possible into the filter strips located on the northern and southern boundaries of the site.

In the event of a fire/firewater, the surface water flows will be isolated and contained by the use of penstock valves located at each discharge point in the concrete bund wall.

As noted in section 4.2.3 (above) the shear and shredder areas will drain to the northern and southern boundary filter drains utilising the existing falls as far as possible.

Both of these areas (i.e. northern and southern) have been modelled to determine the water levels that will need to be contained at each boundary in order to achieve the required containment capacity of 900 m^3.

The proposals for bunding and the extent and depth of the firewater for both northern and southern boundaries are illustrated on Drawing No. 21.121 C14 (Firewater Containment Plan) by James & Nicholas LLP (copy appended - ref. Appendix D).

6.1 NORTHERN BOUNDARY CONTAINMENT

The low point of the yard area along the northern boundary is +9.600 m rising to a level of +9.875m at the apex at which point the direction of fall changes (i.e. to fall towards the southern boundary).

The overall containment volume has been modelled by calculating the volume at the mid-height between the various contour levels shown on the above-referenced drawing (i.e. Drawing No. 21.121 C14 by James & Nicholas LLP – ref Appendix D) using Site 3D software by Microplot Ltd. The results of the modelling are illustrated in Figure 8, below (N.B the levels indicated are mid-height between contours).

The modelling indicates that the maximum volume of firewater that could be contained in the northern boundary area is 167.84 m^3 with a maximum depth of water of 0.2625 m at the low point of the site.

Any volume of firewater above 167.84 m^3 would flow from the northern area of the site down towards the southern boundary of the site where it would be contained (ref. 6.2, below).

Level (m)	Area (m^2)	Depth (m)	Volume (m^3)	Cumulative Volume (m^3)
9.625	11.005	0.2625	2.89	2.89
9.650	35.224	0.2375	8.37	11.25
9.675	60.885	0.2125	12.94	24.19
9.700	89.928	0.1875	16.86	41.05
9.725	124.566	0.1625	20.24	61.30
9.750	165.73	0.1375	22.79	84.08
9.775	213.652	0.1125	24.04	108.12
9.800	254.176	0.0875	22.24	130.36
9.825	300.547	0.0625	18.78	149.14
9.850	356.768	0.0375	13.38	162.52
9.875	425.072	0.0125	5.31	167.84

Figure 8 – Cumulative Volume Storage at Northern Boundary

6.2 SOUTHERN BOUNDARY CONTAINMENT

The lowest level on this boundary is +8.600 m at the south-east corner of the site adjacent to the existing maintenance building.

The overall containment volume has been modelled by calculating the volume at the mid-height between the various contour levels shown on the above-referenced drawing (i.e. Drawing No. 21.121 C14 by James & Nicholas LLP – ref Appendix D) using Site 3D software by Microplot Ltd. The results of the modelling are illustrated in Figure 9, below (N.B. the levels indicated are mid-height between contours).

The modelling indicates that for a maximum depth of water of 600 mm at the lowest point of the southern boundary, the volume that will be contained in the southern boundary area is 1070.14m^3.

It is noted that a maintenance building located within this area will potentially cause a loss of volume of a maximum of circa 74 m^3, i.e. the residual containment capacity in the southern boundary area is circa 1070.14 m^3, i.e. in excess of the required level of 900 m^3.

Level Above (m)	Area (m2)	Water Depth (m)	Volume (m3)	Cumulative Volume (m3)
8.625	18.532	0.5875	10.89	10.89
8.650	55.596	0.5625	31.27	42.16
8.675	87.371	0.5375	46.96	89.12
8.700	102.793	0.5125	52.68	141.80

8.725	122.987	0.4875	59.96	201.76
8.750	131.572	0.4625	60.85	262.61
8.775	139.528	0.4375	61.04	323.66
8.800	149.062	0.4125	61.49	385.14
8.825	156.354	0.3875	60.59	445.73
8.850	166.659	0.3625	60.41	506.14
8.875	176.341	0.3375	59.52	565.66
8.900	185.627	0.3125	58.01	623.67
8.925	198.661	0.2875	57.12	680.78
8.950	226.451	0.2625	59.44	740.23
8.975	267.863	0.2375	63.62	803.84
9.000	282.839	0.2125	60.10	863.95
9.025	223.739	0.1875	41.95	905.90
9.050	223.494	0.1625	36.32	942.22
9.075	243.204	0.1375	33.44	975.66
9.100	265.901	0.1125	29.91	1005.57
9.125	297.44	0.0875	26.03	1031.60
9.150	324.531	0.0625	20.28	1051.88
9.175	358.732	0.0375	13.45	1065.33
9.200	384.9	0.0125	4.81	1070.14

Figure 9 – Cumulative Volume Storage at Southern Boundary

7.0 DRAINAGE MAINTENANCE SCHEDULES

7.1 DETENTION BASIN MAINTENANCE SCHEDULE

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass for access routes	Monthly (during growth season) or as when required
	Cut meadow grass in and round the basin	Half yearly (spring – before nesting season then in autumn)
	Manage other vegetation and remove nuisance plants	Monthly
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banks, structures, pipework etc. for evidence for physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year) then annually or as when required.
	Check SPEL ESR chamber	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlet, outlets and main basin when required.	Annually
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
Remedial Actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Repair of inlets and outlets	As required
	Relevel uneven surfaces and reinstate design levels	As required

7.2 CELLULAR SOAKAWAY TANK MAINTENANCE SCHEDULE

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface or filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually or as required
Remedial actions	Repair/rehabilitate inlets, outlets, overflows and vents	As required
Remedial Actions	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as required	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required.

7.3 FILTER STRIP MAINTENANCE SCHEDULE

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Establish pre-treatment systems for silt accumulation and establish appropriate slit removal frequencies	Six Monthly
	Remove sediment from pre-treatment devices.	Annually
Occasional Maintenance	At locations with high pollution loads remove first layer of clean stone and geotextile and wash/replace	Yearly unless it is established it needs to be sooner or later
	Replace filter medium	20 years

APPENDIX A

INFILTRATION RATES BY TFW GROUP LTD

terra firma
Geotechnical & Geoenvironmental Specialists
www.terrafirmawales.co.uk

Our Ref: DE/17250/NEW ROAD

Your Ref:

Contact: David Emanuel

8th June 2022

James and Nicholas LLP

For the attn. of Mr Karl Jones (karl.jones@jamesandnicholas.com)

Dear Mr Jones

NEW ROAD, CELSA, ROVER WAY

TFW Group Limited has been retained by James and Nicholas LLP to assist with a proposed new road at CELSA, south of Rover Way, Cardiff.

In April and May 2022 TFW Group Limited attend site to perform trial pits, undertake soakage testing, undertake chemical analysis and perform Plate Load Tests.

Trial pits were performed by a 30 Tonne excavator with a toothed bucket. Despite the size of the machine excavations were often difficult on account of the ground's density. The locations of the excavations are presented in **Figure 01**.

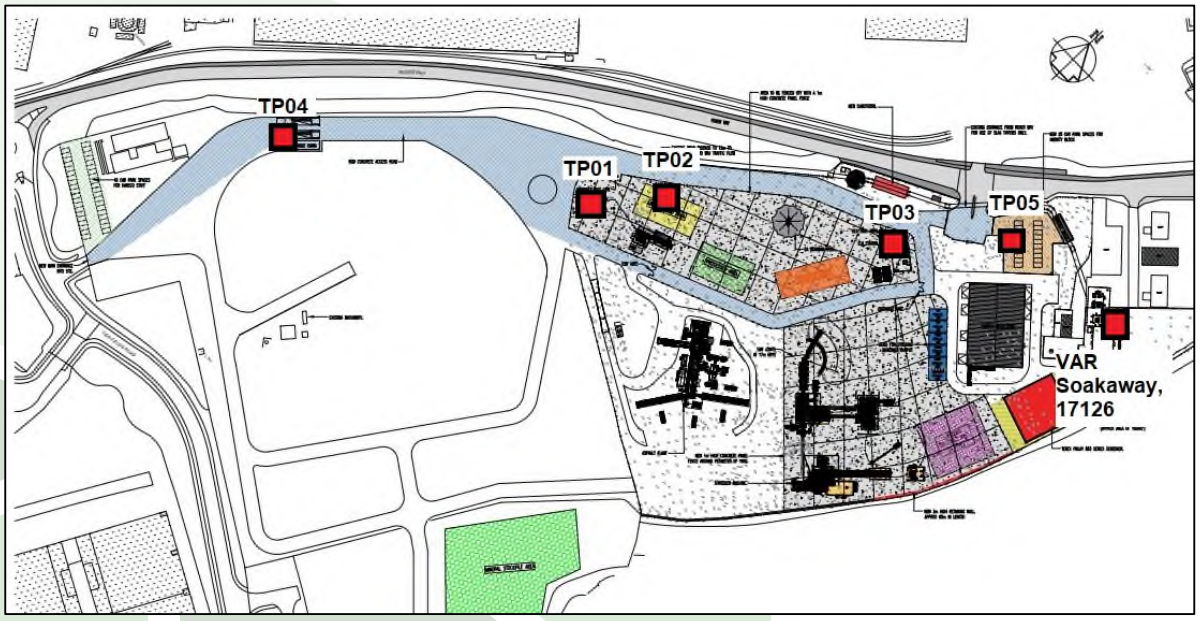


Figure 01. Trial Pit Locations (not to scale)

Ground Conditions
The ground conditions encountered are summarised in **Table 01**.

Table 01. Summary of Ground Conditions	
TP01	**GL – 0.6:** Dense to very dense, grey, slightly silty sandy GRAVEL to COBBLE including brick, metal and slag. **0.6 – 1.2:** Dense to very dense, brown, silty sandy GRAVEL to COBBLE including metal, brick and slag. Trial Pit Dry.
TP02	**GL – 0.4:** Dense to very dense, grey, silty, very sandy GRAVEL of slag **0.4 – 0.9:** Dense to very dense, dark-grey, silty sandy GRAVEL of slag. Trial Pit Dry
TP03	**GL – 0.9:** Dark-brown, silty sandy GARVEL including slag, brick, metal and plastic. Marker tape encountered at 0.9m Trial Pit Dry
TP04	**GL – 1.0:** Very dense, grey to brown, silty sandy GRAVEL to COBBLE Trial Pit Dry
TP05	**GL – 0.5:** Very dense, grey to brown, clayey/silty sandy GRAVEL to COBBLE Trial Pit Dry

In 2019 Terra Firma Wales Ltd performed three shallow and three deep boreholes at the Aggregate and Asphalt Plant (Terra Firma Wales Ltd Job Reference 15264). The approximate location of these boreholes is contained within the area marked on **Figure 02**.

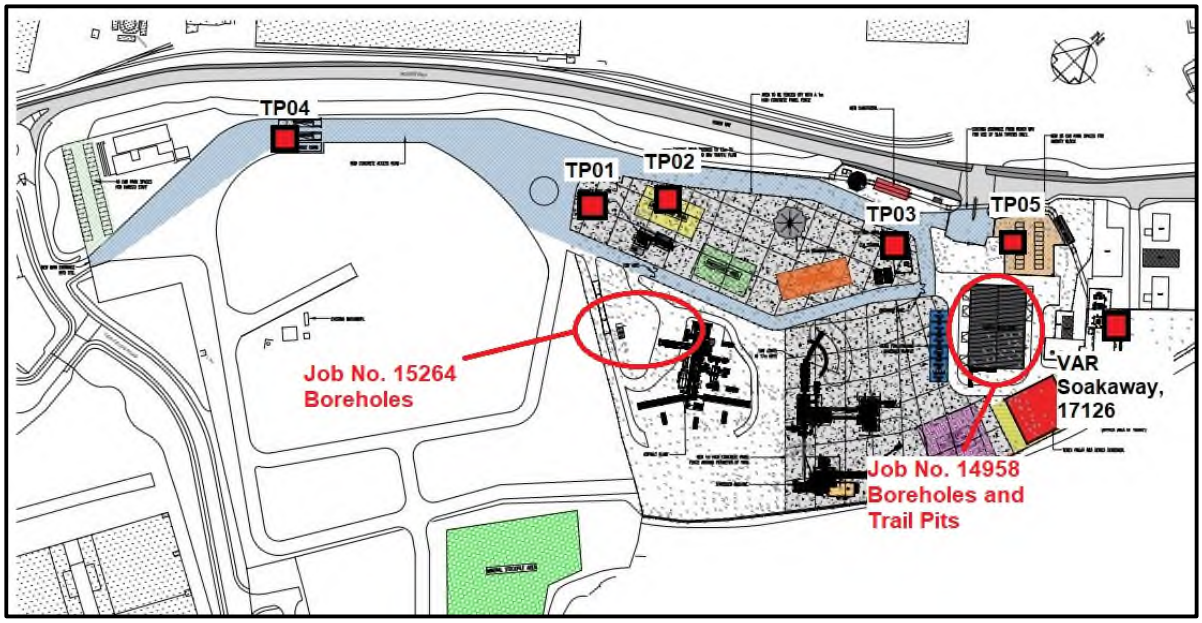


Figure 02. Approximate location of 2019 investigations (not to scale)

The Job No. 15264 boreholes encountered between 7.3m and 7.7m of made ground, recovered as grey to black, granular material including brick and concrete fragments, with traces of clay. The made ground was slow to drill on account of its density and in-situ testing recorded SPT-C Values of >50. Below the made ground, soft clay was encountered, extending to a depth of between 15.0m and 16.4m below ground level, where weathered marl was encountered.

In 2018, near the north-eastern end of the proposed road, Terra Firma Wales Ltd observed the excavation of three trial pits and six rotary boreholes (Job No. 14958). Between 4.7m and 6.5m of made ground were encountered, comprising generally dense to very dense, sandy GRAVEL to BOULDER including slag, concrete and brick. Beneath the made ground grey clay was noted with some gravels and possible channel deposits in two location (silty SAND with gravel). Basal GRAVEL was encountered at one location between 18.3m and 19.0m bgl. Weathered Marl was encountered between 17.6m and 22.3m bgl.

Soakage Tests
Recorded soakage rates are presented in **Table 02**.

Table 02. Summary of Soakage Test Results			
	TP01	**TP02**	**TP04**
Test 1	5.66×10^{-5} ms^{-1}	6.56×10^{-5} ms^{-1}	1.17×10^{-4} ms^{-1}
Test 2	4.21×10^{-5} ms^{-1}	7.39×10^{-5} ms^{-1}	1.11×10^{-4} ms^{-1}
Test 3	3.96×10^{-5} ms^{-1}	4.19×10^{-5} ms^{-1}	1.11×10^{-4} ms^{-1}

A soakaway was attempted in TP05 at 0.5m although the water level did not change over the observation period.

However, soakaways have been successfully performed at greater depth near the eastern end of the new road, at the proposed VAR Static Compensator (Terra Firma Report 17126, February 2022) where soakage rates of soakage rates of between 2.27×10^{-5} ms^{-1} and 1.76×10^{-5} ms^{-1} were recorded within the made ground in a 2.4m deep pit.

Soakaway Test Results are presented in **Annex A**.

CHEMICAL ANALYSIS

During the Investigation 6 samples were submitted for chemical analysis for a broad suite of common industrial determinants and asbestos. Four samples were also subject to volatile/semi volatile organic compounds (VOC/SVOC) analysis. Chemical test results are presented in **Annex B**.

The results of the chemical analysis are summarised in **Tables 03**, along with the published Generic Assessment Criteria for Human Health in a Commercial/Industrial setting.

Project: 17250 Celsa												
Client: Terra Firma (Wales) Ltd	Chemtest Job No.:						22-15458	22-15458	22-15458	22-15458	22-18521	22-18521
Quotation No.: Q21-24021	Chemtest Sample ID.:				Commercial/ Industrial Guidelines	Source	1418011	1418012	1418013	1418014	1431404	1431405
	Sample Location:						TP01	TP02	TP02	TP03	TP04	TP05
	Sample Type:						SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):						0.1	0	0.4	0	0.0	0.0
	Bottom Depth (m):							0.4	0.9	0.9	1.0	0.5
	Asbestos Lab:						NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
ACM Type	U	2192		N/A			-	-	-	-	-	-
Asbestos Identification	U	2192		N/A			No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A			-	-	-	-	-	-
Moisture	N	2030	%	0.020			5.1	7.6	9.4	11	7.1	7.2
Soil Colour	N	2040		N/A			Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A			Stones	Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A			Sand	Sand	Sand	Sand	Gravel	Gravel
pH	M	2010		4.0			11.4	10.8	10	9.7	11.0	10.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	240,000		8.4	13	3.4	3	3.0	4.7
Cyanide (Total)	M	2300	mg/kg	0.50	480	CLEA (WITHDRAWN)	< 0.50	< 0.50	0.7	0.8	< 0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010			0.14	0.14	0.041	0.061	0.22	0.17
Arsenic	M	2455	mg/kg	0.5	640	S4UL	4.8	3.8	13	17	7.5	11
Cadmium	M	2455	mg/kg	0.10	190	S4UL	2.9	2.3	2.9	4.0	4.0	2.8
Chromium	M	2455	mg/kg	0.5			1200	1100	210	220	970	1000
Mercury Low Level	M	2450	mg/kg	0.05	1,100	S4UL	0.13	0.10	1.2	1.3	0.09	0.31
Copper	M	2455	mg/kg	0.50	68,000	S4UL	270	300	66	76	240	470
Nickel	M	2455	mg/kg	0.50	980	S4UL	70	61	58	66	140	230
Lead	M	2455	mg/kg	0.50	2,330	C4SL	170	83	270	350	180	370
Selenium	M	2455	mg/kg	0.25	12,000	S4UL	0.71	0.53	0.70	0.72	1.1	1.2
Zinc	M	2455	mg/kg	0.50	730,000	S4UL	1300	1100	520	720	1100	1100
Chromium (Trivalent)	N	2490	mg/kg	1.0	8600	S4UL	1200	1100	210	220	970	1000
Chromium (Hexavalent)	N	2490	mg/kg	0.50	33	S4UL	< 0.50	0.53	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	3,200	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	7,800	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	2,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	9,700	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	17	46
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	59,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	57	580
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	1,600,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	150	800
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	1,600,000	S4UL	< 1.0	< 1.0	< 1.0	66	4300	1600
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	1,600,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0			< 5.0	< 5.0	< 5.0	66	4500	3000
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	26,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	56,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	3,500	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	16,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	36,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	65
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	28,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	52	88
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	28,000	S4UL	< 1.0	< 1.0	< 1.0	180	170	380
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	28,000	S4UL	< 1.0	< 1.0	< 1.0	< 1.0	17	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0			< 5.0	< 5.0	< 5.0	180	240	530
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0			< 10	< 10	< 10	240	4700	3600
Naphthalene	M	2700	mg/kg	0.10	190	S4UL	< 0.10	< 0.10	4	5.2	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	83,000	S4UL	< 0.10	< 0.10	0.67	0.88	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	84,000	S4UL	< 0.10	< 0.10	0.75	0.67	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	63,000	S4UL	< 0.10	< 0.10	0.71	0.41	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	22,000	S4UL	< 0.10	< 0.10	3	1.5	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	520,000	S4UL	< 0.10	< 0.10	0.65	0.31	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	23,000	S4UL	0.78	< 0.10	4.2	2.1	0.58	0.38
Pyrene	M	2700	mg/kg	0.10	54,000	S4UL	0.89	< 0.10	4.5	2.5	0.72	3.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	170	S4UL	< 0.10	< 0.10	2.9	1.3	< 0.10	2.8
Chrysene	M	2700	mg/kg	0.10	350	S4UL	< 0.10	< 0.10	4.1	2.5	< 0.10	6.2
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	44	S4UL	< 0.10	< 0.10	4.3	2.3	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	1,200	S4UL	< 0.10	< 0.10	1.8	1.1	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	35	S4UL	< 0.10	< 0.10	3.2	1.9	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	500	S4UL	< 0.10	< 0.10	2.2	1.3	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	3.5	S4UL	< 0.10	< 0.10	0.59	0.4	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	3,900	S4UL	< 0.10	< 0.10	2.3	1.5	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0			< 2.0	< 2.0	40	26	< 2.0	13

Table 03. Summary of Soil Chemical Testing and Commercial GACs

During VOC/SVOC testing only benzene, toluene, ethyl-benzene, xylene and selected PAH species were detected and these were at concentration significantly below the corresponding GACs. All other determinants tested were either not detected or at concentrations below their corresponding Generic Assessment Criteria for an industrial setting.

Asbestos was not detected during screening.

GEOTECHNICAL TESTING

Two samples of slag were submitted to GSTL to assess swelling potential via their in-house method. Volume changes of between 0.05% and 0.07% were recorded, which would be considered insignificant. The results of the geotechnical testing are presented in **Annex C**.

On 27th April 2022, 5 No. Plate Load Tests were performed along the route of the proposed road using a 600mm plate. The applied load was taken to 300 kN/m^2 and the process included an off-load/reload cycle. The location of the Plate Load Tests are presented in **Figure 03** and the results of the tests are summarised in **Table 06**.

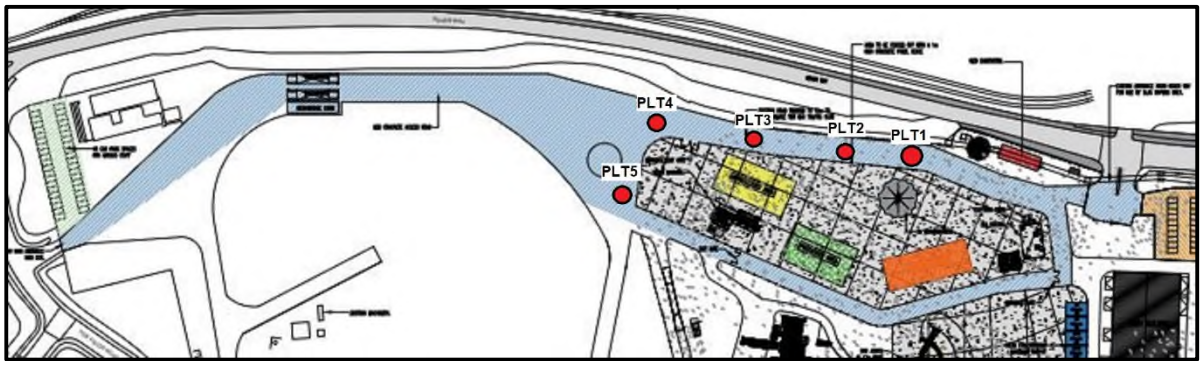


Figure 03. Location of Plate Load Tests

Table 06. Results of Plate Load Tests

Location	Average Plate Settlement after 2nd Load Cycle at 300kN/m^2 (mm)
PLT 1	0.90
PLT 2	0.30
PLT 3	0.46
PLT 4	1.36
PLT 5	0.83

Plate Load Test Results are presented in **Annex C**.

We trust that the above is to your satisfaction, however, if you have any queries or require any further information please do not hesitate to contact us.

Yours sincerely
for: Terra Firma (Wales) Ltd

Mr D Emanuel

Annex A
Soakage Test Results

Terra Firma (Wales) Ltd. 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA
Tel: 029 2073 5354 **Fax:** 029 2073 5433 **Email:** info@terrafirmawales.co.uk **www.terrafirmawales.co.uk**
Registered in Wales No. 4013230. VAT No: 753 2566 25. Registered Office: 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA

SOAKAWAY TEST

terra firma
Geotechnical & Geoenvironmental Specialists

Site Name: CELSA New Road
Project Number: 17250
Date: 26/04/2022
Engineer: DE

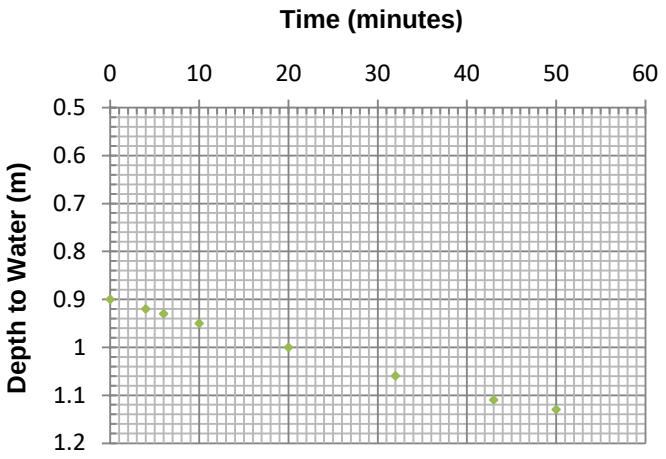
Trial Pit: **TP01**

TEST 1

Length	2.00	m
Bredth	2.00	m
Depth	1.20	m
Fill Level	0.90	m

V_{p75-25}	0.6	m^3
a_{p50}	5.2	m^2
t_{p75-25}	34	minutes

Soil Infiltration Rate, f **5.66E-05** **ms^{-1}**

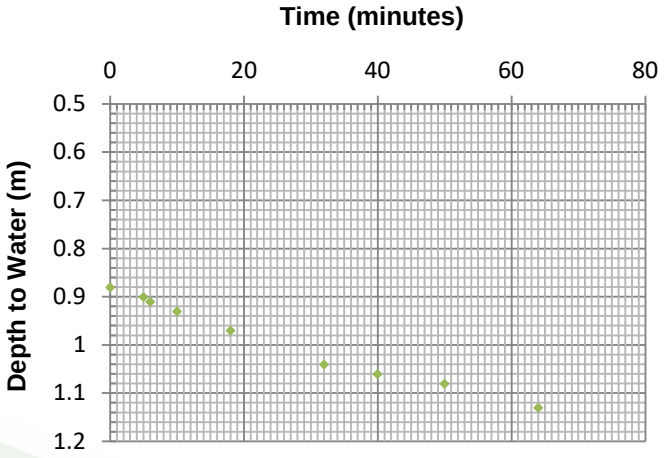


TEST 2

Length	2.00	m
Bredth	2.00	m
Depth	1.20	m
Fill Level	0.88	m

V_{p75-25}	0.64	m^3
a_{p50}	5.28	m^2
t_{p75-25}	48	minutes

Soil Infiltration Rate, f **4.21E-05** **ms^{-1}**

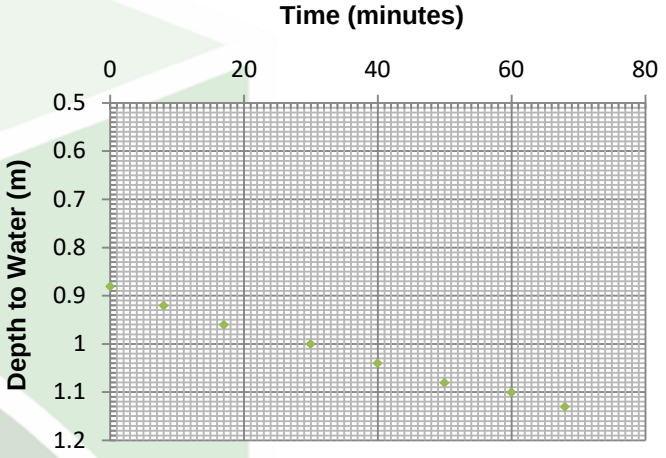


TEST 3

Length	2.00	m
Bredth	2.00	m
Depth	1.20	m
Fill Level	0.88	m

V_{p75-25}	0.64	m^3
a_{p50}	5.28	m^2
t_{p75-25}	51	minutes

Soil Infiltration Rate, f **3.96E-05** **ms^{-1}**



REMARKS:
Test carried out in accordance with BRE Digest 365 (2016)

SOAKAWAY TEST

terra firma
Geotechnical & Geoenvironmental Specialists

Site Name: CELSA New Road
Project Number: 17250
Date: 26/04/2022
Engineer: DE

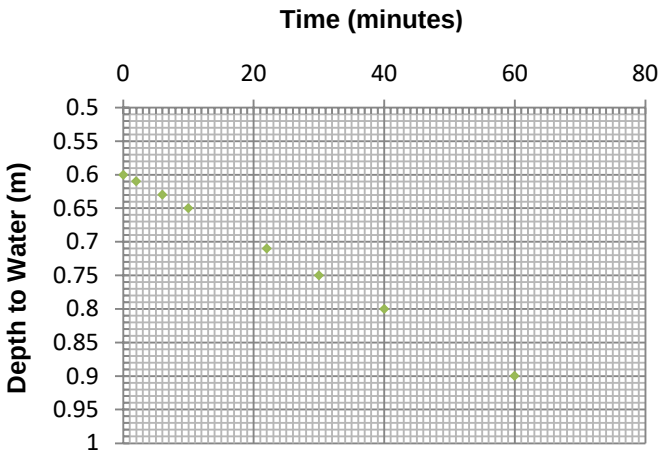
Trial Pit: **TP02**

TEST 1

Length	2.00	m
Bredth	2.50	m
Depth	0.90	m
Fill Level	0.60	m

V_{p75-25}	0.75	m^3
a_{p50}	6.35	m^2
t_{p75-25}	30	minutes

Soil Infiltration Rate, f **6.56E-05** **ms^{-1}**

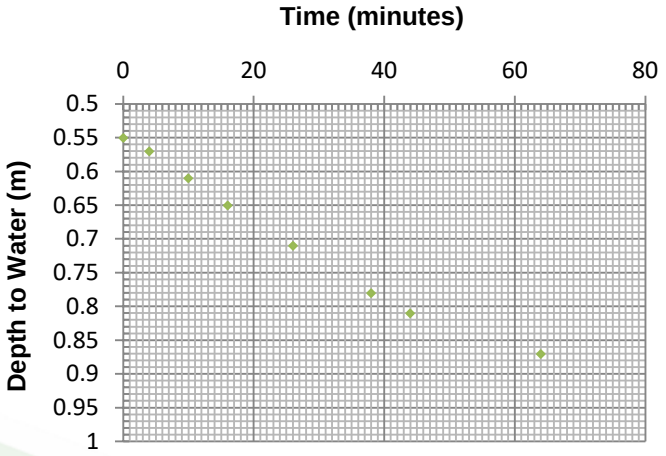


TEST 2

Length	2.00	m
Bredth	2.50	m
Depth	0.90	m
Fill Level	0.55	m

V_{p75-25}	0.875	m^3
a_{p50}	6.575	m^2
t_{p75-25}	30	minutes

Soil Infiltration Rate, f **7.39E-05** **ms^{-1}**

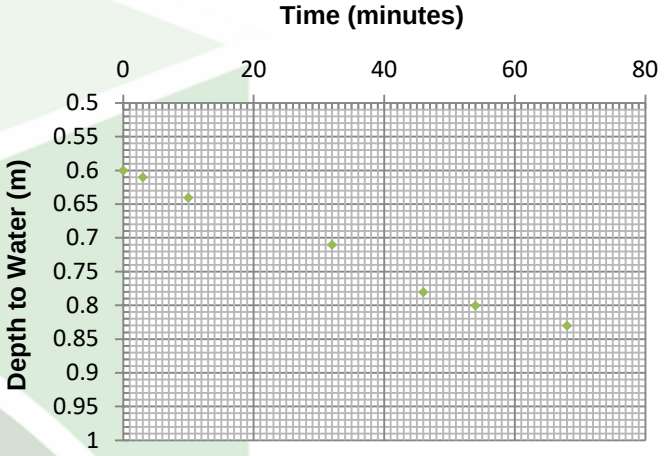


TEST 3

Length	2.00	m
Bredth	2.50	m
Depth	0.90	m
Fill Level	0.60	m

V_{p75-25}	0.75	m^3
a_{p50}	6.35	m^2
t_{p75-25}	47	minutes

Soil Infiltration Rate, f **4.19E-05** **ms^{-1}**



REMARKS:
Test carried out in accordance with BRE Digest 365 (2016)

SOAKAWAY TEST

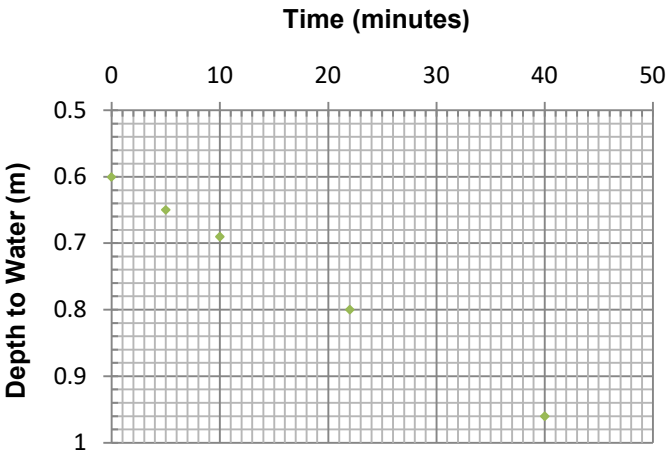
terra firma
Geotechnical & Geoenvironmental Specialists

Site Name: CELSA New Road
Project Number: 17250
Date: 17/05/2022
Engineer: DE

Trial Pit: **TP04**

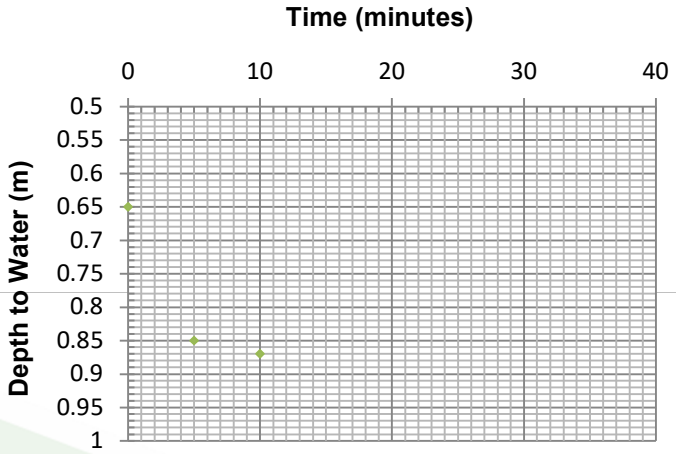
TEST 1

Length	2.00	m
Bredth	2.50	m
Depth	1.00	m
Fill Level	0.60	m
V_{p75-25}	1	m^3
a_{p50}	6.8	m^2
t_{p75-25}	21	minutes
Soil Infiltration Rate, f	**1.17E-04**	**ms^{-1}**



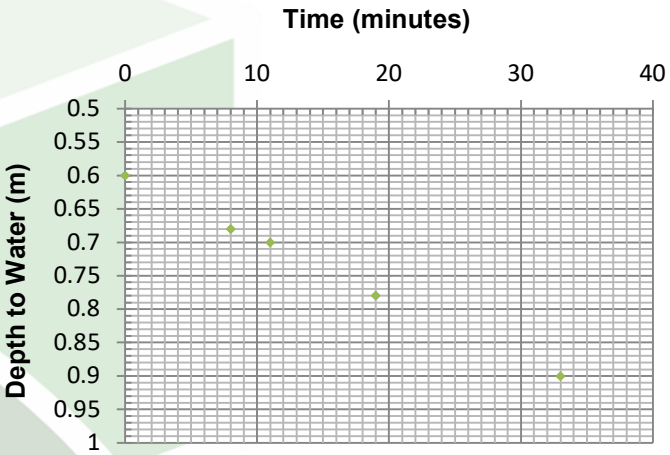
TEST 2

Length	2.00	m
Bredth	2.50	m
Depth	1.00	m
Fill Level	0.65	m
V_{p75-25}	0.875	m^3
a_{p50}	6.575	m^2
t_{p75-25}	20	minutes
Soil Infiltration Rate, f	**1.11E-04**	**ms^{-1}**



TEST 3

Length	2.00	m
Bredth	2.50	m
Depth	1.00	m
Fill Level	0.60	m
V_{p75-25}	1	m^3
a_{p50}	6.8	m^2
t_{p75-25}	22	minutes
Soil Infiltration Rate, f	**1.11E-04**	**ms^{-1}**



REMARKS:
Test carried out in accordance with BRE Digest 365 (2016)

Annex B
Chemical Test Results

Terra Firma (Wales) Ltd. 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA
Tel: 029 2073 5354 **Fax:** 029 2073 5433 **Email:** info@terrafirmawales.co.uk **www.terrafirmawales.co.uk**
Registered in Wales No. 4013230. VAT No: 753 2566 25. Registered Office: 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-15458-1		
Initial Date of Issue:	03-May-2022		
Client	Terra Firma (Wales) Ltd		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	Dave Emanuel		
Project	17250 Celsa		
Quotation No.:	Q21-24021	**Date Received:**	27-Apr-2022
Order No.:		**Date Instructed:**	27-Apr-2022
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	04-May-2022
Date Approved:	03-May-2022		

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021		**Chemtest Sample ID.:**			1418011	1418012	1418013	1418014
		Sample Location:			TP01	TP02	TP02	TP03
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.1	0	0.4	0
		Bottom Depth (m):				0.4	0.9	0.9
		Asbestos Lab:			NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-
Moisture	N	2030	%	0.020	5.1	7.6	9.4	11
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand
pH	M	2010		4.0	[A] 11.4	[A] 10.8	[A] 10.0	[A] 9.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	[A] 8.4	[A] 13	[A] 3.4	[A] 3.0
Cyanide (Total)	M	2300	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] 0.70	[A] 0.80
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.14	[A] 0.14	[A] 0.041	[A] 0.061
Arsenic	M	2455	mg/kg	0.5	4.8	3.8	13	17
Cadmium	M	2455	mg/kg	0.10	2.9	2.3	2.9	4.0
Chromium	M	2455	mg/kg	0.5	1200	1100	210	220
Mercury Low Level	M	2450	mg/kg	0.05	0.13	0.10	1.2	1.3
Copper	M	2455	mg/kg	0.50	270	300	66	76
Nickel	M	2455	mg/kg	0.50	70	61	58	66
Lead	M	2455	mg/kg	0.50	170	83	270	350
Selenium	M	2455	mg/kg	0.25	0.71	0.53	0.70	0.72
Zinc	M	2455	mg/kg	0.50	1300	1100	520	720
Chromium (Trivalent)	N	2490	mg/kg	1.0	1200	1100	210	220
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	0.53	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] 66
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] 66
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] 180

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd			**Chemtest Job No.:**		22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021			**Chemtest Sample ID.:**		1418011	1418012	1418013	1418014
			Sample Location:		TP01	TP02	TP02	TP03
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.1	0	0.4	0
			Bottom Depth (m):			0.4	0.9	0.9
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] 180
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[A] < 10	[A] < 10	[A] < 10	[A] 240
Naphthalene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 4.0	[A] 5.2
Acenaphthylene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.67	[A] 0.88
Acenaphthene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.75	[A] 0.67
Fluorene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.71	[A] 0.41
Phenanthrene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 3.0	[A] 1.5
Anthracene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.65	[A] 0.31
Fluoranthene	M	2700	mg/kg	0.10	[A] 0.78	[A] < 0.10	[A] 4.2	[A] 2.1
Pyrene	M	2700	mg/kg	0.10	[A] 0.89	[A] < 0.10	[A] 4.5	[A] 2.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 2.9	[A] 1.3
Chrysene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 4.1	[A] 2.5
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 4.3	[A] 2.3
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 1.8	[A] 1.1
Benzo[a]pyrene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 3.2	[A] 1.9
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 2.2	[A] 1.3
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 0.59	[A] 0.40
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	[A] < 0.10	[A] < 0.10	[A] 2.3	[A] 1.5
Total Of 16 PAH's	M	2700	mg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] 40	[A] 26
Dichlorodifluoromethane	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Chloromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Vinyl Chloride	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromomethane	M	2760	µg/kg	20	[A] < 20	[A] < 20	[A] < 20	[A] < 20
Chloroethane	U	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Trichlorofluoromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1-Dichloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Trans 1,2-Dichloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1-Dichloroethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
cis 1,2-Dichloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromochloromethane	U	2760	µg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Trichloromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1,1-Trichloroethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Tetrachloromethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1-Dichloropropene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Benzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] 7.1
1,2-Dichloroethane	M	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Trichloroethene	N	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2-Dichloropropane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021		**Chemtest Sample ID.:**			1418011	1418012	1418013	1418014
		Sample Location:			TP01	TP02	TP02	TP03
		Sample Type:			SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.1	0	0.4	0
		Bottom Depth (m):				0.4	0.9	0.9
		Asbestos Lab:			NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Dibromomethane	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromodichloromethane	M	2760	µg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
cis-1,3-Dichloropropene	N	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Toluene	M	2760	µg/kg	1.0	[A] 1.7	[A] < 1.0	[A] < 1.0	[A] 5.5
Trans-1,3-Dichloropropene	N	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
1,1,2-Trichloroethane	M	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Tetrachloroethene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,3-Dichloropropane	U	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Dibromochloromethane	U	2760	µg/kg	10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
1,2-Dibromoethane	M	2760	µg/kg	5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Chlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,1,1,2-Tetrachloroethane	M	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Ethylbenzene	M	2760	µg/kg	1.0	[A] 1.3	[A] < 1.0	[A] < 1.0	[A] 1.4
m & p-Xylene	M	2760	µg/kg	1.0	[A] 2.9	[A] < 1.0	[A] < 1.0	[A] 6.4
o-Xylene	M	2760	µg/kg	1.0	[A] 1.3	[A] < 1.0	[A] < 1.0	[A] 1.8
Styrene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Tribromomethane	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Isopropylbenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Bromobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2,3-Trichloropropane	N	2760	µg/kg	50	[A] < 50	[A] < 50	[A] < 50	[A] < 50
N-Propylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
2-Chlorotoluene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,3,5-Trimethylbenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
4-Chlorotoluene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Tert-Butylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2,4-Trimethylbenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Sec-Butylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,3-Dichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
4-Isopropyltoluene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,4-Dichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
N-Butylbenzene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2-Dichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2-Dibromo-3-Chloropropane	U	2760	µg/kg	50	[A] < 50	[A] < 50	[A] < 50	[A] < 50
1,2,4-Trichlorobenzene	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Hexachlorobutadiene	U	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
1,2,3-Trichlorobenzene	U	2760	µg/kg	2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0	[A] < 2.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
N-Nitrosodimethylamine	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Phenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd			**Chemtest Job No.:**		22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021			**Chemtest Sample ID.:**		1418011	1418012	1418013	1418014
			Sample Location:		TP01	TP02	TP02	TP03
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.1	0	0.4	0
			Bottom Depth (m):			0.4	0.9	0.9
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
2-Chlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Bis-(2-Chloroethyl)Ether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,3-Dichlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,4-Dichlorobenzene	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,2-Dichlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Methylphenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Bis(2-Chloroisopropyl)Ether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachloroethane	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
N-Nitrosodi-n-propylamine	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Methylphenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Nitrobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Isophorone	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Nitrophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4-Dimethylphenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Bis(2-Chloroethoxy)Methane	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4-Dichlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
1,2,4-Trichlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Naphthalene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Chloroaniline	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachlorobutadiene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Chloro-3-Methylphenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Methylnaphthalene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Nitrophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachlorocyclopentadiene	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4,6-Trichlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4,5-Trichlorophenol	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Chloronaphthalene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2-Nitroaniline	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Acenaphthylene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Dimethylphthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,6-Dinitrotoluene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Acenaphthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
3-Nitroaniline	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Dibenzofuran	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Chlorophenylphenylether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
2,4-Dinitrotoluene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Fluorene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Diethyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Nitroaniline	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50

Results - Soil

Project: 17250 Celsa

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-15458	22-15458	22-15458	22-15458
Quotation No.: Q21-24021		**Chemtest Sample ID.:**			1418011	1418012	1418013	1418014
			Sample Location:		TP01	TP02	TP02	TP03
			Sample Type:		SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.1	0	0.4	0
			Bottom Depth (m):			0.4	0.9	0.9
			Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Azobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
4-Bromophenylphenyl Ether	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Hexachlorobenzene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Pentachlorophenol	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Phenanthrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.1
Anthracene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Carbazole	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Di-N-Butyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Fluoranthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.9
Pyrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.6
Butylbenzyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Benzo[a]anthracene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.3
Chrysene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.3
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Di-N-Octyl Phthalate	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Benzo[b]fluoranthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.7
Benzo[k]fluoranthene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 0.56
Benzo[a]pyrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.3
Indeno(1,2,3-c,d)Pyrene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 0.99
Dibenz(a,h)Anthracene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Benzo[g,h,i]perylene	M	2790	mg/kg	0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] 1.1
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Organic Matter BS1377	N	2930	%	0.10	[A] 0.90	[A] 1.6	[A] 0.30	[A] 3.3

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1418011			TP01		A	Amber Glass 250ml
1418011			TP01		A	Plastic Tub 500g
1418012			TP02		A	Amber Glass 250ml
1418012			TP02		A	Plastic Tub 500g
1418013			TP02		A	Amber Glass 250ml
1418013			TP02		A	Plastic Tub 500g
1418014			TP03		A	Amber Glass 250ml
1418014			TP03		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2790	Semi-Volatile Organic Compounds (SVOCs) in Soils by GC-MS	Semi-volatile organic compounds(cf. USEPA Method 8270)	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
2930	Organic Matter	Organic Matter	Acid Dichromate digestion/Titration

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-15463-1		
Initial Date of Issue:	06-May-2022		
Client	Terra Firma (Wales) Ltd		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	Jamie Alderman		
Project	17250 Celsa		
Quotation No.:	Q21-24021	**Date Received:**	27-Apr-2022
Order No.:		**Date Instructed:**	27-Apr-2022
No. of Samples:	3		
Turnaround (Wkdays):	7	**Results Due:**	06-May-2022
Date Approved:	06-May-2022		
Approved By:			
Details:	Stuart Henderson, Technical Manager		

Results - 2 Stage WAC

Project: 17250 Celsa

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-15463								
Chemtest Sample ID:	1418022								
Sample Ref:									
Sample ID:									
Sample Location:	TP01								
Top Depth(m):	0.1								
Bottom Depth(m):									
Sampling Date:									
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			[A] 0.72	3	5	6
Loss On Ignition	2610	M	%			2.6	--	--	10
Total BTEX	2760	M	mg/kg			[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			0.16	1	--	--
TPH Total WAC (Mineral Oil)							500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				12.0	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.56	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0003	0.0002	0.0007	0.0023	0.5	2	25
Barium	1455	U	5.9	2.4	12	27	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.030	0.027	0.060	0.27	0.5	10	70
Copper	1455	U	0.030	0.013	0.061	0.021	2	50	100
Mercury	1455	U	0.00009	0.00016	0.00018	0.0015	0.01	0.2	2
Molybdenum	1455	U	0.11	0.071	0.22	0.73	0.5	10	30
Nickel	1455	U	0.0012	0.0007	0.0025	0.0076	0.4	10	40
Lead	1455	U	0.0070	0.0064	0.014	0.064	0.5	10	50
Antimony	1455	U	0.0012	0.0020	0.0024	0.020	0.06	0.7	5
Selenium	1455	U	0.0037	0.0028	0.0074	0.029	0.1	0.5	7
Zinc	1455	U	0.038	0.019	0.076	0.20	4	50	200
Chloride	1220	U	64	29	130	310	800	15000	25000
Fluoride	1220	U	2.2	2.2	4.4	22	10	150	500
Sulphate	1220	U	< 1.0	10	< 10	94	1000	20000	50000
Total Dissolved Solids	1020	N	1900	1500	3900	15000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	10	3.5	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	6.8

Leachate Test Information	
Leachant volume 1st extract/l	0.337
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.112

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 17250 Celsa

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-15463								
Chemtest Sample ID:	1418023								
Sample Ref:									
Sample ID:									
Sample Location:	TP02								
Top Depth(m):	0								
Bottom Depth(m):	0.4								
Sampling Date:									
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			[A] < 0.20	3	5	6
Loss On Ignition	2610	M	%			0.85	--	--	10
Total BTEX	2760	M	mg/kg			[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)							500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				10.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.23	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0003	0.0002	0.0006	0.0024	0.5	2	25
Barium	1455	U	1.1	0.74	2.1	8.0	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.046	0.017	0.092	0.22	0.5	10	70
Copper	1455	U	0.026	0.010	0.053	0.049	2	50	100
Mercury	1455	U	0.00092	0.00039	0.0018	0.0048	0.01	0.2	2
Molybdenum	1455	U	0.17	0.048	0.34	0.70	0.5	10	30
Nickel	1455	U	0.0007	< 0.0005	0.0013	0.0012	0.4	10	40
Lead	1455	U	0.0020	0.0010	0.0040	0.011	0.5	10	50
Antimony	1455	U	0.0015	0.0022	0.0030	0.021	0.06	0.7	5
Selenium	1455	U	0.0055	0.0026	0.011	0.031	0.1	0.5	7
Zinc	1455	U	0.006	0.003	0.012	0.036	4	50	200
Chloride	1220	U	8.1	1.7	16	28	800	15000	25000
Fluoride	1220	U	2.0	1.5	4.0	16	10	150	500
Sulphate	1220	U	28	25	56	260	1000	20000	50000
Total Dissolved Solids	1020	N	12000	490	24000	25000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	4.5	2.6	< 50	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	8.0

Leachate Test Information	
Leachant volume 1st extract/l	0.335
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.303

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - 2 Stage WAC

Project: 17250 Celsa

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-15463								
Chemtest Sample ID:	1418024								
Sample Ref:									
Sample ID:									
Sample Location:	TP03								
Top Depth(m):	0								
Bottom Depth(m):	0.9								
Sampling Date:									
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			[A] 36	3	5	6
Loss On Ignition	2610	M	%			10	--	--	10
Total BTEX	2760	M	mg/kg			[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			0.25	1	--	--
TPH Total WAC (Mineral Oil)							500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			24	100	--	--
pH	2010	M				9.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.015	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0085	0.0077	0.017	0.079	0.5	2	25
Barium	1455	U	0.067	0.038	0.13	0.43	20	100	300
Cadmium	1455	U	< 0.00011	< 0.00011	< 0.00011	< 0.00011	0.04	1	5
Chromium	1455	U	0.0048	0.023	0.0095	0.20	0.5	10	70
Copper	1455	U	0.0042	0.0040	0.0084	0.0080	2	50	100
Mercury	1455	U	0.00015	0.00010	0.00030	0.0011	0.01	0.2	2
Molybdenum	1455	U	0.077	0.017	0.15	0.27	0.5	10	30
Nickel	1455	U	0.0024	0.0029	0.0048	0.028	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.5	10	50
Antimony	1455	U	0.0083	0.0046	0.017	0.052	0.06	0.7	5
Selenium	1455	U	0.0031	0.0026	0.0061	0.027	0.1	0.5	7
Zinc	1455	U	< 0.003	0.079	< 0.003	0.66	4	50	200
Chloride	1220	U	6.1	20	12	180	800	15000	25000
Fluoride	1220	U	0.57	0.34	1.1	3.8	10	150	500
Sulphate	1220	U	71	19	140	280	1000	20000	50000
Total Dissolved Solids	1020	N	260	130	520	1500	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	12	5.7	< 50	67	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	8.1

Leachate Test Information	
Leachant volume 1st extract/l	0.335
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.296

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1418022			TP01		A	Amber Glass 250ml
1418022			TP01		A	Plastic Tub 500g
1418023			TP02		A	Amber Glass 250ml
1418023			TP02		A	Plastic Tub 500g
1418024			TP03		A	Amber Glass 250ml
1418024			TP03		A	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
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N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
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T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-18521-1
Initial Date of Issue:	25-May-2022
Client	Terra Firma (Wales) Ltd
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA
Contact(s):	Dave Emanuel
Project	17250 CELSA

Quotation No.:		**Date Received:**	19-May-2022
Order No.:		**Date Instructed:**	19-May-2022
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	25-May-2022
Date Approved:	25-May-2022		

Approved By:

Details: Stuart Henderson, Technical Manager

Results - Soil

Project: 17250 CELSA

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-18521	22-18521
Quotation No.:		**Chemtest Sample ID.:**			1431404	1431405
		Sample Location:			TP04	TP05
		Sample Type:			SOIL	SOIL
		Top Depth (m):			0.0	0.0
		Bottom Depth (m):			1.0	0.5
		Date Sampled:			17-May-2022	17-May-2022
		Asbestos Lab:			DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	7.1	7.2
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones
Soil Texture	N	2040		N/A	Gravel	Gravel
pH	M	2010		4.0	11.0	10.7
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	3.0	4.7
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50
Sulphate (Acid Soluble)	U	2430	%	0.010	0.22	0.17
Arsenic	M	2455	mg/kg	0.5	7.5	11
Cadmium	M	2455	mg/kg	0.10	4.0	2.8
Chromium	M	2455	mg/kg	0.5	970	1000
Mercury Low Level	M	2450	mg/kg	0.05	0.09	0.31
Copper	M	2455	mg/kg	0.50	240	470
Nickel	M	2455	mg/kg	0.50	140	230
Lead	M	2455	mg/kg	0.50	180	370
Selenium	M	2455	mg/kg	0.25	1.1	1.2
Zinc	M	2455	mg/kg	0.50	1100	1100
Chromium (Trivalent)	N	2490	mg/kg	1.0	970	1000
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	17	46
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	57	580
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	150	800
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	4300	1600
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	4500	3000
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	65
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	52	88

Results - Soil

Project: 17250 CELSA

Client: Terra Firma (Wales) Ltd		**Chemtest Job No.:**			22-18521	22-18521
Quotation No.:		**Chemtest Sample ID.:**			1431404	1431405
		Sample Location:			TP04	TP05
		Sample Type:			SOIL	SOIL
		Top Depth (m):			0.0	0.0
		Bottom Depth (m):			1.0	0.5
		Date Sampled:			17-May-2022	17-May-2022
		Asbestos Lab:			DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	170	380
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	17	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	240	530
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	4700	3600
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	0.58	0.38
Pyrene	M	2700	mg/kg	0.10	0.72	3.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	2.8
Chrysene	M	2700	mg/kg	0.10	< 0.10	6.2
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	13
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10
Organic Matter BS1377	N	2930	%	0.10	2.0	3.4

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
2930	Organic Matter	Organic Matter	Acid Dichromate digestion/Titration

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Annex C
Geotechnical Test Results

Terra Firma (Wales) Ltd. 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA
Tel: 029 2073 5354 **Fax:** 029 2073 5433 **Email:** info@terrafirmawales.co.uk **www.terrafirmawales.co.uk**
Registered in Wales No. 4013230. VAT No: 753 2566 25. Registered Office: 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 59304

Client Ref:
Client PO:

Report Date: **22-05-2022**

Client **Terrafirma Wales Ltd**
5 Deryn Court
Wharfedale Road
Pentwyn
Cardiff
CF23 7HB

Contract Title: **CELSA**
For the attention of: **David Emanuel**

Date Received: **28-04-2022**
Date Completed: **22-05-2022**

Test Description	Qty
Determination of the Swelling Potential of Fill Material (Rapid Slag Expansion Test) In House Test Method DIHM 003 - @ Non Accredited Test	2
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

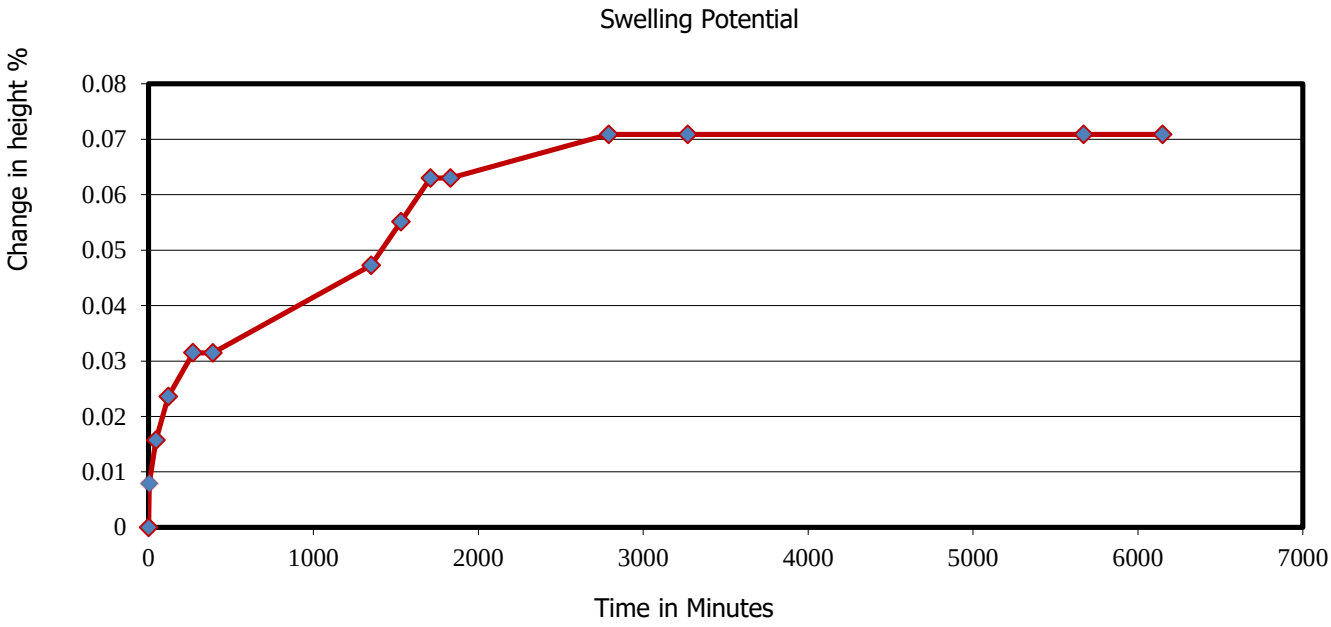
Approved Signatories:
Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)
Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

Test Report: **Determination of the Swelling Potential of Fill Material. Rapid Assessment, In house Method**

Client:	Terra Firma Wales
Client ref:	Unknown
Location:	CELSA
Contract Number:	59304
Date Test Started:	09/05/22
Sample Number:	TP01
Depth (m) :	0.40-0.90m
Tested By:	Conal Aliffe
Description:	Black gravelly silty ASHFILL/SLAG

INITIAL CONDITIONS.		**FINAL CONDITIONS.**	
Initial Height - mm:	127.00	Final Height - mm:	127.09
Moisture Content - %:	8.5	Moisture Content - %:	9
Bulk Density - Mg/m3:	1.89	Bulk Density - Mg/m3:	1.91
Dry Density - Mg/m3:	1.74	Dry Density - Mg/m3:	1.74
Test Temperature C°:	90		



Swelling after 96 Hours -%
0.07

For and behalf of GEO Site & Testing Services Ltd

Remarks:

Authorised By:
Richard John (Quality/Technical Manager)

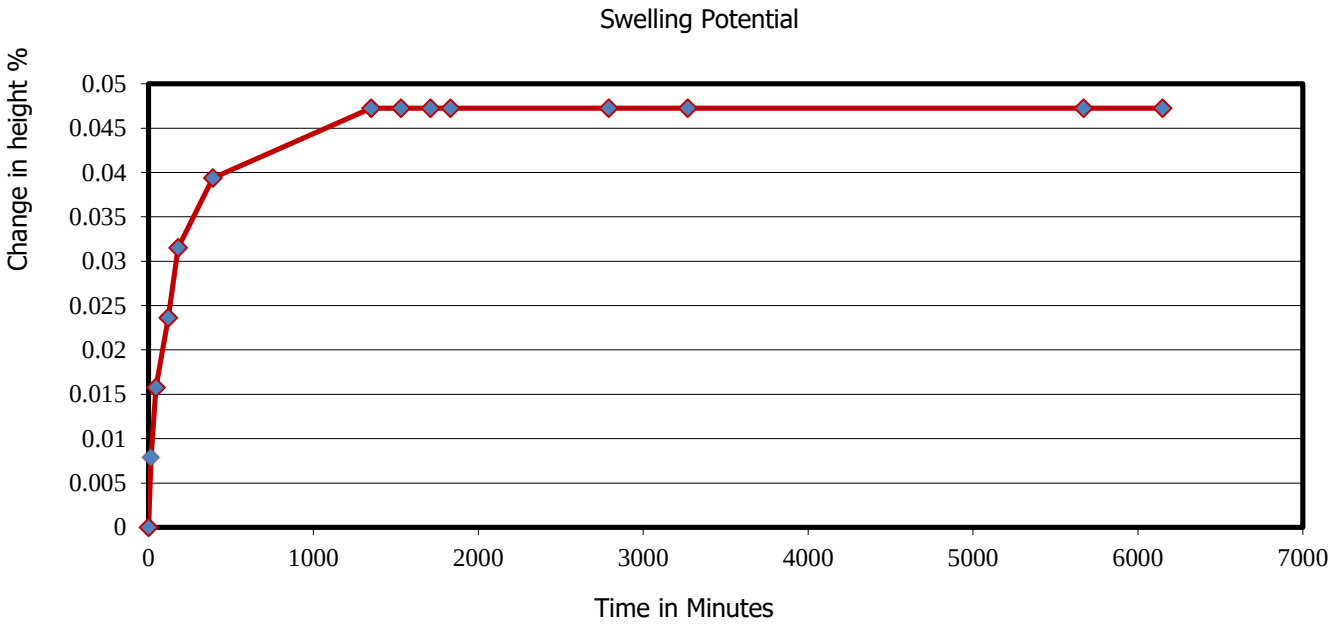
GSTL
GEO SITE & TESTING SERVICES LTD

Date: 22.5.22

Test Report: **Determination of the Swelling Potential of Fill Material. Rapid Assessment, In house Method**

Client:	Terra Firma Wales
Client ref:	Unknown
Location:	CELSA
Contract Number:	59304
Date Test Started:	09/05/22
Sample Number:	TP02
Depth (m) :	0.60-1.20m
Tested By:	Conal Aliffe
Description:	Black gravelly silty ASHFILL/SLAG

INITIAL CONDITIONS.		**FINAL CONDITIONS.**	
Initial Height - mm:	127.00	Final Height - mm:	127.06
Moisture Content - %:	11.9	Moisture Content - %:	13
Bulk Density - Mg/m3:	1.88	Bulk Density - Mg/m3:	1.91
Dry Density - Mg/m3:	1.68	Dry Density - Mg/m3:	1.68
Test Temperature C°:	90		



Swelling after 96 Hours -%
0.05

For and behalf of GEO Site & Testing Services Ltd

Remarks:

Authorised By:
Richard John (Quality/Technical Manager)

GSTL
GEO SITE & TESTING SERVICES LTD

Date: 22.5.22

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

Test Reference: Test 1 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

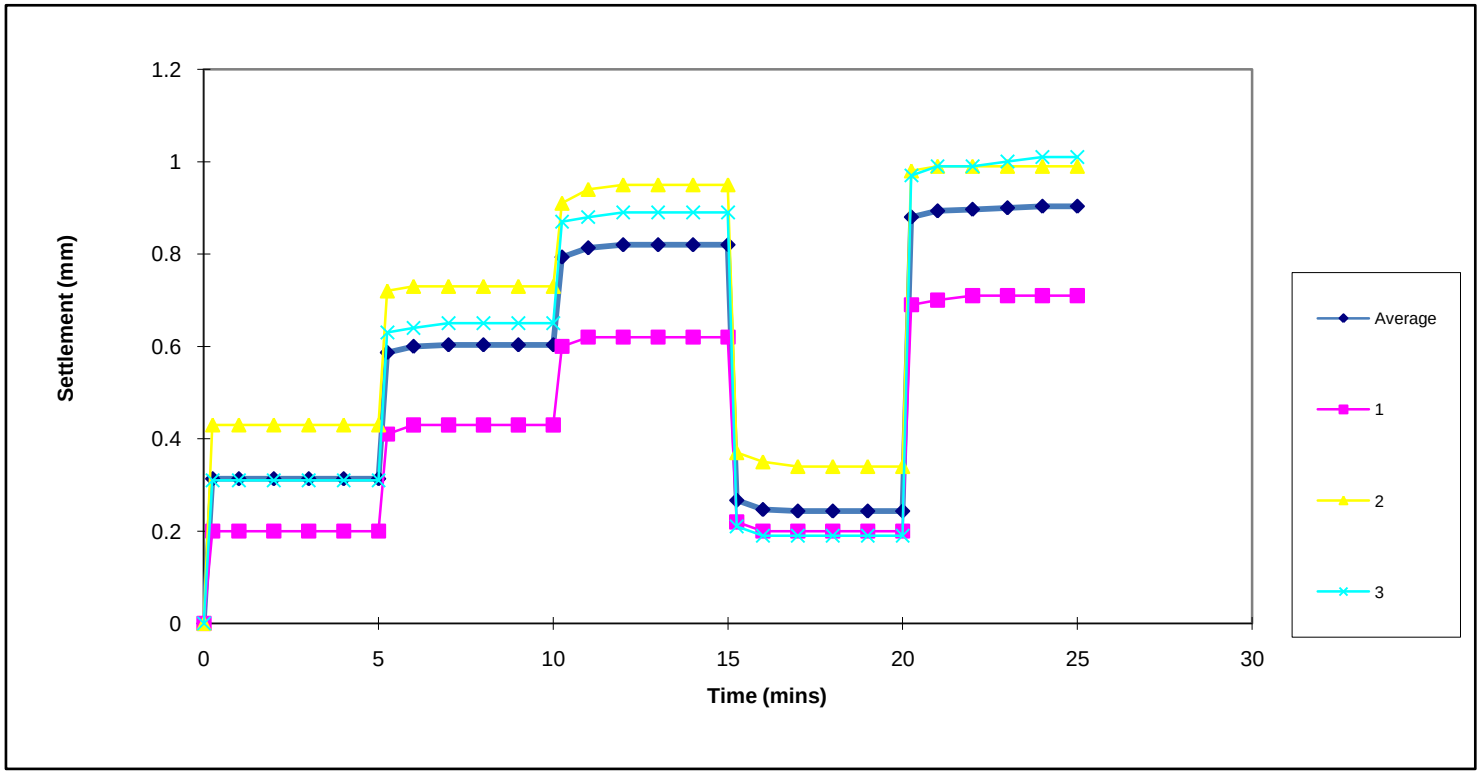
		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.20	0.43	0.31	0.31
	1	0.20	0.43	0.31	0.31
	2	0.20	0.43	0.31	0.31
	3	0.20	0.43	0.31	0.31
	4	0.20	0.43	0.31	0.31
	5	0.20	0.43	0.31	0.31
200kN/m^2 Load	5.25	0.41	0.72	0.63	0.59
	6	0.43	0.73	0.64	0.60
	7	0.43	0.73	0.65	0.60
	8	0.43	0.73	0.65	0.60
	9	0.43	0.73	0.65	0.60
	10	0.43	0.73	0.65	0.60
300kN/m^2 Load	10.25	0.60	0.91	0.87	0.79
	11	0.62	0.94	0.88	0.81
	12	0.62	0.95	0.89	0.82
	13	0.62	0.95	0.89	0.82
	14	0.62	0.95	0.89	0.82
	15	0.62	0.95	0.89	0.82
0kN/m^2 Unload	15.25	0.22	0.37	0.21	0.27
	16	0.20	0.35	0.19	0.25
	17	0.20	0.34	0.19	0.24
	18	0.20	0.34	0.19	0.24
	19	0.20	0.34	0.19	0.24
	20	0.20	0.34	0.19	0.24
300kN/m^2 Load	20.25	0.69	0.98	0.97	0.88
	21	0.70	0.99	0.99	0.89
	22	0.71	0.99	0.99	0.90
	23	0.71	0.99	1.00	0.90
	24	0.71	0.99	1.01	0.90
	25	0.71	0.99	1.01	0.90

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot

Test Reference: Test 1



Contract:

Celsa, Rover Way, Cardiff

Date:

27.04.22

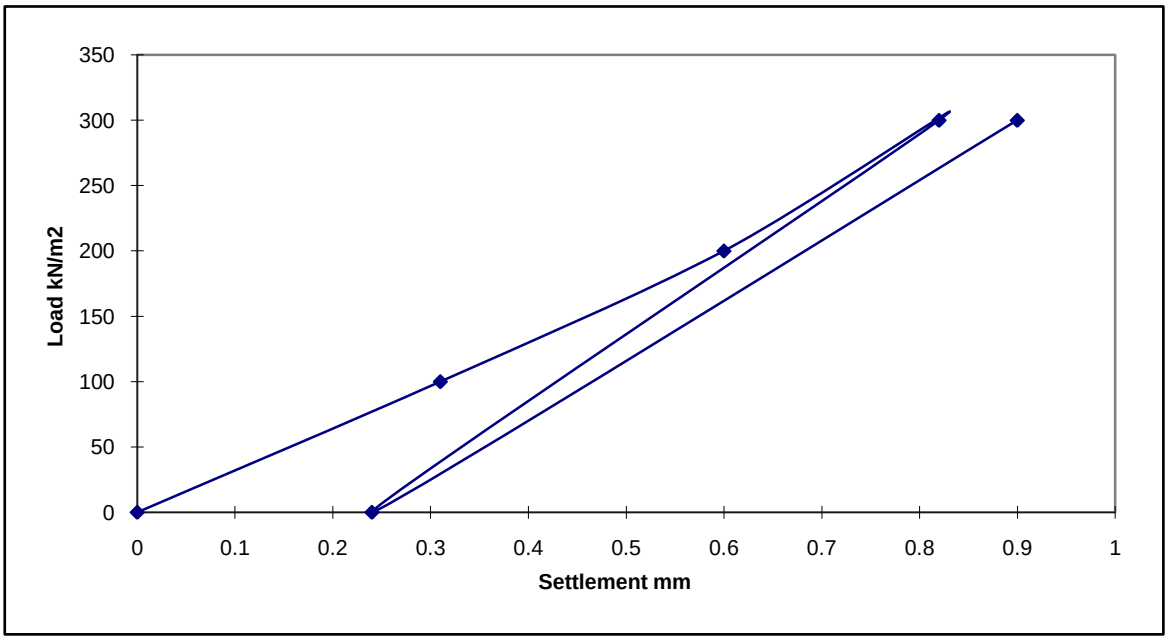
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 1	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.31	100	5
0.60	200	10
0.82	300	15
0.24	0	20
0.90	300	25

Deformation Modulus (Ev1)	157.3	MN/m2
Elastic Modulus (Ev2)	195.5	MN/m2
Compaction Ratio (Ev2/Ev1)	1.2	
Degree of Rebound	70.7	%
Modulus of subgrade reaction (k762)	379.6	MPa/m
Approximate CBR value	**284.6**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

Test Reference: Test 2 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

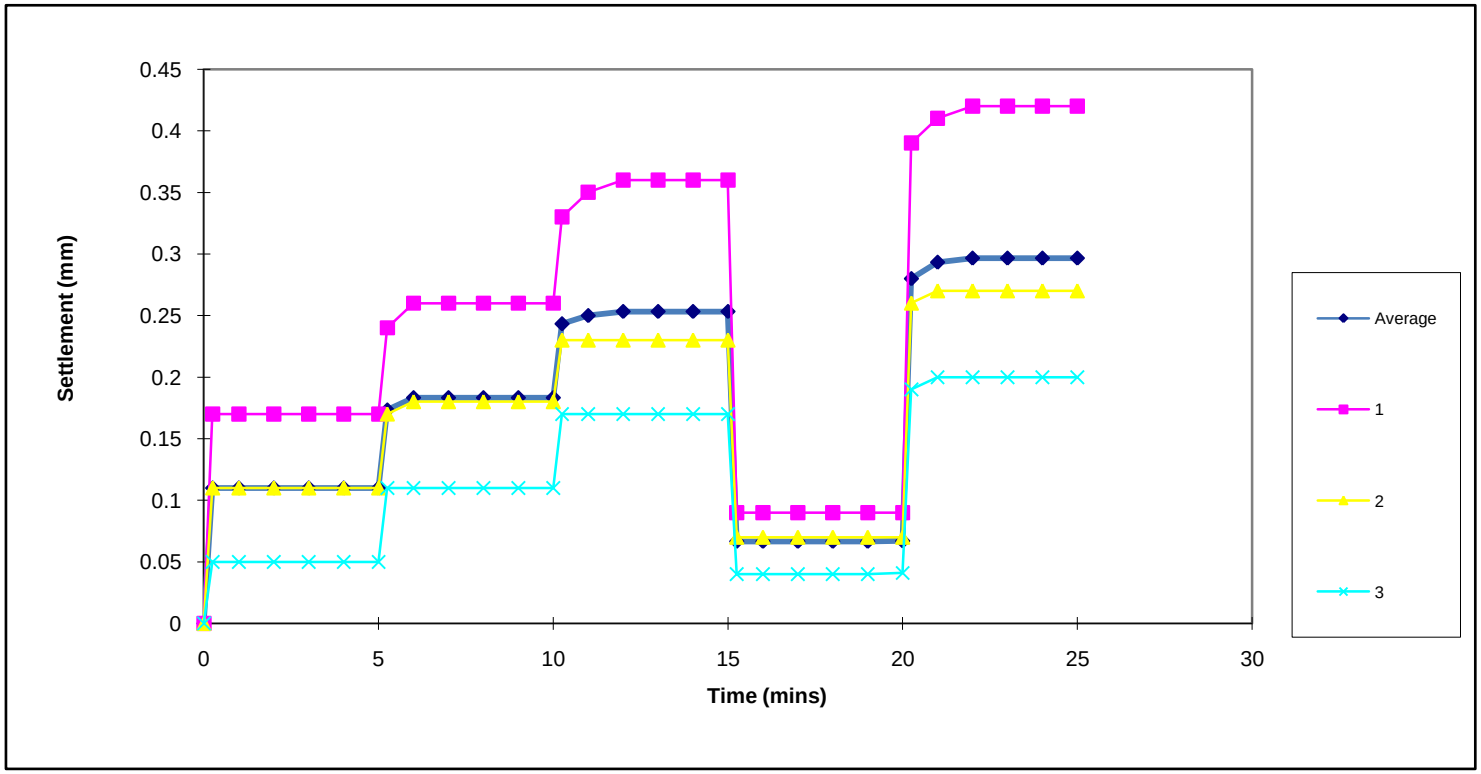
		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.17	0.11	0.05	0.11
	1	0.17	0.11	0.05	0.11
	2	0.17	0.11	0.05	0.11
	3	0.17	0.11	0.05	0.11
	4	0.17	0.11	0.05	0.11
	5	0.17	0.11	0.05	0.11
200kN/m^2 Load	5.25	0.24	0.17	0.11	0.17
	6	0.26	0.18	0.11	0.18
	7	0.26	0.18	0.11	0.18
	8	0.26	0.18	0.11	0.18
	9	0.26	0.18	0.11	0.18
	10	0.26	0.18	0.11	0.18
300kN/m^2 Load	10.25	0.33	0.23	0.17	0.24
	11	0.35	0.23	0.17	0.25
	12	0.36	0.23	0.17	0.25
	13	0.36	0.23	0.17	0.25
	14	0.36	0.23	0.17	0.25
	15	0.36	0.23	0.17	0.25
0kN/m^2 Unload	15.25	0.09	0.07	0.04	0.07
	16	0.09	0.07	0.04	0.07
	17	0.09	0.07	0.04	0.07
	18	0.09	0.07	0.04	0.07
	19	0.09	0.07	0.04	0.07
	20	0.09	0.07	0.04	0.07
300kN/m^2 Load	20.25	0.39	0.26	0.19	0.28
	21	0.41	0.27	0.20	0.29
	22	0.42	0.27	0.20	0.30
	23	0.42	0.27	0.20	0.30
	24	0.42	0.27	0.20	0.30
	25	0.42	0.27	0.20	0.30

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot

Test Reference: Test 2



Contract:

Celsa, Rover Way, Cardiff

Date:

27.04.22

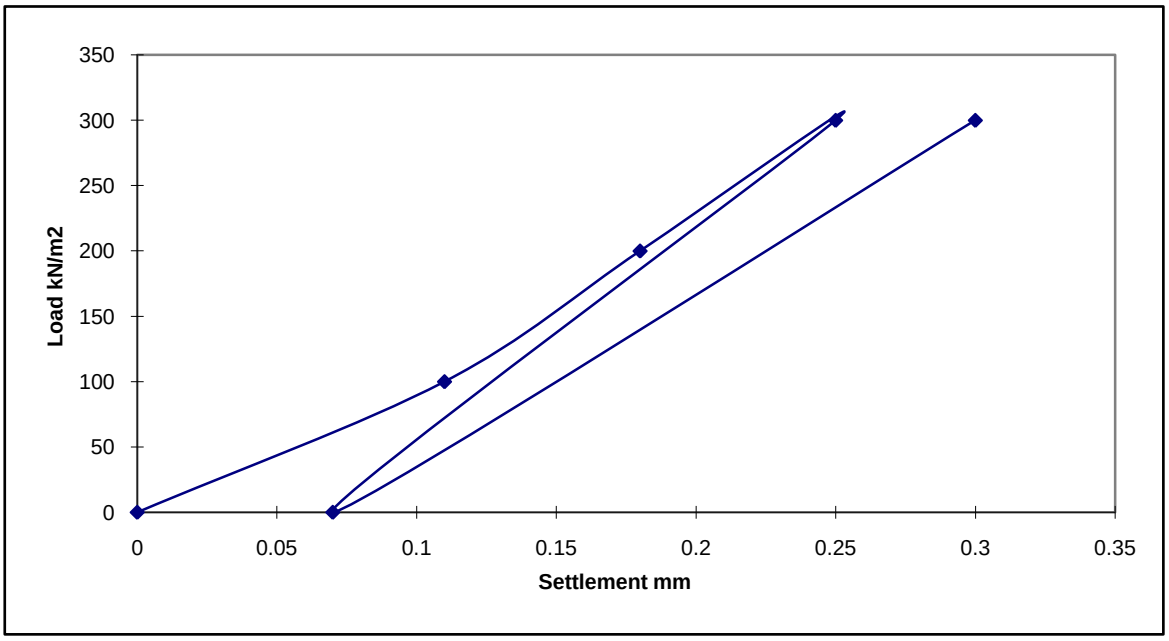
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 2	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.11	100	5
0.18	200	10
0.25	300	15
0.07	0	20
0.30	300	25

Deformation Modulus (Ev1)	516.0	MN/m2
Elastic Modulus (Ev2)	560.9	MN/m2
Compaction Ratio (Ev2/Ev1)	1.1	
Degree of Rebound	72.0	%
Modulus of subgrade reaction (k762)	1245	MPa/m
Approximate CBR value	**2229.8**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

Test Reference: Test 3 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

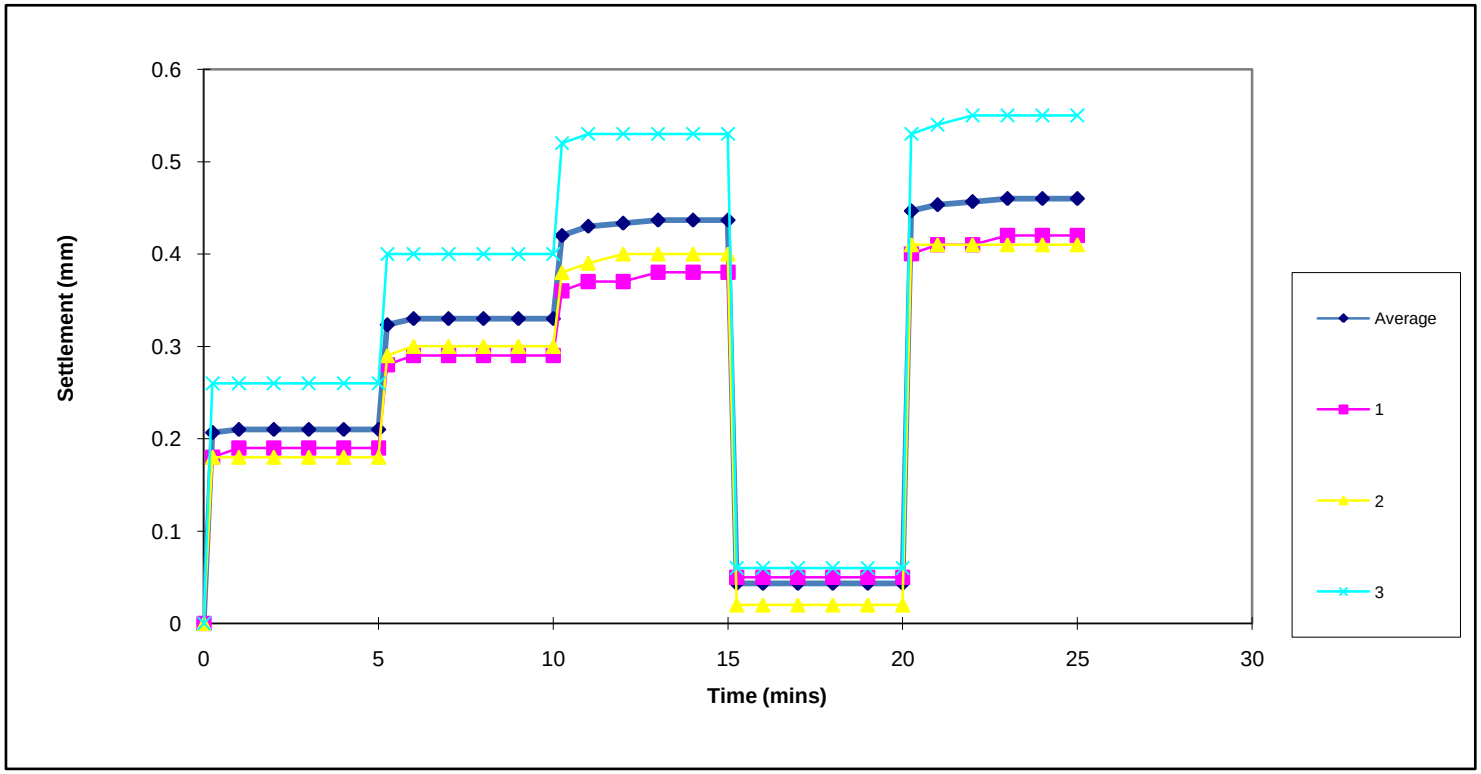
		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.18	0.18	0.26	0.21
	1	0.19	0.18	0.26	0.21
	2	0.19	0.18	0.26	0.21
	3	0.19	0.18	0.26	0.21
	4	0.19	0.18	0.26	0.21
	5	0.19	0.18	0.26	0.21
200kN/m^2 Load	5.25	0.28	0.29	0.40	0.32
	6	0.29	0.30	0.40	0.33
	7	0.29	0.30	0.40	0.33
	8	0.29	0.30	0.40	0.33
	9	0.29	0.30	0.40	0.33
	10	0.29	0.30	0.40	0.33
300kN/m^2 Load	10.25	0.36	0.38	0.52	0.42
	11	0.37	0.39	0.53	0.43
	12	0.37	0.40	0.53	0.43
	13	0.38	0.40	0.53	0.44
	14	0.38	0.40	0.53	0.44
	15	0.38	0.40	0.53	0.44
0kN/m^2 Unload	15.25	0.05	0.02	0.06	0.04
	16	0.05	0.02	0.06	0.04
	17	0.05	0.02	0.06	0.04
	18	0.05	0.02	0.06	0.04
	19	0.05	0.02	0.06	0.04
	20	0.05	0.02	0.06	0.04
300kN/m^2 Load	20.25	0.40	0.41	0.53	0.45
	21	0.41	0.41	0.54	0.45
	22	0.41	0.41	0.55	0.46
	23	0.42	0.41	0.55	0.46
	24	0.42	0.41	0.55	0.46
	25	0.42	0.41	0.55	0.46

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot

Test Reference: Test 3



Contract:

Celsa, Rover Way, Cardiff

Date:

27.04.22

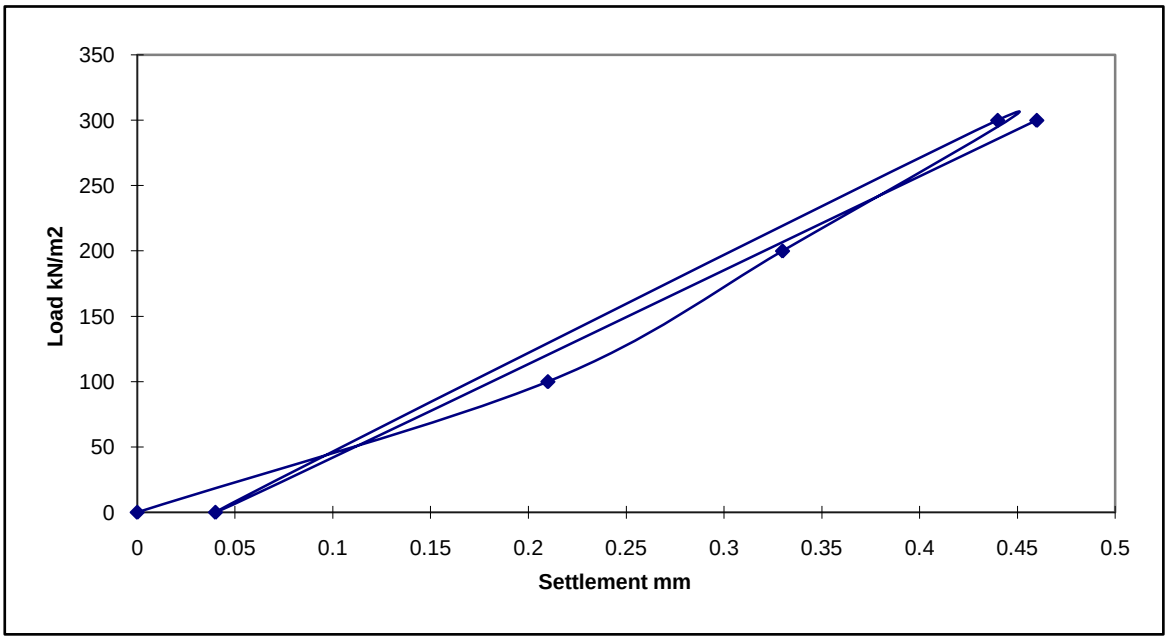
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 3	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.21	100	5
0.33	200	10
0.44	300	15
0.04	0	20
0.46	300	25

Deformation Modulus (Ev1)	293.2	MN/m2
Elastic Modulus (Ev2)	307.1	MN/m2
Compaction Ratio (Ev2/Ev1)	1.0	
Degree of Rebound	90.9	%
Modulus of subgrade reaction (k762)	707.4	MPa/m
Approximate CBR value	**837.1**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

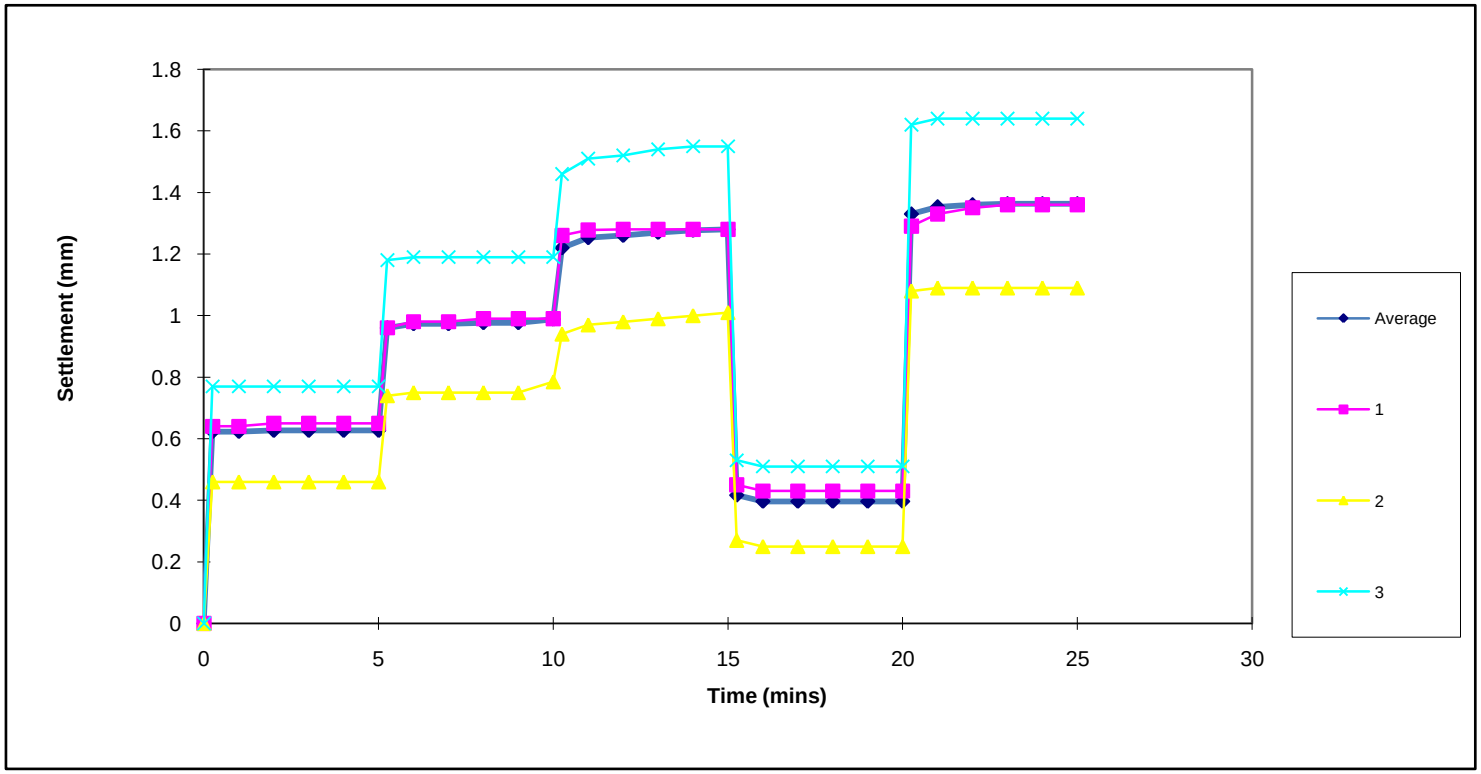
Test Reference: Test 4 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.64	0.46	0.77	0.62
	1	0.64	0.46	0.77	0.62
	2	0.65	0.46	0.77	0.63
	3	0.65	0.46	0.77	0.63
	4	0.65	0.46	0.77	0.63
	5	0.65	0.46	0.77	0.63
200kN/m^2 Load	5.25	0.96	0.74	1.18	0.96
	6	0.98	0.75	1.19	0.97
	7	0.98	0.75	1.19	0.97
	8	0.99	0.75	1.19	0.98
	9	0.99	0.75	1.19	0.98
	10	0.99	0.79	1.19	0.99
300kN/m^2 Load	10.25	1.26	0.94	1.46	1.22
	11	1.28	0.97	1.51	1.25
	12	1.28	0.98	1.52	1.26
	13	1.28	0.99	1.54	1.27
	14	1.28	1.00	1.55	1.28
	15	1.28	1.01	1.55	1.28
0kN/m^2 Unload	15.25	0.45	0.27	0.53	0.42
	16	0.43	0.25	0.51	0.40
	17	0.43	0.25	0.51	0.40
	18	0.43	0.25	0.51	0.40
	19	0.43	0.25	0.51	0.40
	20	0.43	0.25	0.51	0.40
300kN/m^2 Load	20.25	1.29	1.08	1.62	1.33
	21	1.33	1.09	1.64	1.35
	22	1.35	1.09	1.64	1.36
	23	1.36	1.09	1.64	1.36
	24	1.36	1.09	1.64	1.36
	25	1.36	1.09	1.64	1.36

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot	Test Reference: Test 4



Contract:	Date:
Celsa, Rover Way, Cardiff	27.04.22

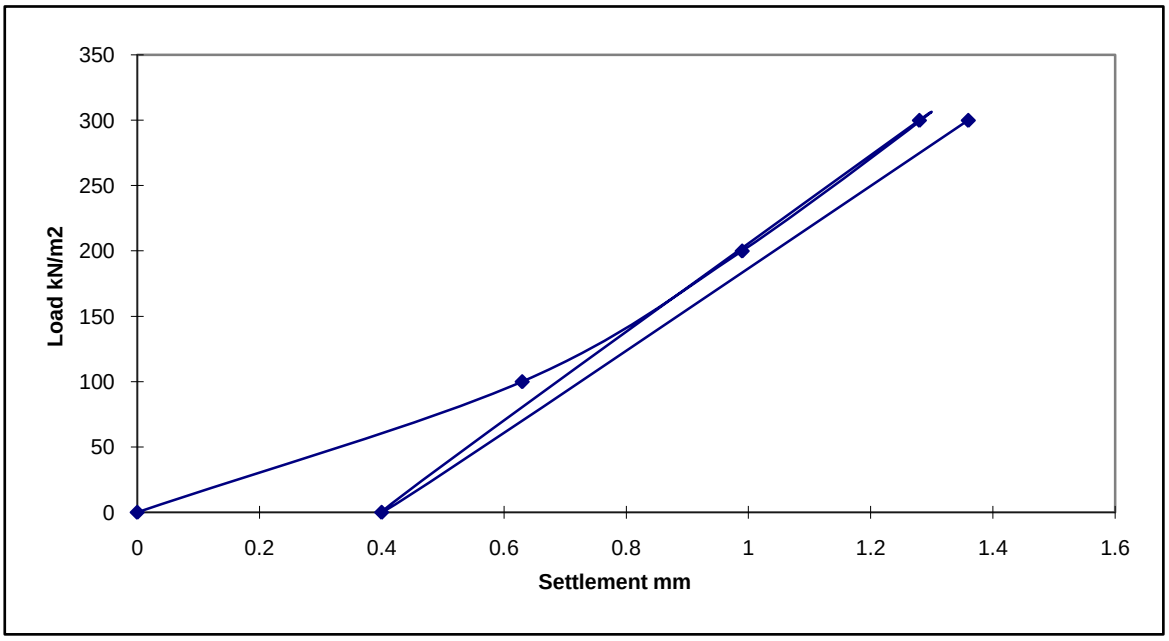
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 4	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.63	100	5
0.99	200	10
1.28	300	15
0.40	0	20
1.36	300	25

Deformation Modulus (Ev1)	100.8	MN/m2
Elastic Modulus (Ev2)	134.4	MN/m2
Compaction Ratio (Ev2/Ev1)	1.3	
Degree of Rebound	68.8	%
Modulus of subgrade reaction (k762)	243.2	MPa/m
Approximate CBR value	**131.6**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Data

Contract: Celsa, Rover Way, Cardiff | Date: 27.04.22

Test Reference: Test 5 | Test Depth: Surface | Plate Diameter: 600mm | Seating Load: 7.5kN/m^2

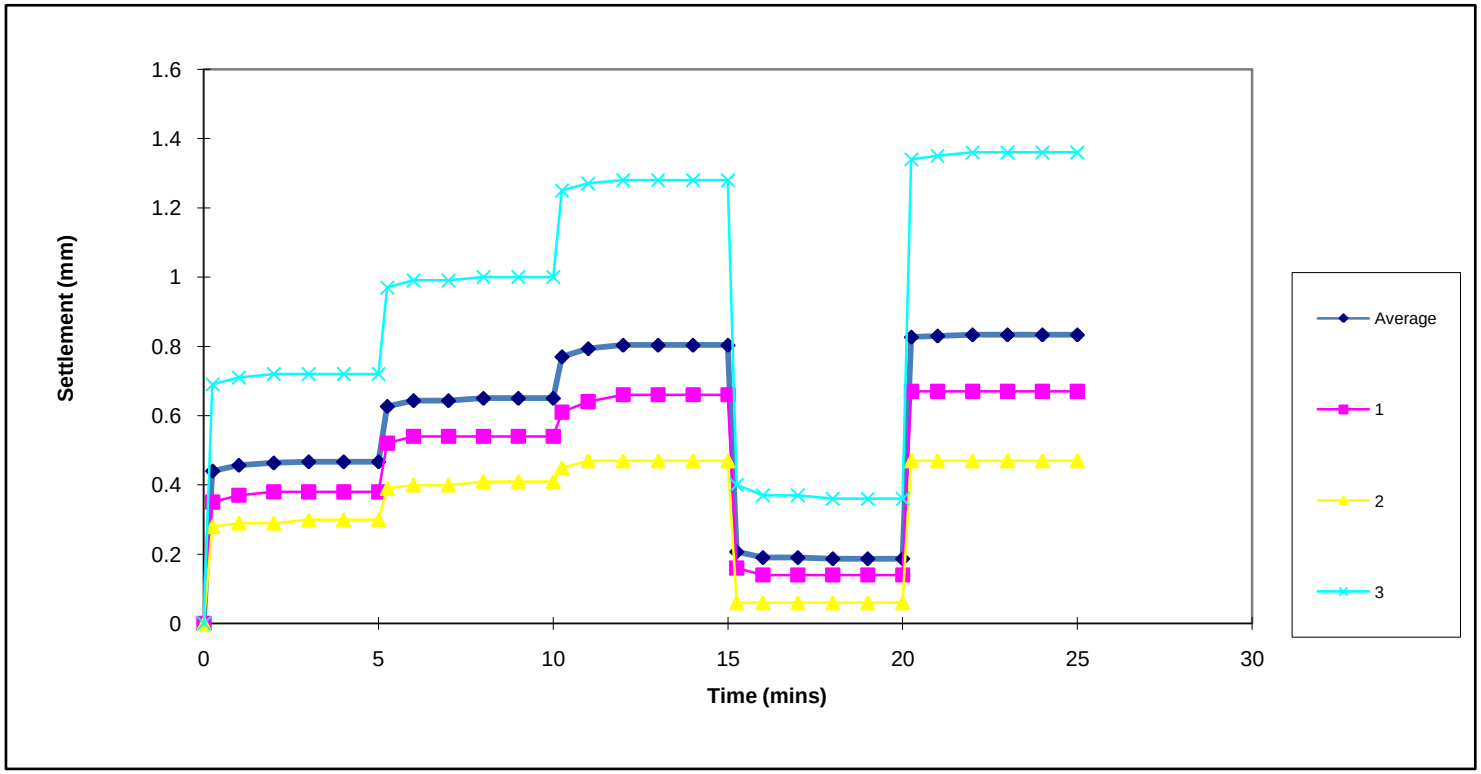
		Travel Gauges set on plate			
	Time (mins)	Gauge 1	Gauge 2	Gauge 3	Average Plate Settlement mm
100kN/m^2 Load	0	0	0	0	0
	0.25	0.35	0.28	0.69	0.44
	1	0.37	0.29	0.71	0.46
	2	0.38	0.29	0.72	0.46
	3	0.38	0.30	0.72	0.47
	4	0.38	0.30	0.72	0.47
	5	0.38	0.30	0.72	0.47
200kN/m^2 Load	5.25	0.52	0.39	0.97	0.63
	6	0.54	0.40	0.99	0.64
	7	0.54	0.40	0.99	0.64
	8	0.54	0.41	1.00	0.65
	9	0.54	0.41	1.00	0.65
	10	0.54	0.41	1.00	0.65
300kN/m^2 Load	10.25	0.61	0.45	1.25	0.77
	11	0.64	0.47	1.27	0.79
	12	0.66	0.47	1.28	0.80
	13	0.66	0.47	1.28	0.80
	14	0.66	0.47	1.28	0.80
	15	0.66	0.47	1.28	0.80
0kN/m^2 Unload	15.25	0.16	0.06	0.40	0.21
	16	0.14	0.06	0.37	0.19
	17	0.14	0.06	0.37	0.19
	18	0.14	0.06	0.36	0.19
	19	0.14	0.06	0.36	0.19
	20	0.14	0.06	0.36	0.19
300kN/m^2 Load	20.25	0.67	0.47	1.34	0.83
	21	0.67	0.47	1.35	0.83
	22	0.67	0.47	1.36	0.83
	23	0.67	0.47	1.36	0.83
	24	0.67	0.47	1.36	0.83
	25	0.67	0.47	1.36	0.83

SOUTH WALES GROUND TESTING

SOUTH WALES GROUND TESTING

Plate Load Test Settlement v Time Plot

Test Reference: Test 5



Contract:

Celsa, Rover Way, Cardiff

Date:

27.04.22

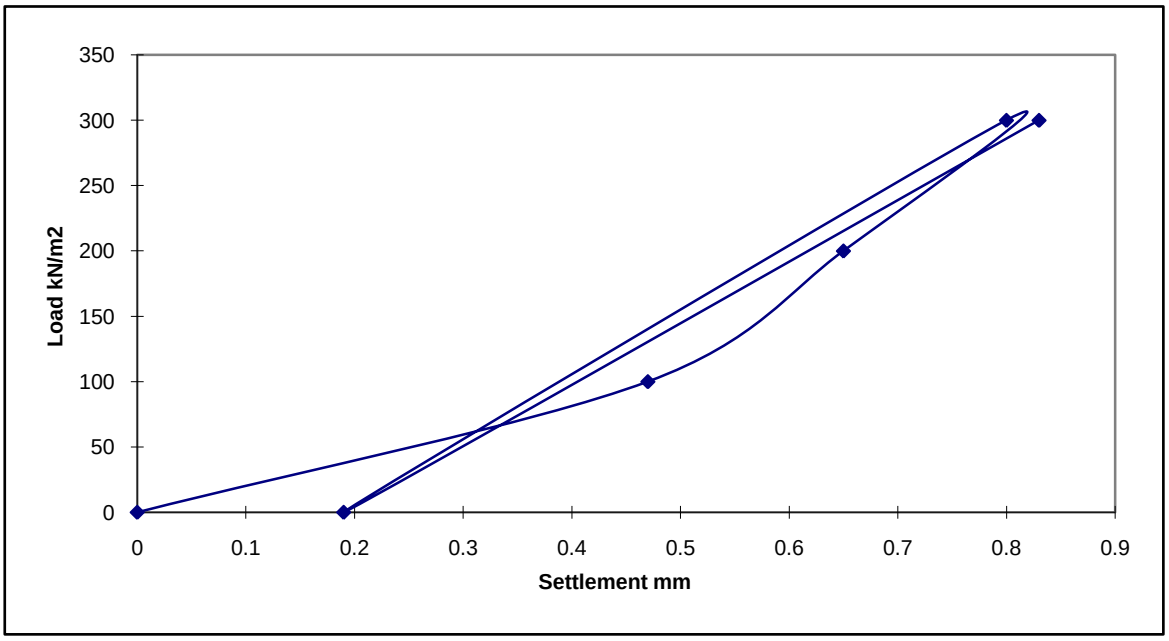
SOUTH WALES GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 5	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Compacted slag

Average Plate Settlement (mm)	Load (kN/m^2)	Time (mins)
0	0	0
0.47	100	5
0.65	200	10
0.80	300	15
0.19	0	20
0.83	300	25

Deformation Modulus (Ev1)	161.3	MN/m2
Elastic Modulus (Ev2)	201.6	MN/m2
Compaction Ratio (Ev2/Ev1)	1.3	
Degree of Rebound	76.3	%
Modulus of subgrade reaction (k762)	389.1	MPa/m
Approximate CBR value	**297.1**	%



Notes:

1: Circular steel plate bedded on uniform coarse sand.
2: Tracked excavator used as counter weight.
3: Load applied to plate via hydraulic jack and loading columns.
4: Each load increment applied until plate settlement less than 0.01mm per minute.
5: Plate settlement measured by three travel gauges fixed to datum beams.
6: Load measured using UKAS calibrated electric load cell.

SOUTH WALES GROUND TESTING

Approved by : D. McArthur

David McArthur BSc MSc ARSM

REMARKS: Test carried out in accordance with BS1377.1990, Part 9.
k752 for 600mm circular plate = pressure requied to achieve 1.25mm penetration x 0.83

CONTRACT:	Date: 27.04.22
Celsa,m Rover Way, Cardiff	Sheet 1 of 1

APPENDIX B

DCWW MAP

Dŵr Cymru
Welsh Water

PPA0006475

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

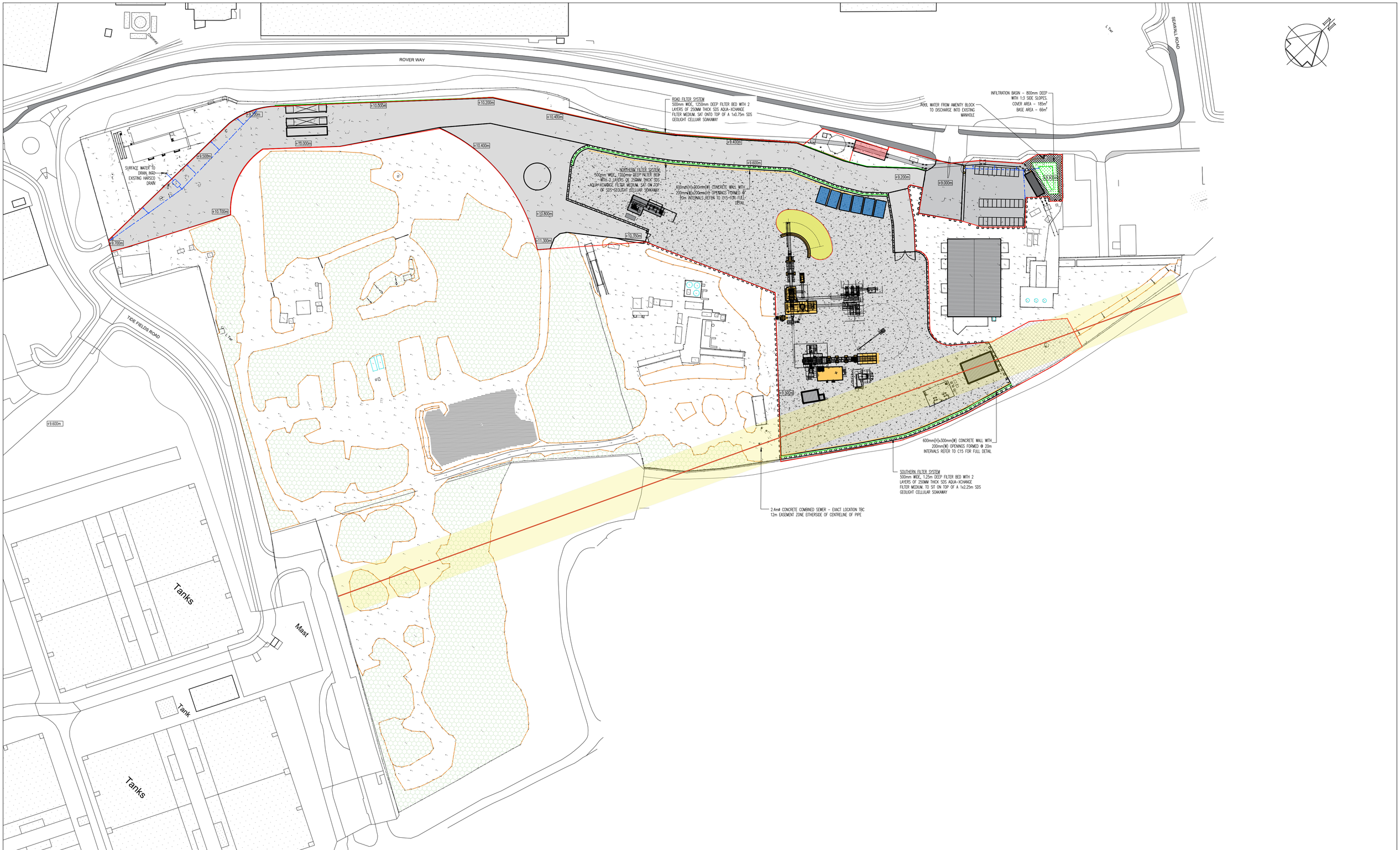
Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Map Ref:	321525,176305
Map scale:	1:1250
Printed by:	Sara Edwards
Printed on:	10 Mar 2022

APPENDIX C

PROPOSED DRAINAGE DESIGN LAYOUT



Job No: 21.121 | Drawing No: C04 | Rev: B | scales: 1:1000 @ A1

No.	REVISION	by	date
A	DRAWING NUMBER REVISED FROM C05 TO C04	RP	08.06.22
B	DRAINAGE LAYOUT UPDATED. FLOOD PREVENTION WALLS ADDED. DETAILING REMOVED.	RP	17.06.22

No.	REVISION	by	date

NOTES

1 *Do not scale from this drawing*
2 *All dimensions to be checked on site*
3 *'As built' drawings are prepared, in part, based upon information furnished by others. While this information is believed to be reliable, James & Nicholas LLP assume no responsibility for the accuracy of 'As built' drawings or for any errors or omissions that may have been incorporated into them as a result of incorrect information provided to us by others. Those relying on an 'As built' drawing are advised to obtain independent verification of its accuracy.*

STAGE

PLANNING

REFER ALSO TO THE FOLLOWING:
Drawings:

21121 C05 REV A PROPOSED PERMITTING LAYOUT
21121 C09 PROPOSED DRAINAGE PLAN - SHREDDER YARD AREA
21121 C10 PROPOSED DRAINAGE PLAN - AMENITY BLOCK
21121 C11 PROPOSED DRAINAGE PLAN - ROAD AREA 1
21121 C12 PROPOSED DRAINAGE PLAN - ROAD AREA 2
21121 C13 PROPOSED DRAINAGE CATCHMENT PLAN
21121 C14 FIREWATER CONTAINMENT PLAN
21121 C15 DRAINAGE DETAILING SHEET 1 OF 2
21121 C16 DRAINAGE DETAILING SHEET 2 OF 2

Bending Schedules:

CLIENT

CELSA GROUP | CELSA STEEL UK

james&nicholas
Grove House, Grove Place, Port Talbot SA13 1XA • Tel 01639 885431 • Fax 01639 891687
admin@jamesandnicholas.com • www.jamesandnicholas.com
James & Nicholas Limited Liability Partnership. Registered in the UK No. OC303071

Job title
REDEVELOPMENT, SCRAP HANDLING FACILITY, MINERAL SITE, TREMORFA, CELSA

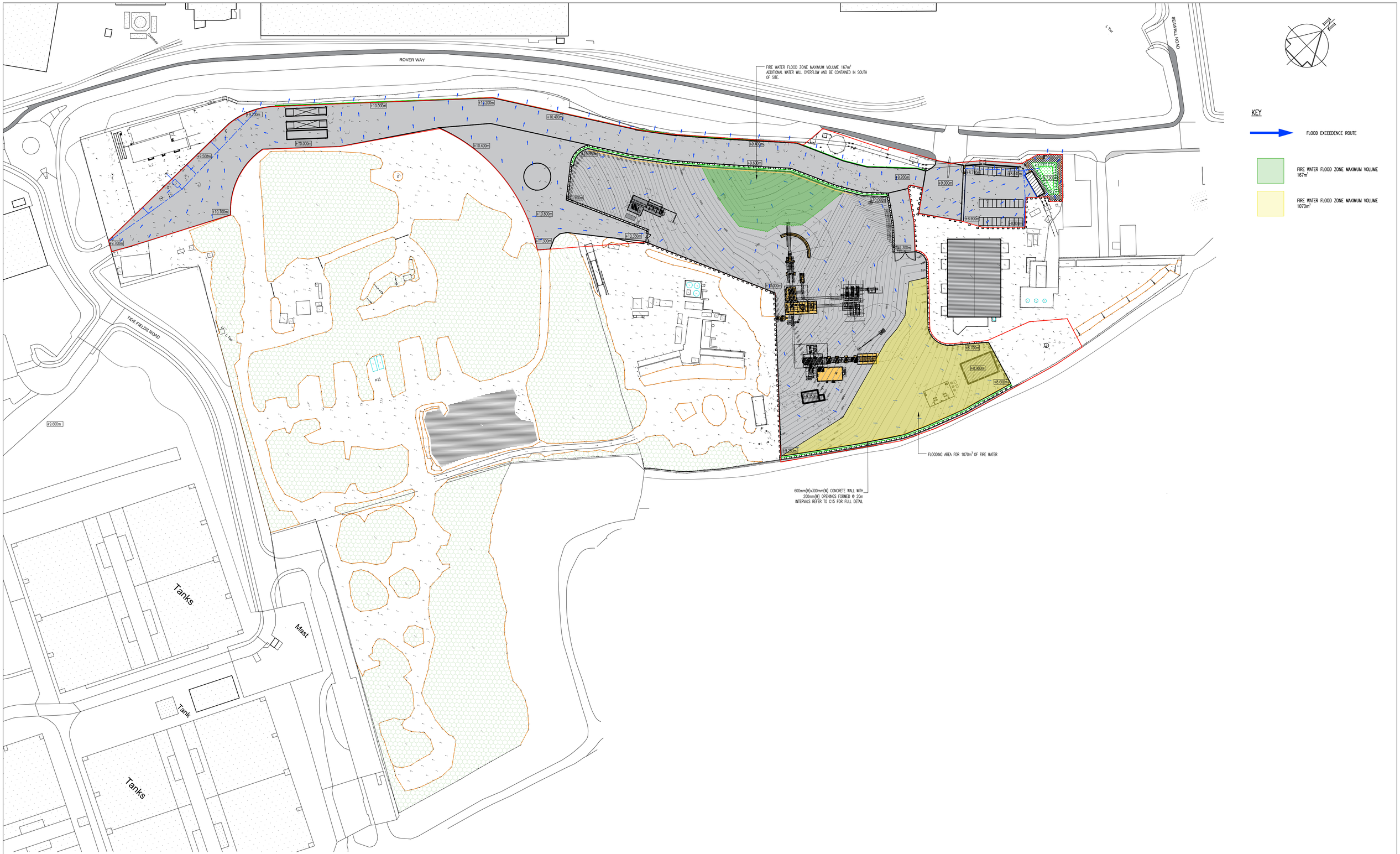
Drawing title
PROPOSED DRAINAGE LAYOUT - SITE WIDE

	by	date
drawn	K.J	22.04.22
checked	K.J	22.04.22
approved	K.J.T	22.04.22

Job No: 21.121 | Drawing No: C04 | Rev: B | scales: 1:1000 @ A1

APPENDIX D

FIREWATER CONTAINMENT PLAN



No.	REVISION	by	date

No.	REVISION	by	date

NOTES
1 Do not scale from this drawing
2 All dimensions to be checked on site
3 'As built' drawings are prepared, in part, based upon information furnished by others. While this information is believed to be reliable, James & Nicholas LLP assume no responsibility for the accuracy of 'As built' drawings or for any errors or omissions that may have been incorporated into them as a result of incorrect information provided to us by others. Those relying on an 'As built' drawing are advised to obtain independent verification of its accuracy.

STAGE
PLANNING

REFER ALSO TO THE FOLLOWING:
Drawings:

21121 C04 REV B PROPOSED DRAINAGE PLAN
21121 C10 PROPOSED DRAINAGE PLAN – AMENITY BLOCK
21121 C11 PROPOSED DRAINAGE PLAN – ROAD AREA 1
21121 C12 PROPOSED DRAINAGE PLAN – ROAD AREA 2
21121 C15 DRAINAGE DETAILING SHEET 1 OF 2
21121 C16 DRAINAGE DETAILING SHEET 2 OF 2

Bending Schedules:

CLIENT
CELSA GROUP™ CELSA STEEL UK

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James & Nicholas Limited Liability Partnership. Registered in the UK No. OC303071

	by	date
drawn	R.P	17.06.22
checked	K.J	17.06.22
approved	K.J.T	17.06.22

Job title
REDEVELOPMENT, SCRAP HANDLING FACILITY, MINERAL SITE, TREMORFA, CELSA

Drawing title
FIREWATER CONTAINMENT PLAN

Job No:	Drawing No:	Rev:
21.121	C14	

scales: 1:1000 @ A1

Job No: 21.121 | Drawing No: C14 | Rev:
scales: 1:1000 @ A1

APPENDIX E

NORTHERN FILTER STRIP 1 IN 1, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Half Drain Time : 114 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.267	0.267	13.4	99.6	O K
30 min Summer	8.335	0.335	13.4	124.8	O K
60 min Summer	8.389	0.389	13.4	144.9	O K
120 min Summer	8.454	0.454	13.4	169.1	O K
180 min Summer	8.478	0.478	13.4	178.2	O K
240 min Summer	8.488	0.488	13.4	181.7	O K
360 min Summer	8.486	0.486	13.4	180.9	O K
480 min Summer	8.470	0.470	13.4	175.2	O K
600 min Summer	8.449	0.449	13.4	167.2	O K
720 min Summer	8.424	0.424	13.4	157.8	O K
960 min Summer	8.369	0.369	13.4	137.4	O K
1440 min Summer	8.266	0.266	13.4	99.1	O K
2160 min Summer	8.150	0.150	13.4	55.7	O K
2880 min Summer	8.081	0.081	13.4	30.1	O K
4320 min Summer	8.045	0.045	12.2	16.8	O K
5760 min Summer	8.038	0.038	10.3	14.2	O K
7200 min Summer	8.034	0.034	9.1	12.5	O K
8640 min Summer	8.031	0.031	8.3	11.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	48.186	0.0	18
30 min Summer	31.737	0.0	32
60 min Summer	20.272	0.0	60
120 min Summer	13.646	0.0	106
180 min Summer	10.686	0.0	142
240 min Summer	8.930	0.0	176
360 min Summer	6.868	0.0	246
480 min Summer	5.664	0.0	314
600 min Summer	4.861	0.0	384
720 min Summer	4.280	0.0	452
960 min Summer	3.485	0.0	584
1440 min Summer	2.604	0.0	836
2160 min Summer	1.947	0.0	1188
2880 min Summer	1.593	0.0	1504
4320 min Summer	1.222	0.0	2200
5760 min Summer	1.027	0.0	2928
7200 min Summer	0.908	0.0	3632
8640 min Summer	0.828	0.0	4360

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.029	0.029	7.7	10.6	O K
15 min Winter	8.267	0.267	13.4	99.6	O K
30 min Winter	8.336	0.336	13.4	125.1	O K
60 min Winter	8.392	0.392	13.4	145.8	O K
120 min Winter	8.457	0.457	13.4	170.3	O K
180 min Winter	8.477	0.477	13.4	177.6	O K
240 min Winter	8.481	0.481	13.4	179.2	O K
360 min Winter	8.463	0.463	13.4	172.6	O K
480 min Winter	8.430	0.430	13.4	160.1	O K
600 min Winter	8.390	0.390	13.4	145.2	O K
720 min Winter	8.347	0.347	13.4	129.2	O K
960 min Winter	8.261	0.261	13.4	97.4	O K
1440 min Winter	8.122	0.122	13.4	45.6	O K
2160 min Winter	8.046	0.046	12.4	17.3	O K
2880 min Winter	8.038	0.038	10.3	14.2	O K
4320 min Winter	8.029	0.029	7.9	10.8	O K
5760 min Winter	8.025	0.025	6.7	9.1	O K
7200 min Winter	8.022	0.022	5.8	8.0	O K
8640 min Winter	8.020	0.020	5.3	7.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.770	0.0	5032
15 min Winter	48.186	0.0	18
30 min Winter	31.737	0.0	32
60 min Winter	20.272	0.0	60
120 min Winter	13.646	0.0	114
180 min Winter	10.686	0.0	144
240 min Winter	8.930	0.0	184
360 min Winter	6.868	0.0	262
480 min Winter	5.664	0.0	338
600 min Winter	4.861	0.0	410
720 min Winter	4.280	0.0	478
960 min Winter	3.485	0.0	608
1440 min Winter	2.604	0.0	836
2160 min Winter	1.947	0.0	1104
2880 min Winter	1.593	0.0	1468
4320 min Winter	1.222	0.0	2200
5760 min Winter	1.027	0.0	2920
7200 min Winter	0.908	0.0	3536
8640 min Winter	0.828	0.0	4408

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.019	0.019	5.0	6.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.770	0.0	5032

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.965

Time (mins) From:	To:	Area (ha)
0	4	0.965

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m) 8.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	392.0	372.4	1.000	392.0	372.4

Infiltration Trench

Infiltration Coefficient Base (m/hr) 0.26000 Trench Width (m) 0.5
Infiltration Coefficient Side (m/hr) 0.26000 Trench Length (m) 196.0
Safety Factor 2.0 Slope (1:X) 142.0
Porosity 0.50 Cap Volume Depth (m) 0.000
Invert Level (m) 9.000 Cap Infiltration Depth (m) 0.000

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 267 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.593	0.593	13.4	221.0	O K
30 min Summer	8.780	0.780	13.4	290.6	O K
60 min Summer	8.963	0.963	13.4	358.5	O K
120 min Summer	9.088	1.088	13.7	405.1	O K
180 min Summer	9.132	1.132	13.9	422.0	O K
240 min Summer	9.140	1.140	13.9	424.9	O K
360 min Summer	9.122	1.122	13.8	418.0	O K
480 min Summer	9.094	1.094	13.7	407.4	O K
600 min Summer	9.063	1.063	13.6	395.8	O K
720 min Summer	9.029	1.029	13.5	383.1	O K
960 min Summer	8.953	0.953	13.4	354.8	O K
1440 min Summer	8.801	0.801	13.4	298.2	O K
2160 min Summer	8.596	0.596	13.4	221.8	O K
2880 min Summer	8.431	0.431	13.4	160.5	O K
4320 min Summer	8.214	0.214	13.4	79.6	O K
5760 min Summer	8.098	0.098	13.4	36.6	O K
7200 min Summer	8.052	0.052	13.4	19.2	O K
8640 min Summer	8.046	0.046	12.3	17.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	101.817	0.0	18
30 min Summer	68.482	0.0	33
60 min Summer	44.117	0.0	62
120 min Summer	27.070	0.0	122
180 min Summer	20.322	0.0	180
240 min Summer	16.550	0.0	238
360 min Summer	12.327	0.0	296
480 min Summer	9.959	0.0	360
600 min Summer	8.418	0.0	426
720 min Summer	7.325	0.0	494
960 min Summer	5.859	0.0	634
1440 min Summer	4.263	0.0	898
2160 min Summer	3.106	0.0	1280
2880 min Summer	2.497	0.0	1648
4320 min Summer	1.872	0.0	2336
5760 min Summer	1.550	0.0	3000
7200 min Summer	1.358	0.0	3672
8640 min Summer	1.231	0.0	4376

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.042	0.042	11.4	15.8	O K
15 min Winter	8.594	0.594	13.4	221.2	O K
30 min Winter	8.782	0.782	13.4	291.0	O K
60 min Winter	8.966	0.966	13.4	359.7	O K
120 min Winter	9.095	1.095	13.7	407.8	O K
180 min Winter	9.144	1.144	13.9	426.3	O K
240 min Winter	9.156	1.156	14.0	430.8	O K
360 min Winter	9.127	1.127	13.9	419.8	O K
480 min Winter	9.090	1.090	13.7	405.9	O K
600 min Winter	9.044	1.044	13.6	388.8	O K
720 min Winter	8.992	0.992	13.4	369.2	O K
960 min Winter	8.875	0.875	13.4	326.0	O K
1440 min Winter	8.645	0.645	13.4	240.4	O K
2160 min Winter	8.355	0.355	13.4	132.3	O K
2880 min Winter	8.153	0.153	13.4	57.1	O K
4320 min Winter	8.045	0.045	12.0	16.6	O K
5760 min Winter	8.037	0.037	10.0	13.8	O K
7200 min Winter	8.033	0.033	8.8	12.1	O K
8640 min Winter	8.030	0.030	8.0	11.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.140	0.0	5136
15 min Winter	101.817	0.0	18
30 min Winter	68.482	0.0	32
60 min Winter	44.117	0.0	62
120 min Winter	27.070	0.0	118
180 min Winter	20.322	0.0	176
240 min Winter	16.550	0.0	230
360 min Winter	12.327	0.0	326
480 min Winter	9.959	0.0	374
600 min Winter	8.418	0.0	452
720 min Winter	7.325	0.0	528
960 min Winter	5.859	0.0	674
1440 min Winter	4.263	0.0	952
2160 min Winter	3.106	0.0	1320
2880 min Winter	2.497	0.0	1644
4320 min Winter	1.872	0.0	2204
5760 min Winter	1.550	0.0	2888
7200 min Winter	1.358	0.0	3584
8640 min Winter	1.231	0.0	4312

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.027	0.027	7.3	10.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.140	0.0	5136

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.965

Time (mins) From:	To:	Area (ha)
0	4	0.965

james&nicholas		Micro Drainage
Date 30/05/2022 12:24	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m) 8.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	392.0	372.4	1.000	392.0	372.4

Infiltration Trench

Infiltration Coefficient Base (m/hr) 0.26000 Trench Width (m) 0.5
Infiltration Coefficient Side (m/hr) 0.26000 Trench Length (m) 196.0
Safety Factor 2.0 Slope (1:X) 142.0
Porosity 0.50 Cap Volume Depth (m) 0.000
Invert Level (m) 9.000 Cap Infiltration Depth (m) 0.000

james&nicholas		Micro Drainage
Date 30/05/2022 12:22	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 335 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.779	0.779	13.4	290.3	O K
30 min Summer	9.039	1.039	13.5	386.9	O K
60 min Summer	9.298	1.298	14.7	485.1	O K
120 min Summer	9.474	1.474	15.8	552.7	O K
180 min Summer	9.552	1.552	16.4	583.2	O K
240 min Summer	9.581	1.581	16.7	594.8	O K
360 min Summer	9.573	1.573	16.6	591.6	O K
480 min Summer	9.542	1.542	16.4	579.4	O K
600 min Summer	9.504	1.504	16.0	564.5	O K
720 min Summer	9.464	1.464	15.7	548.9	O K
960 min Summer	9.379	1.379	15.2	516.0	O K
1440 min Summer	9.204	1.204	14.2	449.0	O K
2160 min Summer	8.950	0.950	13.4	353.7	O K
2880 min Summer	8.730	0.730	13.4	271.8	O K
4320 min Summer	8.418	0.418	13.4	155.7	O K
5760 min Summer	8.226	0.226	13.4	84.1	O K
7200 min Summer	8.119	0.119	13.4	44.5	O K
8640 min Summer	8.066	0.066	13.4	24.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	19
30 min Summer	89.648	0.0	33
60 min Summer	58.187	0.0	62
120 min Summer	35.502	0.0	122
180 min Summer	26.659	0.0	182
240 min Summer	21.716	0.0	240
360 min Summer	16.145	0.0	308
480 min Summer	13.001	0.0	374
600 min Summer	10.944	0.0	438
720 min Summer	9.481	0.0	506
960 min Summer	7.517	0.0	646
1440 min Summer	5.373	0.0	924
2160 min Summer	3.828	0.0	1324
2880 min Summer	3.025	0.0	1704
4320 min Summer	2.215	0.0	2420
5760 min Summer	1.806	0.0	3112
7200 min Summer	1.568	0.0	3752
8640 min Summer	1.413	0.0	4408

james&nicholas		Micro Drainage
Date 30/05/2022 12:22	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.049	0.049	13.1	18.1	O K
15 min Winter	8.780	0.780	13.4	290.6	O K
30 min Winter	9.041	1.041	13.5	387.5	O K
60 min Winter	9.303	1.303	14.7	486.7	O K
120 min Winter	9.482	1.482	15.9	556.0	O K
180 min Winter	9.566	1.566	16.5	588.9	O K
240 min Winter	9.601	1.601	16.9	602.8	O K
360 min Winter	9.594	1.594	16.8	599.9	O K
480 min Winter	9.552	1.552	16.4	583.5	O K
600 min Winter	9.505	1.505	16.1	565.1	O K
720 min Winter	9.453	1.453	15.7	544.9	O K
960 min Winter	9.336	1.336	14.9	499.7	O K
1440 min Winter	9.083	1.083	13.7	403.5	O K
2160 min Winter	8.707	0.707	13.4	263.4	O K
2880 min Winter	8.411	0.411	13.4	153.1	O K
4320 min Winter	8.075	0.075	13.4	27.9	O K
5760 min Winter	8.043	0.043	11.6	16.0	O K
7200 min Winter	8.038	0.038	10.2	14.0	O K
8640 min Winter	8.034	0.034	9.2	12.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	5064
15 min Winter	132.256	0.0	18
30 min Winter	89.648	0.0	33
60 min Winter	58.187	0.0	62
120 min Winter	35.502	0.0	120
180 min Winter	26.659	0.0	176
240 min Winter	21.716	0.0	232
360 min Winter	16.145	0.0	336
480 min Winter	13.001	0.0	382
600 min Winter	10.944	0.0	460
720 min Winter	9.481	0.0	538
960 min Winter	7.517	0.0	694
1440 min Winter	5.373	0.0	996
2160 min Winter	3.828	0.0	1404
2880 min Winter	3.025	0.0	1756
4320 min Winter	2.215	0.0	2332
5760 min Winter	1.806	0.0	2848
7200 min Winter	1.568	0.0	3616
8640 min Winter	1.413	0.0	4352

james&nicholas		Micro Drainage
Date 30/05/2022 12:22	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.031	0.031	8.4	11.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	5136

james&nicholas		Micro Drainage
Date 30/05/2022 12:22	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.965

Time (mins) From:	To:	Area (ha)
0	4	0.965

james&nicholas		Micro Drainage
Date 30/05/2022 12:22	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m) 8.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	392.0	372.4	1.000	392.0	372.4

Infiltration Trench

Infiltration Coefficient Base (m/hr) 0.26000 Trench Width (m) 0.5
Infiltration Coefficient Side (m/hr) 0.26000 Trench Length (m) 196.0
Safety Factor 2.0 Slope (1:X) 142.0
Porosity 0.50 Cap Volume Depth (m) 0.000
Invert Level (m) 9.000 Cap Infiltration Depth (m) 0.000

APPENDIX F

SOUTHERN FILTER STRIP 1 IN 1, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

james&nicholas		Micro Drainage
Date 30/05/2022 12:32	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Half Drain Time : 179 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.126	0.376	11.0	114.3	O K
30 min Summer	8.227	0.477	11.0	145.0	O K
60 min Summer	8.319	0.569	11.0	172.9	O K
120 min Summer	8.439	0.689	11.0	209.4	O K
180 min Summer	8.485	0.735	11.0	223.6	O K
240 min Summer	8.507	0.757	11.0	230.2	O K
360 min Summer	8.520	0.770	11.0	234.1	O K
480 min Summer	8.514	0.764	11.0	232.4	O K
600 min Summer	8.499	0.749	11.0	227.7	O K
720 min Summer	8.478	0.728	11.0	221.3	O K
960 min Summer	8.425	0.675	11.0	205.2	O K
1440 min Summer	8.312	0.562	11.0	170.8	O K
2160 min Summer	8.155	0.405	11.0	123.1	O K
2880 min Summer	8.031	0.281	11.0	85.5	O K
4320 min Summer	7.877	0.127	11.0	38.7	O K
5760 min Summer	7.809	0.059	11.0	18.0	O K
7200 min Summer	7.796	0.046	10.2	14.0	O K
8640 min Summer	7.792	0.042	9.3	12.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	48.186	0.0	18
30 min Summer	31.737	0.0	33
60 min Summer	20.272	0.0	62
120 min Summer	13.646	0.0	120
180 min Summer	10.686	0.0	168
240 min Summer	8.930	0.0	200
360 min Summer	6.868	0.0	266
480 min Summer	5.664	0.0	336
600 min Summer	4.861	0.0	406
720 min Summer	4.280	0.0	476
960 min Summer	3.485	0.0	610
1440 min Summer	2.604	0.0	880
2160 min Summer	1.947	0.0	1256
2880 min Summer	1.593	0.0	1612
4320 min Summer	1.222	0.0	2292
5760 min Summer	1.027	0.0	2944
7200 min Summer	0.908	0.0	3672
8640 min Summer	0.828	0.0	4312

james&nicholas		Micro Drainage
Date 30/05/2022 12:32	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	7.789	0.039	8.6	11.9	O K
15 min Winter	8.126	0.376	11.0	114.4	O K
30 min Winter	8.229	0.479	11.0	145.5	O K
60 min Winter	8.321	0.571	11.0	173.6	O K
120 min Winter	8.445	0.695	11.0	211.3	O K
180 min Winter	8.494	0.744	11.0	226.3	O K
240 min Winter	8.511	0.761	11.0	231.2	O K
360 min Winter	8.514	0.764	11.0	232.1	O K
480 min Winter	8.493	0.743	11.0	225.9	O K
600 min Winter	8.460	0.710	11.0	215.9	O K
720 min Winter	8.420	0.670	11.0	203.7	O K
960 min Winter	8.329	0.579	11.0	175.9	O K
1440 min Winter	8.149	0.399	11.0	121.4	O K
2160 min Winter	7.933	0.183	11.0	55.6	O K
2880 min Winter	7.811	0.061	11.0	18.5	O K
4320 min Winter	7.790	0.040	8.8	12.2	O K
5760 min Winter	7.784	0.034	7.4	10.2	O K
7200 min Winter	7.780	0.030	6.6	9.1	O K
8640 min Winter	7.777	0.027	6.0	8.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.770	0.0	5024
15 min Winter	48.186	0.0	18
30 min Winter	31.737	0.0	32
60 min Winter	20.272	0.0	60
120 min Winter	13.646	0.0	118
180 min Winter	10.686	0.0	172
240 min Winter	8.930	0.0	220
360 min Winter	6.868	0.0	278
480 min Winter	5.664	0.0	356
600 min Winter	4.861	0.0	434
720 min Winter	4.280	0.0	508
960 min Winter	3.485	0.0	652
1440 min Winter	2.604	0.0	920
2160 min Winter	1.947	0.0	1260
2880 min Winter	1.593	0.0	1528
4320 min Winter	1.222	0.0	2164
5760 min Winter	1.027	0.0	2856
7200 min Winter	0.908	0.0	3664
8640 min Winter	0.828	0.0	4264

james&nicholas		Micro Drainage
Date 30/05/2022 12:32	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 2 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	7.775	0.025	5.5	7.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.770	0.0	5136

james&nicholas		Micro Drainage
Date 30/05/2022 12:32	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.081

Time (mins) From:	To:	Area (ha)
0	4	1.081

james&nicholas		Micro Drainage
Date 30/05/2022 12:32	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m)	7.750	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.26000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.26000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	320.0	304.0	1.000	320.0	304.0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.26000	Trench Length (m)	146.0
Safety Factor	2.0	Slope (1:X)	247.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.750	Cap Infiltration Depth (m)	0.000

james&nicholas		Micro Drainage
Date 30/05/2022 12:31	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 309 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.575	0.825	11.0	250.9	O K
30 min Summer	8.841	1.091	11.5	331.8	O K
60 min Summer	9.093	1.343	13.6	411.9	O K
120 min Summer	9.265	1.515	15.7	468.8	O K
180 min Summer	9.330	1.580	16.6	490.6	O K
240 min Summer	9.348	1.598	16.8	496.7	O K
360 min Summer	9.348	1.598	16.8	497.0	O K
480 min Summer	9.328	1.578	16.5	490.1	O K
600 min Summer	9.301	1.551	16.2	481.0	O K
720 min Summer	9.272	1.522	15.7	471.3	O K
960 min Summer	9.211	1.461	14.9	450.6	O K
1440 min Summer	9.087	1.337	13.5	409.9	O K
2160 min Summer	8.907	1.157	11.9	352.6	O K
2880 min Summer	8.733	0.983	11.0	298.8	O K
4320 min Summer	8.430	0.680	11.0	206.6	O K
5760 min Summer	8.214	0.464	11.0	141.0	O K
7200 min Summer	8.068	0.318	11.0	96.6	O K
8640 min Summer	7.966	0.216	11.0	65.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	101.817	0.0	19
30 min Summer	68.482	0.0	33
60 min Summer	44.117	0.0	62
120 min Summer	27.070	0.0	122
180 min Summer	20.322	0.0	180
240 min Summer	16.550	0.0	224
360 min Summer	12.327	0.0	284
480 min Summer	9.959	0.0	350
600 min Summer	8.418	0.0	420
720 min Summer	7.325	0.0	492
960 min Summer	5.859	0.0	634
1440 min Summer	4.263	0.0	912
2160 min Summer	3.106	0.0	1340
2880 min Summer	2.497	0.0	1732
4320 min Summer	1.872	0.0	2504
5760 min Summer	1.550	0.0	3224
7200 min Summer	1.358	0.0	3896
8640 min Summer	1.231	0.0	4584

jamesnicholas		Micro Drainage
Date 30/05/2022 12:31	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	7.896	0.146	11.0	44.3	O K
15 min Winter	8.576	0.826	11.0	251.1	O K
30 min Winter	8.842	1.092	11.5	332.3	O K
60 min Winter	9.097	1.347	13.6	413.2	O K
120 min Winter	9.275	1.525	15.8	472.2	O K
180 min Winter	9.347	1.597	16.8	496.4	O K
240 min Winter	9.372	1.622	17.1	504.9	O K
360 min Winter	9.365	1.615	17.0	502.8	O K
480 min Winter	9.341	1.591	16.7	494.3	O K
600 min Winter	9.303	1.553	16.2	481.6	O K
720 min Winter	9.263	1.513	15.6	468.2	O K
960 min Winter	9.176	1.426	14.5	439.2	O K
1440 min Winter	8.992	1.242	12.6	379.5	O K
2160 min Winter	8.695	0.945	11.0	287.2	O K
2880 min Winter	8.406	0.656	11.0	199.4	O K
4320 min Winter	7.999	0.249	11.0	75.8	O K
5760 min Winter	7.805	0.055	11.0	16.9	O K
7200 min Winter	7.795	0.045	9.8	13.6	O K
8640 min Winter	7.791	0.041	8.9	12.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.140	0.0	5248
15 min Winter	101.817	0.0	18
30 min Winter	68.482	0.0	33
60 min Winter	44.117	0.0	62
120 min Winter	27.070	0.0	118
180 min Winter	20.322	0.0	174
240 min Winter	16.550	0.0	228
360 min Winter	12.327	0.0	290
480 min Winter	9.959	0.0	366
600 min Winter	8.418	0.0	446
720 min Winter	7.325	0.0	526
960 min Winter	5.859	0.0	682
1440 min Winter	4.263	0.0	984
2160 min Winter	3.106	0.0	1428
2880 min Winter	2.497	0.0	1816
4320 min Winter	1.872	0.0	2504
5760 min Winter	1.550	0.0	2992
7200 min Winter	1.358	0.0	3608
8640 min Winter	1.231	0.0	4352

james&nicholas		Micro Drainage
Date 30/05/2022 12:31	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	7.788	0.038	8.3	11.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.140	0.0	4992

james&nicholas		Micro Drainage
Date 30/05/2022 12:31	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.081

Time (mins) From:	To:	Area (ha)
0	4	1.081

james&nicholas		Micro Drainage
Date 30/05/2022 12:31	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m) 7.750 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	320.0	304.0	1.000	320.0	304.0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.26000	Trench Length (m)	146.0
Safety Factor	2.0	Slope (1:X)	247.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.750	Cap Infiltration Depth (m)	0.000

james&nicholas		Micro Drainage
Date 30/05/2022 12:30	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 334 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.831	1.081	11.4	328.7	O K
30 min Summer	9.173	1.423	14.5	438.2	O K
60 min Summer	9.500	1.750	18.4	548.5	O K
120 min Summer	9.722	1.972	20.8	624.1	Flood Risk
180 min Summer	9.820	2.070	21.8	657.4	Flood Risk
240 min Summer	9.856	2.106	22.2	669.9	Flood Risk
360 min Summer	9.875	2.125	22.4	676.2	Flood Risk
480 min Summer	9.855	2.105	22.2	669.5	Flood Risk
600 min Summer	9.815	2.065	21.8	655.8	Flood Risk
720 min Summer	9.767	2.017	21.2	639.6	Flood Risk
960 min Summer	9.670	1.920	20.2	606.6	O K
1440 min Summer	9.495	1.745	18.4	547.0	O K
2160 min Summer	9.284	1.534	15.9	475.3	O K
2880 min Summer	9.115	1.365	13.8	419.0	O K
4320 min Summer	8.826	1.076	11.4	327.4	O K
5760 min Summer	8.546	0.796	11.0	242.0	O K
7200 min Summer	8.345	0.595	11.0	180.8	O K
8640 min Summer	8.199	0.449	11.0	136.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	19
30 min Summer	89.648	0.0	33
60 min Summer	58.187	0.0	62
120 min Summer	35.502	0.0	122
180 min Summer	26.659	0.0	180
240 min Summer	21.716	0.0	224
360 min Summer	16.145	0.0	282
480 min Summer	13.001	0.0	348
600 min Summer	10.944	0.0	416
720 min Summer	9.481	0.0	486
960 min Summer	7.517	0.0	626
1440 min Summer	5.373	0.0	908
2160 min Summer	3.828	0.0	1320
2880 min Summer	3.025	0.0	1732
4320 min Summer	2.215	0.0	2552
5760 min Summer	1.806	0.0	3288
7200 min Summer	1.568	0.0	4032
8640 min Summer	1.413	0.0	4752

james&nicholas		Micro Drainage
Date 30/05/2022 12:30	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.093	0.343	11.0	104.3	O K
15 min Winter	8.831	1.081	11.4	328.8	O K
30 min Winter	9.175	1.425	14.5	438.9	O K
60 min Winter	9.505	1.755	18.5	550.4	O K
120 min Winter	9.735	1.985	20.9	628.6	Flood Risk
180 min Winter	9.842	2.092	22.0	665.0	Flood Risk
240 min Winter	9.887	2.137	22.5	680.4	Flood Risk
360 min Winter	9.896	2.146	22.6	683.4	Flood Risk
480 min Winter	9.873	2.123	22.4	675.7	Flood Risk
600 min Winter	9.824	2.074	21.8	658.9	Flood Risk
720 min Winter	9.762	2.012	21.2	637.8	Flood Risk
960 min Winter	9.637	1.887	19.9	595.3	O K
1440 min Winter	9.414	1.664	17.5	519.4	O K
2160 min Winter	9.141	1.391	14.1	427.7	O K
2880 min Winter	8.887	1.137	11.8	346.1	O K
4320 min Winter	8.355	0.605	11.0	184.0	O K
5760 min Winter	7.994	0.244	11.0	74.1	O K
7200 min Winter	7.815	0.065	11.0	19.7	O K
8640 min Winter	7.797	0.047	10.3	14.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	5440
15 min Winter	132.256	0.0	18
30 min Winter	89.648	0.0	33
60 min Winter	58.187	0.0	62
120 min Winter	35.502	0.0	118
180 min Winter	26.659	0.0	174
240 min Winter	21.716	0.0	228
360 min Winter	16.145	0.0	288
480 min Winter	13.001	0.0	364
600 min Winter	10.944	0.0	442
720 min Winter	9.481	0.0	520
960 min Winter	7.517	0.0	674
1440 min Winter	5.373	0.0	968
2160 min Winter	3.828	0.0	1424
2880 min Winter	3.025	0.0	1872
4320 min Winter	2.215	0.0	2636
5760 min Winter	1.806	0.0	3288
7200 min Winter	1.568	0.0	3752
8640 min Winter	1.413	0.0	4376

jAMES&nicholAS		Micro Drainage
Date 30/05/2022 12:30	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	7.793	0.043	9.5	13.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	5080

james&nicholas		Micro Drainage
Date 30/05/2022 12:30	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.081

Time (mins) From:	To:	Area (ha)
0	4	1.081

james&nicholas		Micro Drainage
Date 30/05/2022 12:30	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m)	7.750	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.26000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.26000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	320.0	304.0	1.000	320.0	304.0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	0.5
Infiltration Coefficient Side (m/hr)	0.26000	Trench Length (m)	146.0
Safety Factor	2.0	Slope (1:X)	247.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	8.750	Cap Infiltration Depth (m)	0.000

APPENDIX G

ROAD FILTER STRIP 1 IN 1, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Half Drain Time : 140 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.550	0.300	10.0	83.0	O K
30 min Summer	8.628	0.378	10.0	104.5	O K
60 min Summer	8.693	0.443	10.0	122.5	O K
120 min Summer	8.773	0.523	10.0	144.6	O K
180 min Summer	8.803	0.553	10.0	153.0	O K
240 min Summer	8.816	0.566	10.0	156.6	O K
360 min Summer	8.819	0.569	10.0	157.3	O K
480 min Summer	8.807	0.557	10.0	153.9	O K
600 min Summer	8.787	0.537	10.0	148.3	O K
720 min Summer	8.762	0.512	10.0	141.7	O K
960 min Summer	8.707	0.457	10.0	126.4	O K
1440 min Summer	8.599	0.349	10.0	96.5	O K
2160 min Summer	8.466	0.216	10.0	59.6	O K
2880 min Summer	8.376	0.126	10.0	34.9	O K
4320 min Summer	8.301	0.051	10.0	14.0	O K
5760 min Summer	8.292	0.042	8.4	11.7	O K
7200 min Summer	8.288	0.038	7.5	10.4	O K
8640 min Summer	8.284	0.034	6.8	9.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	48.186	0.0	18
30 min Summer	31.737	0.0	32
60 min Summer	20.272	0.0	62
120 min Summer	13.646	0.0	116
180 min Summer	10.686	0.0	148
240 min Summer	8.930	0.0	182
360 min Summer	6.868	0.0	252
480 min Summer	5.664	0.0	322
600 min Summer	4.861	0.0	390
720 min Summer	4.280	0.0	458
960 min Summer	3.485	0.0	590
1440 min Summer	2.604	0.0	850
2160 min Summer	1.947	0.0	1208
2880 min Summer	1.593	0.0	1552
4320 min Summer	1.222	0.0	2204
5760 min Summer	1.027	0.0	2936
7200 min Summer	0.908	0.0	3672
8640 min Summer	0.828	0.0	4360

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.282	0.032	6.3	8.8	O K
15 min Winter	8.550	0.300	10.0	83.0	O K
30 min Winter	8.629	0.379	10.0	104.8	O K
60 min Winter	8.696	0.446	10.0	123.2	O K
120 min Winter	8.779	0.529	10.0	146.1	O K
180 min Winter	8.804	0.554	10.0	153.1	O K
240 min Winter	8.813	0.563	10.0	155.6	O K
360 min Winter	8.802	0.552	10.0	152.5	O K
480 min Winter	8.772	0.522	10.0	144.2	O K
600 min Winter	8.733	0.483	10.0	133.5	O K
720 min Winter	8.690	0.440	10.0	121.7	O K
960 min Winter	8.601	0.351	10.0	97.0	O K
1440 min Winter	8.444	0.194	10.0	53.6	O K
2160 min Winter	8.305	0.055	10.0	15.3	O K
2880 min Winter	8.292	0.042	8.4	11.7	O K
4320 min Winter	8.283	0.033	6.5	9.0	O K
5760 min Winter	8.277	0.027	5.4	7.6	O K
7200 min Winter	8.274	0.024	4.8	6.7	O K
8640 min Winter	8.272	0.022	4.4	6.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.770	0.0	5136
15 min Winter	48.186	0.0	18
30 min Winter	31.737	0.0	32
60 min Winter	20.272	0.0	60
120 min Winter	13.646	0.0	116
180 min Winter	10.686	0.0	162
240 min Winter	8.930	0.0	188
360 min Winter	6.868	0.0	268
480 min Winter	5.664	0.0	344
600 min Winter	4.861	0.0	416
720 min Winter	4.280	0.0	490
960 min Winter	3.485	0.0	626
1440 min Winter	2.604	0.0	866
2160 min Winter	1.947	0.0	1144
2880 min Winter	1.593	0.0	1468
4320 min Winter	1.222	0.0	2188
5760 min Winter	1.027	0.0	2936
7200 min Winter	0.908	0.0	3656
8640 min Winter	0.828	0.0	4304

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.271	0.021	4.1	5.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.770	0.0	5000

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.797

Time (mins) From:	To:	Area (ha)
0	4	0.797

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m) 8.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	291.0	276.4	1.000	291.0	276.4

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.26000	Trench Length (m)	388.0
Safety Factor	2.0	Slope (1:X)	142.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	9.000	Cap Infiltration Depth (m)	0.000

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 255 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	8.913	0.663	10.0	183.4	O K
30 min Summer	9.121	0.871	10.7	241.4	O K
60 min Summer	9.313	1.063	12.1	297.2	O K
120 min Summer	9.433	1.183	13.2	333.6	O K
180 min Summer	9.470	1.220	13.5	345.1	O K
240 min Summer	9.477	1.227	13.6	347.3	O K
360 min Summer	9.466	1.216	13.5	344.0	O K
480 min Summer	9.443	1.193	13.3	336.9	O K
600 min Summer	9.416	1.166	13.0	328.6	O K
720 min Summer	9.387	1.137	12.7	319.7	O K
960 min Summer	9.324	1.074	12.2	300.7	O K
1440 min Summer	9.197	0.947	11.2	263.2	O K
2160 min Summer	9.013	0.763	10.0	210.9	O K
2880 min Summer	8.835	0.585	10.0	161.6	O K
4320 min Summer	8.582	0.332	10.0	91.9	O K
5760 min Summer	8.428	0.178	10.0	49.3	O K
7200 min Summer	8.344	0.094	10.0	26.0	O K
8640 min Summer	8.305	0.055	10.0	15.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	101.817	0.0	18
30 min Summer	68.482	0.0	33
60 min Summer	44.117	0.0	62
120 min Summer	27.070	0.0	122
180 min Summer	20.322	0.0	180
240 min Summer	16.550	0.0	210
360 min Summer	12.327	0.0	274
480 min Summer	9.959	0.0	342
600 min Summer	8.418	0.0	410
720 min Summer	7.325	0.0	484
960 min Summer	5.859	0.0	624
1440 min Summer	4.263	0.0	896
2160 min Summer	3.106	0.0	1300
2880 min Summer	2.497	0.0	1676
4320 min Summer	1.872	0.0	2380
5760 min Summer	1.550	0.0	3064
7200 min Summer	1.358	0.0	3744
8640 min Summer	1.231	0.0	4408

jAMES&nicholAS		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.297	0.047	9.4	13.0	O K
15 min Winter	8.914	0.664	10.0	183.6	O K
30 min Winter	9.123	0.873	10.7	241.8	O K
60 min Winter	9.316	1.066	12.1	298.3	O K
120 min Winter	9.442	1.192	13.3	336.5	O K
180 min Winter	9.485	1.235	13.7	349.9	O K
240 min Winter	9.493	1.243	13.8	352.3	O K
360 min Winter	9.475	1.225	13.6	346.7	O K
480 min Winter	9.444	1.194	13.3	336.9	O K
600 min Winter	9.405	1.155	12.9	325.0	O K
720 min Winter	9.362	1.112	12.5	312.0	O K
960 min Winter	9.268	1.018	11.7	284.0	O K
1440 min Winter	9.074	0.824	10.4	228.0	O K
2160 min Winter	8.768	0.518	10.0	143.2	O K
2880 min Winter	8.530	0.280	10.0	77.3	O K
4320 min Winter	8.300	0.050	9.9	13.8	O K
5760 min Winter	8.291	0.041	8.2	11.4	O K
7200 min Winter	8.286	0.036	7.2	10.0	O K
8640 min Winter	8.283	0.033	6.5	9.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.140	0.0	5040
15 min Winter	101.817	0.0	18
30 min Winter	68.482	0.0	33
60 min Winter	44.117	0.0	62
120 min Winter	27.070	0.0	118
180 min Winter	20.322	0.0	174
240 min Winter	16.550	0.0	226
360 min Winter	12.327	0.0	282
480 min Winter	9.959	0.0	362
600 min Winter	8.418	0.0	440
720 min Winter	7.325	0.0	518
960 min Winter	5.859	0.0	672
1440 min Winter	4.263	0.0	966
2160 min Winter	3.106	0.0	1364
2880 min Winter	2.497	0.0	1704
4320 min Winter	1.872	0.0	2204
5760 min Winter	1.550	0.0	2936
7200 min Winter	1.358	0.0	3568
8640 min Winter	1.231	0.0	4400

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.281	0.031	6.1	8.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.140	0.0	5096

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.797

Time (mins) From:	To:	Area (ha)
0	4	0.797

james&nicholas		Micro Drainage
Date 30/05/2022 14:05	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m) 8.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	291.0	276.4	1.000	291.0	276.4

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.26000	Trench Length (m)	388.0
Safety Factor	2.0	Slope (1:X)	142.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	9.000	Cap Infiltration Depth (m)	0.000

james&nicholas		Micro Drainage
Date 30/05/2022 14:04	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 289 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.118	0.868	10.7	240.5	O K
30 min Summer	9.387	1.137	12.7	319.7	O K
60 min Summer	9.638	1.388	15.4	398.2	O K
120 min Summer	9.789	1.539	17.3	447.7	Flood Risk
180 min Summer	9.845	1.595	18.0	466.2	Flood Risk
240 min Summer	9.863	1.613	18.3	472.3	Flood Risk
360 min Summer	9.864	1.614	18.3	472.6	Flood Risk
480 min Summer	9.839	1.589	17.9	464.2	Flood Risk
600 min Summer	9.804	1.554	17.4	452.4	Flood Risk
720 min Summer	9.766	1.516	16.9	439.9	Flood Risk
960 min Summer	9.689	1.439	16.0	414.6	O K
1440 min Summer	9.538	1.288	14.2	366.4	O K
2160 min Summer	9.337	1.087	12.3	304.5	O K
2880 min Summer	9.163	0.913	11.0	253.2	O K
4320 min Summer	8.848	0.598	10.0	165.4	O K
5760 min Summer	8.619	0.369	10.0	102.0	O K
7200 min Summer	8.475	0.225	10.0	62.1	O K
8640 min Summer	8.386	0.136	10.0	37.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	19
30 min Summer	89.648	0.0	33
60 min Summer	58.187	0.0	62
120 min Summer	35.502	0.0	122
180 min Summer	26.659	0.0	180
240 min Summer	21.716	0.0	208
360 min Summer	16.145	0.0	270
480 min Summer	13.001	0.0	338
600 min Summer	10.944	0.0	410
720 min Summer	9.481	0.0	480
960 min Summer	7.517	0.0	618
1440 min Summer	5.373	0.0	896
2160 min Summer	3.828	0.0	1300
2880 min Summer	3.025	0.0	1704
4320 min Summer	2.215	0.0	2464
5760 min Summer	1.806	0.0	3168
7200 min Summer	1.568	0.0	3824
8640 min Summer	1.413	0.0	4504

james&nicholas		Micro Drainage
Date 30/05/2022 14:04	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	8.333	0.083	10.0	23.0	O K
15 min Winter	9.119	0.869	10.7	240.7	O K
30 min Winter	9.389	1.139	12.8	320.2	O K
60 min Winter	9.643	1.393	15.4	399.7	O K
120 min Winter	9.801	1.551	17.4	451.6	Flood Risk
180 min Winter	9.864	1.614	18.3	472.6	Flood Risk
240 min Winter	9.882	1.632	18.5	478.8	Flood Risk
360 min Winter	9.878	1.628	18.5	477.4	Flood Risk
480 min Winter	9.846	1.596	18.0	466.7	Flood Risk
600 min Winter	9.799	1.549	17.4	450.7	Flood Risk
720 min Winter	9.749	1.499	16.7	434.4	Flood Risk
960 min Winter	9.647	1.397	15.5	401.1	O K
1440 min Winter	9.444	1.194	13.3	337.2	O K
2160 min Winter	9.160	0.910	10.9	252.6	O K
2880 min Winter	8.867	0.617	10.0	170.5	O K
4320 min Winter	8.437	0.187	10.0	51.8	O K
5760 min Winter	8.298	0.048	9.6	13.3	O K
7200 min Winter	8.292	0.042	8.3	11.5	O K
8640 min Winter	8.288	0.038	7.5	10.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	5152
15 min Winter	132.256	0.0	18
30 min Winter	89.648	0.0	33
60 min Winter	58.187	0.0	62
120 min Winter	35.502	0.0	118
180 min Winter	26.659	0.0	174
240 min Winter	21.716	0.0	224
360 min Winter	16.145	0.0	280
480 min Winter	13.001	0.0	358
600 min Winter	10.944	0.0	436
720 min Winter	9.481	0.0	514
960 min Winter	7.517	0.0	666
1440 min Winter	5.373	0.0	966
2160 min Winter	3.828	0.0	1404
2880 min Winter	3.025	0.0	1812
4320 min Winter	2.215	0.0	2460
5760 min Winter	1.806	0.0	2880
7200 min Winter	1.568	0.0	3672
8640 min Winter	1.413	0.0	4336

james&nicholas		Micro Drainage
Date 30/05/2022 14:04	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	8.285	0.035	6.9	9.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	5136

jamesnicholas		Micro Drainage
Date 30/05/2022 14:04	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.797

Time (mins) From:	To:	Area (ha)
0	4	0.797

james&nicholas		Micro Drainage
Date 30/05/2022 14:04	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Complex Structure

Cellular Storage

Invert Level (m)	8.250	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.26000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.26000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	291.0	276.4	1.000	291.0	276.4

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.26000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.26000	Trench Length (m)	388.0
Safety Factor	2.0	Slope (1:X)	142.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	9.000	Cap Infiltration Depth (m)	0.000

APPENDIX H

INFILTRATION BASIN 1 IN 1, 1 IN 30 AND 1 IN 100-YEAR CALCULATIONS

james&nicholas

Date 30/05/2022 14:03 | Designed by karlj

Micro Drainage

Innovyze | Source Control 2019.1

Summary of Results for 1 year Return Period (+40%)

Half Drain Time : 47 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.427	0.227	4.6	18.0	O K
30 min Summer	9.464	0.264	5.0	21.6	O K
60 min Summer	9.485	0.285	5.2	23.6	O K
120 min Summer	9.511	0.311	5.5	26.3	O K
180 min Summer	9.514	0.314	5.5	26.7	O K
240 min Summer	9.510	0.310	5.5	26.3	O K
360 min Summer	9.493	0.293	5.3	24.5	O K
480 min Summer	9.473	0.273	5.1	22.5	O K
600 min Summer	9.453	0.253	4.9	20.5	O K
720 min Summer	9.433	0.233	4.7	18.6	O K
960 min Summer	9.397	0.197	4.3	15.3	O K
1440 min Summer	9.341	0.141	3.8	10.4	O K
2160 min Summer	9.285	0.085	3.2	6.1	O K
2880 min Summer	9.255	0.055	2.9	3.8	O K
4320 min Summer	9.241	0.041	2.3	2.8	O K
5760 min Summer	9.235	0.035	2.0	2.4	O K
7200 min Summer	9.231	0.031	1.7	2.1	O K
8640 min Summer	9.229	0.029	1.6	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	48.186	0.0	17
30 min Summer	31.737	0.0	30
60 min Summer	20.272	0.0	48
120 min Summer	13.646	0.0	82
180 min Summer	10.686	0.0	116
240 min Summer	8.930	0.0	152
360 min Summer	6.868	0.0	218
480 min Summer	5.664	0.0	284
600 min Summer	4.861	0.0	348
720 min Summer	4.280	0.0	410
960 min Summer	3.485	0.0	532
1440 min Summer	2.604	0.0	778
2160 min Summer	1.947	0.0	1128
2880 min Summer	1.593	0.0	1472
4320 min Summer	1.222	0.0	2200
5760 min Summer	1.027	0.0	2896
7200 min Summer	0.908	0.0	3672
8640 min Summer	0.828	0.0	4360

james&nicholas

Date 30/05/2022 14:03 | Designed by karlj

Innovyze | Source Control 2019.1

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	9.227	0.027	1.5	1.8	O K
15 min Winter	9.427	0.227	4.6	18.0	O K
30 min Winter	9.465	0.265	5.0	21.7	O K
60 min Winter	9.484	0.284	5.2	23.6	O K
120 min Winter	9.504	0.304	5.4	25.7	O K
180 min Winter	9.500	0.300	5.4	25.2	O K
240 min Winter	9.489	0.289	5.3	24.0	O K
360 min Winter	9.459	0.259	5.0	21.1	O K
480 min Winter	9.428	0.228	4.6	18.1	O K
600 min Winter	9.399	0.199	4.3	15.4	O K
720 min Winter	9.373	0.173	4.1	13.1	O K
960 min Winter	9.327	0.127	3.6	9.3	O K
1440 min Winter	9.265	0.065	3.0	4.6	O K
2160 min Winter	9.242	0.042	2.4	2.9	O K
2880 min Winter	9.235	0.035	2.0	2.4	O K
4320 min Winter	9.228	0.028	1.5	1.9	O K
5760 min Winter	9.223	0.023	1.3	1.6	O K
7200 min Winter	9.221	0.021	1.1	1.4	O K
8640 min Winter	9.219	0.019	1.0	1.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	0.770	0.0	5136
15 min Winter	48.186	0.0	17
30 min Winter	31.737	0.0	30
60 min Winter	20.272	0.0	48
120 min Winter	13.646	0.0	88
180 min Winter	10.686	0.0	126
240 min Winter	8.930	0.0	162
360 min Winter	6.868	0.0	230
480 min Winter	5.664	0.0	296
600 min Winter	4.861	0.0	362
720 min Winter	4.280	0.0	424
960 min Winter	3.485	0.0	548
1440 min Winter	2.604	0.0	778
2160 min Winter	1.947	0.0	1100
2880 min Winter	1.593	0.0	1456
4320 min Winter	1.222	0.0	2200
5760 min Winter	1.027	0.0	2912
7200 min Winter	0.908	0.0	3656
8640 min Winter	0.828	0.0	4392

james&nicholas		Micro Drainage
Date 30/05/2022 14:03	Designed by karlj	
Innovyze	Source Control 2019.1	

Summary of Results for 1 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	9.218	0.018	1.0	1.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	0.770	0.0	4992

Rainfall Details

Rainfall Model	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.184

Time (mins) From:	To:	Area (ha)
0	4	0.184

Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Basin Structure

Invert Level (m) 9.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	66.0	0.800	185.0

james&nicholas

Date 30/05/2022 14:02 | Designed by karlj

Micro Drainage

Innovyze | Source Control 2019.1

Summary of Results for 30 year Return Period (+40%)

Half Drain Time : 79 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.630	0.430	6.8	39.9	O K
30 min Summer	9.711	0.511	7.7	50.3	Flood Risk
60 min Summer	9.762	0.562	8.3	57.4	Flood Risk
120 min Summer	9.777	0.577	8.5	59.6	Flood Risk
180 min Summer	9.774	0.574	8.4	59.1	Flood Risk
240 min Summer	9.764	0.564	8.3	57.7	Flood Risk
360 min Summer	9.735	0.535	8.0	53.6	Flood Risk
480 min Summer	9.705	0.505	7.6	49.5	Flood Risk
600 min Summer	9.676	0.476	7.3	45.7	O K
720 min Summer	9.648	0.448	7.0	42.1	O K
960 min Summer	9.596	0.396	6.4	35.9	O K
1440 min Summer	9.514	0.314	5.5	26.6	O K
2160 min Summer	9.425	0.225	4.6	17.9	O K
2880 min Summer	9.365	0.165	4.0	12.5	O K
4320 min Summer	9.292	0.092	3.3	6.5	O K
5760 min Summer	9.255	0.055	2.9	3.8	O K
7200 min Summer	9.246	0.046	2.6	3.1	O K
8640 min Summer	9.242	0.042	2.4	2.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	101.817	0.0	17
30 min Summer	68.482	0.0	31
60 min Summer	44.117	0.0	54
120 min Summer	27.070	0.0	86
180 min Summer	20.322	0.0	122
240 min Summer	16.550	0.0	156
360 min Summer	12.327	0.0	224
480 min Summer	9.959	0.0	290
600 min Summer	8.418	0.0	356
720 min Summer	7.325	0.0	420
960 min Summer	5.859	0.0	546
1440 min Summer	4.263	0.0	794
2160 min Summer	3.106	0.0	1148
2880 min Summer	2.497	0.0	1504
4320 min Summer	1.872	0.0	2208
5760 min Summer	1.550	0.0	2936
7200 min Summer	1.358	0.0	3632
8640 min Summer	1.231	0.0	4344

Date 30/05/2022 14:02 | Designed by karlj | Checked by

Innovyze | Source Control 2019.1

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	9.239	0.039	2.2	2.6	O K
15 min Winter	9.631	0.431	6.8	40.0	O K
30 min Winter	9.713	0.513	7.7	50.6	Flood Risk
60 min Winter	9.765	0.565	8.3	57.9	Flood Risk
120 min Winter	9.774	0.574	8.4	59.2	Flood Risk
180 min Winter	9.764	0.564	8.3	57.7	Flood Risk
240 min Winter	9.745	0.545	8.1	55.1	Flood Risk
360 min Winter	9.702	0.502	7.6	49.1	Flood Risk
480 min Winter	9.659	0.459	7.1	43.5	O K
600 min Winter	9.618	0.418	6.7	38.5	O K
720 min Winter	9.581	0.381	6.3	34.0	O K
960 min Winter	9.515	0.315	5.6	26.8	O K
1440 min Winter	9.416	0.216	4.5	17.0	O K
2160 min Winter	9.320	0.120	3.5	8.7	O K
2880 min Winter	9.262	0.062	3.0	4.3	O K
4320 min Winter	9.241	0.041	2.3	2.8	O K
5760 min Winter	9.234	0.034	1.9	2.3	O K
7200 min Winter	9.230	0.030	1.7	2.0	O K
8640 min Winter	9.228	0.028	1.5	1.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.140	0.0	5072
15 min Winter	101.817	0.0	17
30 min Winter	68.482	0.0	31
60 min Winter	44.117	0.0	58
120 min Winter	27.070	0.0	92
180 min Winter	20.322	0.0	130
240 min Winter	16.550	0.0	168
360 min Winter	12.327	0.0	238
480 min Winter	9.959	0.0	308
600 min Winter	8.418	0.0	374
720 min Winter	7.325	0.0	440
960 min Winter	5.859	0.0	568
1440 min Winter	4.263	0.0	810
2160 min Winter	3.106	0.0	1168
2880 min Winter	2.497	0.0	1500
4320 min Winter	1.872	0.0	2204
5760 min Winter	1.550	0.0	2936
7200 min Winter	1.358	0.0	3672
8640 min Winter	1.231	0.0	4384

james&nicholas		Micro Drainage
Date 30/05/2022 14:02	Designed by karlj	
Innovyze	Source Control 2019.1	

Summary of Results for 30 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	9.226	0.026	1.4	1.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.140	0.0	5088

Rainfall Details

Rainfall Model	FEH
Return Period (years)	30
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.184

Time (mins) From:	To:	Area (ha)
0	4	0.184

james&nicholas		Micro Drainage
Date 30/05/2022 14:02	Designed by karlj	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Basin Structure

Invert Level (m) 9.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	66.0	0.800	185.0

james&nicholas

Date 30/05/2022 13:59 | Designed by karlj

Micro Drainage

Innovyze | Source Control 2019.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 81 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.727	0.527	7.9	52.5	Flood Risk
30 min Summer	9.828	0.628	9.0	67.2	Flood Risk
60 min Summer	9.897	0.697	9.9	78.3	Flood Risk
120 min Summer	9.916	0.716	10.1	81.5	Flood Risk
180 min Summer	9.918	0.718	10.1	81.8	Flood Risk
240 min Summer	9.910	0.710	10.0	80.6	Flood Risk
360 min Summer	9.882	0.682	9.7	75.8	Flood Risk
480 min Summer	9.848	0.648	9.3	70.4	Flood Risk
600 min Summer	9.815	0.615	8.9	65.2	Flood Risk
720 min Summer	9.782	0.582	8.5	60.4	Flood Risk
960 min Summer	9.722	0.522	7.8	51.8	Flood Risk
1440 min Summer	9.621	0.421	6.7	38.8	O K
2160 min Summer	9.512	0.312	5.5	26.4	O K
2880 min Summer	9.436	0.236	4.7	18.9	O K
4320 min Summer	9.343	0.143	3.8	10.6	O K
5760 min Summer	9.289	0.089	3.2	6.3	O K
7200 min Summer	9.258	0.058	2.9	4.0	O K
8640 min Summer	9.247	0.047	2.7	3.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.256	0.0	18
30 min Summer	89.648	0.0	32
60 min Summer	58.187	0.0	58
120 min Summer	35.502	0.0	88
180 min Summer	26.659	0.0	124
240 min Summer	21.716	0.0	158
360 min Summer	16.145	0.0	226
480 min Summer	13.001	0.0	294
600 min Summer	10.944	0.0	360
720 min Summer	9.481	0.0	426
960 min Summer	7.517	0.0	550
1440 min Summer	5.373	0.0	794
2160 min Summer	3.828	0.0	1164
2880 min Summer	3.025	0.0	1528
4320 min Summer	2.215	0.0	2248
5760 min Summer	1.806	0.0	2944
7200 min Summer	1.568	0.0	3672
8640 min Summer	1.413	0.0	4312

jAMES&nicholAS		Micro Drainage
Date 30/05/2022 13:59	Designed by karlj Checked by	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Summer	9.244	0.044	2.5	3.0	O K
15 min Winter	9.727	0.527	7.9	52.6	Flood Risk
30 min Winter	9.830	0.630	9.1	67.6	Flood Risk
60 min Winter	9.901	0.701	9.9	79.0	Flood Risk
120 min Winter	9.915	0.715	10.1	81.3	Flood Risk
180 min Winter	9.909	0.709	10.0	80.4	Flood Risk
240 min Winter	9.894	0.694	9.8	77.8	Flood Risk
360 min Winter	9.849	0.649	9.3	70.6	Flood Risk
480 min Winter	9.802	0.602	8.7	63.2	Flood Risk
600 min Winter	9.756	0.556	8.2	56.5	Flood Risk
720 min Winter	9.713	0.513	7.7	50.6	Flood Risk
960 min Winter	9.635	0.435	6.9	40.5	O K
1440 min Winter	9.514	0.314	5.5	26.7	O K
2160 min Winter	9.394	0.194	4.3	15.0	O K
2880 min Winter	9.318	0.118	3.5	8.6	O K
4320 min Winter	9.248	0.048	2.7	3.3	O K
5760 min Winter	9.240	0.040	2.2	2.7	O K
7200 min Winter	9.235	0.035	1.9	2.4	O K
8640 min Winter	9.232	0.032	1.8	2.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Summer	1.306	0.0	5120
15 min Winter	132.256	0.0	17
30 min Winter	89.648	0.0	31
60 min Winter	58.187	0.0	58
120 min Winter	35.502	0.0	94
180 min Winter	26.659	0.0	132
240 min Winter	21.716	0.0	170
360 min Winter	16.145	0.0	242
480 min Winter	13.001	0.0	312
600 min Winter	10.944	0.0	380
720 min Winter	9.481	0.0	446
960 min Winter	7.517	0.0	572
1440 min Winter	5.373	0.0	822
2160 min Winter	3.828	0.0	1188
2880 min Winter	3.025	0.0	1532
4320 min Winter	2.215	0.0	2148
5760 min Winter	1.806	0.0	2944
7200 min Winter	1.568	0.0	3632
8640 min Winter	1.413	0.0	4296

james&nicholas		Micro Drainage
Date 30/05/2022 13:59	Designed by karlj	
Innovyze	Source Control 2019.1	

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
10080 min Winter	9.229	0.029	1.6	2.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
10080 min Winter	1.306	0.0	5104

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 321481 176363 ST 21481 76363
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.184

Time (mins) From:	To:	Area (ha)
0	4	0.184

james&nicholas		Micro Drainage
Date 30/05/2022 13:59	Designed by karlj	
Innovyze	Source Control 2019.1	

Model Details

Storage is Online Cover Level (m) 10.000

Infiltration Basin Structure

Invert Level (m) 9.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.26000 Porosity 1.00
Infiltration Coefficient Side (m/hr) 0.26000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	66.0	0.800	185.0