ASPHALT BATCHING PLANT
CELSA STEEL WORKS
ROVER WAY
CARDIFF

Flood Consequences Assessment

Prepared for: Harsco Metals Group Ltd

SLR Ref: 416.09604.00001
Version No: FINAL
June 2019

BASIS OF REPORT

CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

DRAWINGS

APPENDICES

1.0 Introduction

1.1 Terms of Reference

SLR Consulting Limited (SLR) was appointed by Harsco Metals Group Ltd to prepare a Flood Consequences Assessment (FCA) to support a planning application for the installation and operation of an Asphalt Batching Plant and associated infrastructure within the Celsa Steel Works site on land to the south of Rover Way, Cardiff, CF24 5PH (the Site).

1.2 Site Location

The application site, which is approximately 1.13 hectares (ha) (11,300m^2) in area, is located entirely within the administrative boundary of Cardiff Council and the electoral ward of Splott. The site is located within the eastern confines of Cardiff, approximately 2.5km east of the city centre and immediately south of Tremorfa.

1.3 Existing Site & Surroundings

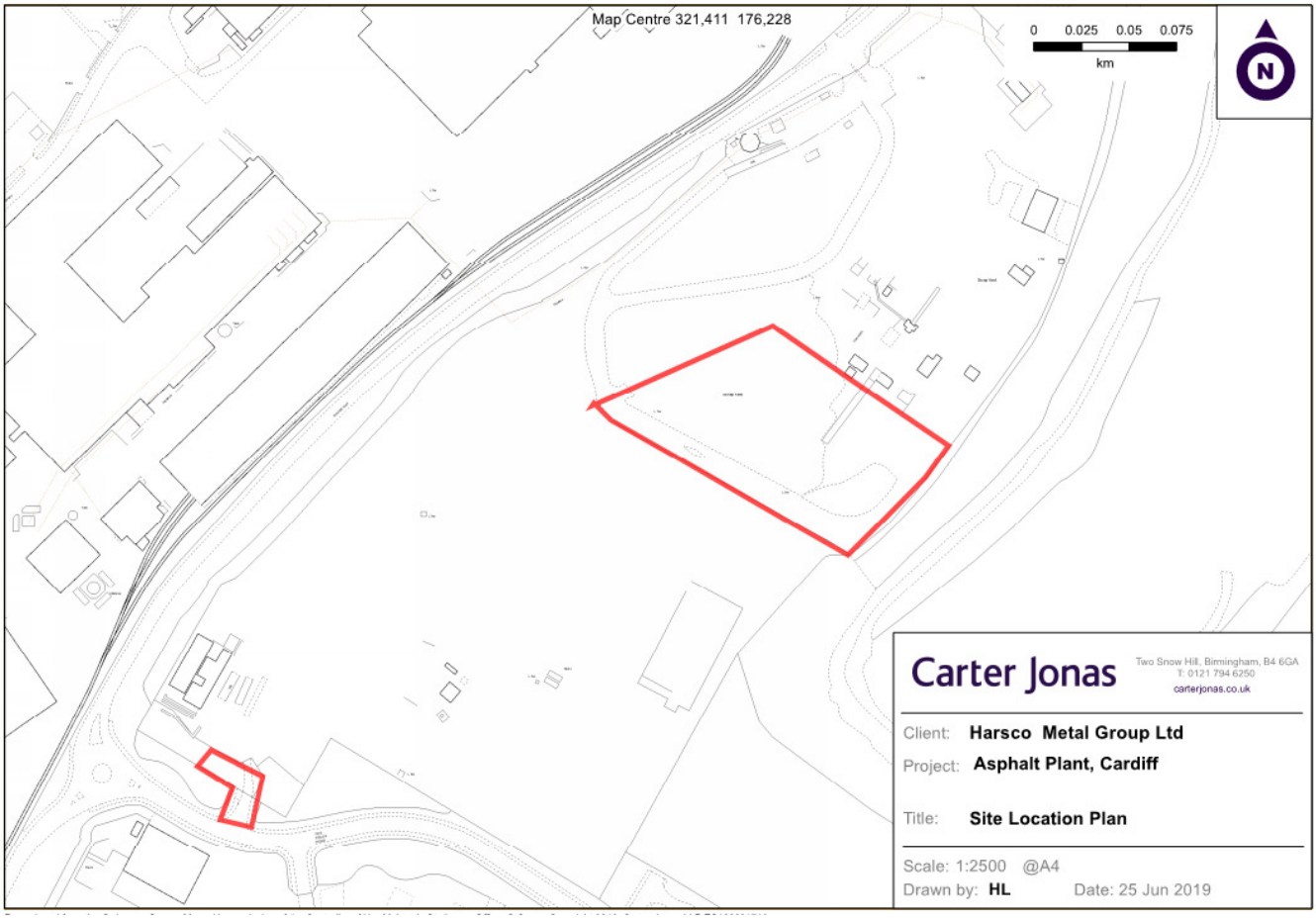
The site, which is irregular in shape, is located within the southern extent of the wider Celsa Steel UK site on Rover Way. This southern operational area is bound by Rover Way to the north and west, beyond which is the remainder of the Celsa Steel UK site, including the principal smelt shop and other industrial buildings. Tide Fields Road bounds the site to the south, beyond which is a Welsh Water works. Finally, the site is bound by an unnamed track to the east, beyond which is Cardiff Motocross Centre MX and the Severn Estuary

Access into the southern Celsa Steel site is taken either from the northern boundary, via Rover Way, or via the southern boundary, via Tide Fields Road.

The asphalt plant is to be located within a 1.13 ha (11,300m^2) plot within the north-eastern confines of the southern Celsa Steel UK site. This plot is bound by internal haul roads along its north-western and south-western bounds. The asphalt plant area is then bound by further operational waste sorting land to the north-east and scrub land to the south-east, beyond which is the Cardiff Motocross Centre MX and the Severn Estuary. The asphalt plant is centred at National Grid Reference (NGR) ST 21470 76265 as illustrated by Figure 1-1.

The general arrangement of the proposed development is shown by Drawing O1994-00-01-07.05 Rev 2 enclosed at Appendix 03.

Figure 1-1: Site Location Plan



1.4 Best Practice

This FCA has been prepared under the direction of a Technical Director for Hydrology at SLR who specialises in flood risk and associated planning matters. This FCA report has been completed in accordance with guidance presented within the latest revision of Planning Policy Wales[1] (PPW) and its associated Technical Advice Note 15[2] (TAN15), taking due account of current best practice documents relating to assessment of flood risk published by the British Standards Institution BS8533[3].

1 Planning Policy Wales Edition 10, Welsh Government (December 2018)
2 Technical Advice Note 15: Development and Flood Risk to Planning Policy Wales (2004)
3 BS8533:2011, Assessing and managing flood risk in development: Code of Practice (1st Edition, October 2011)

2.0 Site Appraisal

2.1 Topography

A topographic survey was completed by Alpine Land Surveyors Ltd in April 2019 and is enclosed at Appendix 01.

With reference to the survey there is very little topographic variation across the location of the proposed asphalt plant, with levels varying between approximately 9.1m AOD to 9.6m AOD.

2.2 Hydrological Features

There are no hydrological features located on the Site. Rhymney River is located approximately 1km north of the Site, and the Bristol Channel located approximately 230m to the east of the Site. Cardiff Bay is located approximately 3km south west of the Site. A combined sewer passes under the eastern part of the Site, from northeast to southwest. Welsh Water Asset Maps are enclosed in Appendix 02.

2.3 Existing Drainage Arrangements

The proposed area of the asphalt plant is currently laid mainly to concrete, however, in places the concrete has deteriorated. There is evidence that some parts of the concrete hardstanding may have been formally drained, however, there are no records of the former drainage system. In the absence of any watercourses, or drains, in the vicinity of the site, it is likely that the any drainage system that may have existed discharged to soakaways rather than to the combined sewer.

2.4 Geological and Hydrogeological Features

A site investigation completed by Terra Firma (Wales) Limited reported that the site is underlain by a mantle of very dense made ground over alluvium which is underlain by the Mercia Mudstone Group. This consistent with published geological mapping that indicates the site is underlain by the '*Mercia Mudstone Group - Mudstone*' with superficial deposits of '*Tidal Flat Deposits - Clay, Silt and Sand'.*

The site investigation encountered made ground to a depth of between 7.3 and 7.7m indicating the extensive filling that has taken place in the past.

The bedrock beneath the site is designated by Natural Resources Wales as a Secondary B aquifer[4], described as *'predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.'*

4 British Geological Survey Aquifer designation data, http://mapapps2.bgs.ac.uk/geoindex/home.html

3.0 Development Proposals

The proposed development will involve the construction of an Asphalt Batching Plant and associated infrastructure at the Celsa Steel Works site.

The plant will be located within the central confines of the red line site area as shown by Figure 1-1, with an area to the west utilised for vehicular access, fill and departure via entry and exit weighbridges. Within the eastern confines of the site, there will be a total of five bunded materials storage bays located along the northern and southern boundaries, thereby leaving a central area for the manoeuvring of vehicles.

The materials storage bays will be constructed from large prefabricated concrete blocks which lock together when stacked and covered by way of a pre-fabricated roof to keep materials dry.

To accommodate the new concrete pad and erection of the Asphalt Batching Plant, a settlement lagoon and soakaway is to be constructed along the northeastern boundary of the application site (adjacent to the SIMS Metal site). This is discussed further in Section 9.0.

The batching plant itself will comprise of a range of storage silos, feed and weigh hoppers, belt feeders, conveyors, a rotary dryer, bucket elevator, deck screens, paddle mixer, dust collection skimmer and fill bag, bitumen tanks, fibre pellet additive system and a control cabin.

Delivery vehicles and mixer trucks will access the site via the internal haul roads within the Celsa Steel Works site, gaining access to and from the highway via Tide Fields Road which bounds the site to the south. No vehicular access will be available via the access onto Rover Way

There is an existing concrete pad on site and this will be utilised as part of the proposals. As such, the proposed works would include for the upgrading of the existing concrete pad where necessary to support the weight of the Asphalt Batching Plant, weighbridges and associated HGVs.

The general arrangement of the proposed asphalt plant is shown by Drawing O1994-00-01-07.05 Rev 2 enclosed at Appendix 03.

4.0 Potential Sources of Flooding

4.1 Screening Study

There are a number of potential sources of flooding and these include:

- Flooding from rivers or fluvial flooding;
- Flooding from the sea or tidal flooding;
- Flooding from surface water/land;
- Flooding from groundwater;
- Flooding from sewers; and
- Flooding from reservoirs, canals, and other artificial sources.

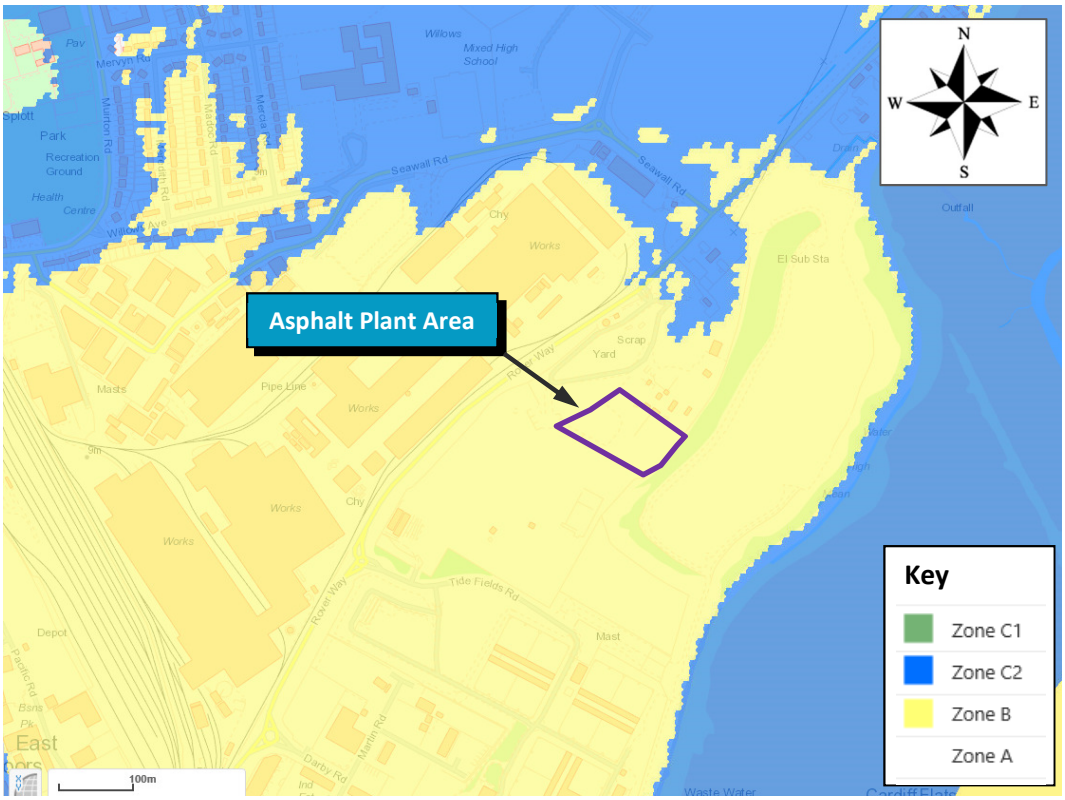
The flood risk from each of these potential sources is discussed below.

4.1.1 Flooding from Fluvial or Tidal Flooding

The indicative flood maps published on the Development Advice Map (DAM) for Wales website[5] indicate that the Site lies within Zone B, which is defined as land known to have flooded in the past, as evidenced by sedimentary deposits. An extract of the Development Advice Maps is provided by Figure 4-1.

The flood risk from tidal and fluvial sources is therefore considered further in Section 5.0.

Figure 4-1: Extract of the Development Advice Map for Wales

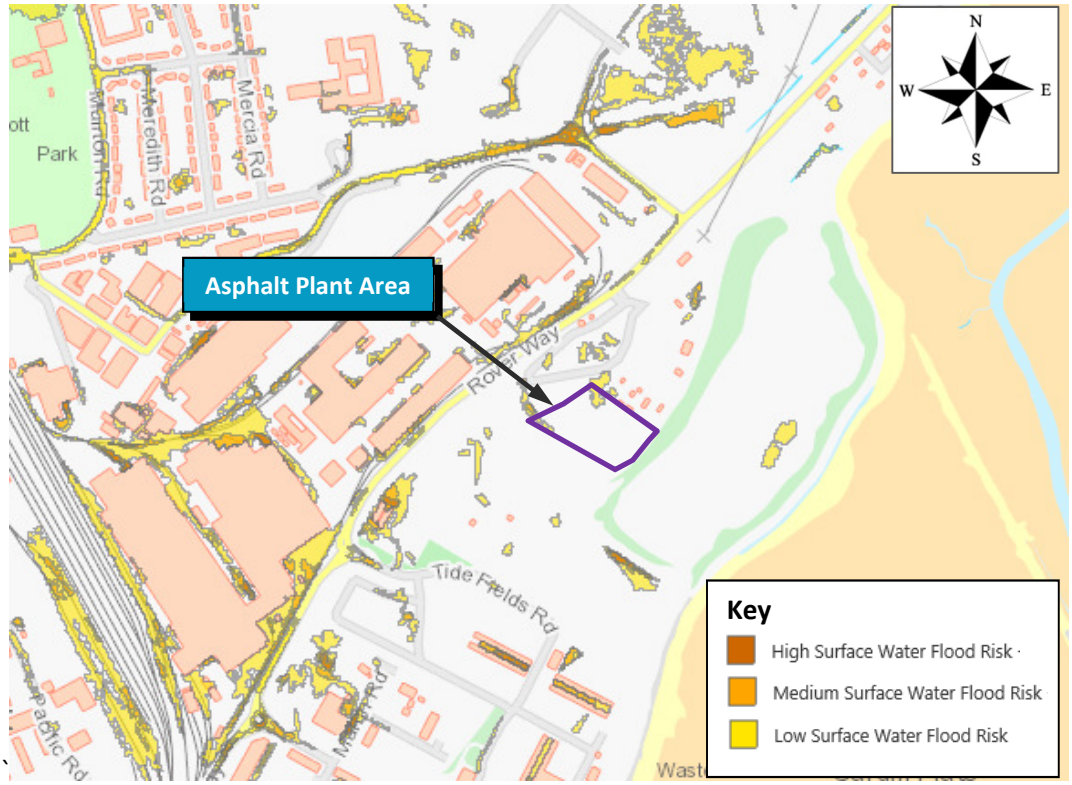


5 Natural Resources Wales, Development Advice Map (Accessed June 2019) https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en

4.1.2 Flooding from Surface Water/Land

The Natural Resources Wales (NRW) Surface Water Flood Risk Maps indicate that the majority of the Site is not at risk of surface water flooding, however there are some areas within the application boundary that are at Low risk of surface water flooding. These are isolated areas of surface water ponding and are not connected to any overland flow path. An extract of the Surface Water Flood Risk Map for Wales is provided in Figure 4-2.

Figure 4-2: Extract of the Surface Water Flood Risk Map for Wales



The predicted flooding depth in these limited area for rainfall events with a return period between 1 in 1,000 (0.1% AEP[6]) and 1 in 100 (1% AEP) is between 0.15m and 0.30m.

Surface water flood risk at the Site is therefore low and has not been considered further.

4.1.3 Flooding from Groundwater

The flood risk from elevated groundwater levels is considered unlikely to give rise to a significant flood risk. Underlying geology at site is shown as tidal flat superficial deposits overlying mudstone bedrock with a significant mantle of made ground.

No incidences of groundwater flooding have been recorded at the Site, therefore the risk is deemed to be negligible and has not been considered further.

4.1.4 Flooding from Sewers

Welsh Water asset maps show a combined sewer running north east to south west through the centre of the Site. A copy of these plans is provided in Appendix 02. It is understood that there are no manholes on the route

6 Annual Exceedance Probability

of this large diameter sewer in the vicinity of the Site and the likelihood of a sewer of this diameter blocking is considered remote.

Flooding from this source is therefore considered unlikely to be significant and has not been considered further.

4.1.5 Flooding from Reservoirs, Canals and other Artificial Sources

The NRW Risk of Flooding from Reservoirs mapping indicates that there is no significant risk of flooding from this source.

There are no canals or other artificial sources of flood risk in the vicinity of the Site.

Flooding from these sources has therefore not been considered further.

4.2 Summary of Sources of Flooding

A summary of the potential sources of flooding and the flood risk arising from them is presented in Table 4-1.

Table 4-1 Potential Sources of Flooding

Potential Source of Flooding	Flood Risk at the Site
Fluvial or Tidal Flooding	**Yes**
Surface Water/Land	No
Groundwater	No
Sewers	No
Reservoirs, Canals and other Artificial Sources	No

5.0 Assessment of flood risk

5.1 Screening

The review of potential flood risk at the Site summarised in Table 4-1 indicates that the Site may have been subject to historic flooding based on the presence of sedimentary deposits.

A review of available data has therefore been completed to assess the potential flood risk to the Site.

5.2 NRW Data

A formal data request was made to NRW to obtain modelled flood levels in the vicinity of the Site. This response is contained in Appendix 04. NRW confirm that the principal flood risk to the site is from the tidal River Severn.

The current tidal flood map in this area was updated by NRW in 2013. This mapping study uses peak sea levels from within the Severn Estuary, based on the set of extreme sea levels published by the Environment Agency in 2011 for the baseline year of 2008.

Modelled levels for the Site have been estimated based on interpolation between upstream and downstream model nodes. The baseline (2008) potential peak water levels for a range of return periods are presents in Table 5-1.

Table 5-1 2008 Baseline Extreme Sea Levels (m AOD) (including the 95% confidence band)

Location	Annual Exceedence Probability (AEP)					
	4%	2%	1.33%	1%	0.5%	0.1%
Site	7.93	8.04	8.22	8.28	8.51	9.08

With reference to the topographic survey enclosed at Appendix 01, the data in Table 5-1 indicates that the Site lies above the 0.1% AEP event for baseline extreme sea levels. This is consistent with Drawing '*Figure 1: Current Floodmap [V201901]*' enclosed at Appendix 04.

6.0 Climate Change

NRW have adjusted the 2008 baseline data based on the DEFRA climate change guidance set out in Table 6-1.

Table 6-1 Sea Level Rise

Assumed Vertical Land Movement	1990-2025	2025-2055	2055-2085	2085-2115
-0.5mm	3.5mm/yr	8.0mm/yr	11.5mm/yr	14.5mm/yr

Based on an assumed 75-year life of the proposed development up to 2094, NRW have calculated the potential peak water levels at the site, including an adjustment based on data confidence. The potential peak water levels for the life of the proposed development are summarised in Table 6-2.

Table 6-2 Peak Water Levels up to 2094

Year	Sea Level Rise (m)	Sea Level (m aOD)	
		0.5%	0.1%
2019	0.0385	8.55	9.12
2094	0.7750	9.29	9.86

With reference to the topographic survey enclosed at Appendix 01, that with the advent of climate change, the lower-lying parts of the Site may be at risk of tidal flooding over the lifetime of the development.

7.0 Policy Requirements for the Development

7.1 National Planning Policy

The planning system regulates development and land use in the public interest, with the aim of ensuring sustainable development that balances environmental, economic and social needs of society.

In Wales, a series of planning policy technical advice notes provide advice on a number of subjects. TAN15 aims to reduce, or at the very least avoid increasing, flood risk by ensuring an integrated approach to land use planning and flood risk management. To achieve this, local authorities are responsible for controlling development, including that in the floodplain which may be affected by flooding, or where changes in runoff may increase flood risk elsewhere.

Developers are required to provide an assessment demonstrating the following:

- The consequences of flooding on the proposed development.
- The consequences of the proposed development on flood risk elsewhere within the locality for a range of potential flooding scenarios.
- That appropriate mitigation measures can be incorporated within the design of the development to ensure the development minimises risk to life, damage to property and disruption to others living and working on the Site or elsewhere.

7.2 Site Acceptability

Section 6 of TAN15[2] requires that new development should be directed away from Zone C and towards suitable land in Zone A or Zone B. With reference to TAN15 Figure 2, the proposed development would be considered a *'Less vulnerable development'*.

Given the context of the proposed development, an asphalt plant located on the wider Cesla Steel Works site, and its position within Zone B of the DAM, the application is considered to be appropriate in terms of flood risk.

With reference to the topographic survey enclosed at Appendix 01, the Site is above the current 0.1% AEP tidal flood level. On this basis TAN15 does not require application of the Justification Test.

8.0 Flood Mitigation Measures

Whilst the Justification Test does not have to be applied to the proposed development, it is appropriate to consider if any flood mitigation measures are required, particularly given the potential impact of climate change on sea levels.

In addition, the impact of the proposed development on the flood risk elsewhere should be considered.

8.1 Design Flood Level

Paragraph A1.14 of TAN15 sets out recommend 'thresholds' for acceptable frequency of flooding. Given the type of development, a 0.5% AEP threshold is considered appropriate for the Asphalt Plant.

Therefore, based on the predicted peak tidal flood levels for the Site over the lifetime of the development and allowing a minimum freeboard of 300mm to cater for uncertainty, it is the proposed that design flood level of **9.59m AOD** is adopted.

8.2 Flood Resilience

It is recommended that any static plant, or equipment, that might be vulnerable to the effects of floodwaters is set at a minimum level of **9.59m AOD.** This would apply particularly to any electrical equipment.

8.3 Flood Risk Elsewhere

The proposed development will not significantly alter existing ground levels and therefore there will be no reduction in floodplain storage or obstruction of flood flows. The proposed drainage strategy described in Section 9.0 will require some limited earthworks to provide a positive drainage system, however, these aim to balance cut and fill volumes.

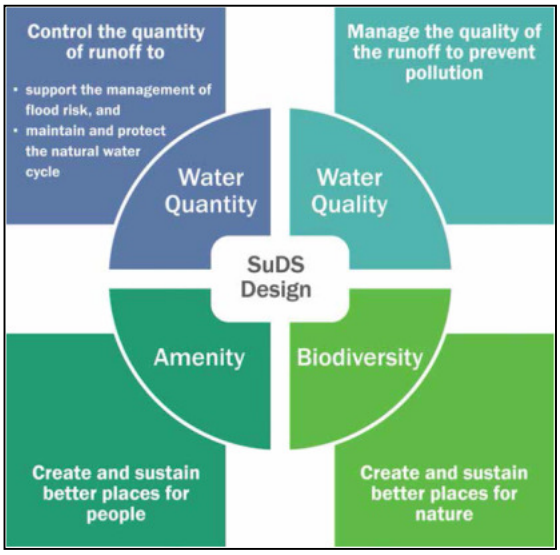
A surface water drainage strategy has been developed to ensure that the proposed development will not increase the flood risk elsewhere through an increase surface water runoff. This is described in Section 9.0.

9.0 Surface Water Drainage

9.1 Sustainable Drainage Systems

Current best practice guidance, The SuDS Manual (CIRIA Report C753)[7], promotes sustainable water management (SuDS) as a means of mitigating the impact of development. The 'four pillars' of SuDS are shown by Figure 9-1.

Figure 9-1
Four Pillars of SuDS (after CIRIA Report C753)

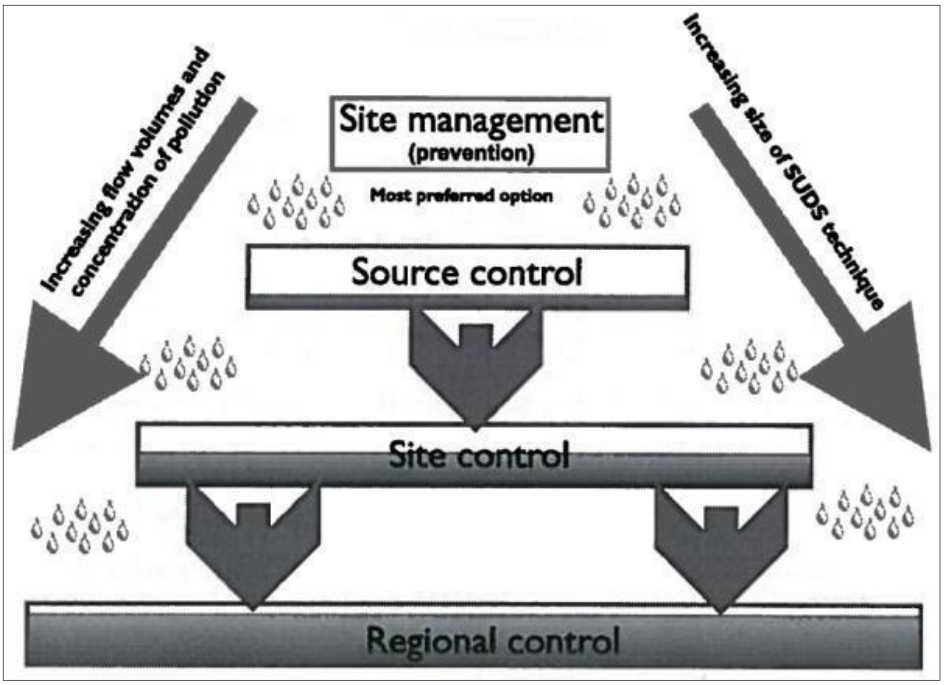


The SuDS Manual identifies a hierarchy of SuDS for managing runoff, commonly referred to as a '*management train*', which summarised below and is depicted by Figure 9-2.

- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).
- **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site).
- **Regional Control** – management of runoff from several sites, typically in a retention pond or wetland.

[7] CIRIA (2015). Report C753, The SuDS Manual

Figure 9-2
SuDS Management Train



It is generally accepted that the implementation of SuDS, as opposed to conventional drainage systems, provides a number of benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- Reducing potable water demand through rainwater harvesting;
- Improving amenity through the provision of public open spaces and wildlife habitat; and replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

9.2 Proposed Discharge Arrangement

With reference to the SuDS Manual, the hierarchy of preferred disposal options for surface water runoff from development sites in decreasing order of sustainability is:

- Infiltration to Ground;
- Discharge to Surface Waters; or
- Discharge to Sewer.

Table 9-1 summarises the suitability of disposal methods in the context of the Site and the proposed development.

Table 9-1
Suitability of Surface Water Disposal Methods

Surface Water Disposal Method (in Order of Preference)	Suitability Description	Method Suitable? (Y / N)
Infiltration to Ground	A site investigation and infiltration testing has indicated that the made ground deposits are sufficiently permeable to allow the use of soakaways as a means of surface water disposal. The issue of discharging surface water runoff into made ground is discussed below.	Y
Discharge to Surface Waters	There are no surface waters in the vicinity of the site to which a connection could be made.	N
Discharge to Sewer	There are no sewers in the vicinity of the site to which a connection could be made.	N

9.3 Proposed Drainage Strategy

9.3.1 Asphalt Plant Area

The existing concrete hardstanding is to be retained and upgraded to serve the proposed Asphalt Plant Area. The hardstanding will be formally drained.

As set out in Table 9-1, the only means of disposing of surface water runoff from the Asphalt Plant Area is via infiltration drainage, i.e. the use of a soakaway.

It has also to be accepted that the movement of feedstock into the storage bins and vehicle movements along the Delivery and Dispatch Route are likely to deposit silts derived from the made ground onto the concrete hardstanding. Without mitigation, these silts would significantly impair the performance of the soakaway through siltation.

It is therefore proposed to incorporate a siltation lagoon and attenuation storage area immediately upstream of the soakaway. This has the advantage of significantly reducing the size of the soakaway required.

9.3.2 Lorry Delivery and Dispatch Route

The existing track along which the Asphalt Plant will be accessed is to be retained and improved, however, it will not be formally drained. Therefore no specific drainage measures are required.

9.4 Contributing Area

The Lorry Delivery and Dispatch Route will not be formally drained and therefore will not contribute to surface water runoff.

The Asphalt Plant Area extends to 1ha and is currently laid to hardstanding, however, any formal drainage that may have existed has long since fallen into disrepair and the area is understood to be prone to shallow flooding.

9.5 Water Quantity Design Standard

9.5.1 Control of Runoff Volume

Section 3.3.1 of The SuDS Manual sets out volume control criteria for:

- Frequent rainfall events.
- Extreme rainfall events.

9.5.2 Frequent rainfall events

The SuDS Manual requires '*the prevention of runoff from the [Site] for the majority of small (frequent) rainfall events (or for the initial depth of rainfall for larger events)*'. This is known as *Interception* and '*Inception of about 5mm is normally achievable.*'

With reference to Section 24.8 of The SuDS Manual:

'*Inception can be delivered using one or a combination of process:*

- *Rainwater harvesting*
- *Infiltration*
- *Evapotranspiration using temporary shallow ponding or storage within the soil or upper aggregate layers.*'

This requirement is explicitly met through the proposed use of a soakaway as a means of surface water disposal and therefore no specific measures are required to prevent runoff from the site for the majority of small rainfall events.

9.5.3 Extreme rainfall events

For extreme rainfall events, the drainage system should be designed such that '*the volume of runoff from the Site (or development) area [does] not exceed the volume of runoff from the equivalent area in its natural undeveloped or "greenfield" state*'.

Again, as the site is to be drained to a soakaway this requirement is explicitly met and therefore no specific measures are required to mitigate any increase in runoff volume for extreme rainfall events.

9.6 Maximum Allowable Discharge

With reference to The SuDS Manual:

'runoff should where possible be restricted to the greenfield 1 in 1 year [100% AEP] runoff rate during all events up to and including the 1 in 100 year [1% AEP] rainfall event with climate change.'

In practice the maximum allowable discharge will be set by the design of the siltation lagoon and soakaway. These are discussed in Section 9.9.

9.7 Design Exceedance Arrangement

Should the attenuation storage capacity be exceeded by an event of greater severity than that designed for, the excess floodwater would be retained on site by the existing topography.

9.8 Water Quality

There are two issues to address when considering the impact of the proposed development on the water environment and, in this case, groundwaters in particular:

- The quality of the runoff draining to the soakaway; and
- The potential impact of discharging runoff into made ground.

The silt that will be washed off the concrete hardstanding will be largely derived from the stockpiles of slag and the made ground which it is understood also largely comprises slag.

Surface water runoff will therefore be discharged via a soakaway into the made ground comprising largely of slag.

9.8.1 Leaching Test Review

The results of WAC leaching test performed on made ground samples completed as part of the Geotechnical & Geo-environmental study[8] have therefore been used to estimate the likely leaching of analytes from the silt runoff when stored in a settlement lagoon.

There are three samples of made ground which have been subjected to 2 Stage WAC testing and the results are summarised in Table 9-2 with reference to the leaching potential. The longer-term leaching potential is viewed by examining the cumulative 10:1[9] leach in mg/kg.

To assess the leaching in terms of the soluble analyte leaching from the solid, the cumulative figure is divided by a factor of 10 because it represents a 10 parts liquid to 1 part solids leach. Given the size of the settlement pond and the likely volume of silt which might settle over a period (i.e. at the start of a storm event the liquids to solids ratio is likely to be greater than 10:1 with the 'first flush' effect, however, as the event develops the ratio is likely to be considerably greater than 10:1) this is seen as a viable and conservative approach.

The results indicate that most of the metals are non-detected, or of low concentration. In terms of other analytes chloride is low and sulfate, although higher in concentration, is not likely to be an issue as the mean is below relevant EQS.

In terms of pH, this is, as expected relatively high and alkaline. However, there are two important points:

- When the surface water is exposed to atmosphere, it is likely that the carbon dioxide concentration in the water will increase and, given that this is an acidic gas, the pH of the water will decrease; and
- The pH of the ground analysis is 8.1 – 9.6. pH is a measure of the hydrogen ion concentration in the water and it is log scale: $pH = -\log_{10} [H^+]$. Therefore, if the settlement water maintained a pH = c.10 - 11 and the pH of the groundwater volume to which it infiltrates is c.8-9, then there is a factor of at least 10 difference between the two. Consequently, discharge into the groundwater is likely to have little or no impact on the pH of the underlying water.

[8] Geotechnical & Geo-environmental Report: Aggregate Production Area Celsa, Rover Way, Cardiff Prepared for HARSCOP Metals and Minerals (Terra Firma (Wales) Ltd., 2019)
[9] 10 parts liquid to 1 part solids

Table 9-2
Results of WAC Testing

Sample	BH 1 (0.5-1.5)		BH 2 (0.5-1.5)		BH3 (0.5-1.5)	
Analyte	mg/kg	mg/l	mg/kg	mg/l	mg/kg	mg/l
As	<0.05	<0.005	<0.05	<0.005	<0.05	<0.005
Ba	<0.5	<0.05	0.7	0.07	<0.5	<0.05
Cd	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
Cr	<0.05	<0.005	<0.05	<0.005	<0.05	<0.005
Cu	<0.05	<0.005	<0.05	<0.005	<0.05	<0.005
Hg	<0.005	<0.0005	<0.005	<0.0005	<0.005	<0.0005
Mo	0.11	0.011	0.1	0.01	0.11	0.011
Ni	<0.05	<0.005	<0.05	<0.005	<0.05	<0.005
Pb	<0.01	<0.001	<0.01	<0.001	<0.01	<0.001
Sb	<0.01	<0.001	0.011	0.0011	0.012	0.0012
Se	0.048	0.0048	0.045	0.0045	0.049	0.0049
Zn	<0.5	<0.05	<0.5	<0.05	<0.5	<0.05
Cl	430	43	570	57	400	40
F	18	1.8	10	1	21	2.1
SO4	2800	280	1600	160	3000	300
TDS	4600	460	7000	700	3800	380
pH		9.8		11.6		10.1

It is therefore concluded that the runoff in the settlement pond is likely to have no significant impact on the water quality in the underlying groundwater.

Infiltration of a 'relatively' clean water into the made ground has the potential to cause leaching of made ground components. Examination of the soil chemistry suggests that only aspect which might cause an issue is the TPH concentrations in the soil.

These heavy end hydrocarbons as shown by the analysis and are not present as polyaromatic compounds and are a combination of aliphatic and aromatic hydrocarbons (based on the site usage possibly a mixture of lubrication oils, diesel and tarmac). Typically, these have very low solubility and therefore it would not be expected they would be mobilised by infiltrating water from the settlement pond.

The fact that these TPH's were not detected in the groundwater confirms their low solubility.

9.8.2 Operational Considerations

The Asphalt Plant Area will be trafficked by both road-going lorries and site plant and therefore there is a risk of hydrocarbons and metals entering the drainage system. Siltation is addressed above.

It is proposed to fit a baffle to the outlet from the siltation basin such that it will act as a retention interceptor.

The primary means of addressing metals is through settlement and therefore the proposed settlement which is designed to remove particles down to a fine silt (4µm) will address this potential contaminant.

9.8.3 Conclusions

It is concluded that disposal of surface water runoff via a soakaway into the underlying made ground will have no significant impact on groundwaters.

It is also of note that surface water runoff from an adjacent recently consented development[10] also discharges to ground via a soakaway.

9.9 Preliminary Hydraulic Design

9.9.1 Settlement Lagoon

It can be shown[11] that to settle a fine silt the ratio of the throughflow to surface area of a settlement lagoon should be approximately 1×10^{-5}.

The drainage system has to remain operational over a range of storm events up to and including the 1% AEP storm allowing for the impact of climate change; an uplift of 40%.

The MicroDrainge[12] Quick Storage Estimate (QSE) module has therefore been used to estimate the attenuation volumes required for a range of outflows to the soakaway. Clearly the greater the rate of discharge to the soakaway the larger surface area is required to ensure settlement of fine silts.

Given the space constraints on site, a hybrid solution is proposed with a dedicated settlement lagoon for the lower return period events and flooding of the southern half of the Asphalt Plant Area for the higher return period events. The proposed drainage strategy is shown by Drawing 001.

The outlet to the soakaway has been limited to $5ls^{-1}$ and therefore a surface area of $500m^2$ for the settlement lagoon is required. However, as discussed above, a considerable attenuation volume will be required to limit the run-off from the 1ha of concrete hardstanding for the 1% AEP storm allowing for the impact of climate change.

The attenuation volume provided by the settlement lagoon at the point water would spill into the adjacent surface storage area is approximately $340m^3$ and therefore with reference to summary of the QSE analysis enclosed at Appendix 05 will cater for storm event up to an including a 20% (1 in 5) AEP event.

9.9.2 Soakaway

Infiltration testing in the made ground as part of the site investigation indicates an infiltration rate of approximately 5×10^{-4} ms^{-1}. A copy of the results of the infiltration testing is enclosed at Appendix 06.

Based on the BRE 365 Guidance, a 2.1m diameter soakaway would provide sufficient capacity for a discharge of $5ls^{-1}$. The time to half empty the attenuation storage for the 1% AEP storm allowing for the impact of climate change would be less than 24 hours.

---

[10] Planning Application Reference 18/02065/MJR

[11] Technical Management of Water in the Coal Mining Industry (National Coal Board, 1982)

[12] https://www.innovyze.com/en-us/products/microdrainage

A copy of the preliminary soakaway sizing is enclosed at Appendix 07.

9.10 SuDS Approval Body

A separate application to the Cardiff Council SAB Team has been made for a full planning application using the on-line portal.

10.0 Conclusion

10.1 Background

This report has been commissioned to consider the flood consequences of constructing an asphalt batching plant and associated infrastructure at the Celsa Steel Works site, Rover Way, Cardiff.

10.2 Flood Risk Screening

The Development Advice Map data shows that the Site lies within Zone B, however a review of information provided by Natural Resources Wales concludes that there is currently not a significant risk of flooding to the Site from fluvial or tidal sources.

Whilst the flood risk to the Site will increase with the advent of climate change, and in particular the impact on sea levels, this can be readily mitigated.

Flood risk from all other potential sources was also reviewed and found to be not significant.

10.3 Drainage Design

It is only the Asphalt Plant Area that is to be formally surfaced and drained. A review of available drainage options confirmed that the only viable solution is to dispose of surface water runoff via a soakaway. However, as the site is underlain by a significant depth of made ground, a detailed review of the properties of the made ground has been completed to confirm that the proposed drainage strategy would have no impact on groundwater.

Runoff from the Asphalt Plant Area will pass through a settlement lagoon to remove fine silts prior to discharge to the soakaway. To limit the size of the settlement lagoon, runoff is to be attenuated to $5ls^{-1}$ with attenuation provided by the lagoon itself and flooding of part of the Asphalt Plant Area for more extreme events.

DRAWINGS

N

A

A'

B

B

9.8

9.6

9.4

9.2

9.0

8.8

9.18

7.43

IL 8.68

IL 7.93

8.68

ARMCO BARRIER

SOAKAWAY CHAMBER
2.1m dia

150mm dia HDPE PIPE

FLOW CONTROL MANHOLE
1.2m dia

UPSTAND

0 10 20 30 40m 60 80 100

Metres 1:1000

NOTES

BASE LAYER FROM DEVELOPMENT PLAN, NEW AGGREGATE AND ASPHALT PLANTS AT CELSA CARDIFF, REF 01994-00-01-07.05 REV 1. DATED 01.10.2018

LEGEND

- SITE BOUNDARY
- SLOT DRAIN
- 7.43 PROPOSED LEVELS
- 9.0 PROPOSED CONTOURS
- C SECTION LINES (SEE DWG 002)
- 2.1m Ø SOAKAWAY
- 1.2m Ø CHAMBER
- SETTLEMENT LAGOON
- SURFACE STORAGE AREA
- FOUL SEWER
- PIPE TO SOAKAWAY

DRAFT

Revision	By	Chk'd By	Date	Comments
2	AB	IW	05.19	site sump wider, MH added
1	AB	IW	05.19	pipe added, bays moved
0	AB	IW	05.19	

HARSCO METALS&MINERALS

SLR global environmental solutions
FULMAR HOUSE
BEIGNON CLOSE
OCEAN WAY
CARDIFF. CF24 5PB
T: 029 2049 1010
F: 029 2048 7903
www.slrconsulting.com

Site
CELSA STEEL SITE

Project
ASPHALT PRODUCTION

Drawing Title
SURFACE WATER DRAINAGE STRATEGY

Scale
1:500 @A2

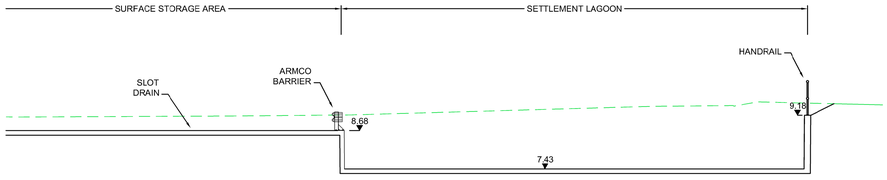
Date
JUNE 2019

Drawing Number
001

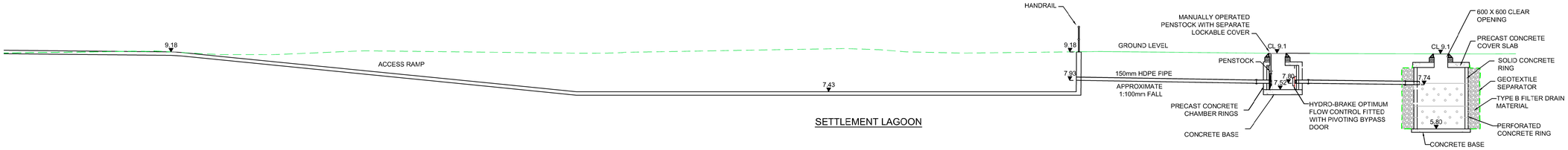
Revision
2

DRAFT

416.09604.00001.18.001.2 Site.dwg



SECTION B-B'



SECTION A-A'

N

NOTES

1. ALL PIPES CONNECTING TO THE CHAMBERS SHALL HAVE AN ARTICULATED SECTION (ROCKER PIPE) WITH A JOINT AS CLOSE AS POSSIBLE TO THE CHAMBER TO PERMIT SUBSEQUENT MOVEMENT.
2. EXCAVATION TO EXTEND TO WIDTH OF 500mm ALL AROUND THE SOAKAWAY CHAMBER. BACKFILL WITH THERMALLY BONDED NON-WOVEN (TERRAM 1000 OR EQUIVALENT)

LEGEND

- SITE BOUNDARY
- SLOT DRAIN
- 7.43 PROPOSED LEVELS
- 9.0 PROPOSED CONTOURS
- SECTION LINES (SEE DWG 002)
- 2.1m Ø SOAKAWAY
- 2.1m Ø CHAMBER
- SETTLEMENT LAGOON
- SURFACE STORAGE AREA
- FOUL SEWER
- PIPE TO SOAKAWAY

0 1 2 3 4m 6 8 10

Metres 1:100

DRAFT

Revision	By	Chk'd By	Date	Comments
2	AB	IW	06.19	stte sump wider, MH added
1	AB	IW	06.19	pipe added, bays moved
0	AB	IW	06.19	

HARSCO METALS&MINERALS

SLR global environmental solutions
FULMAR HOUSE
BEIGNON CLOSE
OCEAN WAY
CARDIFF. CF24 5PB
T: 029 2049 1010
F: 029 2048 7903
www.slrconsulting.com

Site: CELSA STEEL SITE

Project: ASPHALT PRODUCTION

Drawing Title: **SURFACE WATER DRAINAGE STRATEGY SECTIONS**

Scale: AS SHOWN @A1

Date: JUNE 2019

Drawing Number: **002**

Revision: **2**

DRAFT

4:\6.09924.00001.18.002.2 Sections.dwg

APPENDIX 01

Topographic Survey

Rev	Amendments	Date	By

NOTES:

1. SITE GRID AND LEVELS ARE BASED UPON ORDNANCE SURVEY VIA THE ACTIVE GPS NETWORK.

Do not scale this drawing

KEY

TSB	TRAFFIC SIGNAL BOX
PHB	PHONE BOX
PB	POST BOX SQUARE
PB	POST BOX ROUND
GRILL	GRILL SQUARE
GRILL	GRILL ROUND
BL	BOLLARD
BIN	BIN SQUARE
BIN	BIN ROUND
38.32	SPOT LEVEL
TAR	TARMAC
GR	GRASS
H/S	HARDSTANDING
BL	BOLLARD
BB	BELISHA BEACON
RS	ROAD SIGN
SIGN	SIGN
NP	STREET NAMEPLATE
TS	TRAFFIC SIGNAL
TSC	TRAFFIC SIGNAL CONTROLLER
IC	INSPECTION COVER
MH	MANHOLE
MH	MANHOLE
MP	MARKER POST
TP	TELEGRAPH POLE
LC	LIGHTING COLUMN
G	GULLY
WM	WATER METER
SV	SLUICE VALVE
ST	STOP TAP
FH	FIRE HYDRANT
BT	BRITISH TELECOM
CATV	CABLE TV
TV	CABLE TV
GV	GAS VALVE
1.0BR	BRICK WALL
1.0BL	BLOCK WALL
1.0ST	STONE WALL
	HEDGEROW/TREE CANOPY
2.0 P+W	FENCE
DK	DROPPED KERB

APPROX N

Alpine Land Surveyors Ltd
, Tower Business Centre, Hirwaun Industrial Estate, Hirwaun, Aberdare. CF44 9UP
Tel/Fax: 01685 814544 Mobile: 07980 404 208
j.price@alpinelandsurveyors.co.uk

CLIENT

TERRA FIRMA

WALES LTD

PROJECT

TOPOGRAPHICAL SURVEY

EXTERNAL YARDS.

CELSA, CARDIFF.

Scales	1:250	Date	12.04.19
Drawn	MJH	Checked:	TC
Project Reference No.		ALS/02382	
Drawing Number		001	

A1

Rev	Amendments	Date	By

NOTES:

1. SITE GRID AND LEVELS ARE BASED UPON ORDNANCE SURVEY VIA THE ACTIVE GPS NETWORK.

Do not scale this drawing

KEY

□	TSB	TRAFFIC SIGNAL BOX
□	PHB	PHONE BOX
□	PB	POST BOX SQUARE
○	PB	POST BOX ROUND
□	GRILL	GRILL SQUARE
○	GRILL	GRILL ROUND
□	BL	BOLLARD
□	BIN	BIN SQUARE
○	BIN	BIN ROUND
38.32		SPOT LEVEL
	TAR	TARMAC
	GR	GRASS
	H/S	HARDSTANDING
⊙	BL	BOLLARD
⊙	BB	BELISHA BEACON
⊙	RS	ROAD SIGN
⊙	SIGN	SIGN
⊙—NP		STREET NAMEPLATE
⊙	TS	TRAFFIC SIGNAL
□	TSC	TRAFFIC SIGNAL CONTROLLER
□	IC	INSPECTION COVER
□	MH	MANHOLE
◯	MH	MANHOLE
⊸	MP	MARKER POST
○	TP	TELEGRAPH POLE
○	LC	LIGHTING COLUMN
□	G	GULLY
□	WM	WATER METER
□	SV	SLUICE VALVE
□	ST	STOP TAP
□	FH	FIRE HYDRANT
□	BT	BRITISH TELECOM
□	CATV	CABLE TV
△	TV	CABLE TV
□	GV	GAS VALVE
1.0BR		BRICK WALL
1.0BL		BLOCK WALL
1.0ST		STONE WALL
		HEDGEROW/TREE CANOPY
		FENCE
2.0 P+W		DROPPED KERB
DK		

APPROX N

Alpine Land Surveyors Ltd
, Tower Business Centre, Hirwaun Industrial Estate, Hirwaun, Aberdare. CF44 9UP
Tel/Fax: 01685 814544 Mobile: 07980 404 208
j.price@alpinelandsurveyors.co.uk

CLIENT
TERRA FIRMA
WALES LTD

PROJECT
TOPOGRAPHICAL SURVEY
EXTERNAL YARDS.
CELSA, CARDIFF.

Scales 1:250	Date 12.04.19
Drawn MJH	Checked: TC
Project Reference No.	ALS/02382
Drawing Number	002

A1

Rev	Amendments	Date	By

NOTES:

1. SITE GRID AND LEVELS ARE BASED UPON ORDNANCE SURVEY VIA THE ACTIVE GPS NETWORK.

Do not scale this drawing

KEY

TSB	TRAFFIC SIGNAL BOX
PHB	PHONE BOX
PB	POST BOX SQUARE
PB	POST BOX ROUND
GRILL	GRILL SQUARE
GRILL	GRILL ROUND
BL	BOLLARD
BIN	BIN SQUARE
BIN	BIN ROUND
38.32	SPOT LEVEL
TAR	TARMAC
GR	GRASS
H/S	HARDSTANDING
BL	BOLLARD
BB	BELISHA BEACON
RS	ROAD SIGN
SIGN	SIGN
NP	STREET NAMEPLATE
TS	TRAFFIC SIGNAL
TSC	TRAFFIC SIGNAL CONTROLLER
IC	INSPECTION COVER
MH	MANHOLE
MH	MANHOLE
MP	MARKER POST
TP	TELEGRAPH POLE
LC	LIGHTING COLUMN
G	GULLY
WM	WATER METER
SV	SLUICE VALVE
ST	STOP TAP
FH	FIRE HYDRANT
BT	BRITISH TELECOM
CATV	CABLE TV
TV	CABLE TV
GV	GAS VALVE
1.0BR	BRICK WALL
1.0BL	BLOCK WALL
1.0ST	STONE WALL
	HEDGEROW/TREE CANOPY
2.0 P+V	FENCE
DK	DROPPED KERB

APPROX N

Alpine Land Surveyors Ltd
. Tower Business Centre, Hirwaun Industrial Estate, Hirwaun, Aberdare. CF44 9UP
Tel/Fax: 01685 814544 Mobile: 07980 404 208
j.price@alpinelandsurveyors.co.uk

CLIENT
TERRA FIRMA
WALES LTD

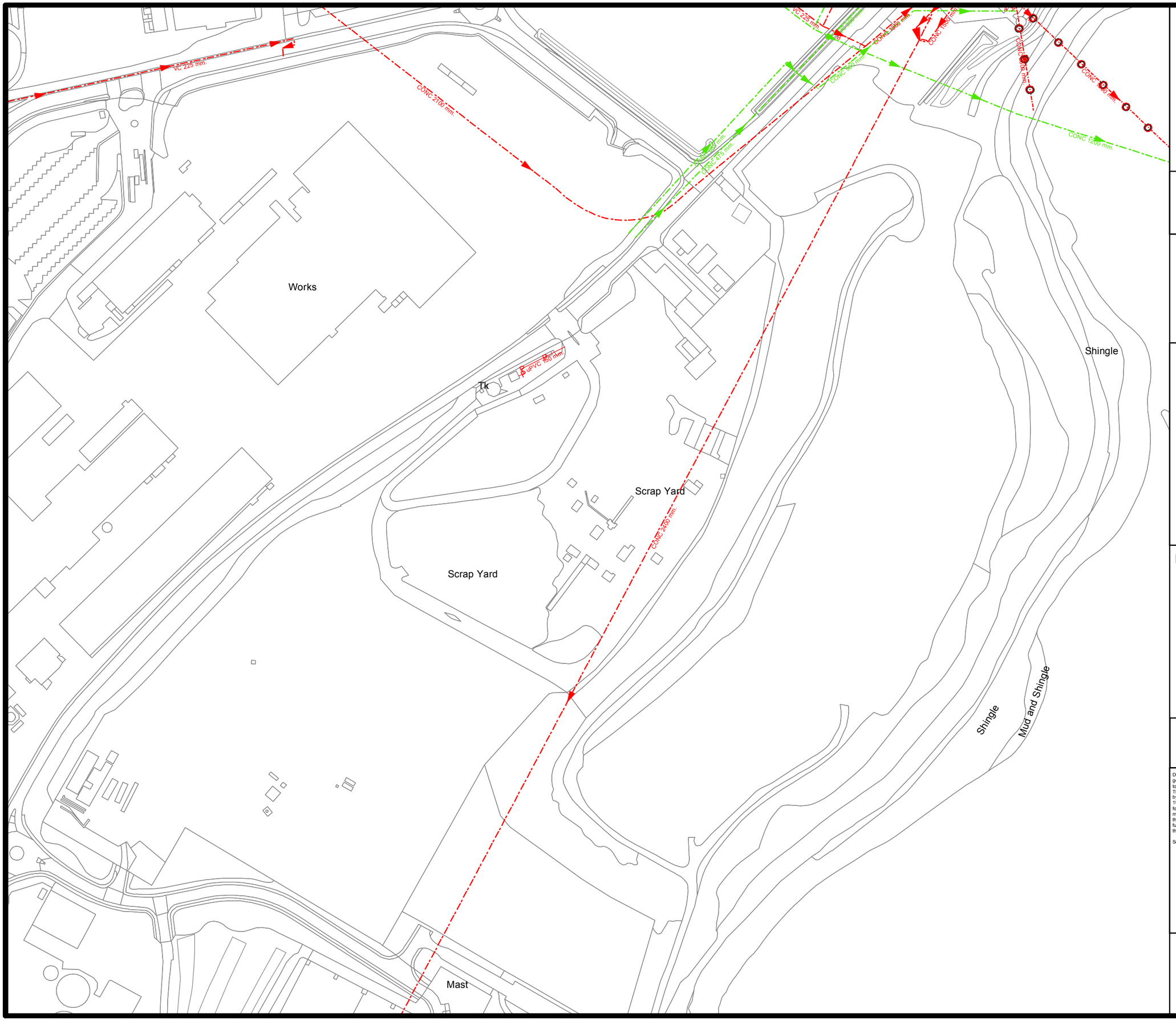
PROJECT
TOPOGRAPHICAL SURVEY
EXTERNAL YARDS.
CELSA, CARDIFF.

Scales 1:250	Date 12.04.19
Drawn MJH	Checked: TC
Project Reference No.	ALS/02382
Drawing Number	003

A1

APPENDIX 02

Welsh Water Asset Plans



Dŵr Cymru
Welsh Water

Seawall Road, Rover Way

N
W E
S

LEGEND(Representative of most common features)

Waste network:

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

NB: Sewer symbol colour indicates the type.

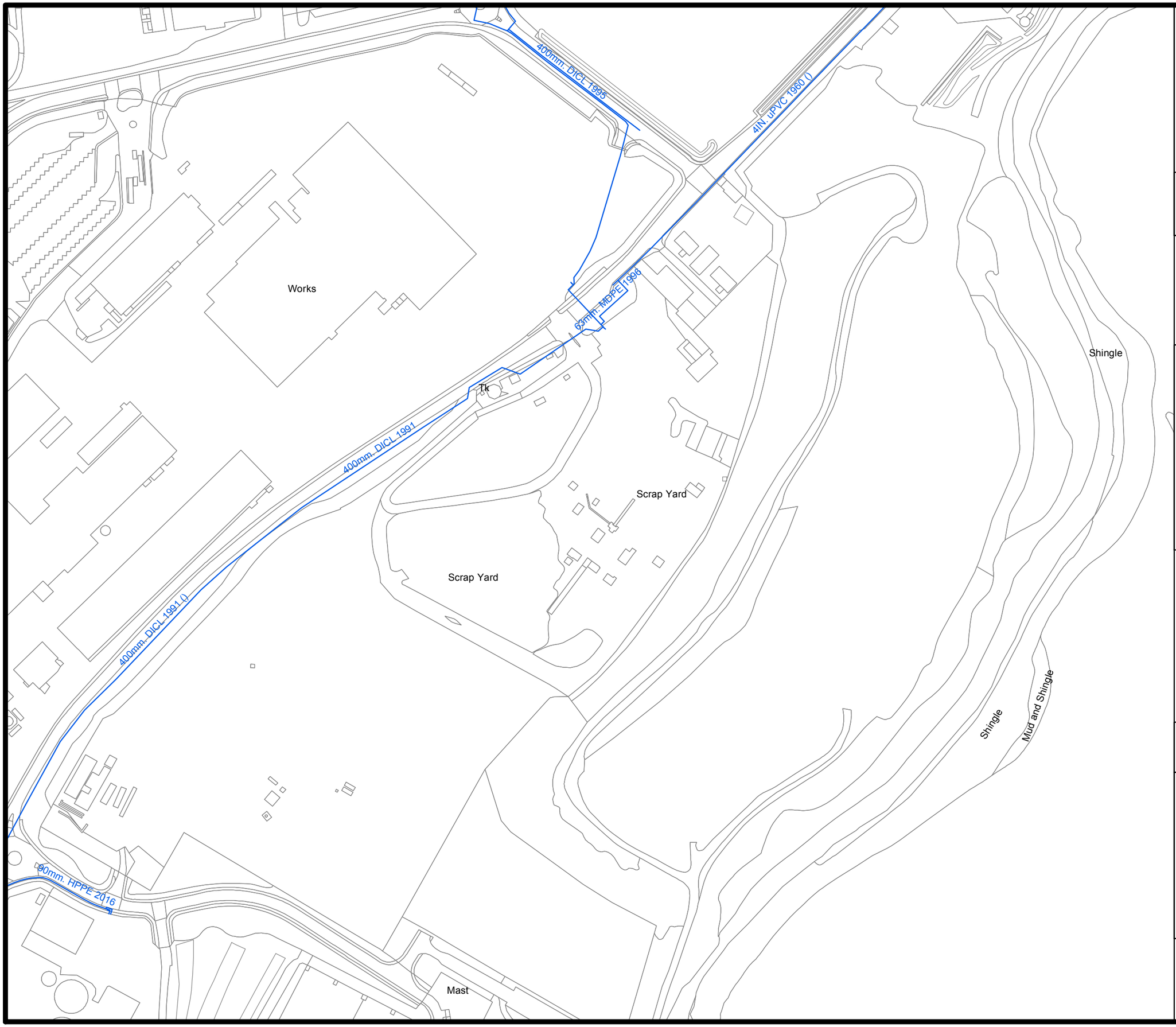
RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

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

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	321527,176306
Map scale:	1:2500
Printed by:	John Emma
Printed on:	05 Feb 2019



Dŵr Cymru
Welsh Water

Seawall Road, Rover Way

N
W E
S

LEGEND

Clean network:

- Sluice valve
- Pressure reducing valve
- Meter
- Bulk meter
- Hydrant (FH)
- Cap end
- Air valve
- Stop tap
- Water Treatment Works
- Water Pumping Station
- Existing main
- Non-operational main
- Raw Water

NB: Water main symbol colour indicates the type.

LIGHT BLUE - Trunk
DARK BLUE - Distribution
YELLOW - Raw Water

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

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	321527,176306
Map scale:	1:2500
Printed by:	John Emma
Printed on:	05 Feb 2019

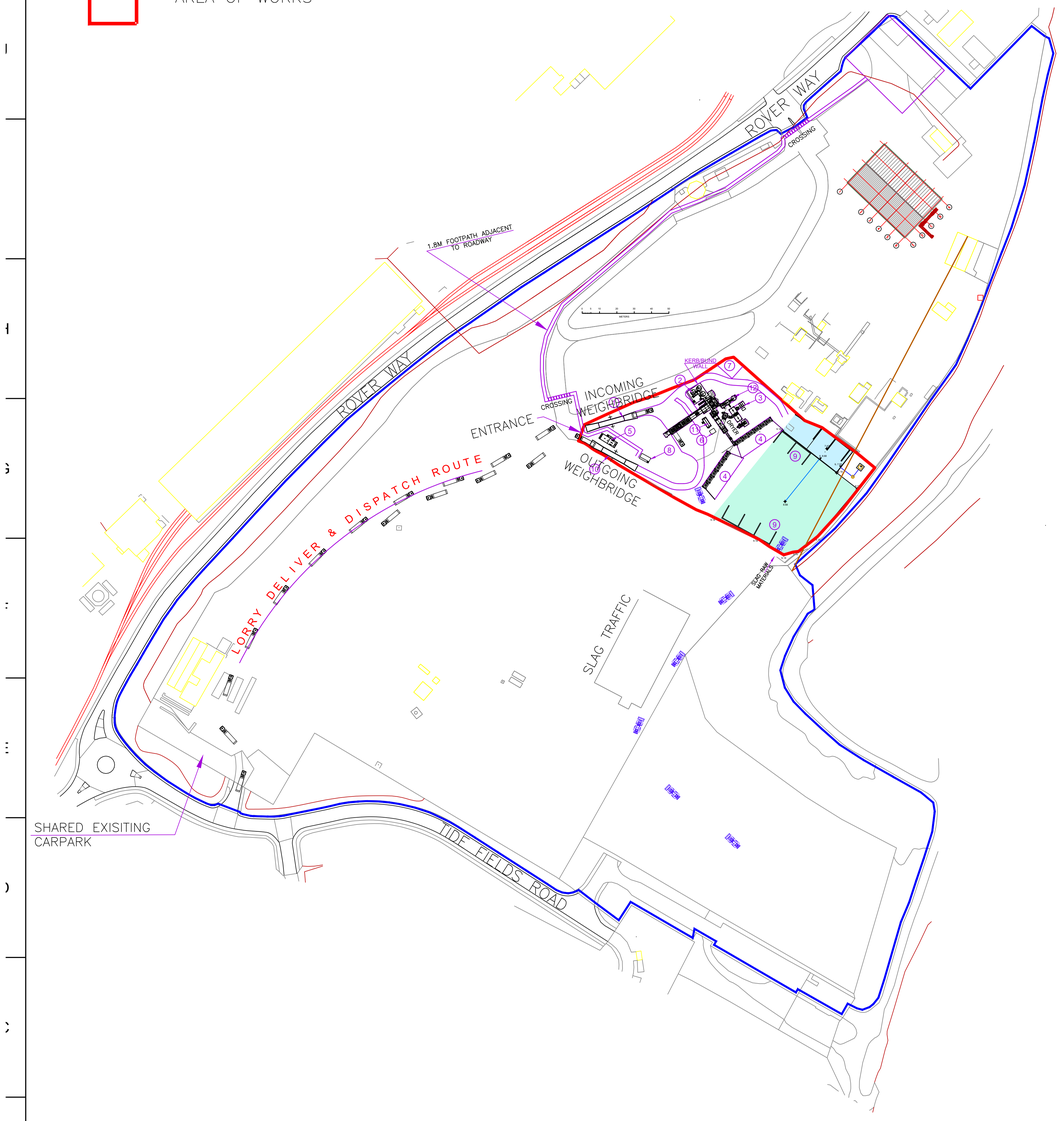
APPENDIX 03

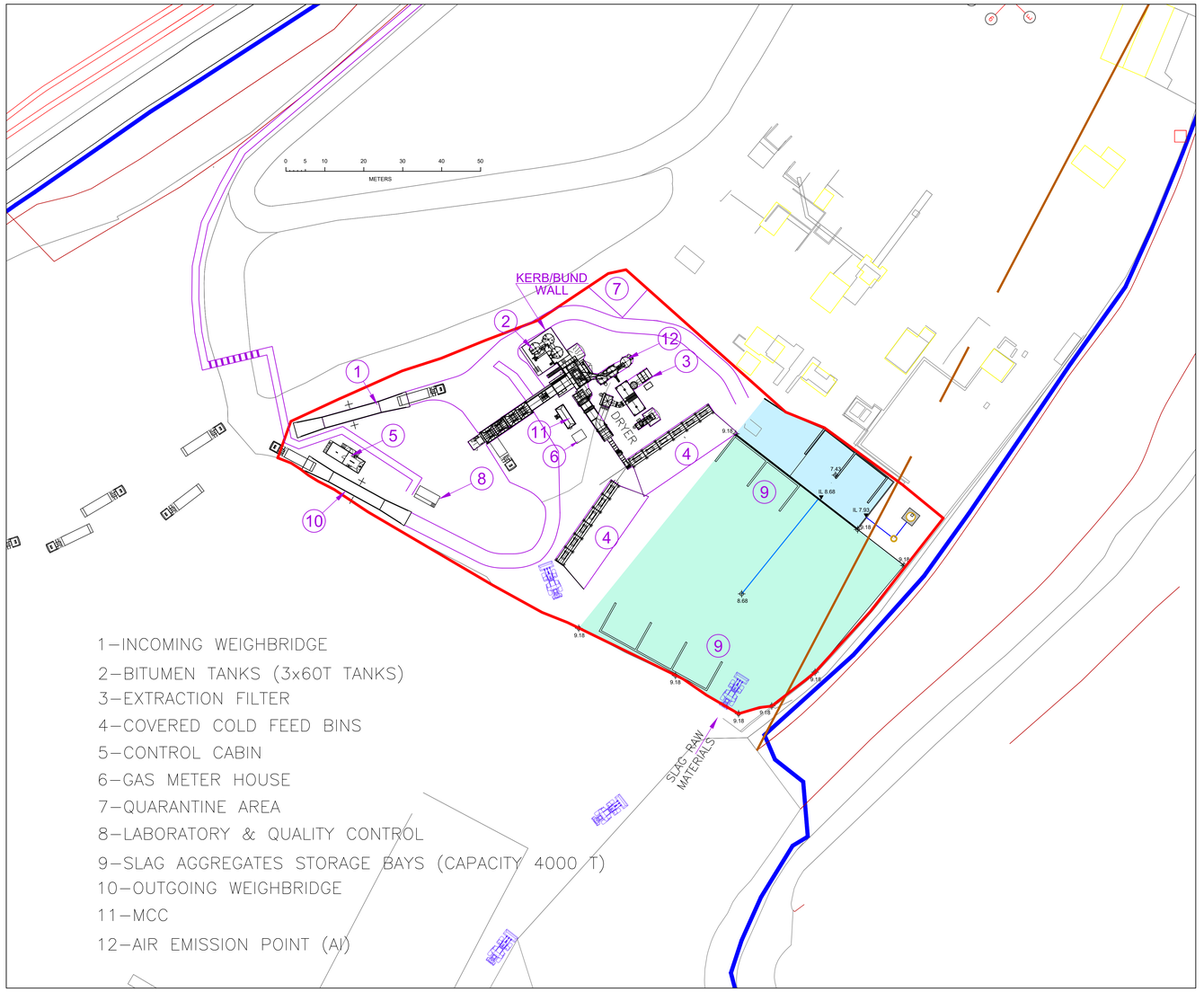
Development Layout

LEGEND

DENOTES CELSA SITE OWNERSHIP
AREA = 150,669m² (15.07ha)

AREA OF WORKS





1—INCOMING WEIGHBRIDGE
2—BITUMEN TANKS (3x60T TANKS)
3—EXTRACTION FILTER
4—COVERED COLD FEED BINS
5—CONTROL CABIN
6—GAS METER HOUSE
7—QUARANTINE AREA
8—LABORATORY & QUALITY CONTROL
9—SLAG AGGREGATES STORAGE BAYS (CAPACITY 4000 T)
10—OUTGOING WEIGHBRIDGE
11—MCC
12—AIR EMISSION POINT (AI)

ASPHALT PLANT AREA
(CIRCA 10,022 M²)
SCALE 1:500 ON A0

NOTES

1. Do not scale from this drawing
2. Dimensions are for reference only
3. Plants' components and their locations are preliminary and may change during design stage
4. This drawing is prepared, in part, based on information provided by others. While this information is believed to be reliable, Harsco Metals assume no responsibility for inaccuracies, errors or omissions that might have been incorporated into this drawing as a result of incorrect information provided to us
5. This drawing is for planning purposes only. Not to be used for construction

RevNo	Revision note	Date	Signature	Checked
2	GENERAL UPDATE FOR PLANNING	25.06.2019	AI/RM	RM
1	STREET NAMES ADDED	01.10.2018	AI	
0	RELEASED FOR DISCUSSION	26.09.2018	AI	

OWNER: HARSCO METALS&MINERALS

ENGINEERING DEPT.
HARSCO HOUSE, Bradmarsh Business Park, The Point, Bradmarsh Way
Rotherham, S60 1BW, UK. TELEPHONE +44(0)1709 536850, FAX +44(0)1709 536805

VENDOR/CONSULTANT:

PROJECT: ASPHALT PRODUCTION AT CELSA CARDIFF

PROJECT No.: O1994

	NAME	SIGN	DATE
ENGR	AI		25.09.18
DRAWN	AI		26.09.18
CHKD			
APPD			

TITLE:- NEW ASPHALT PLANT AT CELSA CARDIFF. LOCATION PLAN OPTION 7.5

SCALE 1:1250

DRG. NO. O1994-00-01-07.05

SIZE A0 | REV. 2

RELEASED FOR
☐ PRELIMINARY ☑ INFORMATION ☐ APPROVAL ☐ FABRICATION ☐ CONSTRUCTION

APPENDIX 04

NRW Correspondence

ATI-17236a – Celsa Steel , Rover Way , Cardiff

E:321531 N:176293

1.0 Current Flood Map

Figure 1 shows the current Flood Map (version 201901) at this location. The Flood Map represents the undefended fluvial and tidal flood extents derived from a combination of detailed and generalised modelled data.

The current tidal flood map in this area was updated by NRW in 2013. This mapping study uses sea levels from within the Severn Estuary, based on the set of extreme sea levels published by the EA in 2011 (*ref2)* for the baseline year of 2008. The levels were adjusted for climate change from 2008 to 2013 (+17.5mm), projected inland over a digital terrain model to produce elevation and depth grids as well as outlines for both the 0.5% (1 in 200) AEP (annual exceedance probability) and the 0.1% (1 in 1000) AEP tidal events.

More information on the Flood Map can be obtained from the Natural Resources Wales website http://www.naturalresources.wales/floodriskmap.

2.0 Extreme Sea Levels & Climate Change Guidance

Sea levels used in this projection model come from a nationally consistent set of extreme sea levels (*ref 2*). These levels were derived using a tidal model calibrated to UK tidal gauge data. The model output is provided for node locations spaced at approximately 2km. 95% confidence bounds for these values were also derived using the confidence intervals for each node location. The extreme sea levels comprise still water level including storm surge, however they do not account for local wave action. The baseline estimations are for the year 2008, so climate change is calculated relative to this year, for example add 28mm for the year 2016.

Extreme sea levels for the node points closest to the site location are included in **Table 1** for a range of return periods (events) e.g. T100 is the 1 in 100 year return period tide, which is equivalent to the 1% AEP (Annual Exceedance Probability). The node locations are shown in **Figure 2**.

Table 1: 2008 Baseline Extreme Sea Levels for adjacent nodes

Node	Easting	Northing	Extreme Event Sea Level (mAOD)					
			T25	T50	T75	T100	T200	T1000
408	322058	176877	7.75	7.86	7.94	8.00	8.13	8.50
410	321133	174749	7.69	7.81	7.88	7.94	8.08	8.46

To provide the estimate of extreme sea levels for the site (**Table 2**), levels were interpolated from the adjacent nodes.

Table 2: 2008 Baseline Extreme Sea Levels interpolated between adjacent nodes

Node	Easting	Northing	Extreme Event Sea Level (mAOD)					
			T25	T50	T75	T100	T200	T1000
Site	321615	176039	7.73	7.84	7.92	7.98	8.11	8.48
95% Confidence Bound (+/- m):			*0.20*	*0.20*	*0.30*	*0.30*	*0.40*	*0.60*
Combined Level (inc 95%):			*7.93*	*8.04*	*8.22*	*8.28*	*8.51*	*9.08*

The current guidance on climate change from DEFRA is as follows:

Table 3: Sea level rise, mm per year

Assumed vertical land movement	1990-2025	2025-2055	2055-2085	2085-2115
-0.5	3.5	8.0	11.5	14.5

The calculated future extreme sea levels are shown in **Table 4 and 5.**

Table 4: Design Scenario (excluding 95% Confidence Bound)

Year	Sea level rise(m)	Extreme Event Sea Level (mAOD)	
		T200	T1000
2019	0.039	8.1	8.5
2094	0.775	8.9	9.3
2119	1.138	9.2	9.6

Table 5: Sensitivity Scenario (including 95% Confidence Bound)

Year	Sea level rise(m)	Extreme Event Sea Level (mAOD)	
		T200	T1000
2019	0.039	8.5	9.1
2094	0.775	9.3	9.9
2119	1.138	9.6	10.2

Table 5 shows the figures when adopting a precautionary approach as advised by Agency guidance *(ref 4)*, these levels include the upper level 95% confidence bound.

3.0 Additional Information

The local authority may be able to provide information on issues such as localised flooding from sewers, drains and culverts.

4.0 References

1. Tidal Flood Mapping Study (Penarth and Chepstow), Study report Issue 1, Atkins July 2008
2. Department for Environment, Food and Rural Affairs, 2011. *Technical Report Design sea levels*. R&D Report SC060064. Defra/Environment Agency
3. Flood and Coastal Defence Appraisal Guidance: FCDPAG3 Economic Appraisal. Supplementary Note to Operating Authorities – Climate Change Impacts; October 2006; Department for Environment, Food and Rural Affairs.
4. Using the national coastal flood boundary data for England and Wales, Environment Agency Operational Instruction 490_11, Issued 4/2/2011

5.0 Notes

Undefended scenarios are provided as being a possible worst case scenario in the event of defence failure. They are used as the basis of the Flood Map.

Extreme sea levels provided as part of this project are accurate to one decimal place (**Table 4**). Two decimal places have been provided to show the gradual change between nodes seen in the model, however, this does not imply greater accuracy.

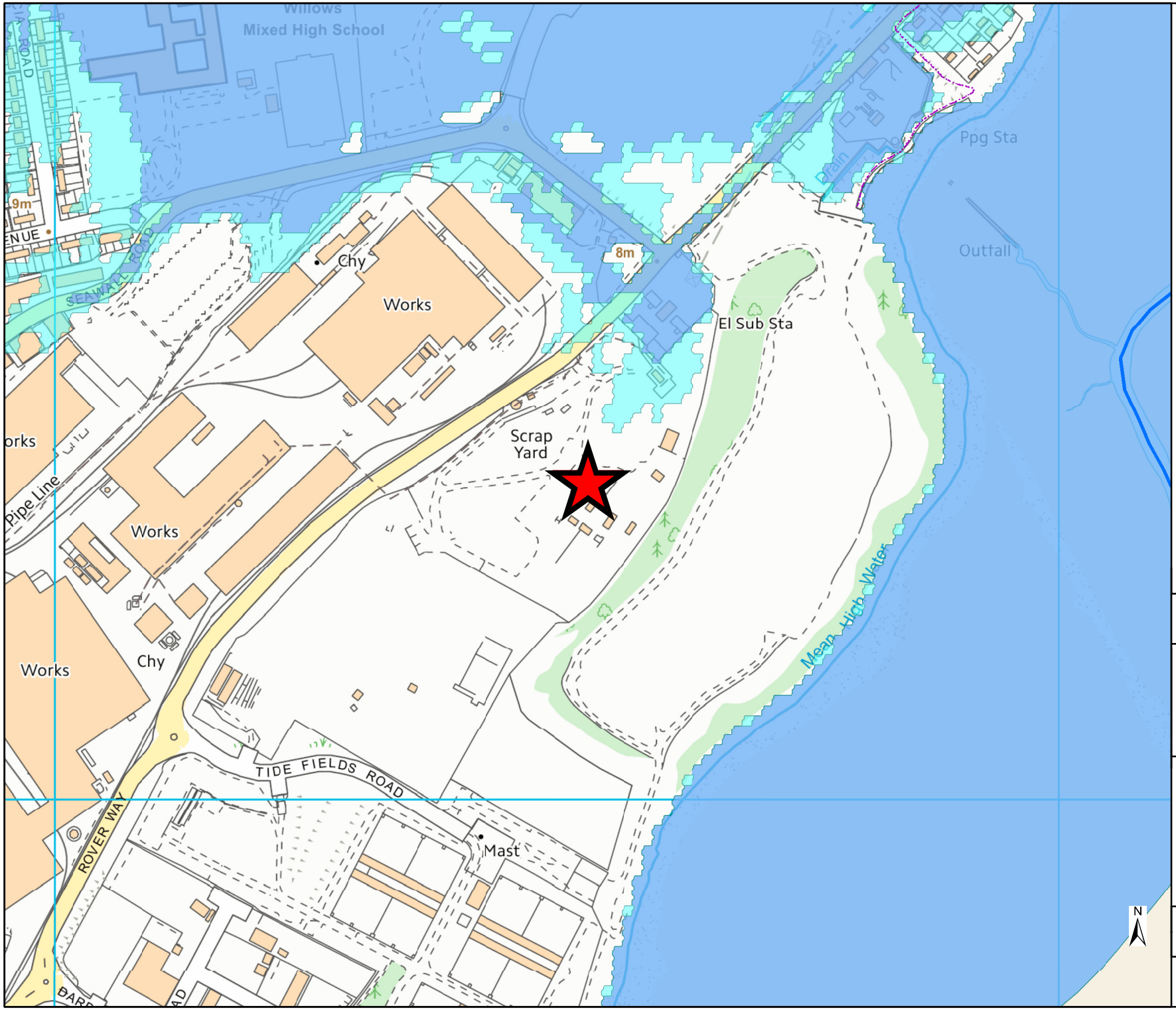
The scope of the model is the mapping of flood risk, it is not intended for detailed design.

The model should be considered as the starting point for more detailed modelling, commensurate with the consequences of flooding at the site of interest.

NRW models are available under licence agreement for the purpose of further development. Contact Natural Resources Wales Data Distribution team for details of terms, conditions and pricing.

If the data is used in support of an FCA, please include the reference number.
Please refer to NRW standard terms and conditions.

Flood Risk Analysis
10/04/2019



Legend

- Site Location
- Flood Zone 3 (1 in 100 year undefended fluvial and 1 in 200 year undefended tidal extents)
- Flood Zone 2 (1 in 1000 year undefended fluvial and tidal extents)
- Areas benefiting from defences
- Defences
- Flood Storage Area
- Main Rivers

Cyfoeth Naturiol Cymru
Natural Resources Wales

Project

Celsa Steel , Rover Way , Cardiff
[Ref: ATI-17236a]

Drawing

Figure 1:
Current Floodmap
[v201901]

Date

10 Apr 2019

Scale 1:5,000


CARDIFF /
CAERDYDD
406
408
410
Legend
Site Location
Projection Lines
Extreme Sea Level Node
Cyfoeth Naturiol Cymru
Natural Resources Wales
Project
Celsa Steel , Rover Way , Cardiff
[Ref: ATI-17236a]
Drawing
Figure 2:
Extreme Sea Level
Node Locations
Date
10 Apr 2019
Scale 1:40,000
N

FCA / FRA Standard Notice for Flood Product 4

Information warning

We (Natural Resources Wales) do not promise that the Information supplied to You will always be accurate, free from viruses and other malicious or damaging code (if electronic), complete or up to date or that the Information will provide any particular facilities or functions or be suitable for any particular purpose. You must ensure that the Information meets your needs and are entirely responsible for the consequences of using the Information. Please also note any specific information warning or guidance supplied to you.

Permitted use

- The Information is protected by intellectual property rights and whilst you have certain statutory rights which include the right to read the Information, you are granted no additional use rights whatsoever unless you agree to the licence set out below.
- Use of this information / data is subject to payment of a £50 licence fee (+VAT) for each person seeking the benefit of the licence
- To activate this licence you do not need to contact us (unless you need to pay us a licence fee) but if you make any use in excess of your statutory rights you are deemed to accept the terms below.

Licence

We grant you a worldwide, royalty-free (apart from the £50 licence fee), perpetual, non- exclusive licence to use the Information subject to the conditions below.

You are free to:

- copy, publish, distribute and transmit the Information
- adapt the Information
- exploit the Information commercially, for example, by combining it with other Information, or by including it in your own product or application

You must (where you do any of the above):

- acknowledge the source of the Information by including the following attribution statement: *"Contains Natural Resources Wales information © Natural Resources Wales and database right*" ensure that you do not use the Information in a way that suggests any official status or that We endorse you or your use of the Information
- ensure that you do not mislead others or misrepresent the Information or its source or use the Information in a way that is detrimental to the environment, including the risk of reduced future enhancement
- ensure that your use of the Information does not breach the General Data Protection Regulation (GDPR) 2018 or the Privacy and Electronic Communications (EC Directive) Regulations 2003

These are important conditions and if you fail to comply with them the rights granted to you under this licence, or any similar licence granted by us will end automatically.

No warranty

The Information is licensed 'as is' and We exclude all representations, warranties, obligations and liabilities in relation to the Information to the maximum extent permitted by law. We are not liable for any errors or omissions in the Information and shall not be liable for any loss, injury or damage of any kind caused by its use. We do not guarantee the continued supply of the Information.

Governing Law

This licence is governed by the laws of England and Wales.

Definitions

"Information" means the information that is protected by copyright or by database right (for example, literary and artistic works, content, data and source code) offered for use under the terms of this licence.

Advisory Information

The data in this Product is specific to a site. Supporting evidence will be required to justify the use of the information away from the specified site. If the data is used for a different site, without sufficiently strong supporting evidence, then there is a risk that the FCA will be rejected.

APPENDIX 05

QSE Analysis Summary

Celsa Steel Asphalt Plant

Quick Storage Estimate Analysis Summary

Impermeable Area (m^2)	10,000
Infiltration coeff	0
Settlement Velocity	1.00E-05

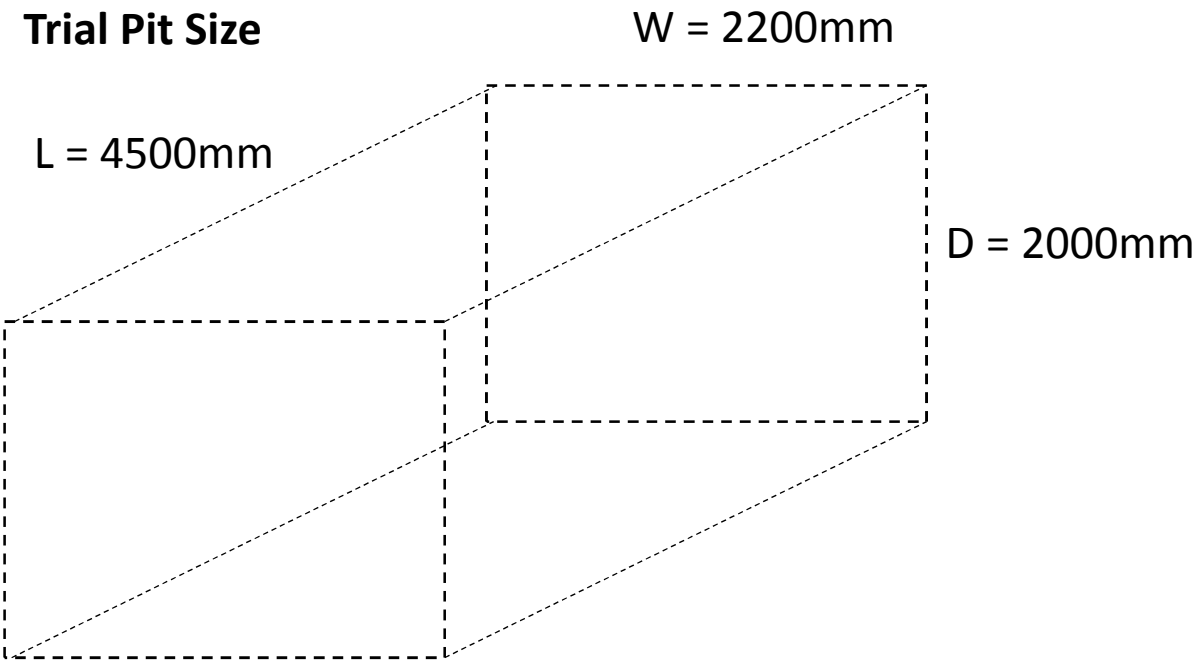
Return Period	Max Discharge (ls^{-1})	QSE (m^3)	Upper (m^3)	Area (m2)	Depth (m)
1	5	108 - 217	217	500	0.43
	10	68 - 149	149	1,000	0.15
	20	41 - 96	96	2,000	0.05
	30	29 - 73	73	3,000	0.02
	40	19 - 60	60	4,000	0.02
	50	13 - 51	51	5,000	0.01
5	5	190 - 342	342	500	0.68
	10	128 - 250	250	1,000	0.25
	20	87 - 171	171	2,000	0.09
	30	67 - 136	136	3,000	0.05
	40	55 - 116	116	4,000	0.03
	50	44 - 100	100	5,000	0.02
10	5	248 - 424	424	500	0.85
	10	174 - 317	317	1,000	0.32
	20	121 - 226	226	2,000	0.11
	30	96 - 183	183	3,000	0.06
	40	82 - 158	158	4,000	0.04
	50	69 - 141	141	5,000	0.03
20	5	319 - 516	516	500	1.03
	10	230 - 397	397	1,000	0.40
	20	163 - 293	293	2,000	0.15
	30	135 - 242	242	3,000	0.08
	40	115 - 211	211	4,000	0.05
	50	102 - 190	190	5,000	0.04
100	5	542 - 785	785	500	1.57
	10	413 - 633	633	1,000	0.63
	20	317 - 506	506	2,000	0.25
	30	268 - 433	433	3,000	0.14
	40	238 - 387	387	4,000	0.10
	50	214 - 354	354	5,000	0.07
100 + 40% CC	5	844 - 1240	1240	500	2.48
	10	662 - 938	938	1,000	0.94
	20	506 - 798	798	2,000	0.40
	30	431 - 689	698	3,000	0.23
	40	382 - 617	617	4,000	0.15
	50	350 - 565	565	5,000	0.11

APPENDIX 06

Infiltration Testing

Infiltration Test Celsa Steelphalt Cardiff 18/04/2019

Trial Pit Size



Excavated Test Pit

Material from Test Pit

Material removed from test pit show a mixture of materials – primarily slag.

Test Methodology

1. Measure length, width and depth of pit
2. Rapidly fill the pit with water to within 1.0m of the surface
3. Mark a reference point (i.e. a long pole or plank across the pit to measure off)
4. Measure the distance from the reference point to the water as it drops
5. Record time of each measurement
6. Continue until pit is at least 75% empty
7. Repeat three times

Test 1

Aim to fill the pit to 1m of surface with a water bowser 2670 Ltrs at approx. 550 ltrs/minute.

Unable to fill the pit to 1m

Dip tested pit and level of 570 mm

Timed from this level to empty pit

Time taken 135 seconds

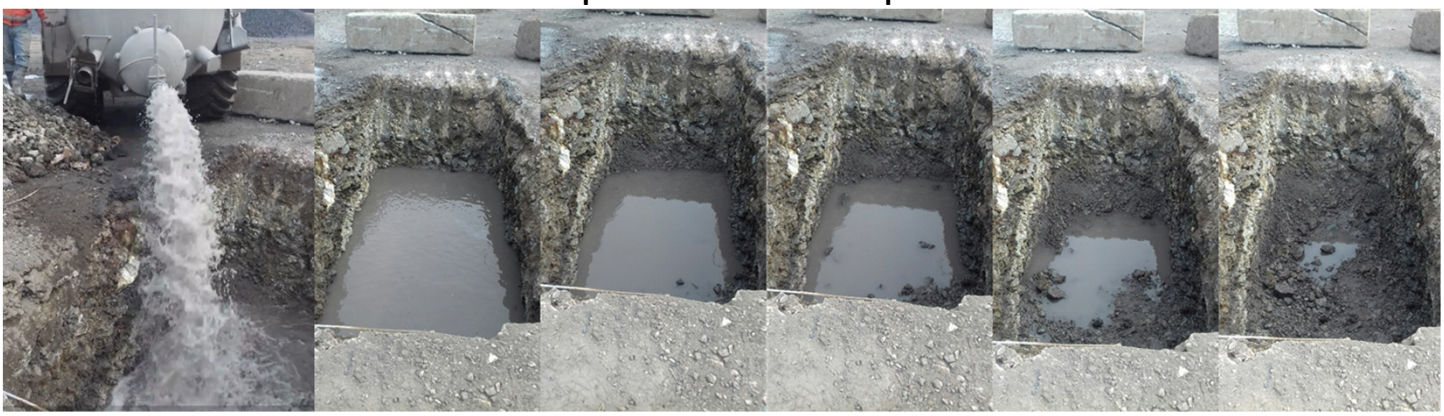
Test 2

As we were unable to fill pit to 1m from top – started timing when water bowser started to fill pit with 2670 litres of water to when the pit was empty.

2670 Litres emptied from test pit in 470 seconds

Test 3

As Test 2 =2670 Litres emptied from test pit in 516 seconds

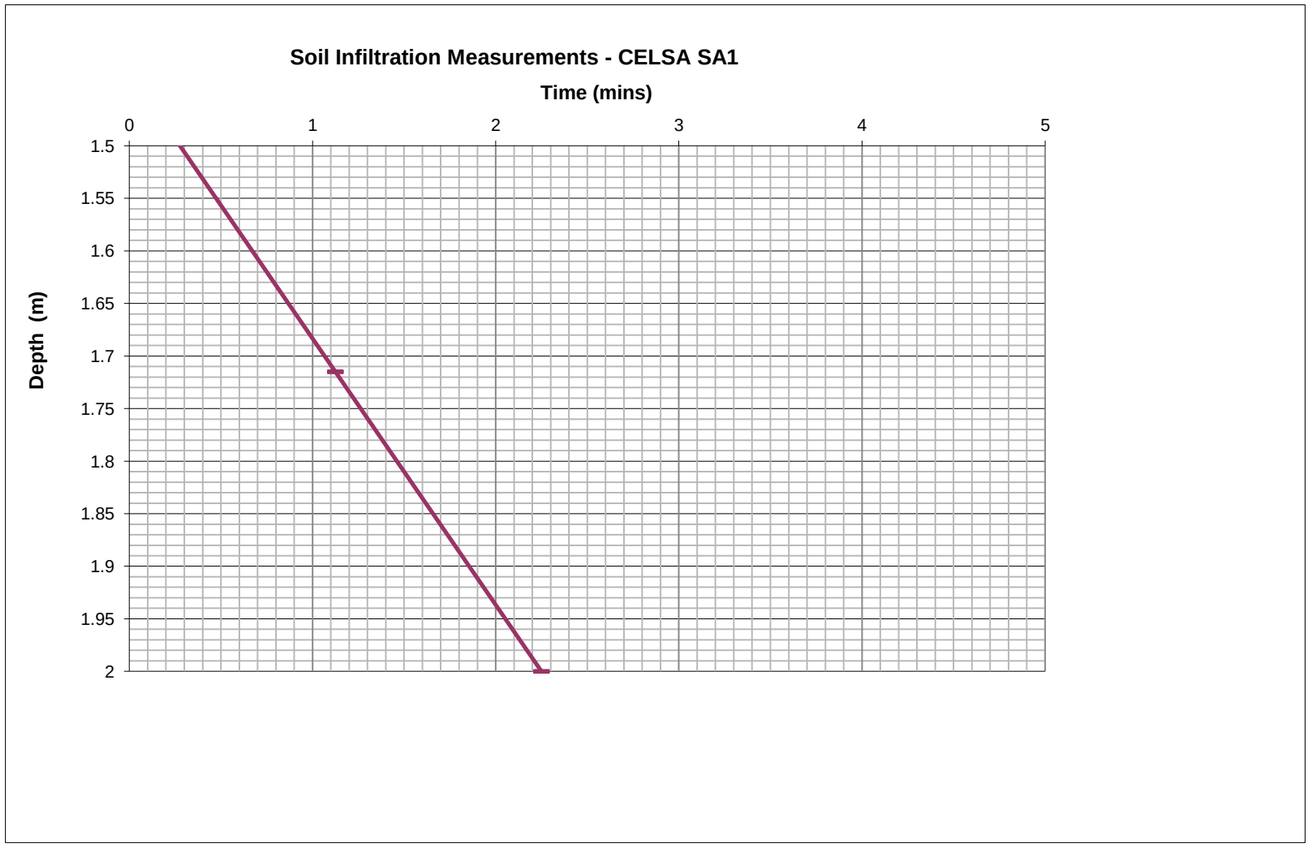


terrafirma
Terra Firma (Wales) Limited
Wharfedale Road, Pentwyn
Cardiff
CF23 7HB
Tel: 029 20 375 354
Fax: 029 20 735 433
Email: info@terrafirmawales.co.uk

Site Name: CELSA
Number: 15264
Date Undertaken: 04/2019
Test No.: SA1 **Fill 1**

	Depth to Water (m)	Time(mins)
(Top of test / effective depth - 100%)	1.43	0
	1.715	1.125
	2	2.25
(Base of pit / effective depth - 0%)	2.000	

Length of Trial Pit (m)	4.50	
Width of Trial Pit (m)	2.20	
Depth of Trial Pit (m)	2.00	
Effective Storage Depth (m)	0.570	
Vp25	1.5725	
Vp75	1.8575	
Vp75-25	2.822	
50% effective depth (m)	0.285	
Mean Surface area ap50 (m2)	13.719	
Time for 25% **Outflow** (t_{p25})	0.55	-
Time for 75% **Outflow** (t_{p75})	1.7	-
tp75 - 25	1.15	-
Soil Infiltration Rate (m/s)	**0.002980633**	-



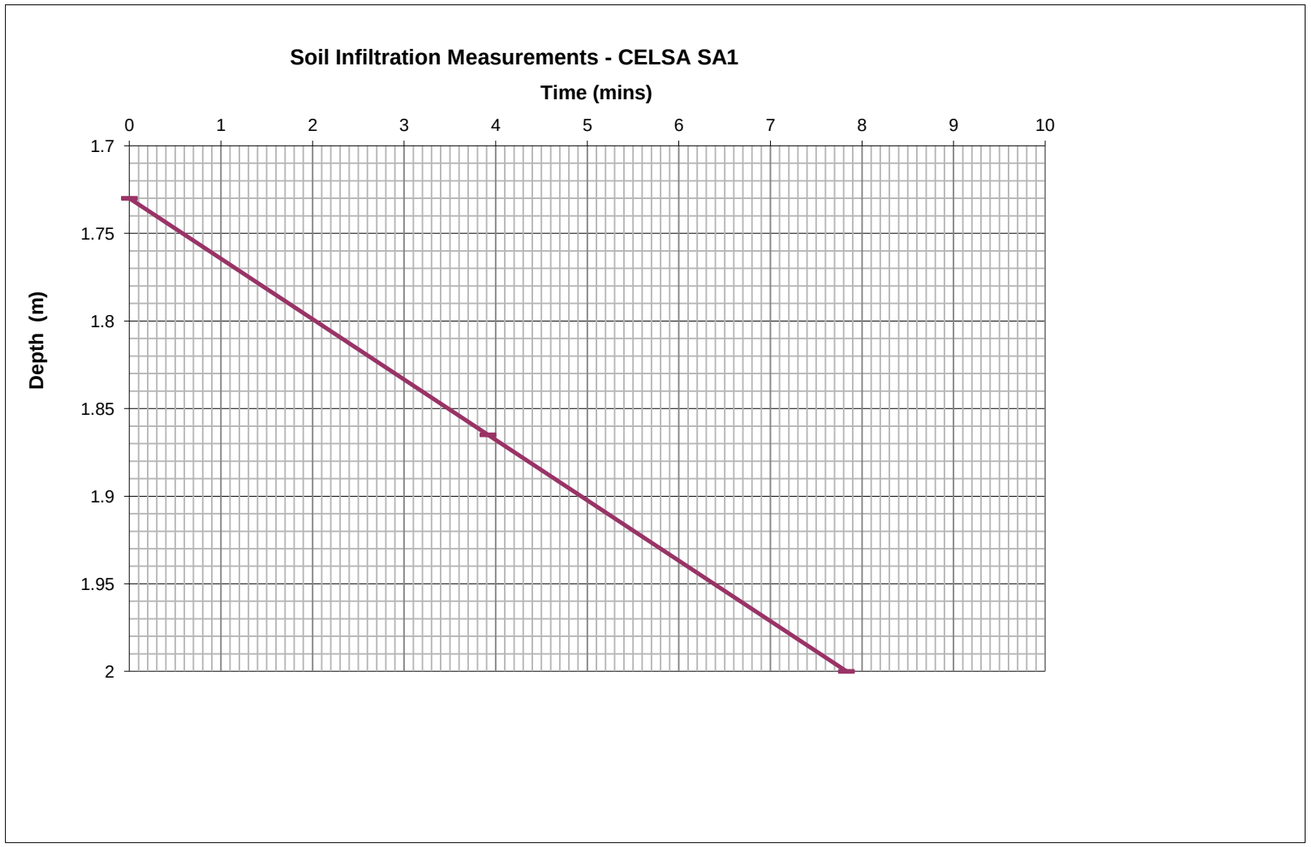
Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BRE Digest 365- March 2007'
This worksheet can be used to determine soil infiltration rates from trial pit field measurements
Worksheet options are identified by a green background

terrafirma
Terra Firma (Wales) Limited
Wharfedale Road, Pentwyn
Cardiff
CF23 7HB
Tel: 029 20 375 354
Fax: 029 20 735 433
Email: info@terrafirmawales.co.uk

Site Name: CELSA
Number: 15264
Date Undertaken: 04/2019
Test No.: SA1 **Fill 2**

	Depth to Water (m)	Time(mins)
(Top of test / effective depth - 100%)	1.73	0
	1.865	3.915
	2	7.83
(Base of pit / effective depth - 0%)	2.000	

Length of Trial Pit (m)	4.50	
Width of Trial Pit (m)	2.20	
Depth of Trial Pit (m)	2.00	
Effective Storage Depth (m)	0.270	
Vp25	1.7975	
Vp75	1.9325	
Vp75-25	1.337	
50% effective depth (m)	0.135	
Mean Surface area ap50 (m2)	11.709	
Time for 25% **Outflow** (t_{p25})	1.9	-
Time for 75% **Outflow** (t_{p75})	5.8	-
tp75 - 25	3.9	-
Soil Infiltration Rate (m/s)	**0.00048779**	-



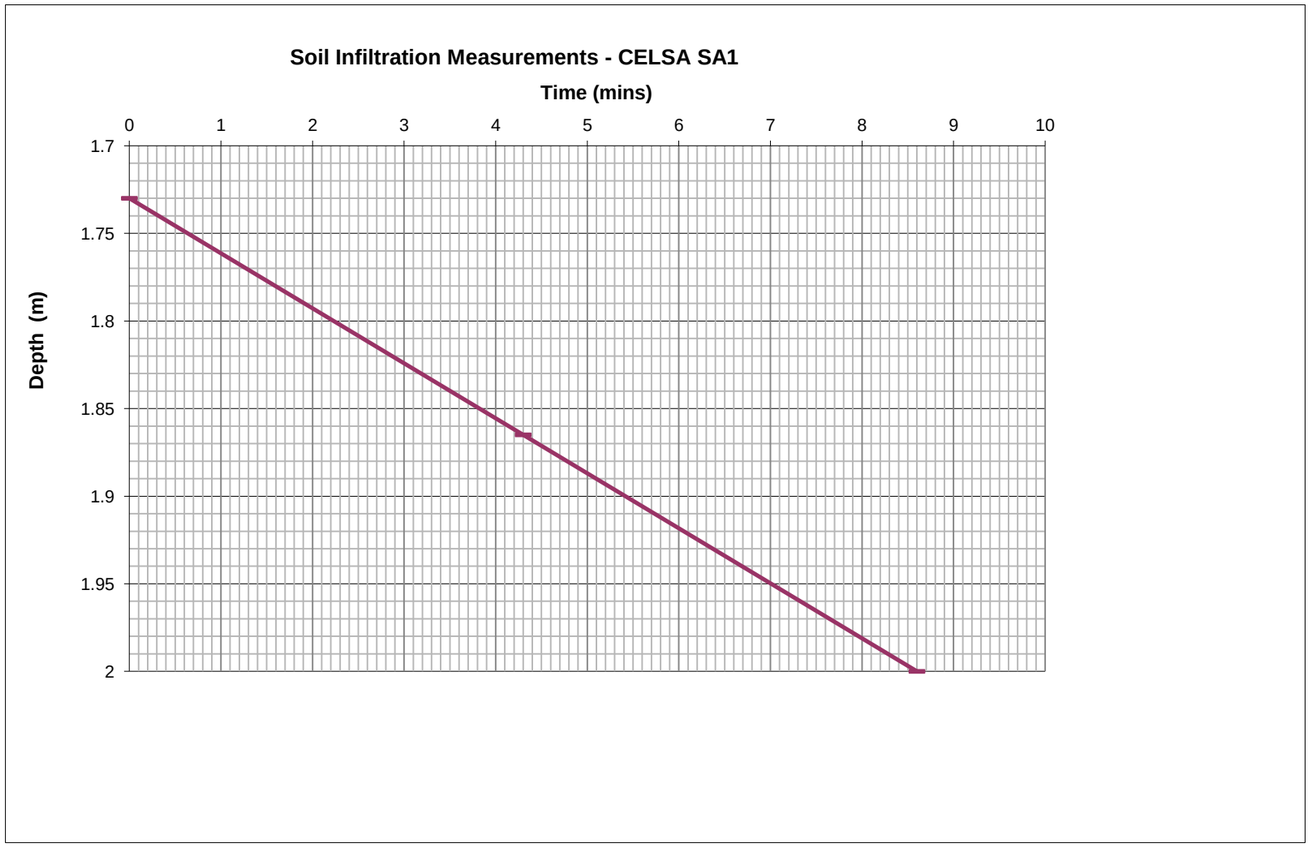
Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BRE Digest 365- March 2007'
This worksheet can be used to determine soil infiltration rates from trial pit field measurements
Worksheet options are identified by a green background

terrafirma
Terra Firma (Wales) Limited
Wharfedale Road, Pentwyn
Cardiff
CF23 7HB
Tel: 029 20 375 354
Fax: 029 20 735 433
Email: info@terrafirmawales.co.uk

Site Name: CELSA
Number: 15264
Date Undertaken: 04/2019
Test No.: SA1 **Fill 3**

	Depth to Water (m)	Time(mins)
(Top of test / effective depth - 100%)	1.73	0
	1.865	4.3
	2	8.6
(Base of pit / effective depth - 0%)	2.000	

Length of Trial Pit (m)	4.50	
Width of Trial Pit (m)	2.20	
Depth of Trial Pit (m)	2.00	
Effective Storage Depth (m)	0.270	
Vp25	1.7975	
Vp75	1.9325	
Vp75-25	1.337	
50% effective depth (m)	0.135	
Mean Surface area ap50 (m2)	11.709	
Time for 25% **Outflow** (t_{p25})	2.1	-
Time for 75% **Outflow** (t_{p75})	6.4	-
tp75 - 25	4.3	-
Soil Infiltration Rate (m/s)	**0.000442415**	-



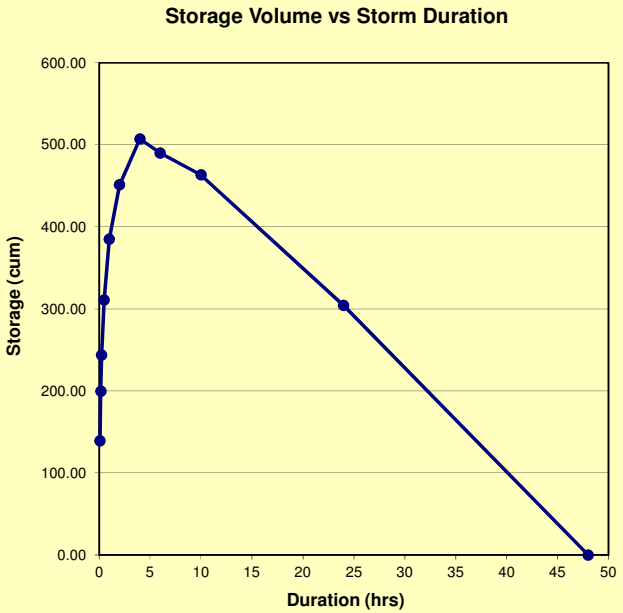
Soil Infiltration Worksheet: This worksheet has been produced in combination with the document 'BRE Digest 365- March 2007'
This worksheet can be used to determine soil infiltration rates from trial pit field measurements
Worksheet options are identified by a green background

APPENDIX 07

Preliminary Soakaway Sizing

Soakaway Design to BRE 365 - Chamber Soakaways

Project	Celsa Steel, Cardiff	
Job No.	416.09604.00001	
Catchment		
Drained Area	10000	sqm
Soil Data		
Infiltration Rate	5.00E-04	m/s
Depth of infiltration horizon	2	m
Rainfall Data		
M5-60	20	mm/hr
Ratio r	0.4	(0.27 to 0.45)
Design Return Period	100	Years
Soakaway Details		
Soakaway Diameter	2.1	m
Storage Depth	2	m
Void Ratio of fill	0.3	
Ring Clearance	0.3	m
Results		
Length of Pit Side	2.9	m
as50	11.6	sqm
Storage Volume (Chamber)	6.92	cum
Storage Volume (Backfill)	2.33	cum
Total Storage Volume	9.26	cum
Required Storage Volume	507.31	cum
Maximum time to Half Empty	12.15	hrs



Duration hrs	Z1 Factor r = 0.42	Rainfall M5-D	Z2 Factor	Rainfall M100-D	Inflow l/s	Outflow l/s	Net Inflow l/s	Storage cum	Time to half empty (hrs)
0.08	0.38	7.60	1.85	14.08	469.46	5.80	463.66	139.04	3.33
0.17	0.53	10.60	1.92	20.32	338.84	5.80	333.04	199.74	4.78
0.25	0.64	12.80	1.94	24.88	276.42	5.80	270.62	243.56	5.83
0.50	0.81	16.20	1.98	32.15	178.60	5.80	172.80	311.03	7.45
1	1.00	20.00	2.03	40.60	112.78	5.80	106.98	385.12	9.22
2	1.20	24.00	2.05	49.30	68.47	5.80	62.67	451.20	10.80
4	1.42	28.40	2.08	59.08	41.03	5.80	35.23	507.31	12.15
6	1.57	31.40	1.96	61.51	28.48	5.80	22.68	489.78	11.73
10	1.74	34.80	1.93	67.22	18.67	5.80	12.87	463.40	11.10
24	2.16	43.20	1.86	80.54	9.32	5.80	3.52	304.30	7.29
48	2.50	50.00	1.81	90.50	5.24	5.80	-0.56	0.00	0.00

Factor Z1

Ratio r / Duration	5 mins	10 mins	15 mins	30 mins	1 hour	2 hour	4 hours	6 hours	10 hours	24 hours	48 hours
0.27	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10	4.00
0.30	0.34	0.49	0.59	0.77	1.00	1.25	1.57	1.78	2.12	2.84	3.50
0.33	0.35	0.50	0.61	0.78	1.00	1.23	1.53	1.73	2.04	2.60	3.25
0.36	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.00	2.42	2.90
0.39	0.37	0.52	0.63	0.80	1.00	1.21	1.46	1.62	1.82	2.28	2.70
0.42	0.38	0.53	0.64	0.81	1.00	1.20	1.42	1.57	1.74	2.16	2.50
0.45	0.39	0.54	0.65	0.82	1.00	1.19	1.38	1.51	1.68	2.03	2.30

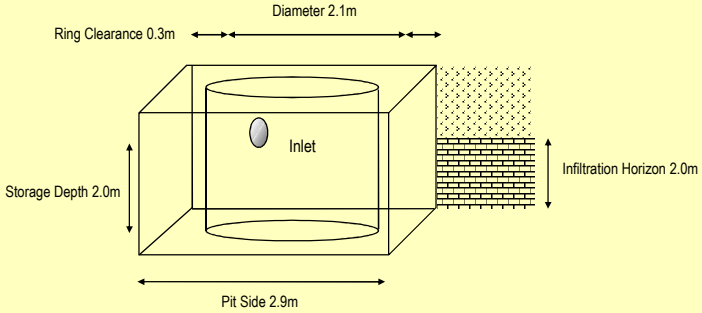
Factor Z2(100)

	100
5	1.79
10	1.91
20	2.03
30	1.97
40	1.89
50	1.81
100	1.54

Factor Z2

M5/MD	*1*	*2*	*5*	*10*	*30*	*50*	*100*
5	0.62	0.72	1.00	1.18	1.48	1.56	1.79
10	0.61	0.70	1.00	1.21	1.53	1.65	1.91
20	0.64	0.72	1.00	1.23	1.60	1.73	2.03
30	0.68	0.75	1.00	1.21	1.57	1.70	1.97
40	0.70	0.77	1.00	1.18	1.51	1.64	1.89
50	0.72	0.79	1.00	1.16	1.45	1.58	1.81
100	0.78	0.83	1.00	1.12	1.31	1.40	1.54

Summary



Required Storage Volume = 507.31 cum
Design Storage Volume = 9.26 cum
Maximum time to half empty = 12.1 hrs < 24 hrs

M5-60 Design Rainfall = 20 mm/hr
Ratio r = 0.42
Design Return Period = 100 years

Rev C LLW 25-01-02

EUROPEAN OFFICES

United Kingdom

AYLESBURY
T: +44 (0)1844 337380

BELFAST
T: +44 (0)28 9073 2493

BRADFORD-ON-AVON
T: +44 (0)1225 309400

BRISTOL
T: +44 (0)117 906 4280

CAMBRIDGE
T: + 44 (0)1223 813805

CARDIFF
T: +44 (0)29 2049 1010

CHELMSFORD
T: +44 (0)1245 392170

EDINBURGH
T: +44 (0)131 335 6830

EXETER
T: + 44 (0)1392 490152

GLASGOW
T: +44 (0)141 353 5037

GUILDFORD
T: +44 (0)1483 889800

LEEDS
T: +44 (0)113 258 0650

LONDON
T: +44 (0)203 691 5810

MAIDSTONE
T: +44 (0)1622 609242

MANCHESTER
T: +44 (0)161 872 7564

NEWCASTLE UPON TYNE
T: +44 (0)191 261 1966

NOTTINGHAM
T: +44 (0)115 964 7280

SHEFFIELD
T: +44 (0)114 245 5153

SHREWSBURY
T: +44 (0)1743 23 9250

STAFFORD
T: +44 (0)1785 241755

STIRLING
T: +44 (0)1786 239900

WORCESTER
T: +44 (0)1905 751310

Ireland

DUBLIN
T: + 353 (0)1 296 4667

France

GRENOBLE
T: +33 (0)4 76 70 93 41