Circular Waste Solutions

Castell Bach Engineering Ltd.

109-RP-002 – Drainage Plan

THE TREATMENT WORKS

Westfield Industrial Park,
Waunarlwydd,
Swansea
SA5 4SF

Revision C – 24th Mar 23

REVISION TRACKING

Revision	Date	Revision Purpose	Description of Revision / Key Changes
A	6th Feb 23	Internal Check	Initial draft for internal checking
B	9th Mar 23	Issued for Information	Incorporating Client Comments
C	24th Mar 23	Issued for Information	Incorporating comments from Client
1			
2			

Contents

1 EXECUTIVE SUMMARY

This document presents the drainage plan for the Waste Treatment Works in Waunarlwydd.

Drainage scheme is based on a closed system which contains and controls all surface water run-off and process spills within site. All contained liquids are inspected by operators to ensure no contamination enters the down stream drainage infrastructure.

Existing offsite discharges to adopted sewers are disconnected, with all flows now diverted to a single licenced discharge point (S1) with consent to discharge up to 500m^3/day.

Drainage consists of a mix of existing and new gravity and pumped drainage systems. All pumps are manually operated, with water being inspected by operators to confirm no contamination prior to pumping.

For bunded area, this report demonstrates compliance with industry standards for , in particular CIRIA C736 - *Containment systems for the prevention of pollution*.

Surface water run-off has also been discussed and reviewed in line with a conservative loading basis. The report shows, that with even a conservative loading, the proposed systems can accommodate the flows and have an allowance for firewater run off.

2 Introduction

2.1 Project Background

The Client proposes to extend and modify an existing industrial site in Waunarlwydd

The site will process and treat approximately 32,000 tonnes of regionally sourced non-hazardous and hazardous industrial waste waters and liquids per annum, using a combination of treatment and separation technologies to produce 'clean' liquid effluents suitable for disposal to sewer and recovered oil and other products suitable for resale and reuse.

A drainage philosophy for the site has already been prepared for the site by others. Castell Bach Engineering Ltd. has been appointed by the Client to complete a drainage plan which expands on the philosophy and provides further details of the proposed drainage scheme.

2.2 Scope of document

The scope of this document is to provide a drainage plan to support the development as outlined in Section 2.1.

This drainage plan document builds on the site drainage philosophy as introduced in the Site Condition Report (Ref A-3). It expands on and develops what has been considered to be an accepted drainage philosophy.

It explores maximum surface water flow rates through the existing consented discharge point. It also provides guidance on sizing requirements for secondary and tertiary containment bunds within the facility.

This drainage plan has been informed by guidance from publicly available information, known site constraints, mindful of existing infrastructure and current best practice and industry standards.

2.3 Location

The proposed development is at:
The Treatment Works
Westfield Industrial Park
Titanium Road
Waunarlwydd
SA5 4SF

"UK Grid Reference Finder"
www.gridreferencefinder.com

Grid Reference:
51.646507,-4.017843

Latitude, Longitude
260506E, 196121N

The site consists of developed, greenfield spaces and offices/workshops.

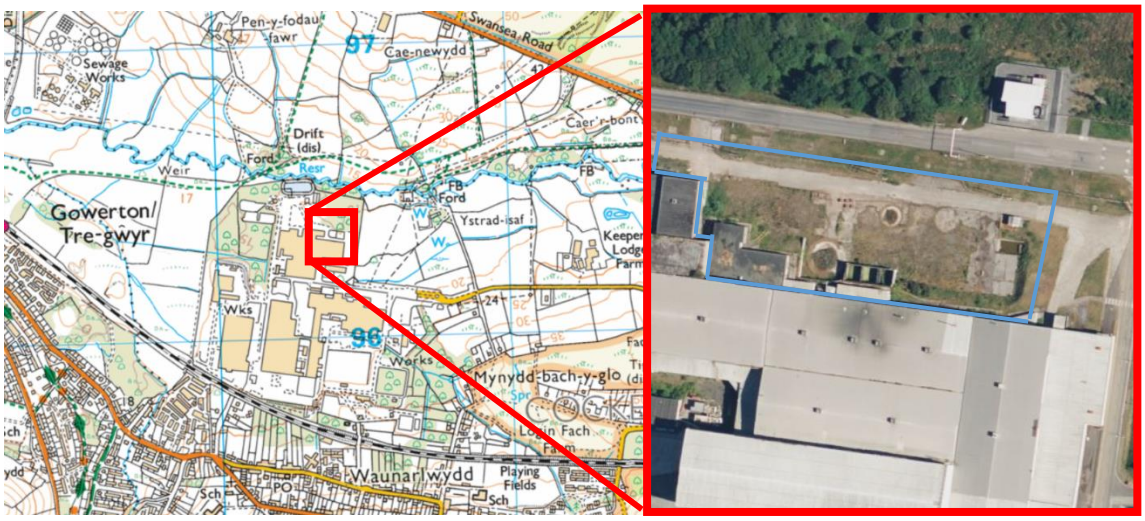


Figure 2.1 – Proposed Development Location (Source: https://www.bing.com/maps)

2.4 General Assumptions and exclusions

Assumptions have been made as part of this report. The following assumptions and exclusions have formed the basis of this work and drainage report:

1. The proposed development consists of the development of an existing industrial site.
2. The drainage scheme has been developed in line with the site condition report.
3. Existing roof drainage systems discharge via an existing discharge point – no change to this arrangement is proposed.
4. All bunded areas will contain and control any spills.
5. Sustainable drainage, whilst important, is not the governing consideration due to the potential for contamination and this being an industrial site.
6. Fire fighting water is accounted for in bund containment volume calculations.
7. Rainfall Events considered are as follows:
    a. For bunded areas, 3 days considered (2 days rainfall prior to an event, with one day during an event).
8. Site is not classified as a COMAH site.

2.5 Client Documentation

REF	DOCUMENT TITLE	DOCUMENT REFERENCE	REVISION/DATE
A-1	Existing Drainage Layout	21456-SK-801	Jan 22
A-2	Topographical Survey (Sheets 1-4)	216467-A	Nov 21
A-3	Site Condition Report	SOL2012CWS01	Dec 20
A-4	Environmental Search	271676341	Jan 21
A-5	CWS Geotech Desk Study	ESP.8061.3653	Feb 22
A-6	CWS Geotech Report	ESP.8061.02.3705	May 22

Table 2.1 – Client documentation

2.6 References

REF	DOCUMENT TITLE / SOURCE	DOCUMENT NUMBER / WEBLINK	REVISION
1	Bing Maps (website)	Bing.com/maps	May 2021
2	Google Maps (Website)	www.google.co.uk/maps	May 2021
3	Ciria SuDS Manual 2015	Ciria C753	2015
4	Containment systems for the prevention of pollution - Secondary, tertiary and other measures for industrial and commercial premises	C736	2014
5	Recommended non-statutory standards for sustainable drainage (SuDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems by Welsh Assembly Government	ISBN: 978 1 4734 8768 0	2017
6	Building Regulations Document - Drainage and Waste Disposal Approved Document H	Building Regulations – Approved Document H	2010
7	Sewers for Adoption 7th Edition	7th Edition	2012
8	British Water – Code of Practice -Flow and Loads – 4, Sizing Criteria, Treatment Capacity for Sewage Treatment Systems	ISBN 978-1-903481-10-3	2013
9	Cranfield Soil and Agrifood Institute “Soil Scapes”.	http://www.landis.org.uk/soilscapes/	2018
10	Urban Drainage by David Butler, Christopher Digman, Christos Makropolous and John W. Davies.	ISBN 978-1-4978-5058-5	4th Edition
11	Urban Drainage by David Butler, Christopher Digman, Christos Makropolous and John W. Davies.	ISBN 978-1-4978-5058-5	4th Edition

Table 2.2 – References and attachments

3 Proposed Development

3.1 Legacy Site and Drainage

The existing site is a decommission waste handling facility, located within a wider industrial area.

Despite the site being decommissioned a number of years ago, a number of physical infrastructure remain, including concrete hard standings, drainage systems, vessel foundations, offices and associated ancillary civils.

There is an existing 375mm Dia. Foul sewer (adopted), to the north of the site, outside of the boundary which runs east to west.

As a licenced waste handling facility, this site also has a consented sewer emissions connection point to a foul sewer (see connection F02 below). This is located within the south of the site. This connection point has a licenced allowable flow rate of 500m^3/day.

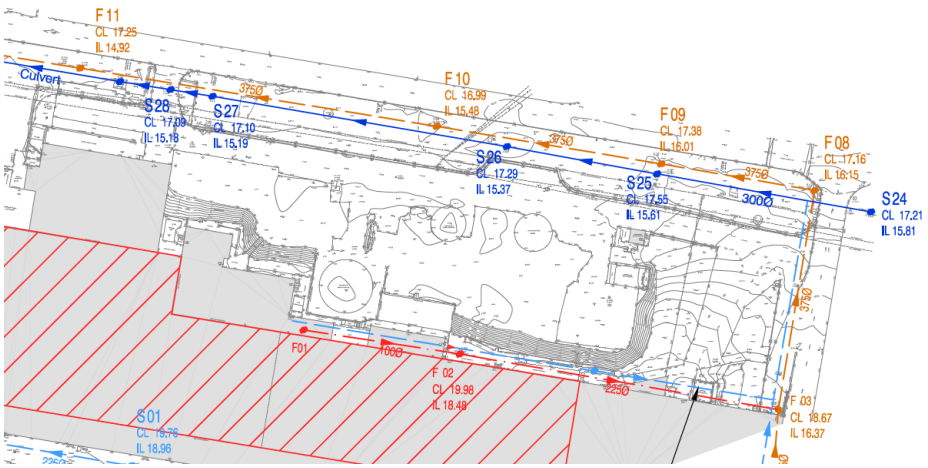


Figure 3.1 – legacy Site and Drainage (Extract from Client Provided Drawing (Ref A-1) – Appendix E)

3.2 Proposed Site

The new site is a waste treatment facility which is focused around storage and treatment of contaminated liquids. Ancillary equipment, offices and facilities make up the remainder of the site.

New site drainage consists entirely of impermeable hard standing. All areas, which form part of the process areas, and or vehicle access routes will be hard surfaced.

Paved areas are serviced by an open drainage system which is designed, installed and operated to prevent any possible pathways for contamination to enter the ground.

Figure 3.2 – Proposed Site Layout (Extract from 109-CL-001 – Appendix B)

3.3 Flood Risks

Flood risk assessments have been completed by others as part of the site condition report (Rev A-4). That assessment concluded that the site was at risk from surface water flooding at the 1:75 yr return period, with high levels of rainfall overwhelming the drainage systems or be unable to soakaway into the ground immediately.

This document looks to available data to provide high level verification of the above and provide additional supporting information for inclusion in the narrative about how to deal with surface water run off on site.

The below information has been sourced from Natural Resource Wales flooding maps.

3.3.1 River courses – NO IDENTIFIED RISKS

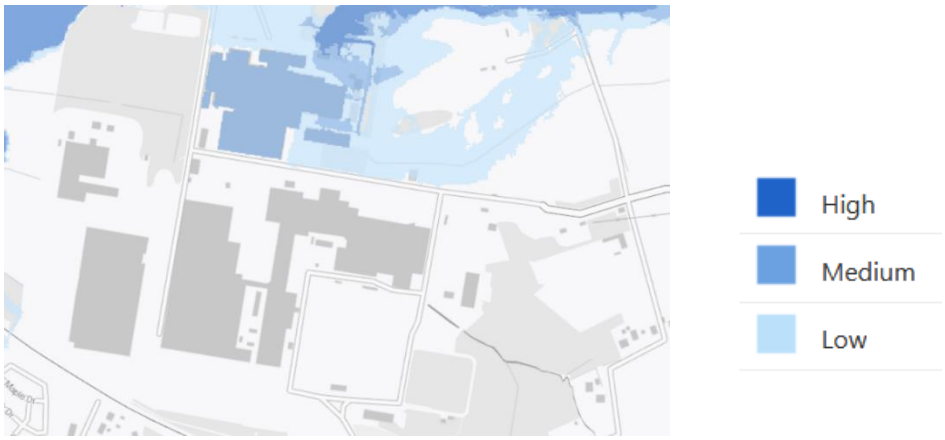


Figure 3.3 – Extract from NRW Flood risk maps – Surface Water

3.3.2 Surface Water and Small Water courses – HIGH RISK

Some of the site is in an area with 0.1% to 1% (1 in 1000 or 1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change.

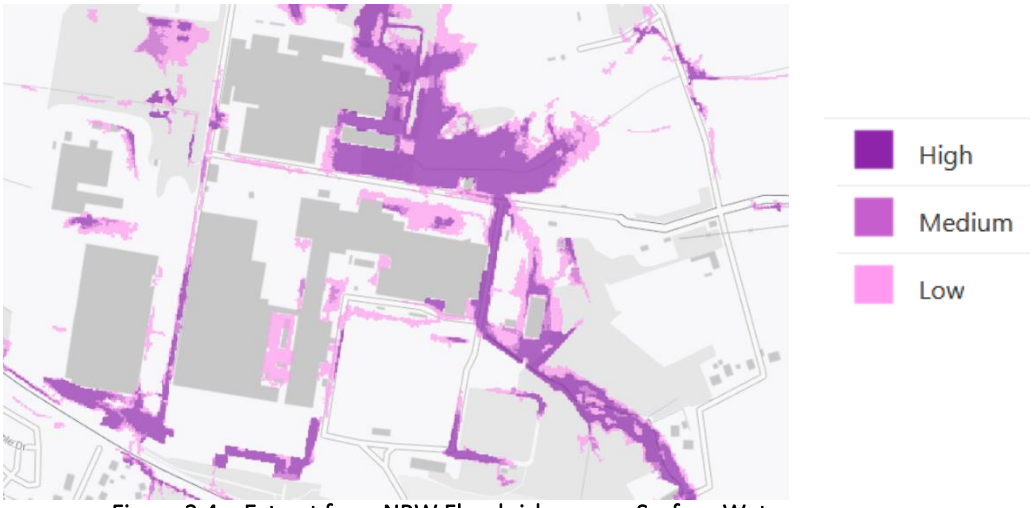


Figure 3.4 – Extract from NRW Flood risk maps – Surface Water

3.3.3 Sea – NO IDENTIFIED RISK

There is no identified risk within 0.1% to 0.5% (1 in 1000 to 1 in 200) chance of flooding from the sea in a given year including the effects of climate change.

Figure 3.5 – Extract from NRW Flood risk maps – Sea Flooding

4 Drainage Plan

4.1 General

This document builds on the drainage scheme as introduced in Client document "Site Condition Report" (ref A-3).

Circular Waste Solutions propose to utilise the drainage infrastructure in place from the previously permitted Alcoa effluent treatment plant. This was specifically designed as a sealed drainage system with integral bunding and containment. Any surface water run-off from waste storage/processing areas will be controlled, processed and discharged to foul sewer under the trade effluent consent held by the site.

There will be no discharges to controlled waters from the facility.

Site uses a mix of gravity and pumped systems, with localised discrete containment areas all in accordance with *CIRIA C736 - Containment systems for the prevention of pollution*. All contained areas will be manually inspected prior to local activation of pumping to downstream networks.

To achieve this design the following drainage systems / modifications will be implements.

1) All on-site systems which connect to off-site surface water (adopted) systems will be disconnected.
2) Storage vessels and containers will be located within bunded areas. Each bunded area, will control and contain surface water and primary containment breaches.
3) Spill containment areas will be discrete areas, with dedicated collection pumped sump for all run-off within bunds. Each bund will have its own sump and pump. Containment areas, may incorporate a number of rain catchment areas.
4) Sumps will be sized to allow for installation of a manually operated pump. Pumps will not run without local "positive activation" by operator.
5) Contained liquids within sumps will be inspected for any pollution/contamination by operator prior to activation of pumps. Pumps will not be activated if sampling shows evidence of any contaminants.
6) Where secondary containment is required, bunded volumes will provide sufficient containment potential spills from vessels within and include an allowance for rainfall. Volume requirements (and by extension the requirement for bund wall height) of secondary containment sizing shall be based on the greater of:
   - 110% of largest vessel's working volume
   - 25% of total combined vessel working volumes (where more than one vessel is located within a bund).
   - 100% of largest vessel plus rainfall allowance
   - 25% of total combined vessel working volumes plus rainfall allowance.
7) In addition to the sizing requirements above, an allowance for firewater within each bund has been accounted for.
8) Pumps within sumps will discharge to either intermediate storage tanks/ vessels, or discharge direct to final effluent tanks. Where required this will be treated.
9) Final effluent tanks shall be used for attenuation of all site surface water run off prior to discharge off site via the consented discharge point. All liquids contained within the final effluent tank shall be inspected by an operator prior to positive activation of the manual discharge pump.
10) Client has confirmed that if an event were to occur, operations will look to empty levels within bunds as quick as possible, and as such the need to account for 8 days of rainfall after a spill event is not required.

Note:
Assumption is that freeboard and wave fetch do not need to be considered for secondary containment sizing.

4.2 Surface Water Runoff

The site is an industrial facility which requires a closed drainage system with no opportunity for contaminants to enter the ground or flow offsite. The drainage design will follow industry guidelines for prevent of pollution *Ciria C736 - Containment systems for the prevention of pollution* as the overriding guiding document for this plan.

There are limited opportunities for incorporating sustainable urban drainage system (SuDS) principals in the drainage plan due to the requirement for containment drainage systems. Ciria guidance C753 is not the overriding guidance document for the drainage design. However, some of the key principals which underpin design of surface water management schemes striving to meet the requirements of SuDS are naturally implemented within our scheme. These include:

- Manage water on, or close to, the surface and as close to the source of the runoff as possible.
- Treat rainfall as a valuable natural resource.
- Ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it.
- Manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development.
- Take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep by considering a 1 in 10-year storm plus 10% increase for climate change.

4.2.1 Surface Water Design Storm Return Period

CIRIA guidance on containment systems advises that secondary containment should consider 1 in 10year return periods for sizing containment requirements (inclusive of 10% increase for climate change). This is the governing return period used in the drainage design for bund sizing. This in combination with the allowances for potential spills and firewater use governs the sizing of the bunds.

However, for a conservative assessment of impact of just rainfall on operations and therefore to check on sizing of pumps; an additional check has been included in this design to determine what maximum on site surface water rainfall could be seen in a 1 in 100 year return period and hence understand the impact on capacity of the 500m^3/day discharge consent in place for the site.

This return period shall be used as a basis for determining surface water volumes which would need to be accounted for in the final effluent discharge point, but not govern the design thereof.

4.2.2 Surface water catchment and flow paths

Surface water run offs will follow proposed (and existing) site gradients. Based on existing topographical surveys (Ref A-2) there will be a number of different catchment areas. Catchment areas will have discrete flow paths for surface water run off to dedicated collection points within the system.

A visualisation of surface water catchments and flow profiles can be seen in Figures 4.1 and 4.2 below.

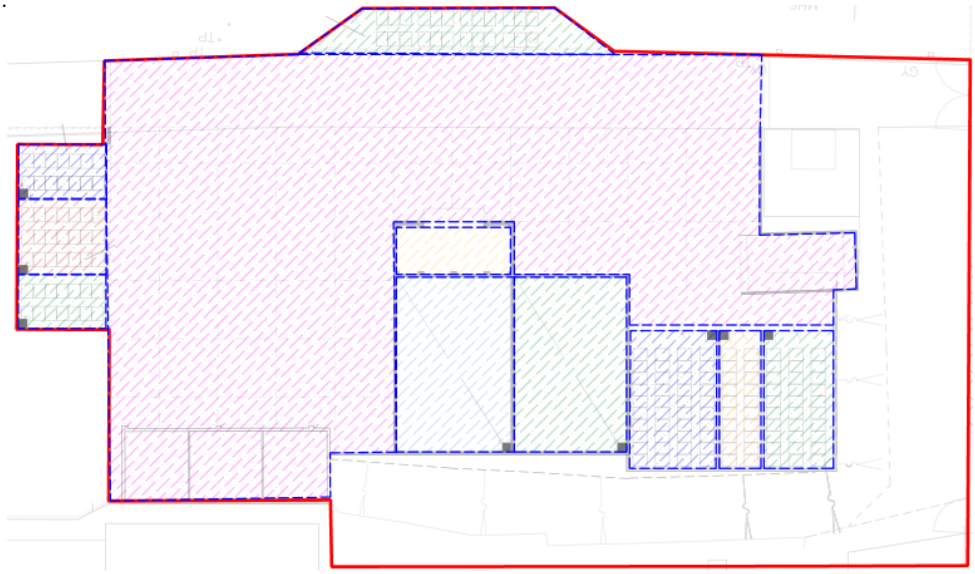


Figure 4.1 –Idealisation of surface water catchment areas

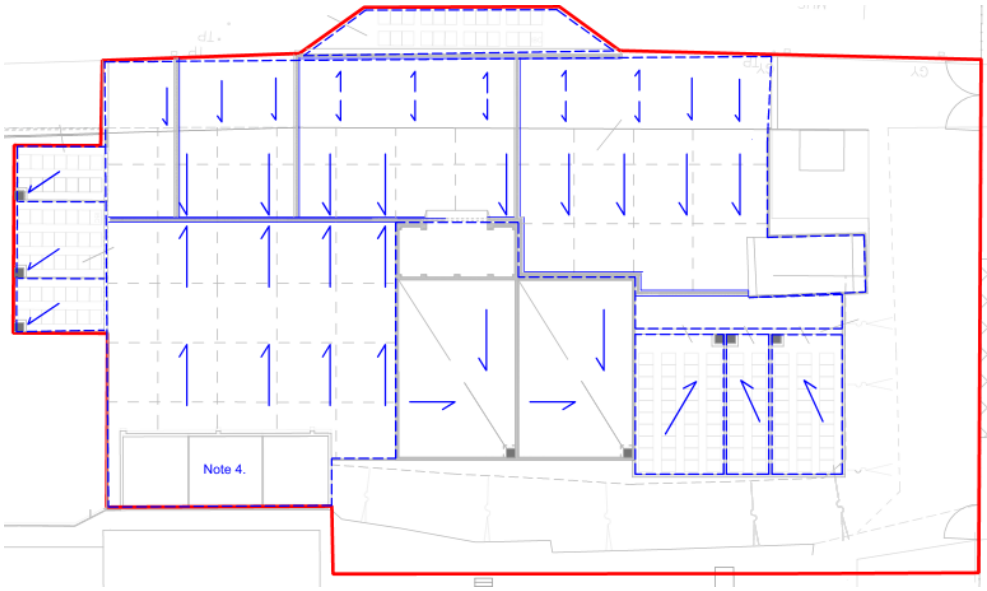


Figure 4.2 –Approximation of surface water profiles

Where catchment areas, are bunded areas, they have independent discrete systems, which are checked by an operator prior to discharge to the next downstream connection point. Where catchment areas, are not designed as secondary containment, and are only susceptible to accidental, incidental spills (e.g. roads) then they may be combined to a common sump before being pumped away. No pump shall be activated unless an operator positively confirms that there is no contamination within the liquid retained.

4.2.3 Surface Water Volumes

The modified rational method has been used to determine flow rates on site. As mentioned in section 4.2.1 , the surface water calculations have been run to establish a worst case design condition for sizing of the pumps. It does not constitute a basis for the volumes of secondary containment required, this is discussed further in section 4.4.

4.3 Fire water

Firewater has been accounted for in the sizing of bunded areas with an allowance provided in each of the bunded/kerbed areas. Please refer to the Fire Prevention and Mitigation Plan (FPMP) which considers the fire water requirements in more detail.

4.4 Contaminated Spill Containment Requirements

Contamination of the ground will not be possible in the event of a failure of a storage vessel.

Drainage design is to utilise bunded areas and kerbed hardstanding to contain and control any spills. In areas. Bund containment volume capacity will be in line with Ciria C736. Containment requirements have been calculated (Appendix C) with a summary of the output presented in table 4.2 below.

Basis of sizing includes the following assumptions:

1) Vessel volumes stated are “brim-full” capacities of the primary containment of each vessel. Physical overflows have been disregarded.
2) Rainfall has been calculated based on the following rainfall event and additional allowances:
    a. 1 in 10 year event (10 percent Annual Exceedance Probability (AEP))
    b. 2 days period of rainfall prior to, and one day during a spill event.
    c. Fire water has been accounted for with allowances shown in table 4.2 below
3) Rainfall values have been based on the guidance within CIRIA C736, however a sense check of rainfall values as calculated using the Modified Rational Method has also been carried out. The more onerous requirements have been selected in each instance.

The above is in line with Client operational procedures for control and discharge of bunded areas.

Summary of containment provided within each bunded area is shown below.

Area ID	Description	Total Contained Inventory Volume (m^3)	Containment Required (m^3)	Bund Wall Height	Total Containment Provided (m^3)	Fire Water (m^3)
Aqueous Treatment	4 large vessels, a number of smaller	87.0	48.0	500mm	73.2	25.2
Oily Water	5 large vessels, a number of smaller	202.5	62.3	500mm	71.5	9.1
Storage Area A - Acid	80 IBCs stored in an open bunded area	80.0	8.4	100mm	9.0	0.6
Storage Area A - Oil	40 IBCs stored in an open bunded area	40.0	4.9	100mm	5.3	0.3
Storage Area A - Caustic	60 IBCs stored in an open bunded area	60.0	7.0	100mm	7.3	0.3
Storage Area B – North*	28 IBCs stored inside	28.0	1.1	100mm	3.2	2.1
Storage Area B – Mid*	42 IBCs stored inside	42.0	1.1	100mm	5.0	3.9
Storage Area B – South*	28 IBCs stored inside	28.0	1.1	100mm	3.2	2.1
Reception Area R2	24 IBCs stored in an open area	24.0	7.94	100mm	7.8	0.4
Final Effluent Tank**	Paving /Hardstanding surrounding Tank (R3)	240.0	257.3	100mm	260	2.7

*storage area B located within building. Roof run off captured and managed separately. Bund containment assumes no rain.
** assuming each of the chambers are independent.

Table 4.2 – Summary of bund containment.

4.5 Drainage Design

The drainage scheme includes a number of trains of drainage. Mixing gravity and pumps systems, interconnected by balancing/attenuation tanks.

All bunded areas, will have dedicated local sumps which will pump waters downstream in system. No pumps will be activated without positive confirmation that waters are clean by operator sampling. Therefore, no contaminated waters will be able to be pumped downstream within the system.

Gravity drains from roads and hard standings will be connected to paving drainage to a common sump at boundary of R3.

Should a spill occur or contamination be found within the sumps/chambers then this contained within sumps/bunds until it can be dealt with by spill control processes.

Paved area “R3” shall act as secondary containment for the effluent tanks 1 and 2, it shall also provide tertiary containment for storage area A, B and R2 and the oil and water and aqueous treatment tank bunds.

4.5.1 Existing tie-ins

Chamber S28 as shown on figure 3.1 is an existing connection point for discharge of on-site surface water from paved areas and roofs. This is the only known offsite connection, excluding the consented effluent point (S1).

Part of this design is to disconnect/blank this connection.

4.5.2 Exceedance

System is designed to accommodate surface water run off from a 1 in 10 yr storm, inclusive of climate change allowance, for a storm duration of 3 days (2 days prior to and one day during an event). Office buildings are elevated and drainage systems are split into discrete areas for redundancy in the overall capacity of surface water run off.

Where firewater allowance within bunded areas is exceeded, or where a storm event greater than that designed for is experienced, bunds will overflow into the tertiary containment area (R3) to control any potential firewater run off which can be pumped to the dedicated 120m^3 firewater run off tank.

Any and all flows will flow away from equipment and buildings, so there is no risk of flooding of site buildings.

4.5.3 Betterment

By reducing reliance on adopted sewers to the north of the site, the project is introducing a level of betterment to existing infrastructure within the area. This may in turn reduce the risks associated with flooding of the site, should there have been any issues regarding existing systems surcharging during intense storm periods (as introduced in Section 3.3.2).

5 Safety and Maintenance

5.1 Safety

The Client is ultimately responsible for the safe construction, testing and operation of the proposed scheme.

Whilst Castell Bach under CDM Regs 2015, is not the Principal Designer on this project, we understand the importance of working with all project stakeholders in identifying, removing, elimination, reducing and communicating any foreseen risks.

Health and safety of the drainage scheme starts with design. Risk assessments at the design stage are an important step and should include the identification of any hazards in the design, suitable actions to eliminate or reduce the risks to builders, maintainers and users of the systems and the information regarding the residual risks in order that they may be effectively controlled on site.

A preliminary risk assessment can be found in Appendix F. This risk assessment can be used as a foundation to build upon during the detailed design stage with the selected Principal Designer.

5.2 Existing systems

Prior to commissioning of the drainage systems, it is recommended that existing systems are tested for water tightness and suitability for continued use.

5.3 Regular Inspections

Operators' inspections are integral to the systems' functionality. It is proposed that operators check each chamber at the beginning and end of each shift as a minimum to ensure that chambers don't surcharge and that any spills are identified at earliest opportunity.

5.4 Maintenance

As with any drainage system, the asset owner must incorporate this design into their ongoing maintenance regime. It is recommended that the systems are inspected twice a year, both before the autumn and after winter. Chambers should be inspected annually and emptied as required. Inspection regime should be managed as part of site maintenance plan.

The maintenance of the permeable paving should be in accordance with the manufacturer's recommendations (See section 10.2.2).

6 Conclusion

6.1 Conclusion

Drainage plan has been designed to create a discrete, independent, drainage system which contains and controls all onsite surface water run off in accordance with CIRIA C736..

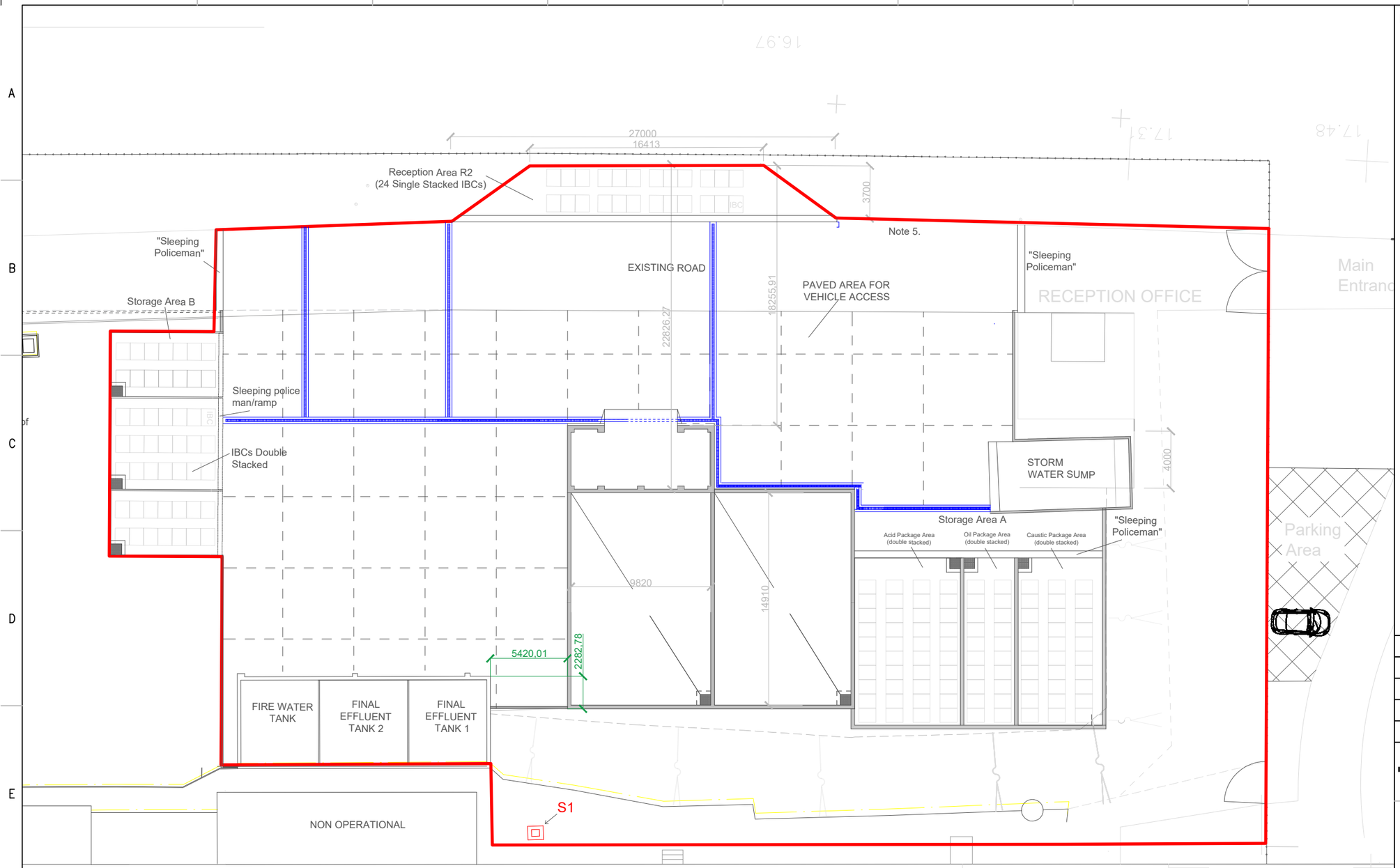
Client preferred philosophy of utilising operators to locally check for contamination within discrete containment areas prior to pumping to manage and mitigate risk of contamination has been incorporated into the proposed design.

Drainage plan shows that the design meets national and regulatory requirements for control and containment of surface water runoff and possible sources of contamination. All surface water will be discharged, once confirmed to be non-contaminated, via a single licenced discharge point (S1) off site. Any contaminated surface water will be treated on site.

The drainage design also identifies betterment of existing offsite adopted systems by reducing discharge into those systems.

Appendix A – NRW FLOOD MAP – SURFACE WATER

Appendix B – Site Layout



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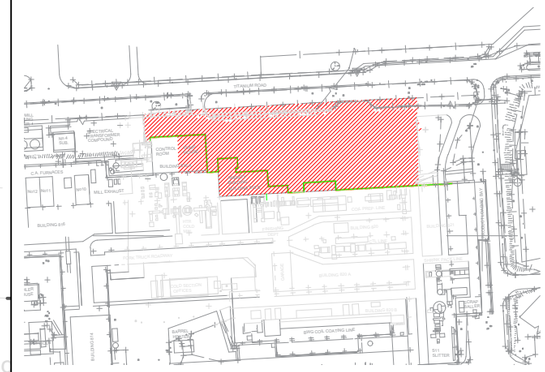


General Notes:

1) Indicative layout for information only to support permit and planning applications. Not for construction.
2) Layout orientated to site north.

REV	DATE	DESCRIPTION				
REV	DATE	DESCRIPTION				
2	20-02-23	UPDATED_LAYOUT_PROPOSED				
1	30-MAY-22	ISSUED_FOR_INFORMATION	JW	JW	PJ	
0	13-12-19	ISSUED_FOR_CLIENT_COMMENT	JW	JW		
REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK	APP

CDM 2015 Notes:

1) Castell Bach Engineering Ltd. as Designer, informs Client of their responsibilities under CDM Regs 2015. Including but not limited to:
   a) Providing pre-construction information to designer and contractor;
   b) Providing suitable welfare facilities for duration of project;
   c) Allowing sufficient time and resources at each stage of the
   d) Prepares and updates the site Health and Safety file.for site and/or project.
2) Contractor will provide a construction phase plan before that phase begins.
3) Designer has based design on Client provided information, elimination foreseeable health and safety risks and has taken steps to reduce or control any risks that cannot be eliminated.

CIRCULAR WASTE SOLUTIONS

Castell Bach Engineering Ltd

PROJECT
CIRCULAR_WASTE_SOLUTIONS-FEASIBILITY_STUDY
-

TITLE
SITE_LAYOUT
-

SCALE	PROJECT No	DOCUMENT No	REV
NTS	109	109-CL-001	2

(A3 Sheet)

Appendix C– Calculations

Rainfall Calculation

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-001		
Calculation description	Rainfall - 1in10 yr	Date	30th Jan 23

This set of calculations is based on methods set out within The Modified Rational Method.

The surface water system shall been designed to a 1 in 10 year storm, with an additional 10% allowance for climate change.

Rainfall data used for this calculation

Site location =	X: 260506, Y: 196121		
M5-60 =	17	mm	*(5 year, 60 minute rainfall total)*
Rainfall ratio =	0.3		*(ratio of M5-60 minute to M5-2 day total rainfalls)*

Impermeable area used in this calculation

Area =	1	m^2	(bunds / paving /roads / roofs)
% run-off =	95	%	

For converting M5-60min to M5-D where D is any storm duration in hours, follow the computer method as set out in the Design and Analysis of urban storm drainage - The Wallingford Procedure: Volume 1 - Principles, methods and practice

$$\ln(M5-D)=\ln D+\ln\left(1.06\frac{M5-60min}{48r}\right)+\left[\frac{\ln\left(\frac{721}{1+15D}\right)\ln\left(\frac{48r}{1.06}\right)}{\ln\left(\frac{721}{16}\right)}\right]$$

For converting M5-D to MT-D where T is any return period, as above, the computer method sets out the following:

$$\ln\left(\frac{MT-D}{M5-D}\right)=C_r(\ln(T)-1.5)$$

Where Cr is dependent on geographic location concerned and the values of M5-D. Cr is expressed by the following:

$$C_r=J_0+J_1(M5-D)+J_2(M5-D)^2$$

The constants J0, J1 and J2 are dependent on M5-D and are referenced direct from Volume 1 of the Wallingford Proceduce, Table 6.1.

Rainfall Calculation

Project Number	109	By	JW
Project Title	The Treatment Works		
Calculation Reference	109-CA-001		
Calculation description	Rainfall - 1in10 yr	Date	30th Jan 23

Inflow/Outflow Calculations

Storm Duration, D (min)	M5-D Rainfall (mm)	M10-D rainfall (mm)	M10-D + 10% CC (mm)	Rainfall Intensity (mm/hr)	Volume of Flow (m3)
5	**5.4**	**6.3**	**7.0**	**83.4**	**0.007**
10	**8.0**	**9.4**	**10.4**	**62.2**	**0.010**
15	**9.8**	**11.5**	**12.7**	**50.8**	**0.012**
30	**13.1**	**15.6**	**17.2**	**34.4**	**0.016**
60	**17.0**	**20.4**	**22.4**	**22.4**	**0.021**
120	**21.6**	**25.9**	**28.5**	**14.3**	**0.027**
240	**27.2**	**32.5**	**35.8**	**8.9**	**0.034**
360	**31.0**	**36.9**	**40.6**	**6.8**	**0.039**
600	**36.5**	**43.2**	**47.5**	**4.8**	**0.045**
4320	**68.3**	**78.1**	**86.0**	**1.2**	**0.082**

1 in 10 year return period, inclusive of 20% climate change. For a 72 hour storm duration is =

0.082 m3

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	20th Feb 23

This document summarises the containment requirements for the bunded area on Site - Aqueous Treatment Plan.

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Aqueous Treatment Plan Bund

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)	
R1	36	1	36	
R2	36	1	36	
Future 1		1	0	Potential for future Tanks excluded.
Future 2		1	0	Potential for future Tanks excluded.
disolver	2	1	2	
disolver	2	1	2	
scrubber	1	1	1	
Filter Bath	10	1	10	
		Total Volume	**87**	m^3

Size of Bunded Area = 146.4 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 12.01 m^3

Containment Requirements - Conditions		
25% =	21.75	m^3
110%=	39.60	m^3
		m^3
100%+3 day	48.01	m^3
25%+3day	33.76	m^3

Bund Containment Required = 48.0 m^3

Height of Bund Wall= 0.5 m

Actual Containment Provided **73.2** m^3

With an allowance for FW of **25.2** m^3

*Assuming bund surface is level

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	20th Feb 23

This document summarises the containment requirements for the bunded area on Site.

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Oily Water Treatment Plant

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
Tank 1	36	1	36
Tank 2	36	1	36
Tank 3	36	1	36
Tank 4	36	1	36
Tank 5	32	1	32
Offloading	19	1	19
T 105	7.5	1	7.5
		Total Volume	**202.5** m^3

Size of Bunded Area = 143 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 11.72 m^3

Containment Requirements - Conditions		
25% =	50.63	m^3
110%=	39.60	m^3
100%+3 day	47.72	m^3
25%+3day	62.35	m^3

Bund Containmen Required = 62.3 m^3

Height of Bund Wall = 0.5 m

Actual Containme Provided = **71.5** m^3

With an allowance for FW of = **9.1** m^3

*Assuming bund surface is level

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	20th Feb 23

This document summarises the containment requirements for the bunded area on Site. Storage Area A - East of Site (part 1).

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance. Maximum containment values have been used, not operational.

Storage Area A - Acid Package Area (westernmost)

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
IBCs	1	80	80
			0
		Total Volume	**80** m^3

Size of Bunded Area = 90 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 7.38 m^3

Containment Requirements - Conditions		
25% =		m^3
110%=	1.10	m^3
100%+ 3day	8.38	m^3
25%+3day		m^3

Bund Containment Required = 8.4 m^3

Height of Bund Wall = 0.1 m

Actual Containment Provided = **9.0** m^3

With an allowance for FW of = **0.6** m^3

*Assuming bund surface is level

* Client confirms that loss of containment risk assessment has been completed and 25% of total volume for IBCs not to be considered.

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	9th Mar 23

This document summarises the containment requirements for the bunded area on Site. Storage Area A - East of Site (part 1).

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Storage Area A - Oil Package Area (middle)

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
IBCs	1	40	40
			0
		Total Volume	**40** m^3

Size of Bunded Area = 48 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 3.94 m^3

Containment Requirements - Conditions		
25% =		m^3
110%=	1.10	m^3
100%+ 3day	4.94	m^3
25%+3day		m^3

Bund Containment Required = 4.9 m^3

Height of Bund Wall = 0.1 m

Actual Containment Provided = **5.3** m^3

With an allowance for FW of = **0.3** m^3

*Assuming bund surface is level

* Client confirms that loss of containment risk assessment has been completed and 25% of total volume for IBCs not to be considered.

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	9th Mar 23

This document summarises the containment requirements for the bunded area on Site. Storage Area A - East of Site (part 1).

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Storage Area A - Caustic Package Area (eastern most)

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
IBCs	1	60	60
			0
	Total Volume		**60** m^3

Size of Bunded Area = 72.6 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 5.95 m^3

Containment Requirements - Conditions		
25% =		m^3
110%=	1.10	m^3
100%+ 3day	6.95	m^3
25%+3day		m^3

Bund Containment Required = 7.0 m^3

Height of Bund Wall = 0.1 m

Actual Containment Provided = **7.3** m^3

With an allowance for FW of = **0.3** m^3

*Assuming bund surface is level

* Client confirms that loss of containment risk assessment has been completed and 25% of total volume for IBCs not to be considered.

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	9th Mar 23

This document summarises the containment requirements for the bunded area on Site. Storage Area B - Northern Containment.

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Storage Area B - northern containment

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
IBCs	1	28	28
			0
			0
			0
			0
			0
		Total Volume	**28** m^3

Size of Bunded Area = 32.4 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 0.00 m^3

(indoors - rain not relevant)

Containment Requirements - Conditions		
25% =		m^3
110%=	1.10	m^3
		m^3
100%+3 day	1.00	m^3
25%+3day		m^3

Bund Containment Required = 1.1 m^3

Height of Bund Wall = 0.1 m

Actual Containment Provided = **3.2** m^3

With an allowance for FW of = **2.1** m^3

*Assuming bund surface is level

* Client confirms that loss of containment risk assessment has been completed and 25% of total volume for IBCs not to be considered.

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	9th Mar 23

This document summarises the containment requirements for the bunded area on Site. Storage Area B - middle containment.

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Storage Area B - middle containment

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
IBCs	1	42	42
			0
			0
			0
			0
			0
		Total Volume	**42** m^3

Size of Bunded Area = 48 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 0.00 m^3

(indoors - rain not relevant)

Containment Requirements - Conditions		
25% =		m^3
110%=	1.10	m^3
		m^3
100%+3 day	1.00	m^3
25%+3day		m^3

Bund Containment Required = 1.1 m^3

Height of Bund Wall = 0.1 m

Actual Containment Provided = **5.0** m^3

With an allowance for FW of = **3.9** m^3

*Assuming bund surface is level

* Client confirms that loss of containment risk assessment has been completed and 25% of total volume for IBCs not to be considered.

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	9th Mar 23

This document summarises the containment requirements for the bunded area on Site. Storage Area B - south containment.

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Storage Area B - South containment

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
IBCs	1	28	28
			0
			0
			0
			0
			0
		Total Volume	**28** m^3

Size of Bunded Area = 32.4 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 0.00 m^3

(indoors - rain not relevant)

Containment Requirements - Conditions		
25% =		m^3
110%=	1.10	m^3
		m^3
100%+3 day	1.00	m^3
25%+3day		m^3

Bund Containment Required = 1.1 m^3

Height of Bund Wall = 0.1 m

Actual Containment Provided = **3.2** m^3

With an allowance for FW of = **2.1** m^3

*Assuming bund surface is level

* Client confirms that loss of containment risk assessment has been completed and 25% of total volume for IBCs not to be considered.

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	20th Feb 23

This document summarises the containment requirements for the bunded area on Site. Reception Area R2 (north of road).

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

Reception Area R2

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
IBCs	1	24	24
			0
			0
			0
			0
			0
		Total Volume	**24** m^3

Size of Bunded Area = 78 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 6.40 m^3

Containment Requirements - Conditions		
25% =		m^3
110%=	1.10	m^3
		m^3
100%+3 day	7.40	m^3
25%+3day		m^3

Bund Containment Required = 7.4 m^3

Height of Bund Wall = 0.1 m

Actual Containment Provided = **7.8** m^3

With an allowance for FW of = **0.4** m^3

*Assuming bund surface is level

* Client confirms that loss of containment risk assessment has been completed and 25% of total volume for IBCs not to be considered.

Containment Requirements

Project Number	109	By	JW
Project Title	The Treatment Works	Checked	
Calculation Reference	109-CA-003		
Calculation description	Containment Requirements	Date	20th Feb 23

This document summarises the containment requirements for the bunded area on Site for R3. This area serves as the secondary containment for the 2 effluent Tanks. It also include the roof run-off from Shed B.

Containment Volumes calculated shall be the greater of containment requirements in accordance with Ciria 736 guidance. Including greater of 25% of total containment, 110% of single largest vessel. It also considers a conservative approach by assessing for a storm event during a 2 days before and 1 day during (72hrs total) an event with 10% climate change allowance.

Maximum containment values have been used, not operational.

FINAL EFFLUENT TANKS

Contains	Individual Volume (m^3)	Number of	Combined Volume (m^3)
Eff Tank 1	120	1	120
Eff Tank 2	120	1	120
			0
			0
			0
			0
		Total Volume	**240** m^3

Size of Bunded Area = 1554.6 m^2

additional allowance for storage B roof rainfall directed to bund area.

120 m^2

AS CALCULATED

1 in 10 AEP rainfall Volume = 0.08 per m^2

Volume of Rain within 72 hours = 137.32 m^3

Containment Requirements - Conditions		
25% =	60.00	m^3
110%=	132.00	m^3
100%+3 day	257.32	m^3
25%+3day	197.32	m^3

Bund Containment Required = 257.3 m^3

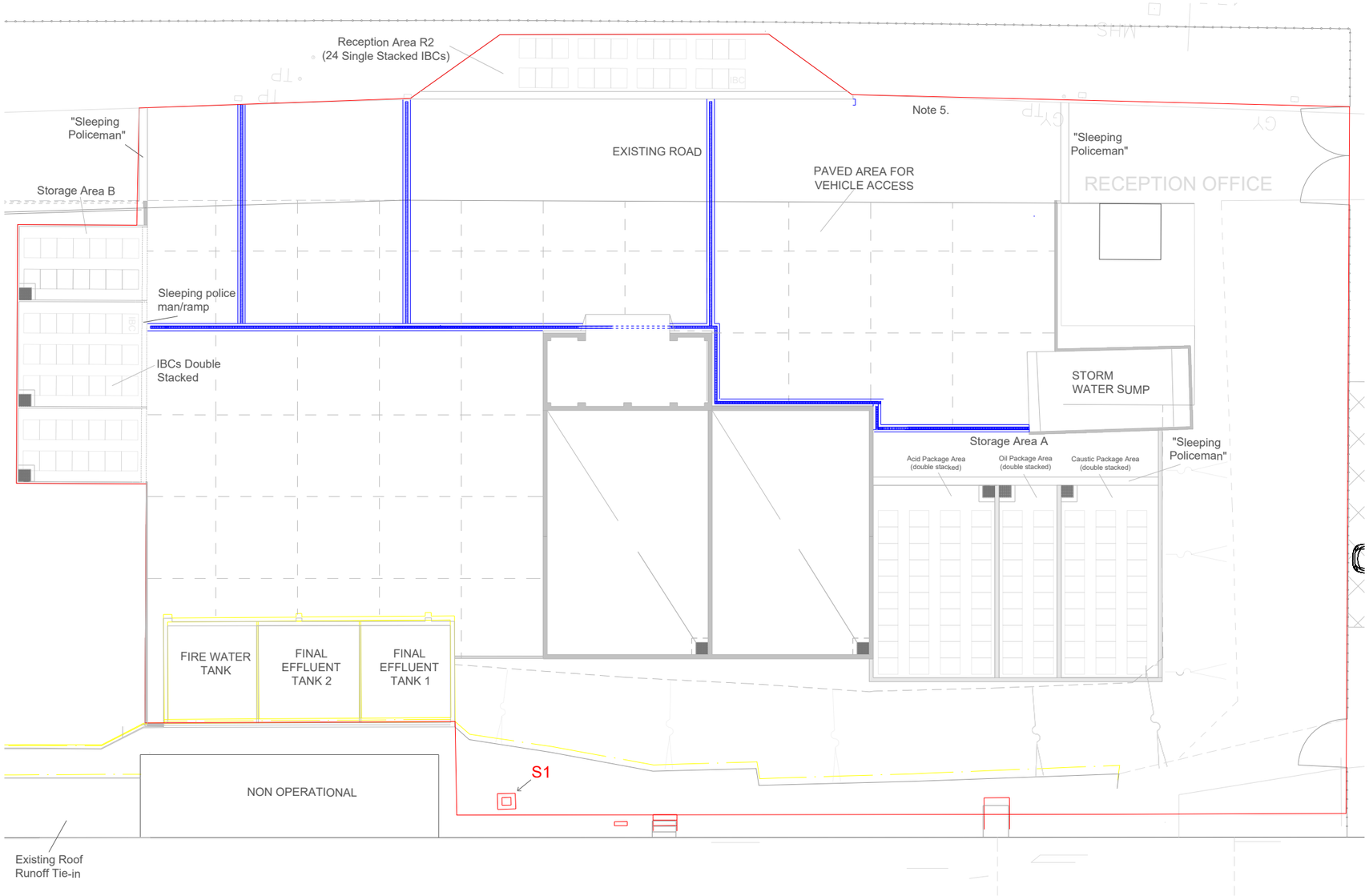
Height of Bund Wall= 0.10 m

Actual Containment Provided **260.0** m^3 as calculated in model

With an allowance for FW of **2.7** m^3

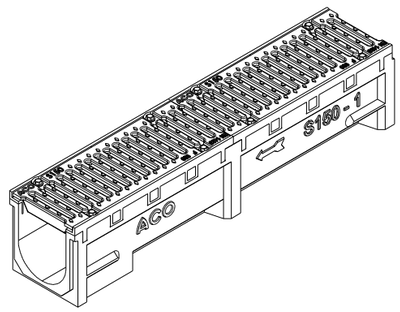
Appendix D– Drainage Layout

DRAINAGE PLAN



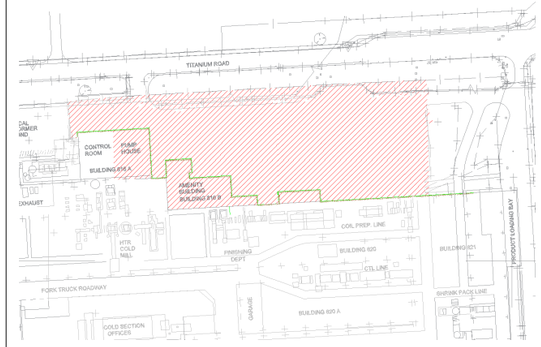
CDM 2015 Notes:

1) Castell Bach Engineering Ltd. as Designer, informs Client of their responsibilities under CDM Regs 2015. Including but not limited to:
   a) Providing pre-construction information to designer and contractor;
   b) Providing suitable welfare facilities for duration of project;
   c) Allowing sufficient time and resources at each stage of the
   d) Prepares and updates the site Health and Safety file.for site and/or project.
2) Contractor will provide a construction phase plan before that phase begins.
3) Designer has based design on Client provided information, elimination foreseeable health and safety risks and has taken steps to reduce or control any risks that cannot be eliminated.



TYPICAL LINEAR DRAINAGE CHANNEL - ACO S150 HEAVY DUTY (OR SIMILAR APPROVED).

KEY



General Notes:

1) Indicative drainage layout for information only, not for construction.
2) New drainage to be designed to CIRIA 736, CIRIA 753 and Building Regulations Approved Documents.
3) All existing surface water off-site discharge points blocked. All surface water run-off on site rerouted to new/existing sumps prior to pumping off site via licenced waste connection.
4) Existing road kerbs to be made good and ensure suitable for secondary containment.
5) All existing systems to have water drop tests to verify water tightness.
6) All new paving to be laid to falls of 1:150.
7) Existing manhole bunged up and utilised as a common pumped sump.
8) 2no. Above ground 9m^3 (G1 & G2) tanks utilised as receivers for surface water prior to pumping to final effluent tanks. Note that these tanks are balanced and act as one 18m^3 tank.

REV	DATE	DESCRIPTION	DESGN	DRWN	CHKD	APPROVED
3	09-Mar-23	RE-ISSUED FOR INFORMATION	JW	JW	PJ	
2	30-Jan-23	RE-ISSUED FOR INFORMATION	JW	JW	PJ	
1	30-May-22	ISSUED FOR INFORMATION	JW	JW	PJ	
0	8-May-22	ISSUED FOR REVIEW	JW	JW		
REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK	APP

Circular Waste Solutions

CIRCULAR WASTE SOLUTIONS

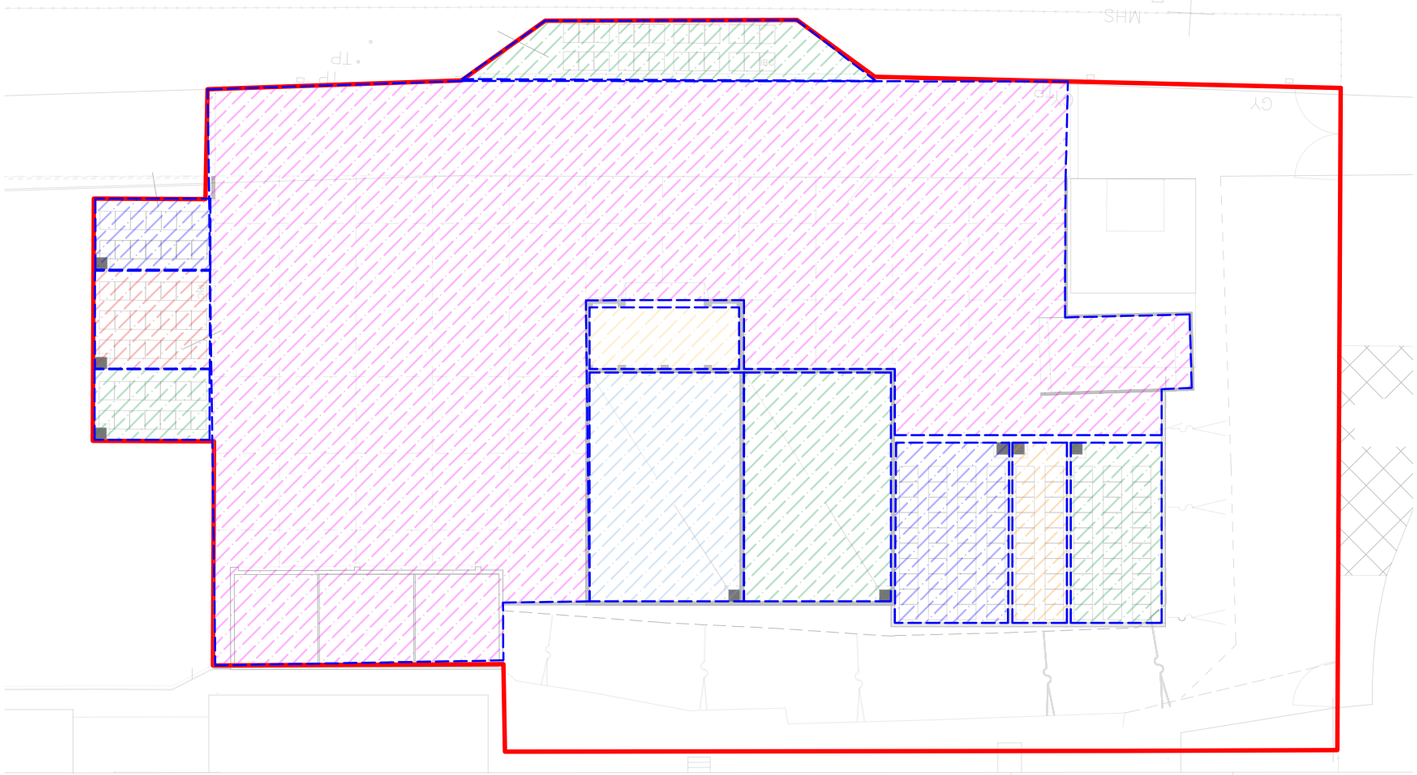
Castell Bach Engineering Ltd

PROJECT
CIRCULAR_WASTE_SOLUTIONS-FEASIBILITY_STUDY
-

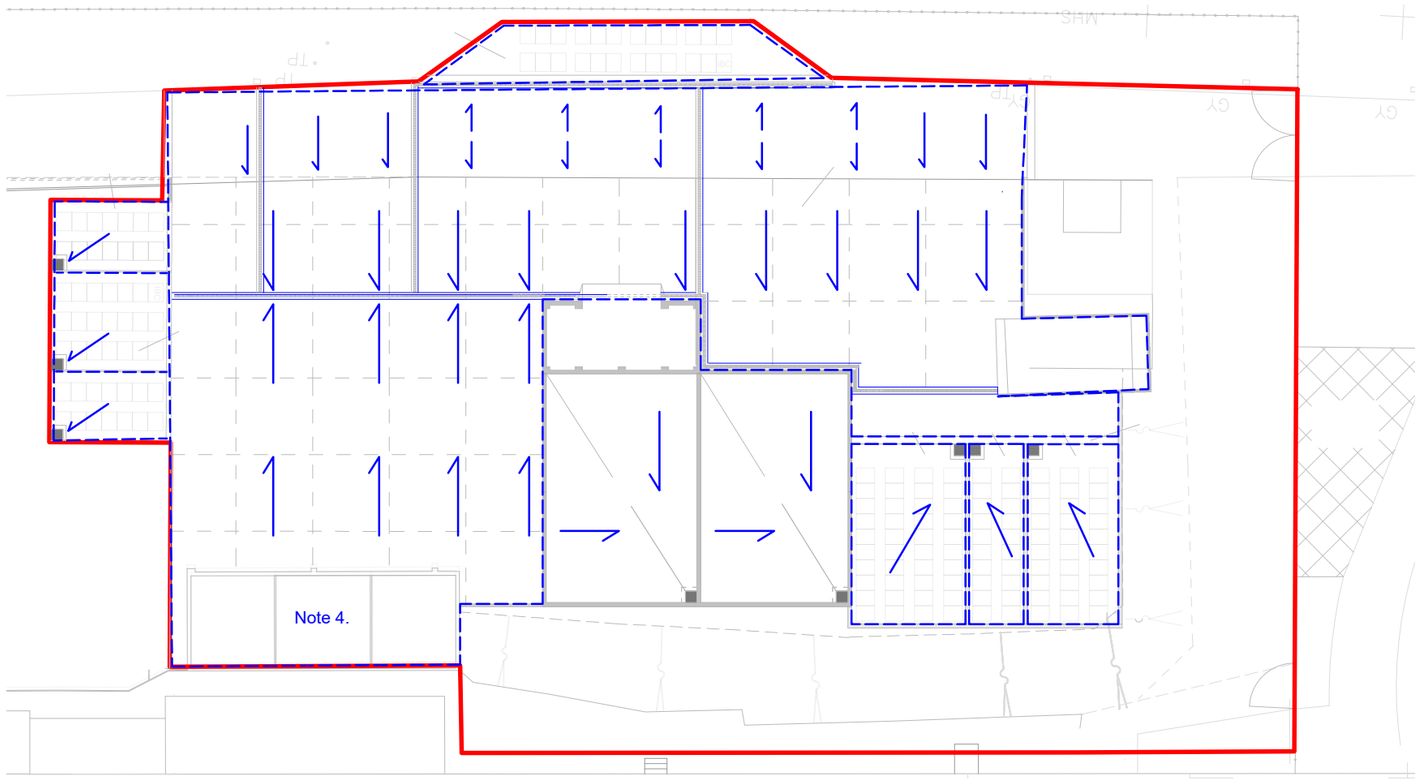
TITLE
SITE_DRAINAGE
-

SCALE	PROJECT No	DOCUMENT No	REV
NTS	109	109-CL-002	3

(A3 Sheet)



SURFACE WATER CATCHMENT AREAS



SURFACE WATER FLOW PROFILES

General Notes:

1) Catchment areas, based on existing topographical information and proposed storage areas. Colours are arbitrary with no inferred meaning.

REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK	APP
3	9–Mar–23	ISSUED FOR INFORMATION	JW	JW	PJ	
2	30–Jan–23	ISSUED FOR INFORMATION	JW	JW	PJ	
1	16–May–22	ISSUED FOR INFORMATION	JW	JW	PJ	
0	8–May–22	ISSUED FOR REVIEW	JW	JW		
REV	DATE	DESCRIPTION	DESIGN	DRAWN	CHK	APP

CIRCULAR WASTE SOLUTIONS

Castell Bach Engineering Ltd

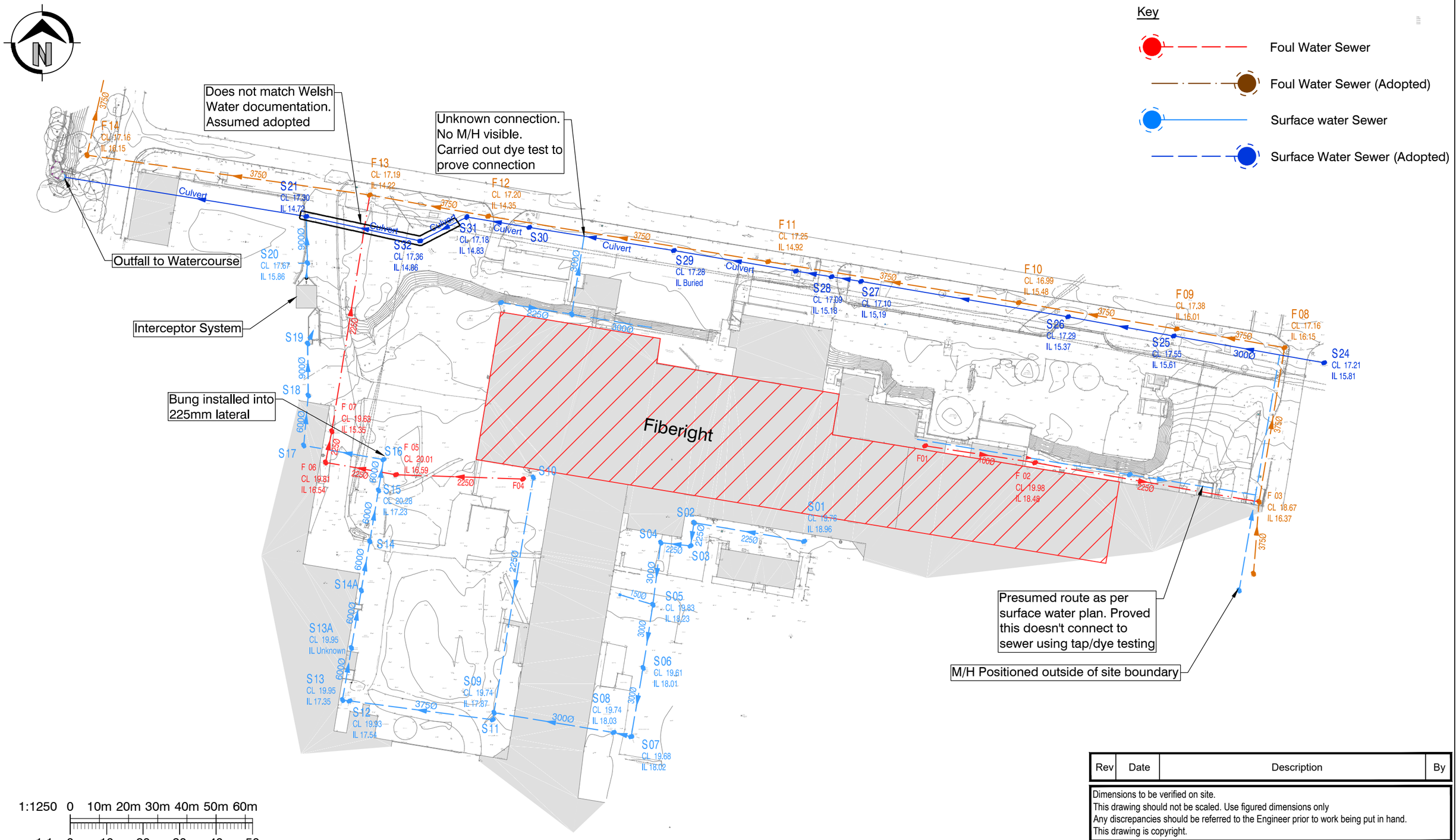
PROJECT
CIRCULAR_WASTE_SOLUTIONS–FEASIBILITY_STUDY
–

TITLE
SITE_SURFACE_WATER_CATCHMENTS_AND_PROFILES
–

SCALE	PROJECT No	DOCUMENT No	REV
NTS	109	109–CK–003	3

(A3 Sheet)

Appendix E – Legacy Drainage Layout



1:1250 0 10m 20m 30m 40m 50m 60m

1:1 0 10 20 30 40 50

Rev	Date	Description	By

Dimensions to be verified on site.
This drawing should not be scaled. Use figured dimensions only
Any discrepancies should be referred to the Engineer prior to work being put in hand.
This drawing is copyright.

Drawing Status

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QuadConsult ENGINEERS IN PARTNERSHIP
Consulting Civil & Structural Engineers

Client: Fiberight

Project: Fiberight Swansea

Title: EXISTING DRAINAGE LAYOUT

Designed by	Drawn by	Checked by	Date	Scales @ A3 size
-	GS	IMH	JAN'22	1:1250

Drawing No: 21456-SK-801-0

File name: 21456-SK-801-Existing Drainage Layout.dwg

Appendix F– Drainage Risk Assessment

DRAINAGE RISK ASSESSMENT

Project	CWS Treatment Facility	**Client**	CWS	**Prepared By**	JW
Reference	109-RA-001	**Project Phase**	Design	**Checked By**	
Date	16th May 22			**Revision**	

All consequences and likelihoods ranked out of 5, with 5 referring to worse case

Report on drawing Risk Threshold	>	6

Consequence						
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5
	Likelihood				

Ref	Initial Risk	Initial			Mitigation	Mitigation			Residual Risk	Report on Drawings or To Client	Amendment (with date)	Update			Report on Drawings	Comments
		Consequence	Likelihood	Score		Consequence	Likelihood	Score				Consequence	Likelihood	Score		
1	Failure of Vessels containing liquids hazardous to environment	5	2	10	Design Secondary containment to contain spills. Design in accordance with CIRIA guidance.	5	1	5	Fire fighting water not considered. If firewater is used, seconndary containment may over spill	No						
2	Working with hazardous materials, causing harm to workers, civilians and the environment	4	3	12	COSHH - safe working practices. Tidy work spaces.	2	1	2		No						
3	Injury during lifting, fall from height, pinch points, lifting.	4	3	12	Follow safe working guidelines. Working from height, manual handling and watch for pinch points on hands during lift. Ensure beam is adequately restrained during lifting and positioning.	2	2	4		No						
4	Drainage system blocking	4	3	12	Maintenance regime and in accordance with manufacturers recommendations.	2	2	4	Blockage to system could still occur with delay in remediation by asset owner.	No						
5	Flammable materials - fire during construction	4	2	8	Safe storage of materials on site. Tidy work spaces, and use of non flammable materials in accordance with Building Regulations Approved Document Part B	3	1	3		No						
6	Flooding of site post construction.	5	3	15	System designed for 1 in 100 year storm (including an additional 30% for climate change) over a 60minute period.	5	1	5		No						
7	Unknown construction - deviation from assumptions could lead to inadequate installation / operation of drainage systems.	5	3	15	Ensure Client and Contractor check all assumptions prior to works commencing. Any deviations or conflicts to be brought to the attention of the engineer immediately.	5	1	5	Inform Client/Contractor of their responsibilities. Contractor to not progress works unless all assumptions checked and verified.	No						
8	during construction - excavation safety - collapsed sides	5	3	15	Excavations to be safely executed. Battered sides or shoring of sides. Safe access provided and edge protection to sides of excavations	5	1	5		No						

DRAINAGE RISK ASSESSMENT

Project	CWS Treatment Facility	**Client**	CWS	**Prepared By**	JW
Reference	109-RA-001	**Project Phase**	Design	**Checked By**	
Date	16th May 22			**Revision**	

All consequences and likelihoods ranked out of 5, with 5 referring to worse case

Report on drawing Risk Threshold	>	6

Consequence						
5	5	10	15	20	25
4	4	8	12	16	20
3	3	6	9	12	15
2	2	4	6	8	10
1	1	2	3	4	5
	1	2	3	4	5
	Likelihood				

Ref	Initial Risk	Initial			Mitigation	Mitigation			Residual Risk	Report on Drawings or To Client	Amendment (with date)	Update			Report on Drawings	Comments
		Consequence	Likelihood	Score		Consequence	Likelihood	Score				Consequence	Likelihood	Score		
9	during construction - excavation safety- water flooding	4	3	12	excations may require dewatering during works. Infiltration rates may allow for water to no accumulate, however provision for dewatering shall be considered.	3	1	3		No						
10	Final levels of paving / road lead to flooding	5	2	10	Contractor to check all dimensions/ levels assumed. Any deviations from assumptions in drainage design to be communicated to Castell Bach Engineering Ltd for verification.	5	1	5		No						
11	Potentially contaminated surface water run off from paved areas subjected to vehicle movements	4	2	8	Contractor to check all dimensions/ levels assumed. Any deviations from assumptions in drainage design to be communicated to Castell Bach Engineering Ltd for verification.	5	1	5		No						