MOTT MACDONALD

CONTAINMENT ASSESSMENT FOR AFAN SLUDGE TREATMENT CENTRE

July, 2023

Confidential

This page left intentionally blank for pagination.

Mott MacDonald
Unit No 101, 1st floor
Nomura Building
Hiranandani Gardens
Powai
Mumbai
400 076
Maharashtra
India

T +91 22 4908 0100
mottmac.com

CONTAINMENT ASSESSMENT FOR AFAN SLUDGE TREATMENT CENTRE

July, 2023

Confidential

Mott MacDonald Private Limited.
Registered office: 101, Nomura,
Hiranandani Gardens, Powai, Mumbai 400
076, Maharashtra, India. CIN
U74210MH1970PTC014650

Issue and Revision Record

Revision	Submission Date	Originator	Checker	Approver	Description
01	21/07/2023	Vishal Gavali	Bill O'Leary	Rosie Green	Containment assessment for WwTW

Document reference: B16399-123532-ZZ-XX-RP-WA-HY1008

Information class: Secure

Contents

Tables

Figures

Abbreviation and Definition

WwTW - Wastewater Treatment Works

IED - Industrial Emission Directives

THP - Thermal Hydrolysis Plant

STC - Sludge Treatment Centre

TCO - Enhanced Secondary Containment Options

Executive summary

Mott MacDonald has been appointed by Welsh Water to carry out a containment assessment of Afan Wastewater Treatment Works (WwTW). The purpose of the project is to assess the existing capacity available to store accidental spills from the Afan WwTW and identify potential high-level enhanced secondary containment mitigation which could be implemented.

This study is based on CIRIA C736 Containment Systems for the Prevention of Pollution (London, 2014), which provides guidance on identifying the hazards, assessing the risks, and mitigating the potential consequences of a failure of the primary sludge storage facility/source. The sources are referred from the Industrial Emission Directives (IED) Permit Application - Main Supportive Document (MSD) for Afan WwTW prepared earlier by Mott MacDonald in July 2022

In this study, containment options are identified that enhance the existing secondary containment options that are currently available within the site. These existing secondary containment options include kerbs and speed humps, and these are considered based on the information from the as built drawings.

This report discusses the site's condition, potential sources, modelling of surface water flows and sludge pathways to identify the spill containment requirement, and the effectiveness of the proposed enhanced secondary containment assessment in case of failure of the assets/tanks in Afan WwTW.

In this study, the high-level enhanced secondary containment options are proposed based on the spill modelling and assessment. The modelled spill volume was found to be greater than both the CIRIA C736 110% and 25% containment capacity requirements.

These proposed high-level enhanced secondary containment options have been discussed with the site operators to assess feasibility. Further details and optimizations of the high-level enhanced secondary containment options should be carried out in the subsequent design phases.

The hydraulic modelling demonstrates that the proposed mitigation options meet the CIRIA C736 volume requirements and are are effective at retaining sludge on the site even in the case of a recent rainfall event that has caused ponding on the site.

1 Introduction

1.1 Background

Sewage sludge[1] is the residue produced by wastewater treatment processes. It is a residual semi solid slurry, produced as a by-product when industrial or municipal wastewater is treated. Since it is a by-product of treated wastewater, it must be managed and disposed of properly. The sludge contains both organic and inorganic materials, as well as a large concentration of plant nutrients and pathogens. Treating the sludge reduces its weight and volume, at the same time reducing its disposal costs and potential health risks on land, plants, humans, and animals. Hence, the Sludge Treatment Centre (STC) is important for the safe disposal of sludge.

Mott MacDonald has been appointed by Welsh Water to carry out a containment assessment of Afan Wastewater Treatment Works (WwTW). The purpose of the project is to assess the existing capacity available to contain accidental spills from the Afan WwTW and identify potential high-level enhanced secondary containment mitigation that could be implemented. The study is based on *CIRIA C736 Containment Systems for the Prevention of Pollution (London, 2014)*[2], which provides guidance on identifying the hazards, assessing the risks, and mitigating the potential consequences of a failure of the primary storage facility, as well as the design of new containment systems. Different levels of containment are described in Section 1.2.

1.2 Levels of Containment

Primary containment or storage is the most important means of preventing major incidents involving the loss of sludge. It comprises the equipment used to store or transfer sludge such as storage tanks, intermediate bulk containers (IBCs), drums, pipework, valves, pumps and associated management and control systems. It also includes equipment that prevents the loss of primary containment under abnormal conditions, such as high-level alarms linked to shut-down systems.

Secondary containment minimises the consequences of a failure of the primary storage. It comprises equipment that is external to and structurally independent of the primary storage, for example, localised concrete or earth bunds around storage tanks, or the walls of a warehouse storing drums. Secondary containment may also provide storage capacity for firefighting and cooling water.

Tertiary containment minimises the consequences of a failure in the primary and secondary containment systems by providing an additional level of protection preventing the uncontrolled spread of the sludge. These include purpose-built structures such as diversion tanks and lagoons but can also use other measures such as containment kerbing to roadways and parking areas and impervious liners and/or flexible booms. Tertiary containment will be used when there is an event that causes the escape of liquids from the secondary containment through failure or overflow (e.g., bund joint failure, or firewater overflowing from a bund or escaping from a building/warehouse during a prolonged fire).

[1] https://www.conserve-energy-future.com/types-uses-methods-sludge.php
[2] https://gptenvironmental.co.uk/CIRIA_report_C736_-_Containment_systems_for_the_prevention_of_pollution.pdf

1.3 Overview of Site and Activities

Afan STC is situated in Afan WwTW, which is located within Port Talbot, adjacent to the Bristol Channel. The address for the site is Afan WwTW, Phoenix Wharf, Harbour Road, Port Talbot, SA13 1RA (NGR SS 76061 87329).

The WwTW is operated under the Urban Wastewater Treatment Regulations (UWwTR) and has a standalone Water Discharge Activity Environmental Permit. The waste activities at the site comprises of imports, physio-chemical and Anaerobic Digestion (AD) treatment, and the storage of waste, all for recovery purposes. The STC solely handles waste derived from the wastewater treatment process, either indigenously produced on-site or imported. The site undertakes AD of sewage sludge from the on-site WwTW only.

This document discusses the site's condition, potential pollution sources, modelling of surface water flows and sludge pathways to determine the spill containment requirement, and the effectiveness of the proposed containment assessment in the event of catastrophic failure of assets or tanks within the STC.

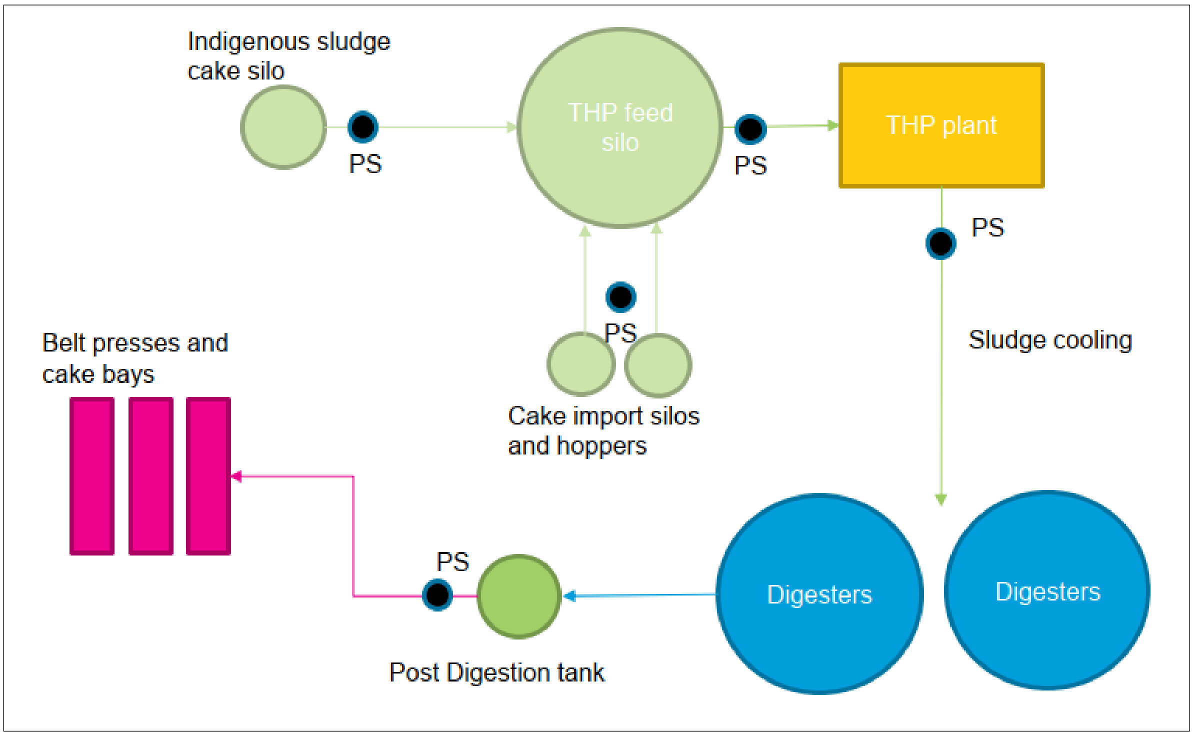
2 Site Assessment

2.1 Site Operation and Process

Afan STC is situated within Afan WwTW to treat urban wastewater indigenous sludge produced at the WwTW. The flow diagram of the process at the STC is shown in Figure 2.1 where the assets involved in the sludge treatment process and sludge flow direction are marked.

Indigenous Secondary sludge is transferred from SAS tank to centrifuges, where the first dose of polymer is added. The thickened sludge is then pumped into indigenous cake silo where it is pumped into Thermal Hydrolysis Plant (THP) feed silo. The THP feed silo also receives thickened sludge cake from imported cake silos/hoppers. From the THP feed silo, sludge is pumped into THP process which travels through pulper reactors, and flash tank. The sludge is processed by using pressurized steam in THP. Steam condensate and gases are either recaptured back into the THP process or captured in the foul gas drum and discharged into the digester. Treated sludge from the flash tank is pumped into digesters after cooling it to approximately 40ºC where it is retained for a minimum of 13 days. The sludge is then transferred via gravity into the Post Digester Sludge Tank (PDST). From here it is pumped up to belt presses (sludge thickeners). Digested sludge is dewatered to 26 – 30% dry solids before being transferred to cake barn (consisting of 3 bays) and left to mature for 4 days. After which it is taken away to be spread to land or quarantined off-site if it has not met the required pathogen limits.

Figure 2.1: Process Flow Diagram for STC



Source: IED Permit Application (Afan Main Supporting Document PDF) - 100123523_MSD_AFA, July 2022

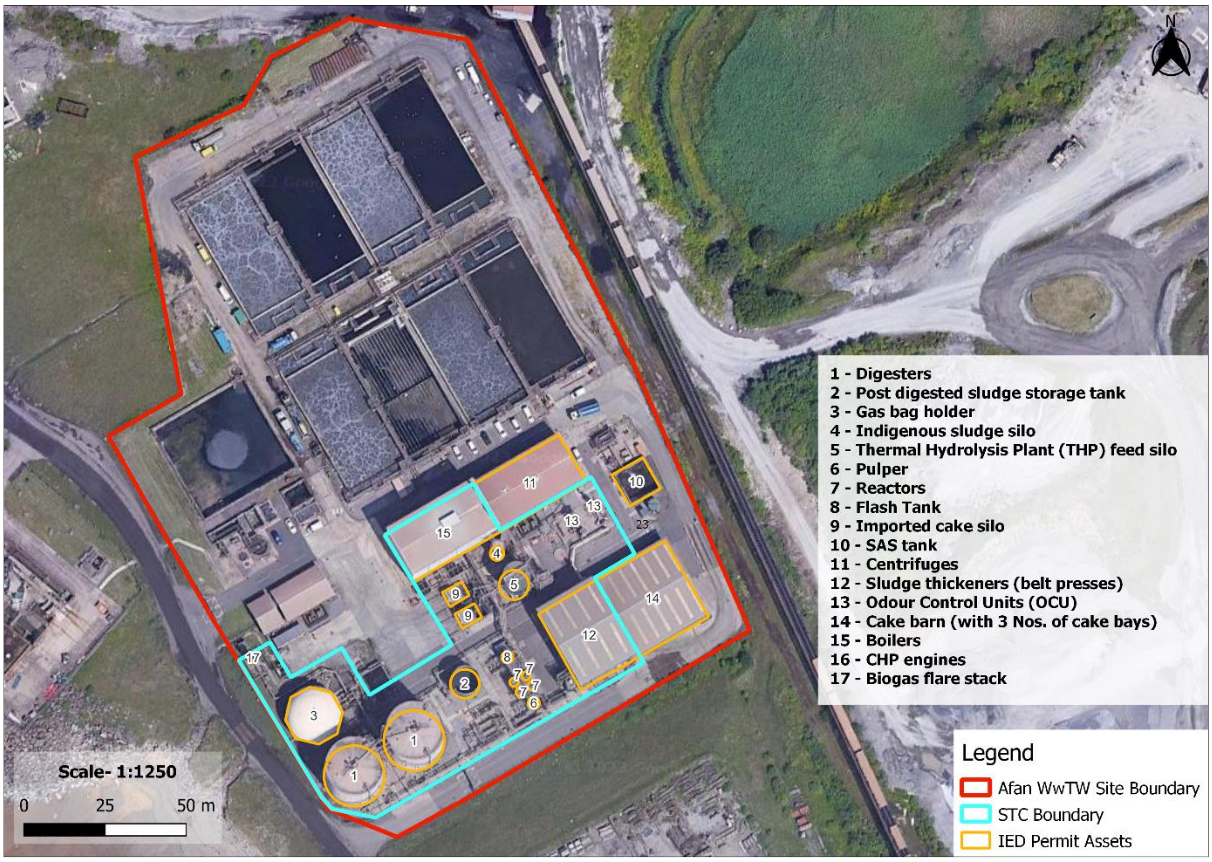
The IED permit includes the assets which are tabulated in Table 2-1 and the location of these assets is marked in Figure 2.2.

Table 2-1: List of IED permit assets

Sr. No.	Asset Name	Description	Volume/ Capacity	Considered as "Source"	Justification to consider as source
1	Digesters	2 Nos.	4250 m^3 each	Yes	Digested sludge
2	Post digested sludge storage tank	1 No.	500 m^3	Yes	Digested sludge
3	Gas bag holder	1 No.	2000 m^3	No	Biogas
4	Indigenous sludge silo	1 No.	100 m^3	Yes	Thickened sludge
5	Thermal Hydrolysis Plant (THP) feed silo	1 No.	600 m^3	Yes	Thickened sludge
6	Pulper	1 No.	42 m^3	Yes	Thickened sludge
7	Reactors	4 Nos.	13 m^3 each	Yes	Thickened sludge
8	Flash Tank	1 No.	42 m^3	Yes	Treated sludge
9	Imported cake silo	2 Nos.	40 m^3 each	Yes	Thickened sludge
10	SAS tank	1 No.	400 m^3	No	Raw sludge
11	Centrifuges	2 Nos.	-	No	Thickened sludge
12	Sludge thickeners (belt presses)	3 Nos.	-	No	Digested sludge
13	Odour Control Units (OCU)	2 Nos.	-	No	Odorous air
14	Cake barn (with 3 Nos. of cake bays)	1 Nos.	450m^3	No	Matured sludge
15	Boilers	2 Nos.	3.9MWth each	No	-
16	CHP engines	2 Nos.	3.745MWth each	No	-
17	Biogas flare stack	1 No.	1,500m^3/hr	No	Excess biogas

Source: IED Permit Application (Afan Main Supporting Document PDF) - 100123523_MSD_AFA, July 2022

Figure 2.2: IED Permit Assets



Loss of containment consist of loss of gaseous materials, failure of the liquid containment systems and material storages. In order to minimise the potential for accidental releases, various measures have been adopted at the site. All staff have been provided with responsibility for the handling or transfer of gaseous/liquid materials receive appropriate training for their role. All staff on site receive training in site emergency procedures and the actions to take in the event of discovering a gas leak/liquid spillage and the use of spill containment measures as part of their mandatory site induction training. Regular monitoring of storage vessels, pipework and gas levels/fluid levels shall be undertaken to ensure no fugitive emissions are being released and to ensure the structural integrity of the system remains uncompromised. All sludge treatment activities are undertaken in enclosed buildings or tanks.

2.2 Site Condition

The Site Condition Report (SCR)[3] provides detailed information about land use, geology, hydrogeology and flooding which can be found in the sections below.

2.2.1 Hydrology and flooding

The beach associated with the Bristol Channel is located adjacent to the south-western corner of the proposed permit boundary, with a tidal mark seen approximately 40m from the site boundary. The

[3] IED Permit Application - 100123523_SCR_AFA (2022)

outline of a pond is also seen approximately 40m to the north-east of the wider WwTW site. Various flood risks are referred[4] and the details are provided in the following sub sections.

2.2.1.1 Risk of flooding from rivers

The current Natural Wales flood map (Figure 2.3) shows the WwTW site, including the proposed permit boundary, is at very low risk (less than 0.1% chance of flooding each year) of flooding from rivers and local watercourses.

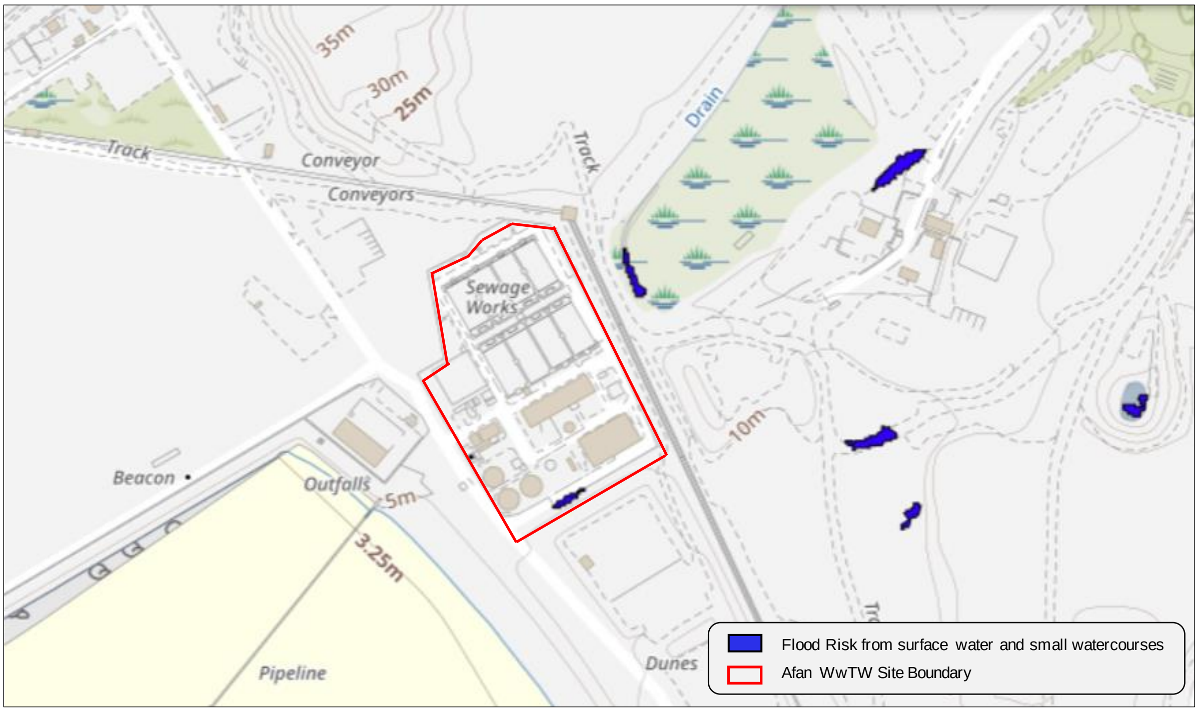
Figure 2.3: Flood Risk from Rivers

2.2.1.2 Risk of flooding from surface water and small watercourses

As per the Figure 2.4, most of the site area is unlikely to experience surface water flooding. There is a very small area that is at low risk of flooding near the road along the southern boundary of the site.

[4] https://check-your-flood-risk.naturalresources.wales

Figure 2.4: Flood Risk from surface water and small watercourses



2.2.1.3 Risk of flooding from the sea

The Figure 2.5 shows that, the location of the site is at very low risk from sea flooding.

Figure 2.5: Risk of flooding from the sea

In summary, the flood risk due to various sources is very low (less than 0.1% chance of flooding each year) - Refer to Appendix A for the flood risk report.

2.2.1.4 Risk of flooding from Groundwater

The site is located in an area of 'Landscaped Ground' which refers to the area of reclaimed land. The site, lies upon an area of Blown Sand, comprising sand which are observed as superficial deposits. The Blown Sands superficial aquifer is designated as a Secondary A aquifer. Tidal Flat Deposits can be found adjacent to the site on the east side, and Marine Beach Deposits can be found adjacent to it on the west side. The Marine Beach Deposits are classified as a Secondary Undifferentiated aquifer. The site lies upon the South Wales Middle Coal Measures Formation and further underlain by the South Wales Lower Coal Measures Formation, which both comprise mudstone, siltstone and sandstone. The South Wales Middle Coal Measures formation is designated as a Secondary A aquifer.

The north of the wider WwTW site lies within an area of groundwater flooding capability with potential flooding at the surface. Directly north of the WwTW site there is potential for flooding of property situated below ground level. There are no areas of the proposed permit boundary indicated as being affected by groundwater flooding.

2.3 Site Hazard

Site Hazard is estimated using the Anaerobic Digestion Bioresources Association (ADBA) classification tool. In this tool, hazard rating is provided for sources, pathways, and receptors separately to identify the overall site hazard rating. Based on the likelihood of different risks and site hazard rating, site risk is evaluated, and the corresponding containment design class required is identified to be Class 3.

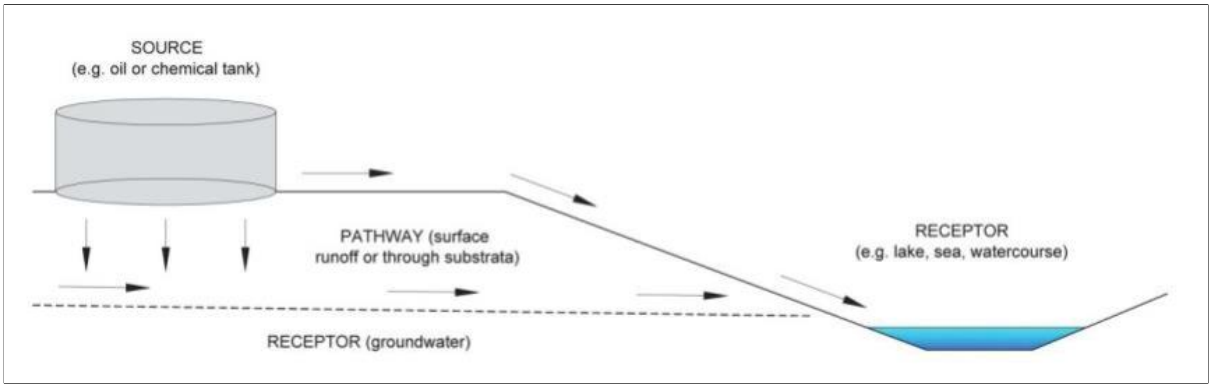
The ADBA tool with all the details discussed above is attached in Appendix B.

3 Source – Pathway – Receptor Analysis

3.1 Introduction

Source - Pathway - Receptor analysis is important for determining the Site Hazard Rating which helps to identify the level of containment requirement. Figure 3.1 shows the schematics diagram of the Source, Pathways and Receptors.

Figure 3.1: Schematic diagram of Source - Pathway - Receptor



The following sections discuss how the potential sources are identified, and how the sludge would travel/ spread along the pathways and reach the receptors.

3.2 Source

3.2.1 Tanks

A list of tanks considered to be potential sources are tabulated in Table 3-1. The location of these tanks can be referred from Figure 2.2.

Table 3-1: List of potential sources within STC

Sr. No.	Asset Name	Description	Volume/ Capacity
1	Digesters	2 Nos.	4250 m^3 each
2	Post digested sludge storage tank	1 No.	500 m^3
3	Indigenous sludge silo	1 No.	100 m^3
4	Thermal Hydrolysis Plant (THP) feed silo	1 No.	600 m^3
5	Pulper	1 No.	42 m^3
6	Reactors	4 Nos.	13 m^3 each
7	Flash Tank	1 No.	42 m^3
8	Imported cake silo	2 Nos.	40 m^3 each

Source: IED Permit Application (Afan Main Supporting Document PDF) - 100123523_MSD_AFA, July 2022

3.2.2 Firefighting Water

There is a Gas bag holder near the Digester (see Figure 2.2) and in the event of a fire at the site, the volumes of firefighting water put onto the site to quell a fire are important to consider as a potential source of flooding. The capacity of the Gas bag holder is 2000 m^3 in total (approximately 2.2 tonnes) and based on this quantity, the severity of a potential fire is categorised as medium by CIRIA C736 (see Table 3-2). The volume of firefighting demand is around 4000 m^3, however, as per CIRIA C736 this is specifically for chemical plants. The volume of water required would be less for a STC site compared to chemical plants. It is considered that the fire-fighting water demand would be less than 4000 m^3 and it is less than the highest volume identified from the sources listed in Table 3-1. Hence, the firefighting water is not considered further as a potential source in this study.

Table 3-2: Firefighting water demand

Table 4.4 Forecast of firefighting water needed to tackle major chemical plant fires (courtesy ICI)

Plant hazard rating[1]	Firefighting water demand
High severity	Total demand 1620–3240 m^3/hr for four hours
Medium severity	Total demand 1080–1620 m^3/hr for four hours
Low severity	Total demand 540–1080 m^3/hr for four hours

Notes[1]

High severity includes plants with:

- over 500 tonnes of flammable liquid above its flashpoint
- over 50 tones LPG above its boiling point and over 50 bars
- over 100 tonnes combustible solid with ready flame propagation
- other factors what increase severity

Medium severity covers plants that fall between high and low severity ratings.

Low severity includes plants with:

- less than 5 tonnes flammable liquids above or below flashpoint
- less than 100 kg flammable gas under 1 bar or a flash liquid
- less than 5 tonnes readily combustible solid
- other factors that decrease severity

Source: CIRIA C736

3.2.3 Cake Barn

The Cake Barn at the site is located inside the sludge dewatering building and is used to store treated cake after the dewatering of digested sludge to 26% - 30%. This cake barn is shielded by surrounding walls and a roof.

3.3 Pathway

Pathways are how a hazardous substance would reach a receptor. As per CIRIA C736, the area of search for potential receptors is governed by the potential pathways and these might include:

1. Simple overland flow following the local topography.
2. Existing pipes, sewers, drains or other underground features that could lead to a receptor such as a watercourse.
3. Permeable sub-soils and strata underlying a site that could provide a pathway to groundwater or a watercourse.

Multiple combinations of pathways may exist and should be considered. In considering the hazard rating of potential pathways the following should be considered[5].

1. The distance between the source and the various potential receptors.
2. Site layout (including topography), and the position and effectiveness of drains and other internal and external pathways.
3. Geographical, geological, and hydrogeological features that could either impede or facilitate the escape of inventory from the site. In addition, building foundations may impede or alter sub-surface drainage paths.
4. Climatic conditions and expected variability.
5. The direct effects of fire and the introduction of firefighting water, or foam.
6. The presence of treatment plants (on or off-site).
7. Modification of the inventory during passage through the pathway such as the cooling of a liquid.
8. Inventory that is not particularly mobile in ambient conditions may be soluble in water.
9. The scale of potential incidents (larger incidents and firewater generally have greater potential for mobilisation in the environment than smaller spills).

Two potential pathways are identified at Afan STC which are overland flow and subsurface flow.

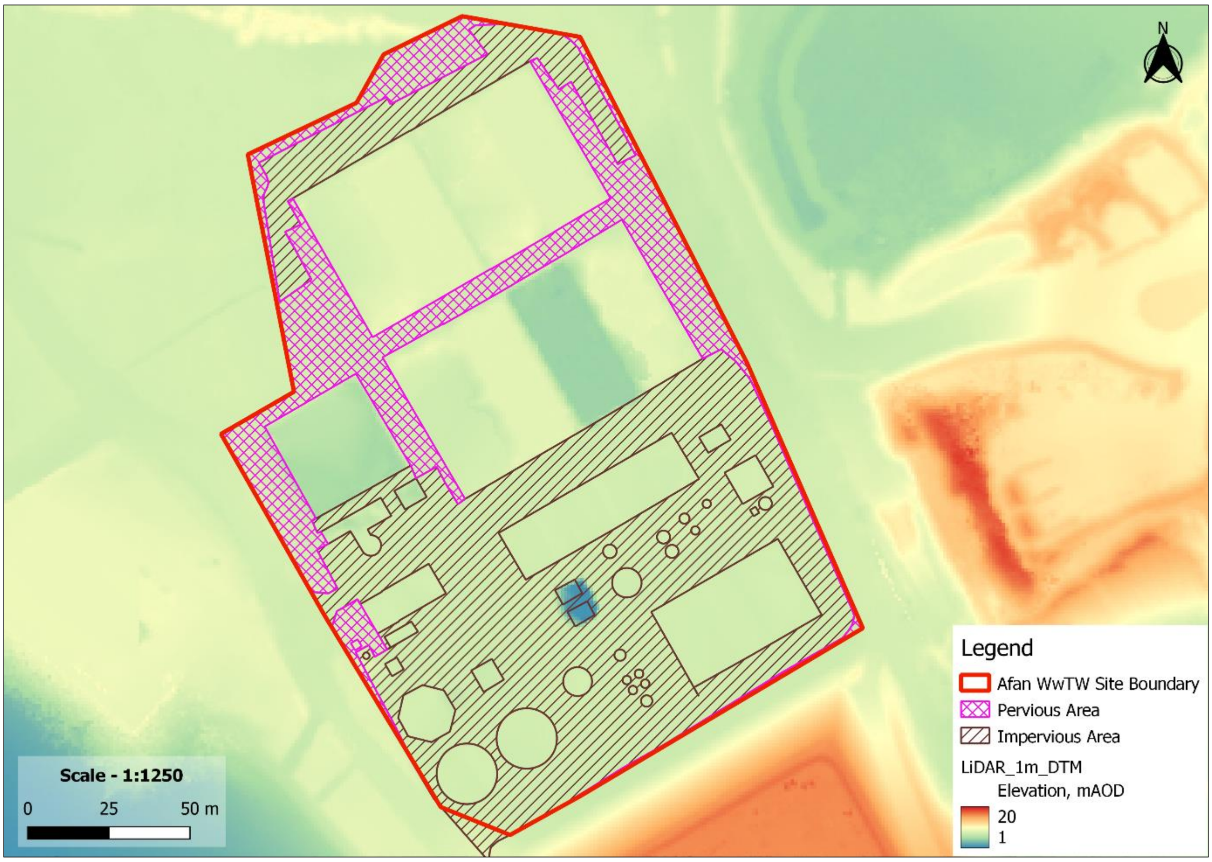
3.3.1 Overland Flow Pathway

Overland flow paths within the site are as per the existing topography. From the LiDAR data, it is observed that the elevation at the site varies from 7mAOD to 9.5mAOD. The rainfall-runoff water flows based on the topography and towards the area that has a relatively low elevation (Refer to Figure 3.2).

The majority of the site is covered by impervious layers (Roads and concrete area around the assets) (Refer to Figure 3.2). These will serve as a major pathway for sludge to reach the on-site receptors.

[5] https://gptenvironmental.co.uk/CIRIA_report_C736_-_Containment_systems_for_the_prevention_of_pollution.pdf

Figure 3.2: Pathways at Afan WwTW



3.3.2 Groundwater/Subsurface Flow Pathway

There are some grass and bushes (pervious area) within the site which could potentially serve as a pathway for sludge to enter the groundwater (see Figure 3.2).

3.4 Receptor

3.4.1 Off-Site Receptors

Afan WwTW is located adjacent to the Bristol Channel. The site does not fall with a nitrate vulnerable zone or within 500m of a Site of Special Scientific Interest (SSSI)[6].

3.4.1.1 Designated Sites

There are several designated sites in the vicinity of Afan WwTW, and these are tabulated in Table 3-3.

[6] Source - IED Permit Application (Afan Main Supporting Document PDF) - 100123523_SCR_AFA.pdf

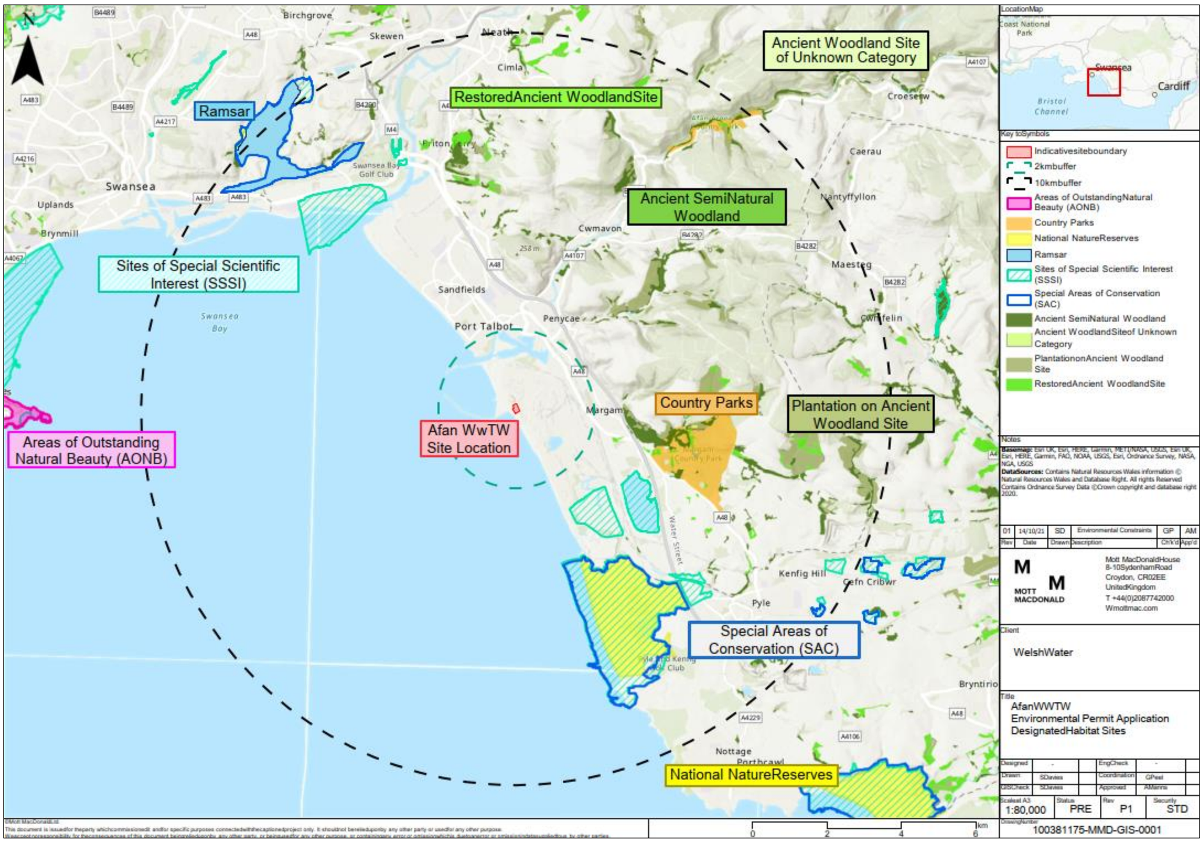
Table 3-3: List of Statutory designated habitat within 2km and 10km of the site

Sr. No.	Site Designation	Comments
1	Areas of Outstanding Natural Beauty (AONB)	Located west of the site
2	Country Parks	Located east & north-east of the site
3	National Nature Reserves	Located south-east of the site
4	Ramsar	Located north-west of the site
5	Sites of Special Scientific Interest (SSSI)	Located south-east & north-west of the site
6	Special Areas of Conservation (SAC)	Located south-east & north-west of the site
7	Ancient Semi Natural Woodland	Located from north to south-east of the site at various locations
8	Ancient Woodland Site of Unknown Category	Located north-east of the site
9	Plantation on Ancient Woodland Site	Located from north to south-east of the site at various locations
10	Restored Ancient Woodland Site	Located from north to south-east of the site at various locations

Source: IED Permit Application - 100123523_ConstraintsMaps_AFA

Sites listed in the above table (within 2km and 10km) are marked in Figure 3.3 below.

Figure 3.3: Statutory designated habitat sites within 2km and 10km of the site



3.4.2 On-Site Receptors

3.4.2.1 WwTW Assets

There are assets within WwTW which could potentially receive sludge from the failure of various sources (see Figure 3.4). These receptors are listed in Table 3-4.

Figure 3.4: Receptors within WwTW

Table 3-4: List of Receptors within WwTW

<table>
<tr><th>Sr. No.</th><th>List of Receptors</th><th>Assets within</th></tr>
<tr><td>1</td><td>Digesters</td><td rowspan="9">STC</td></tr>
<tr><td>2</td><td>Post digested sludge storage tank (PDST)</td></tr>
<tr><td>3</td><td>Gas bag holder</td></tr>
<tr><td>4</td><td>Indigenous sludge silo</td></tr>
<tr><td>5</td><td>Thermal Hydrolysis Plant (THP) feed silo</td></tr>
<tr><td>6</td><td>Pulper</td></tr>
<tr><td>7</td><td>Reactors</td></tr>
<tr><td>8</td><td>Flash Tank</td></tr>
<tr><td>9</td><td>Imported cake silo</td></tr>
<tr><td>10</td><td>SAS tank</td><td rowspan="2">WwTW</td></tr>
<tr><td>11</td><td>Centrifuges (Inside Existing Dewatering Building)</td></tr>
</table>

Sr. No.	List of Receptors	Assets within
12	Sludge thickeners (belt presses) (Inside Sludge Dewatering Building)	STC
13	Odour Control Unit 1 & 2	
14	Cake barn	WwTW
15	Boilers 2 nos. (Inside Existing Drier Building)	STC
16	CHPs 2 Nos. (Inside Existing Drier Building)	
17	Biogas flare stack	
18	Part of Odour Control Unit 1	
19	Return Liquor Chamber	
20	Strain Press Area	WwTW
21	Boiler Water Treatment Tank	
22	Boiler Water Treatment Booster Set	
23	Site Lab	
24	FE Outlet Chamber	STC
25	Admin Building	WwTW
26	Industrial Water Pumping Station	
27	Grit Trap with SBR Inlet PS & Storm Overflow Inlet Channel	
28	SBR Outlet Pumping Station	
29	Storm Tank	
30	SBR Basins	
31	Natural Gas Kiosk	

3.4.2.2 Sensitive Human Receptors

The closest sensitive human receptors are the staff in the Office Building (Refer to Figure 3.4) which are within 10 m of the critical sources.

4 Failure Assessment

4.1 Introduction

This section discusses the modelling of the site carried out to identify the potential impact due to the failure of possible sources identified in Section 3. Hydraulic modelling (spill modelling) has been carried out to understand the potential extent of sludge which could result due to a catastrophic failure of a sludge storage asset occurring after a 24-hour antecedent 10-year design storm.

4.2 Factors influencing sludge movement

When there is a sudden failure, the sludge from the critical sources would follow the local topography of the site as shown in Figure 4.1. The movement of sludge is influenced by various factors as below.

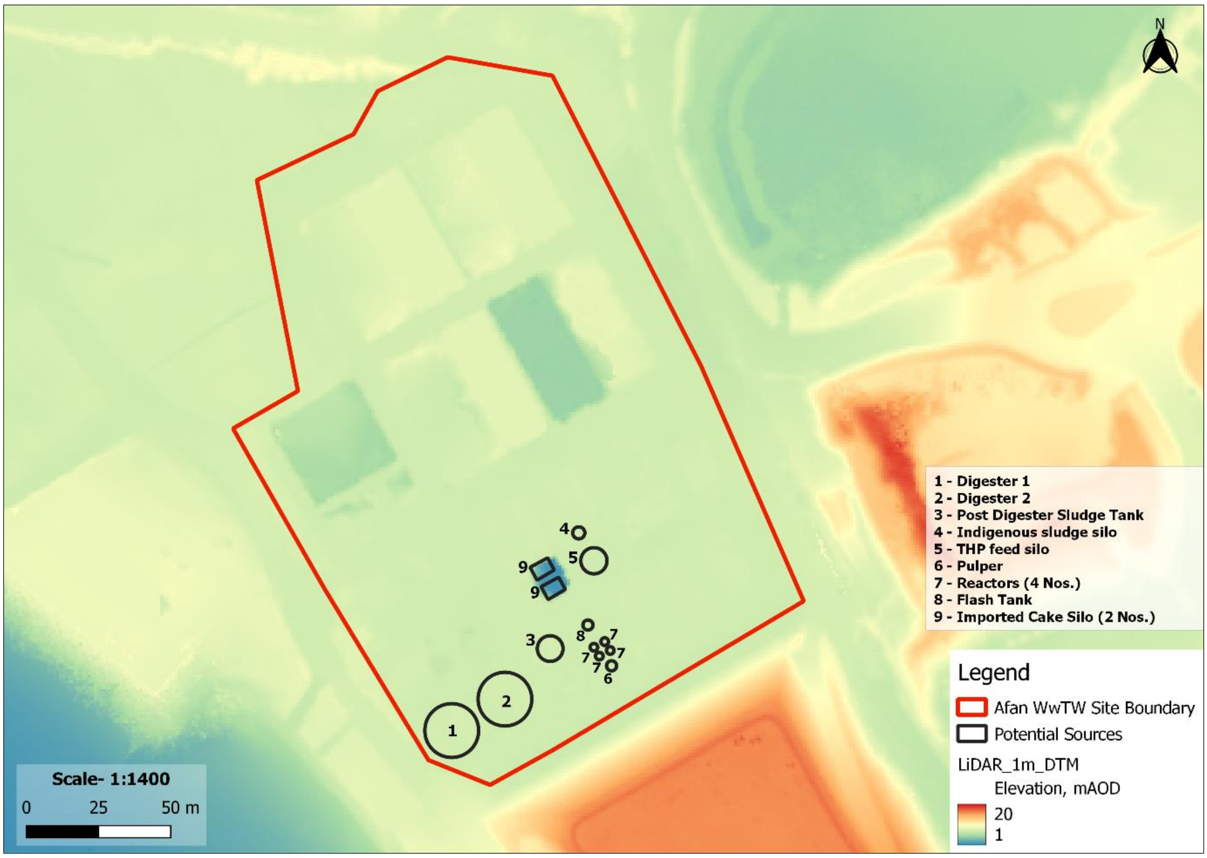
a) Topography
b) Surface Roughness
c) Initial storage/ water levels

4.2.1 Topography

The ground elevations on the site generally varies between 7mAOD to 9.5mAOD. Both the digesters are installed in the south-west corner of the site and are raised about 23m above the ground. The Post Digested Sludge Tank is located in the south of the site (at a height of approximately 10.5m) along with the Pulper, Reactors and Flash Tank which are approximately 7.5m above the ground. Figure 4.1 shows the presence of a 6m deep well surrounding the imported cake silo[7]. Indigenous Sludge Silo and THP Feed Silo are located at the centre of the site which are approximately 11m and 15m above the ground respectively.

[7] As confirmed with the site manager

Figure 4.1: Topography with Potential Sources



4.2.2 Surface Roughness

Different surface types are represented within the model as shown in Figure 4.2 to replicate the on-site condition in the model. The roughness values are assigned based on the land use listed in Table 4-1.

Figure 4.2: Different Surface types within WwTW

Table 4-1: Manning's n value adopted in the model

Materials ID	Manning's n	Description
1	0.100	Buildings
2	0.013	Roads - Concrete/ Asphalt
3	0.013	Hard standing area around the assets - Concrete finish
4	0.027	Earth with short grass & few weeds
5	0.030	Sand/Gravels
6	0.035	Pasture/ Short grass
7	0.060	Woodland - Trees with heavy growth of sprouts
8	0.100	All tanks - Raised above the ground

Source: Open Channel Hydraulics, Ven Te Chow

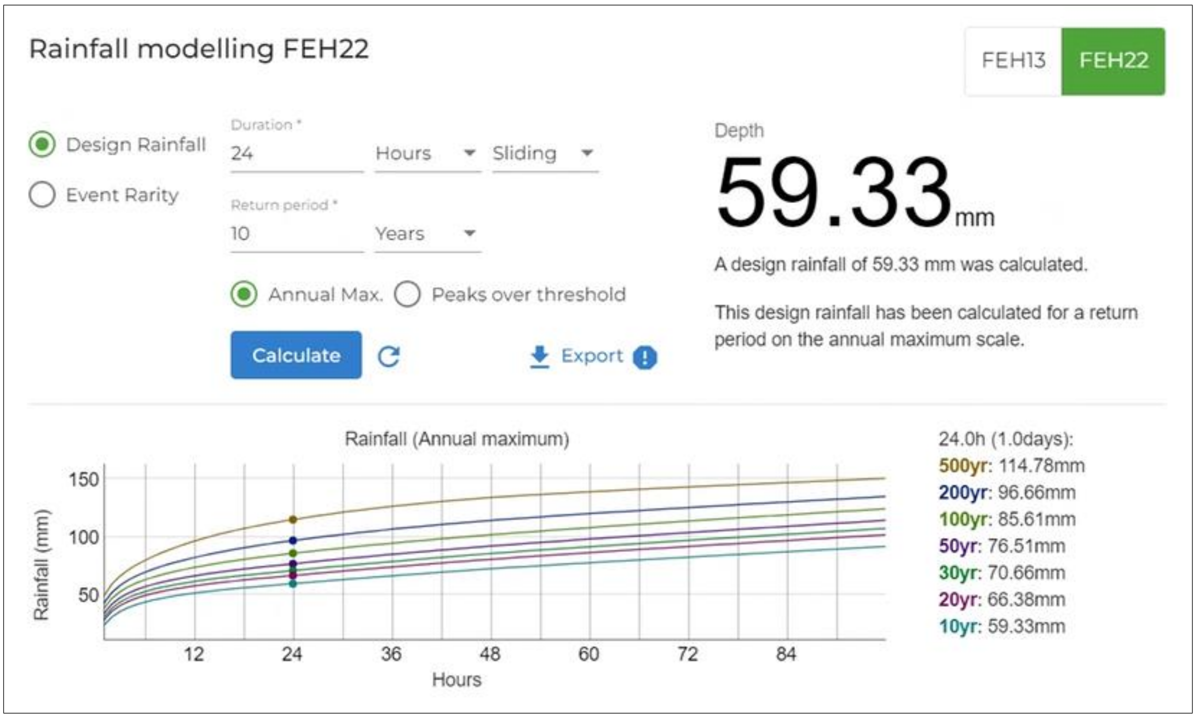
4.2.3 Initial Conditions/Initial Water Level

Sludge movement and storage depends on the available storage on the site. An initial model run was therefore carried out which simulated the impact of a 24-hour duration, 1 in 10-year (10% AEP) rainfall event. This provides initial conditions on the site where ponding had occurred in low-lying areas of the site. The details of the rainfall data used are described in Section 4.2.4.

4.2.4 Rainfall

Figure 4.3 shows the annual maximum rainfall depth of 59.33 mm for a 10-year return period of 24-hour duration. Two rainfall profiles (Winter and Summer) were derived from FEH13 and analysed for further assessment.

Figure 4.3: Rainfall data – Afan WwTW



The available storage on the site was assessed by the Direct Rainfall approach. In this approach, 1 in 10-year (10% AEP) design rainfall for summer and winter were applied over the entire site boundary (model extent) and the water levels were captured at the end of a 24-hour model simulation. The final water levels on the site are subsequently used in defining the storage capacity in the site after the design storm event. Hence, this scenario named 'Pre-Failure' helps in capturing the existing storage capacity at the site prior to failure. The 'Post-Failure' scenario represents the failure of the source with the initial condition representing the available storage capacity after the rainfall event. In this scenario, the initial condition is included in the model as initial water levels (IWL) from the 'Pre-Failure' case.

4.3 Pre-Failure Scenario

In this scenario, the model is updated with the inputs discussed in Sections 4.2.1, 4.2.2 and 4.2.4 (viz. Topography, surface roughness and the rainfall). Two scenarios of the model were run for a duration of 24-hour representing Summer and Winter rainfall. Based on the model results, the highest water level between these two events at the end of the 24-hour simulation is considered for further assessment.

4.4 Post Failure assessment

4.4.1 Breach Inputs

4.4.1.1 Location

The list of potential sources tabulated in Table 3-1 are considered in the failure assessment. Out of all the potential sources, the volume of the Digesters is significantly higher than other assets. Failure of all the potential sources were assessed separately and the interaction was noted in the spread of sludge from the failure of these sources. As a result, based on the sludge extent, depth and volume of the sources, two Digesters are identified as the critical sources for the breach analysis. These two Digesters are located close together in the south-west corner of the site and are raised about 23 metres above the ground.

4.4.1.2 Volume

A breach is represented by applying a hydrograph (with a rectangular shape) discharging the volume of the asset being modelled over a one-minute duration[8]. This represents the sudden failure of the source when a catastrophic failure occurs, and the entire contents of each source are released in one minute.

The two digesters (with a volume of 4250 m^3 each) are likely to fail individually and are therefore modelled individually.

The peak of the hydrograph is derived from the total volume in cubic meters (Example: Digester 1 - 4250 m^3) divided by the number of seconds in a minute (60 seconds) to obtain a constant inflow for one minute (4250 ÷ 60 = 70.83 m^3/s). The details of each scenario and results are discussed in Section 4.4.2.

The breach of the source in the model without any rainfall data helps to understand the extent of pollutant spread. Failure of each source and its sludge extents are discussed in the following sections.

4.4.2 Breach – Failure of critical sources

The spread of sludge varies depending on the source of the breach. Sludge spreads all over the site area from the location of critical sources. The failure of each critical source is discussed in the following sections.

4.4.2.1 Failure of Digesters

There are two digesters with the same capacity (4250 m^3). From the location of the Digesters in the south-west corner of the site, sludge spreads towards the east, west and north. The extent of the sludge does not vary significantly depending on which of the two Digesters fails. The sludge also flows outside the WwTW boundary through different access roads within the site. Refer Figure 4.4 and Figure 4.5 for more understanding of sludge extent over the site area.

[8] Source: CFRAM Guidance Note 24 – Breach Analysis, 2013

Figure 4.4: Sludge extent - Failure of Digester 1

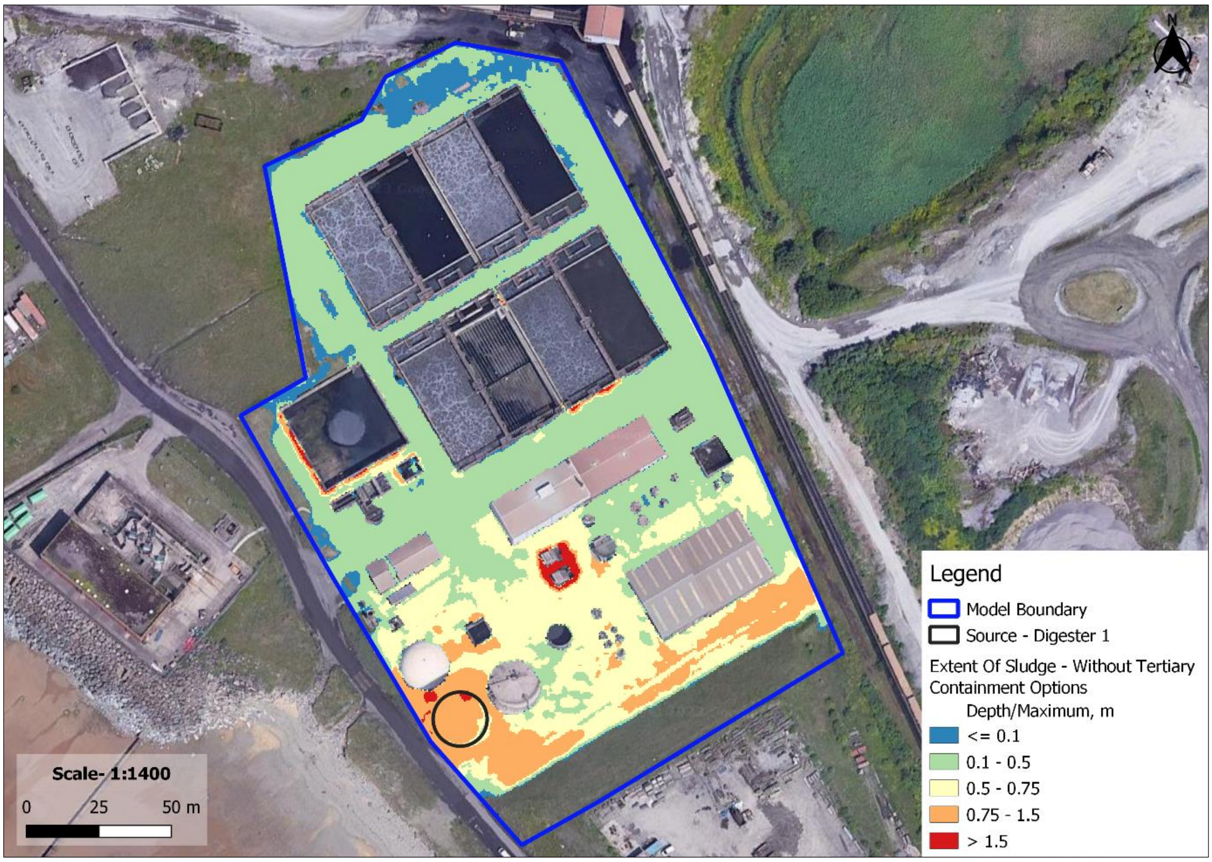
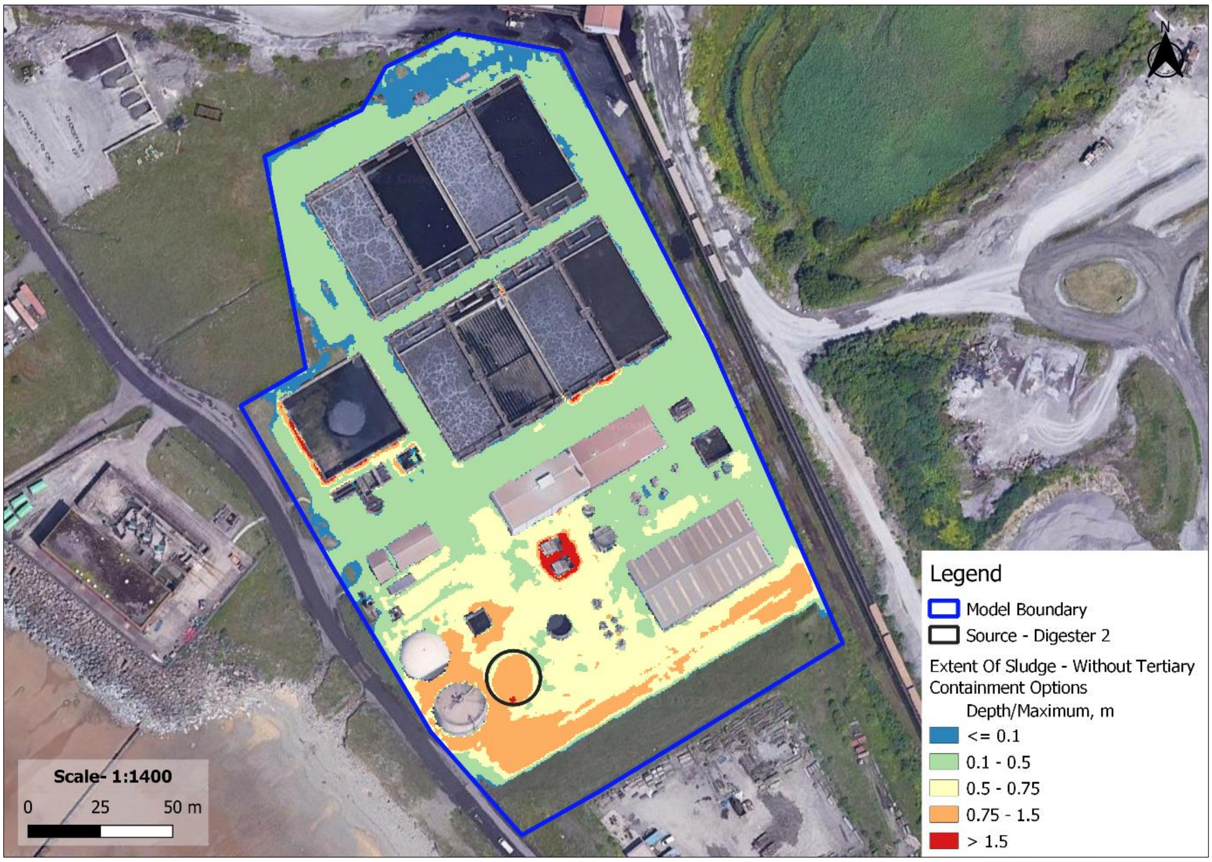


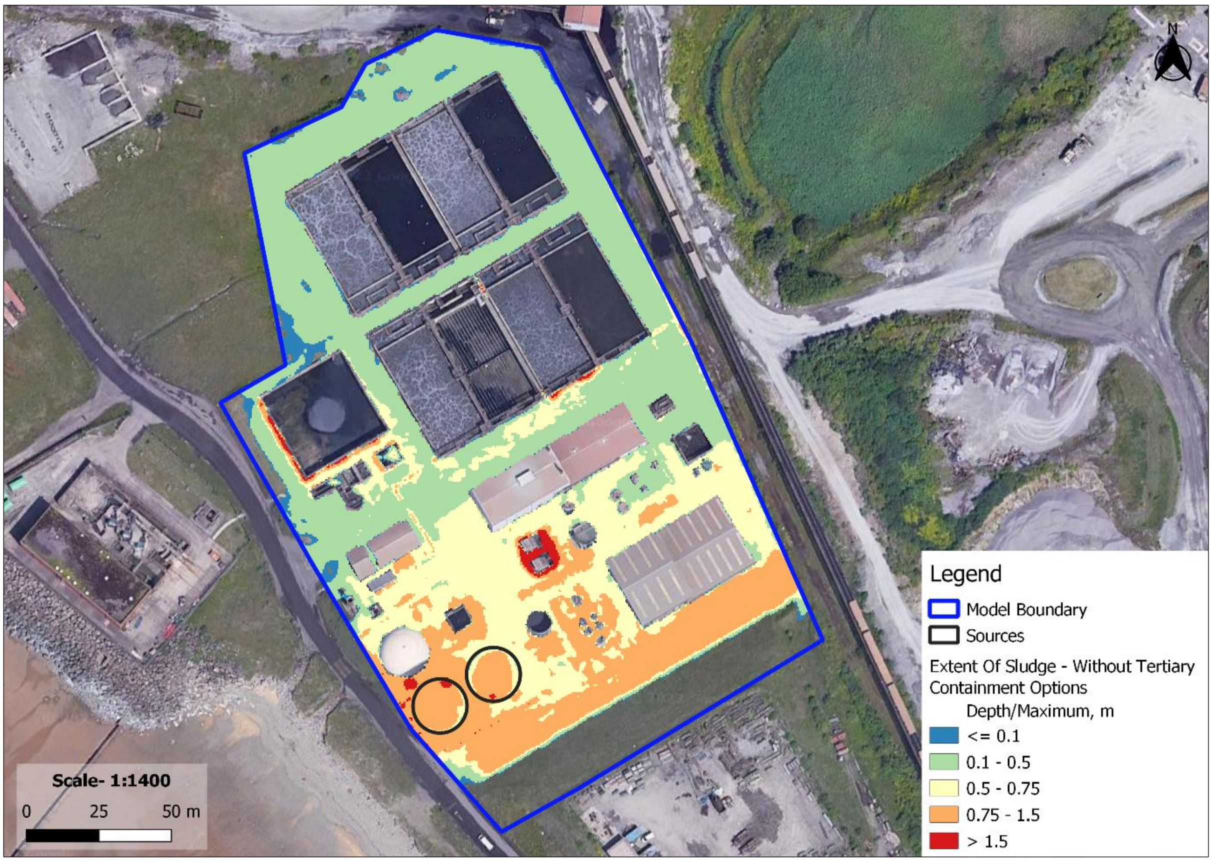
Figure 4.5: Sludge extent - Failure of Digester 2



4.4.3 Breach with Initial Water Levels

The post-failure scenario includes the initial water level (obtained from the pre-failure scenario model run) followed by breaching of the different sources (Digester 1 and Digester 2). The combined sludge extent from the failure of these sources together with initial water levels is shown in Figure 4.6. During the breach analysis, it is observed that the sludge spreads over almost the entire site area.

Figure 4.6: Combined Extent of Sludge from the post-failure of all sources - Without TCO



As per CIRIA C736, the volume contained must be the larger of 110% of the capacity of the largest tank or 25% of the total storage capacity within the bunded area. The 110% and 25% rules were compared with the volume considered in the model including storage due to rainfall-runoff (Refer Table 4-2). The volume of storage on the site which is considered by combining the volume of critical source and rainfall runoff volume due to antecedent rainfall is relatively high compared to the other two criteria and hence the containment capacity considered in this study for identifying the enhanced secondary containment options is sufficient.

Table 4-2: Containment system capacity comparison - '110 per cent' and '25 per cent' rules

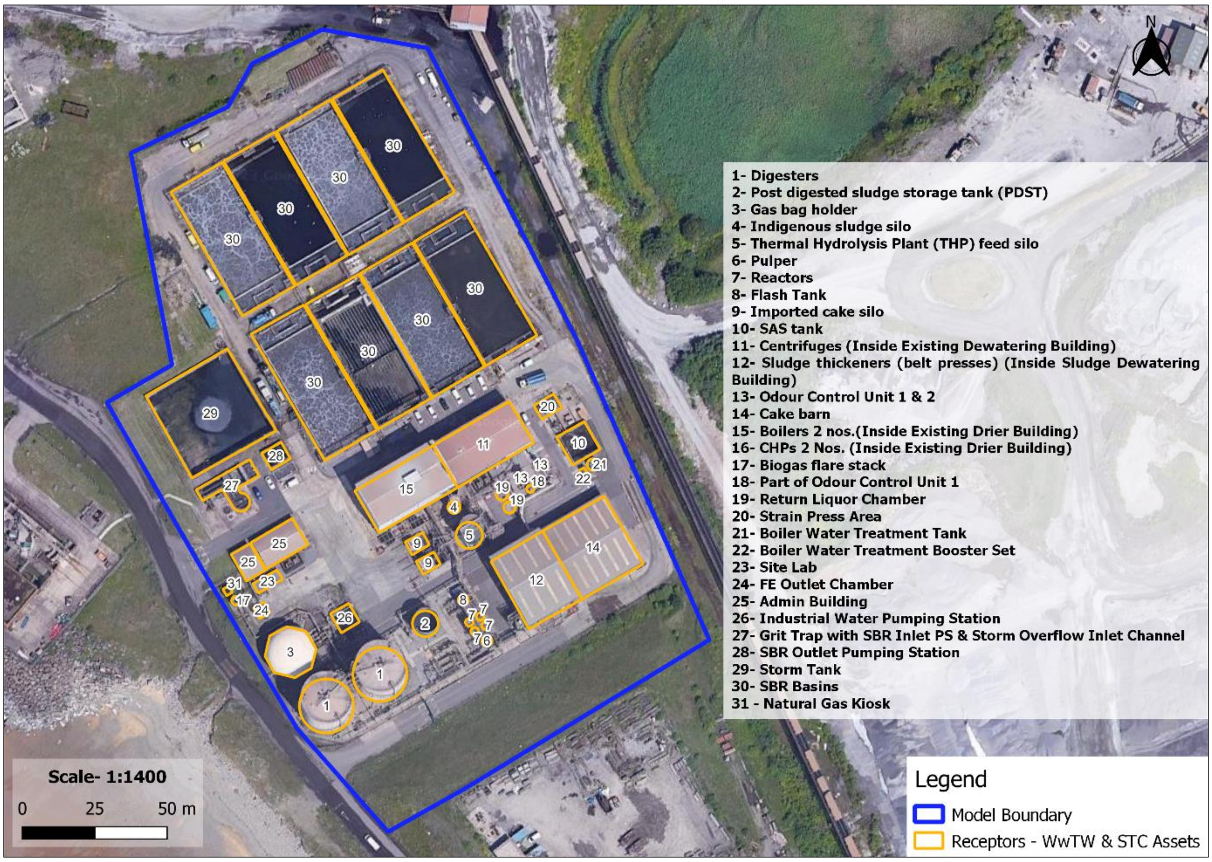
110% of the capacity of the largest tank within bund (in m^3)	25% of the total capacity of all the tanks within the bund (in m^3)	Total volume including antecedent 24-hr rainfall (in m^3)
4675	2479	5215.19

In summary, the following scenarios were used in the failure assessment of the STC.

a) Pre-Failure - Rainfall is applied over the site to extract the initial water levels (IWL) at the end of a 24-hour simulation with provision of existing secondary containment options which includes kerbs and speed humps.
b) Post-Failure without containment options - Breaching of the critical source is applied with IWL defined and with provision of existing secondary containment options but no enhanced secondary containment options are included,
c) Post Failure with containment options - Breaching of the critical source is applied with IWL defined along with the containment options i.e. both existing secondary and recommended enhanced secondary containment options. Enhanced secondary containment options are discussed in Section 5.

The assets within WwTW (on-site receptors) that are affected by the footprint of sludge around/ within them from the above failure scenarios are marked in Figure 4.7.

Figure 4.7: Combined Receptors from the post-failure of all sources - Without TCO



5 Proposed Mitigation

This section provides a detailed assessment of the mitigation measures which are being proposed and the potential impact of these improvements.

5.1 Enhanced Secondary Containment options

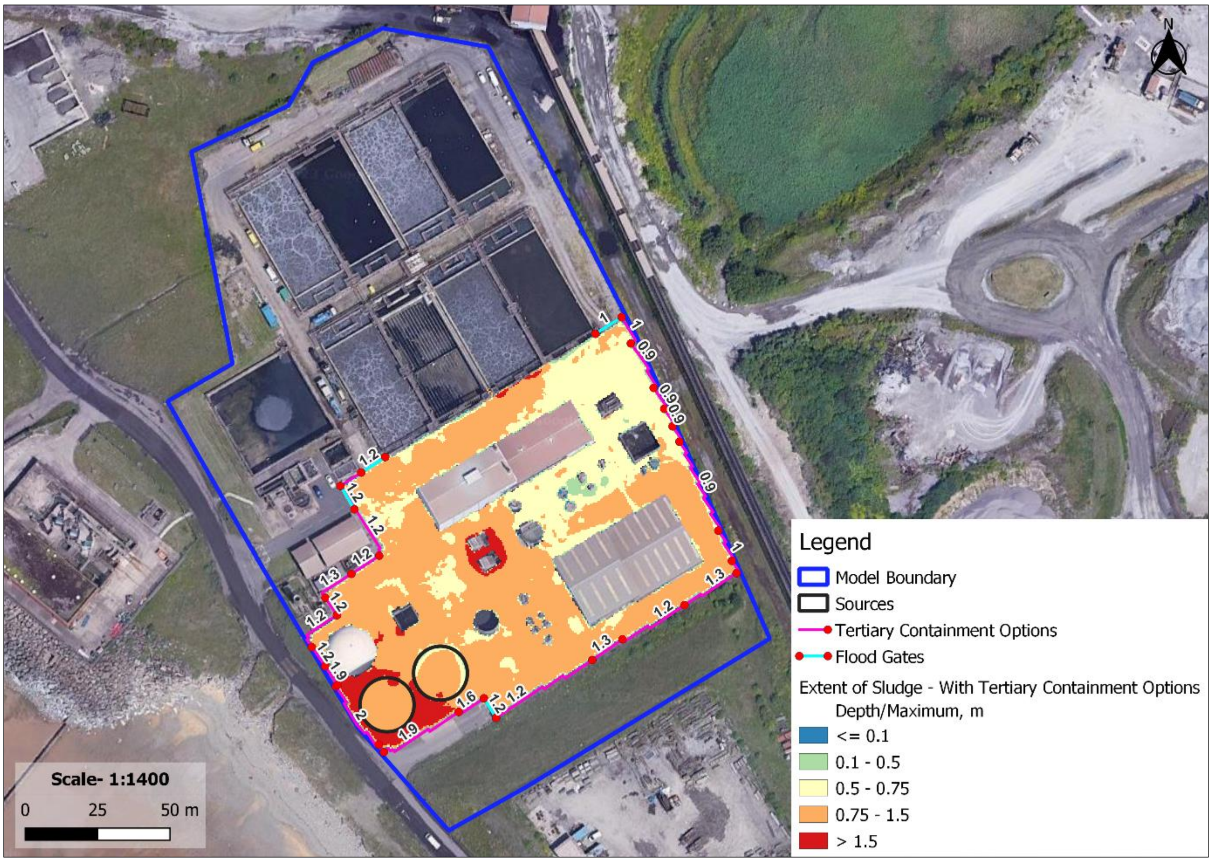
The recommended enhanced secondary Containment Options (TCO) have been agreed following discussions with site managers to ensure their feasibility. There are critical assets (such as the Admin building, Site Laboratory and Final Effluent Outlet Chamber) which need to be protected. Hence the TCO are recommended to ensure the protection of these critical assets and avoid the sludge leaving the WwTW site. The TCO are intended to contain the sludge within the site by utilizing the existing gates as flood gates whilst having a minimum impact on the operation of the site.

Figure 5.1 shows the bunds and flood gates with the approximate height along with the location of critical sources.

Figure 5.1: Enhanced Secondary Containment Options

The height of the bunds represented does not include any freeboard and they are estimated roughly based on the maximum depth of the sludge adjacent to the bunds as shown in Figure 5.2.

Figure 5.2: Combined Extent of Sludge from the post-failure of all sources - With TCO



The height of the bund would vary based on the topography and hence detailed design of these enhanced secondary containment options should be carried out in the subsequent stages to optimize the height of the bunds. Also, it should be ensured that the structural strength of building can withstand the weight of this depth of sludge around it.

Enhanced Secondary Containment options proposed are:

- Bunds along the east and west side of the site to prevent sludge to flow out of site boundary.
- Bunds near the location of critical asset (Administrative building, site laboratory and Final Effluent outlet chamber) to avoid the sludge entering in it.
- Bunds along the south side of the site to prevent the sludge to flow outside the site.
- Flood gates on both side of SBR units to provide access to the SBR units and other assets on north side of the site.
- Flood gates across both the entry and exit roads.

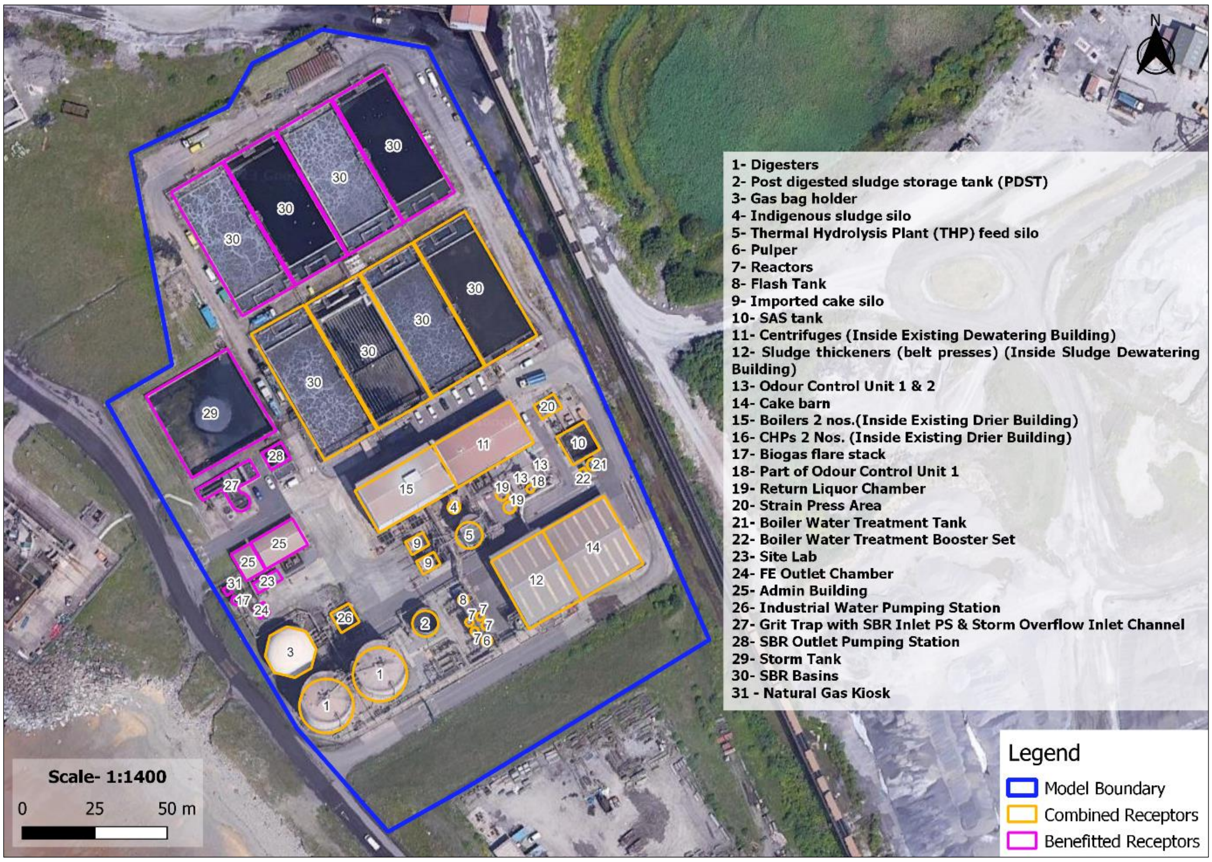
Various containment options (refer to Appendix C for details) were assessed. Following the consultation with Welsh Water, the site owner/operators are advised to proceed with the most suitable options based on feasibility, access and operations close to the bund.

The cake barn is located within the sludge dewatering building, and it is recommended to ensure the barn would be closed on all the sides to avoid any spill from it. Any potential inlets to the drainage system which are located within the modelled extent of the sludge which could discharge sludge to the watercourse are recommended to be covered with drain covers (Refer to Appendix C) in the event of catastrophic failure of the sludge source.

5.2 Impact of Enhanced Secondary Containment Options

Figure 5.2 shows the combined extent of sludge following the inclusion of containment measures within WwTW. The modelling shows that there is no flow occurring off-site, into the critical assets and into the permeable areas within the site. Due to the presence of containment option, the receptors that are benefitted are marked in Figure 5.3.

Figure 5.3: Receptors after inclusion of Enhanced Secondary Containment Options



After the inclusion of enhanced secondary containment options, the list of receptors which remain at risk is tabulated in Table 5-1 together with the depth of sludge. The highest depth of sludge (2.7 m) is found near Digester 1 due to its close proximity to the bunds.

Table 5-1: Receptors with sludge depth – Post failure with containment options

Sr. No.	List of Receptors	Maximum depth of sludge, m (Without TCO)	Maximum depth of sludge, m (With TCO)	Assets within
1	Digester - 2 nos.	2.7	2.7	STC
2	Post digested sludge storage tank (PDST)	0.8	1.0	
3	Gas bag holder	1.5	1.9	
4	Indigenous sludge silo	0.7	0.9	

Sr. No.	List of Receptors	Maximum depth of sludge, m (Without TCO)	Maximum depth of sludge, m (With TCO)	Assets within
5	Thermal Hydrolysis Plant (THP) feed silo	0.9	1.0	
6	Pulper	1.0	1.2	
7	Reactors - 4 nos.	1.1	1.3	
8	Flash Tank	0.8	0.9	
9	Imported cake silo[9]	6.8	7.0	
10	SAS tank	0.7	0.8	WwTW
11	Centrifuges (Inside Existing Dewatering Building)	0.6	0.8	
12	Sludge thickeners (belt presses) (Inside Sludge Dewatering Building)	0.8	0.9	STC
13	Odour Control Unit 1 & 2	0.5	0.6	
14	Cake barn	0.9	0.9	WwTW
15	Boilers 2 nos. (Inside Existing Drier Building)	0.7	1.1	STC
16	CHPs 2 Nos. (Inside Existing Drier Building)	0.7	1.1	
17	Biogas flare stack	0.3	-	
18	Part of Odour Control Unit 1	0.5	0.5	
19	Return Liquor Chamber - 2 nos.	0.6	0.7	
20	Strain Press Area	0.6	0.9	WwTW
21	Boiler Water Treatment Tank	0.8	0.8	
22	Boiler Water Treatment Booster Set	0.7	0.8	
23	Site Lab	1.2	-	
24	FE Outlet Chamber	0.7	-	STC
25	Admin Building	0.9	-	WwTW
26	Industrial Water Pumping Station	1.2	1.7	
27	Grit Trap with SBR Inlet PS & Storm Overflow Inlet Channel	1.1	-	
28	SBR Outlet Pumping Station	1.4	-	
29	Storm Tank	2.3	-	
30	SBR Basins – 8 nos.	2.6	2.9	
31	Natural Gas Kiosk	0.4	-	

From the table above, it can be seen that the depth of sludge increases (by up to 0.5 m) around a number of the receptors due to the presence of enhanced secondary containment options. The assets which are protected by enhanced secondary containment options have no sludge around them (Admin building, Site lab and Final Effluent outlet chamber).

[9] Sludge depth provided is from the bottom of the well near the cake silo

6 Conclusion

The hydraulic modelling shows that the proposed mitigation options are successful in retaining sludge on the site even in the event of a recent rainfall event that has resulted in ponding on the site. The volume contained is greater than the larger of both 110% of the largest tank capacity and 25% of the total storage within the bunded area.

The entire WwTW lies within Flood Risk Zone 1 and is therefore classified as very low risk (Less than 0.1% Annual Exceedance Probability of flooding) from fluvial, sea and surface water flooding according to Wales flood maps (Refer the flood risk report attached in Appendix A). Fluvial and tidal flooding were not considered in the modelling and development of mitigation options.

The high-level enhanced secondary containment options are proposed in a way that the pollutants (sludge) are contained within the site boundary and to prevent it from entering into the critical assets and other sensitive receptors.

The drain covers are recommended for the drainage inlets where they are located within the modelled extents of the sludge which could discharge sludge to the nearby watercourse.

The spread of pollutants is shown to be contained almost within the IED permit boundary. However, the assets within the permit boundary will be surrounded by sludge. Continuing operation of the site will require that these assets are provided with protection.

7 Assumptions

The model is built and assessed with various assumptions as listed below. The complex drainage and spill containment requirements are identified by developing a 2D model using TUFLOW software. The model helps to visualize the performance of any proposed containment design.

1) The sludge spillage was modelled as a typical water flow in terms of viscosity.
2) ADBA classification tool was updated with the available limited information received from the client.
3) The extent of the model is adopted based on the property boundary of WwTW and bit extended along the ridges wherever necessary.
4) Buildings, tanks, and other assets within WwTW which are elevated above the ground are raised in the model (post-failure scenario) based on information received from the client and a high roughness value is assigned. However, at a few locations (where information from the client) is missing, the height of the buildings/ assets is assumed from 3D buildings in Google Earth.
5) In the pre-failure scenario, the buildings/ assets are raised by only 0.3m as there are instabilities caused where rainfall is added to the areas of the assets and then immediately flows off the elevated area and falls to ground level.
6) As per the discussion with client, any kind of survey data which includes topography/ grid elevation points (Covering the entire WwTW boundary) was not available. Hence, the latest LiDAR data of 1m resolution downloaded from https://datamap.gov.wales/ has been used in the assessment which provides sufficient details to prepare terrain surface for the study.
7) Land use is represented by downloading the OS Vector Map. Additionally, buildings and roads were digitized and included in the model based on Google Satellite Aerial Imagery.
8) FEH22 design rainfall is generated using the catchment descriptors of the site location downloaded from https://fehweb.ceh.ac.uk/GB/map. Rainfall is extracted for a 10-year return period 24-hour duration using the InfoWorks ICM tool.
9) The breach/failure analysis was undertaken by applying the point inflow in the model. The location of the point inflow is the same as that of the storage facility. The breach was represented by a rectangular hydrograph with the volume of the asset discharged over a one-minute duration[10] representing the sudden failure of the source.
10) In the breach analysis, the tanks are raised by 0.5m only in their respective failure scenario to avoid the instabilities and represent the real-time situation at the time of failure.
11) The density of Biogas from biogas holder is assumed to be 1.1 kg/m3 for calculating the volume of firefighting water required at the site.
12) The enhanced secondary containment options were included in the pre-failure scenario with the provision for cross drainage (openings in the bund) to simulate the initial water levels for the post failure scenarios and the cross drainage must be assessed in the detailed design stage to minimise any loss of flood storage.

[10] Source: CFRAM Guidance Note 24 – Breach Analysis, 2013

13) The existing buildings/structures have potential structural strength, and they are fit enough to constrain and retain the sludge around them

A. Flood Risk Report at Afan WwTW

Flood risk report for the area within 10 metres of:

AFAN WATER TREATMENT, PHOENIX WHARF, THE DOCKS, PORT TALBOT, SA13 1RA

Very low risk	**Flooding from rivers** Risk less than 0.1% chance each year
Very low risk	**Flooding from the sea** Risk less than 0.1% chance each year
Very low risk	**Flooding from surface water and small watercourses** Risk less than 0.1% chance each year

The risk levels are: High, Medium, Low and Very low.

This area:

- Does not benefit from flood defences
- Has no recorded flooding

This risk level takes into account the effect of any flood defences that may be in this area. Flood defences reduce, but do not completely stop the chance of flooding as they can be overtopped or fail.

Please note

We cannot give the flood risk for individual buildings because this depends on building features and other local factors like drainage conditions.

Source: https://check-your-flood-risk.naturalresources.wales

B. Site Risk Assessment from the ADBA tool

B.1 Hazard Posed

B.1.1 Source

Material	Physical properties	Quantity	units	Storage	Flammability	Corrosive	Ecotoxicity (based on LD and quantity)	Environmental hazard rating	Justification
Inventory									
Raw Sludge	Liquid	80	m3	Steel	Not flammable			H	2 x Imported cake silo - 40 m3 each
Raw Cake	Solid	450	m3	Reinforced concrete	Not flammable			H	Cake barn (with 3 No. cake bays, 4-day retention approx. 450m3 total cake bay storage capacity, covered by barn)
							Inventory Overall Rating	H	Any material with a "High" rating means the overall rating is High
Process									
Digested sludge	Liquid	8500	m3	Concrete	Not flammable			H	2 x Digesters - 4250 m3 each
Digested sludge	Liquid	500	m3	Glass Fused Steel	Not flammable			H	1 x Post digested sludge storage tank (PDST)
Biogas	Gas	2000	m3	Textile material (HEYTex Biogas) with a	Flammable			L	1 x Gas bag holder
Thickened sludge	Liquid	100	m3	Steel	Not flammable			H	1 x Indigenous sludge silo
Thickened sludge	Liquid	600	m3	GFS	Not flammable			H	1 x Thermal Hydrolysis Plant (THP) feed silo
Thickened sludge	Liquid	42	m3	Stainless steel	Not flammable			H	1 x Pulper
Thickened sludge	Liquid	52	m3	Stainless steel	Not flammable			H	4 x Reactors - 13 m3 each
Treated sludge	Liquid	42	m3	Stainless steel	Not flammable			M	1 x Flash Tank
ndigenous secondary sludg	Liquid	400	m3	Reinforced concrete	Not flammable			H	1 x SAS tank
Thickened sludge	Liquid	-		Steel	Not flammable			H	1 x Centrifuges - 2 Nos.
Digested sludge	Liquid	-		Steel	Not flammable			H	3 x Sludge thickeners (belt presses)
Excess biogas	Gas	-		Stainless steel	Flammable			L	1 x Biogas flare stack (1,500m3/hr max)
							Process Overall Rating	H	Any material with a "High" rating means the overall rating is High
Additives and site									
Diesel	Liquid	500	Litres					M	Used boilers during emergencies, however it is a rare occurrence. Ordered on an ad hoc basis
Poly	Solid	50	tonnes					M	Used as flocculant to enhance thickening and dewatering processes. Cationic Polyacrylamides (FloPam FO4440 and FloPam
Antifoam	Liquid	40	Litres					M	Used in digesters to prevent foaming
Grease	Liquid	20	Litres					H	Used for lubrication plant and equipment
Lubrication oils	Liquid	100	Litres					H	Used for lubricating plant and equipment
Sodium Chloride	Solid	250	kg					L	Rocksalt, Salt Tablets, granular & low bro
							Chemicals Overall Rating	H	
Fire fighting agents and cooling water									
							Spillages Overall Rating		
							Sources Overall Hazard	H	

B.1.2 Pathway

Pathway - the route from primary containment to receptor								Environmental hazard rating	Notes
Mitigation - do these apply?									
If a secondary containment system is present…								L	A secondary containment option is present on site in the form of kerbs and speed humps of 150mm and 100mm heights, respectively.
If the rain water drainage system in the secondary containment fails safe…								L	
							Path & Mitigation	L	
Climatic conditions									
Annual rainfall < 1000 mm									NA
Annual rainfall > 1000 mm								M	Average annual rainfall is around 1197 mm
Snow accumulation is possible									NA
Fire Fighting Water									
Inflammable materials normally present on site in large quantities?								M	Biogas and some of the chemicals used in the WwTW are flammable
Location									
Site is in a flood plain								L	The entire STC lies within Flood Risk Zone 1
Site is at bottom of a hill									NA
Site is connected to a sewage treatment works								H	STC is within a Waste Water Treatment Works
							Site Considerations Overall Rating	H	
							Pathway Overall Hazard Rating	**H**	

B.1.3 Receptor

Receptors	Within	units						Environmental hazard rating	Notes
Watercourses and bodies									
Swansea Bay	113	m						H	
							Water Overall Rating	H	
Habitation									
Industry & supporting offices at Port Talbot	350	m						H	As per Odour Management Plan, there are four offices at Port Talbot. However, only the nearest one is considered in habitation
Sinter Plant	650	m						H	As per Odour Management Plan
Associated British Ports	1.5	km						M	As per Odour Management Plan
Taibach	2	km						M	As per Odour Management Plan
Margam	2	km						M	As per Odour Management Plan
Aberavon	2.5	km						M	As per Odour Management Plan
							Habitation Overall Rating	H	
Other									
WRC and STC assets	10	m						H	
Areas of Outstanding Natural Beauty (AONB)	>5	km						L	Located west of the site
Country Parks	>5	km						L	Located east & north-east of the site
National Nature Reserves	>5	km						L	Located south-east of the site
Ramsar	>5	km						L	Located north-west of the site
Sites of Special Scientific Interest (SSSI)	>5	km						L	Located south-east & north-west of the site
Special Areas of Conservation (SAC)	>5	km						L	Located south-east & north-west of the site
Ancient SemiNatural Woodland	>5	km						L	Located from north to south-east of the site at various locations
Ancient Woodland Site of Unknown Category	>5	km						L	Located north-west & north-east of the site
Plantation on Ancient Woodland Site	>5	km						L	Located from north to south-east of the site at various locations
Restored Ancient Woodland Site	>5	km						L	Located from north to south-east of the site at various locations
							Other Overall Rating	H	
							Receptors Overall Hazard Rating	H	

B.2 Site Hazard Rating

Calculated hazard ratings:			
Source	Pathway	Receptor	**Site Hazard Rating**
H	H	H	**High**

Possible Combination			Site Hazard
L	L	L	Low
M	M	L	Low
H	L	L	Low
M	M	M	Medium
H	M	L	Medium
H	H	L	Medium
H	M	M	High
H	H	M	High
H	H	H	High

B.3 Likelihood of loss of containment

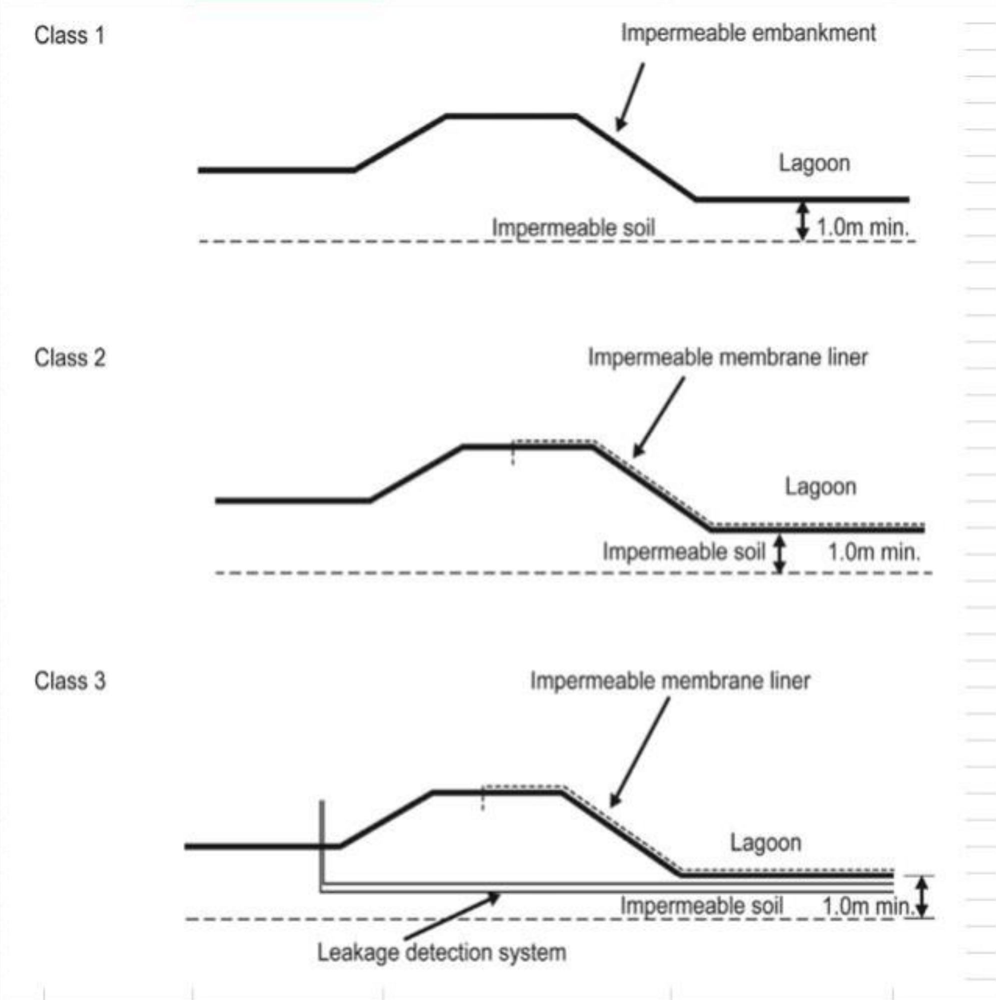
Risk of loss of containment	Annual probability of loss of containment
High	Greater than 1% (1 in 100)
Medium	Between 1% (1 in 100) an 0.0001% (1 in 1 million)
Low	Less than 0.0001% (1 in a million)

Risk #	Description of Risk	UNMITIGATED LIKELIHOOD	Mitigation applied	MITIGATED LIKELIHOOD	High	Site Overall Likelihood
1	Operational failures, such as failure of plant, or human failure by operators	H	Tertiary containment option is proposed	L		
2	Shortfalls in design – lack of alarms and fail-safe devices	L		L		
3	Structural failure – materials, components, detailing, corrosion or when exposed to heat and flame	H	Tertiary containment option is proposed	L		
4	Abuse – inappropriate change of use or other misuse	L		L		
5	Impact, eg from a vehicle	L		L		
6	Vandalism, terrorism, force majeure etc	L		L		
7	Fire or explosion	H	Tertiary containment option is proposed	L		
8	Geological factors -subsidence etc	H	Tertiary containment option is proposed	L		
9	Ageing or deteriorating assets/sub-components.	M	Tertiary containment option is proposed	L		
10	Lightning strike	L		L		

B.4 Site Risk and Classification

Site Hazard Rating	Likelihood	Overall Site Risk Rating	Indicated Class of Secondary Containment Required
High	High	**High**	**Class 3**

B.5 Standard containment designs



It should be stressed that in all cases the ground and soil conditions should comply with the impermeability, stability and durability criteria set out previously. Where impermeable linings and leakage detection systems are required these are as an **additional** level of protection and **not** to compensate for inadequate ground and soil conditions.

C. Spill Containment Equipment

Equipment	Reactive	Proactive	Ease of Remote Activation	Retrofittable	Manual Handling	Solar Powered	Testable	Sustainability & Recycling. L=LOW	Suitable for Firewater Containment	Comments
Spill Kit	Yes	No	N/A	Yes	Yes	N/A	No	L	No	Mainly used for maintenance and small volume spills, should be used by trained staff. Generates contaminated waste which requires disposal.
Fixed Bund	Yes	Yes	N/A	Yes	N/A	N/A	Yes	H	Yes	Refer to CIRIA736. Expensive and generally requires capital investment. Essential for high risk storage. Normally only protects the primary vessel.
Portable Bund	Yes	No	N/A	Yes	Yes	N/A	Yes	H	No	Designed for storage of IBC's mainly used in production areas.
Chemical Store	Yes	Yes	N/A	Yes	N/A	N/A	Yes	H	Yes	Primarily used for Chemical and IBC storage. Normally fitted with bunded base.
Drain Cover	Yes	No	N/A	Yes	Yes	N/A	Yes	L	Yes	Drain covers are part of the spill kit and require correct fitting. Clay mats are single use only. When used for spills it is important to use correct PPE. Can expose operator to the spillage. No containment capacity so tertiary area must be good to prevent ground contamination.
DrainBlok	Yes	Yes	N/A	Yes	Yes	N/A	Yes	L	No	DrainBlok can be used multiple times to seal off drainage. These are used by the fire service when the site has no control of drainage run off. Requires trained operators.
Fixed Bladder System	Yes	Yes	Yes	Yes	No	Yes	Yes	H	No	Uses a fixed bladder (stopper). Originally developed in 1998 as a single use emergency containment valve. Air leaks and rodent damage can make them unreliable. Any air leaks will result in containment loss. Easy to retrofit to most drains. Large stoppers are slow to inflate. Not suitable for long term fire water containment due to air leakage.
Penstock Valves / Sluice Gates	Yes	Yes	Yes	Yes	Yes/No	No	Yes	L	Yes/No	Penstocks require correct installation and are most suited to the water and process industry. Have been used as the preferred containment valve by the Environmental Regulators. The word Penstock is generic and fails to consider the leak rate of valves. Any site using a valve for containment should consider the need for the valve to stop all flow. Expensive and difficult to retrofit to drains.
ToggleBlok	Yes	Yes	Yes	Yes	Yes/No	Yes	Yes	H	Yes	Specifically designed as a drop seal valve for spill and fire water containment. Developed to use low power radio and solar power.

Source: Making Water Pollution Prevention Pay (Prepared by David Cole from Sandfield Penstock Solutions, 2018)