J840 – STC IED Containment

Aylesbury STC – Containment Options Report

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Thames Water

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Project Manager:	Harindra Gunasinghe
Author:	Carl Rendora
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Contents

1. Executive Summary

Thames Water is required by the Environment Agency to provide secondary containment to their sludge treatment centres to satisfy provisions of the Industrial Emissions Directive and to safeguard the operation of the adjacent sewage treatments works. Twenty-five sludge treatment centres have been identified where containment proposals are required. This report deals with the proposals for Aylesbury.

Aylesbury STW serves a population equivalent of 99,300 for the town of Aylesbury and its environment. The sludge treatment centre shares the same site as the sewage treatment works.

CIRIA Report 736 – Containment systems for the prevention of pollution sets out principles and direction. This report sets out options to apply the CIRIA 736 principles within the accepted constraints of a retrofitted solution.

There are 13 tanks in total containing sludge the total operational sludge volume of approximately 14,935m^3, most constructed of steel, with individual volumes varying between 50 to 2,095m^3, refer to section 3.4.1 for details on tanks and volumes. The site is generally low lying and flat. There are three containment volumes to consider at Aylesbury each set by a different rule:

Containment Area	**Volume**	**Rule**
Primary digester area	2773m^3	largest tank plus rainfall
Press liquor return tank area	1037m^3	110%
Secondary digester area	2154m^3	25%

An initial review, together with TW Site Operations, was carried out to confirm that the working of the sewage treatment works would not be compromised by any proposal. In the review, close containment and wide containment options were discussed. Within the discussions, failure of a primary digester tank (largest spilled tank) was addressed by adopting a wide containment area for both the primary and secondary digesters. However, this option was abandoned as despite the large area the containment height would still restrict vehicles from entering. Therefore, close containment options were chosen for the primary digester, secondary digester and return liquor holding tank areas. Refer to Section 4.1 for details on the options reviewed and Section 4.3 for the preferred option. Below a summary of the preferred option:

Containment Area	Description of containment
Primary Digesters	• Close containment with top level of containment at 72.60mAOD, bund walls typically 0.5-0.75m after reprofiling of ground. • A 750 gravity pipeline will convey sludge from the spill area to the adjacent disused Humus tanks. • Framed steel sheeting will be placed on the western boundary to mitigate the effects of jetting. • 3 ramps will provide access for vehicles as area is frequently visited during the day and reprofiled ground levels allow the use of ramps
Secondary Digester Area	• Close containment with top level of containment at 72.52mAOD, reinforced concrete wall to be constructed typically will be 1.1m to contain spillage. • Access provided for infrequent vehicular access by large flood gates. Steps provided for pedestrian access to the area.
Press liquor return tank area	• Tank receives centrifuge effluent • Close containment with bund walls top level of containment at 72.42mAOD. Bund walls will be 0.61m at its highest • Walls will divert spillage into 1 large disused radial flow humus tank. The ground around the tanks will be resurfaced and regraded to enable spill volumes to discharge into the humus tank. • 1 ramp to provide access for vehicles and steps for pedestrians to access equipment behind containment area.
Summary	• Option reduces impact to operational access as no containment boundaries cross main access roads. • Minimal conveyance routes that require regular and onerous maintenance.

Float valves will also be installed onto surface water drains to prevent spilled sludge from returning immediately to the head of the works.

Bund heights are being set to provide freeboard considering both static conditions when the containment has been filled and during the transient condition at initial failure. There is the potential for some flow to overtop the access ramps during the conditions of the initial burst which is addressed by tertiary containment and conveyance to the site drainage system which discharges to the inlet works.

In addition to the creation of bunds, which due to space constraints are likely to be formed from concrete, existing grass or gravelled areas will be replaced with a bound impermeable material (high cement replacement concrete) to provide a surface that can be cleared of sludge to meet an eight-day recovery period. Vehicular access into the containment areas is by ramps (speed humps) restricted to nom 250-300mm in height; traffic movements on site make the use of permanent flood gates impracticable. Whilst the site is identified as requiring Class 2 containment (impermeable soil with a liner), the proposed solution is intending to use concrete (with no liner) on the basis of the impermeability of the concrete, inherent strength, and long-term mechanical resistance.

The general layout of the proposed solution is presented below:

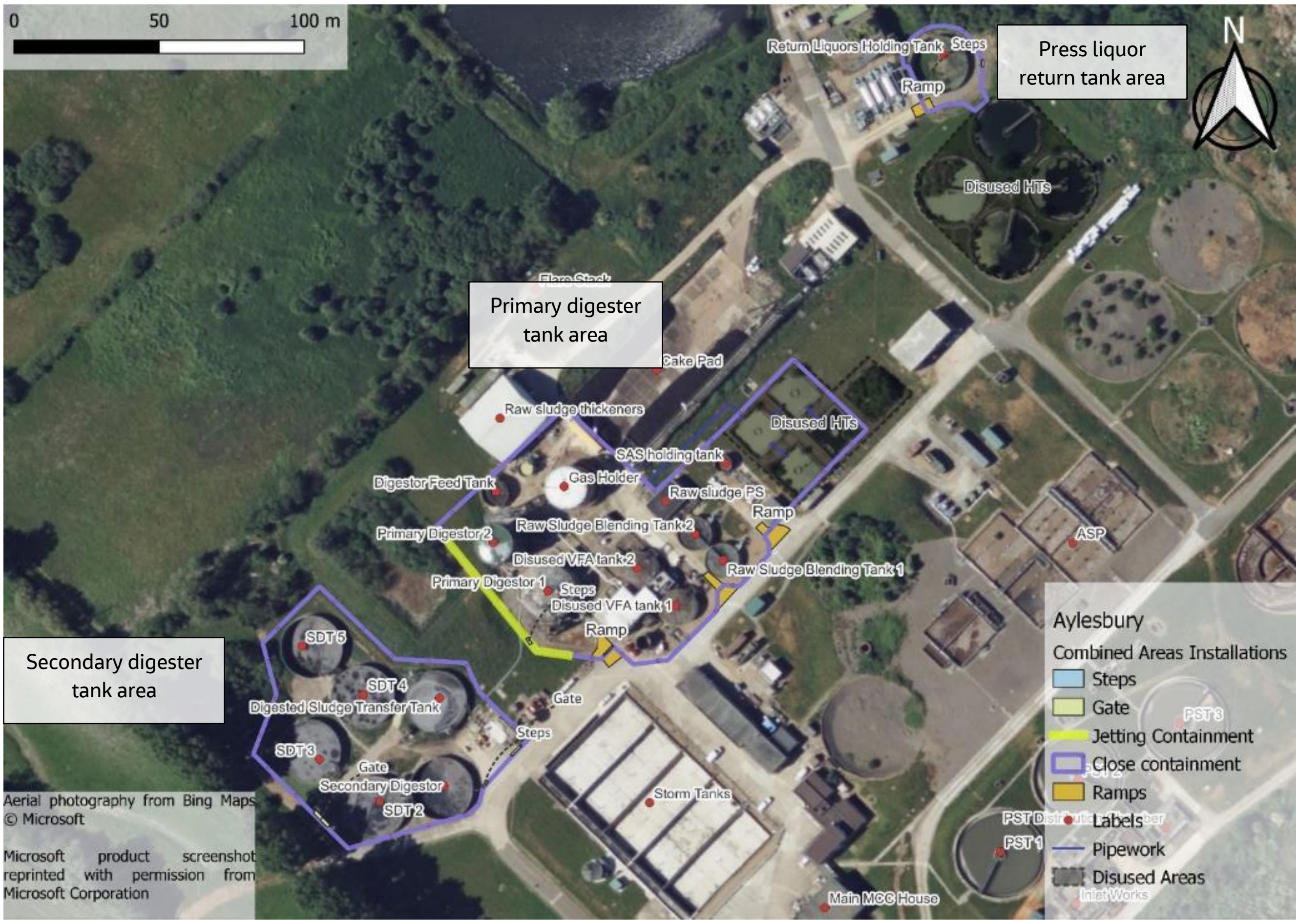

Figure 1-1 General layout of containment for Aylesbury STW

2. Background

Following initial audits by the Environment Agency (EA) in 2019 that examined the primary, secondary, and tertiary containment provisions for Thames Water's anaerobic digestion (AD) process and associated tanks, the EA reported *"there is no provision of secondary containment for the AD process at any of Thames Water's sites. Catastrophic tank failure may impact nearby receptors and the operation of adjacent sewage treatment activities".* Jacobs were appointed to assess site risks and outline the options available for providing remote secondary containment of a catastrophic tank or digester failure across 25 Thames Water sites. Based on CIRIA C736 and ADBA risk assessment tools this containment report addresses the site-specific risks at Aylesbury and outlines the options available for providing remote secondary containment in the event of a catastrophic tank or digester failure.

The current assessment identified gaps between the existing conditions of the sludge assets in Aylesbury STW and the requirements to meet the industrial standard (i.e., CIRIA C736 and The Anaerobic Digestion and Bioresources Association Limited (ADBA)). Site-specific risks, credible failure scenario and design containment volume for the Aylesbury STW were identified through a desktop study, Light Detection and Ranging Analysis (LiDAR) analysis and a site visit.

Aylesbury STC, contained within Aylesbury Sewage Treatment Works (Figure 2-1) is located to the north-west of Aylesbury. The site is situated in an area surrounded on the north-west by River Thame (a tributary of River Thames), on the south-west by Bear Brook (a tributary of River Thames), on the north-east by Chiltern Railways and on the south-east by Rabans Lane Industrial Area.

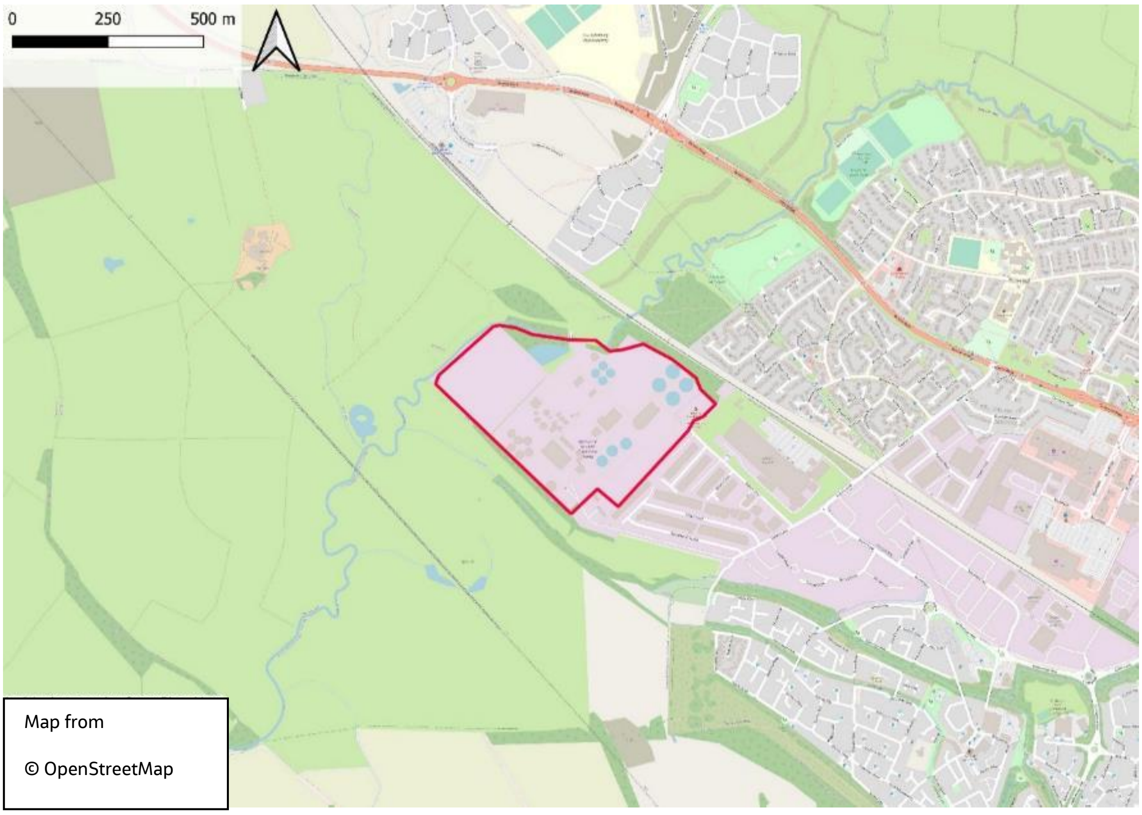

Figure 2-1 Location of Aylesbury STW

Figure 2-2 Satellite image of Aylesbury STW location next to industrial estate

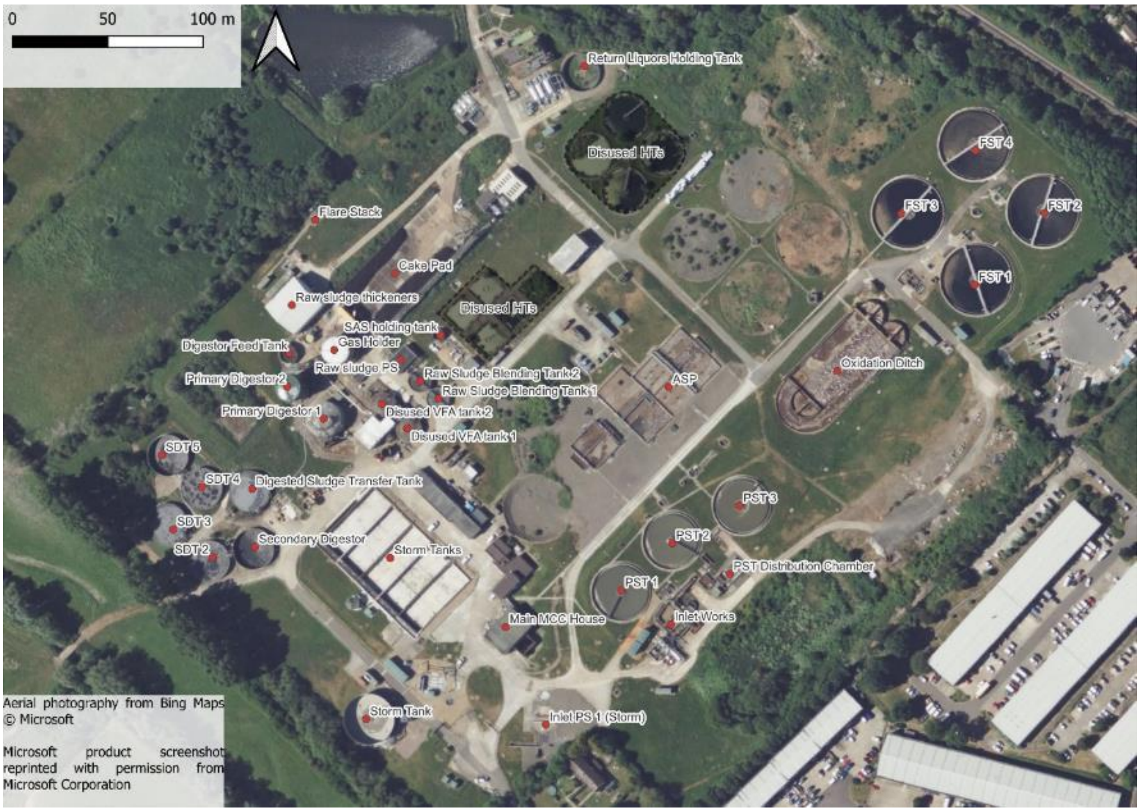

Figure 2-3 Labelled image of the assets within Aylesbury STW

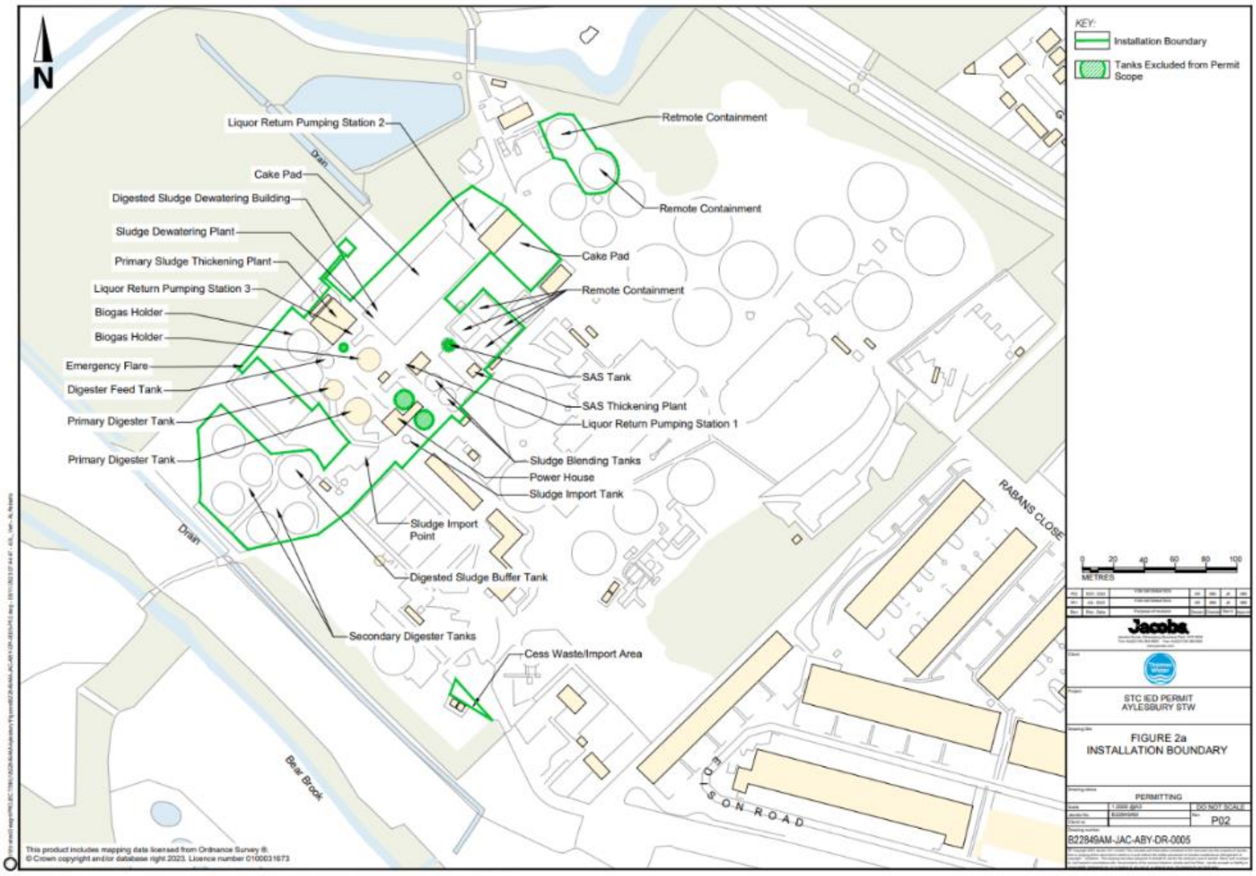

Figure 2-4 Boundary of permitted IED area and the assets

3. Proposed Containment at Aylesbury STW

3.1 CIRIA C736

This containment option report has been prepared using CIRIA C736 as the basis of design and guidelines. Where a deviation from C736 has been recommended it is highlighted in the text.

CIRIA guidance document C736 *(Containment systems for the prevention of pollution – Secondary, tertiary, and other measures for industrial and commercial premises, 2014)* describes various options for containment of spillages from a credible failure scenario. It makes reference to a key plan, reproduced below;

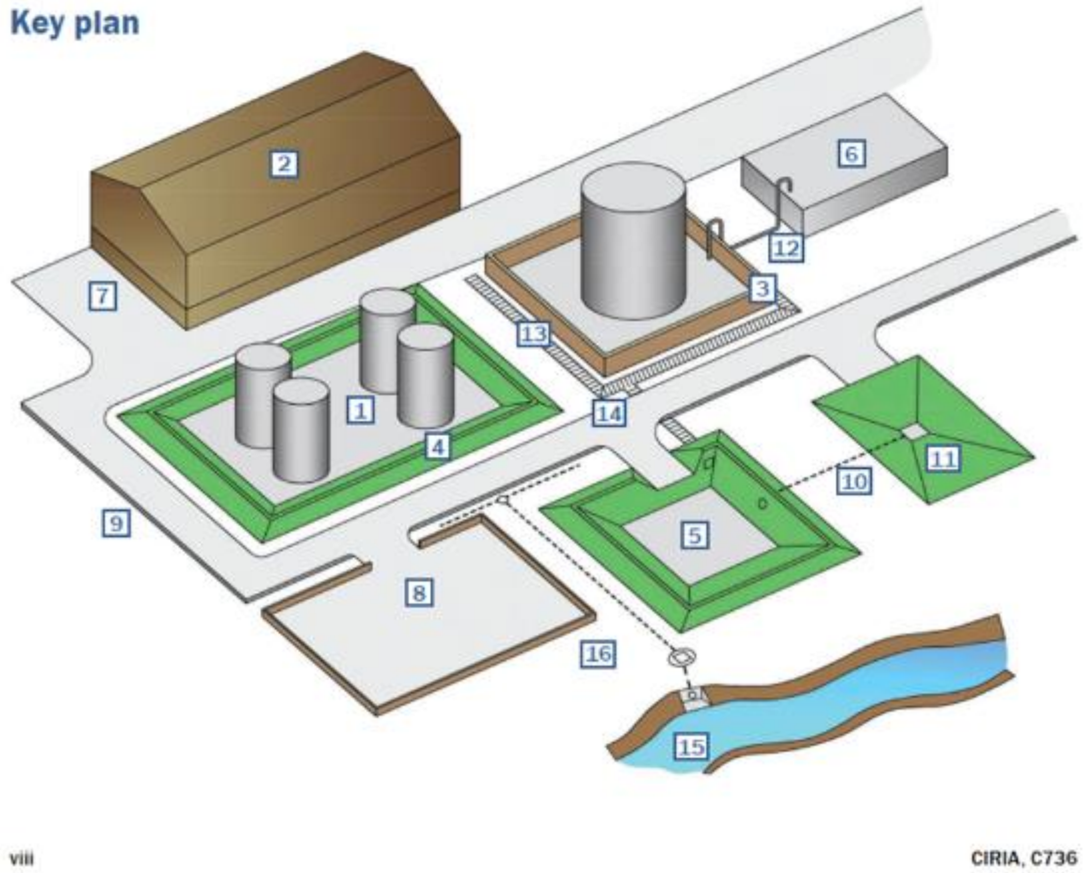

Figure 3-1 Diagram of primary, secondary and tertiary containment examples

- Primary containment is provided by the actual tank or vessel [1]

- **Secondary containment** is provided by a bund immediately surrounding the primary vessel e.g. [3] and [4], or by a lagoon [5] or tank [6]. If containment is provided away from the primary vessels this is known as **remote containment** and may be considered as either **remote secondary** or **tertiary containment**.

- **Tertiary containment** can be provided by a number of means including lagoons [5], or impermeable areas such car parks [8]. Roadways with high kerbing of sufficient height [9] can also form part of a tertiary containment system, or the **transfer system** to the remote containment.

The distinction between *remote secondary* and *tertiary* containment is not always clear but, if properly designed, a combined system can be provided that is capable of providing the necessary degree of environmental protection. The overriding concern is not the terminology but the robustness and reliability of the system which depends on a number of factors such as;

- Its complexity – the more there is to go wrong, the greater the risk. Passive systems relying solely on gravity are more reliable than pumped.
- Whether manual intervention is relied on to make the system work or whether the system can be automated to include fail-safes and interlocks.
- The ease of maintenance and monitoring of the system's integrity, and repair of any defects.

During and after an incident any rainfall runoff from the remote secondary storage areas, from the spillage catchment areas and from the transfer systems must also be prevented from reaching any outfall(s) to surface water by closure of control valve(s).

3.2 Objectives of remote secondary containment

The objectives of the remote secondary containment measures proposed in this report are to safely contain spillages from credible failure scenarios and prevent them from:

- escaping off site
- entering surface waters
- percolating into groundwater
- being pumped back to the inlet of the sewage works in an uncontrolled manner.

The remote secondary containment will be provided by maximising the use of existing impermeable surfaced areas to provide a fail-safe passive system that relies on gravity rather than pumps. A means of leak detection that will automatically trigger isolation valves at key locations in the drainage system is also proposed.

3.2.1 Uncontained Spill modelling

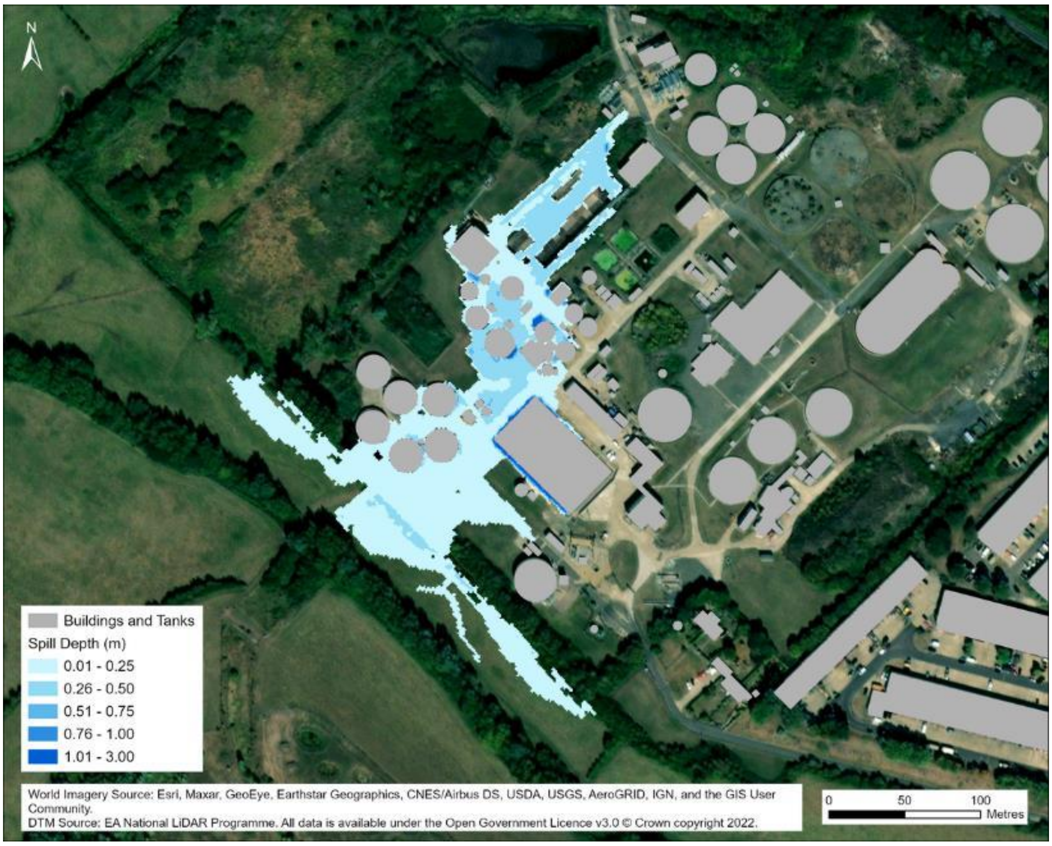

Figure 3-2 Uncontained Spill Model Results

Figure 3-2 shows the sludge spill mapping of an uncontained event in Aylesbury STW. A potential sludge spill from the Primary Digester will not be self-contained within the site and therefore passive containment needs to be implemented to safeguard the nearby receptors. According to the model, the spill will leave the site boundary (by the south-west site boundary) in approximately 3 minutes following failure of one of the Primary Digesters.

The sludge content will then split and part of it will travel north-east within the STW although the majority will travel south, will pass nearby the Secondary Digesters and will leave the site by the south-west site boundary. Once leaving the site the sludge will travel along the south-west site boundary on the green area immediately outside the STW. The flow will continue spreading in the adjacent green area to the north-west and south-east but will also travel south-west until it reaches the dense vegetation located near Bear Brook. The modelling results showed that there will be no sludge reaching the Rabans Lane Industrial Area.

3.3 Site Classification Aylesbury

Based on the use of the ADBA risk assessment, considering the source, pathway and receptor risk Aylesbury site hazard rating is deemed to be High. When considering the mitigated likelihood as low a Class 2 secondary containment is required.

Table 1 Risk rating

Source Risk	Pathway Risk	Receptor Risk	Site Hazard Rating	Likelihood	Overall Site Risk Rating
High	Medium	High	High	Low	Medium (Class 2)

Refer to Appendix 1 for summary of the ADBA risk assessment tool.

3.3.1 Spill Volume Summary

There are two components that contribute to the required capacity of secondary containment, the source spill volume requiring containment and rainfall. Section 4 of CIRIA 736 forms the basis of this assessment. Section 4.2 reviews current industry practice relating to source spill volume, section 4.2.8 then summarises current industry practice relating to source spill volume in a tabular form. It can be seen from section 4.2.8 that sewage sludges and associated regulations / guidance are not listed.

Within section 4.2.1 there is detailed reference to the use of 110% of the largest tank or 25% of the total tank inventory volume, whichever is greater, and the rationale for this. CIRIA recognises that this approach is not quantitative or based on a risk assessment and are arbitrary methods. Section 4.3 and 4.4 provide guidance on a quantitative risk assessment methodology and this is what is being used for the calculation of the required capacity for containment in this report.

3.3.2 Total Spill Volumes

For each containment area, the containment volume has been checked against the largest tank + rainfall, the 110% and 25% rule and for each the largest tank + rainfall applies.

The total design contained volumes comprise:

1. Primary digester area: 2773m^3
2. Press liquor return tank area: 1037m^3
3. Secondary digester area: 2154m^3

Table 2 Estimating critical spill volumes

Primary digester area		
25% Rule	1344	
110% Rule	1650	
Largest + rainfall	2773	Emerging critical case
Press liquor return tank area		
25% Rule	236	
110% Rule	1037	**Emerging critical case**
Largest + rainfall	993	
Secondary digester area		
25% Rule	2154	**Emerging critical case**
110% Rule	216	
Largest + rainfall	1875	

3.4 Aylesbury STW Summary of Containment volumes and assets

3.4.1 Assets for Containment

The tanks for which containment is required are summarised below:

Table 3 List of tanks and volumes

Tank Purpose	No.	Operational Volume (m^3)	Total Volume (m^3)	Material
Sludge Blending Tanks	2	549	1098	Concrete
Digester Feed tank	1	154	154	Steel
Primary digester	1	2095	2095	Steel
Primary digester	1	1980	1980	Steel
Secondary digester	5	1436	7180	Steel
Secondary digester	1	1436	1436	Steel
Sludge Import Tank	1	30	30	Steel

3.4.2 Digital Terrain Model

Figure 3-3 Digital Terrain Model of Aylesbury Sewage Treatment Works

There is an effluent channel for the STW discharging to River Thame, located at the north of the STW. Considering the topography of the sludge area (as shown in Figure 3-3), the high-resolution contouring revealed that the site slopes from the south-east side to the north-west. There is a natural bund between the Rabans Lane Industrial Area and the site. In the event of catastrophic failure of one of the primary digesters, spilled sludge would generally flow to the north-west and south-west east, with partial sludge flowing south (through the green area located between the north-west boundary of the site and the River Thame), and possibly could reach the River Thame. The spill could potentially travel to the south-west of the site and reach the Bear Brook.

3.4.3 Contained Model Output and Contour Maps

Figure 3-4 Contour lines within containment area 1

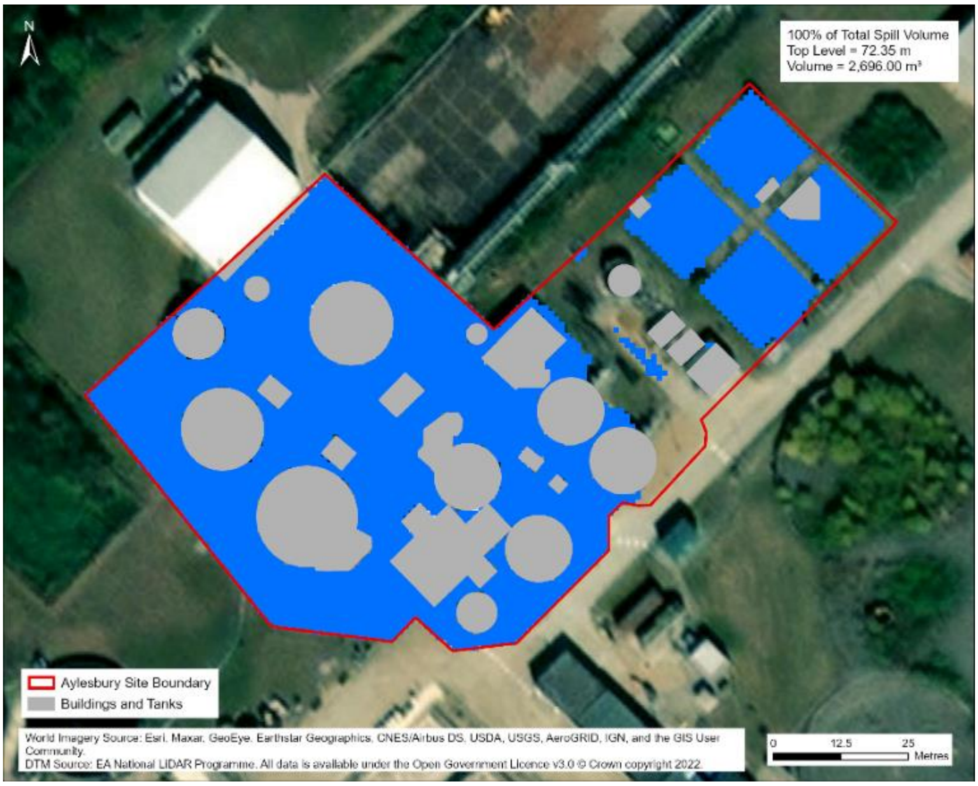

Figure 3-5 – Contained model output for area 1 showing top level of liquid at 72.35mAOD

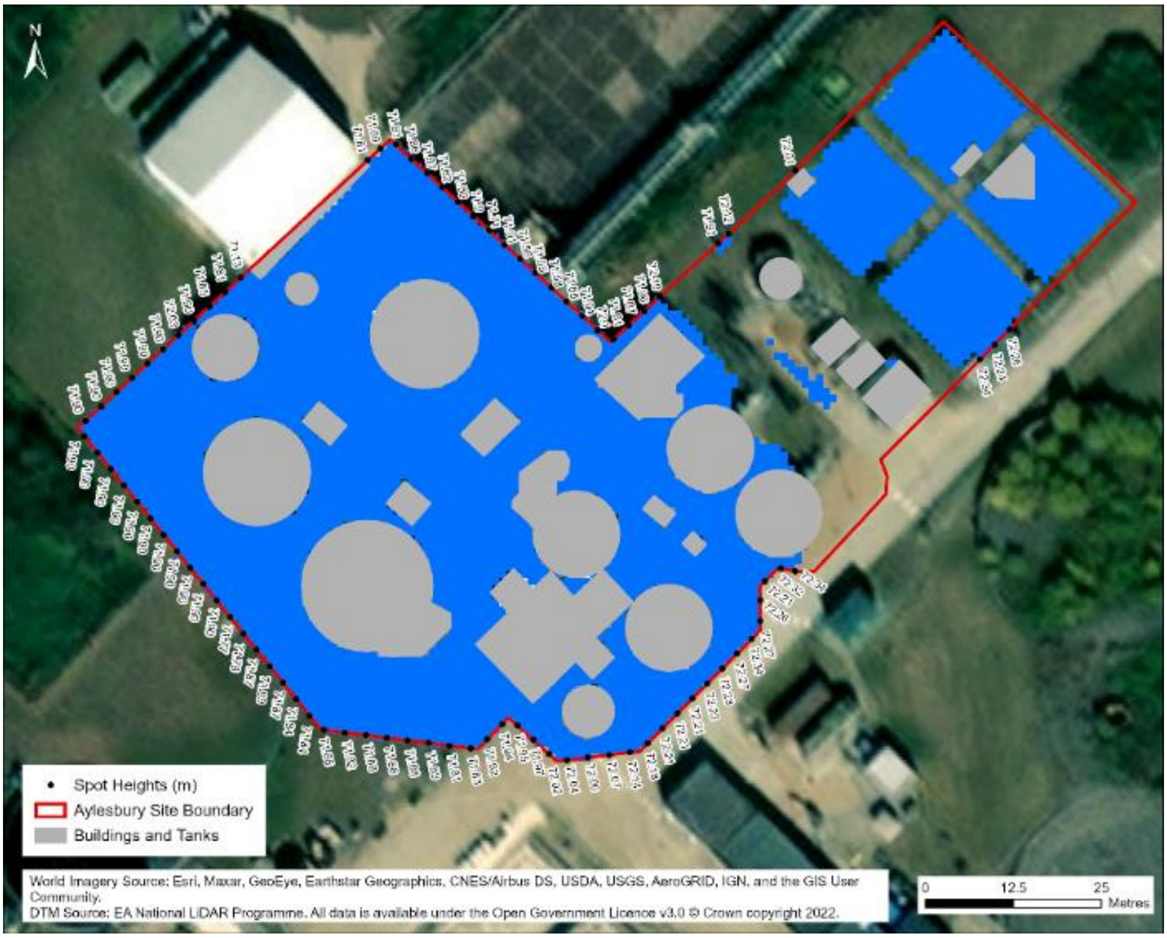

Figure 3-6 - Contained model output for area 1 showing ground elevations at boundary

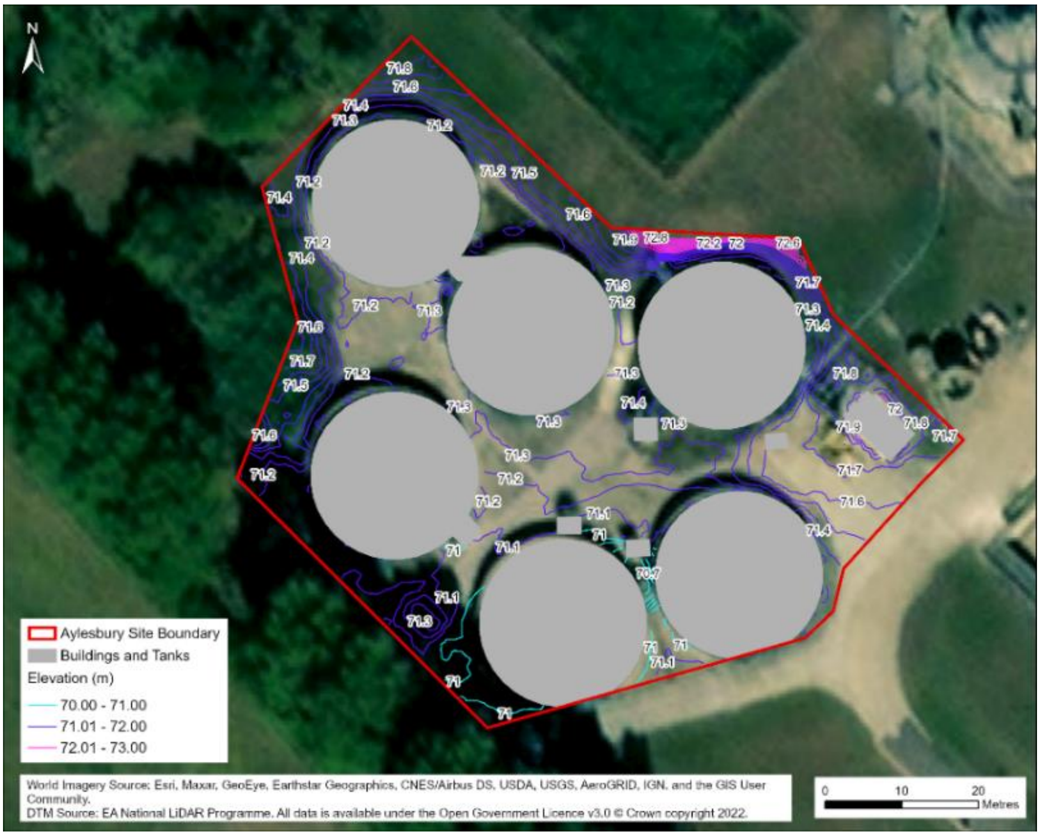

Figure 3-7 – Contour lines within containment area 2

Figure 3-8 - Contained model output for area 2 showing top water level at 72.17mAOD

Figure 3-9 - Contained model output for area 2 showing ground elevations at boundary

Figure 3-10 – Contour lines within containment area 3

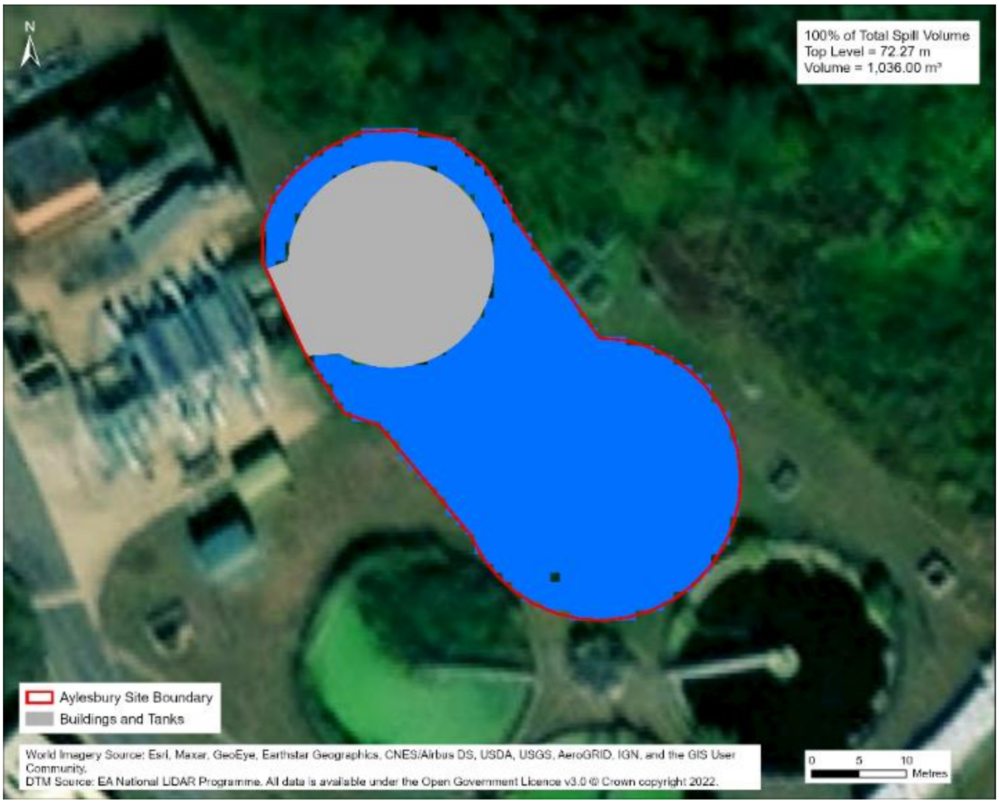

Figure 3-11 - Contained model output for area 3 showing top water level at 72.27mAOD

Figure 3-12 - Contained model output for area 3 showing the ground elevations at boundary

Table 4 – Levels associated with each containment area

Area	Top Water Level (mAOD)	GL at access (mAOD)	Depth at access (m)	Top level of containment (mAOD)
Primary digester area	72.35	71.92, 72.21, 72.4	0.42*, 0.14, 0	72.60
Secondary digester area	72.27	71.07, 71.6	1.20, 0.87	72.52
Press liquor return tank area	72.17	71.55	0.72*	72.42

*reprofiling of the ground required to allow construction of ramp at these access points

Table 4 above compares the top water level with the lowest spot height from the modelling results. The median depth against the boundary wall is then calculated within each containment area. This more accurately reflects the spill depths as the containment area will be resurfaced and regraded to limit the spill depth.

It also shows the proposed height of any containment bunding according to the top water level. The containment bunding is set by adding 250mm to the top water level to provide freeboard to prevent overtopping from the surge effects.

3.5 Identified Constraints

3.5.1 Operational constraints

3.5.1.1 Clean-up time

The time to recovery and return site back to operation has been set at 3 days as Thames Water operations state they cannot achieve this in a significantly shorter time, e.g. 48hrs.

3.5.1.2 Surface cleaning

The existing ground surfaces around the sludge treatment tanks consist mainly of grass and gravel that will need to be replaced with an impermeable surface, such as concrete, to facilitate the cleanup. The impermeable surface will be gently sloped to aid with the sludge spill flow path towards the drainage network.

It is noted that concreting these areas may slow emergency access to underground surfaces and there is a trade-off between the advantages of digging up existing surfaces (in grass or gravel) vs. decreasing the clean-up effort required in the event of a sludge spill.

Whilst the site is identified as requiring Class 2 containment (impermeable soil with a liner and leakage detection system), the proposed solution is intending to use concrete (with no liner) based on the impermeability of the concrete, inherent strength, and long-term mechanical resistance. Remedial works to existing concrete slabs/roads will be undertaken to ensure that they provide a competent surface, for example resealing of joints.

3.5.1.3 Access and Traffic Thoroughfare

Vehicular access through the flow guiding walls will be via ramps (speed humps) restricted to nom 300mm in height and 1:15 slope.

Flood gates have been included at the proposed entry points into the close containment areas around the secondary digesters.

To allow access on foot, steps with handrails will be constructed to allow workers to traverse the walls.

3.5.1.4 Existing Services

Several above ground pipes can be seen from aerial images which may need to be relocated during construction/excavation.

3.5.2 Geotechnical and Environmental constraints

Much of the site is composed of made-up ground from previous civil works, these mounds can be seen in the map of the sites topography and will need to be considered when placing foundations for the bunding, especially to the west of the primary digesters and the east of the secondary digesters where an old lagoon was once present.

Figure 3-13 Map of Aylesbury STW showing contours

The existing shrubbery within the containment area shall be removed and area infilled with concrete. To compensate for the loss of shrubbery, alternative areas shall be identified onsite for compensation planting or planting containers installed onsite.

3.5.3 Other constraints

None

3.6 Design allowance for rainfall

In addition to the maximum volume arising from a credible failure scenario, extra allowance for rainfall that may accumulate within the contained area before and after an incident has been made. The CIRIA guidance recommends that the containment volume should include an allowance for the total rainfall accumulated in response to a 1 in 10-year return period events for the 24 hours preceding an incident and for the duration of the incident and recovery. Thames Water has confirmed a three-day period for the incident and recovery. The arising average rainfall depths for a 1 in 10-year storm over the event period for Aylesbury is 72.1 mm. It should be noted that the rainfall depths for Aylesbury have been estimated using the depth-duration-frequency rainfall model contained on the *Flood Estimation Handbook* (FEH), which provides location specific rainfall totals for given durations and return periods.

3.7 Planned Site Upgrade

Thames Water Operations noted that upgrades to the site are proposed including cake pad reconstruction and enlargement, sludge press and dewatering ancillaries.

4. Secondary Containment

The constituent parts of secondary containment are;

- The contained area itself.
- The transfer system.
- Isolation of the drainage from both the contained area and from the transfer system.

For Aylesbury, where possible, existing features of the site (e.g., building structures and impermeable surfaces) are used as much as possible to provide the remote secondary containment to reduce cost. The options considered, modifications and their functionality at Aylesbury STW are listed below:

- Bund/walls to contain liquid. The heights of bund/walls given in Section 4.1 are the minimum heights required such that that top of the bund/wall is equal to the top water level plus a 250mm freeboard consideration for potential surge (to reflect the planned use of concrete walls with a recurved profile to return flow back on itself) in accordance with CIRIA.
- Containment ramps to provide a barrier for the liquid on roads that still need to be accessible to vehicles for site operation. The maximum height of these will be 300-350mm to avoid issues with vehicle passage. The risk of spill at the ramps is mitigated by conveyance of the flow to site drainage and return to the head of the works.
- Local infill of grass/gravel to create an impermeable surface and facilitate containment and conveyance.
- Steps will provide a containment barrier and allow access in and out of the containment area where foot traffic is high, but vehicular access is not needed. These steps will have handrails to facilitate safe passage over them.
- Flood gates to installed where areas with foot traffic are low and where infrequent vehicular access may be necessary.

4.1 Containment Options

Two options were investigated and developed with operations. The first option considers close containment solutions for 3 individual sludge tank areas. The second considers a wide area solution supported by one close containment area.

4.1.1 Option 1 – Three close containment areas

Table 5 provides a summary of Option 1.

Containment Area	Description of containment
Primary Digesters	• Close containment with top level of containment at 72.60mAOD, bund walls typically 0.5-0.75m after reprofiling of ground. • A 750 gravity pipeline will convey sludge from the spill area to the adjacent disused Humus tanks. • Framed steel sheeting will be placed on the western boundary to mitigate the effects of jetting. • 3 ramps will provide access for vehicles as area is frequently visited during the day and reprofiled ground levels allow the use of ramps
Secondary Digester Area	• Close containment with top level of containment at 72.52mAOD, reinforced concrete wall to be constructed will be 1.27m at its highest to contain spillage. • Access provided for infrequent vehicular access by large flood gates. Steps provided for pedestrian access to the area.
Press liquor return tank area	• Tank receives centrifuge effluent • Close containment with bund walls top level of containment at 72.42mAOD. Bund walls will be 0.62m at its highest • Walls will divert spillage into 1 large disused radial flow humus tank. The ground around the tanks will be resurfaced and regraded to enable spill volumes to discharge into the humus tank. • 1 ramp to provide access for vehicles and steps for pedestrians to access equipment behind containment area.
Summary	• Option 1 reduces impact to operational access as no containment boundaries cross main access roads. • Minimal conveyance routes that require regular and onerous maintenance.

Table 5 – Summary of containment for each containment area element

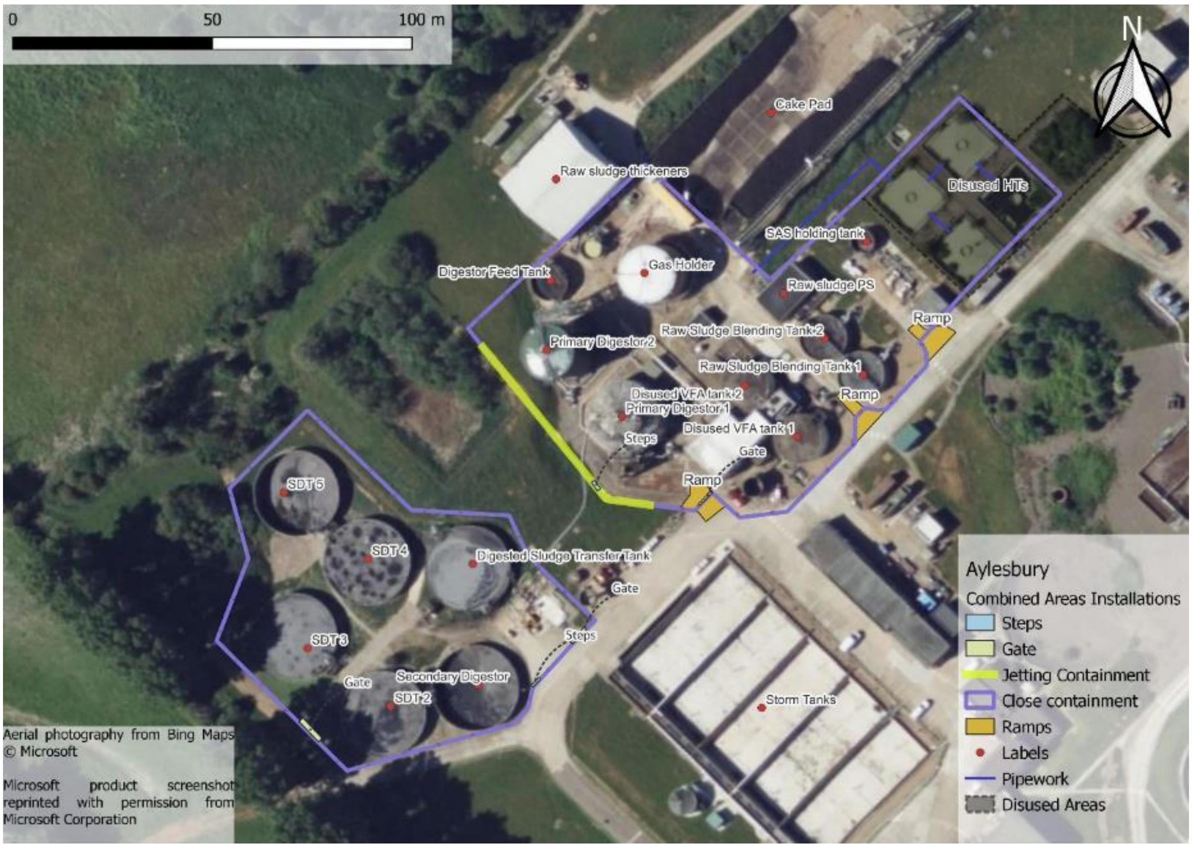

Figure 4-1 - Option 1 - Close containment areas for Primary and Secondary Digesters

Figure 4-2 - Option 1 – Close Containment Area with a transfer channel to the disused Humus Tanks

4.1.2 Option 2 – Wide area containment supplemented with one close containment area

Figure 4-3 – Option 2 - 1 wide and 1 close containment area

Option 2 in Figure 4-3 comprises of 1 wide containment area and 1 smaller, close containment area. This option was discussed with Thames Water Operations and ruled out as operatives preferred that their main access would not be blocked with ramps. The estimated containment height was also above 300mm meaning vehicles would not be able to enter the area regardless. The conveyance channel or pipework also presented challenges of regular maintenance. Modelling and costings associated with this option did not progress.

4.2 Mitigation of Site-Specific Risks

4.2.1 Jetting and Surge Flows

Due to the location of the tanks and their distance from the boundary of the containment area, escape of flows by jetting is not an issue.

The natural topography of the site and the distance to the boundaries of the containment area results in a low risk of surge overwhelming the containment.

4.2.2 Flooding

According to the UK Government's Flood Map for Planning, some small elements of the site fall within Zones 2 and 3. The sludge treatment assets and the proposed containment areas for the sludge facilities fall within Zone 1 (low risk) as shown in Figure 4-4.

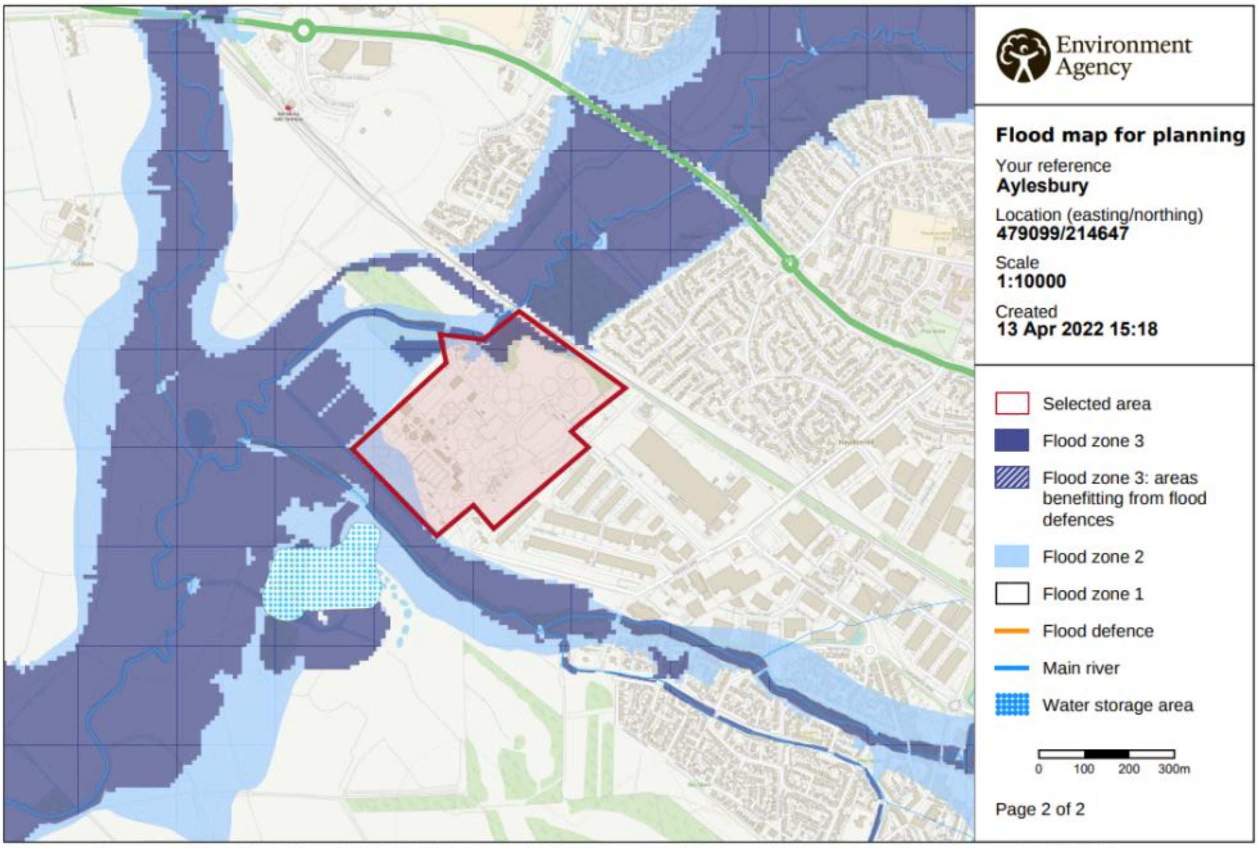

Figure 4-4 Extent of Fluvial flooding in Aylesbury due to extreme weather events

4.3 Identification of Preferred Option

The preferred containment proposal is Option 1 which considers the following advantages:

- Efficient use of assets/space (using roads and elevated areas to act as natural bunding)
- Practicality of installation (lower containment bund construction required)
- A lower bund wall will minimise long term site operational impacts including line of sight and ease of access.
- Access road operation simplified by use of ramps to cross containment lines rather than by the use of floodgates

H&S and CDM risks

- Flood gates not suitable for areas of high traffic movement – mitigated;
- Cable ducts and fibre ducts act as a potential conduit to transport sludge around site and will require sealing.
- Confirm that the containment walls do not impact the existing DSEAR equipment rating.

5. Site Drainage and liquor returns

5.1 Process flow diagram

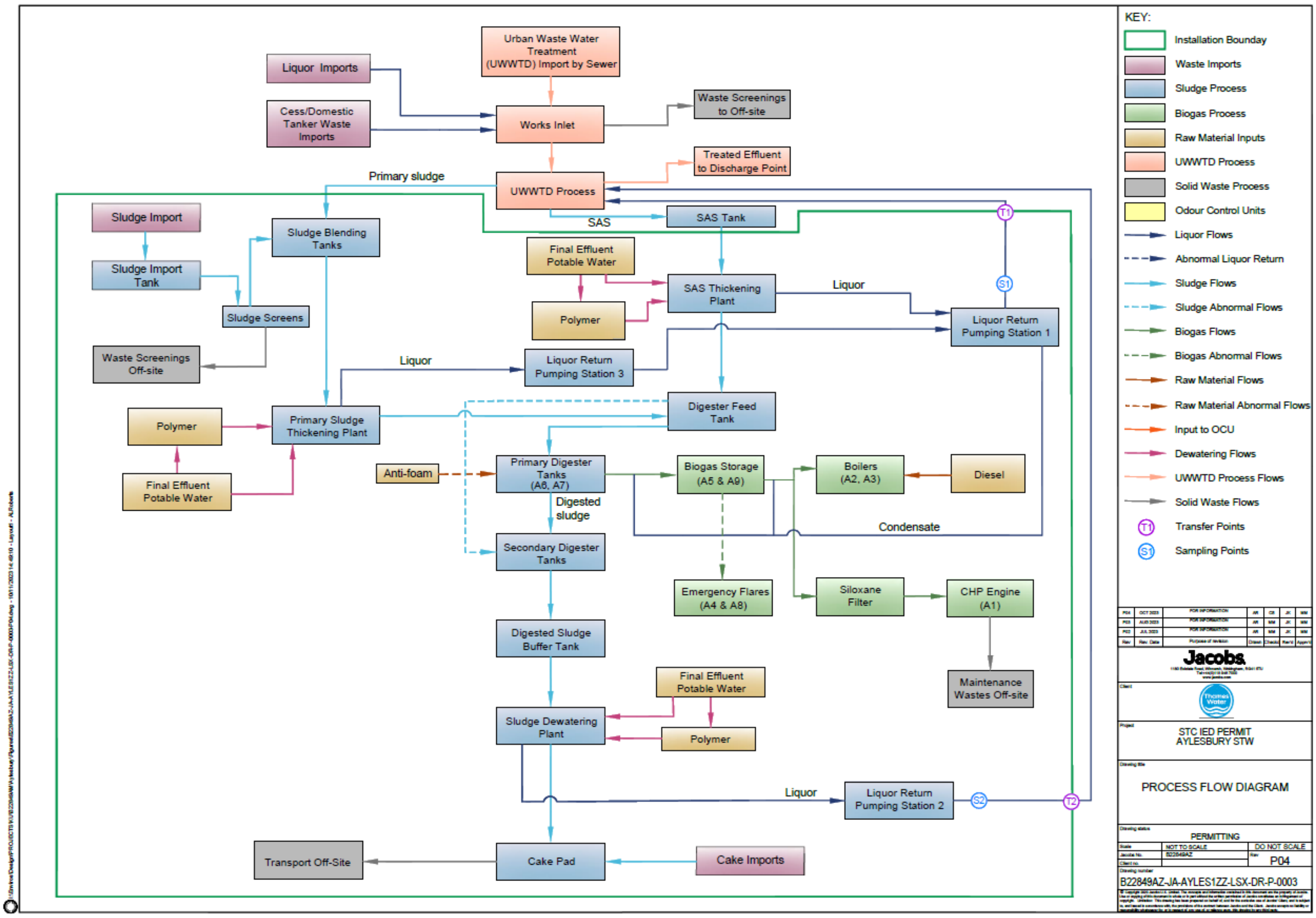

Figure 5-1 Process flow diagram Aylesbury STW

5.2 Foul Process and Effluent Drainage

There are no existing site drainage plans. From site visits it has been indicated that the site drains fully to the works inlet. Supplementary survey work has been undertaken to confirm the discharge at Aylesbury.

Containment options onsite involve replacing existing impervious areas with concrete. This will result in a small increase in site surface waters, which are likely to have a negligible additional effect on the head of the works given the scale of flow to full treatment at Aylesbury.

5.3 Liquor Returns

The existing liquor return system is not being altered by the containment system, other than the control modifications proposed in Section 5.4.

Details of the liquor returns sampling are being developed outside of this report for incorporation within the permit submission.

5.4 Automatic Isolation Valves

For the catastrophic loss of containment scenarios for digester area discussed, such a loss could be automatically detected by the level sensors in the tanks. A catastrophic failure would be identified by the rate of change in tank level being larger than expected at normal operation. The signal from the sensors would be used to generate an alarm.

In the event of a catastrophic sludge spill, flows entering the head of the works via the drainage pipes could adversely impact the sewage works treatment process. Therefore, in the event of a catastrophic loss of containment, this line should be isolated.

It is recommended that float operated isolation valves are installed on all outgoing drainage lines from the containment area. These valves will remain normally open but will close when high levels in the existing drainage system are encountered. This drainage configuration will have the following impacts:

- In heavy or intense rain events these drainage isolation valves may be triggered, and operators onsite will need to manual operate these valves to release flows into the existing drainage network.
- In minor or slow flow tank spill events, the sludge spill will flow into the existing drainage network (and into the head of the works) unless operators intervene to isolate the drainage networks. Due to the flow to full treatment at Aylesbury being large, minor spill flows will not adversely impact the process.
- In most locations, to accommodate the new isolation valves, new manholes need to be constructed over the existing drainage lines.

6. Conclusions

This section summarises the findings of the containment assessment options report for Aylesbury Sewage Treatment Works.

Based upon the Anaerobic Digestion Bioresources Association (ADBA) containment assessment tool; the site carries an overall site risk rating of Medium meaning that Class 2 containment is needed.

The total contained volumes comprise:

Containment Area	Volume	Rule
Primary digester area	2773m^3	largest tank plus rainfall
Press liquor return tank area	1037m^3	110%
Secondary digester area	2154m^3	25%

Containment Area	Description of containment
Primary Digesters	• Close containment with typically 0.5-0.75m bund walls which divert spillage into 4 disused humus tanks. Due to locally raised ground above the maximum spill depth between the sludge tanks and disused Humus tanks, a pipeline will be installed to gravitate flow into the tanks. Potential for small sludge spills to be stored in the disused tanks alone. • Framed steel sheeting will be placed on the western boundary to mitigate the effects of jetting. • 3 large ramps will provide access for vehicles as area is frequently visited during the day.
Secondary Digester Area	• Close containment with typically 1.1m high reinforced concrete walls to contain spillage. • Access provided for infrequent vehicular access by large flood gates. Steps provided for pedestrian access to the area.
Press liquor return tank area	• Close containment with 0.61m bund walls which divert spillage into 1 large disused humus tank. The ground around the tanks will be resurfaced and reprofiled to enable spill volumes to discharge into the humus tank. • 1 ramp to provide access for vehicles and steps for pedestrians to access equipment behind containment area.

The contained spill modelling retains the tank contents and associated rainfall within the site boundary and the flows can be managed by TW operations for return to treatment. Ground levels within the containment area are being reprofiled as part of the replacement of permeable materials. Without reprofiling the containment area, water may pond to a depth of 1.2-2.3m in some of the various tank areas.

Existing gravelled and grass areas within the containment will be replaced with concrete. Elements of the site roads will be replaced/repaired to allow them to present an impermeable surface.

In addition to the containment elements, isolation of the site drainage system linked to the containment area will be required to mitigate the risk of unmanaged flows impacting the sewage treatment works. Freeboard allowances and the profile of the containment bund wall provides mitigation against surge effects.

Appendix 1 ADBA Site Hazard Risk assessment summary for Aylesbury STW

ADBA Industry Guidance and CIRIA C736 state how the site hazard rating of the site risk and classification are to be calculated. A summary of the hazard risks for Aylesbury STW are as follows:

Source – There is one main source that has been identified:

1. Sludge digestate

The Source Hazard rating was determined as **High**.

Pathway – There are three pathways that have been identified:

1. The process and site drains take any liquid to the head of the works which would negatively impact the process stability on site and would eventually impact on the receiving watercourse without mitigation. Mitigation measures being applied
2. The site is on the edge of the flood plain
3. Sludge treatment centre is integrated with large sewage works; as a consequence,

The Pathway Hazard rating was determined as **Medium**.

Receptor – There are two potential receptors which have been identified:

1. The site is within 250m of a populated area and situated to the west of a number of warehouses.
2. Bear brook and River Thame are less than 100m from the site

The Receptor Hazard rating was determined as **High**.

Likelihood – The mitigated likelihood is **low**, which reflects the use of materials, the tank systems do not have a history of failure, the tanks are designed to British Standards and installed by competent contractors and Thames Water undertake regular site tours giving the opportunity to identify early indications of potential issues.

Based on the information above the overall site risk rating was calculated to be **Medium** which means that **Class 2 secondary containment** is required.