J840 – STC IED Containment

Didcot STC – Containment Options Report

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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 Didcot.

Didcot STW serves a population equivalent of 37,000 for the town of Didcot 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.

At Didcot there are 12 tanks containing sludge with a total operational sludge volume of some 9140m^3. The liquid sludge is stored in concrete and steel tanks with individual volumes varying between 27 to 1304m^3 and the majority of the tanks are steel, refer to section 3.4.1 for details on tanks and volumes. The site is generally low lying and flat. The containment volume of 2863m^3 is driven by the largest spilled tank plus rainfall rule rather than the 25% rule (25% of sum of tank volumes) or 110% rule (of the largest single tank) of the total tanks volume. The containment volume identified reflects the potential escape volume from the tanks and the 1 in 10-year rainfall that could arrive during the clean-up period.

An initial review together with TW operations was carried out to confirm that the working of the sewage treatment work would not be compromised by proposal. In the review closed containment and wide containment options were discussed. Within this report, failure of a primary digester tank (largest spilled tank) has been addressed by adopting a wide containment area. 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:

1. Wide area containment area, whereby spilled sludge is contained within a bunded boundary with sufficient area to generate shallow depth that does not deny emergency access to equipment when the spill has been contained. Access and containment will be provided through the use of ramps, gates, and steps depending on access requirements. Perspex walls will be placed where taller tanks sit close to the sites boundary to mitigate the effects of jetting. Gravel and natural ground areas will be removed and replaced with plain concrete to prevent seepage of spilled sludge liquid into the ground. Float valves will 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 concrete (with no liner) on the basis of the impermeability of the concrete, inherent strength, and long-term mechanical resistance.

The containment volume identified reflects the potential escape volume from the tanks and the 1 in 10-year rainfall that could arrive during the clearing up period, which exceeds the 110/25%-rules.

The general layout of the proposed solution is presented below:

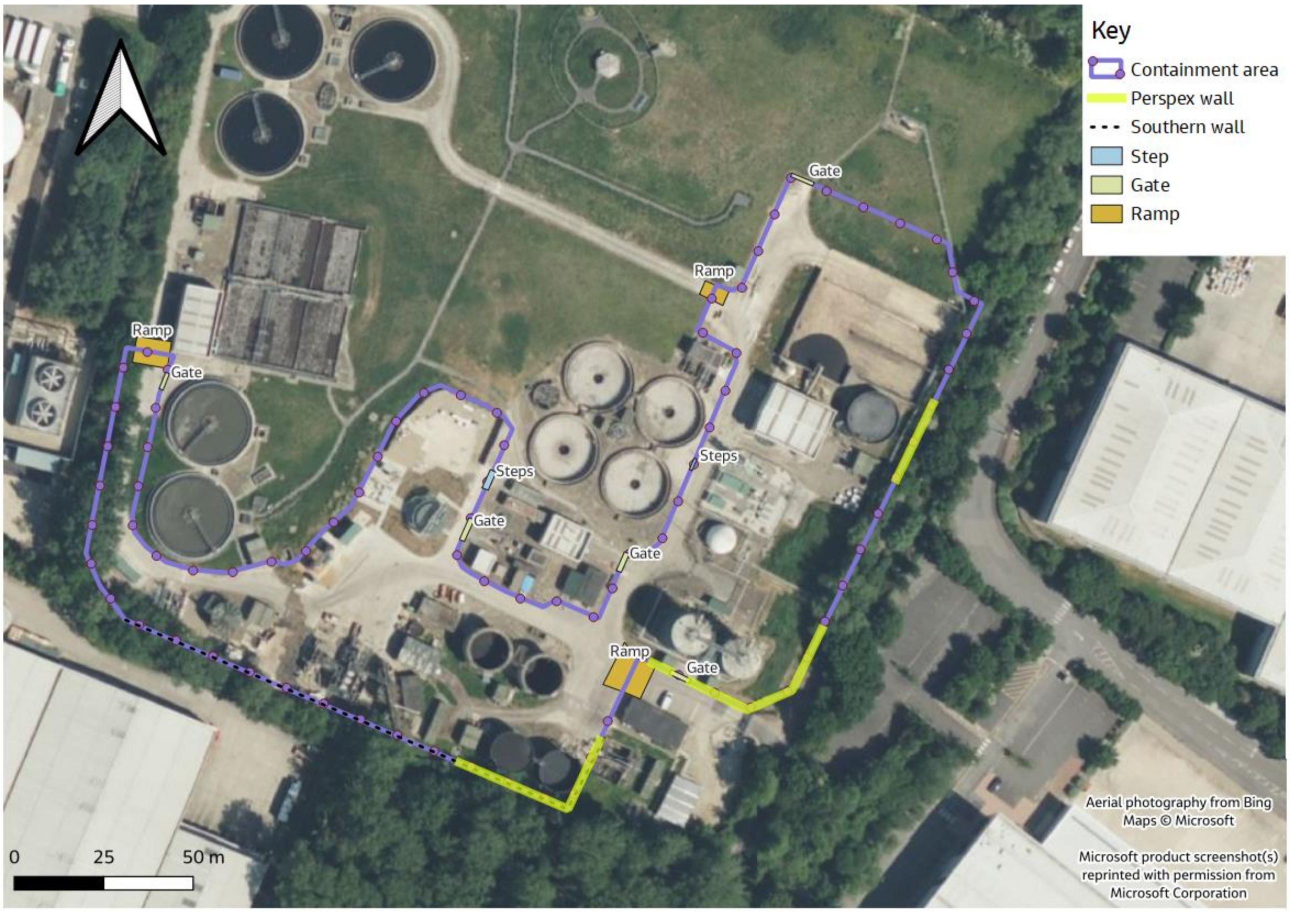

Figure 1.1 General layout of containment for Didcot STW

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 Didcot 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 Didcot 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 Didcot STW were identified through a desktop study, Light Detection and Ranging Analysis (LiDAR) analysis and a site visit.

Didcot STC, contained within Didcot Sewage Treatment Works (Figures 2-1 to 2-4) is located north of the A4130 near the Didcot Parkway station surrounded by the Southmead Industrial Estate in Didcot, Oxfordshire. Didcot is a small rural town that sits 14km south of Oxford Central and 9km west of Wallingford. The nearest residential properties are located within 200m of the southern boundary.

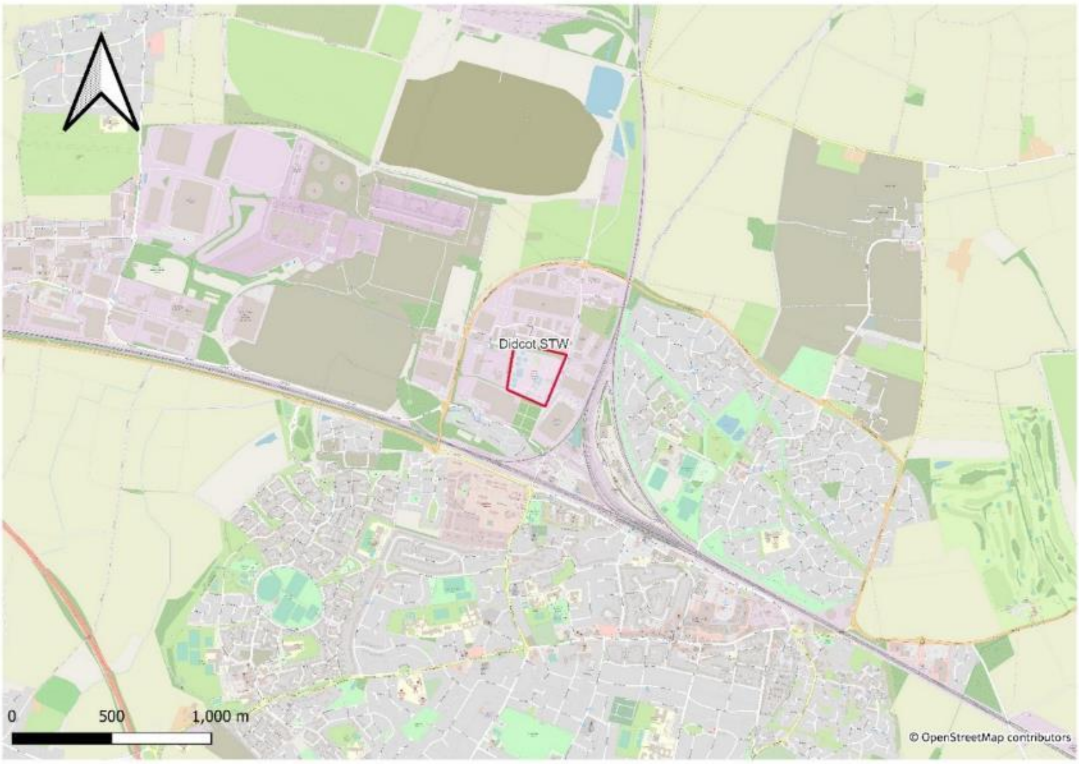

Figure 2.1 Location of Didcot STW

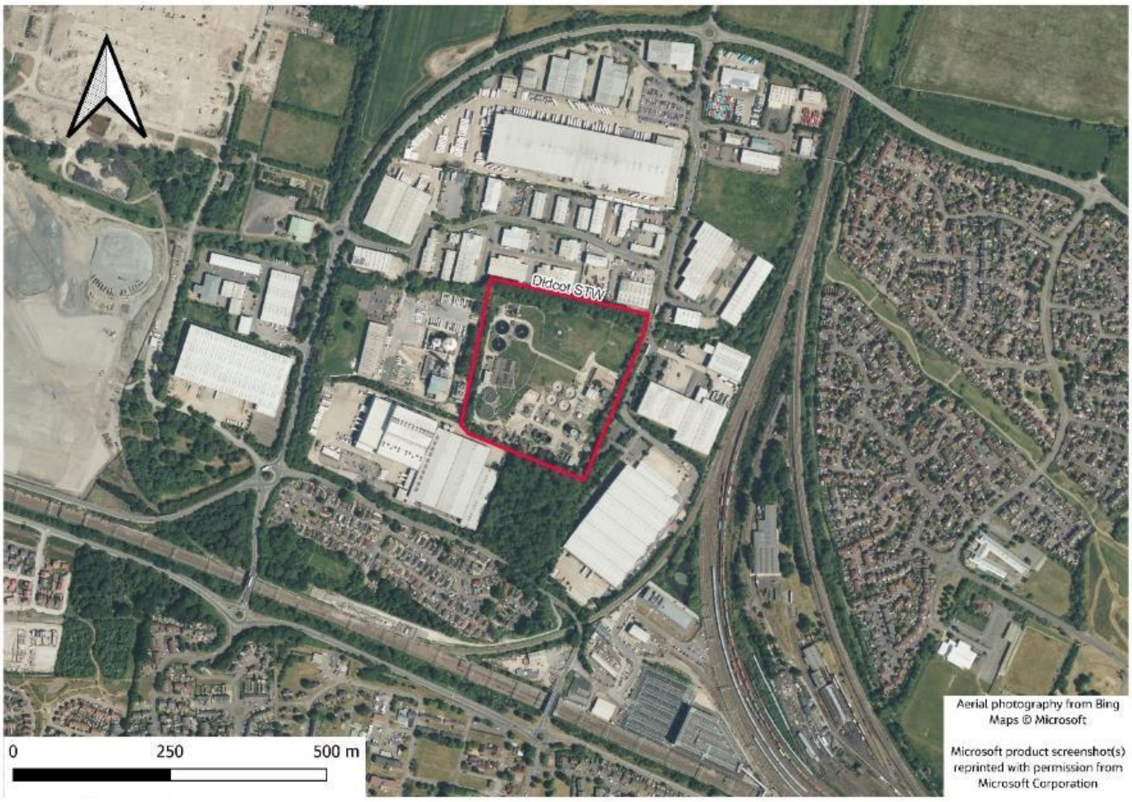

Figure 2.2 Satellite image of Didcot STW location within industrial estate

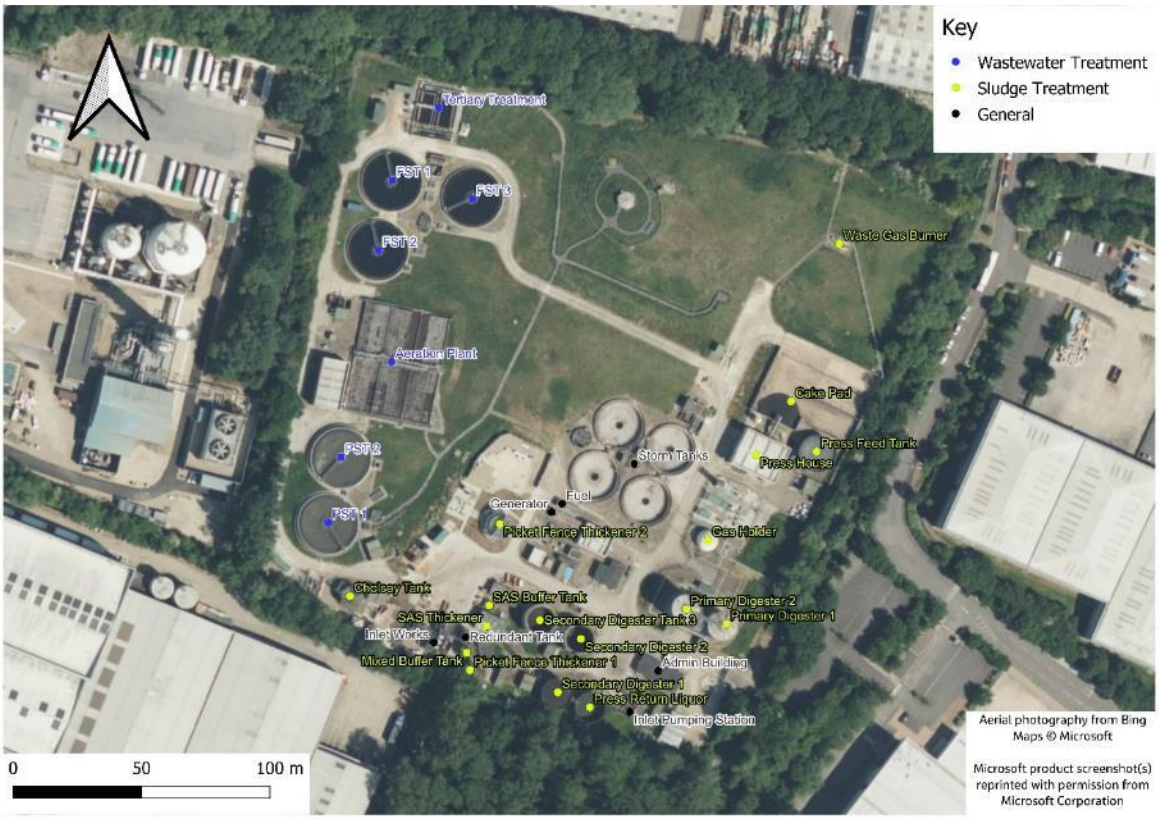

Figure 2.3 Labelled image of the assets within Didcot STW

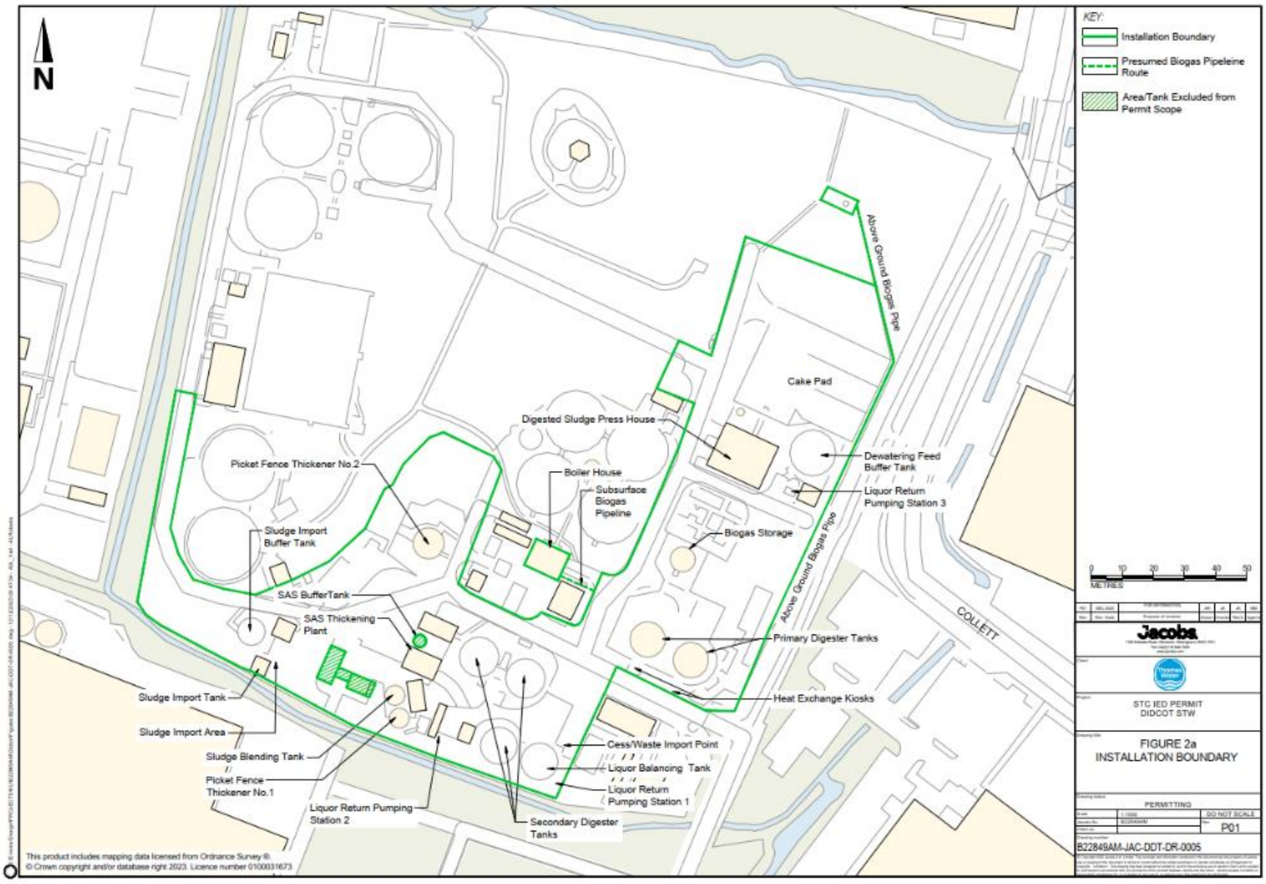

Figure 2.4 Labelled image of the assets within Didcot STW

3. Proposed Containment at Didcot 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;

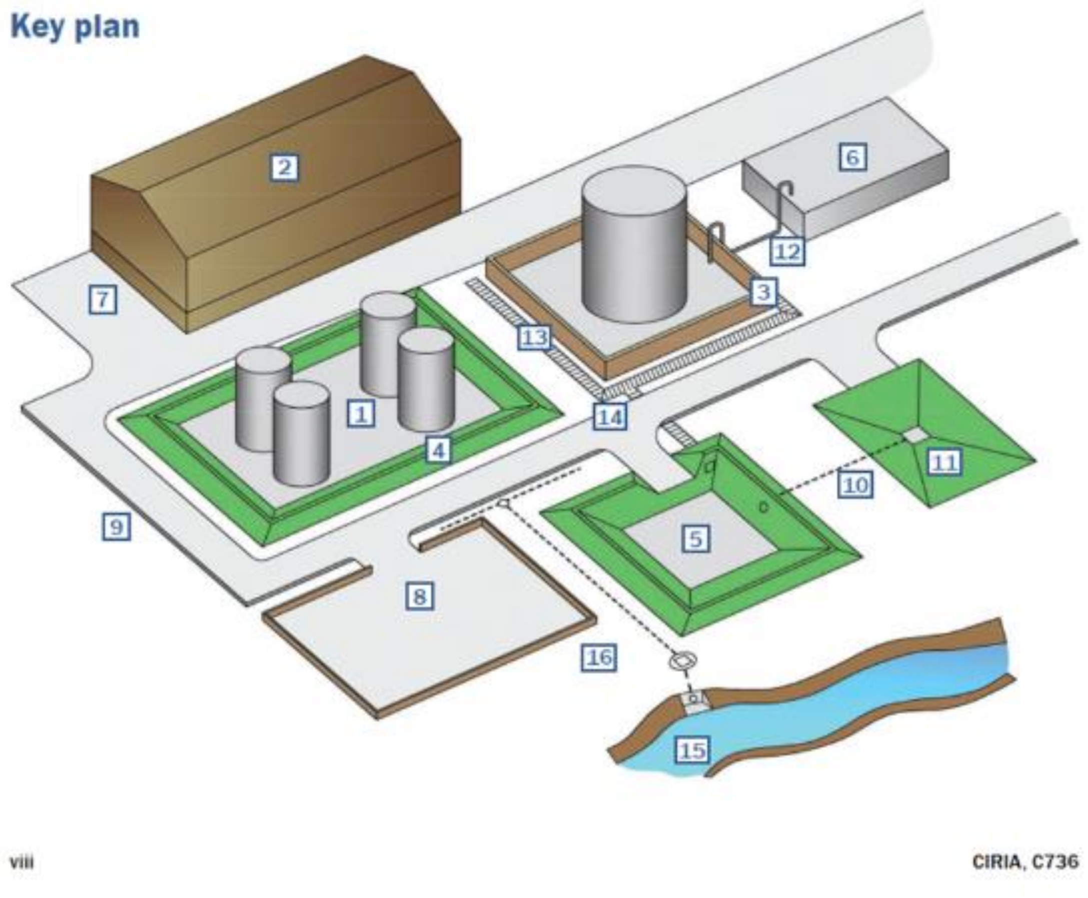

Figure 3.1 Diagram of primary, secondary and tertiary containment examples

-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

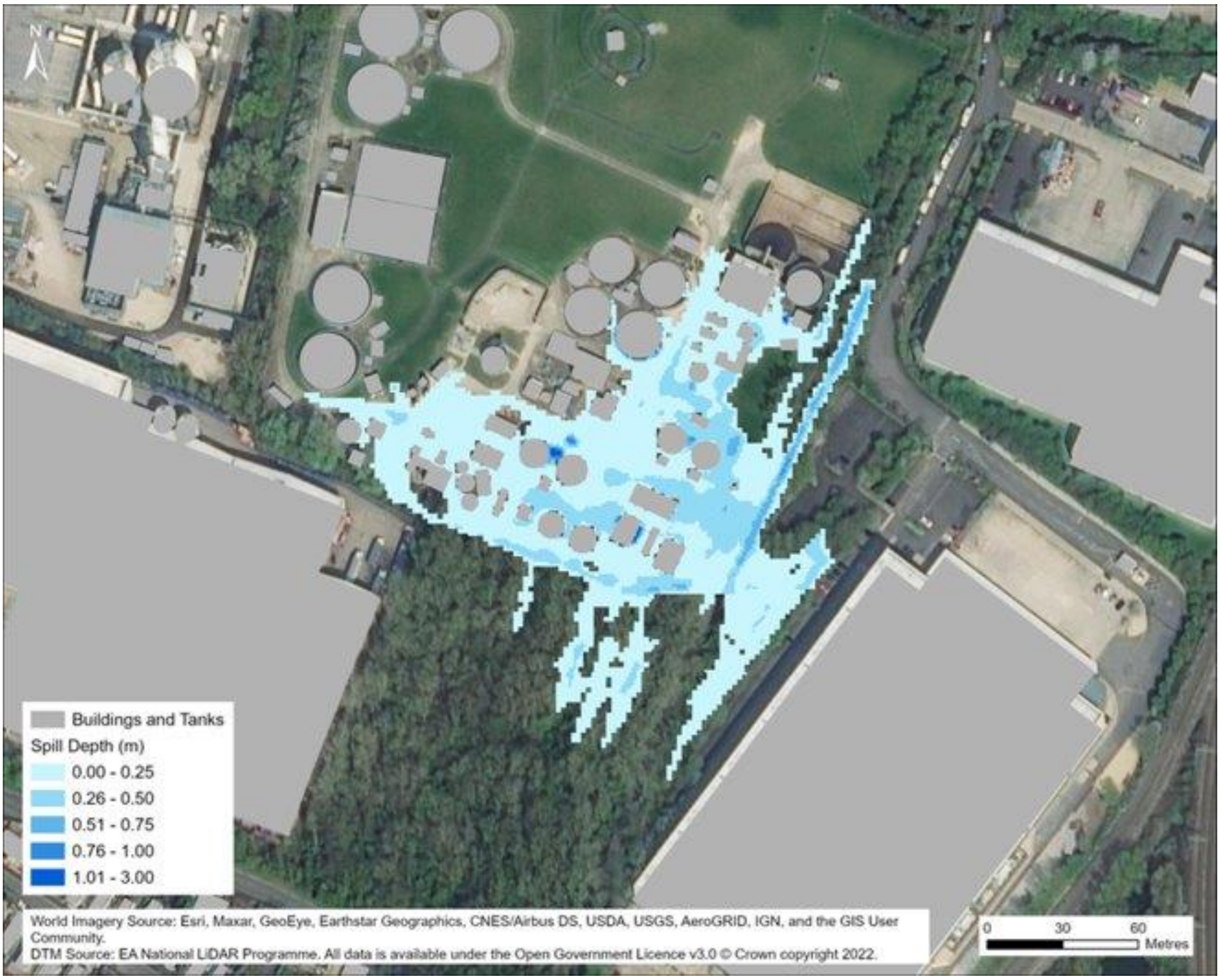

Figure 3.2 Uncontained Spill Model Results

Figure 3.2 shows the sludge spill mapping of an uncontained event in Didcot STW. It shows the potential sludge spill from one of the Digesters 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 via the south and eastern boundaries in approximately 1 minute following failure of one of the digesters.

Assuming the spilled sludge originates from the failure of one of the Primary Digesters on site, the spill would first fill the primary digester area; part of the sludge would then flow west towards the primary sedimentation tanks through the internal paths surrounding the secondary digesters, the SAS Buffer tank, the SAS thickener and the adjacent buildings. Part of this sludge will spread southwards escaping at the southern site boundary through the gaps between the assets in this area into the vegetative/forested area located south of the site.

Sludge is also expected to spread to the north of the site along the pathway that borders Collet Road while the rest of it will flow eastwards into the Accord UK Distribution Centre car park area.

Some of the sludge from the failed tank will gravitate northwards through the internal pathways surrounding the Storm Tanks, Gas Bag, and the Press house towards the cake pad area. Along the way, it will further branch to the east of the site and will leave the eastern site boundary through the gap located south of the Press House

Some of this sludge will branch northwards along the eastern boundary and would stop near the cake pad area.

3.3 Site Classification Didcot

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

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

Table 1 Risk rating

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

The containment volume has been checked against the 110 and 25% rule and the 25% rule applies.

The total design contained volume comprises 2863m^3 (Size of largest tank, 1304m3 + 3 days rainfall, 1559), compared to 110% rule of 1434m^3 and the 25% rule of 2106 m^3.

Table 2 Estimating critical spill volumes

25% Rule	2106	
110% Rule	1434	
Largest + rainfall	**2863**	Emerging critical case

3.4 Didcot 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 Operational Volume (m^3)	Material
Sludge Import Tank	1	27.5	27.5	Steel
Sludge Import Buffer Tank	1	670	670	Steel
Picket Fence Thickener 1	1	861	861	Steel
Picket Fence Thickener 2	1	525	525	Steel
Sludge Blending Tank	1	861	861	Steel
Primary Digester Tanks	2	1,304	2,608	Steel
Secondary Digester Tanks	2	865	1,730	Concrete
Secondary Digester Tank (GRP)	1	594	594	Steel
Dewatering Feed Buffer Tank	1	670	670	Steel
Liquor Balancing Tank	1	594	594	Steel

3.4.2 Digital Terrain Model

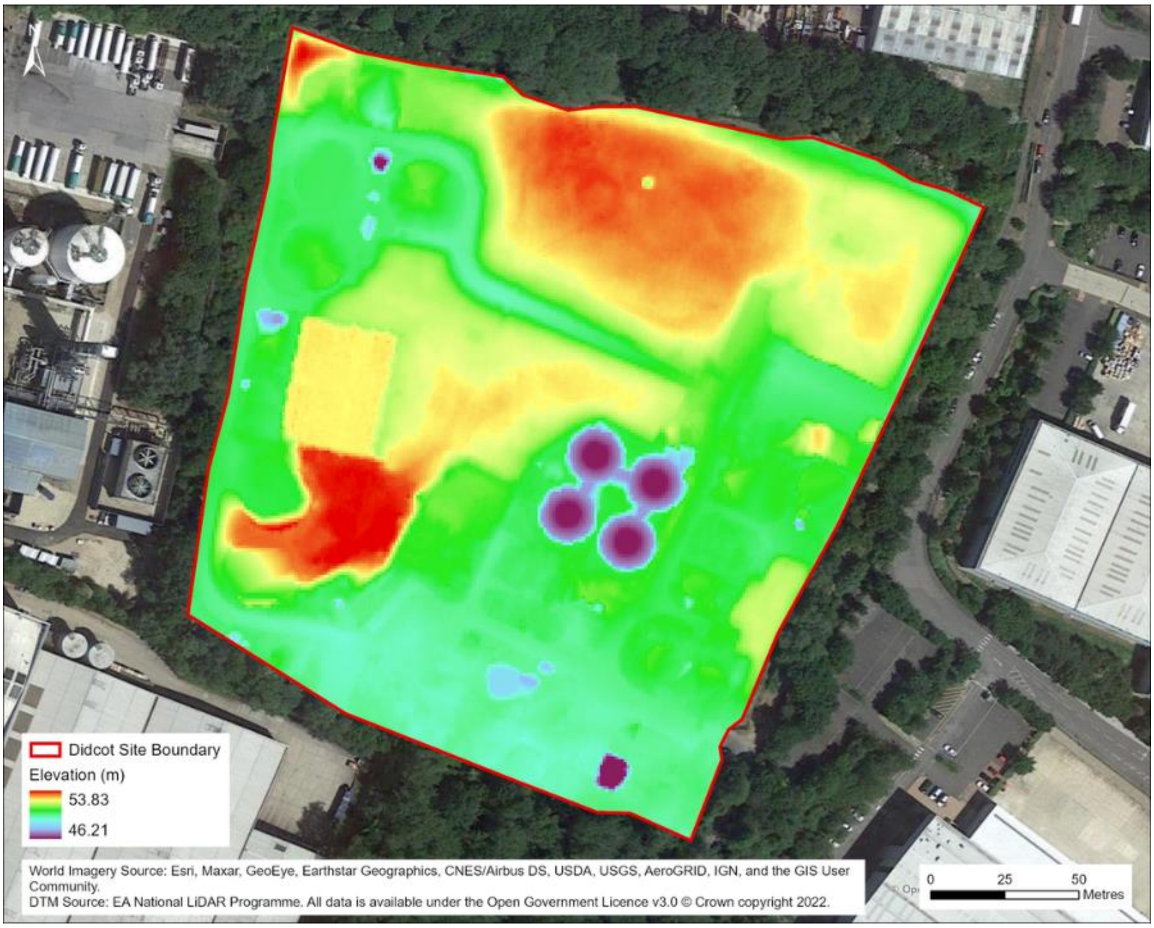

Figure 3.3 Digital Terrain Model of Didcot Sewage Treatment Works

The final treated effluent from the sewage works is discharged into the Moor Ditch. Considering the topography of the sludge area shown in Figure 3.3 the high-resolution contouring reveals the sludge assets are located on slightly lower ground. There are gaps on the southern boundary of the STW which in the event of catastrophic tank failure of one of the sludge assets would result in spilled sludge flowing southwards into the nearby forested area. There is also a gap on the South-eastern berm and spilled sludge would eventually travel beyond this gap eastwards to the nearby footpath and into the bounds of the Accord UK Distribution Centre.

Figure 3.4 Contour lines within the containment area

3.4.3 Contained Model Output

Figure 3.5 Contained model output showing top level of liquid at 52.00mAOD

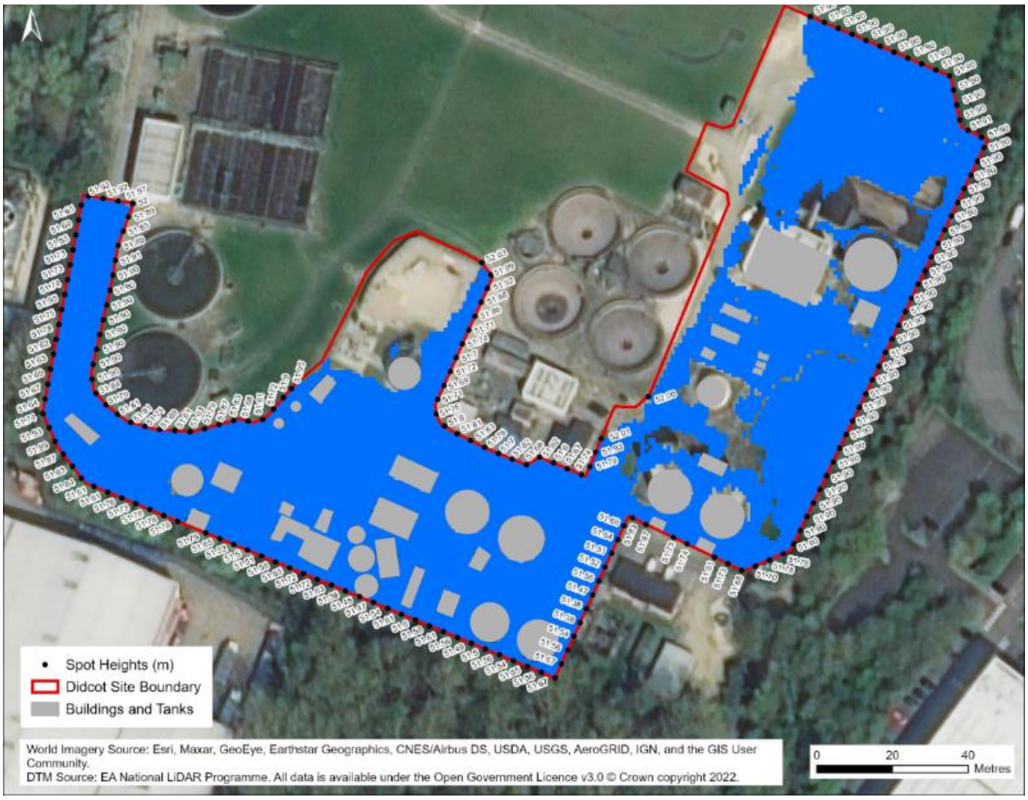

Figure 3.6 Contained model output showing ground elevations at boundary

The contained models in Figure 3.5 and Figure 3.6 show that the spillage will be contained within the site with the wide containment area. Figure 3.5 shows the top water level at 52.00mAOD and Figure 3.6 shows the ground level elevations at the boundary, with the lowest elevations on the southern boundary at 51.38mAOD. This means the spilled liquid at those points will be 620mm high. From this it can be deduced that the maximum height of the bunding will be 870mm allowing 250mm 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 8 days which aligns with the CIRIA guidance maximum 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.

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 300 mm in height and 1:15 slope. This has been possible on the main circulation route.

Flood gates have been included at selected entry points into the containment area where space prevents the use of a ramp, for example access to the inverters at the secondary digesters.

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. The southern and eastern boundaries will also require the removal of vegetation should a bund be built.

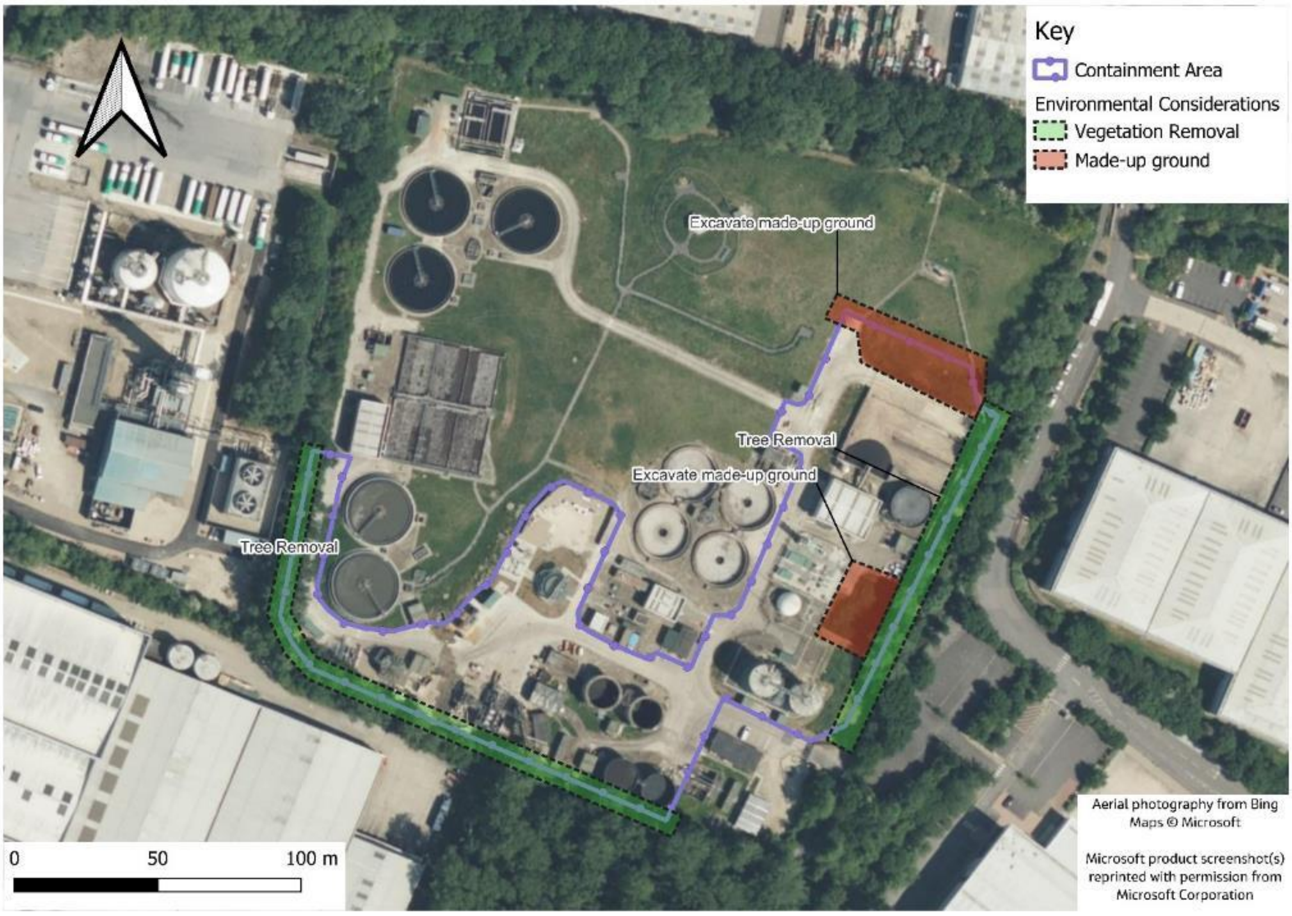

Figure 3.7 Map of Didcot STW showing areas where natural environment will be disturbed

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

There is a bridle path to the east of the site. Any high walls along this path may need planning permission due to their effect on the aesthetics of the area.

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 the incident and for the duration of the incident, a three-day period in this case. The arising average rainfall depths for a 1 in 10-year storm over the event period for Didcot is 71mm. It should be noted that the rainfall depths for Didcot 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 major upgrades to the site are proposed including a new PST, new lane on the ASP, new FFP and double amount of storm capacity.

- Containment construction as part of the preferred option may interfere with planned upgrades and connections

- The planned construction of major storage assets could potentially be combined or repurposed with sludge containment construction for a more cost-effective solution, but at this point the containment proposals seek to avoid sterilising areas with potential to accommodate new construction

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 Didcot, 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 Didcot 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 250-300mm 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 to provide a barrier but still 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 provide a barrier to areas where foot traffic is not as high, but where vehicular access may be necessary.
- All buildings within the containment and transfer areas must either have doors that lie above the top water levels detailed in Section 4.1 or any equipment inside must be raised off the ground to level above the top water level.

4.1 Containment Options

4.1.1 Option 1 – Wide Containment Area, Ramps, Flood Gates Steps and Perspex

Containment option 1 was developed in conjunction with Thames Water Operations and is illustrated in Figure 4.1

Option 1 comprises of 3 key elements:

- Wide containment using bunding between 500mm and 870mm high, perspex walls, gates steps and ramps.
- Excavation of made-up ground to increase containment area.
- Installation of float valves to control the escape of spilled sludge directly to head of works.

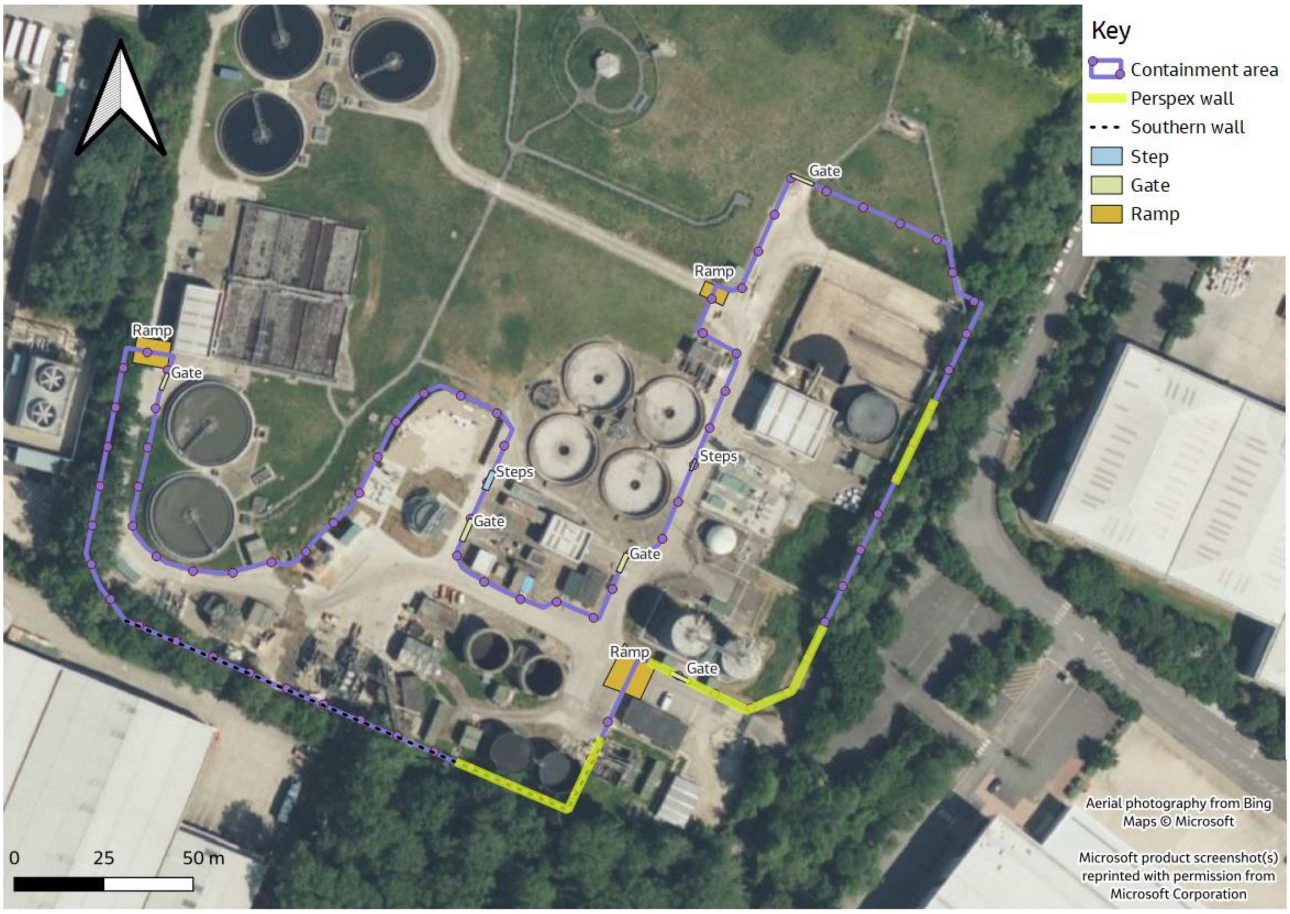

Figure 4.1 Option 1 - Wide Containment Area

In order to keep the containment height low a large containment area was drawn. The largest spilled tank + rainfall rule dictated that this area gives an approximate containment height of around 200mm if all land is of equal elevation, allowing bund walls to be at least 450mm high. The southern boundary is expected to have higher bunding (870mm) as liquids will naturally want to pool on the south where the ground is lower. In order to keep the spilled sludge within the containment area and to not escape via the roads, ramps of 300mm height sloped at 1:15 will be built as an extension of the bunding. In order to mitigate the risks of jetting perspex walls will be installed complete with steel framing to the south and west of the primary digesters, the secondary digestor and press liquor return tank.

The ground north of the cake-pad as well as to the east of the gas holder is raised made-up ground placed from previous excavations. This is area that will be levelled to contain the spilled sludge. Current models have set these areas to a level of 51.9mAOD. Once removed the areas will be concreted to prevent spillage from seeping into the ground and facilitate clean-up. These areas can be seen clearly in Figure 3.7 marked 'excavate made-up ground'.

4.1.2 Option 2 – Two close containment areas using extra space

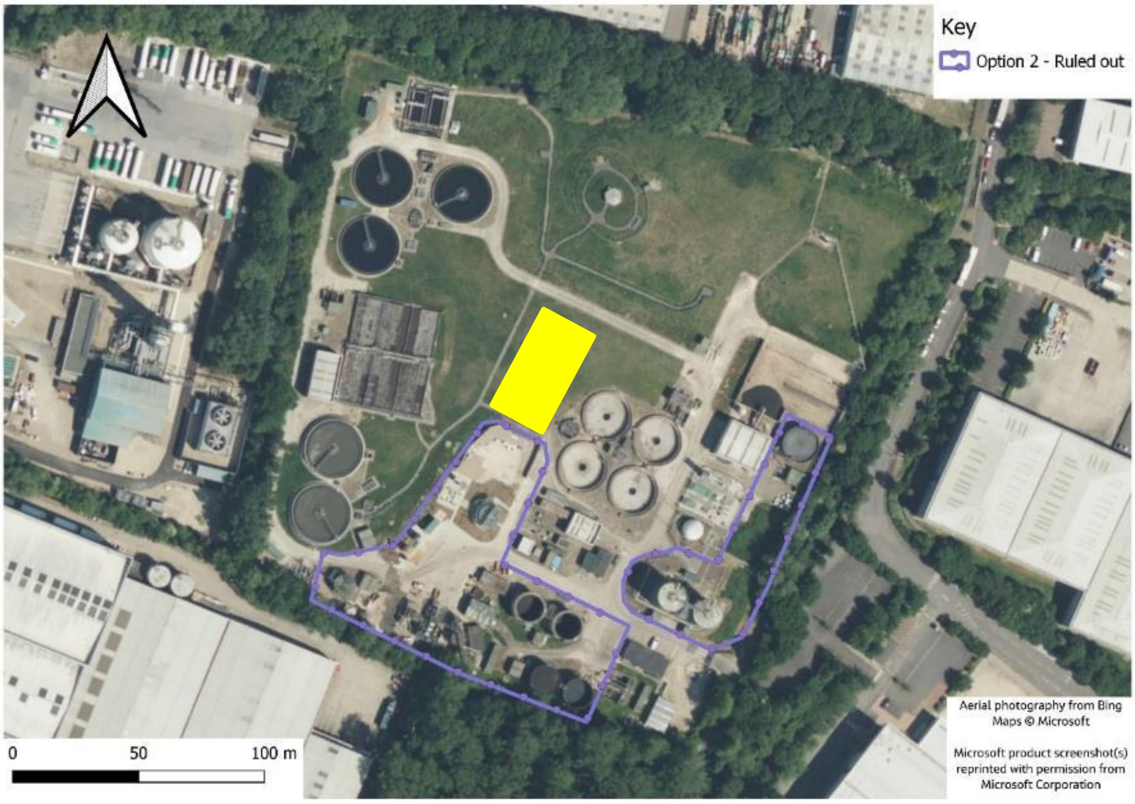

Figure 4.2 1 wide and 1 close containment areas

Option 2 in Figure 4.2 comprises of 1 wide containment area and 1 smaller close containment area. This option was discussed with Thames Water Operations and ruled out due to the bund wall height and non-availability of extra space in yellow. 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, there is a risk of contamination through jetting. Especially from the primary digestors, secondary digestor and the press liquor returns tank which sit close the site boundary. This will be mitigated through the installation of perspex screen walls.

The likelihood of jetting occurring however is deemed low as failure is more likely to begin with major seeping from the tanks which would be spotted during routine site walkabout tours each day.

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, the sludge area is in Flood Zone 1, as shown in Figure 4-3 below.

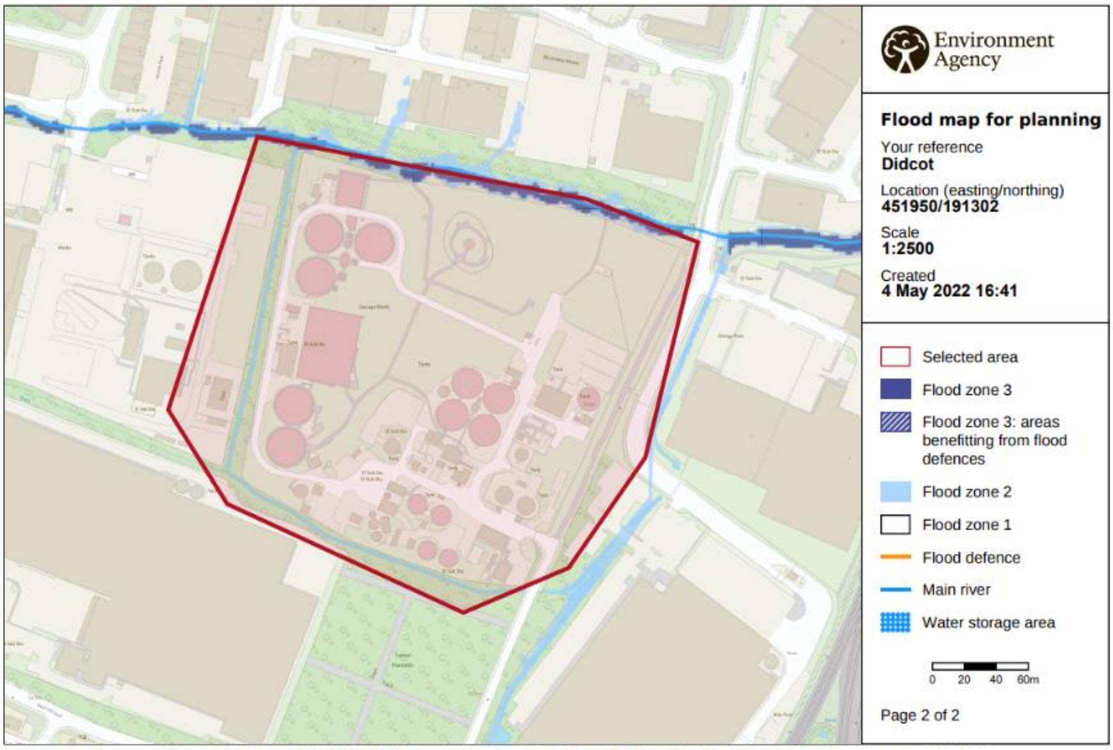

Figure 4.3 Extent of Fluvial flooding in Didcot due to extreme weather events

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. Flood gates retained where exceptional access required.

H&S and CDM risks

- Flood gates not suitable for areas of high traffic movement
- Sealing of Cable ducts and fibre ducts to mitigate issue of acting as conduit to transport sludge around site.
- Confirm that the containment walls do not impact the existing DSEAR equipment rating.
- Interfacing of the containment project with proposed tank remedial works.

5. Site Drainage and liquor returns

5.1 Process flow diagram

The process flow diagram is presented in Figure 5-1 below.

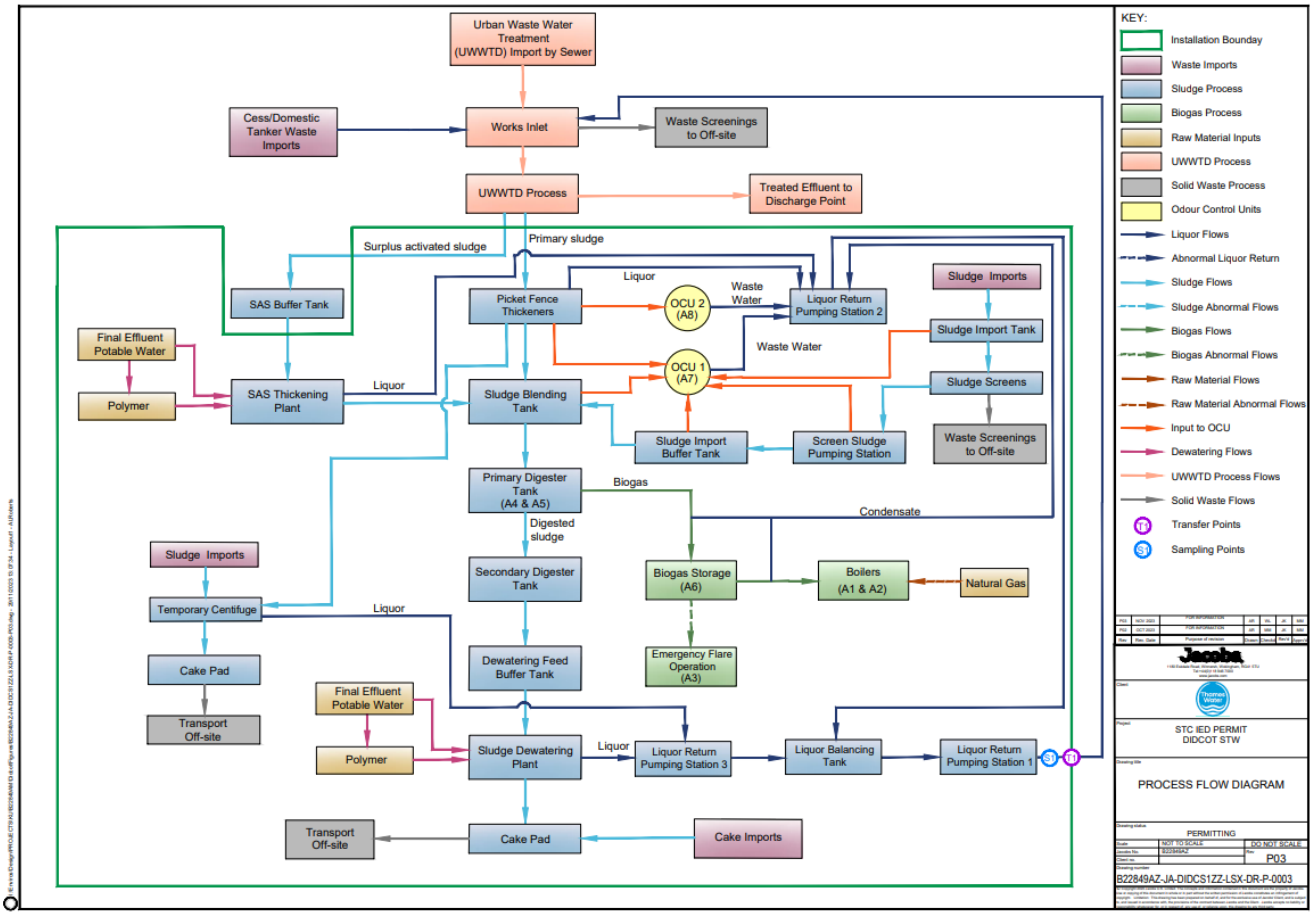

Figure 5.1 Process flow diagram for WTW

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 Didcot.

Containment options onsite involve replacing existing permeable 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 Didcot.

5.3 Liquor Returns

The existing liquor return system is not being altered by the containment system, other than the control modifications proposed in 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 exiting 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 Didcot 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 Didcot 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 assessment focuses on site-specific risks and outlines the options available for providing secondary containment of a catastrophic tank or digester failure.

- Low bunding around the wide containment area (500-1000mm high)
- Ramps at road crossings (1:15, 300-400mm high)
- Flood gates and steps for preventing flow and allowing access at the same time.
- Perspex walls where tanks sit close to the boundary to mitigate jetting

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. Due to gradients across the site, water may pond to a depth of 0-500mm. The volume for containment is driven by the largest tank + rainfall rule. The modelling results show that bunding and Perspex wall heights can be adjusted in some areas, in order to give a more refined design that may reduce cost of installation.

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. 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.

The total design contained volume comprises 2863m^3 (Size of largest tank, 1304m^3 + 4 days rainfall , 1559m^3), compared to 110% rule of 1434m^3 and the 25% rule of 2106 m^3.

Freeboard allowances and the profile of the containment bund wall provides mitigation against surge effects. Jetting escape is mitigated by the location of the tanks being remote to the containment boundary. Supplementary mitigation in the form of Perspex walling may be required on the bridlepath boundary.

Appendix 1 ADBA Site Hazard Risk assessment summary Didcot 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 Didcot STW are as follows:

Source – There are two sources that have been identified:

1. Sludge digestate
2. Polyelectrolyte chemicals (Ferric Sulphate) for sludge thickening.

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.
2. Sludge treatment centre is integrated with large sewage works; as a consequence, the Pathway Hazard rating was determined as **Medium**.
3.

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

1. The site is within 180m of a populated area and surrounded by a number of warehouses.

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

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.