MOTT MACDONALD

Banbury Sewage Treatment Works (STW)

Historic Environment Desk-Based Assessment

November 2021

Mott MacDonald
10 Temple Back
Bristol BS1 6FL
United Kingdom

T +44 (0)117 906 9500
mottmac.com

Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Banbury Sewage Treatment Works (STW)

Historic Environment Desk-Based Assessment

November 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
1A	24/11/21	M Reynolds	E Dennis	R Cameron	First Draft

Document reference: J975.01-JE-BANBS1ZZ-100-AS-EN-0107

Information class: Standard

Contents

Tables

Figures

Executive summary

This historic environment desk-based assessment (DBA) has been produced by Mott MacDonald Limited (MML) on behalf of Thames Water Utilities Ltd., in advance of proposed development at Banbury Sewage Treatment Works (STW). The DBA will provide baseline information to help determine the heritage constraints of the proposed works, assess the potential impacts, and draw up an appropriate mitigation strategy.

Thames Water are proposing works at Banbury STW. The works will replace the Combined Heat and Power (CHP) engine and out of specification gas equipment, along with the installation of improvements and upgrades associated with the replacements. These works are required in order to enable the STW to fulfil necessary operational requirements.

The STW is located at the eastern fringe of Banbury, Oxfordshire (postcode OX16 4RZ), within the Thorpe Way industrial estate. The Site comprises an area of approximately 17 hectares (ha), centred on OS Grid Reference SP 47088 40152. However, the main area of works will be concentrated within the northern portion of the Site.

There are no designated or non-designated heritage assets identified by the DBA within the Site. Within the 1km study area, there is one scheduled monument, seven Grade II listed buildings, three Conservation Areas and three non-designated built heritage assets. The Site is located within a modern industrial area and is well screened from all designated assets by intervening urban and industrial development. Although the STW is potentially visible from the Oxford Canal Conservation Area, the nature and location of the proposed works will not alter the STW in a way that would change any vistas from the canal. The assessment finds that there will be no impact upon any heritage assets, nor any alteration to their setting, as a result of the scheme.

This assessment has identified evidence for activity within the study area from the prehistoric, medieval, post-medieval and modern periods. The potential for archaeological remains within the Site are considered to be low for the prehistoric (specifically Iron Age), medieval and post-medieval periods, and negligible for all other periods. However, multiple phases of development within the STW are likely to have resulted in substantial truncation of any potential archaeological deposits.

Oxfordshire County Archaeological Services have requested a detailed narrative and assessment of previous below ground impacts relating to the Site before making any recommendations. In line with this advice, it is recommended that this assessment is reviewed following further GI works that are due to take place in December 2021 within the main area of works. This will allow a more informed estimation of the levels of made ground and likely extents of archaeological survival within the Site.

1 Introduction

1.1 Overview

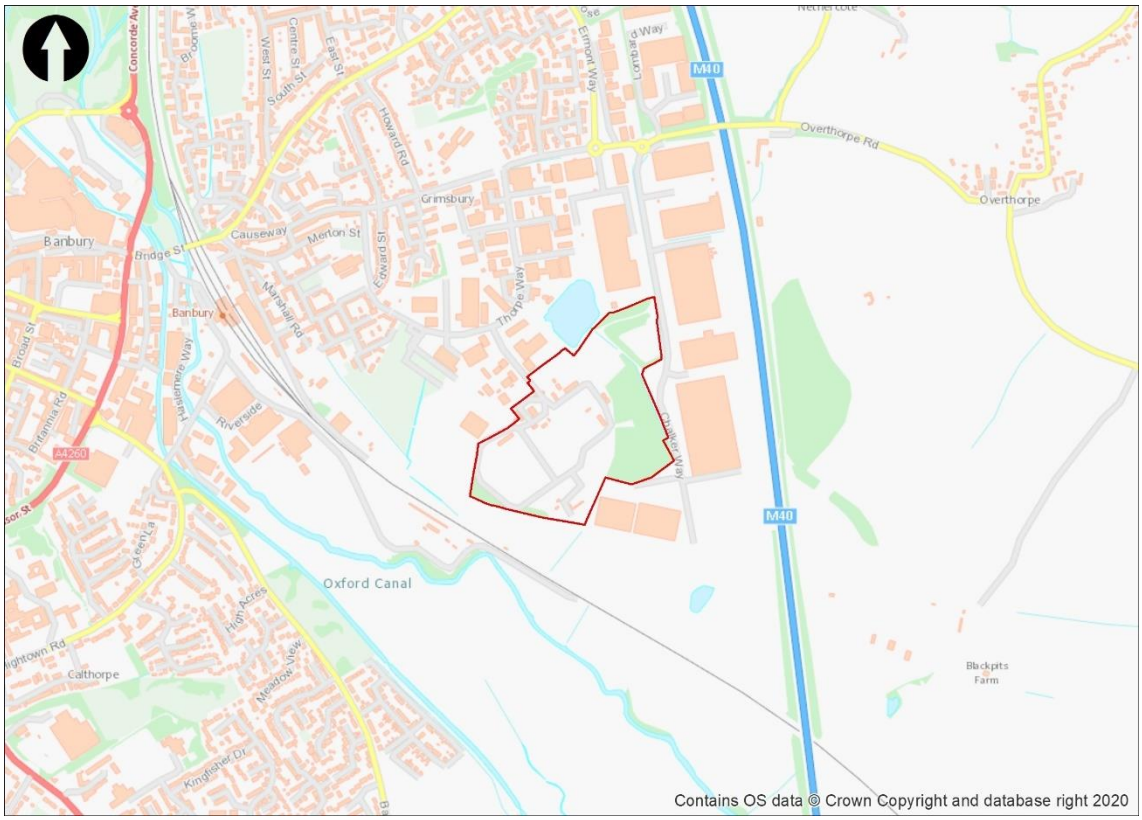
This historic environment desk-based Assessment (DBA) has been produced by Mott MacDonald Limited (MML) on behalf of Thames Water Utilities Limited (hereafter 'Thames Water'), in advance of proposed development at Banbury Sewage Treatment Works (STW) (hereafter the 'Site'). The DBA will provide baseline information to help determine the heritage constraints of the proposed works, assess the potential impacts and draw up an appropriate mitigation strategy. It is anticipated that the Site will fall under permitted development.

1.2 Site location

The Site is located within Thames Water owned land in Banbury, Oxfordshire (postcode OX16 4RZ and National Grid Reference (NGR) SP 47088 40152) (Figure 1.1). The STW, comprises an area of approximately 17 hectares (ha), within an industrial area on the eastern fringes of Banbury. The main area of works associated with the scheme will take place within the northern section of the STW (Figure 1.2).

Although the Site falls within the county of Oxfordshire, the eastern section of the study area includes falls partly within Northamptonshire.

Figure 1.1: Location of Banbury STW



Source: Mott MacDonald

Figure 1.2: Main area of works

Source: Mott MacDonald

1.3 Project description

Thames Water is proposing to undertake works at Banbury STW. The works will replace the Combined Heat and Power (CHP) engine and out of specification gas equipment, along with the implementation of improvements and upgrades associated with the replacements. These works are required in order to enable the STW to fulfil necessary operational requirements.

The proposals are yet to be finalised, but the current proposed works plan includes modifications and / or replacements to several installations, components and infrastructure. Full details of the present proposals may be found in document P0065 and drawing J975.01-JE-BANBS1ZZ-201-DR-ZD-0 in Appendix C. In summary, the works are expected to comprise:

- Civil modifications to the new CHP Engine location including road modifications and modifications to site drainage
- New containerised CHP Engine, installed on a slab measuring 10x25m and 300mm thick
- New Biogas Booster
- New Siloxane Filter
- New Biogas Dehumidifier
- New Biogas Analyser

- New CHP Exhaust Stack. The stack height has not yet been determined, but is not expected to be significantly different to that of the existing stack at the Site.
- New interconnecting biogas pipework between existing gas system, CHP and associated gas system installations
- New Condensate Pots, on a slab measuring 3x2m and 250mm thick.
- Modifications to the existing hot water system
- New CHP clean and waste lube oil tanks and interconnecting pipework
- New CHP System Motor Control Centre (MCC)
- New CHP MCC Kiosk
- Decommissioning of the existing CHP Engine
- Landscaping of land adjacent to the north fence line.

Total excavation across most of the site is anticipated to be 675mm Below Ground Level (BGL). Deeper excavations will be required for the CHP slab, manholes, draw pits and an MCC trench. The maximum expected excavation for installation of the CHP slab is expected to be c. 2m BGL. The surface drainage system will involve two 1.5m diameter manholes installed to a depth of 2m BGL, while the condensate drainage will require another five 1.2m diameter manholes installed to a depth of 1m BGL.

The redundant CHP and equipment will be safely decommissioned, dismantled, and removed after the works are completed. The existing CHP slab is expected to be retained.

Temporary works associated with the scheme will involve:

- Temporary site fence modification to install a new access gate for site traffic.
- Temporary haul roads for construction traffic
- Crane pads at various locations that are yet to be determined
- Rainwater and silt mitigation, the details of which are not yet determined.

2 National and local planning policy

The proposed development falls under Permitted Development and as such is not subject to national and local planning policy. It is, however, good practice to adhere to policies relating to archaeology and heritage as general guidance.

2.1 Overarching legislation

The overarching legislation in relation to heritage and archaeology in Britain is provided by:

- The Ancient Monuments and Archaeological Areas Act 1979
  - Act to consolidate and amend the law relating to ancient monuments; to make provision for the investigation, preservation and recording of matters of archaeological or historical interest and (in connection therewith) for the regulation of operations or activities affecting such matters.
- The Planning (Listed Building and Conservation Areas) Act 1990
  - Act to consolidate certain enactments relating to special controls in respect of buildings and areas of special architectural or historic interest with amendments to give effect to recommendations of the Law Commission.
- The Water Industry Act 1991
  - Act to consolidate enactments relating to the supply of water and the provision of sewerage services, with amendments to give effect to recommendations of the Law Commission.

Paragraph 3: General environmental and recreational duties

1. *It shall be the duty of each of the following, that is to say—*
   a. *the Secretary of State;*
   b. *the Director; and*
   c. *every company holding an appointment as a relevant undertaker,*

in formulating or considering any proposals relating to any functions of a relevant undertaker (including, in the case of such a company, any functions which, by virtue of that appointment, are functions of the company itself) to comply with the requirements imposed in relation to the proposals by subsections (2) and (3) below.

2. *The requirements imposed by this subsection in relation to any such proposals as are mentioned in subsection (1) above are—*
   a. *a requirement, so far as may be consistent—*
      i. *with the purposes of any enactment relating to the functions of the undertaker; and*
      ii. *in the case of the Secretary of State and the Director, with their duties under section 2 above,*

so to exercise any power conferred with respect to the proposals on the person subject to the requirement as to further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological or physiographical features of special interest;

   b. *a requirement to have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural or historic interest; and*

c. *a requirement to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora, fauna, features, buildings, sites or objects.*

3. *The requirements imposed by this subsection in relation to any such proposals as are mentioned in subsection (1) above are, subject to the requirements imposed by subsection (2) above—*

   a. *a requirement to have regard to the desirability of preserving for the public any freedom of access to areas of woodland, mountains, moor, heath, down, cliff or foreshore and other places of natural beauty;*

   b. *a requirement to have regard to the desirability of maintaining the availability to the public of any facility for visiting or inspecting any building, site or object of archaeological, architectural or historic interest; and*

   c. *a requirement to take into account any effect which the proposals would have on any such freedom of access or on the availability of any such facility.*

2.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published on 27th March 2012, revised on the 24th July 2018 and updated on the 20th July 2021, and replaced all previous national planning policy documents. Paragraphs 189 – 208 of the NPPF address the conservation and enhancement of the historic environment; these set out the local planning authority's responsibilities when dealing with planning proposals which have the potential to impact on cultural heritage assets. These policies emphasise the importance of balancing the need for the conservation of heritage assets with the desirability of new development. Those relative to this scheme include:

> ***189**: Heritage assets range from sites and buildings of local historic value to those of the highest significance, such as World Heritage Sites which are internationally recognised to be of Outstanding Universal Value. These assets are an irreplaceable resource, and should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations.*
>
> ***190**: Plans should set out a positive strategy for the conservation and enjoyment of the historic environment, including heritage assets most at risk through neglect, decay or other threats. This strategy should take into account:*
>
> *a) the desirability of sustaining and enhancing the significance of heritage assets, and putting them to viable uses consistent with their conservation;*
> *b) the wider social, cultural, economic and environmental benefits that conservation of the historic environment can bring;*
> *c) the desirability of new development making a positive contribution to local character and distinctiveness; and*
> *d) opportunities to draw on the contribution made by the historic environment to the character of a place.*
>
> ***194**: In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum the relevant historic environment record should have been consulted and the heritage assets assessed using appropriate*

expertise where necessary. Where a site on which development is proposed includes, or has the potential to include, heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation.

***195**: Local planning authorities should identify and assess the particular significance of any heritage asset that may be affected by a proposal (including by development affecting the setting of a heritage asset) taking account of the available evidence and any necessary expertise. They should take this into account when considering the impact of a proposal on a heritage asset, to avoid or minimise any conflict between the heritage asset's conservation and any aspect of the proposal.*

***197**: In determining planning applications, local planning authorities should take account of:*

a) *the desirability of sustaining and enhancing the significance of heritage assets,*
b) *the positive contribution that conservation of heritage assets can make to sustainable communities including their economic vitality; and*
c) *the desirability of new development making a positive contribution to local character and distinctiveness.*

***198**: In considering any applications to remove or alter a historic statue, plaque, memorial or monument (whether listed or not), local planning authorities should have regard to the importance of their retention in situ and, where appropriate, of explaining their historic and social context rather than removal.*

***203**: The effect of an application on the significance of a non-designated heritage asset should be taken into account in determining the application. In weighing applications that directly or indirectly affect non-designated heritage assets, a balanced judgement will be required having regard to the scale of any harm or loss and the significance of the heritage asset.*

***205**: Local planning authorities should require developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible. However, the ability to record evidence of our past should not be a factor in deciding whether such loss should be permitted.*

***208**: Local planning authorities should assess whether the benefits of a proposal for enabling development, which would otherwise conflict with planning policies but which would secure the future conservation of a heritage asset, outweigh the disbenefits of departing from those policies.*

2.3 Local Planning Policy

The Cherwell Local Plan 2011-2031 (Part 1) was originally adopted on the 20th July 2015 and makes the following provisions for the protection of the historic environment[1].

Policy ESD 13: Local Landscape Protection and Enhancement

Opportunities will be sought to secure the enhancement of the character and appearance of the landscape, particularly in urban fringe locations, through the restoration, management or

[1] Cherwell Local Plan 2011-2031, 2015 [online] available at: https://www.cherwell.gov.uk/downloads/download/45/adopted-cherwell-local-plan-2011-2031-part-1-incorporating-policy-bicester-13-re-adopted-on-19-december-2016 [accessed 20 October 2021]

enhancement of existing landscapes, features or habitats and where appropriate the creation of new ones, including the planting of woodlands, trees and hedgerows.

Development will be expected to respect and enhance local landscape character, securing appropriate mitigation where damage to local landscape character cannot be avoided. Proposals will not be permitted if they would:

- *Cause undue visual intrusion into the open countryside*
- *Cause undue harm to important natural landscape features and topography*
- *Be inconsistent with local character*
- *Impact on areas judged to have a high level of tranquillity*
- *Harm the setting of settlements, buildings, structures or other landmark features, or*
- *Harm the historic value of the landscape.*

Policy ESD 15: The Character of the Built and Historic Environment

Successful design is founded upon an understanding and respect for an area's unique built, natural and cultural context. New development will be expected to complement and enhance the character of its context through sensitive siting, layout and high quality design. All new development will be required to meet high design standards. Where development is in the vicinity of any of the District's distinctive natural or historic assets, delivering high quality design that complements the asset will be essential.

New development proposals should:

- *Be designed to deliver high quality safe, attractive, durable and healthy places to live and work in. Development of all scales should be designed to improve the quality and appearance of an area and the way it functions*
- *Deliver buildings, places and spaces that can adapt to changing social, technological, economic and environmental conditions*
- *Support the efficient use of land and infrastructure, through appropriate land uses, mix and density/development intensity*
- *Contribute positively to an area's character and identity by creating or reinforcing local distinctiveness and respecting local topography and landscape features, including skylines, valley floors, significant trees, historic boundaries, landmarks, features or views, in particular within designated landscapes, within the Cherwell Valley and within conservation areas and their setting*
- *Conserve, sustain and enhance designated and non designated 'heritage assets' (as defined in the NPPF) including buildings, features, archaeology, conservation areas and their settings, and ensure new development is sensitively sited and integrated in accordance with advice in the NPPF and NPPG. Proposals for development that affect non-designated heritage assets will be considered taking account of the scale of any harm or loss and the significance of the heritage asset as set out in the NPPF and NPPG. Regeneration proposals that make sensitive use of heritage assets, particularly where these bring redundant or under used buildings or areas, especially any on English Heritage's At Risk Register, into appropriate use will be encouraged*
- *Include information on heritage assets sufficient to assess the potential impact of the proposal on their significance. Where archaeological potential is identified this should include an appropriate desk based assessment and, where necessary, a field evaluation.*
- *Respect the traditional pattern of routes, spaces, blocks, plots, enclosures and the form, scale and massing of buildings. Development should be designed to integrate with existing*

streets and public spaces, and buildings configured to create clearly defined active public frontages

- *Reflect or, in a contemporary design response, re-interpret local distinctiveness, including elements of construction, elevational detailing, windows and doors, building and surfacing materials, mass, scale and colour palette*
- *Promote permeable, accessible and easily understandable places by creating spaces that connect with each other, are easy to move through and have recognisable landmark features*
- *Demonstrate a holistic approach to the design of the public realm to create high quality and multi-functional streets and places that promotes pedestrian movement and integrates different modes of transport, parking and servicing. The principles set out in The Manual for Streets should be followed*
- *Consider the amenity of both existing and future development, including matters of privacy, outlook, natural lighting, ventilation, and indoor and outdoor space*
- *Limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation*
- *Be compatible with up to date urban design principles, including Building for Life, and achieve Secured by Design accreditation*
- *Consider sustainable design and layout at the master planning stage of design, where building orientation and the impact of microclimate can be considered within the layout*
- *Incorporate energy efficient design and sustainable construction techniques, whilst ensuring that the aesthetic implications of green technology are appropriate to the context (also see Policies ESD 1 - 5 on climate change and renewable energy)*
- *Integrate and enhance green infrastructure and incorporate biodiversity enhancement features where possible (see Policy ESD 10: Protection and Enhancement of Biodiversity and the Natural Environment and Policy ESD 17 Green Infrastructure). Well designed landscape schemes should be an integral part of development proposals to support improvements to biodiversity, the micro climate, and air pollution and provide attractive places that improve people's health and sense of vitality*
- *Use locally sourced sustainable materials where possible.*

The Council will provide more detailed design and historic environment policies in the Local Plan Part 2.

The design of all new development will need to be informed by an analysis of the context, together with an explanation and justification of the principles that have informed the design rationale. This should be demonstrated in the Design and Access Statement that accompanies the planning application. The Council expects all the issues within this policy to be positively addressed through the explanation and justification in the Design & Access Statement. Further guidance can be found on the Council's website.

The Council will require design to be addressed in the pre-application process on major developments and in connection with all heritage sites. For major sites/strategic sites and complex developments, Design Codes will need to be prepared in conjunction with the Council and local stakeholders to ensure appropriate character and high quality design is delivered throughout. Design Codes will usually be prepared between outline and reserved matters stage to set out design principles for the development of the site. The level of prescription will vary according to the nature of the site.

Policy ESD 16: The Oxford Canal

We will protect and enhance the Oxford Canal corridor which passes south to north through the District as a green transport route, significant industrial heritage, tourism attraction and major leisure facility through the control of development. The length of the Oxford Canal through Cherwell District is a designated Conservation Area and proposals which would be detrimental to its character or appearance will not be permitted. The biodiversity value of the canal corridor will be protected.

We will support proposals to promote transport, recreation, leisure and tourism related uses of the Canal where appropriate, as well as supporting enhancement of the canal's active role in mixed used development in urban settings. We will ensure that the towpath alongside the canal becomes an accessible long distance trail for all users, particularly for walkers, cyclists and horse riders where appropriate.

Other than appropriately located small scale car parks and picnic facilities, new facilities for canal users should be located within or immediately adjacent to settlements. The Council encourages pre-application discussions to help identify significant issues associated with a site and to consider appropriate design solutions to these and we will seek to ensure that all new development meets the highest design standards.

3 Methodology

3.1 Consultation

The relevant Historic Environment Record (HER) data has been purchased from the Oxfordshire HER, received 11 October 2021, and Northamptonshire HER, received 7 October 2021. The Site falls entirely within the county of Oxfordshire, but part of the study area extends into Northamptonshire.

While the Scheme is likely to fall under permitted development, consultation was sought from the local authority as best practice.

The Oxfordshire County Archaeological Services were contacted on 20 October 2021 in order to clarify the nature of mitigation they would request for the scheme. In a response dated 22 October 2021, it was agreed that the Site was likely to have been subjected to considerable ground disturbance that would have had a significant effect on the potential for any below ground archaeological remains to be present. The service requested that the DBA looks to provide a detailed narrative and assessment of previous below ground impacts relating to the site, review of existing levels of made ground and the impact depths of current proposals. The service would wait until receipt of the DBA before providing any detailed comments on the proposals, so further consultation will be required regarding mitigation.

3.2 Assessment Methodology

Baseline information has been gathered within a 1km radius of the site (hereby referred to as the 'study area'). This search radius is considered sufficient to produce a comprehensive baseline for the site and will allow for an understanding of the archaeological potential and historic significance to be established, and subsequently for appropriate mitigation to be recommended for the proposed development regarding heritage.

The DBA follows the 2017 updated Chartered Institute for Archaeologists' (CIfA) Standard and Guidance for Historic Environment Desk-Based Assessment, and Historic England's Conservation Principles, Policies and Guidance (Historic England, 2008). The CIfA guidance outlines the necessity of the DBA to enable appropriate mitigation strategies where necessary, in line with the local and national policies in place. The following actions have been undertaken for this assessment:

- An examination of local, regional and national planning policies in relation to the historic environment;
- A search of the Historic England National Heritage List for England (NHLE) dataset for designated heritage assets within the study area[2];
- A search of the Oxfordshire and Northamptonshire HER for archaeological sites, archaeological findspots, locally listed buildings, archaeological priority areas and archaeological event locations within the study area[3];
- A search of the relevant published and unpublished archaeological sources within the wider area via the Archaeological Data Service (ADS);

[2] NHLE data downloaded 11 October 2021

[3] Oxfordshire HER data obtained 11 October 2021; Northamptonshire HER data obtained 7 October 2021

- A search of the Portable Antiquities Scheme (PAS) database for additional findspots within the study area;
- An examination of relevant aerial imagery held by the National Collection of Aerial Photography (NCAP)[4];
- An examination of Google Earth Pro, for historic images;
- An examination of the British Geological Survey (BGS) data;
- An inspection of the cartographic evidence for the land use history of the site;
- An examination of the other available online historic sources (identified in footnotes where relevant); and,
- A site walkover, undertaken on in order to determine the topography, existing land use and character of the area.
- A visit to the Oxfordshire History Centre to consult historical maps and documents. Enquiries were also made to the Northamptonshire Archive for any relevant material.

Appendix A includes maps that show the location of known historic environment features within the study area. These have been allocated a unique Mott MacDonald reference number (MM01, MM02 etc.), which is listed in a gazetteer in Appendix B and is referred to in the text. All distances quoted in the text are approximate (within 5m) and refer to the distance between the heritage asset and the closest proposed option.

3.3 Guidance

The following guidance has been used for this assessment:

- The 2000 Water and Sewerage (Conservation, Access and Recreation) Code of Practice Order;
- The 2008 Historic England Conservation Principles, Polices and Guidance;
- The 2014 Chartered Institute for Archaeologists (CIfA) Standard and Guidance for Historic Environment Desk-Based Assessment (updated 2017);
- The 2015 Historic England Management of Research Projects in the Historic Environment (MoRPHE): Project Managers Guide;
- The 2015 Historic England Historic Environment Good Practice Advice in Planning Note 2: Managing Significance in Decision – Taking in the Historic Environment (GPA2);
- The 2017 Historic England Environment Good Practice Advice in Planning Note 3: The Setting of Heritage Assets (GPA3);
- The 2020 Design Manual for Roads and Bridges (DMRB) LA 104 – Environmental assessment and monitoring;
- The 2020 DMRB LA 106 – Cultural heritage assessment; and
- The 2020 Thames Water Asset Management Asset Standard Section 1 of 1: Ecology and Heritage Screening Specification.

3.4 Assumptions and Limitations

The following assumptions and limitations have been assumed for this historic environment DBA;

- the DBA is reliant on available data. Designated data is up to date as of October 2021;

[4] https://ncap.org.uk/

- databases are limited in their ability to predict new sites and the information from the NHLE and HER has been used as a starting point for further research rather than as a definitive list;
- the current understanding of the extent and survival of archaeological remains within the study area is based on data relevant to the appraisal which has been selected based on professional judgement. However, the specific nature, extent, date, degree of preservation and significance of known and potential archaeological remains is impossible to predict without invasive investigation. There is the possibility that further or more complex unknown buried archaeology exists on sites which have not been recorded with the HER;
- documentary sources are rare before the medieval period, and many historic documents are inherently biased. Older primary sources often fail to accurately locate sites and interpretation can be subjective;
- historic maps provide a glimpse of land-use at a specific moment. It is therefore possible that short-term structures or areas of land-use are not shown and therefore not recorded within this assessment; and
- this DBA is based on an early stage design and may be subject to change should the design be significantly altered later.

4 Baseline

4.1 Geology and topography

The bedrock geology of the Site is of Charmouth Mudstone Formation. This sedimentary rock was formed during the Jurassic Period (approximately 152 to 157 million years ago). No superficial deposits are recorded by the BGS within the area of the Site.

No borehole data has been recorded by the BGS within the area of the Site. Ground Investigation data supplied by Thames Water suggests that the ground conditions broadly comprise 0.5m of made ground (stone chippings and cobbles) overlaying 2.4m of stiff clay below which is c. 5.1m of clay.[5] However, no data was recorded within the main area of works, so the depths of made ground and underlying geology of this area is not certain. Additional ground investigation relating to this scheme is planned to take place December 2021.

The Site is located upon a low rise within the landscape. Elevation is generally level at around 96m AOD within the main area of the Site but slopes down to c. 90m AOD towards the south-west, north-east and south-east of the Site. A rise in the east of the Site forms a ridge at c. 96m AOD. Land use within the Site consisted of sewage treatment works and landscaping. The surrounding landscape is an industrial estate to the north and east of the Site, with open fields to the south and south-west. The Site is c.100m to the north-east of Banbury railway line, c. 240m west of the M40, c.120m north of the River Cherwell and c. 435m north-east of the Oxford Canal. The Site is bordered by an industrial estate to the north and east, with open fields to the south. An area of vegetation and trees is incorporated into the eastern edge of the Site.

4.2 Historic Landscape Characterisation

The Historic Landscape Characterisation (HLC) of the Site is recorded as being Civic Amenities - Sewerage Treatment Works (1882-1920). Adjacent to the western, eastern and southern boundaries of the Site, the HLC is classed as Planned Enclosure (1811-1881), noted to be contemporary with the creation of the London and North Western Railway (L&NWR) railway, the former route of which lies to the south of the Site. Adjacent to the north-west of the Site, the HLC is classed as Industry- Industrial estate (1921-1999)

4.3 Local Authority designations

4.3.1 Conservation Areas

The Site itself does not fall within any Conservation Areas. However, three Conservation Areas fall within the 1km study area. These Conservation Areas relate to the Oxford Canal, c. 440m south-west of the Site; Grimsbury, c. 565m north-west of the Site; and Overthorpe, c. 955m north-east of the Site.

4.3.1.1 Oxford Canal

The Oxford Canal Conservation Area encompasses the route of the canal as it passes through the Cherwell District, with the addition of a small section that crosses into South Northamptonshire. In addition to preservation of the canal itself, the Conservation Area is concerned with the preservation of the architecture; related engineering installations and infrastructure; and the character of the immediate landscape along the length of the canal.

[5] Mott MacDonald 2021 *Technical Note Banbury STW. CHP System Upgrade.* p. 5

Almost every structure directly or indirectly associated with the canal are of importance to the Conservation Area. An important part of the character of the Conservation Area includes views from the canal. Given the open, linear nature of most of the canal, all rural views to and from the canal should be treated as potentially sensitive, although the canal is mostly enclosed, so these views are often limited.[6] The management plan identifies specific 'Positive Vistas' and landmarks that are of particular importance.

4.3.1.2 Grimsbury

The Grimsbury Conservation Area is a 19th century suburb of Banbury that was constructed by the Banbury Freehold Land Society. The development provided the working class with the opportunity for house ownership that would also enable voting rights. By providing the working class with voting rights, this in turn provided the potential for political reform. Architecturally, the area is in keeping with contemporary suburbs of the town. However, the importance of the Conservation Area derives from its significant contribution to the political history of Banbury.[7] Although over half of the Conservation Area falls within the study area, the intervening industrial estate and urban development entirely screens it from the STW.

4.3.1.3 Overthorpe

The Overthorpe Conservation Area was designated in 1978 and encompasses the historic core of Overthorpe village. The village contains distinctive characteristics of architecture, construction and layout, and includes multiple Grade II listed buildings, none of which fall within the study area. The Conservation Area seeks to protect the distinctive characteristics of the village and closed and intimate views within the historic part of the village.[8] Only the very edge of the spatial extents of the Conservation Area falls within the study area.

4.4 Designated heritage assets

There are no World Heritage Sites, Registered Battlefields or Registered Parks and Gardens within the Site or the study area.

4.4.1 Scheduled monument

There is one scheduled monument within the study area: The Former World War I National Filling Factory (MM01, List Entry: 1409811), c. 280m to the east of the Site. The monument is the site of one of the 'Ministry of Munitions' explosives filling factories built in 1915 to meet ammunition shortages. The Banbury factory, known as NFF No. 9 was one of the earliest purpose-built factories of this type. The factory was a major local employer by 1916 and a major supplier of ammunition, but was closed in 1924, after which the buildings were destroyed by 'thermal remediation'.[9] This location may have been used as a training site during the Second World War.

The site now consists of a series of well-defined earthworks, standing and buried remains. A portion of the western part was truncated by the M40 motorway. MM01 is considered of national importance due to:

- The considerable contribution of the factory to the war effort;
- The rare extent to which the remains are preserved and legible;

[6] Cherwell District Council. 2012 *Oxford Canal Conservation Area Appraisal*. Pp. 30-31

[7] Cherwell District Council, 2007, *Grimsbury Conservation Area Appraisal*

[8] South Northamptonshire Council. 2015. *Overthorpe Conservation Area Appraisal and Management Plan*

[9] Deliberate, controlled burning to ensure destruction of any residual explosives.

- The diversity of the different elements of the site; and
- The potential for the remains to make a significant contribution to understanding of the site.[10]

4.4.2 Built heritage

4.4.2.1 Designated built heritage assets

There are seven listed buildings within the study area, all of which are Grade II:

- Bridge over Mill Stream (MM02), c.945m to the north-west of the Site.
- Old Town Hall (Chapman Brothers) (MM03), c.885m to the west of the Site.
- Lamprey and Son Limited Agricultural Merchants, St Leonards Primary School (MM04), c.830m to the north-west of the Site.
- Home Farmhouse (MM05), c.910m to the north-east of the Site.
- Foxes Lift Bridge (171) AT SP 470 389 Oxford Canal (MM06), c.960m to the south of the Site.
- Elephant and Castle Hotel (MM07), c.805m to the north-west of the Site.
- Oxford Canal Haynes Lift Bridge (170) (MM08), c.750m to the south of the Site.

Bridge Over Mill Stream (NHLE: 1409811)

This Grade II listed building is the remains of the original 13th Century bridge across the Cherwell. The bridge is now mainly obscured by a 19th century railway bridge. The setting of the bridge within its original location along the courses of the Mill Stream and River Cherwell is essential to the understanding of the monument. The structure derives its heritage value from its historical and evidential values as a surviving element of the original medieval history of Banbury.

Old Town Hall (Chapman Brothers) (NHLE: 1199858)

This Grade II listed building was originally the Town Hall and was built in Market Place in 1790. It was moved and rebuilt at its present location alongside the canal in c. 1860. The building now functions as a warehouse and derives its heritage value from its historical and evidential value as part of the post-medieval development of Banbury and its civic structures.

Lamprey and Son Limited Agricultural Merchants, St Leonards Primary School (NHLE: 1200124)

This Grade II listed building was originally built in 1860-1861 by G.E Street and originally functioned as a school, but now functions as offices. The building derives its heritage value from its historical value as a former school and part of the post-medieval development of Banbury.

Home Farmhouse (NHLE: 1200143)

This Grade II listed building is a 17th century farmhouse, now functioning as a private residence. The building has some later alterations, including a 20th century skylight. The building derives heritage value from its historic and evidential values as an example of post-medieval agricultural building.

[10] Historic England NHLE entry: https://historicengland.org.uk/listing/the-list/list-entry/1409811 [Accessed 20 October 2021]

Elephant and Castle Hotel (NHLE: 1369549)

This Grade II listed building was built in the late 17th to early 18th century and was originally a house. The building underwent multiple refurbishment and alteration in the 20th century, including the construction of a brick-built extension that formed part of the establishment. The hotel has closed and the building is being converted into flats.[11] The location of the building within the post-medieval development area of Banbury and along the main route into the town are essential elements to its setting. The heritage value of the building derives from its historical and evidential value as a part of the post-medieval development of Banbury, and from communal value as a former public house.

Foxes Lift Bridge (171) AT SP 470 389 Oxford Canal (NHLE: 1249079) and Oxford Canal Haynes Lift Bridge (170) (NHLE: 1369563)

Both these Grade II listed structures are 18th century lift-bridges, with 19th and 20th century alterations. The lift bridges are part of a series of lift bridges remaining from the original construction of the Oxford Canal and are of a type that is rare in England. The structures derive their value from their historical association with the early Oxford Canal and evidential value as an example of a now rare type of 18th century engineering fixture. The bridges also have a mutual group value that extends to other examples of this type along the Oxford Canal.

4.4.2.2 Non-designated built heritage assets

There are three non-designated built heritage assets within the study area:

- St Leonards Church, Middleton Road (MM28), c. 820m north-west of the Site;
- Methodist Chapel, West Street (MM29), c. 965m north-west of the Site;
- The Bowling Green Public House (MM38), c. 520m north-east of the Site.

4.5 Historic map regression

The cartographic evidence utilised for this report dates to the post-medieval and modern periods and comprises maps, including Ordnance Survey mapping, of the 16th to the 20th centuries. Maps consulted are included in Table 4.1, with a description of any changes.

Enquiries at the Oxfordshire History Centre and Northamptonshire Archives indicate that the area of the Site does not appear to have been included in any available tithe or enclosure maps.

Table 4.1: Historic map regression for the site of Banbury STW

Map	Description
Christopher Saxton's Map of Berkshire, Buckinghamshire and Oxfordshire 1574	The map depicts the general relative locations of settlements and river courses. The settlement of Banbury is shown, but no details are recorded.
Speed's Map of Northamptonshire 1627	The settlement of Banbury is shown, along with the bridge crossing the Cherwell. The minor settlements of Grimsbury and Overthorpe are not shown.
Bryants map of Northamptonshire 1827	This map depicts the land east of the Cherwell. No features are depicted within the Site area. The roads heading east from Banbury are shown, and the area of Grimsbury is shown as including a small number of dispersed buildings along the roads. Despite almost certainly being present at the time of the map, Spital Farm is not shown, suggesting that the map is only representative and is not a detailed or reliable representation.

[11] Cherwell District Council. Planning Application - 20/02480/F. https://planningregister.cherwell.gov.uk/Planning/Display/20/02480/F. [Accessed 21 October 2021]

Map	Description
Ordnance Survey. County Series six-inch. Northamptonshire LVIII.SW. First Edition. 1883	The Spital Farm buildings complex is shown as three linear farm buildings forming three sides of a courtyard, across from which to the south-west is shown the farm house building. The farm buildings immediately back onto an open field. Small enclosures to the rear of the farm house building appear to indicate a garden and/or orchard associated with the house. The full area of the Site straddles the boundaries of five fields immediately to the south and south-east of the Spital Farm buildings. However, the main area of the scheme works falls entirely within the field immediately south-east of the Spital Farm building complex. By this time, the development of Railway Terrace and the Grimsbury development have taken place to the north of the Site. The gasworks, station and routes of the railways are shown as they are in the present. A 'Brick, Tile and drainpipe works' is shown between causeway and Duke Street. The '(site of) Hermitage' is recorded on the east end of Banbury Bridge, just north of Cherwell House. The area of the Site within which the scheme is planned falls entirely within an open field to the south-east of the Spital Farm buildings.
Ordnance Survey. County Series six-inch. Oxfordshire VI. First Edition. 1885	The main layout of Banbury to the west of the canal is well established and almost identical to that of the present. The canal bridges 165-167 are shown along the canal. The area of the Site within which the scheme is planned remains unaltered.
Ordnance Survey. County Series six-inch. Oxfordshire VI. Second Edition. 1900.	An irrigation farm is shown to the east of the Site, but there are no notable changes from the 1882/1885 maps. The area of the Site within which the scheme is planned remains unaltered.
Ordnance Survey. County Series six-inch Northamptonshire LVIII. 1923	The Site area remains mostly enclosed fields. However, the first development of sewage works is recorded within the southern enclosed field. A rectangular structure is shown in approximately the location of present-day settlement tanks within the southern area of the STW. Hachures appear to indicate a series of banks forming a rectangular enclosure, possibly earthworks associated with the sewage works. Another small, linear building of unspecified purpose is shown at the north end of a linear bank to the north-east of the first structure. The group is labelled 'Sewage Works'. In the south-west corner of the field immediately to the north of the sewage tank, and to the south of the Spital Farm buildings, a small enclosure contains an isolation hospital of the 'Banbury Corporation'. A smaller square building is also recorded at the east edge of the enclosure. This location is now occupied by an office and car park in the present day STW. Allotment gardens are recorded in the fields north-west of the Spital Farm buildings. Along the east side of the canal, at the eastern edge of the 1920s Banbury urban area, wharf buildings are depicted including a sewage treatment works, Cherwell Works and Mills. To the east of the Site, the extents and layout of the First World War filling factory and connecting tracks and sidings of the light railway are clearly recorded. In Grimsbury, a school has been constructed and a path enlarged to become a road (the present-day School View road). A disused brickworks is recorded just to the east of Grimsbury. The area of the Site within which the scheme is planned remains unaltered.

Map	Description
Ordnance Survey. County Series six-inch. Northamptonshire LVIII.SW. Six inch. 1944	The Site area remains as enclosed fields with the same layout as 1923. The Sewage Works are not labelled in this map, and no structures are shown that correspond exactly with the sewage works structure recorded in 1923. However, a small rectangular structure may represent the tank or other related structure. The linear building recorded in 1923 remains depicted, although no earthworks are shown. The enclosure of the isolation hospital is still depicted, but no structures are shown within the enclosure. The First World War filling factory is no longer shown, with the area of the factory featureless. Within Grimsbury, the 'Brick, Tile and Drain Pipe works' recorded in 1882 are shown as disused. The streets of School View, Howard Street and Edward Street are shown to the east of Grimsbury, with terrace development indicated along the roads. The map is generally less detailed than the 1923 map, so the lack of labels or depictions does not necessarily indicate loss of features or buildings. The area of the Site within which the scheme is planned remains unaltered.
Ordnance Survey National Grid. SP44SE 1:10560 1955.	The Site area remains as enclosed fields with the same layout as in 1944. The field to the south of Spital Farm clearly includes a well-established sewage works, with the circles of eight settlement tanks depicted. The area marked out by earthworks in the 1923 map corresponds with an unlabelled rectangular area marked out in the map. The linear building north-east of the works remains shown. The complex is labelled 'Sewage Works (Borough of Banbury). The enclosure that formerly contained the isolation hospital is still recorded but remains featureless. Allotment gardens are still recorded by annotation to the west of Spital Farm. Small changes and house building have taken place within Grimsbury, including development to the east of Howard Street, but there are no major changes from 1944. The area of the Site within which the main scheme works are planned remains unaltered.
Ordnance Survey National Grid. SP44SE 1:10560 1968.	No notable changes have taken place since 1955.
Ordnance Survey National Grid. SP44SE 1:2500 1973.	The sewage works has expanded, with multiple settlement tanks and filter beds extending within south-western section, with more enclosures and possible filter beds shown in the approximately central area of the Site. The linear building recorded in previous maps is no longer shown. The complex is labelled 'Spital Farm Sewage Works'. The southern field boundary of the field adjacent to Spital Farm has been altered to accommodate the sewage works and cuts through the area of the Site within which the scheme is planned.
Ordnance Survey National Grid. SP44SE 1:2500 1978.	There are few changes from 1973. However, an area to the east of Edward Street has been developed into an industrial estate, marking the beginnings of the Thorpe Way industrial estate. Some of the buildings remaining to the present.

Map	Description
Ordnance Survey National Grid. SP44SE 1:2500 1994.	The sewage works extends to entirely occupy the area of the field plot to the south of Spital Farm. Multiple installations include structures, settlement tanks and filter beds. Some of these installations remain to the present, including group settlement tanks in the south-west and south-east of the Site, filter beds in the central portion of the Site, and multiple buildings across the eastern section of the Site. Within the main area of the Scheme, the proposed location of the new CHP, Siloxane filters, Dehumidifier and Gas booster set is occupied by a circular installation (digester). The northern field boundary of the sewage works has moved further north since 1978 and cuts through the northern part of the Site and the proposed area of the Scheme. The Thorpe Way industrial estate has expanded and the Grimsbury housing development of Levenot Close has been constructed.
Ordnance Survey Landline 1998	Spital Farm has been demolished and the area developed into the present-day section of the Thorpe Way industrial estate. Many of the buildings remain to the present. The boundary of the Sewage Treatment Works is the same as the present day boundary and area of the Site. Within the STW, the oldest group of settlement tanks in the south-west of the site have been demolished. Three of the four sludge digestion tanks of the present day have been constructed in the northern part of the Site.

Note that the dates for aerial and satellite imagery provided by Google Earth may not be accurate.

4.6 Remote Sensing

Although features observed in aerial photographs have contributed to the Open fields project and the creation of monument records within the Oxfordshire and Northamptonshire HER, no comprehensive aerial investigation survey has been carried out within the study area.

4.6.1 Aerial Photographs

Table 4.2: Google Earth Pro examination for the site of Banbury STW

Year	Description
1945	The farm buildings of Spital Farm and the field boundaries are clearly visible as depicted in OS mapping. The sewage treatment works, only partially shown in OS mapping, are visible in the aerial image in an area that corresponds with the south-western part of the Site. The remains of walls of the filling factory are still very clearly visible in the image. The remains of the complex to the south of the filling factory are also visible as earthworks. Ridge and furrow is visible in fields to the south of the L&NWR railway line and to the east of the Site, along what is now the route of the M40. The layout of Grimsbury is shown as depicted in OS mapping, and a wide patchwork of allotments is visible along the southern edge of Grimsbury. The gasworks are clearly visible between the routes of the GWR and L&NWR.
1985	Imagery too low resolution to be of use.
2004	The layout of the sewage treatment works is identical to the present. Allotments are visible immediately to the west of the STW. The land to the west of the M40 is undeveloped fields. Earthworks of the filling factory and south complex are visible and overgrown.
2005-2009	No notable changes from 2004.
2017	The industrial estate north-east of the STW has been constructed on land to the west of the M40, destroying a field of ridge and furrow. The land to the south-east of the STW is in the process of being developed, a car park has been constructed.
2020	No notable changes from 2017

Table 4.3: Aerial Photographic examination for the site of Banbury STW

Photo reference	Description
ASTRAL/OXF/TRACK/0025 0729 1981 (Month and day unknown)	The area of the STW and Spital Farm and clearly shown. The field immediately east of the Spital Farm buildings clearly shows ridge and furrow earthworks. The area of the Site shows multiple installations, mostly consistent with the 1978 Ordnance Survey mapping but with additions likely to have been constructed since 1978. The main area of the scheme is undeveloped.
FAIREY1961:6125/22004 26-July-1961	The image shows the layout of the STW as similar to that shown in the 1955 and 1968 maps, but including two additional treatment tanks in addition to pipework and small structures not shown in the mapping. Ridge and furrow earthworks are clearly visible immediately to the east and west of the STW. Ridge and furrow earthworks are clearly visible within the fields immediately adjacent to the north, east and west of the Spital Farm buildings.

Source: National Collection of Aerial Photography (NCAP) 2021

4.6.2 Lidar

As part of this assessment, inspection of Environment Agency Lidar from 2020 was carried out using a series of visualisations. Much of the study area is occupied by urban development, highway construction and modern land movement. However, the following features were observed within the Lidar Data and shown in Appendix A – Figure 3:

- Traces of ridge and furrow earthworks to the south of the Site. The wide spacing of the furrows suggests a medieval date.[12](MM41)
- Wide spaced ridge and furrow earthworks of probable medieval date within fields to the west of the canal, c. 980m south of the Site. (MM42)
- Extensive areas of wide spaced ridge and furrow of probable medieval date within fields to the west of Overthorpe and east of the M40, c. 40m north-east of the Site (MM43). Most of this ridge and furrow has been recorded within the Open Fields Project.[13] (MM16)

4.7 Site Walkover

A walkover survey of the Site was undertaken by a member of the Mott MacDonald Heritage Team on the 12 October 2021. The purpose of the walkover was to identify and understand the potential risk of the development to both archaeology and built heritage assets within the study area. The survey also aimed to identify any other heritage assets not evident through previous historic research or listed within the HER.

No additional heritage assets were identified during the walkover survey.

The walkover confirmed that the proposed elements of the scheme were likely to have been subjected to significant ground disturbance as a result of past and present developments of the STW infrastructure.

Photographs of the Site taken during the walkover are shown below (Figure 4.1 - Figure 4.4).

[12] Historic England 2018 *Field Systems: Introductions to Heritage Assets*. Historic England. Swindon. p. 8.

[13] Hall D.N. 2001 *Turning The Plough - Midland Open Fields: Landscape Character and Proposals for Management*

Figure 4.1: View north-east across proposed location of new CHP and associated installations

Source: Mott MacDonald 2021

Figure 4.2: View north-west across proposed route of new LV cable

Source: Mott MacDonald 2021

Figure 4.3: View west along proposed route of new biogas pipework

Source: Mott MacDonald 2021

Figure 4.4: View east along proposed route of condensate drainage pipes, north of sludge digestion tanks

Source: Mott MacDonald 2021

4.8 Archaeological and historic background

This overview of the archaeological and historical background will include a review of the available historic environment information within the study area. The historic narrative of the baseline is provided chronologically as follows:

Table 4.4: Archaeological and historic periods used for the purpose of this assessment[14]

Prehistoric Period Dates		Historic Period Dates	
Palaeolithic	500,000 to 100,000 BC	**Roman**	AD 43 to 410
Late Glacial / Mesolithic	100,000 to 4,000 BC	**Early medieval**	AD 410 to 1066
Neolithic / Early Bronze Age	4,000 to 1,600 BC	**Medieval**	AD 1066 to 1540
Middle Bronze Age	1,600 to 1,100 BC	**Post-medieval**	c.AD 1540 to 1900
Late Bronze Age	1,100 to 700 BC	**Modern**	c.AD 1900 to present
Early Iron Age	800 to 300 BC		
Middle Iron Age	400 to 100 BC		
Late Iron Age / Roman Transition	100 BC to AD 43		

Source: Mott MacDonald

These dates are subjective but are used to ease discussion and are obtained from the Historic England Period List[15], in conjunction with professional judgement.

The historic environment baseline has been compiled using the data available from a search of the HER for heritage assets and from the NHLE for designated heritage assets that have been recorded within the study area to date, along with an examination of the relevant published and unpublished archaeological and historic sources and historic mapping. The information contained within the excavation reports for previous investigations has also been examined and summarised to establish the findings of these investigations with the study area and how they relate to the Site. An examination has also been made of heritage assets within the wider landscape to assist in the interpretation of those within the study area and to contribute to the understanding of the archaeological potential. Heritage assets that sit within the study area are labelled with MM numbers and those in the wider landscape are identified by their bibliographic reference.

4.8.1 Prehistoric (500,000 BC – AD 43)

4.8.1.1 The palaeoenvironment

The underling geology suggests that there is no evidence from within the Site that would provide information on the paleoenvironment.

4.8.1.2 Mesolithic (100,000 – 4,000 BC) to Bronze Age (1,600 – 700 BC)

An assemblage of Mesolithic flints including blades, a scraper and a microlith were recovered in the vicinity of Nethercote c. 580m north of the Site (MM10). The PAS records the find of a

[14] Via: http://heritage-standards.org.uk/wp-content/uploads/2015/08/Periods-List-HE-FISH-WP.pdf, [accessed 18 October 2021].

[15] http://www.heritage-standards.org.uk/chronology/ [Accessed 24 November 2021]

Mesolithic or early Neolithic scraper (MM39) within the central area of Banbury, but the find was unstratified and potentially deposited from gravel from an unknown location.

The Jurassic way (MM11) was an important prehistoric routeway following a ridge that connected the north-east and south-west of Britain. Two possible routes are recorded leading north-east from Banbury. At its closest point, the route passes c. 890m north of the Site, although this part of the route would be heavily truncated or destroyed by construction.

The Port Way (MM09) is another routeway that, although alleged to be a Roman road, is of uncertain date and probably has prehistoric origins. The route is recorded as passing c. 625m east of the Site, although no remnants of the trackway are visible.

4.8.1.3 Iron Age (700 BC – AD 43)

Excavations on Overthorpe Road, c. 300m south-east of the Site, have revealed an extensive Iron Age settlement (MM12). The site includes multiple enclosures and round houses with evidence of settlement, animal husbandry and metal working.[16] The central zone of the site appears to indicate a 'ladder settlement'. The evidence appears to indicate that the site was occupied for a long period, with multiple phases of development.

4.8.2 Roman (AD 43 – AD 410)

Banbury is close to the Roman roads of Fosse Way, Ackman Street and Watling Street. However, no sites of the Roman period have been recorded within the study area. A single sherd of Roman pottery was discovered during evaluations immediately to the north-east of the Site[17]. However, the sherd was among a range of medieval to post-medieval sherds recovered from the topsoil and was considered to be redeposited from manuring and not representative of Roman activity[18].

4.8.3 Early medieval (Saxon) (AD 410 – AD 1066)

The name Banbury derives from the early Saxon name 'Banburh'.[19] Although the Site falls within the present day limits of the town of Banbury, the early medieval settlement of Banburh lay a distance to the west of the Cherwell. The exact extents of the settlement are not known, but it is considered likely that it centred around an Anglo-Saxon church that preceded the medieval church known to have occupied the site of the 18th century St Mary's church, c. 1.5km north-west of the Site[20].

The area of Grimsbury, c. 560m to the north-east of the Site, was originally the location of a settlement that may derive its name from the early Saxon name 'Grimburh'[21], suggesting that the settlement was present by the early medieval period.[22] The name 'Grim' may refer to the

[16] Constable, R. 2015. Central M40, Land at Overthorpe Road, Banbury, Phase 2 (Northamptonshire section): Geophysical survey, Taylor, A. 2015. Central M40, Land at Overthorpe Road, Banbury, Phase 2, Northamptonshire section: An archaeological evaluation, Sanchez, D. 2017. Middle Iron Age Settlement, Central M40, Overthorpe Road, Banbury, Phase 2, Northamptonshire Section: An archaeological excavation, Beaverstock, K. 2019. Phase 4: Central M40, Land at Overthorpe, Banbury, Northamptonshire: Geophysical survey, Sanchez, D. 2019. Central M40, Phase 4, Land at Overthorpe Road, Banbury, Northampton: An Archaeological Evaluation, Sanchez, D, and Preston, S. 2021. Central M40, Land at Overthorpe Road, Banbury, Phase 4: Post Excavation Assessment.

[17] No specific location is available, and the sherds were clearly from disturbed topsoil, so no MM asset number has been assigned.

[18] Thames Valley Archaeological Services. 2008. Spital Farm, Overthorpe Road, Banbury, Oxfordshire: Archaeological Evaluation.

[19] 'Meaning a defended enclosure ('burh') of a person names Ban or Banne.

[20] Colvin et al. 1972 in A History of the County of Oxford: Volume 10, Banbury Hundred, ed. Alan Crossley (London: Victoria County History, 1972), 18-28. British History Online: http://www.british-history.ac.uk/vch/oxon/vol10/pp18-28. [Accessed 20 October 2021]

[21] Meaning a defended enclosure of a person named 'Grim', possibly a reference to 'Woden'.

[22] Potts, W. 1978 *A History of Banbury*.

pagan god ‘Woden’, implying the settlement was before the conversion to Christianity in the mid-7th century.[23] The precise extents of the settlement are not known.

The PAS records an early medieval strap end (MM40) that was recovered within the area of Banbury, although the precise location is protected and unavailable. No other sites or finds of the Early medieval period have been recorded within the study area.

4.8.4 Medieval (AD 1066 – AD 1540)

The Domesday book records that by 1086 Banbury as a large settlement of 76 villagers, 17 smallholders and 14 slaves, with lands owned by the Bishop of Lincoln. The centre of medieval Banbury was focused around the castle built by the Bishop of Lincoln in the 12th century, some distance from the medieval church, but still to the west of the Cherwell.

Banbury Bridge (MM02) was originally a 13th century bridge, although it is now obscured by the 19th century railway bridge. An “East Bar”[24] is mentioned in 1351 and 1355, and it has been speculated that there was a Bridge Gate at the east end of Banbury Bridge, c. 890m north-west of the Site (MM15). However, no supporting evidence been identified for a gate at this location and it is considered more likely that the ‘bar’ referred to was Cole Bar, located on Broad Street between the junctions of George Street and Marlborough Road.[25]

A hermitage (MM14) was recorded in 1531 at the foot of a bridge, although the exact location is unknown. Historic mapping records the hermitage as in the vicinity of the eastern end of Banbury Bridge, c. 840m north-west of the Site.[26] Although plausible, the location given for the hermitage may not be entirely accurate.

The Domesday book records Grimsbury as a settlement of 15 villagers, three smallholders and four slaves, with lands owned by Gunfrid of Chocques. The medieval settlement of Grimsbury was focussed around the medieval Grimsbury Manor, now occupied by a 19th century building (NHLE: 119945) c. 1.6km north of the Site.

Extensive fields of ridge and furrow are visible in aerial imagery and lidar data between Overthorpe and the M40 (MM16), indicating the widespread medieval agriculture within the landscape. It is likely that this would have extended over a wider area that has since been levelled and destroyed by later development.

The site of St. Leonard’s hospital for Lepers (MM13) is known to have stood to the east of Banbury Bridge, although the precise location is not known. The earliest reference to the hospital dates from 1265, and in 1376 lands were granted to the hospital and formed the Spital Farm. Suggested locations for the hospital are at the site now occupied by the Elephant and Castle Hotel in Middleton Road, and the site of the farm buildings of Spital Farm. However, no evidence for the hospital or associated features, such as burials, has been identified at either of the suggested locations. The Oxfordshire HER records the site as within in the vicinity of the farmhouse and buildings of Spital Farm[27], c. 60m north-west of the Site (MM13), following the location given on Ordnance Survey mapping of 1882.[28] However, the HER record notes that this location is uncertain, and the farm buildings are believed to have been constructed within the

[23] ibid

[24] A “Bar” in this context is a fortified gate.

[25] Colvin et al. 1972 in A History of the County of Oxford: Volume 10, Banbury Hundred, ed. Alan Crossley (London: Victoria County History, 1972), 18-28. British History Online: http://www.british-history.ac.uk/vch/oxon/vol10/pp18-28. [Accessed 20 October 2021]

[26] OS County Series 1883 Northamptonshire LVIII.SW 6-inch. First Edition

[27] ibid

[28] Ordnance Survey. County Series Northamptonshire 25" Map. 1882

hospital lands rather than at the site of the hospital itself.[29] It could be suggested that the farm buildings might occupy the site of a grange associated with the hospital, but no reference to a grange has been recorded. The earliest depictions of the farmhouse and buildings as shown within 19th century mapping are probably post-medieval buildings[30], although the presence of medieval elements is impossible to determine, and the buildings are now demolished. The Site is located close to the site of the Spital Farm buildings and falls entirely within the farm's lands. Aerial photographs[31] indicate ridge and furrow earthworks in the fields immediately surrounding the farm buildings, and within the fields within which the sewage treatment works were constructed. It therefore appears likely that the land of the Site was in agricultural cultivation throughout the medieval period.

4.8.5 Post-medieval (AD 1540 – AD 1900)

Banbury castle came under siege during the Wars of the Three Kingdoms, and the town suffered considerable destruction through 1644 as a result of conflict and reprisals.[32] Material relating to the wars have been recovered within Banbury (MM48), but no evidence relating to the civil war has been identified within the Site or its immediate vicinity.

The Oxford Canal (MM31), c. 430m from the Site at its closest, opened in 1790. The canal connected Banbury with the Midlands and was both a major engineering achievement and a significant transport route. The trade brought by the canal, significantly the reliable flow of coal from Warwickshire, made a considerable contribution to the prosperity of Banbury and supported the growth of industries within the town. Two wharfs are recorded within Banbury alongside the canal, although neither remain extant (MM18, MM20). Four 19th century bridges are recorded along the canal with the study area. The swing bridge number 169 (MM25) was formerly on the canal c. 490m south-west of the Site. It is no longer extant, but the canal narrows at the site of the bridge. Bridge number 168 (MM24) was sited at the crossing of Tramway Road, c. 780m west of the Site, but now appears to have been replaced by a bridge of 20th century construction. The Grade II Listed Haynes lift bridge (MM08) and Foxes lift bridge (MM06) remain extant and are located south-west of the Site at c. 750m and c. 950m, respectively.

In the 18th century, most of the roads from Banbury were turnpiked, including the route of the Brackley Road, which followed the route of Bridge Street and Middleton Road, heading east from Banbury. A toll house (MM26) for this route was located on Banbury Bridge, c. 880m north-west of the Site, while another two were recorded along Middleton Road (MM27, MM30), c. 890m and 860m north-west of the Site, respectively. None of the toll houses remain extant.

The mid-19th century saw the construction of two railway lines in Banbury. The Great Western Railway (G.W.R) Oxford and Birmingham Branch (MM37), was served by the Banbury General Station, now Banbury Station. The London and North Western Railway (L&N.W.R) Banbury Branch (MM36) ran adjacent to the southern border of the Site and terminated at Merton Street Station (MM32), c. 730m north-west of the Site.

The 19th century saw an expansion in the size and population of Banbury as a result of the trade and industry associated with the canal and, later, the railway. Industrial development within the town was followed by the development of suburbs on all sides of Banbury. In Grimsbury, land

[29] Colvin et al. 1972 in A History of the County of Oxford: Volume 10, Banbury Hundred, ed. Alan Crossley (London: Victoria County History, 1972), 18-28. British History Online: http://www.british-history.ac.uk/vch/oxon/vol10/pp18-28. [Accessed 20 October 2021]

[30] OS County Series 1883 Northamptonshire LVIII.SW 6-inch. First Edition

[31] ASTRAL/OXF/TRACK/0025 0729 1981; FAIREY1961:6125/22004 26-July-1961

[32] Colvin et al. 1972 in A History of the County of Oxford: Volume 10, Banbury Hundred, ed. Alan Crossley (London: Victoria County History, 1972), 18-28. British History Online: http://www.british-history.ac.uk/vch/oxon/vol10/pp18-28. [Accessed 20 October 2021]

along the old causeway was developed to provide for railway and factory employees homes (Railway Terraces). This development was constructed by the Banbury Freehold Land Society, providing the working class with affordable housing and representation through voting rights.

Increased demands for gas could not be met by the gas works was originally sited on the wharf alongside the canal. The Banbury gas works (MM21) were constructed in Grimsbury, to the south-east of Banbury station, in 1852. The gas works closed in 1958 and were demolished to allow development in the later 20th century.

Linear features of post-medieval date were recorded during archaeological investigations[33] on land at Overthorpe Road, c. 240m south-east of the Site (MM33). The exact nature of the features was not clear, and some may be natural, but they did not appear to indicate substantial activity and, given the nature of the land, it seems likely that they were the remains of field boundaries, drainage or enclosures.

4.8.6 Modern (AD 1900 – present)

During the First World War, the dwindling supplies of ammunition on the front lines led to the Ministry of Munitions commissioning a number of National Filling Factories (NFF) across the country. In 1916 a filling factory, NFF no. 9, was constructed to the east of Banbury (MM01), c. 280m east of the Site. The factory provided employment for over 1400 local people, a third of which were women. The factory was a large contributor to the war effort until 1919 when it became used for the destruction of surplus ammunition. Sidings from the L&NWR line (MM34) were used for the transportation of material and munitions to and from the factory and are recorded in Ordnance Survey mapping from 1923.[34] A series of factory sheds to the south of the railway tracks were also part of the factory complex (MM35). The factory closed in 1924 and underwent 'thermal remediation' that destroyed many of the buildings. As a result, the site of the factory now largely comprises earthworks, as well as some buried and standing remains.

An Isolation Hospital of the 'Banbury Corporation' is shown in Ordnance Survey mapping of 1923[35] in the south-west corner of the field adjacent to the Spital Farm buildings (MM44). This falls within the area of the Site, but away from the main area of works associated with the scheme. The building was relatively short lived and was no longer shown in the 1944 Ordnance Survey map. It is possible that it was a temporary building.

Merton Street station closed in 1960, while the L&NWR line remained open for the transportation of cattle traffic until the line closed in 1966. The tracks were removed in 1967, but the route of the line is preserved and the route of the tracks remain legible through well preserved cuttings and embankment earthworks in the landscape.

The first development of sewage treatment works at the Site began in the early 1920s, with the first constructions developing within the boundary of the Site. The treatment works continued to develop and expand throughout the 20th century, reaching the present-day extents by 1998 (See 4.5).

Modern buildings of historical interest recorded within the Oxfordshire HER include the 1909 St Leonard's church (MM28), on Middleton Road c. 830m north-east of the Site, and the Methodist Chapel (MM29) on West Street c. 970m north-west of the Site. The Northamptonshire HER also records The Bowling Green Public House (MM38), a former 19th century farmhouse, c. 520m north-east of the Site.

[33] TVAS, 2019, Central M40 Phase 4, Land at Overthorpe Road, Banbury, Northamptonshire: An Archaeological Evaluation

[34] *ibid.*

[35] Ordnance Survey. County Series six-inch Northamptonshire LVIII. 1923

5 Archaeological potential and significance

5.1 Assessment of significance

The significance of heritage assets has been based on criteria outlined in Table 5.1. The assessment of significance derives from a combination of designated status and professional judgement. The non-statutory criteria set out by the Secretary of State for Digital, Culture, Media and Sport for the scheduling of ancient monuments and listed buildings, as well as assessment criteria adopted by Historic England as part of the Monument Protection Programme (MPP), will be considered as part of this assessment.

Table 5.1: Criteria for assessing significance

Significance	Typical criteria
Very High	Very high importance and rarity, international scale and very limited potential for substitution. These include World Heritage Sites, assets of acknowledged international importance, assets that can contribute significantly to acknowledged international research objectives.
High	High importance and rarity, national scale, and limited potential for substitution. Scheduled monuments, Grade I, II* and II listed buildings and registered parks and gardens, conservation areas and registered battlefields where the asset and its setting retain archaeological, architectural, artistic and/or historic interest which contributes to their value. Non-designated monuments, sites or landscapes that can be shown to have specific nationally important qualities and assets that can contribute significantly to national research objectives.
Medium	Medium or high importance and rarity, regional scale, limited potential for substitution. Grade II listed buildings and registered parks and gardens, and conservation areas where changes to the asset or its setting have diminished the archaeological, architectural, artistic and/or historic interest which contributes to their value. Non-designated sites of regional importance identified through research or survey, monuments or sites that can be shown to have important qualities in their fabric or historical association.
Low	Low or medium importance and rarity, local scale. Non-designated assets – buildings, structures, monuments, or archaeological sites with a local importance for education or cultural appreciation, and which add to local archaeological and historic research. Very badly damaged assets that are of such poor quality that they cannot be classed as high or medium, parks and gardens of local interest.
Negligible	Very low importance and rarity, local scale. Heritage resources identified as being of little archaeological, architectural, artistic or historic interest, resources whose importance is compromised by poor preservation or survival or by contextual associations to justify inclusion into a higher grade.

Source: After LA 104 – Environmental assessment and monitoring and LA 106 – Cultural Heritage Assessment (2020)

5.2 Survival of archaeological deposits

A lack of GI data within the Site means that ground conditions are not precisely known within the main area of the works. However, the Site has been used as a STW since the early 1920s with subsequent development evident from Ordnance Survey mapping. As a result, there is likely to have been a high level of disturbance within the Site boundary and the presence of below ground services is known across the Site.

It is known that the proposed area of the new CHP has multiple underground services, as shown in drawing J975.01-JE-BANBS1ZZ-201-DR-ZD-0 (Appendix C). The Ordnance Survey mapping of 1994 shows that the proposed area of the siloxane filters, dehumidifier and gas booster set was previously occupied by a digester installation, suggesting substantial subsurface disturbance at the location associated both with the installation and any associated

subsurface services. Substantial areas of hardstanding is also present across the Site, likely to have resulted in subsurface disturbance to unknown depths.

5.3 Archaeological potential

Areas of below-ground archaeological remains are difficult to predict, due to no recorded excavations within the site boundary. There is a higher potential for below ground archaeological remains to survive in areas where there has been minimal development.

Table 5.2: Archaeological potential of the site

Historic asset	Significance	Potential
Paleoenvironmental remains	Low, given the likely level of truncation.	The presence of the Site at the top of a rise means that deposits are likely to be shallow and well drained, presenting unfavourable conditions for the survival of paleoenvironmental remains. Furthermore, the high level of disturbance at the Site means that it is highly unlikely that any substantial undisturbed archaeological deposits will remain. It is also likely that paleoenvironmental remains will be severely contaminated due to ground disturbance and decades of sewage treatment processes at the Site. The potential of paleoenvironmental remains is therefore considered to be **negligible**.
Prehistoric remains	In-situ remains would be of medium significance, given likely level of truncation. Residual remains would be of low significance.	A substantial Iron Age settlement was recorded in the land off Overthorpe Road (MM12). No evidence of Iron Age activity has been recorded within the Site or its immediate vicinity, but it is possible that the area of the Site may have formed part of an Iron Age agricultural hinterland. Given the expected level of truncation resulting from the development of the sewage treatment works, it is likely that any archaeological remains would be severely truncated, if not entirely destroyed. However, the full extent of impact is currently difficult to assess without additional ground investigation. The potential for prehistoric remains is therefore considered to be **low**.
Roman	In-situ remains would be of medium significance, given likely level of truncation. Residual remains would be of low significance.	No Roman period archaeology has been identified within the study area, despite a substantial level of archaeological investigation within the immediate landscape associated with the Overthorpe Road Iron Age settlement. The potential for prehistoric remains is therefore considered to be **negligible**.

Early medieval remains	In-situ remains would be of medium significance, given likely level of truncation. Residual remains would be of low significance	No evidence for early medieval activity has been recorded within the vicinity of the Site. It is likely that the main focus of early medieval settlement was concentrated around the settlements of Banbury and Grimsbury, with the area of the Site potentially forming part of an early medieval agricultural hinterland. Surviving remains of this date are likely to consist of chance finds relating to agricultural activity or settlement refuse such as pottery sherds, and unlikely to be of interest for research objectives Given the expected level of truncation resulting from the development of the sewage treatment works, it is likely that any archaeological remains would be severely truncated, if not entirely destroyed. The potential for early medieval remains is therefore considered to be **negligible**.
Medieval remains	In-situ remains would be of low significance, given likely level of truncation. Residual remains would also be of low significance.	Although there is uncertainty over the location of St Leonard's Hospital, the Site occupies an area that appears to have been under ridge and furrow occupation of probably medieval date. This is consistent with the interpretation of Spital Farm being agricultural land granted to St. Leonard's hospital, suggesting the area of the Site was under agricultural cultivation throughout the medieval period. Beyond ridge and furrow, there is no indication of any medieval structures or other evidence within the area of the Site. Any surviving remains are likely to consist of chance finds relating to agricultural activity or settlement refuse such as pottery sherds, and unlikely to be of interest for research objectives. Given the substantial level of surface and subsurface disturbance resulting from the development of the sewage treatment works, it is also expected that little or no traces of ridge and furrow will survive within the area of the Site. The potential for medieval remains is therefore considered to be **low**.
Post-medieval remains	Low Significance	The area of the Site appears to have remained under agricultural cultivation throughout the post-medieval period. The Site falls across multiple field boundaries but, given the substantial level of surface and subsurface disturbance resulting from the development of the sewage treatment works, it is expected the little or no traces will survive within the area of the Site. The potential for post-medieval remains is therefore considered to be **low**.

Modern remains	Negligible significance	The only modern feature recorded within the area of the Site was the Isolation hospital shown in the 1923 Ordnance Survey mapping. The building appeared to be short lived, although some remnants of foundations might remain. However, the substantial level of subsurface disturbance resulting from the development of the sewage treatment works means that any remains are likely to be substantially or entirely disturbed or removed. The location of the hospital is also beyond the area of the main works of the scheme and unlikely to be impacted by the works as currently designed. The potential for modern remains is therefore considered to be **negligible**.

Source: Mott MacDonald, 2021

6 Assessment of Potential Impacts

6.1 Overview

This assessment is based on the guidance contained in Historic England Advice Note 12 – Statement of Heritage Significance: Analysing Significance in Heritage Assets (2019). Paragraph six of this guidance outlines the steps which should be taken to establish potential impact of the scheme on the significance of heritage assets and where appropriate justify any harmful impacts and identify mitigation and enhancements. These steps are:

1. Understand the form, materials and history of the affected heritage asset(s), and/or the nature and extent of archaeological deposits;
2. Understand the significance of the asset(s);
3. Understand the impact of the proposal on that significance;
4. Avoid, minimise, and mitigate negative impact, in a way that meets the objectives of the NPPF; and
5. Look for opportunities to better reveal or enhance significance.

All works proposed at Banbury STW are detailed in Section 1.3.

6.2 Built Heritage

The Site falls entirely within the boundary of the existing STW, located within an area of industrial development on the outskirts of Banbury. The proposed works fall entirely within the boundary of the existing STW and will not result in any alteration to the visual profile, function or character of the STW.

The Site is separated from all designated and non-designated assets through distance and screened by intervening industrial and urban development, topography and foliage. Although Banbury STW is potentially visible from some parts of the Oxford Canal, the proposed works would not be visible from the canal and will not result in any alterations to vistas from the canal.

Any construction traffic associated with the scheme are not expected to be routed in close proximity to any designated assets and the works are unlikely to represent a significant alteration to the existing level of traffic and levels of disturbance associated with the STW and the industrial estate.

As a result, no direct impacts or alteration to the setting of built heritage assets are therefore anticipated from any part of the scheme.

6.3 Archaeological remains

The works are 280m from the ‘Former World War I National Filling Factory, Banbury’ scheduled monument (MM01). The extents of the scheduled monument are well established and there are no aspect of the works that would impact upon the scheduled monument.

The potential for archaeological remains is considered to be low for prehistoric, medieval and post-medieval archaeology, and negligible for all other periods.

Any proposed work that does not involve ground disturbance would not impact potential buried archaeological remains.

As discussed in Section 5.2, it is anticipated that multiple phases of development within the Site are likely to have substantially or entirely destroyed any potential archaeological deposits had these existed. It is also anticipated that made ground of approximately 0.5m in depth is likely to be found across the surface level of the Site. Due to the previous existence of a digester installation, no survival of archaeological deposits is anticipated within the intended location of the new CHP and adjacent installations. However, as there is no GI data within the main area of works, it has not been possible to fully assess the depths of made ground and extent of disturbance across the broader area of the Site. Without this additional data, there remains some possibility that evidence of archaeological activity may remain preserved below made ground and in areas where no disturbance has previously occurred, sealing archaeological levels.

Works involved in the proposed development includes the installation of surface water drainage, condensate drainage, biogas pipework and the MCC trench. These will require excavation to between 0.675m and 2m. The final design of the proposed works and depths are still in the process of being finalised, but there is the potential that these works may severely truncate or destroy any surviving archaeological deposits, should these be present.

7 Conclusions and recommendations

7.1 Conclusions

This DBA has been undertaken to assess the likely historic environment impacts of development proposals at Banbury STW. This assessment has incorporated a review of the available data from the HER within the study area. Plans showing the study area can be seen in Appendix A.

Within the study area there is one scheduled monument, seven Grade II listed buildings, three Conservation Areas and three non-designated built heritage assets. It is not anticipated that there will be any impact upon the significance of these assets, as there are no physical changes to the assets or any proposed works that would result in an alteration to their setting.

The archaeological potential of the entire area of Banbury STW for archaeological deposits within the site is considered to be low for the prehistoric, medieval and post-medieval periods, and negligible for all other periods.

It is anticipated that there has been considerable truncation within the area of the Site as a result of multiple phases of development within the STW. The survival of archaeological remains has been discounted for the proposed site of the CHP and adjacent installations. However, there is insufficient GI data to fully determined the extents of truncation within the expected area of other aspects of the works. Without this data, there remains the possibility for the survival of archaeological remains beneath the level of any made ground or in areas of less disturbance, and therefore the potential for the disturbance of archaeology as a result of the scheme.

7.2 Recommendations

The Oxfordshire County Archaeological Services have agreed that the Site was likely to have been subjected to considerable ground disturbance. However, they have requested a detailed narrative and assessment of previous below ground impacts relating to the Site before making any recommendations. In line with this advice, it is recommended that this assessment is reviewed following further GI works that are due to take place in December 2021 within the main area of works. This will allow a more informed estimation of the levels of made ground and likely extents of archaeological survival within the Site.

Given the limited extent of excavation required by the works and the low potential for archaeological remains, it is considered unlikely that any pre-construction archaeological investigation will be required. Depending upon the extent of disturbance assessed from additional GI data, it is possible that Oxfordshire County Archaeological Services may recommend archaeological monitoring in the form of a watching brief during construction in areas of the Site where previous ground disturbance is considered minimal.

Any archaeological mitigation will be discussed with Oxfordshire County Archaeological Services in advance. It is anticipated that the site will fall under permitted development.

In the event of any unexpected archaeological finds or features being encountered during groundworks, the following mitigation approaches should be employed:

- work should be immediately stopped in the area; and

- the find(s) should be demarked and protected via fencing / blocking off and the appropriate site management (in this instance the Thames Water Environmental Engineer) should be contacted for further guidance.

In order to avoid potential damage to unexpected archaeological finds and features discovered during construction, workers should be trained. This should include basic environmental awareness training provided within the site induction and regular toolbox talks to ensure that contactors working on site are aware of the procedures in place and are provided with the basic information to allow them to identify archaeological finds and features.

8 References

8.1 Bibliography

Beaverstock, K,. 2019, Phase 4: Central M40, Land at Overthorpe, Banbury, Northamptonshire: Geophysical survey

Cherwell District Council, 2007, *Grimsbury Conservation Area Appraisal*

Cherwell District Council, 2012, *Oxford Canal Conservation Area Appraisal*

Cherwell District Council, 2015, Cherwell Local Plan 2011-2031 [online] available at: https://www.cherwell.gov.uk/downloads/download/45/adopted-cherwell-local-plan-2011-2031-part-1-incorporating-policy-bicester-13-re-adopted-on-19-december-2016 [Accessed 20 October 2021]

Cherwell District Council. 2021 Planning Application - 20/02480/F. https://planningregister.cherwell.gov.uk/Planning/Display/20/02480/F. [Accessed 21 October 2021]

Chartered Institute for Archaeologists (CIfA), 2017, *Standard and guidance for historic environment desk-based assessment*

Colvin et al. 1972 "Banbury: Origins and growth of the town," in A History of the County of Oxford: Volume 10, Banbury Hundred, ed. Alan Crossley (London: Victoria County History, 1972), 18-28. British History Online: http://www.british-history.ac.uk/vch/oxon/vol10/pp18-28. [Accessed 20 October 2021]

Colvin et al, 1972 'Banbury: Introduction', in A History of the County of Oxford: Volume 10, Banbury Hundred, ed. Alan Crossley (London, 1972), pp. 5-18. British History Online: http://www.british-history.ac.uk/vch/oxon/vol10/pp5-18 [accessed 20 October 2021].

Highways Agency 2019 *Design Manual for Roads and Bridges* (DMRB), Volume 10, Section 5, LA 116 Cultural heritage asset management plans

Highways Agency 2020a *Design Manual for Roads and Bridges* (DMRB), Volume 11, Section 2, LA 104 Environmental assessment and monitoring

Highways Agency 2020b *Design Manual for Roads and Bridges* (DMRB), Volume 11, Section 3, LA 106 Cultural heritage assessment

Hall D.N. 2001 *Turning The Plough - Midland Open Fields: Landscape Character and Proposals for Management*

Hall, D, 1993, The open fields of Northamptonshire, the case for the preservation of ridge and furrow, Northamptonshire Heritage, Northampton

Historic England 2018 *Field Systems: Introductions to Heritage Assets.* Historic England. Swindon.

Historic England, 2008 *Conservation Principles, Polices and Guidance*

Historic England, 2015 *Management of research projects in the historic environment* (MoRPHE)

Historic England, 2015 *Managing Significance in Decision-Taking in the Historic Environment: Historic Environment Good Practice Advice in Planning: 2*

Historic England, 2017 *The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning Note 3 (Second Edition)*

Mott MacDonald 2021 *Technical Note Banbury STW. CHP System Upgrade*

National Planning Policy Framework, 2019 [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740441/National_Planning_Policy_Framework_web_accessible_version.pdf

Oxford Archaeological Unit. 1992. Archaeological Watching Brief at Echo Park II, Banbury.

Oxford Archaeology. 2002. Watching brief at Palmers Yard, Cherwell Warf, Banbury

Oxford Archaeology. 2012. Banbury Flood Alleviation Scheme. Post-excavation Assessment and Project Design

Oxford Archaeology. 2014. The Archaeology of Banbury Flood Alleviation Scheme, Oxfordshire. Oxford Archaeology Monograph No.21

South Northamptonshire Council. 2015. *Overthorpe Conservation Area Appraisal and Management Plan*

Thames Valley Archaeological Services. 2008, *Land at Spital Farm, Banbury, Oxfordshire: an archaeological desk-based assessment*

Thames Valley Archaeological Services. 2008, *Land at Spital Farm, Banbury, Oxfordshire: an archaeological evaluation*

Thames Valley Archaeological Services. 2014, *M40, Land at Overthorpe Road, Banbury, Northamptonshire: an archaeological evaluation*

Thames Valley Archaeological Services. 2015, *Central M40, Land at Overthorpe Road, Banbury, Phase 2 (Northamptonshire section): Geophysical survey*

Thames Valley Archaeological Services. 2015, *Central M40, Land at Overthorpe Road, Banbury, Phase 2, Northamptonshire section: An archaeological evaluation*

Thames Valley Archaeological Services. 2017, *Middle Iron Age Settlement, Central M40, Overthorpe Road, Banbury, Phase 2, Northamptonshire Section: An archaeological excavation*

Thames Valley Archaeological Services. 2019, Central M40, Phase 4, *Land at Overthorpe Road, Banbury, Northampton: An Archaeological Evaluation*

Thames Valley Archaeological Services. 2021, *Central M40, Land at Overthorpe Road, Banbury, Phase 4: Post Excavation Assessment.*

Thames Water, 2020 *Asset Management Asset Standard Section 1 of 1: Ecology and Heritage Screening Specification*

Watts, V, 2004, The Cambridge Dictionary of English Place-Names: Based on the Collections of the English Place-Name Society, Cambridge: Cambridge University Press

Wilson, D, 1992, Anglo-Saxon Paganism, London: Routledge

8.2 Cartographic sources

Bryants map of Northamptonshire 1827

Christopher Saxton's Map of Berkshire, Buckinghamshire and Oxfordshire 1574

Ordnance Survey Landline 1998

Ordnance Survey National Grid. SP44SE 1:10560 1955.

Ordnance Survey National Grid. SP44SE 1:10560 1968.

Ordnance Survey National Grid. SP44SE 1:2500 1973.

Ordnance Survey National Grid. SP44SE 1:2500 1978.

Ordnance Survey National Grid. SP44SE 1:2500 1994.

Ordnance Survey. County Series six-inch Northamptonshire LVIII. 1923

Ordnance Survey. County Series six-inch. Northamptonshire LVIII.SW. First Edition. 1883

Ordnance Survey. County Series six-inch. Northamptonshire LVIII.SW. Six inch. 1944

Ordnance Survey. County Series six-inch. Oxfordshire VI. First Edition. 1885

Ordnance Survey. County Series six-inch. Oxfordshire VI. Second Edition. 1900.

Speed's Map of Northamptonshire 1627

8.3 Digital and Online Resources

British Geological Survey, 2021 [online] available at: https://www.bgs.ac.uk/ [Accessed October 2021]

Historic England Aerial Archaeology Mapping Explorer: Aerial Archaeology Mapping Explorer (arcgis.com) [Accessed October 2021]

Magic Map, 2021 [online] available at: https://magic.defra.gov.uk/ [Accessed October 2021]

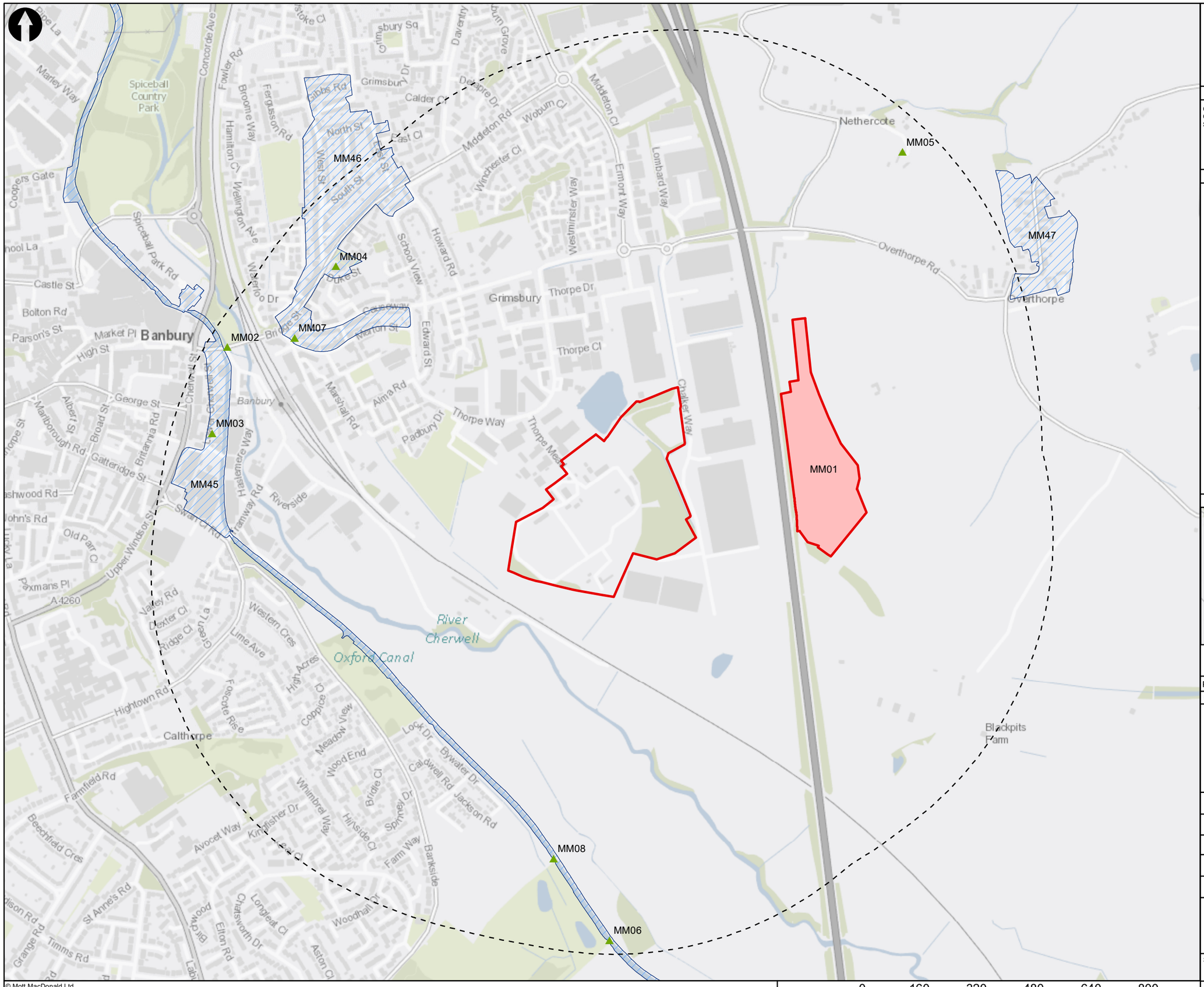
National Collection of Aerial Photography (NCAP) 2021. Available at: NCAP - National Collection of Aerial Photography | NCAP - National Collection of Aerial Photography [Accessed October 2021]

Open Domesday, 2021 [online] available at: https://opendomesday.org/ [Accessed October 2021]

Portable Antiquities Scheme, 2021 [online] available at: https://finds.org.uk/ [Accessed October 2021]

9 Appendices

A. Maps of heritage assets, archaeological investigations and finds



0 160 320 480 640 800 Metres

MOTT MACDONALD
Mott MacDonald House
8-10 Sydenham Road
Croydon, CR0 2EE
United Kingdom
T +44 (0)20 8774 2000
W mottmac.com

Notes

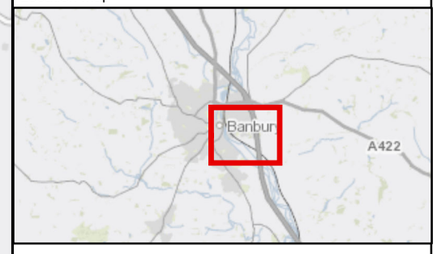
Legend

- Red line boundary
- Red line boundary - 1km study area

Designated Heritage

- Grade II Listed Building
- Scheduled Monument
- Conservation Area

Location Map



Rev	Status	Suitability description	Author	Ch'k'd	App'd	Date
P01	S1	FOR INFORMATION	MR	NC	RC	26/11/21

Thames Water Utilities

Clearwater Court
Vastern Road, Reading RG1 8DB

Location Code: N/A	OS Reference: 100019345	Security Reference: STD
Project Group: N/A	Sub Process: N/A	

Location/Town:
Thorpe Mead, Banbury, OX16 4RZ

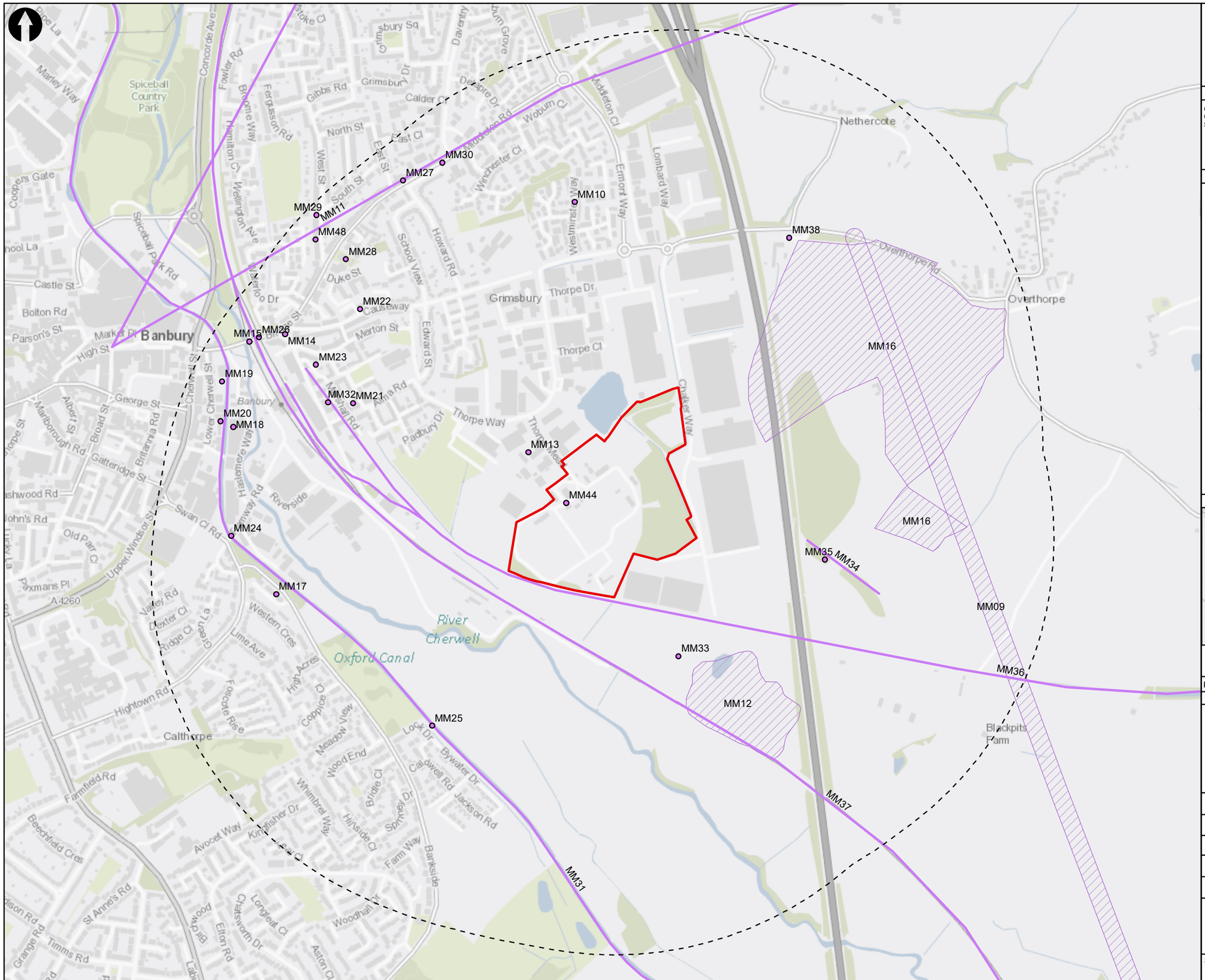
Site Name:
Banbury STW

Project Name:
J975 Banbury CHP Replacement

Title:
Banbury STW
Designated Heritage Assets

Scale:	Sheet Size:	Status:
1:10,000	A3	S1

Drawing Number:	Revision:
Figure 1	P01



MOTT MACDONALD

Mott MacDonald House
8-10 Sydenham Road
Croydon, CR0 2EE
United Kingdom
T +44 (0)20 8774 2000
W mottmac.com

Notes

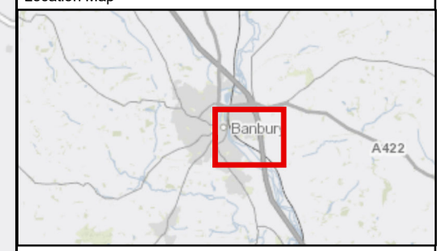
Legend

- Red line boundary
- Red line boundary - 1km study area

Non-Designated Heritage

- Non-Designated Points
- Non-Designated Lines
- Non-Designated Polygons

Location Map



Rev	Status	Suitability description	Author	Ch'k'd	App'd	Date
P01	S1	FOR INFORMATION	MR	NC	RC	26/11/21

Thames Water Utilities

Clearwater Court
Vastern Road, Reading RG1 8DB

Location Code: N/A	OS Reference: 100019345	Security Reference: STD
Project Group: N/A	Sub Process: N/A	

Location/Town:
Thorpe Mead, Banbury, OX16 4RZ

Site Name:
Banbury STW

Project Name:
J975 Banbury CHP Replacement

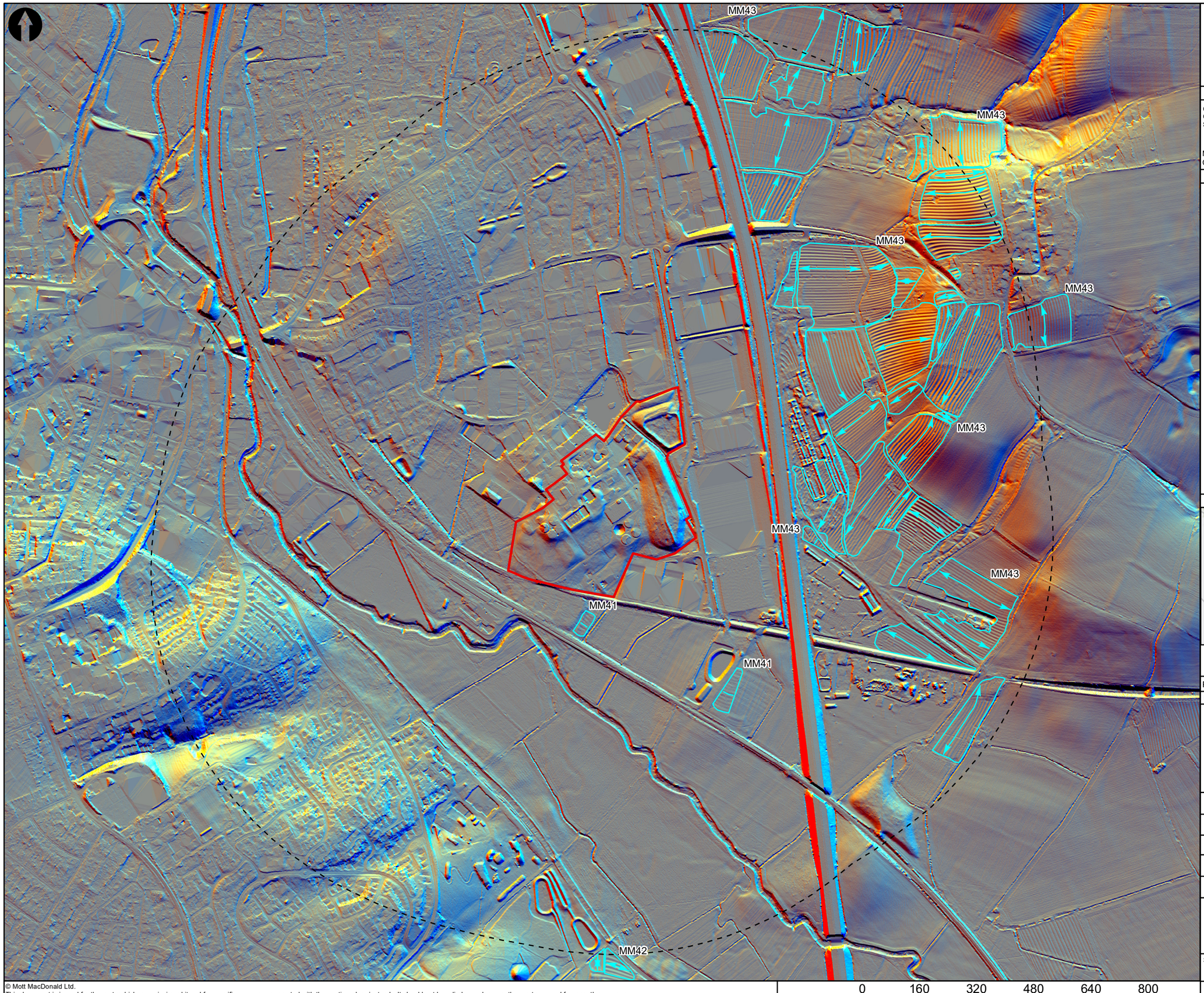
Title:
Banbury STW
Non-Designated Heritage Assets

Scale:	Sheet Size:	Status:
1:10,000	A3	S1

Drawing Number: Figure 2

Revision: P01

0 160 320 480 640 800 Metres



MOTT MACDONALD

Mott MacDonald House
8-10 Sydenham Road
Croydon, CR0 2EE
United Kingdom
T +44 (0)20 8774 2000
W mottmac.com

Notes

Multi-directional hillshade generated in RVT from EA Lidar Composite DTM Data 2020

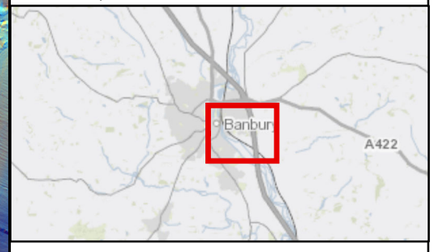
Legend

- Red line boundary
- Red line boundary - 1km study area

Remote Sensing Interpretation

- Extant Ridge and Furrow Direction
- Levelled Ridge and Furrow Direction
- Extant Ridge and Furrow Outline
- Levelled Ridge and Furrow Outline

Location Map



Rev	Status	Suitability description	Author	Ch'k'd	App'd	Date
P01	S1	FOR INFORMATION	MR	NC	RC	26/11/21

Thames Water Utilities

Clearwater Court
Vastern Road, Reading RG1 8DB

Location Code: N/A	OS Reference: 100019345	Security Reference: STD
Project Group: N/A	Sub Process: N/A	

Location/Town:
Thorpe Mead, Banbury, OX16 4RZ

Site Name:
Banbury STW

Project Name:
J975 Banbury CHP Replacement

Title:
Banbury STW
Lidar Transcription

Scale:	Sheet Size:	Status:
1:10,000	A3	S1

Drawing Number: Figure 3

Revision: P01

0 160 320 480 640 800 Metres

B. Gazetteers of designated and non-designated assets

MM no.	Name	HER no.	NHLE ID	Grade	Description	Period	Distance from Site boundary (m)
MM01	Former World War I National Filling Factory, Banbury	NHER: 7112/1	1409811	Scheduled Monument	Factory constructed in 1915-1916 to meet demand for ammunition for the First World War conflict. NFF Banbury was one of the earliest purpose built by the Ministry of Munitions and was known as NFF No.9.	Modern	280
MM02	BRIDGE OVER MILL STREAM		1046184	Grade II Listed Building	Remnants of medieval bridge. Part of the original 13th century bridge, now mainly obscured by the construction of a railway bridge in the C19. Limestone with pointed arches and ribs. Previously Banbury Bridge was noted as having 7 pointed arches, of which only the westernmost appear to survive.	Medieval	945
MM03	OLD TOWN HALL (CHAPMAN BROTHERS)		1199858	Grade II Listed Building	Town Hall, now warehouse. 1790, resited and rebuilt c.1860. Brick. Hipped slate roof. 2 storeys. Pedimented with 5-bay blocked arcade on ground floor. First floor has blocked semi-circular headed window. Roof has base of cupola. Old Town Hall was moved from Market Place to present site on canal c.1860.	Post-medieval	885
MM04	LAMPREY AND SON LIMITED AGRICULTURAL MERCHANTS, ST LEONARDS PRIMARY SCHOOL	OHER: 10761	1200124	Grade II Listed Building	School built 1860-1 by G.E. Street. Closed as school in 1955 and now functions as offices. Coursed squared limestone. Steeply pitched slate roof. Stone copings. Ornamental ridge tiles. Stone lateral stack. Main front facing Middleton Road: long rectangular range with 2 projecting wings to left, the other on the return of the right wing: pointed arched doorways with chamfered soffits, plank doors with wrought iron hinges. The wings have tall pointed arched 3-light windows with lancets, quatrefoils and cusped heads. Elsewhere windows are square headed. Attached rear range dated 1902 not of special architectural interest. Interior not inspected.	Post-medieval	835
MM05	HOME FARMHOUSE		1200143	Grade II Listed Building	Farmhouse, now house. C17 with later alterations. Regular coursed ironstone rubble. Fine jointing. Ironstone quoins. Ironstone copings with moulded kneelers. Steeply pitched slate roof.	Post-medieval	910
MM06	FOXES LIFT BRIDGE (171) AT SP 470 389 OXFORD CANAL		1249079	Grade II Listed Building	Accommodation lift-bridge. L C18 origins, C19 and C20 alterations. Tilting, wooden plank deck with wooden hand rails and two balance beams set at a raking angle. Brick abutments with concrete sills. Brick wing walls with trailing edges and stone rubbing blocks on faces to canal. One of an important series of Oxford Canal lift-bridges, of a type now rare in England.	Post-medieval	960

MM no.	Name	HER no.	NHLE ID	Grade	Description	Period	Distance from Site boundary (m)
MM07	ELEPHANT AND CASTLE HOTEL	OHER: 13918	1369549	Grade II Listed Building	House, now hotel and public house. Late C17/early C18. Regular coursed ironstone rubble. Steeply pitched slate roof. Ironstone copings to left and right. Ironstone quoins. Brick ridge and end stacks to right on rendered stone bases. 2 storeys plus attic. 3-window range. 3-unit plan. Central entrance has 4-centred arched doorway with chamfered soffit and jambs. C20 door. Doorway is flanked by C20 windows with chamfered wooden lintels. 3 similar renewed C20 windows to first floor have chamfered wooden lintels. 2 flat-roofed roof dormers. 2-storey extension to rear left: ironstone with slate roof. Plank door to left with wooden lintel. C20 windows to ground and first floor. Interior not inspected. Large red brick extension attached to the right is not of special architectural interest.	Post-medieval	805
MM08	OXFORD CANAL HAYNES LIFT BRIDGE (170) AT SP 469 391	NHER: 7112/1	1369563	Grade II Listed Building	Originally constructed in Late late 17th-early 18th century as a house. Functioned as a hotel and public house from 19th century until 2020, but now undergoing conversion to flats. Regular coursed ironstone rubble. Steeply pitched slate roof. Ironstone copings to left and right. Ironstone quoins. Brick ridge and end stacks to right on rendered stone bases. 2 storeys plus attic.	Post-medieval	750
MM45	Oxford Canal Conservation Area			Conservation Area	The Oxford Canal Conservation Area encompasses the route of the canal as it passes through the Cherwell District, with the addition of a small section that crosses into South Northamptonshire. In addition to preservation of the canal itself, the Conservation Area is concerned with the preservation of the architecture; related engineering installations and infrastructure; and the character of the immediate landscape along the length of the canal. Almost every structure directly or indirectly associated with the canal are of importance to the Conservation Area.	Post-medieval - Modern	430
MM46	Grimsbury Conservation Area			Conservation Area	19th century suburb of Banbury that was constructed by the Banbury Freehold Land Society. The development provided the working class with the opportunity for house ownership that would also enable voting rights. By providing the working class with voting rights, this in turn provided the potential for political reform. Architecturally, the area is in keeping with contemporary suburbs of the town. However, the importance of the Conservation Area derives from its significant contribution to the political history of Banbury.	Post-medieval	560

MM no.	Name	HER no.	NHLE ID	Grade	Description	Period	Distance from Site boundary (m)
MM47	Overthorpe Conservation Area			Conservation Area	The Overthorpe Conservation Area was designated in 1978 and encompasses the historic core of Overthorpe village. The village contains distinctive characteristics of architecture, construction and layout, and includes multiple Grade II listed buildings. The Conservation Area seeks to protect the distinctive characteristics of the village and closed and intimate views within the historic part of the village.	Post-medieval	960

Source: Historic England NHLE 2021; Oxfordshire HER 2021 (OHER); Northamptonshire HER 2021 (NHER)

MM no.	Name	HER no.	Type	Description	Period	Distance from Site boundary (m)
MM09	The Portway	NHER:55/1	Monument	Prehistoric to medieval trackway. Although a Roman road known as the Port Way is alleged to have run north-west from Akeman Street at Kirtlington in Oxon. There is no real proof that this was a Roman road and if it was then it is likely to have been a minor one.	Prehistoric - Medieval	580
MM10	Mesolithic Flints	OHER:15632	Find Spot	A number of blades or flakes, a scraper and a microlith. Found at Nethercote and now in Banbury Museum.	Mesolithic	585
MM11	The Jurassic Way	NHER:195	Monument	The Jurassic Way is a corridor for traffic, rather than a single track, that dates at least from the Early Bronze Age and may well have begun in the Neolithic. It is in the Early Iron Age, however, that it becomes clearly defined as a line of movement between the culturally progressive centres of Yorkshire and Somerset, the most likely course being the junction of the lias and the oolite.	Prehistoric	865
MM12	Iron Age settlement, Overthorpe Road	NHER:1549/1	Monument	Multiple phases of archaeological investigation has identified an extensive settlement, of which nearly 6ha has been excavated. Excavation has revealed settlement dating between the middle to late Iron Age and comprising ditched enclosures and roundhouses. A poorly preserved crouched inhumation was also found.	Iron Age	300

MM no.	Name	HER no.	Type	Description	Period	Distance from Site boundary (m)
MM13	Site of St Leonard's Hospital for Lepers	OHER:1794	Monument	Medieval leper hospital. Recorded as standing near the east end of Banbury Bridge in 1319. Exact location is unknown. Possible sites are considered to be the site of Elephant and Castle Hotel and the site of the Spital Farm farm buildings. The hospital had ceased to exist before the Dissolution. Its earliest reference is in 1265 when Henry III gave protection to the infirm brethren. In 1376 lands were given to the Hospital and thus came into existence the Spital Farm.	Medieval	95
MM14	Site of Medieval Hermitage	OHER:1803	Monument	Located at the foot of the bridge; first mentioned in 1531 but its exact site is not known. Well defined on a map of 1694 as the Armitage. Now built over.	Medieval	835
MM15	Site of Medieval Bridge Gate	OHER:1815	Monument	Although the town of Banbury was never walled, the Bishop of Lincoln in the C12th built five gates denoting the area of his manor. According to Stukely only three remained in 1712, and all of these had been rebuilt.	Medieval	900
MM16	Open Fields Project: Areas of Survival of Ridge & Furrow	NHER: 9/0/1	Monument	Extensive areas of ridge and furrow recorded from aerial survey and landscape survey.	Medieval	190
MM17	Site of Brickworks	OHER:94	Monument	Brickworks shown on 1885 edition 1:2500 OS map, now under modern housing estate	Post-medieval	655
MM18	Site of Canal Wharf	OHER99	Monument	Canal wharf, shown on 1885 1:2500 OS mapping. No longer extant.	Post-medieval	835
MM19	Site of Lime Kilns	OHER:101	Monument	Lime kilns visible on 1885 1:2500 OS mapping. No longer extant.	Post-medieval	910
MM20	Canal Wharf, Lower Cherwell Street	OHER:102	Monument	Victorian brick-built wharf building with ephemeral traces of other buildings	Post-medieval	875
MM21	Gas Works	OHER:114	Monument	Gas works constructed in 1854 to replace earlier works alongside Oxford Canal. Plant closed in 1958 and was demolished by 2004.	Post-medieval	565
MM22	Site of Brickworks	OHER:115	Monument	Brickworks shown in 1885 Ordnance Survey mapping. No longer present.	Post-medieval	705
MM23	Banbury Merton Street Station	OHER:117	Monument	Opened June 1850 terminus of Bucks Railway branch from Verney Junction. Closed in early 1960's.	Post-medieval	710
MM24	Canal Bridge No 168	OHER:4317	Monument	Canal bridge on Oxford Canal shown on Ordnance Survey mapping from 1883-1955, but no longer extant	Post-medieval	780

MM no.	Name	HER no.	Type	Description	Period	Distance from Site boundary (m)
MM25	Canal Swing Bridge No 169	OHER:4318	Monument	Swing bridge shown in Ordnance Survey mapping, but no longer extant.	Post-medieval	485
MM26	Site of Toll House, Banbury Bridge	OHER:10151	Monument	Early 19th century toll house shown on Bryant map of 1823. Erected by the Banbury to Drayton Trust on the Brackley to Banbury route. Evidenced by turnpike records.	Post-medieval	885
MM27	Site of Toll House, Middleton Road	OHER:10312	Monument	19th century toll house erected by the Banbury to Drayton trust on the Brackley to Banbury route. Shown on 1" Old Series OS Map.	Post-medieval	890
MM28	St Leonard's Church	OHER:10497	Building	Church built c. 1909.	Modern	825
MM29	Methodist Chapel, West Street	OHER:10499	Building	Late 19th century chapel. Foundation stone dated 1871. Massive preaching auditorium with other extensive premises. Building very symmetrical. Façade at gable end.	Post-medieval	970
MM30	Site of Toll House, Banbury Lane, Grimsbury	OHER:11266	Monument	19th century toll house. Erected by Buckingham, Brackley & Banbury Trust on the Brackley to Banbury route. One of two tollhouse sites situated near each other on the Middleton Road.	Post-medieval	860
MM31	Oxford Canal	OHER:16429	Monument	Canal designed by James Brindley and opened in sections between 1774 and 1790 with the purpose of bringing coal from the Coventry coalfields to Oxford and the River Thames.	Post-medieval	440
MM32	Railway siding	OHER: 16734	Monument	Railway siding shown on Ordnance Survey 2nd edition 6 inch mapping. 1898	Post-medieval	625
MM33	Linear features	OHER: 29536	Monument	One post medieval and several undated linear features identified by evaluation (TVAS. 2019. Central M40 Phase 4, Land at Overthorpe Road, Banbury, Northamptonshire: An Archaeological Evaluation.)	Post-medieval	245
MM34	Possible Tramway	NHER:7112/0/10	Monument	A complex of earthwork and structural remains that possibly represent the remains of a tramway.	Modern	310
MM35	Factory Sheds	NHER:7112/0/5	Monument	Multiple sheds to south of the First World War filling factory. Sheds were connected by a hand-propelled tramway.	Modern	365
MM36	London & North Western Railway	NHER: 6296, 6296/1 OHER:8933	Monument	Railway line opened in 1850 and closed to passengers in 1960. Line was used for transportation of cattle until full closure in 1966. Tracks were dismantled in 1967, although railway cutting and embankments survive to the present.	Post-medieval	230
MM37	Great Western Railway (Oxford to Banbury)	NHER: 6719/1 OHER: 8933	Monument	Railway line constructed in 1850 and still operational in the present.	Post-medieval	340

MM no.	Name	HER no.	Type	Description	Period	Distance from Site boundary (m)
MM38	The Bowling Green Public House	NHER: 7112/0/2	Building	Farmhouse. Formerly the Bowling Green Public House, now private residence.	Post-medieval	520
MM39	Side Scraper	PAS: BERK-803364 (PAS)	Find spot	Side-scraper made on a secondary flake, possibly dating to the late Mesolithic / early Neolithic periods. The scraper was found in the middle on a driveway and is likely to have been recently deposited, possibly from gravel. Precise location unknown	Mesolithic-Neolithic	Unknown
MM40	Early medieval strap end	PAS: LANCUM-045F05	Find spot	A copper-alloy strap end of Early Medieval date. Precise location not known.	Early medieval	Unknown
MM41	Ridge and furrow	-	Ridge and furrow	Ridge and furrow visible in Environment Agency 2020 Lidar DTM data	Medieval	50
MM42	Ridge and furrow	-	Ridge and furrow	Ridge and furrow visible in Environment Agency 2020 Lidar DTM data	Medieval	990
MM43	Ridge and furrow	NHER: 9/0/1	Ridge and furrow	Extensive ridge and furrow in the fields west of Overthorpe and Nethercote. Visible in Environment Agency 2020 Lidar DTM data	Medieval	315
MM44	Isolation Hospital	-	Monument	Isolation hospital shown in 1923 Ordnance Survey mapping (County Series six-inch Northamptonshire LVIII), but no longer shown by 1944. Location now under Banbury STW. Possibly a temporary structure.	Modern	Within

Source: Oxfordshire HER 2021 (OHER), Northamptonshire HER 2021 (NHER), Portable Antiquities Scheme 2021 (PAS)

C. Scheme Details

MMB
MOTT MACDONALD
BENTLEY

Technical Note
Banbury STW

CHP System Upgrade

04th May 2021

Mott MacDonald Bentley
Bank House
27 King Street
Leeds LS1 2HL
United Kingdom

T +44 (0)113 426 8563
mottmacbentley.co.uk

Technical Note
Banbury STW

CHP System Upgrade

27th May 2021

Issue and Revision Record

Revision	Date	Originators	Checker	Approver	Description
P01	27/05/2021	Betty Solomon-Assefa Tanbir Ahmed Nick Madeley Ralf Sims Paul Johnson Glenn Dennes	Chris Bolton David Johnson	Zoe Kevanhu	

Document reference: P0065 |

Information class: Standard

Contents

Executive summary

This document has been prepared to support the tender submission for Banbury STW CHP Replacement, scheme reference P0065, solution number S28896, and is expected to be included as contract data. The purpose of this document is to provide a supporting explanation to the bid submission and to give further detail as to where Mott MacDonald Bentley (MMB) can add value to Thames Water through this project.

Site address: Banbury STW, Thorpe industrial Estate, Thorpe Mead, Banbury, Oxfordshire OX16 4RZ.

The need for this project has arisen to replace the existing CHP plant as well as out of specification gas equipment in order to bring aging assets up to the correct current standards.

In summary the scheme involves;

1. Civil modifications to the new CHP Engine location including road modifications and modifications to site drainage
2. New containerised CHP Engine
3. New Biogas Booster
4. New Siloxane Filter
5. New Biogas Dehumidifier
6. New Biogas Analyser
7. New CHP Exhaust Stack
8. New interconnecting biogas pipework between existing gas system, CHP and associated gas system components
9. New Condensate Pots
10. Modifications to existing hot water system
11. New CHP clean and waste lube oil tanks and interconnecting pipework
12. New CHP System MCC
13. New CHP MCC Kiosk
14. Modifications to the site Main Intake LV Switchboard to enable it to accept power from the CHP
15. Decommissioning of the existing CHP Engine

1. Proposed Solution

1.1 Asset Standards

To comply fully with the client's requirements for the site and new installation, the following current Thames Water Specifications listed below have been adhered to and used to inform the design:

Table 1 Thames Water Specifications

Standard / Specification	Date	Ver.
AM-DES-WWT-WWT 10.1 Biogas Handling, Storage & Utilisation-SEC2	05/20	2.0
AM-DES-MEC-F23 M133 Waste Gas Burner – Ground Flare	05/15	3.0
AM-DES-MEC-F23 M134 Waste Gas Burner Flare Stack	04/14	2.0
AM-DES-MEC-F23 M135 Combined Heat & Power Equipment	01/21	2.0
AM-DES-MEC-F23 M147 Mechanical Pipework Systems	09/15	2.0
AM-DES-MEC-F23 M148 Valves	04/15	2.4
AM-DES-MEC-F23 M153 Standpipes	04/14	2.0
AM-DES-MEC-F23 M185 Hoist, Runway Beams & Davits	05/14	2.0
AM-DES-MEC F23 M200 Access Platforms, Ladders, Stairs	05/14	2.0
AM-DES-MEC-F23 M205 Cabinets and Kiosks	04/14	2.0
AM-DES-MEC F23 M400 Pumps General Clauses	04/19	3.0
F15 – Part 00 Electrical Specification for Low Voltage	03/09	3.1
F15 – Part 02 Electrical installations	03/09	3.1
F15 – Part 04 Package Plant	03/09	3.1
F15 – Part 08 VSD's	03/09	3.1
F15 – Part 10 Plant and Feed Mounted Equipment	03/09	3.1
AM-DES-ELE-F25 HV Specification	01/21	5.0
AM-DES-SCADA-F24 (SEC01-SEC12)		
AM-DES-CIV-C01-SEC1 of 1 - Civil Design Standard	12/15	1.0
AM-PRO-FIRE-C197 - Alarm & Detection Systems	11/13	2.0
STDS-CI-02002-B	08/09	B
STDS-CI-02001-B	08/09	B

1.2 Process Basis of Design

Following communications with Thames Water, MMB have been instructed to bid for the Banbury CHP works and gas works based on a 425kWe CHP engine. The closest matching engine from Edina is a 500kWe engine; the supplier has proposed to supply this standard size and tune the installation to suit our requirements.

1.3 Civil and Structural

It is assumed that existing services on site are located according to the following service drawings provided by Thames Water:

- "Banbury STW SERV Services Plan'' (from 'Asset Doc document archive)
- 1L9G-A1-02020-B.dwg

Topographical survey data has been provided by Thames Water as follows:

- 01464RevA

The dimensions and locations of existing structures have been taken from the following drawings provided by Thames Water:

- "Banbury STW SERV Services Plan'' (from 'Asset Doc' document archive)
- GG522C Banbury STW Sludge Treatment BH's 1 to 7
- 1L9G-A1-02020-B.dwg

1.3.1 Civils Summary

The area for the proposed CHP plant is located adjacent to Secondary Digester No. 1 and on the opposite side of the road to the existing CHP. Further details are provided in the site layout Appendix A.

The main civil slabs and structures that are required include:

Table 2 Civil Slab Summary

	Dimensions (m)	Thick (mm)	Area m^2	Volume m^3
Main CHP Slab	10 x 25	300	250	75
Condensate Pot Slab (5No.)	3 x 2	250	30 (total)	7.5 (total)
Layby for CHP	-	150	130	19.5
Pipework Support Plinths (16No.)	0.85 x 0.85	425	11.56 (total)	4.91 (total)
Total			421.56m^2	106.91m^3

In addition to the above, new signage for site roads as well as 25m of ARMCO barrier will be installed for protection of 4nr pipe bridge bases, the MCC kiosk and filter. For new condensate pots on the gas pipework to the individual digesters and new CHP, new bases are included, however where the existing condensate pot is to be replaced it is anticipated that the existing civil base will be re-used.

A length of 150m of ducts, with each run consisting of 3nr 150mm diameter ducts, and 17 draw pits will be installed throughout the new area and provide a power connection to the existing switchboard building.

The land adjacent to the North fence line will be landscaped to ensure biodiversity criteria are met.

1.3.2 Surface Water and Drainage

Surface Water

The key source of surface water from our development is the rainwater across the new CHP slab and layby. It has been assumed that this runoff can be returned to the head of works via the existing Return Liquors Pumping Station (RLPS), and that we can connect into the existing feed pipework. Thames Water operations have commented that the RLPS is a capacity pinch point and a critical asset. Therefore, 2 orifice plates have been included to restrict the surface water flows entering the existing drainage at a new manhole. After which, the flows can be returned to the RLPS at a time when it is manageable.

As recommended in Sewers for Adoption, underground drainage pipes have been designed under full conditions and in accordance with the CIRIA SuDS Manual. To protect from flooding, design rainfall has been increased to a 1 in 100-year return period with climate change allowance.

Using these parameters, and the method in BRE Digest 365 on soakaway design, a design rainfall of 34.5mm/hr has been calculated for Banbury town. A rainfall event of 30-minute duration has been used.

Total runoff rate from the new 380m^2 hardstanding area is 3.64l/s. Attenuation of 6.56m^3 is required to store this flow during the storm event, prior to it being pumped back to the head works. Two manholes of 1.5m diameter and 2m depth provide this attenuation.

In summary, to manage the surface runoff due to the proposed increase in impermeable area at Banbury STW, the following items are required:

- 18m length of 100mm diameter drain pipework.
- 2 number standard road gullies
- 2 number manholes of 1.5m diameter and 2m depth
- 2 number orifice plate to suit the 100mm diameter drains
- Reinstatement of the existing manhole
- An oil interceptor

Condensate

Condensate from new condensate pots and swan neck condensate traps will require a new drainage system. It is currently proposed that condensate will drain via new pipework to an existing manhole situated adjacent to the existing secondary digesters.

To summarise, the condensate drainage will consist of:

- 165m length of 100mm diameter drain pipework
- 8no. standard road gullies
- 5no. manholes of 1.2m diameter and 1m depth.

The figure below depicts the proposed surface water and drainage arrangement envisaged.

Figure 1 Proposed drainage

1.4 Geo-environmental

1.4.1 Geotechnical

The existing ground conditions are assumed from the geotechnical information reports provided by Thames Water as follows:

- "GG522A Banbury STW Stage II.pdf"
- "Appendix L - Banbury Ground Investigation.pdf".

Bore hole 522A/2 is the closest to the new CHP area of works, situated adjacent to the substation. From the borehole data it has been assumed that the ground conditions broadly comprise 0.5m of stone chippings and cobbles, over 2.4m of stiff silty clay, over 5.1m of clay increasing in stiffness with depth.

At bore hole 522A/2 ground level was recorded at 95.05m AOD. Groundwater was found standing at a depth of 5m. At the proposed CHP location ground level was recorded at 92.5m AOD. Maximum excavation will be to a depth of 2m, therefore it is assumed that Groundwater is not likely to be a significant risk to the proposed works.

The total excavation required across the site is anticipated to be 675mm, comprising 300mm for stone sub-base, 75mm for blinding and 300mm for structural concrete. Deeper excavations are required for the drainage manholes, draw pits and MCC trench. This means that we estimate that we'll be founding our new structures on the stiff clay layer which will provide sufficient bearing capacity without the need for piling; the ground should be able to support all new equipment with stone sub-base of circa 300mm thickness, plus removal of any soft spots.

From the historical drawings provided by Thames Water it is shown that there was formerly a digester in the northern part of the area proposed for construction of the new CHP. There is

therefore a risk that excessive fill material will be encountered which will need to be dug out and replaced with compacted stone.

1.4.2 Contamination

Borehole Ground Investigation reports are present in historical data however none were taken in the area of our new CHP slab. A Ground Investigation is required including WAC test on commencement of the project to identify any issues with the ground make up. It is also worth noting that the proposed CHP slab is located on an area of grassland where a previous digester was situated.

For topsoil, it is expected that the majority will be able to be retained on site in similar locations. The cobbles / chippings layer and any made ground will be excavated for the new slab and it is assumed that we will backfill around new structures with suitable arising material. Any surplus will be disposed of offsite. No material will need to be imported for the purposes of landscaping. Due to the former digester in the construction location it is anticipated there will be some material that will be hazardous within the material disposed offsite.

1.4.3 Ecology & Environment

No formal ecological appraisal has been issued to MMB however various constraints have been communicated during the site visits and progress meetings for the scheme, and appropriate mitigation is assumed to be required. Our Environmental Impact Assessment will compromise of a report covering the following environmental points:

- A small amount of vegetation removal will be required for construction of the new CHP unit and associated ancillaries.
- There is potential for archaeological finds in the area in general however at the present time it is assumed that no further work will be required to determine potential of Archaeological finds of importance within construction areas.
- A Preliminary Ecological Assessment will be conducted to obtain an understanding and provide an assessment of potential breeding birds, reptiles, bats, invasive species, badgers and Newts. To the north of the treatment works there is an existing fishing lagoon which will provide a habitat for newts. MMB will ensure that construction activities safeguard runoff to this lagoon. Similarly, there is 1No.Trees to the north of the site boundary which will be adjacent to our new site compound and temporary road. This is a potential location for roosting bats and an understanding of whether any Tree Protection Order's exist will need to be made.
- Biodiversity net gain – This has not yet been assessed by Thames Water or MMB and would need to be carried out as per the standard for Thames Water. This would require the Defra metric to be used and associated conversations with Thames Water Ops / biodiversity to ensure the works are carried out in such a way to minimise impacts and ensure that any enhancements are located in areas that do not affect the working of the sites. Any enhancement will need to be in addition to the 5% already committed to on the SBI areas.

1.4.4 Third Party Permits and Approvals

- Environmental Permitting Regulations (EPR)

  There are no current EPR permits in place for the site to cover the existing CHP. An initial assessment will need to be carried out to determine the full requirements of obtaining any permits under EPR. In particular, the Medium Combustion Plant Directive (MCPD) applies for 'combustion plants with a rated thermal input equal to or greater than 1 MW…'; our estimated thermal input to the new CHP plant is approximately 1.2MW (biogas calorific value 24,287

kJ/m^3, gas flow rate 185Nm^3/hr, CHP fuel energy value 1248kJ/s (kW)). Therefore it is envisaged that an MCPD permit is required.

There are 3No. existing boilers, which can run on both natural and biogas with rated outputs of 428kW (x2) and 1250kW, that emit exhaust gases via their own existing exhaust stack. It is unclear whether the permits required under EPR will also be required to encompass the existing boilers until the initial EPR assessment is completed. Any EPR permits may require encompassing these existing boilers and stack which could present delays to the design and construction programme.

Figure 2 Existing Boiler exhaust stack

- Local Authority (LA) Planning

  A new CHP exhaust stack is required to successfully vent the exhaust gasses emitted from the new CHP engine. Air Dispersion modelling to determine optimum stack height will be completed to determine this output – the results of which will be utilised for any LA planning approvals. Depending on the sensitivity of local receptors in the vicinity of the site, alternative pollutant management devices may need to be considered if the exhaust stack or stack height is rejected by the LA.

  The existing Boiler exhaust stack will not be considered under any LA planning applications.

1.5 Mechanical Systems

Please refer to the Site Layout (Appendix A) and P&IDs (Appendix B & C) for a representation of the proposed M&E system.

Key mechanical equipment further to the CHP system are listed in the table below.

Table 3 Key Mechanical Equipment & Design Parameters

- CHP Unit
  - 1No. Containerised CHP Unit with integrated stack – c.500kWe
- Oil Tanks
  - Clean Oil Tank – 2000L
  - Waste Oil Tank – 2000L

- Gas Equipment (dedicated to new CHP)
  - 1No. Dehumidifier Unit
  - 1No. Gas Analyser
  - 1No. Siloxane Filter
  - 1No. fixed speed Gas Booster

  – Gas flows from 90 to 185Nm^3/hr
- Existing Hot Water System
  - Modifications as required to accommodate new CHP
- Biogas Pipework
  - Condensate Pots on discharge of each Digester – 4No.
  - Replacement Condensate Pot on common Digester Outlet – 1No.
  - New “Pre CHP” Condensate Pot – 1No.
  - Pressure Vacuum Valve (replacement for existing Glycol filled PRVs on Gas Holder) – 1No.
  - Modifications to pipework in the vicinity of the Biogas Holder – 1 No.

The remainder of the existing biogas system will remain as it is now, i.e:

- DN150 pipework between digesters and the common manifold
- DN250 common manifold (i.e. the pipework between the individual DN150 digester connections and the gas holder)
- 1350m^3 gas holder
- No slam shut on gas holder
- No condensate pots to drain gas holder slab (instead this will remain as it is now, drained via DN50 “swan neck” pipes
- No drainage to biogas holder valve pit
- No connection to site drainage to common digester condensate pot
- 200Nm^3/hr single stage (i.e. on/off) waste gas burner
- 3 No. “dual fuel” boilers
- Duty/assist biogas boosters supply gas to boilers and waste gas burner
- Below ground biogas pipework between boosters, boilers and waste gas burner

1.6 Electrical

A new electrical installation for power and control of the new M&E equipment will include a new MCC with PLC and HMI. This MCC will be housed within a GRP kiosk. No generator incomer will be provided.

The main incomer switchboard MCC (located near the site main entrance) will provide the connection point for the new CHP load generation. We have currently priced for a LV solution. An additional 1000A ACB extension tier will be added to this MCC. Modifications to the existing MCC will require a panel assessment by the manufacturer Blackburn Starling to ensure it is fit for purpose and that modifications can take place and certified.

The CHP will not be able to run in “island mode”.

The existing Digester P/VRVs which are fitted with switches to detect operation will be wired to site SCADA via the new CHP MCC PLC.

A new fibre optic Ethernet network will be provided between the site SCADA workstation, the existing Digester MCC/PLC and the new CHP MCC/PLC. Other existing legacy PLCs on the site will continue to communicate with each other and with site SCADA via the existing DH+ network. No existing PLC will be changed.

The existing telemetry outstation will be utilised, with additional points as required for new equipment.

2 Project Risks & Opportunities

2.1 Opportunities

From our experience, we believe that there are multiple opportunities that may reduce the scope of works, associated cost and still ensure compliance with the requirements of the project brief. Refer to the opportunities register is Appendix E.

2.2 Risks

The full table of risks associated with project can be seen in Appendix F. These include design, environmental & ecology, construction & commissioning and procurement risks.

2.3 Further Clarifications

Several technical queries were logged during the tender process and we acknowledge the responses provided by Thames Water up to and including those of 6th April 2021.

Further meetings to highlight nonconformities in the existing Biogas system have taken place on the 8th of April 2021 (Biogas conformities meeting) and 9th April (Bio Gas Production & Waivers Agreements). This has resulted in Thames Water adding to the initial Biogas system scope.

Technical Queries TWEXnet link:

https://twexnet.withbc.com/bc/next.cgi/d224900289/J975.01-JE-BANBS1ZZ-100-TQ-ZD-0035.xlsx

3 Key Interfaces & Existing Asset Condition

This section covers how the project will interface with existing operational assets at Banbury STW.

At the start of the project, we will review these existing conditions with Thames Water and send specialist staff to undertake our own site observations and assessments to confirm the above, plus identify if any intrusive surveys are required. We are not aware of any other projects at the works or planned site activities to improve the condition of existing assets.

MMB will endeavour to return the site to its pre-existing condition; this will include removal and disposal of redundant equipment and materials where necessary.

3.1 Electrical Infrastructure

The new MCC will be powered from the existing LV Switchboard on site. Export load from the CHP will be connected via the LV Switchboard. Modifications to the LV Switchboard are required.

3.2 System Architecture

SCADA

The SCADA is currently a Wonderware 2012 version which will be retained as part of the scheme. Mimics from our new MCC HMI will be integrated onto this SCADA system.

Telemetry

Our new installation will utilise the existing RTU12 Telemetry Outstation PLC. It is assumed that sufficient IO exist for all our new desired signals. Remote monitoring of EICA equipment will be possible via this outstation.

Communication Network

A new ethernet connection will be provided from the existing SCADA to the Digester PLC RTU3 to allow communication via ethernet. Network Node Boxes shall be installed with a fibre patch panel where required if the route of the new ethernet line crosses buildings housing other PLC's.

3.3 Civils

Site roads – A new layby is shown in the figure below, adjacent to the road which gives access to the boiler house. This will be suitable for a HiAB and provide improvements to the south-west

corner of the existing road. No further permanent changes are proposed to the remaining site roads.

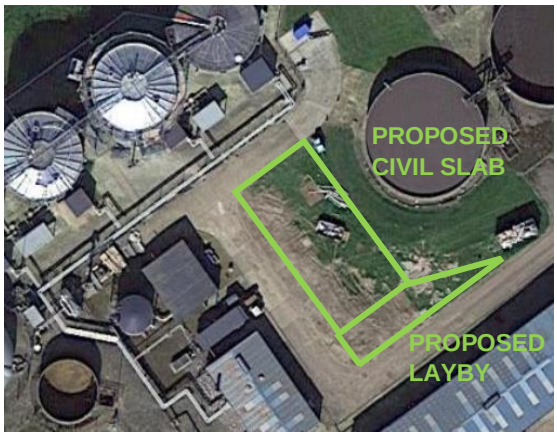


Figure 3 Site Road Interface

- **Drainage** – It is proposed to connect the surface water drainage, for the new CHP main slab and adjacent layby, to the existing drainage. The main slab will be built over the existing drainage manhole shown below, and the interface will be further downstream along the foul line. This line feeds into the return liquor pumping station before being returned to the head of works. It is anticipated that some repair works are likely to be required to the existing manhole.

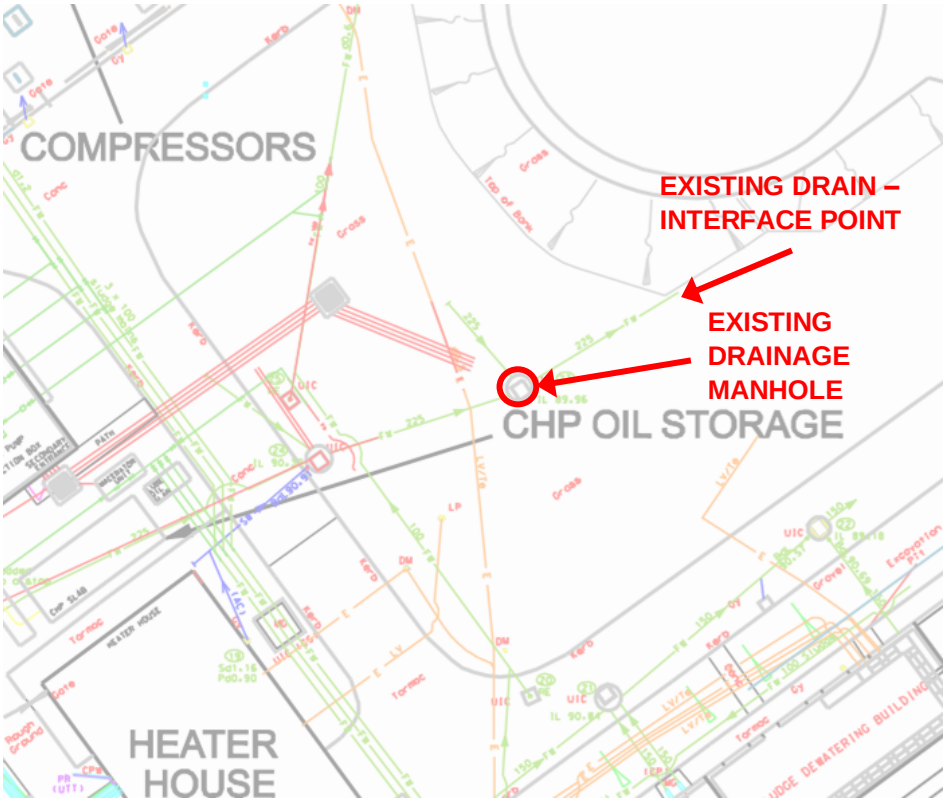


Figure 4 - Drainage Interface

It is proposed that the condensate drainage system will connect to the existing interception chambers as depicted to the north-east of the secondary digester in the figure below. It is

assumed that these chambers are connected to the RLPS where condensate will be returned to the head of the works.

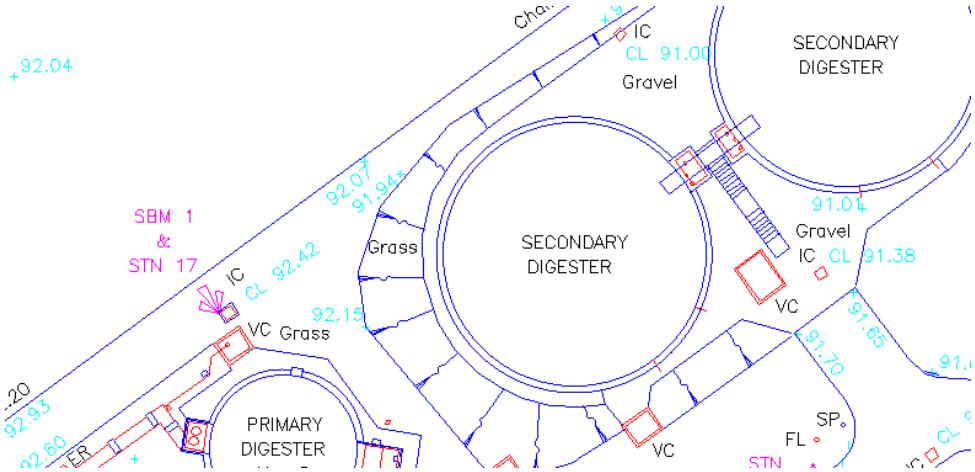


Figure 5 Existing interception chambers adjacent to the existing secondary digesters

- **Site Compound Services –** Local service connections are required for the site establishment and will be made at the start of the project. These are likely to include power, potable water and wastewater. MMB have been advised by Thames Water that existing connections will be available for potable water and power in the proposed compound location.
- **Diversion of buried services –** It is anticipated that services present in the area of works will be diverted. This includes fibre optic cable, foul sewer and earthing nest service diversions. However, the existing 225mm drainage pipe which runs to the RLPS will not be diverted.

3.4 Mechanical

Existing assets currently on site which are being scheduled for re-use and interface with, as part of this new project. These items of equipment include;

- **Biogas** – The biogas supply to the new CHP shall be made via 2No. Tee piece sections on the existing DN250 biogas pipework. This will be pre and post the existing Gas Holder**.**

Figure 6 Pre Gas Holder Pipework where 1No. new Tee piece CHP biogas feed will be installed

Figure 7 Existing DN150 CHP Biogas pipework to be removed

- **CHP Exhaust Gas** – The new containerised CHP shall expel all exhaust gas via a new exhaust stack. Currently this is integral to the existing CHP container however this will be reviewed with respect to any planning requirements.

Figure 8 Existing containerised CHP with exhaust stack and air intake vent which will be removed. Hot water pipes to top right elevation will be redirected to the new CHP area via a new pipe bridge.

- **Existing Boiler System** – New replacement water recirculation pumps will be installed which will interphase with existing boiler pipework.

Figure 9 Existing water recirculation pumps to be replaced

- **Condensate Pots -** Each Digester to Gas Holder DN150 pipework leg will have 1 No. new condensate pots installed. These will tie into the pipework prior to the expansion to DN250.

  The existing condensate pot on the DN250 Gas Holder pipework feed will be replaced with new. All existing SS pipework where possible to be retained.

Figure 10 DN150 Digester outlet pipework where condensate pots are proposed for installation.

Figure 11 Existing condensate pot to be replaced.

- **Pressure Vacuum Relief Valve (P/VRV) -** The existing glycol filled P/VRV will be removed and a new installed. This will tie into the existing DN250 pipework before the Gas Holder.

Figure 12 Existing P/VRV to be removed on Gas Holder feed pipework.

Please refer to Appendix B for the existing Gas System P&ID.

3.5 Demolition

The existing CHP plant will be decommissioned and removed from site. Any telemetry alarms will be made redundant or transferred to the MCC ICA section. The existing slabs will be left redundant and untouched unless any services are required to be diverted beneath them.

Figure 13 Existing CHP Plant

4 Construction Philosophy

4.1 General

There will be a high level of engagement with operations required throughout the construction phase where any process tie-ins are required, service diversions needed and any isolation requirements. Regular progress updates will be planned with the local Operational team and project team to ensure these works are planned, interrogated, and signed off prior to commencement.

Currently to facilitate the above works the construction programme including process commissioning is circa 40weeks, however, this will be re-fined during design as more detail becomes available from the sub-contract elements.

To expedite installation, it is envisaged that M&E equipment is procured and manufactured so that it can be installed in a phased sequence once civil infrastructure has reached a point to accommodate. We have assumed that sub-contractors will commit to a ‘design only’ contract award to provide initial design details for acceptance by Thames Water at Stage Gate 3, following which the normal manufacturing period for equipment has been assumed although this is yet to be confirmed by suppliers.

There will be an extensive cable duct and draw chamber installation as part of the project, this is required to facilitate the new electrical connection from proposed CHP engine location to the TW Low Voltage (LV) switch room. There will also be a period of site disruption due to the need of crossing the main site access road in front of the automated site gate. This disruption will try to be minimised as much as possible with measures such as weekend working, safe digging techniques (vac-ex/air lance) and also potentially re-routing site traffic around proposed temporary ‘construction site’ access road for a small period of time.

To facilitate the connection of the new CHP compartment onto the existing site LV switchboard busbars there will be a requirement for a site outage. This outage will be kept to a minimum but anticipated to be no less than 4hrs. An additional outage will be required within the design phase to survey the existing busbar configuration to enable manufacture.

We envisage offline installation of the new CHP equipment including CHP engine, siloxane filters, blowers and all other associated ancillary equipment once the civil phase has been completed and deemed ready to accept these items. New gas pipework will be installed offline, until planned shutdowns allow connection to our new equipment.

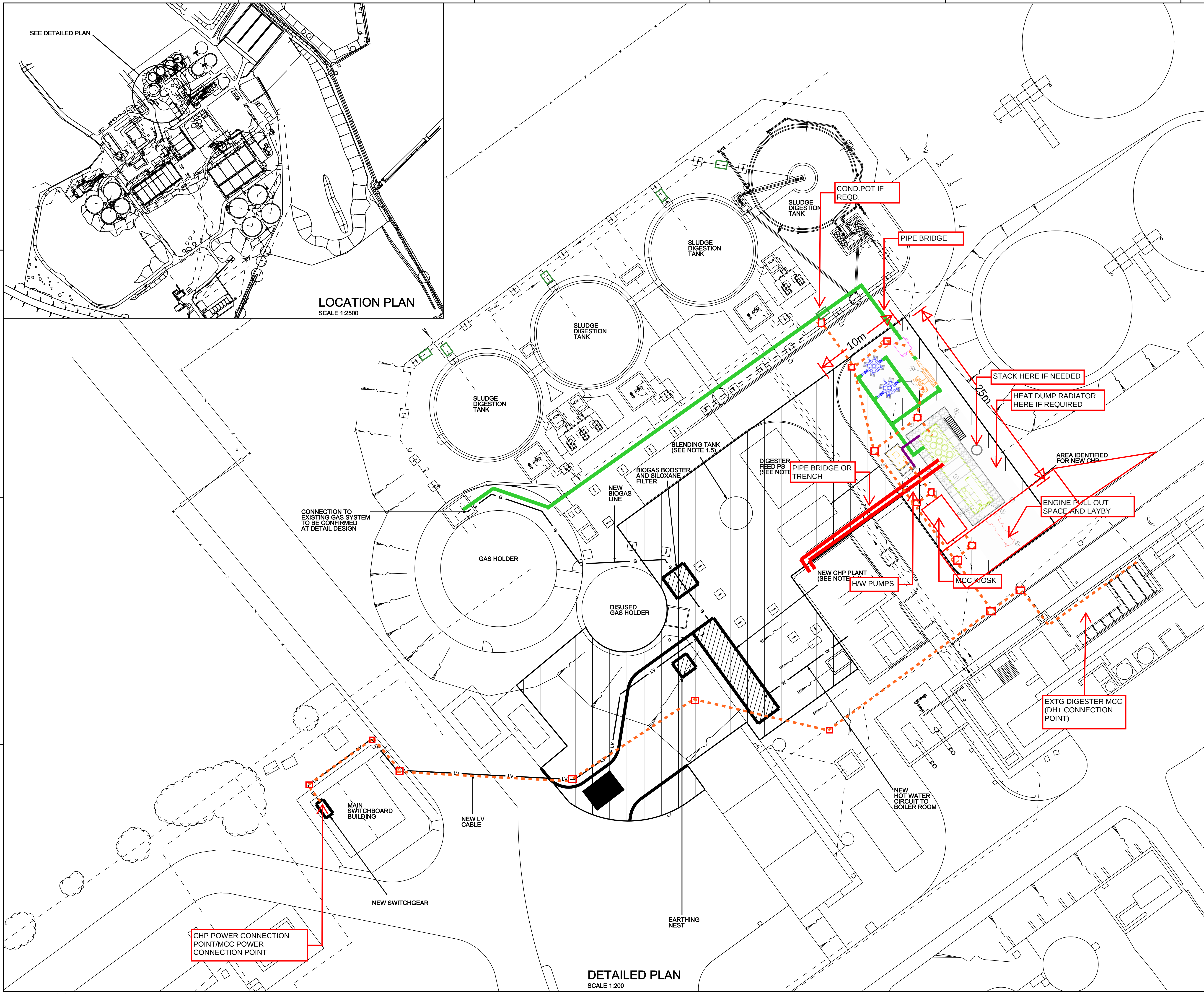
The above working areas will commence after site establishment by dedicated teams and will progress with minimal disruption or interface challenges until final tie-ins which will be discussed, planned and agreed in advance with Thames Water. Digester & gas system tie-ins are to be co-ordinated with Thames Water and will require outages which consist of single digester gas isolation and purging prior to handover to MMB and also for pipework and minor works around the existing gas holder, all gas flow from 4No Digesters will need to be isolated and purged prior to handover to MMB. Similarly, it is assumed that the hot water system will be approved for isolation at the appropriate time during our construction period where required.

4.2 Temporary Works

The list below outlines examples of necessary Temporary Works throughout the construction phase to allow the project to progress. Other requirements might become apparent as design progresses: -

- Temporary site fence modification to install a new access gate for site traffic. This will require modifications to existing ‘palisade’ TW fencing prior to accessing the automated access gate to enter site. This will allow segregation of construction traffic from Operational vehicles as far as reasonably practicable. However, in some instances there will be a requirement for construction traffic to utilise site roads for access, deliveries or re-routing due to construction constraints
- New digester pipework - it is anticipated that civil works for pipework supports will be completed inside the existing demarcated fence line, with no mechanised plant being used due to the risk of striking existing infra-structure. Any existing pipework will be protected by physical barriers prior to work commencing. It is expected that Vacuum Excavation (Vac-Ex) methods utilising air lance systems will be used to assist the groundworks.
- New digester pipework tie-ins – there will be numerous pipework tie-ins which will require considerable discussion, planning and agreement with TW APD and key stakeholders. These include:
  - Isolation, physical separation and purging of the gas take-off lines from each individual digester at separate times for final pipework connection for the new condensate pots. It is assumed that TW will provide this prior to handover to MMB
  - Isolation, physical separation and purging of all gas lines and gas holder for installation of the common digester condensate pot by-pass and also the modified pipework around the existing gas holder will allow connection to the new CHP engine. It is assumed that TW will provide this prior to handover to MMB
  - Connection to the existing boiler system with the new hot water pipework from the new CHP engine. It is anticipated that this can be completed with minimal disruption to site processes
- A new CHP electrical compartment is required to be added to the existing Low Voltage (LV) switchboard. To facilitate this activity a shutdown of this board will be required for a period anticipated no less than 6hrs. To be able to ensure the works carries on operating with minimal disruption the need for standby generation is deemed necessary to supply local MCC’s around site, currently identified are the digester MCC, TSR MCC and Inlet Works MCC. It is anticipated that a further backup standby generator is available in case of a failure during the outage.
- Temporary haul roads for construction traffic. This should not result in any on disruption to the STW operation apart from an increase in construction traffic which will be managed and co-ordinated with TW Ops
- Purging of gas systems as and when required for connections and commissioning. It is assumed that this will be facilitated by TW Ops for the tie-in's as identified previously.
- Within the proposed location for the new CHP engine it has been identified that there are services that will require diversion in this area, these include electrical cables and a foul sewer line. In is propose that for the cables, new ducts will be installed and new cables from ‘point to point’ (no joints) will be installed prior to disconnection and changeover in conjunction with TW Ops & Electrical AP
- Crane pads at various locations to allow for successful and safe installation of equipment.
- It has also been identified that rainwater and silt mitigation will need to be provided to protect the body of water to the North East of the Digesters.

5 Appendix A – Site Layout



DO NOT SCALE - IF IN DOUBT ASK

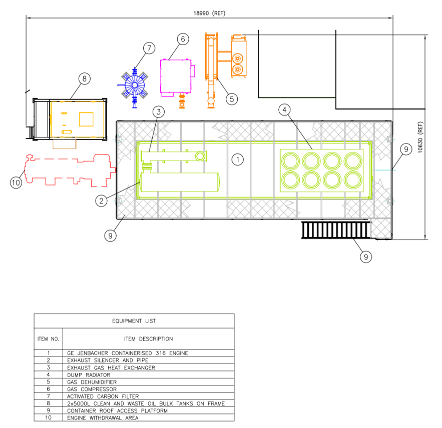
N

NOTES:

1.0 GENERAL

1.1 ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
1.2 ALL LEVELS ARE IN METRES ABOVE ORDINANCE DATUM (NEWLYN).
1.3 ALL DRAWING WORK COMPLETED IN THIRD ANGLE PROJECTION.
1.4 THE EXACT LOCATION OF THE NEW CHP MAY CHANGE WITHIN THE SHADED AREA, SUBJECT TO SITE SURVEYS AND DETAILED DESIGN.
1.5 THE LOCATIONS OF THE BLENDING TANK, DIGESTER FEED PS AND EXISTING CHP ARE INDICATIVE AND NOT TO SCALE.
1.6 BIOGAS PIPE ROUTE, HOT WATER PIPE ROUTE AND CABLE ROUTE SHOWN ON THE DRAWING ARE FOR REFERENCE ONLY, EXACT ROUTES TO BE CONFIRMED AT DETAILED DESIGN STAGE.

LUBE OIL (CLEAN & WASTE)
HOT WATER (FLOW & RETURN)
BIOGAS
CABLE/DUCT
DRAWPIT
CONDENSATE POT



10 m 0 10 m
SCALE 1 : 200
100 m 0 100 m
SCALE 1 : 2500

DRAFT FOR DISCUSSION

Iss	Description	Dsgnr	Chkd	Appd	Date
A	FOR PLANNING ENQUIRY				

Thames Water Utilities
CAPITAL DELIVERY
Rose Kiln Court
Rose Kiln Lane, Reading RG2 0BY

Location Code: BANBS1ZZ	OS Reference: SP4640	Security Reference: UBR	Drawn By: DDH

Project Group: PROCESS
Sub Process:
Location / Town: BANBURY
Site Name: BANBURY STW
Project Name: A060 ADDITIONAL & ACCELERATED CHP INVESTMENT
Contract Name: MAIN CONTRACT
Drawing Title: BANBURY STW
PROPOSED NEW CHP LOCATION AND CABLE ROUTE

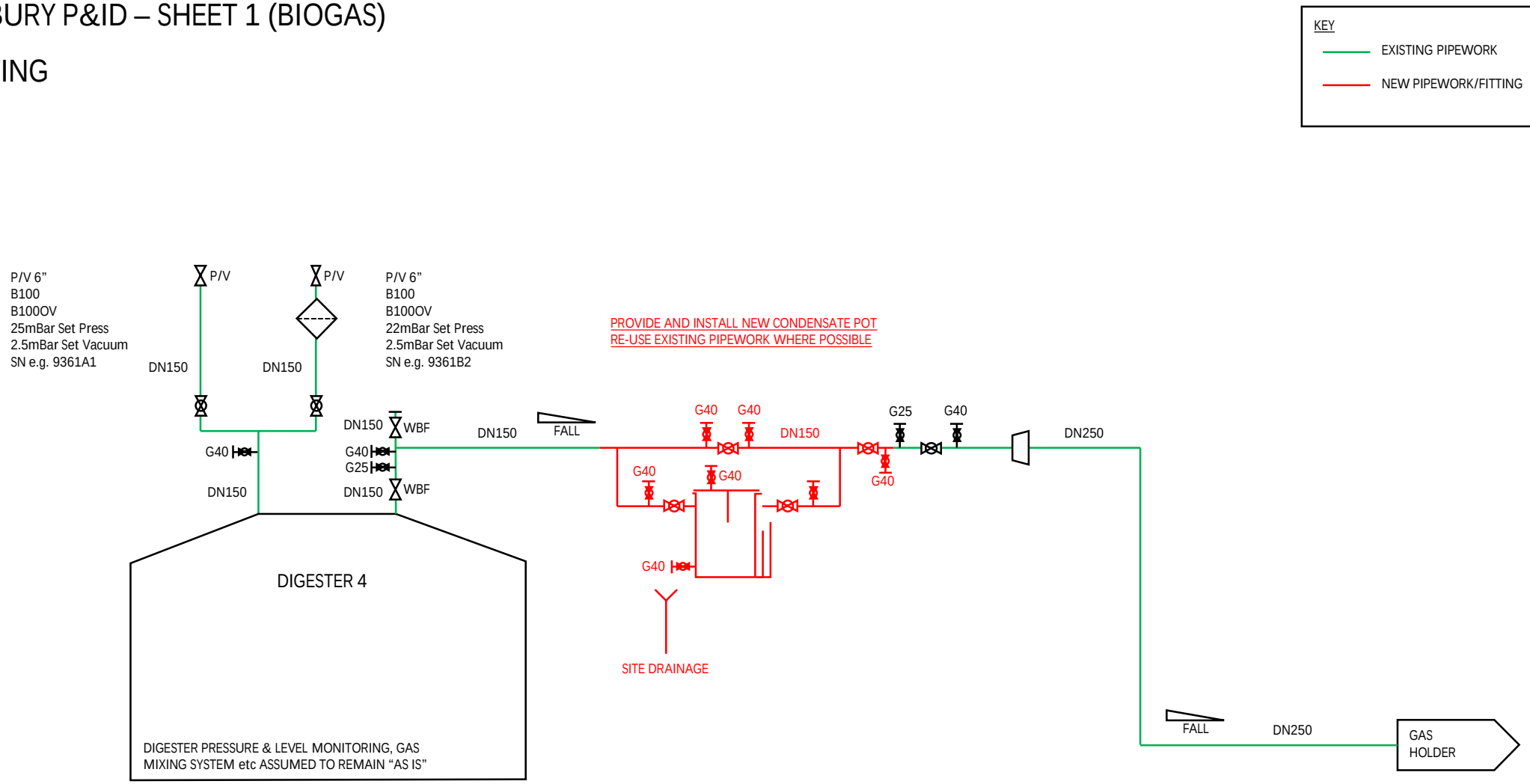
Drawing No.:	Scale:	Sheet Size:	Rev:
A060-A1-02200	1:200, 1:2500	A1	A

PLOTTED ON 18/12/2009 12:38:23 BY JWCLARK
LOCATION : Rose Kiln Court S:\CAD-GH\Prj_TV-Water\HAMPTON_OFFICE\In Design\A060-A1-02200-A.dgn

6 Appendix B – Existing Gas System P&ID

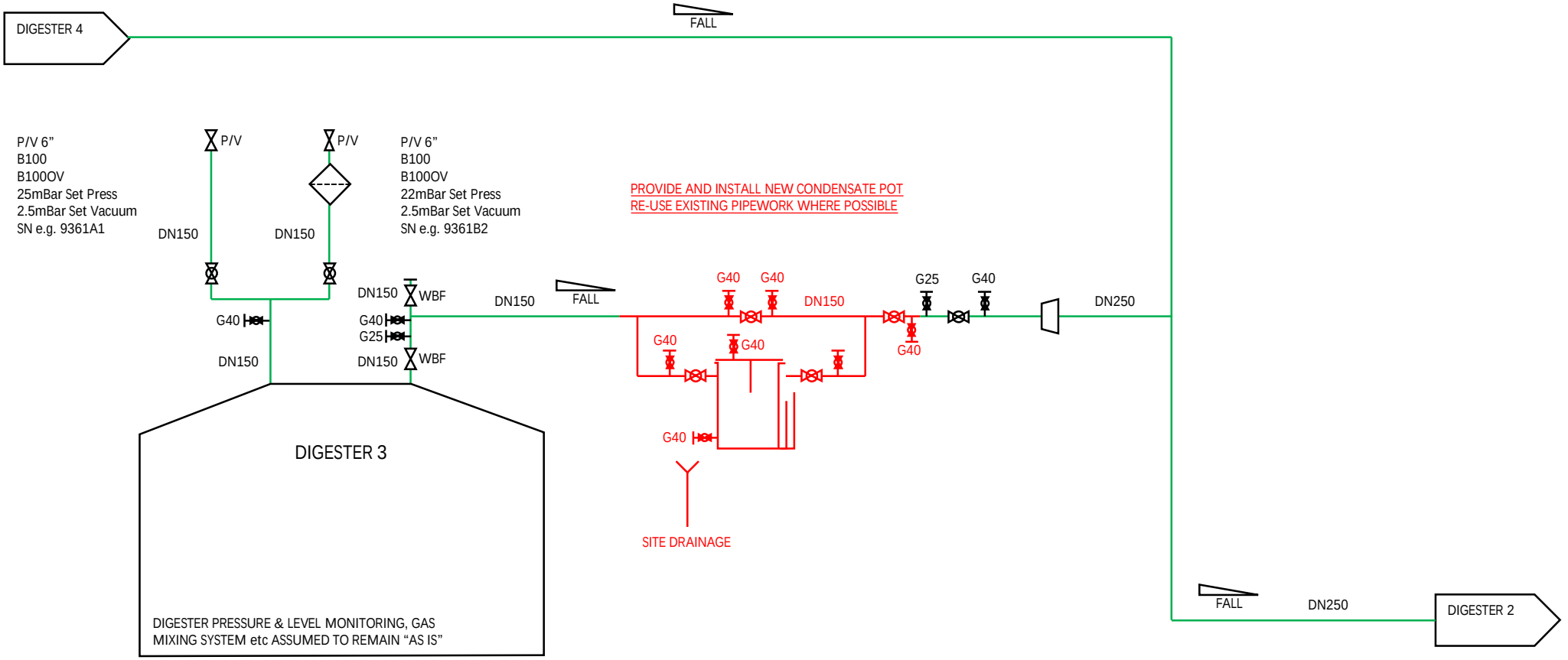
BANBURY P&ID – SHEET 1 (BIOGAS)

EXISTING



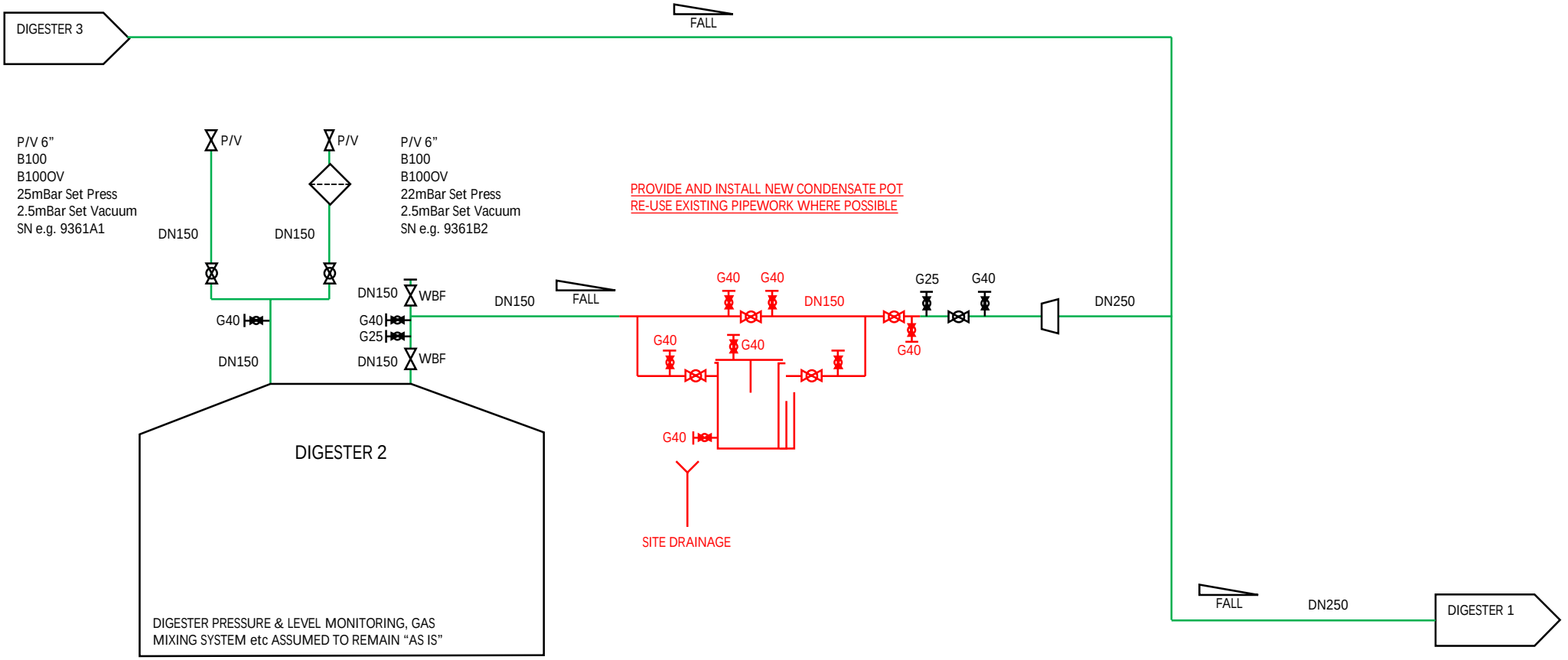
BANBURY P&ID – SHEET 2 (BIOGAS)

EXISTING



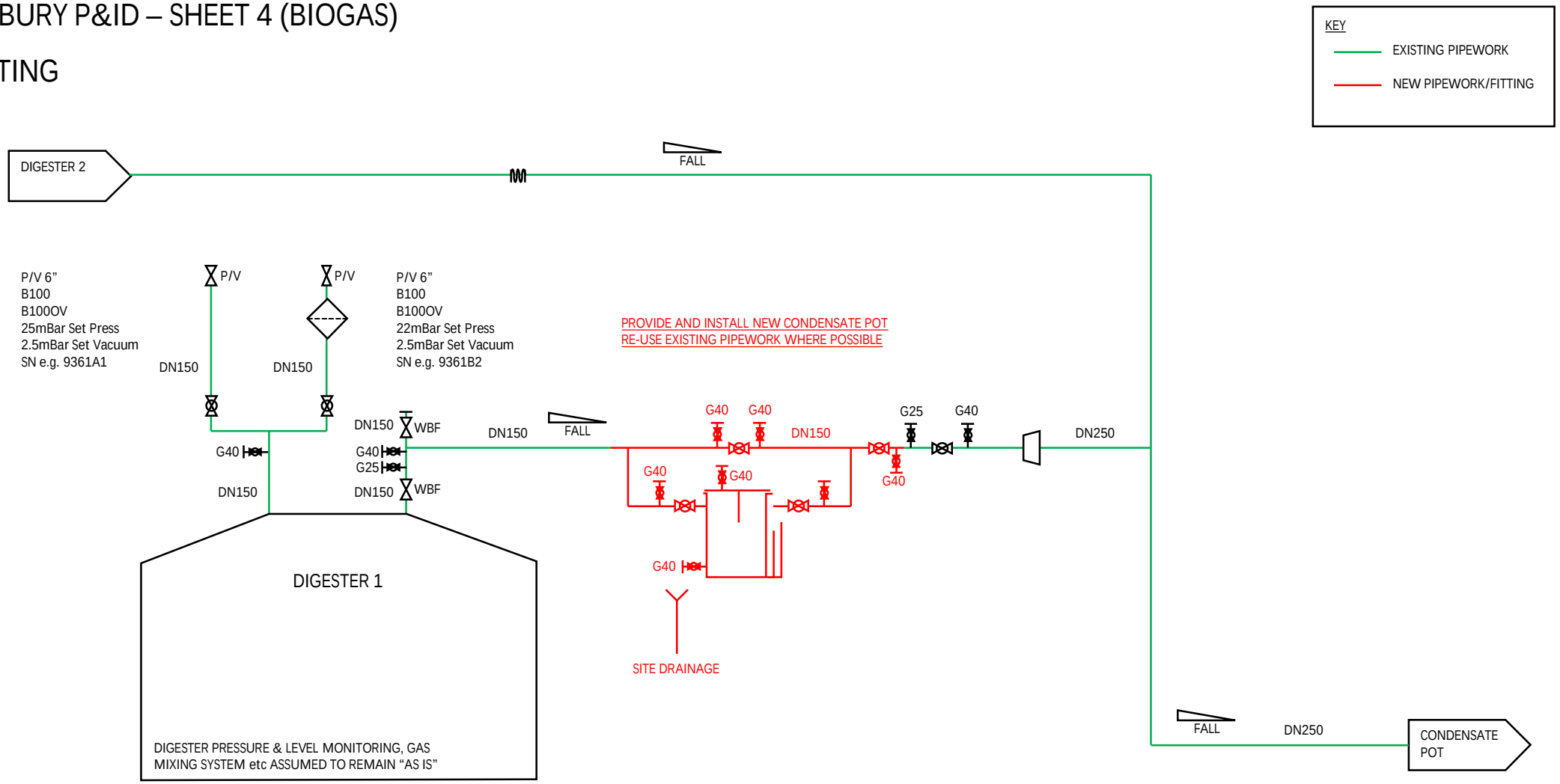
BANBURY P&ID – SHEET 3 (BIOGAS)

EXISTING



BANBURY P&ID – SHEET 4 (BIOGAS)

EXISTING



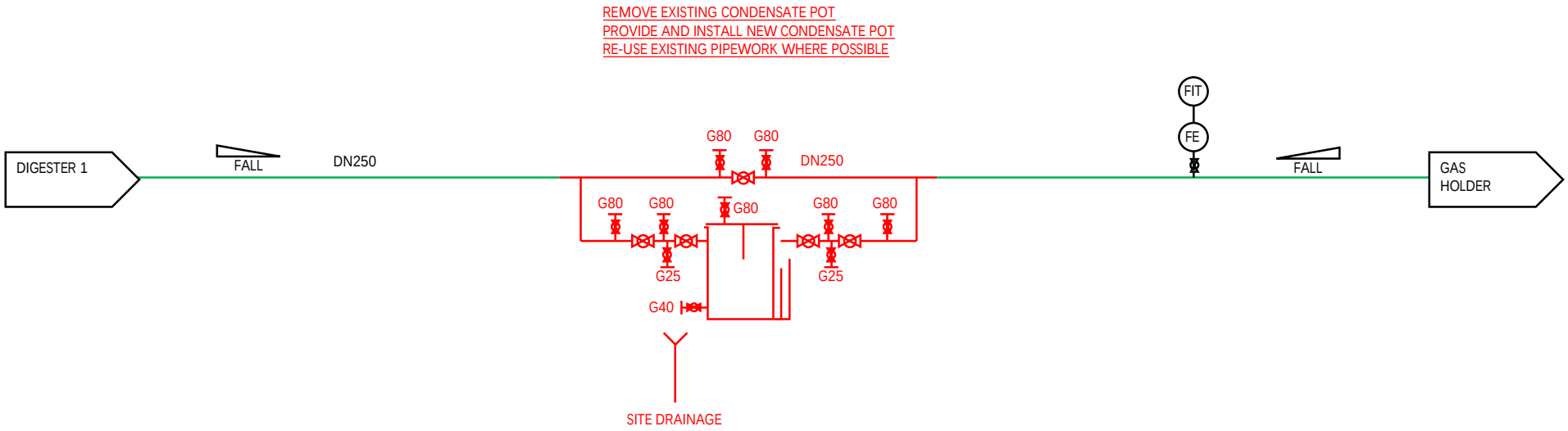
BANBURY P&ID – SHEET 5 (BIOGAS)

EXISTING

KEY

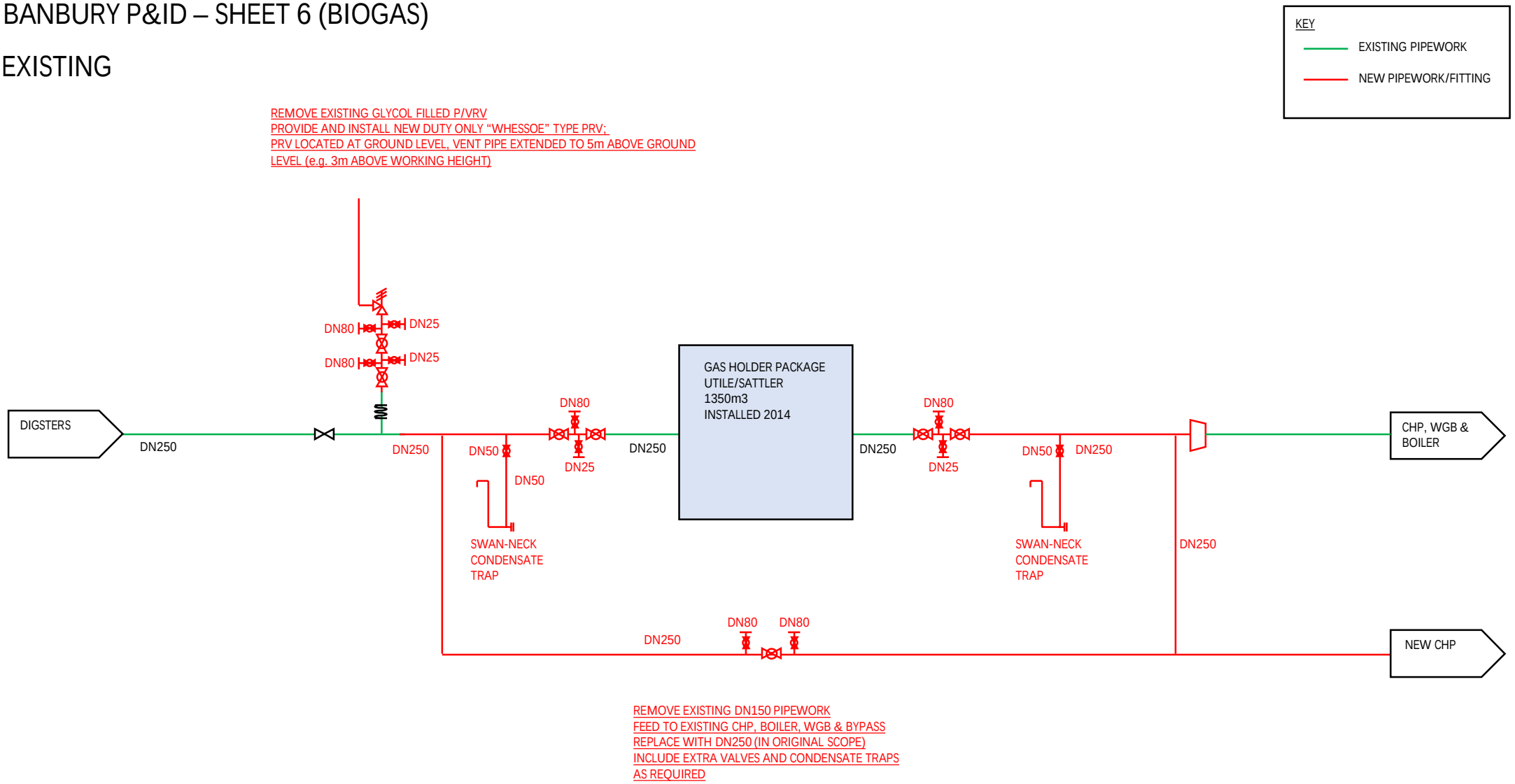
EXISTING PIPEWORK

NEW PIPEWORK/FITTING



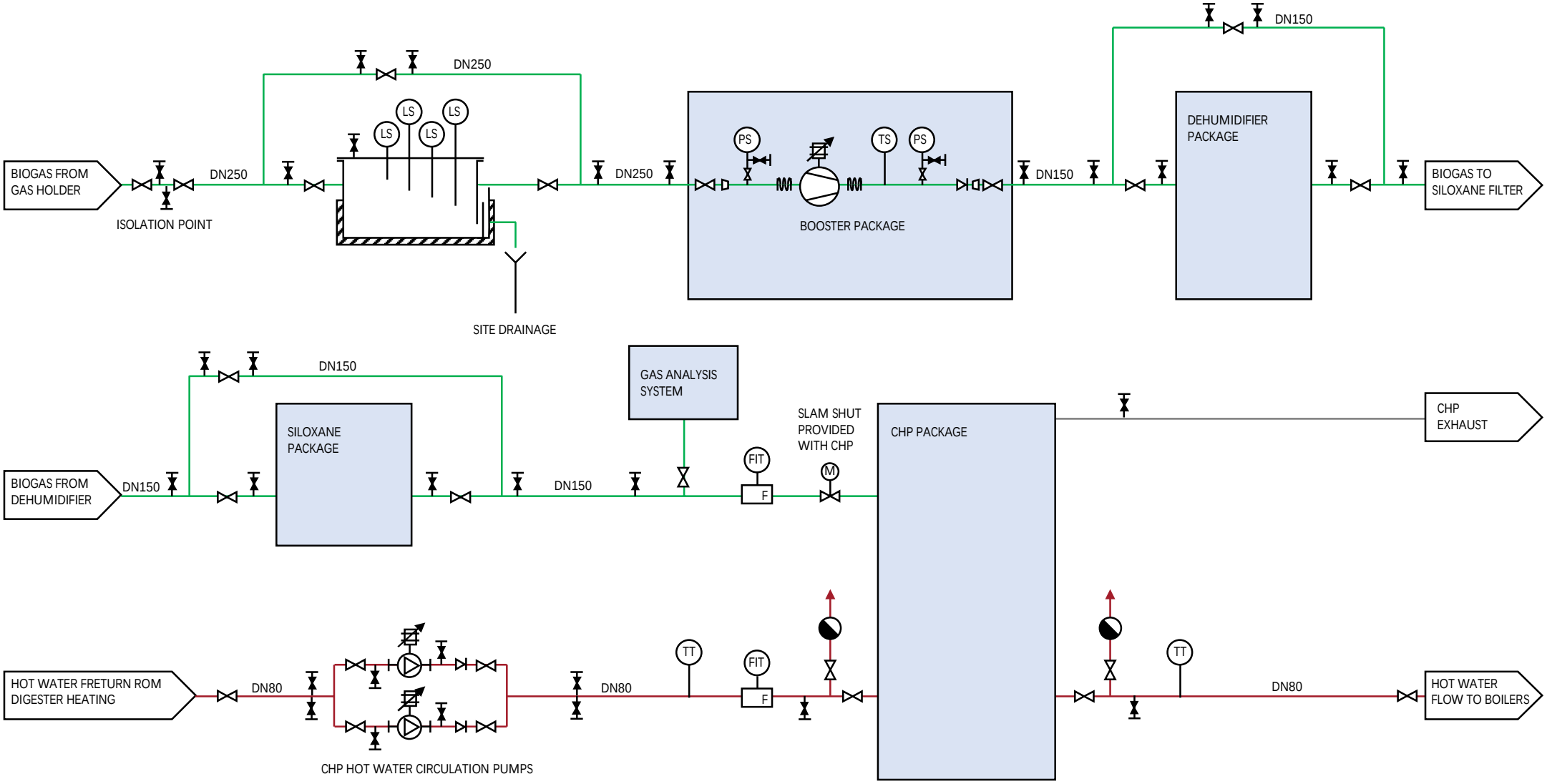
BANBURY P&ID – SHEET 6 (BIOGAS)

EXISTING

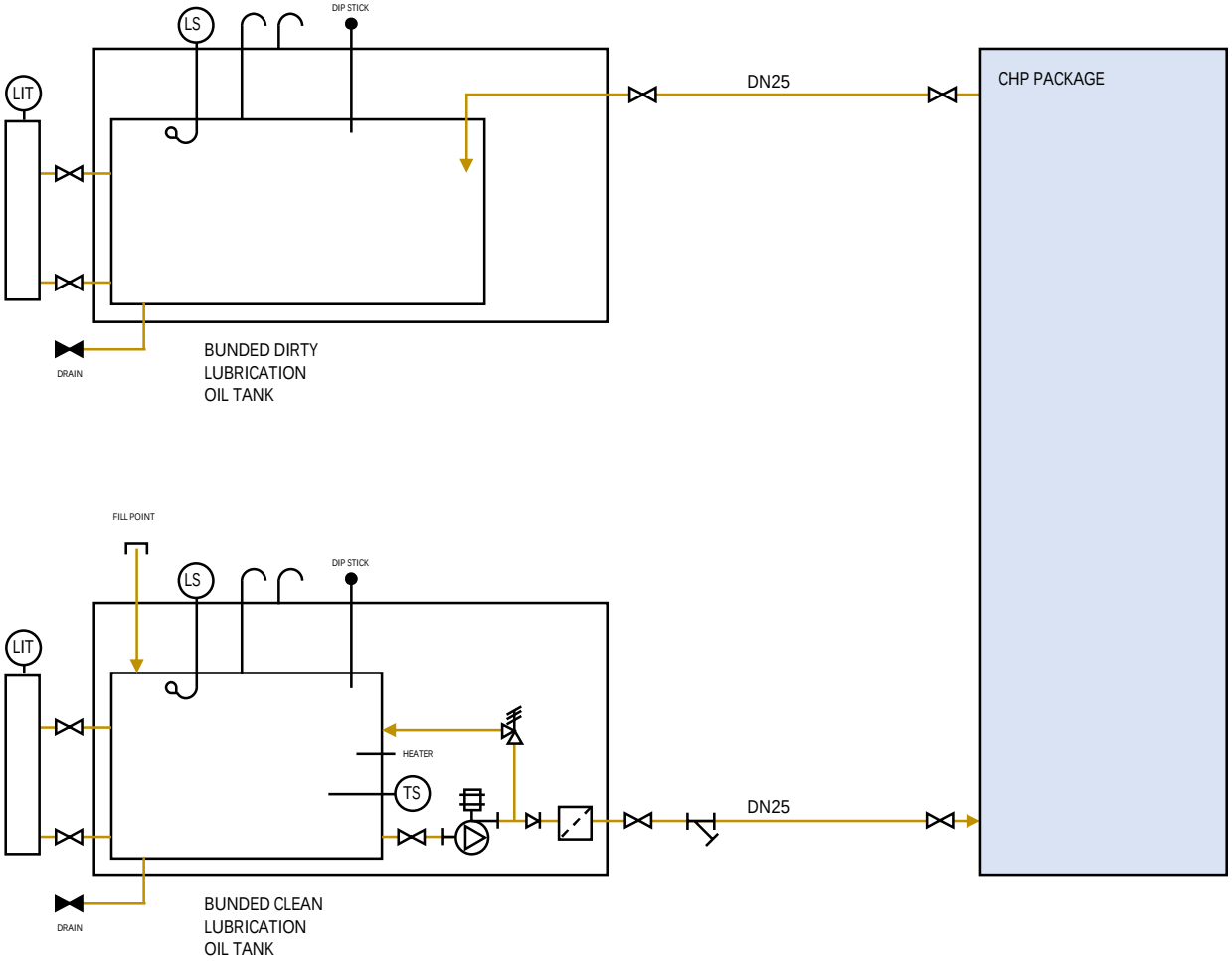


7 Appendix C – New CHP System P&ID

BANBURY P&ID – SHEET 1 (BIOGAS, EXHAUST & HOT WATER)



BANBURY P&ID – SHEET 2 (LUBE OIL)



8 Appendix D – Opportunities Register

Project
Banbury STW CHP Replacement

Revision Date
27/05/2021

Project Value
£3,991,573

Opportunity Owner	Best Case	Opp Allowance
MMB	£ 490,743	£ 40,892
Thames	£ -	£ -
Total	**£ 490,743**	**£ 40,892**
MMB Risk % of Project Value	12.29%	1.02%

Ref	Category	Date	Opportunity Description	Initial Probability	Initial Impact	Initial P/I Score	Initial Best Case Scenario (£)	Initial % Probability	Initial Opp Allowance	Best Case Time Allowance (weeks)	Initial Time Allowance (weeks)	Mitigation Owner Organisation
1		19/05/2021	Opportunity to use any planned digester shut-downs to make connections for new biogas pipework and to reduce the programme.	L	L	TBC	£ 24,435	10%	£ 2,444	3.00	0.30	MMB
2		19/05/2021	Opportunity to replicate designs from past projects - Beddington, Minworth, Worksop, Stoke Bardolph etc	L	L	TBC	£ 20,373	10%	£ 2,037	1.00	0.10	MMB
3		19/05/2021	Hot water pumps may not need to be variable speed (potential reduction in size of MCC and kiosk)	L	L	TBC	£ 31,715	10%	£ 3,172	0.00	0.00	MMB
4		19/05/2021	Opportunity to re-use existing gas pipework supports and plinths (current assumption is all new)	VL	M	TBC	£ 42,873	8%	£ 3,215	0.00	0.00	MMB
5		19/05/2021	Opportunity to replace pipe bridges with a trench across the road.	L	VL	TBC	£ 9,114	10%	£ 911	0.00	0.00	MMB
6		19/05/2021	Opportunity to have use more stone and less concrete for the footpaths and surfaces around the CHP with individual slabs .	VH	VL	TBC	£ 6,179	75%	£ 4,634	0.00	0.00	MMB
7		19/05/2021	Opportunity to save on civils if the new MCC is top-entry.	L	VL	TBC	£ 10,478	25%	£ 2,620	0.00	0.00	MMB
8		19/05/2021	Opportunity to re-use existing gas pipework rather than providing new.	VL	L	TBC	£ 33,143	5%	£ 1,657	10.00	0.50	MMB
9		19/05/2021	Opportunity to reuse existing drainage manhole in the centre of the CHP area.	L	VL	TBC	£ 5,353	10%	£ 535	0.00	0.00	MMB
10		19/05/2021	Opportunity to take out the layby and use the current road as a pit stop	L	VL	TBC	£ 14,838	20%	£ 2,968	2.00	0.40	MMB
11		19/05/2021	Opportunity to reuse existing Siloxane Filters if commissioning shutdowns can be managed and TW accept asset life of existing asset	VL	H	TBC	£ 124,018	5%	£ 6,201	4.00	0.20	MMB
12		19/05/2021	Oppertunity to extend an existing MCC onsite for our new starter sections and utilise an existing ICA PLC if Thames accept risks and require budget reduction	VL	M	TBC	£ 53,790	5%	£ 2,690	0.00	0.00	MMB
13		19/05/2021	Temporary access road could be retained as permanent access to the new CHP area - would require additional cost for re-surfacing at end of project. Risk that temporary road requires Silt buster or similar.	H	VL	TBC	£ 4,000	50%	£ 2,000	0.00	0.00	MMB
14		19/05/2021	Use of exisiting drawpit & ducts once surveyed for the new LV switchboard cable	VL	M	TBC	£ 65,435	2%	£ 1,309	0.00	0.00	MMB
15		19/05/2021	Deviation from Asset Standard to provide a 400KWe CHP engine not the 500KWe provided	L	M	TBC	£ 45,000	10%	£ 4,500	0.00	0.00	MMB
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			

9 Appendix E – Risk Register

Project
Banbury STW CHP Replacement

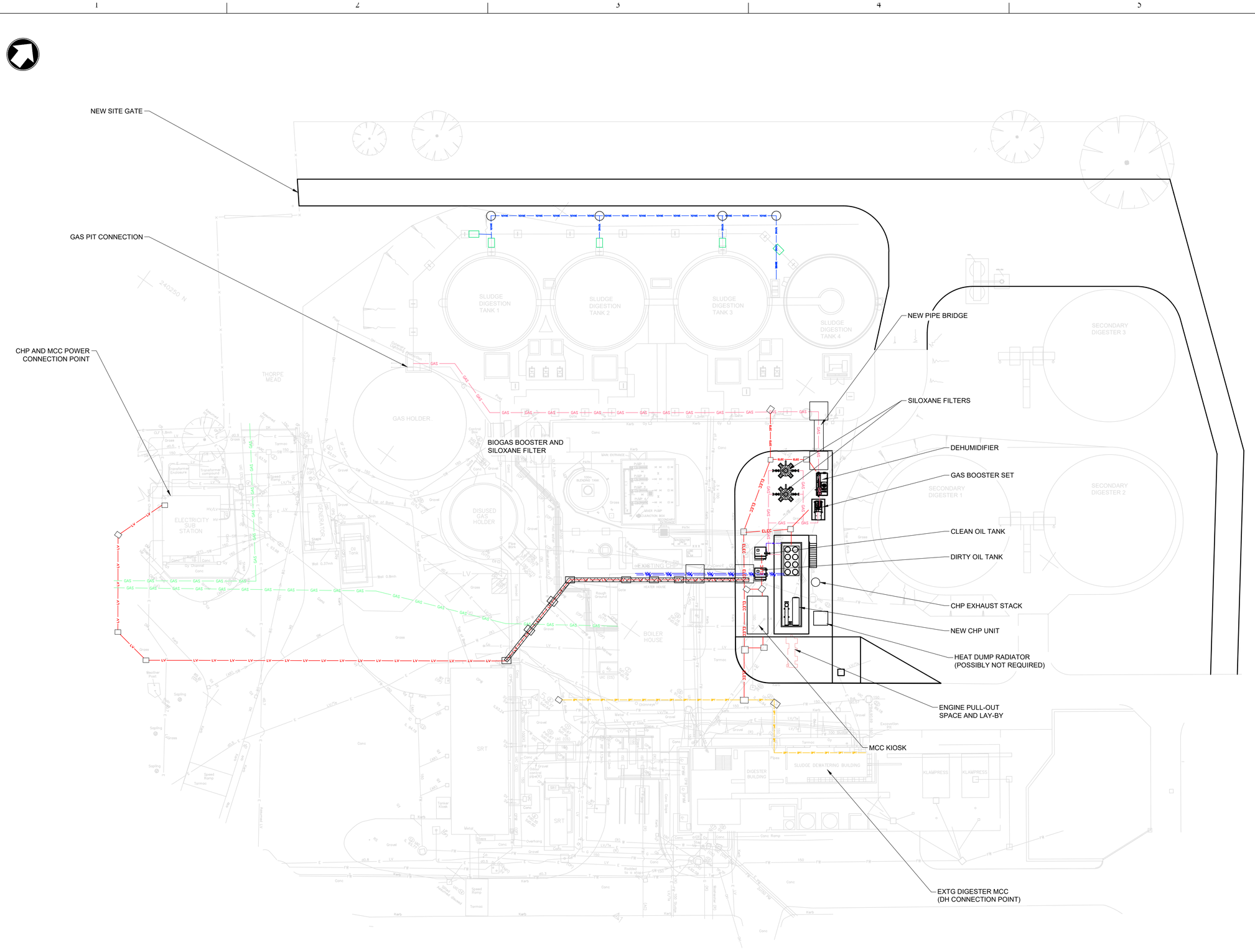
Revision Date
27/05/2021

Project Value
£3,991,573

Risk Owner	Worst Case	Risk Allowance
MMB	£ 1,424,396	£ 166,528
Thames	£ -	£ -
Total	**£ 1,424,396**	**£ 166,528**
MMB Risk % of Project Value	35.69%	4.17%

Ref	Category	Date	Risk Description	Initial Probability	Initial Impact	Initial P/I Score	Initial Worst Case Scenario (£)	Initial % Probability	Initial Risk Allowance	Worst Case Time Allowance (weeks)	Initial Time Allowance (weeks)	Mitigation Owner Organisation
1	Design	10/05/2021	Risk of additional scope due to lack of detailed process data. Risk that design development and changes due to client stakeholder comments results in a extended programme and increased design costs.	VL	VH	TBC	£ 578,468	5%	£ 28,923	0.00	0.00	MMB
2	Design	10/05/2021	Subcontract Solution Scope Growth	L	H	TBC	£ 166,636	20%	£ 33,327	0.00	0.00	MMB
3	Procurement	10/05/2021	Cable size between CHP and "Point of Connection" needs to be increased to what is included	L	VL	TBC	£ 12,332	25%	£ 3,083	3.00	0.75	MMB
4	General	14/05/2021	Delays from the DNO in approving applications for new embedded generation requests including G100 application.	L	M	TBC	£ 97,749	15%	£ 14,662	12.00	1.80	MMB
5	Design	10/05/2021	Potential Tree Protection Order for single tree NE of site. Potential for increase newt trapping and licencing and other F&F. Potential of bats/birds within the working area which needs to be removed/protected.	M	L	TBC	£ 31,900	40%	£ 12,760	12.00	4.80	MMB
6	Planning	10/05/2021	Air Dispersion study may result in a taller or more complex exhaust system, or be combined with the boiler stack which requires a larger civil phase, longer Local Authority approval period.	L	M	TBC	£ 92,659	15%	£ 13,899	10.00	1.50	MMB
7	Environmental	17/05/2021	There is a risk that the existing site / foul drainage is not considered a 'sealed drainage system' for the biogas condensate as defined by the EA SR2009 No 4 document and that a separate biogas condensate drainage system for the site is required following the application submission under EPR	TBC	TBC	TBC	£ -	0%	£ -	0.00	0.00	Thames
8	Operations	10/05/2021	Surface water run-off may contaminate the fishing lake to the north-east of the site boundary.Potentially will require some form of mitigation	L	VL	TBC	£ 10,145	10%	£ 1,015	1.00	0.10	MMB
9	Commissioning	10/05/2021	Risk of adverse effect on digester performance during commissioning of new biogas network may lead to increased commissioning time. Risk that CHP may take longer to commission due to operation issues with existing or new assets. Risk that existing sludges are of different thickness or makeup to what is expected, resulting in challenges during commissioning.	L	M	TBC	£ 78,522	25%	£ 19,631	6.00	1.50	MMB
10	Construction	10/05/2021	Safety risks associated with existing plant - eg gas system lead to additional enabling works to make safe. Risk that purging and making safe takes longer to agree and plan than current programme allowance. Quality of existing assets as per Aylesbury.	L	M	TBC	£ 43,080	20%	£ 8,616	4.00	0.80	MMB

11	Procurement	10/05/2021	London metal Exchange inflation for electrical cabling	VL	M	TBC	£ 73,347	5%	£ 3,667	0.00	0.00	MMB
12	Construction	10/05/2021	Risk of unchartered buried services in construction areas. Cable routes beneath construction areacables may need to be relocated.	M	M	TBC	£ 55,421	30%	£ 16,626	4.00	1.20	MMB
13	Operations	10/05/2021	Risk of critical asset failure during works, particularly at single points of failure - EG Return Liquor PS, Existing Gas Holder, Hot Water Boiler System.	TBC	TBC	TBC	£ -		£ -	0.00	0.00	Thames
15	Construction	10/05/2021	Risk of dealing with adverse publicity or noise/traffic complaints from nearby businesses.	L	VL	TBC	£ 8,805	10%	£ 880	0.00	0.00	MMB
16	Construction	10/05/2021	Temporary access road could be retained as permanent access to the new CHP area - would require additional cost for re-surfacing at end of project. Risk that temporary road requires Silt buster or similar.	VL	L	TBC	£ 25,000	2.5%	£ 625	3.00	0.08	MMB
17	Construction	10/05/2021	Potential that removal of Asbestos in the Bolier Room will be required.	VL	L	TBC	£ 20,000	5%	£ 1,000	2.00	0.10	MMB
18	Construction	10/05/2021	Ground conditions are substantially worse than expected, and additional excavation of made ground and replacement with stone is required for thicker sub-bases.	L	L	TBC	£ 37,188	15%	£ 5,578	3.00	0.45	MMB
19	Construction	10/05/2021	Weather causes programme delay.	VL	L	TBC	£ 32,580	5%	£ 1,629	4.00	0.20	MMB
20	Construction	10/05/2021	Risk that pipework from site to return liquors PS will need to be replaced if found to be in poor condition.	VL	M	TBC	£ 60,565	1%	£ 606	4.00	0.04	MMB
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			
				TBC	TBC	TBC			£ -			



DO NOT SCALE - IF IN DOUBT ASK

MMB
MOTT MACDONALD BENTLEY

Keighley Road
Skipton
BD23 2QR
United Kingdom

T +44 (0) 1756 799425
W mottmacbentley.co.uk

NOTES

1. ALL DIMENSIONS IN MILLIMETRES
2. ALL LEVELS IN METRES AOD

- NATURAL GAS LINE
- BIOGAS
- NEW LV CABLE ROUTE (ABOVE GROUND)
- NEW LV CABLE ROUTE (BURIED)
- CABLE/DUCT
- HOT WATER (FLOW & RETURN)
- CONDENSATE DRAINAGE PIPES
- LUBE OIL (CLEAN & WASTE)
- EXISTING FIBRE OPTIC CABLE
- DRAWPIT
- CONDENSATE POT

1:250 0 12.5m 25m

NOT FOR CONSTRUCTION

CURRENT REVISION INFORMATION

Revision	Status	Suitability Description	Authored	Checked	Reviewed	Date
P01.1	S0	FIRST ISSUE FOR DISCUSSION	TA	DCJ	DCJ	05/10/21

Thames Water Utilities

Clearwater Court
Vastern Road, Reading RG1 8DB

Location Code: BANBS1ZZ	OS Reference: SP4640	Security Reference: N/A
Project Group:	Sub Process:	

Location/Town: Banbury STW, OX16 4RZ

Site Name: Banbury STW

Project Name: J975 Banbury CHP Replacement

Drawing Title: Banbury CHP Upgrade General Arrangement

Scale:	Sheet Size:	Status:
1:250	A1	S0

Drawing Number: J975.01-JE-BANBS1ZZ-201-DR-ZD-0010 Revision: P01.1

200mm 150 100 50 0

PLOTTED ON 19/08/2021 BY FER96015