Non-Technical Summary
Application for a New Bespoke Installation Permit
Three Maids Anaerobic Digestion Plant, Three Maids Farm, Three Maids Hill, Winchester, SO21 2QG

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Quality control sign off

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Abbreviations

AD	Anaerobic Digestion/er
AQMA	Air Quality Management Area
AQIA	Air Quality Impact Assessment
AW	Ancient woodland
BAT	Best Available Techniques
BUU	Biogas upgrading unit
CHP	Combined heat and power engine
CO_2	Carbon dioxide
COMAH	Control of Major Accident Hazards
CQA	Construction Quality Assurance
EA	Environment Agency
ELV	Emission limit value
EMS	Environmental Management System
EP	Emission Point
ETL	Earthcare Technical Limited
EWC	European Waste Catalogue
EVCS	Electric Vehicle Charging Station
H_2S	Hydrogen sulphide
HDPE	High density polyethylene
HRA	Hot rolled asphalt
HSE	Health and Safety Executive
kWthi	Kilowatts of thermal input
LDPE	Low-density polyethylene
LWS	Local Wildlife Site
MCP	Medium Combustion Plant
MCPD	Medium Combustion Plant Directive
n/a	Not applicable
NGR	National Grid Reference
NTS	Non-technical Summary
NVZ	Nitrate Vulnerable Zone
PHI	Priority Habitat Inventory
PVRV	Pressure and vacuum relief valve
PRV	Pressure relief valve

PVC Polyvinyl chloride

SAC Special Area of Conservation

SSAFO The Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010

SCADA Supervisory Control and Data Acquisition

SCR Site Condition Report

SPA Special Protection Area

SPZ Source Protection Zone (for groundwater)

SR Standard Rules

SSSI Site of Special Scientific Interest

TPA Tonnes per annum

1 Introduction

This Non-Technical Summary (NTS) has been prepared by Earthcare Technical Ltd (ETL) on behalf of Acorn Bioenergy Operations Limited 'ABL' in support of an application for a new bespoke Installation Environmental Permit for an anaerobic digestion (AD) plant including the use of resultant biogas for Three Maids AD Plant, located on agricultural land at Three Maids Farm, Three Maids Hill, Winchester, SO21 2QG, centred on National Grid Reference (NGR): SU 46094 33959, herein termed 'the Site'. The plant will be operated by Acorn Bioenergy Operations Limited, herein termed 'the Operator'.

This NTS highlights the key control measures that are proposed to minimise any potential environmental impacts from the site operations and signposts the reader to the key supporting documents for the permit application, which contain further detail.

2 Planning

Planning permission for the site was approved by Winchester City Council on the 10 May 2023 (ref: 22/02037/FUL).

3 Permitting

The operation requires an Installation permit as the proposed AD plant will have a treatment capacity of over 100 tonnes per day which constitutes a listed activity under Part 2 to Schedule 1 of the Environmental Permitting Regulations 2016.

The operation cannot benefit from the appropriate Standard Rules (SR) permit (SR2021 No.8 permit - on-farm anaerobic digestion facility using farm wastes only, including use of the resultant biogas – installations)[1] as:

> The location criteria under permit condition 2.2.4 cannot be met, namely there are areas of Priority Habitat Inventory (PHI) deciduous woodland approximately 20m from the northern and western site boundaries.
> Under Activity 3 of SR2021 No.8 (gas combustion to produce heat and power) the total aggregated rated thermal input for appliances must be less than 5 megawatts. This threshold will be exceeded. The net rated thermal input figures of the proposed plant are shown in Appendix A.

Carbon dioxide (CO_2) capture, treatment and storage from biogas, are to be carried out on site, currently covered under RPS 255 but to be included as a permitted activity in future. [2]For these reasons a new bespoke installation permit is required.

[1] SR 2021-no-8-on-farm-anaerobic-digestion-facility-using-farm-wastes-only-including-use-of-the-resultant-biogas-installations Accessed 8 March 2024

Basic pre-application advice was initially sought from the Environment Agency (EA) in July 2022 (Reference: EPR/FP3945QH/A001). In order to ensure that ensure that all relevant nature and conservation sites have been considered a further basic pre-application request was made in February 2024 (Reference EPR/BP3326SD/P001) to. The Nature and Heritage Conservation Screening Reports are included as Appendix B.

The potential environmental impacts relevant to the bespoke installation permit application have been fully considered in supporting documents to this permit application, and specifically within:

The Air Quality Impact Assessment (AQIA)[3]; and
The site-specific Environmental Risk Assessment (Appendix A of the Environmental Management System (EMS) Manual **(THR-OD-01)**), which also includes the control measures that will be employed.

Details in relation to the proposed Medium Combustion Plant (MCP) forms Appendix A. The calculations for net rated thermal input of plant are detailed in Appendix B of the EMS Manual **(THR-OD-01).**

4 Site Details

4.1 Location

Site Address: Three Maids AD Plant, Three Maids Farm, Three Maids Hill, Winchester, SO21 2QG, Hampshire.
National Grid Reference (approx. centre of Site): SU 46094 33959
Local Authorities: Winchester City Council, a partner district of Hampshire County Council

The Site Location is shown in Figure 1 - Site Location Plan.

The site is 4.5 hectares (11 acres) in extent. The site, formerly farmland, sits within the northwest section of the intersection between the A34 dual carriageway and the A272. The site is located approximately 4 km north northwest of the city of Winchester.

The surrounding area is used principally for arable farming and grassland with pockets of protected Ancient Woodland. There is also a solar farm (120 m north of the site), an area used for muck-away, recycling and aggregates processing (150 m east), a pig farm (approximately 600 m northwest), and Harestock Wastewater Treatment Works (1.6 km south southeast). The site's gradient slopes in a north easterly direction towards the A34 from approximately 93.5m AOD to approximately 87.8m AOD.

The majority of the site boundary contains vegetation which in part of the site provides a visual screen from the surrounding roads.

[3] Earthcare Technical Ltd (March 2024) Three Maids AD Plant Air Quality Impact Assessment (Doc ref: ETL724_AQIA_V1.0_THRM_Mar24)

4.2 Environmental Sensitivities

4.2.1 Geology

The soil type is classified as freely draining, shallow lime-rich soils over chalk with a loamy texture.[4]

4.2.2 Hydrogeology

The site is on free draining soils over chalk and is above a principal aquifer with groundwater vulnerability classified as 'high'.

The site is not within a designated groundwater source protection zone (SPZ) or within a Drinking Water Safeguard Zone (groundwater). The site is within a Nitrate Vulnerable Zone (NVZ).[4]

4.2.3 Surface Water

There is a gulley or surface water ditch to the A34 to the eastern boundary of the site. The Nun's Walk Stream surface water body Catchment area, (part of the wider Itchen Catchment), falls to the south eastern area of the site with the stream itself some 2,830 m south east.[5] The site is not within a Drinking Water Protected Area (surface water) or Drinking Water Safeguard Zone (surface water). The Itchen Catchment is within a nutrient neutrality area, considered during planning.

4.2.4 Flood Risk

The site is within a flood zone 1 which means that there is a low probability of flooding from rivers and the sea[6].

4.2.5 Human Receptors

Human receptors within 1 km of the site are captured in Table 2 below and are shown in Figure 6 – Human Receptor Plan. The village of Littleton lies over 1km from the proposed site.

On the 18 December 2023 Winchester County Council granted planning permission (reference: 23/01594/FUL) for the development of an Electric Vehicle Charging Station (EVCS) with associated ancillary restaurant, outdoor seating and play area on land directly adjacent to the southern site boundary. Whilst the proposed EVCS development is adjacent to the southern boundary of the site, the areas where people will be present i.e., the playground and the restaurant are approximately 120 m from the site boundary. At the time of writing construction had not started.

Magic Maps, Defra Accessed 14 February 2024

[5] Catchment Data Explorer, Environment Agency Accessed 14 February 2024

[6] https://flood-map-for-planning.service.gov.uk/ Accessed 14 February 2024

Table 2: Human Receptors within approximately 1 km

ID	Location	Type of receptor	NGR X	NGR Y	Distance from site boundary (m)	Direction from site
R1	Proposed EVCS development including restaurant and playground	Commercial / Recreational	446194	133714	120	South
R2	The Pringle Group / Concrete 247	Aggregate / recycling	446311	133955	155	East
R3	Three Maids Bungalow	Residential	446081	133569	250	South west
R4	Lower Farm Cottages	Residential	445570	133626	530	West south west
R5	Worthy Down	Residential	446068	134913	730	North east
R6	Down Farm	Residential	446920	133716	750	South east
R7	Off Down Farm Lane (Static caravans)	Residential	446911	133640	750	South east
R8	Winchester Golf Academy	Recreational	446926	133479	815	South east
R9	Littleton Stud	Residential	445362	133307	890	South west
R10	Drovers Way	Residential	445172	133525	960	West south west
R11	Church Lane, St Catherines (Littleton)	Residential	445532	133031	970	South west
R12	Flowerdown Barracks	Residential / Recreational	446484	132768	1,120	South

4.2.6 Ecological Receptors

4.2.6.1 Statutory Designated Sites

There are no statutory designated sites within 2 km of the proposed permitted boundary. The River Itchen Special Area of Conservation (SAC) is approximately 3.5 km from the site at the nearest point.

4.2.6.2 Priority Habitats & Species

There are areas of PHI deciduous woodland approximately 20m from the northern and western site boundaries. There are Local Wildlife Sites and areas of Ancient Woodland within 2 km of the site. These are shown on plans within the Nature and Heritage Conservation Screening Report Appendix B.

4.2.7 Air Quality Management Areas

Winchester City Council have declared an Air Quality Management Area (AQMA) for nitrogen dioxide and particulate matter (PM_{10}) in Winchester City Centre following the one-way travel system in the city.[7] This is approximately 3.8 km to the south east of the site.

The Air Quality Impact Assessment (AQIA)[3] carried out shows the long-term and short-term impacts at all receptors can be screened out as not significant.

4.3 Process Summary

The process description is fully detailed within Section 5 of the EMS Manual **(THR-OD-01)**and depicted as a Process Flow Diagram (Appendix C). A Site Layout Plan is also provided (Figure 3).

The feedstocks for the AD plant are energy crops primarily maize and wholecrop silage, straw and animal manures, supplied by local farms. The AD plant will treat around 94,000 tonnes per year of feedstock.

The solid manures are stored in a dedicated Manure reception building fitted with bespoke emissions abatement plant. The liquid manures are stored in a Liquid feedstock tank (400m^3). The waste feedstocks are macerated, screened, and mixed with recirculated digestate liquor and process water.

Crops are ensiled on site in two silage clamps. The straw is treated in a Straw treatment building; the process involves wetting and chopping. Non-waste feedstocks are fed into the process via two external feed hoppers; a dry feed system into Primary digesters via an auger.

The digesters operate in the mesophilic temperature range at 38-45°C. There are two Primary digesters (PD1 & PD2) which operate in parallel. The two Primary digesters feed into the two Secondary digesters (SD1 & SD2). Both Secondary digesters feed into a single Tertiary digester (TD1). The Primary digesters each have an operational capacity of 5,840m^3, the Secondary digesters and the Tertiary digester each have an operational capacity of 6,430m^3.

Whole digestate from the Tertiary digester is then pasteurised in one of three 35m^3 batch pasteurising tanks. Each batch is heated to over 70°C for a minimum of one hour prior to being cooled via a heat exchanger and then being pumped to the Suspension buffer tank (400m^3). Whole digestate from the

https://uk-air.defra.gov.uk/aqma/maps/ Accessed 5 March 2024

Suspension buffer tank (400m^3) is pumped to the 2 No. separators capable of separating up to 320 tonnes per day (t/d) whole digestate each housed within the Separator covered bunker.

Separated liquor is pumped from the separator to:

the digestate storage bag with working capacity of 7,344m^3 .
the Process water buffer tank (100m^3) which feeds the premix system for the manure and the premix systems on the primary digesters.

The fibre collects in the Separator covered bunker below the separators.

Both the separated liquor and fibre digestate are used as a biofertiliser on nearby farms. Digestate is removed from site either to on farm storage locations or delivered to be spread directly to land for agricultural benefit to meet crop need.

The biogas will be upgraded into biomethane which will be transported offsite for injection at a central gas to grid injection point. In addition, carbon dioxide (CO_2) from the biogas will be captured and t upgraded to 99.9% purity. The treated CO_2 is suitable for almost all industrial and commercial applications in the UK. Upgraded CO_2 would be liquefied and transported by road to end users.

There are 2 No. 1.2 MW CHPs; one of which will burn biogas and the other natural gas to produce heat and electricity. Heat from the CHPs is used to maintain the temperature of the digesters and to provide heat to the pasteurisers.

There is also a dual fuel emergency boiler (550 kW) which can burn biogas or biomethane (or natural gas) to provide heat for the AD process, if one or more of the CHPs is non-operational.

4.4 Infrastructure

The site infrastructure comprises:

Liquid feedstock pre-treatment system (macerate and 30mm screen)
Liquid feedstock tank with mixing system (8 m height x 8 m diameter) (400 m^3)
Manure reception building (24.623 m x 20.154 m x 12.24 m to eaves, 13.53 m to ridge) containing:

Fast acting roller shutter doors
Air handling and emissions abatement plant (CentriAir)
Dedicated manure conveyor feed hopper
Pre-mix system including 30 mm screen.

Emissions abatement plant for Manure reception building
Straw treatment building (41.6 m x 23 m x 7 m to eaves, 8.2 m to ridge) containing:

Bale conveyor.
Destringer
Bale breaker.
Straw mill with water injection
7.9 m x 12.9 m storage bay for crushed wet straw.
2 No. straw extruders with 1 No. feed hopper

1 No. set down bay for prepared extruded straw.

2 No. Silage clamps:

Clamp 1 – 123.75 m x 42.5m wide x 3.52 m high (28,534 m3 capacity)
Clamp 2 – 118.75 m x 40 m x 3.52 m high (25,080 m^3)

1 No. Silage leachate tank with leak detection (50m^3)
2 No. Feed hoppers (external) (150 m^3 each)
5 No. Digesters:

2 No. Primary digesters (5,840 m^3 each)
2 No. Secondary digesters 6,430 m^3 each)
1 No. Tertiary digester (6,430 m^3)

3 No. Pasteurisation tanks (35 m^3 each)
Suspension buffer tank (400 m^3)
Separator covered bunker with roller shutter door:

2 No. Separators
Fibre storage bay floorspace 18 m x 13.2 m x 6.4 m (L x W x H)

2 No. Buffer water tanks (400 m^3 each)
1 No. Process water buffer tank (100 m^3)
1 No. Digestate storage bag in lined bund with leak detection (7,344 m^3 capacity)
1 No. Digestate off-take bay with sump (3 m^3)
Emergency flare – 8.7 m stack height
Biogas upgrade unit (BUU) (includes a gatekeeper as there is no Grid Entry Unit)
Biogas booster on inlet to BUU
Carbon dioxide (CO_2) capture unit
2. No. CO_2 storage tanks (50 m^3 each)
2 No. dual fuel CHP engines with 7 m stacks (TEDOM Quanto 1200 1.2MWe)
1 No. 300 kW chiller between 2 Primary digesters.
1 No. chiller on BUU
2 No. condensate sumps
1 No. 550 kW dual fuel emergency boiler
1 No. diesel emergency generator (770 kVA)
2 No. compressors (compressing gas before injecting into road tankers)
4 No. biomethane / (CO_2) off-take vehicle bays
1 No. secondary containment bunds
Full surface water interceptor and cellular storage system (266 m^3 at 95% void space)
3. No pump containers (1 No. inside bund & 2 No. outside bund)
Site boundary fence
Parking area
Access road
Weighbridge
Site office
1 No. Cesspit (55 m^3)

5 Management

The site is operated by ABL, who are in the process of developing several AD plants nationwide. The AD plants will be managed by ABL, supported by the management team. There will be a Site Manager, who will be responsible for the day-to-day operation of the AD plant and who will act as the Technically Competent Manager (TCM). The Site Manager will manage Site Operatives to assist in day-to-day operations. The Head of Permitting is a TCM who will also provide cover until a Site Manager with the relevant qualifications is in place.

The Site Manager will be managed and supported by the wider ABL management team. Roles and responsibilities are summarised in the Staff Organogram (Appendix D of the EMS Manual **(THR-OD-01)**) and are detailed in Section 10 of the EMS Manual **(THR-OD-01)** and associated Standard Operating Procedures (SOPs).

Contracts will be in place for the supply of feedstocks and off-take of all digestate produced to be applied to land for agricultural benefit.

6 Control of Emissions to Land and Water

6.1 Overview

There are no emissions to land.

Dirty water from the silage clamps and feeder loading area, separator bunker and digestate offtake point is collected and reused in the process. Water collecting within the secondary containment system and roofs is used within the AD process under normal operating conditions.

Clean rainwater from the designated clean areas of the site including vehicle access and movement areas (via a full retention separator) and roofs may be discharged to ground via the underground crate system. The discharge of clean water to ground is not an emission to water per se as this is clean rainwater only. However, it has been given an emission point reference of W1 - Clean surface water from underground storage system. See Figure 2: Permit Boundary & Emission Point Plan

6.2 Primary Containment

6.2.1 Silage Clamps

The 2 No. silage clamps, which will store and contain ensiled crop, have a hot rolled asphalt (HRA) base and three back-filled concrete walls each in a U shape. The clamp dimensions are:

Clamp 1 – 123.75m x 42.5m wide x 3.52m high (28,534m^3 capacity)

Clamp 2 – 118.75m. x 40m x 3.52m high (25,080m^3)

The clamps are Ark Agriculture backfilled design, a patented sloping walled silage clamp system. The design incorporates the following features:

A fall along the axis of the clamps to enable drainage of leachate off the clamp surface to the leachate collection system in front of the clamps.

A rainwater collection system off the silage clamp covers reducing the potential for rainwater inundation of the leachate collection system.

A leak detection system in the backfilled walls in accordance with The Water Resources (Control of Pollution) (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO).

The leak detection drain of the clamps are inspected daily in accordance with Daily Checks **(THR-MP-04)**. The silage clamps are inspected annually when empty, and repairs will be made as necessary, to be signed off by a suitably qualified engineer.

6.2.2 Silage Leachate Tank

Silage effluent arising from the silage clamps flows into 1 No. Silage leachate tank (50 m^3). In preference to storage of leachate below ground, the tank contains level switches and submersible pumps to pump the leachate to the 2 No. Dirty water tanks (400m^3 each) above ground within the secondary containment area.

The capacity calculations in relation to SSAFO are detailed in Section 6.1.2 of the EMS Manual **(THR-OD-01)**.

The Silage leachate tank is constructed of polyethylene and has a secondary liner under the full extent of the tank, carried up to the surface and sealed. A leak detection point is provided between the tank and the liner which will be inspected daily in accordance with Daily Checks **(THR-MP-04).**

The Silage leachate tank benefits from a level sensor linked to SCADA.

6.2.3 Ancillary Tanks

There are 5 No. above ground ancillary tanks namely:

1 No. Liquid feedstock tank (400 m^3)
1 No. Process water buffer tank (100 m^3)
1 No. Suspension buffer tank (400 m^3)
2 No. Buffer water tanks (400 m^3 each)

These tanks are for the storage of slurry, leachate, separated liquor or water for the process and are constructed of concrete and sited within the secondary containment system.

The 3 No. pasteurisation tanks (35 m^3 each) are made from stainless steel and are also within the secondary containment system.

All tanks will be inspected during installation and by a suitably qualified engineer every 5 years.

The ancillary tanks all benefit from level sensors linked to SCADA.

6.2.4 Digesters

The digesters are pre-cast concrete tanks manufactured by A-Consult, assembled on site.

The 2 No. Primary digesters have flat concrete roofs, the 2 No. Secondary digesters and the Tertiary digester have double-membrane gas tight cover roofs. The inner and outer membranes of the covers are PVC coated and the outer membrane is resistant to UV.

Following construction, all digester tanks will be hydrostatically tested and Construction quality assurance (CQA) validated by a suitably qualified engineer to ensure they are fit for use.

All tanks will be inspected by a suitably qualified engineer every 5 years as part of a scheduled tank inspection and de-grit programme.

The digesters all benefit from level sensors and overfilling / foaming prevention sensors linked to SCADA.

6.2.5 Digestate Storage Bag

The Digestate storage bag is manufactured by Wiefferink. It is rectangular (63 m L x 37 m W x 3.75 m H) with a storage capacity of 7,344 m^3 excluding freeboard. The storage bag sits within a lined bund with leak detection which provides 110% secondary containment (8,078 m^3) and a 300 mm freeboard.

The storage bag is manufactured from special reinforced plastic foil, consisting of a polyester fabric fitted on both sides with a biogas-resistant PVC coating. The manufacturers specify that the bag is temperature resistant between - 30°C and + 70°C and is fire retardant <100 mm/min.

The bag is mounted on a low-density polyethylene (LDPE) anti-leakage liner, with a guaranteed 20-year lifespan, within an earth bank with a slope of 2% towards the centre to allow effective bag emptying.

To avoid accumulation of residual emissions inside the storage bag, it is equipped with 3 No. vents.

There is a bag level indicator linked to SCADA. The volume within the Digestate storage bag is restricted to 7,344 m^3 so as to maintain a 300 mm freeboard at all times.

6.2.6 Storage of Oils & Chemicals

Fresh oil and waste oil associated with the operation of the CHPs are stored in bunded tanks.

Diesel and Ad-Blue are stored in bunded tanks. The emergency generator has an integral bunded diesel tank (200 m^3).

Ferric hydroxide powder is kept undercover in the chemical store.

Glycol, sulphuric acid (for Manure reception building emissions abatement plant) and anti-foam are kept in a bunded area in the chemical store.

An Inventory of Substances stored on site will be maintained in Appendix A of the Accident Management Plan Manual **(THR-OD-06)**.[8]

6.3 Secondary Containment

6.3.1 Secondary Containment System for Tanks

The secondary containment system for the AD plant, which is designed in accordance with CIRIA C736, is fully detailed within the Primary & Secondary Containment Report With Bund Capacity Calculations Report produced by the GGP Consult, who designed the system.[2]

The secondary containment system comprises a concrete slab underlain with an HDPE layer as detailed above. There is concrete wall around the slab providing available containment volume equal to 11,234 m^3 based on the proposed minimum wall level of 93.275m AOD. A surge allowance of 250 mm has been incorporated within the construction design wall level in accordance with the CIRIA guidance.

The containment capacity is designed in accordance with CIRIA C736, with the calculations in the report demonstrating 25% of the combined tank volume to be a greater volume than 110% of the largest tank volume. Pipework will not penetrate the containment walls or floor. The primary and secondary containment infrastructure is checked on a daily basis in accordance with Daily Checks **(THR-MP-04).**

The secondary containment sump is inspected daily in accordance with the Secondary Containment Checking & Emptying Procedure **(THR-SOP-03).**

6.3.2 Leak Detection for Concrete Slab

There is an HDPE layer across the whole of the concrete slab within the secondary containment area which provides leak detection to provide further reassurance as to containment integrity. The inspection

[8] Accident Management Plan Manual, Three Maids AD, THR-OD-06, V1.0

of this leak detection system via 1 No. leak detection pot is carried out daily in accordance with Daily Checks **(THR-MP-04).**

6.3.3 Leak Detection for Silage Leachate Tank

The Silage leachate tank has a secondary liner under the full extent of the tank, carried up to the surface and sealed. A leak detection point is provided between the tank and the liner which is inspected daily in accordance with Daily Checks **(THR-MP-04).**

6.3.4 Leak Detection for Digesters

The digesters will sit slightly below the main containment slab to allow the drainage of the slab base to fall towards the secondary containment system sump to the south of the site. Given the tanks are located below the bund slab, but above the HDPE liner, a leak detection system has been incorporated by A-Consult to allow for leak detection of each tank. This system is sealed to prevent leaks escaping into the lower HDPE membrane and or liquid flowing into the system from above.

The 5 No. Digester leak detection pots to be inspected daily in accordance with Daily Checks **(THR-MP-04)**.

Further detail is provided within the Primary & Secondary Containment Report with Bund Capacity Calculations Report by GGP Consult.[9]

6.3.5 Digestate Storage Bag

The Digestate storage bag benefits from secondary containment as it sits within a lined earth bund with the capacity of 110% of the maximum contents of the bag i.e., 8,078 m^3, also providing a 300 mm freeboard above maximum operating level.

Primary & Secondary Containment Report With Bund Capacity Calculations, Three Maids AD, GGP-29348-CON-04, GGP Consult, Issue 04, 23rd February 2024

6.4 Drainage

6.4.1 Overview

The drainage system is designed by GGP Consult and described in their Drainage Impact Assessment report.[10]

This section provides a summary of the drainage which should be read in conjunction with the Drainage Impact Assessment, the Drainage Process Flow Diagram (Appendix D), Figure 4: Drainage Layout and Figure 5: Drainage Catchment Plan.

The entire impermeable surfacing and drainage system is subject to an inspection, maintenance, and repair schedule.

6.4.2 Dirty Areas

Leachate and dirty water from the silage clamps is collected through channel drains running along the front of the clamps falling to 1 No. Silage leachate tank (50 m^3 each). The tank has a level switch and submersible pump which pumps leachate to 2 No. above ground Dirty water tanks (400 m^3 each) for use within the AD process.

The dirty area around the feeders and the digestate separator also drains to the underground storage tank and then to the Dirty water tanks for use in the AD process.

The digestate off-take point benefits from a concrete apron and 3 m^3 spill collection sump.

6.4.3 Condensate

Condensate from gas cooling is collected separately in 2 No. condensate sumps and then recirculated for treatment within the digesters.

6.4.4 Clean Areas

In accordance with the drainage strategy, surface water from hardstanding areas is discharged into a Klargester NSFA030 Full Retention Separator to ensure oil, chemicals and solids are removed. The outflow from the separator along with clean water from building roofs can either be reused within the process or is discharged into a below ground cellular crate system for water storage and infiltration. The cellular storage has been designed to contain 266 m^3 at 95% void space of clean water. The system has been sized to accommodate up to a 1:100-year storm event with a 40% allowance for climate change. The Drainage Impact Assessment should be referred to for full calculations.[10]

There are 3 No. penstocks in place for the clean water drainage system such that any spillages can be contained on site if required:

Before the full retention separator;
After the full retention separator; and
Before the crate storage and infiltration system.

[10] Drainage Impact Assessment, Three Maids AD, GGP-29348-DIA-06, GGP Consult, Issue 04, 23rd February 2024

The penstocks also allow for diversion of clean water into process water capture at periods of low rainfall.

6.4.5 Secondary Containment Drainage

Water collecting within the secondary containment is quality assessed daily in accordance with the Secondary Containment Checking & Emptying Procedure **(THR-SOP-03)**.

Typically, water from the secondary containment bund is treated as dirty and pumped to the Dirty Water tank for treatment in the AD process. If visibly contaminated the source of the contamination will be immediately investigated in accordance with the Spill Control Procedure **(THR-SOP-08)**, and steps taken to resolve it.

The secondary containment system is designed in accordance with CIRIA 736. The required additional capacity for rainfall accumulation has been calculated using a worst-case scenario for a 12-hour period of the site being unmanned (12 hour 1:100 storm event with a 40% allowance for climate change).

In the case of abnormal excess water levels due to an extreme rainfall event clean water from the secondary containment system may be released to the wider environment following pre-determined checks detailed within the Discharge of Flood Water Procedure **(THR-SOP-18)**. In these circumstances, if the visual and olfactory checks confirm that there have been no spillages, and onsite testing confirms that parameters are at acceptable levels, then the water will be pumped out to the surface water crate system as clean water.

6.4.6 Pipework

Above ground substrate pipework is stainless steel, designed for longevity and visible for daily inspection in accordance with Daily Checks **(THR-MP-04)**.

There is no underground pipework except for drainage pipework which is made of suitable material e.g., Poly Vinyl Chloride (PVCu) and sealed, and pressure tested (water & air) prior to completion. All drainage within the containment system is located above the 1.0 mm HDPE membrane, with pipes, channels & chambers to have minimum 175 mm concrete surround.

6.5 Control of Emissions to Land & Water under Abnormal Operations

Control of emissions to water and land under abnormal operating conditions are detailed in the Accident Management Plan Manual **(THR-OD-06)** and associated procedures including the Discharge of Flood Water Procedure **(THR-SOP-18)**.

7 Control of Emissions to Air

7.1 Overview

The emission points to air A1 to A22 inclusive are shown on Figure 2 – Permit Boundary & Emission Point Plan and are shown in Table 3 below:

Table 3: Emission Points to Air

Emission Point Reference	Source
A1	Combined heat and power engine stack 1
A2	Combined heat and power engine stack 2
A3	Emergency flare stack
A4	Emergency boiler stack
A5	Emergency generator stack
A6	Emissions abatement plant stack (Manure reception building)
A7	Biogas upgrade unit PRV
A8	Biogas upgrade unit carbon dioxide vent
A9	Carbon dioxide recovery plant PRV1
A10	Carbon dioxide recovery plant PRV2
A11	Compressor PRV1
A12	Compressor PRV2
A13	Underground leachate tank vent
A14	PVRV on Primary digester 1
A15	PVRV on Primary digester 2
A16	PVRV on Secondary digester 1
A17	PVRV on Secondary digester 2
A18	PVRV on Tertiary digester
A19	Digestate storage bag vent 1
A20	Digestate storage bag vent 2
A21	Digestate storage bag vent 3
A22	Liquid digestate off-take point

7.2 Control of Emissions from the Manure Reception Building & Liquid Feedstock Tank

Air from the Manure reception building and displaced air from the Liquid feedstock tank is treated via a bespoke emissions abatement plant supplied by CentriAir which comprises the following steps:

Sulphuric acid scrubber to remove ammonia.

High intensity ultraviolet (UV) light treatment termed 'ColdOx UV' which provides two wavelengths of UV light to both breakdown complex compounds and to produce ozone, which is used to oxidise Volatile Organic Compounds (VOCs);

Double layer carbon filter as a final polishing step; and

Release of treated air via a 15.5m stack (A6).

The system design will ensure that negative pressure is maintained within the building and an appropriate rate of airflow is maintained for effective treatment in the emissions abatement plant.

7.3 Control of Emissions of Raw Biogas

Biogas pressure is measured by gas pressure sensors within the gas storage infrastructure, and is controlled by SCADA, to ensure process parameters are optimised such that gas production meets demand, and storage capacity is not exceeded (see EMS Manual **(THR-OD-01**), Section 12.2 Process Monitoring), preventing a release to atmosphere via PVRVs.

If, due to equipment or system failure, excess biogas is produced the emergency flare will automatically and immediately ignite to burn the biogas to ensure it is not released to the atmosphere.

The emergency flare is a ground enclosed BAT compliant flare which is sized appropriately; it can burn between 500 to 2,500 Nm^3hr (variable) of biogas.

The predicted maximum production of biogas is 2,329 Nm^3/hr. The maximum production of biomethane from the BUU is around 1,249 Nm^3/hr. The appropriate flare capacity has been calculated considering these figures and worst-case scenarios for production of off-specification biomethane.

The PVRVs on the Primary digesters will operate at 12 mbar (A15 & A16). The PVRVs on the Secondary digesters (A17 & A18) and the Tertiary digester (A19) will operate at 6 mbar. The setting on SCADA will dictate that the emergency flare will automatically start before the PVRVs will release gas, meaning that they are only in place for unforeseen emergency use.

7.4 Control of Fugitive Emissions of Biogas

There will be a Leak Detection and Repair (LDAR) Programme in place for the operational site which will be used to measure levels of VOCs, including methane from a number of monitoring points around the site as identified through the DSEAR risk assessment **(THR-OD-09)** and LDAR programme.

LDAR inspections will be carried out by a third party annually, as a minimum. LDAR reports including tracking of required actions will be retained onsite.

7.5 Control of Combustion Emissions

Biogas treatment is carried out to reduce H_2S, VOCs and NH_3 levels within the biogas as described in the Process Description Section 5.13 of the EMS Manual **(THR-OD-01).** The removal of these trace gases reduces the potential for emissions when the biogas is combusted.

Emissions from combustion plant; CHPs (A1 & A2), emergency flare (A3), emergency boiler (A4), and emergency generator (A5) are controlled through a planned preventative inspection and maintenance regime.

The use of the emergency flare is minimised through the control of gas pressures and volumes through process monitoring.

7.6 Control of Emissions from the BUU

Under normal operating conditions there will be no emissions from the BUU. There is a PRV on the BUU (A7) which will only operate under abnormal operating conditions. If the CO_2 recovery plant is not operating then CO_2 is released from the CO_2 stack on the BUU (A8) as is normal operation when CO_2 capture equipment is not installed.

7.7 Control of Emissions from the CO_2 Recovery Unit

Under normal operating conditions there will be no emissions from the CO_2 recovery unit. The 2 No. CO_2 recovery plant PRVs (A9 and A10) may release under abnormal operating conditions.

7.8 Control of Emissions from Digestate Storage & Off-take

The Digestate storage bag is fitted with 3 No. vents (A20 – A22 inclusive) to allow the venting of residual emissions which would reduce the digestate storage capacity.

The primary control for the release of biogas from the Digestate storage bag is production of stable digestate through process monitoring and management of the AD process (see EMS Manual **(THR-OD-01**) Section 12.2 & 12.3 on Process Monitoring & Management respectively). The three-stage digestion process reduces by-pass and thus residual biogas potential.

There is a carbon filter on the vent for displaced air during off-take of digestate liquor (A22). This will be replaced when required in line with manufacturers / suppliers recommendations.

7.9 Control of Emissions to Air under Abnormal Operations

Control of emissions to air under abnormal operating conditions are further detailed in the Accident Management Plan Manual **(THR-OD-06)** and associated procedures.

8 Control of Amenity Impacts

8.1 Odour

Odour emissions will be minimised through:

Ensuring exposed silage clamp faces are kept tidy and to a minimum in accordance with the Feedstock Management & Loading Procedure **(THR-SOP-04).**

Minimisation of Manure reception building fast acting roller shutter door opening times, when receiving manure, in accordance with the Feedstock Management & Loading Procedure **(THR-SOP-04)**.

Digestate separation and fibre storage being within an enclosed bunker with a roller shutter door, openings controlled in accordance with the Digestate Handling Procedure **(THR-SOP-05)**.

Process monitoring to ensure production of stable digestate with low odour potential in accordance with the Process Monitoring Procedure **(THR-SOP-01)**.

Regular inspection and maintenance of abatement measures including the emissions abatement plant for the Manure reception building in accordance with manufacturers recommendations and the Maintenance Planner **(THR-MP-01).**

The maximum odour impact at a receptor location is below the relevant benchmark of 3.0ouE/m3 for "moderately offensive" odours. Therefore, the site operation is unlikely to cause an odour impact at human receptors. Odour emissions will be controlled in accordance with the Odour Management Plan **(THR-OD-05)**.

8.2 Noise

Noise emissions will be minimised through planned preventative maintenance for all equipment including the CHP(s), emergency flare and the gas storage dome fans which are potential sources of noise emissions, in accordance with the Maintenance Planner **(THR-MP-01)**.

A Noise Impact Assessment was carried out as part of the planning permission application for the site.[11] With respect to predicted noise levels in relation to background measurements:

The report has found that:

• *The numerical assessment during the daytime has concluded a negligible impact at the noise-sensitive receptors, where the emissions rating level resulting from the proposed development has been predicted to lie significantly below the representative background sound level, in the order of at least 12 dB below in the worst case.*

• *The numerical assessment during the night-time has concluded a low impact at the noise-sensitive receptors, where the emissions rating level resulting from the proposed development has been predicted*

Noise Impact Assessment, Ref: 404.11923.00004_0004, SLR Consulting, Version No:1, August 2022

comparable to the representative background sound level in the worst case and 5 to 12 dB below the representative background sound level at the closest receptors.

• The impact from the proposed development has been considered in context in accordance with BS 4142 guidance; the contextual considerations have been shown to support an assessment of a low impact development.

The report concluded:

"Following industry standard methodology and national planning policy guidance, it is concluded that noise from the proposed development would have a low impact in that it is not expected to cause any change in behaviour or attitude at the noise-sensitive receptors; that there would be no adverse impact on health or the quality of life.

Off-site noise emissions were deemed to be insignificant therefore a noise management plan is not required."

If noise emissions are detected off-site then corrective actions will be taken as soon as possible and, if required, a Noise Management Plan will be developed, submitted to the EA and implemented.

8.3 Pests

The presence of pests will be minimised through:

Routine pest monitoring and control;

Use of approved products for pest control products only;

Development and implementation of a Pests Management Plan, if required by the EA.

8.4 Dust

Dust will be minimised through:

Straw treatment being carried out within a dedicated Straw treatment building and the use of water within the preparation process.

Enforcing the 7 miles per hour (MPH) site speed limit for all vehicles on site.

Daily clean down procedures in accordance with a Housekeeping Procedure (**THR-SOP-07)**.

If Daily Checks **(THR-MP-04)** identify that dust may be blowing off site, then the Dust Procedure **(THR-SOP-06)** will be followed.

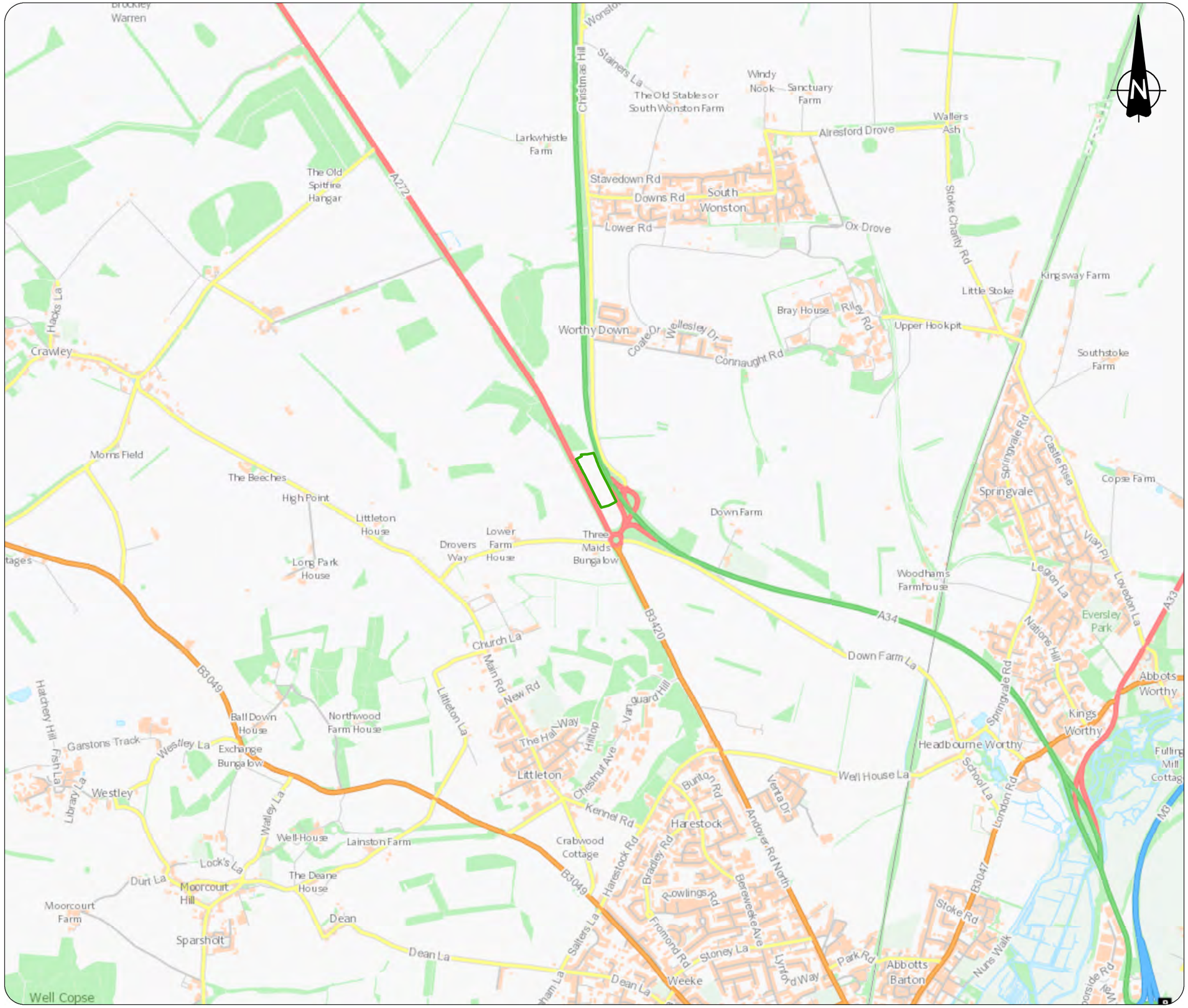
8.5 Bioaerosols

The results of the assessment indicated residual risk from all sources was determined as low or very low. As such, it is concluded that no further control measures, other than those detailed in the assessment, are required in order to reduce the potential for impacts at sensitive locations in the vicinity of the site

9 Control of Climate Change Impacts

Climate change impacts and mitigation controls are considered in a separate site-specific Climate Change Adaptation Risk Assessment **(THR-OD-12)**.

Figures



Earthcare
TECHNICAL

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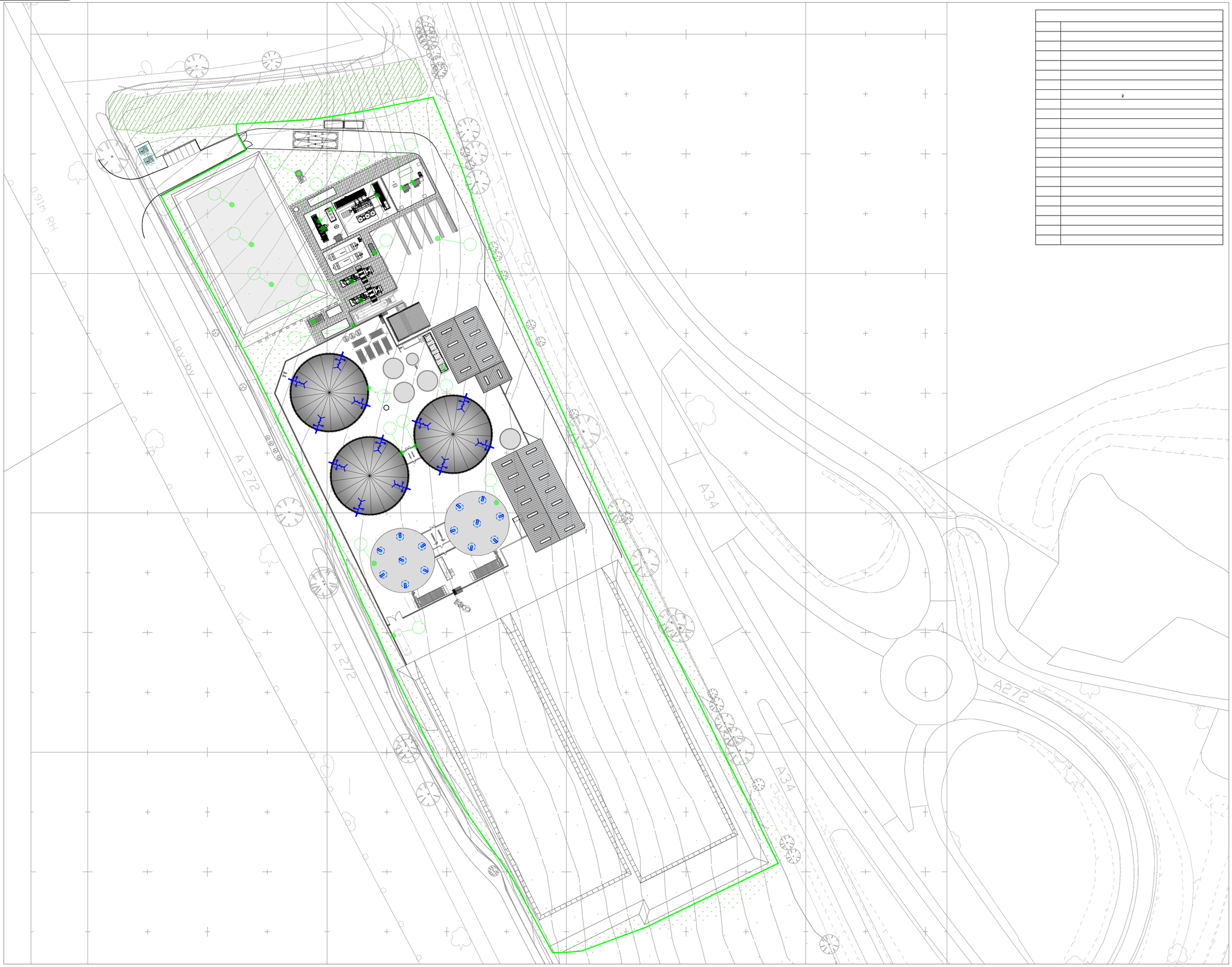

SITE PLAN
Scale: 1:750 @ A1

NOTES:-

1. All dimensions must be checked on site and not scaled from this drawing.
2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
3. All levels shown on this drawing are relative to Agreed Topographic survey
4. This drawing is to be read in conjunction with 29348/100 Series Drawings.
5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.

Perimeter Fence
Permitted Area Boundary (4.453ha)
Emission Release Location
15m Woodland Easement

Rev	Date	Description	DR	CH
E	21/02/24	Issued For Information	SJC	JHC
D	14/02/24	Issued For Information	SJC	JHC
C	01/02/24	Issued For Approval	SJC	JHC
B	31/01/24	Issued For Approval	SJC	JHC
A	17/01/24	Issued For Approval	SJC	JHC

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Email info@ggpconsult.co.uk

Client: acorn

Job Title: AD Plant.
Three Maids

Drawing Title: Site Emissions Plan.

Status: Approval

Scale: As Shown
Date: Jan '24

Drawn By: SJC
Checked: JHC
Approved: JHC

Drg. No.: 29348/202
Rev: E

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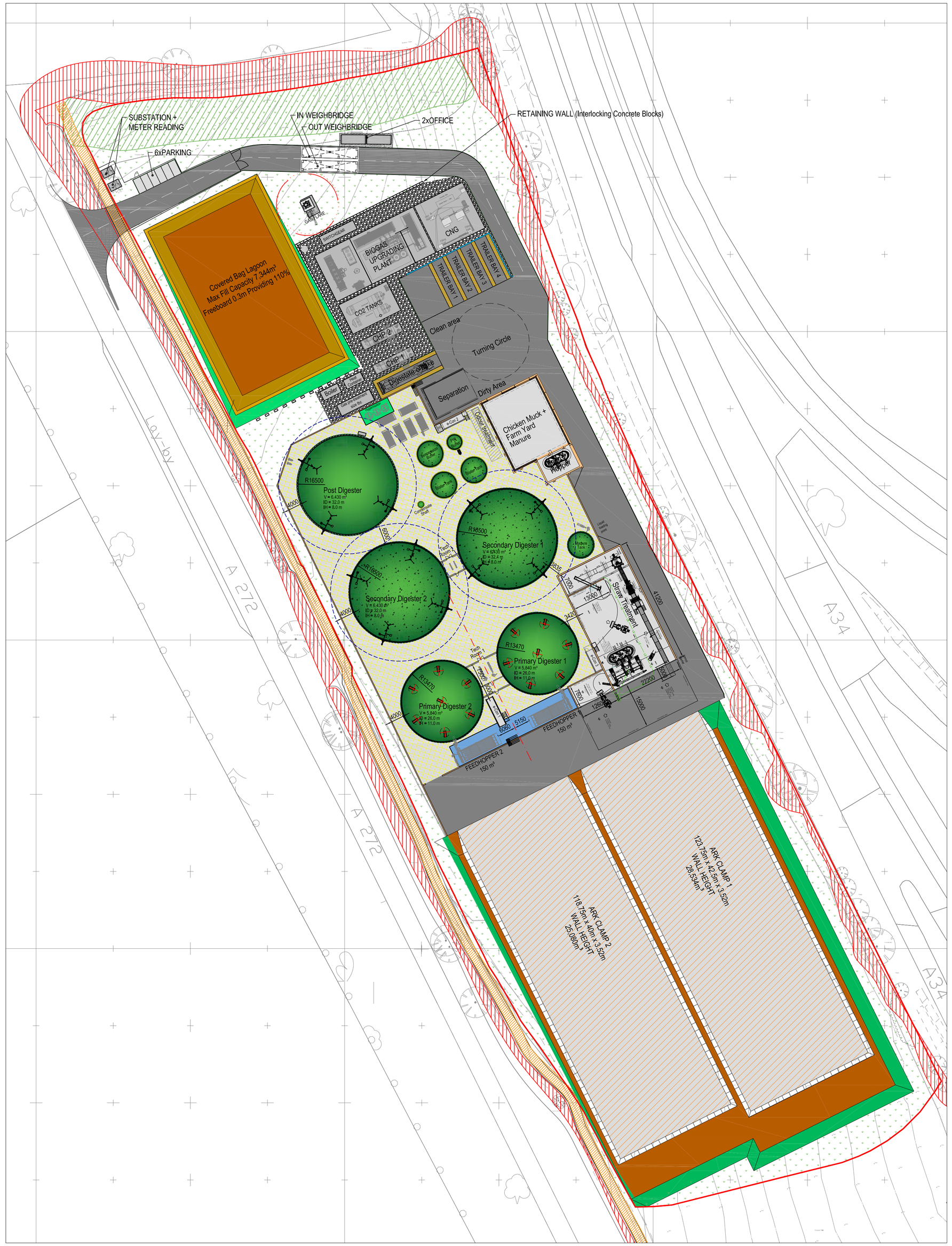

0 50m 100m 150m 200m 250m
Scale 1:5000 @ A1

SITE LOCATION PLAN
Scale: 1:5000 @ A1

SITE PLAN
Scale: 1:750 @ A1

FOR CONSTRUCTION

NOTES:-

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4. This drawing is to be read in conjunction with 29348/100 Series Drawings.
5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.

Site Red Line Boundary (4.453ha)

15m Woodland Easement

Tree Easement

Rev	Date	Description	DR	CH
C6	26/01/24	Tanking Layout amended	MK	JHC
C5	15/01/24	Odour moved	MK	JHC
C4	11/01/24	Switchgear updated to 40ft	MK	JHC
C3	11/01/24	Separation changed	MK	JHC
C2	18/12/23	ISSUED FOR CONSTRUCTION	MK	JHC
C1	08/12/23	ISSUED FOR CONSTRUCTION	MK	JHC

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Email info@ggpconsult.co.uk

Client: acorn

Job Title
AD Plant.
Three Maids

Drawing Title
Site Layout Plan

Status: For Construction

Scale: AS NOTED @ A1
Date: DEC' '23

Drawn By: MK
Checked: JHC
Approved: JHC

Drg. No.: 29348/C/101
Rev: C6

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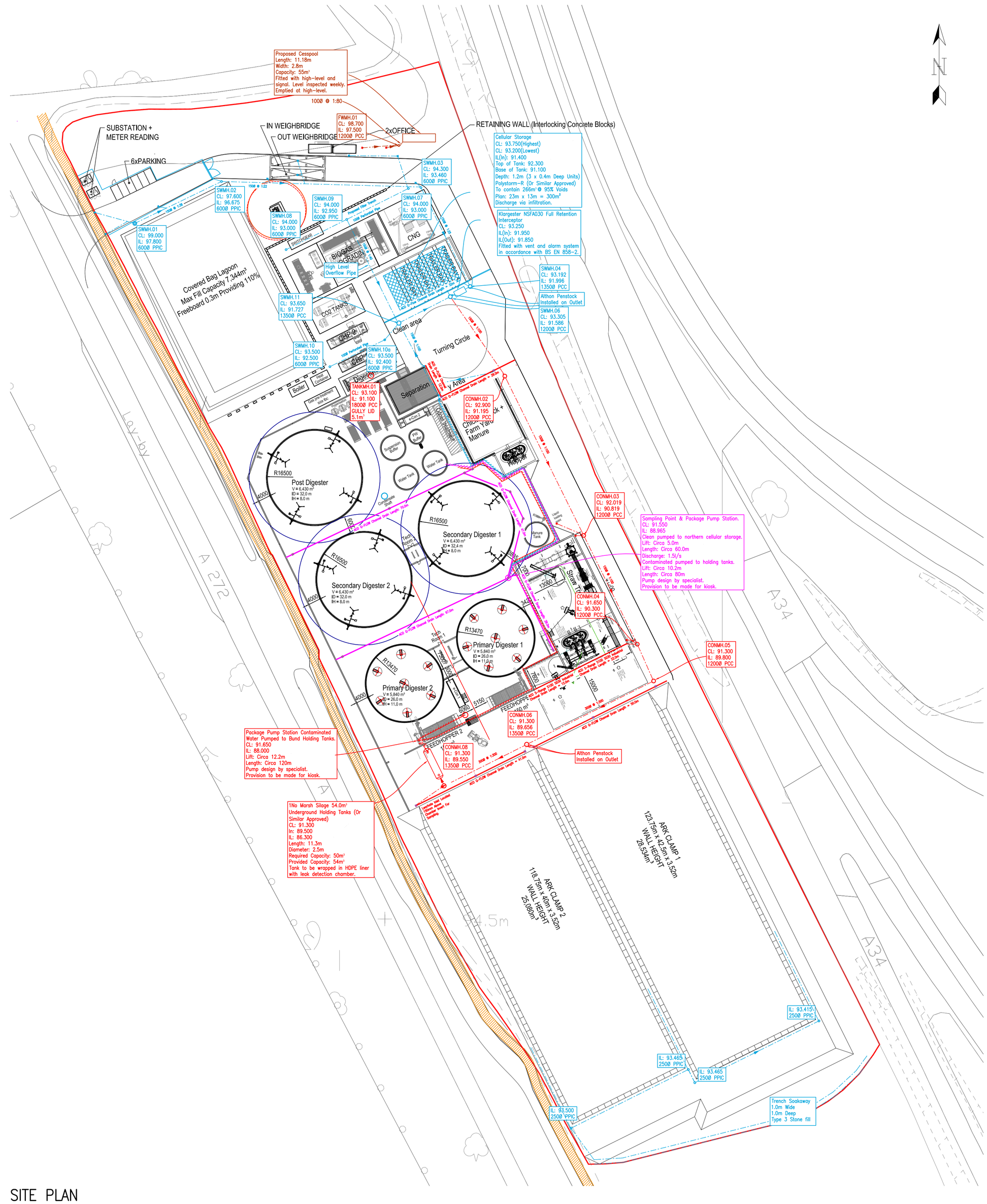

SITE PLAN
Scale: 1:750 @ A1

FOR EA PERMIT

NOTES:-

1. All dimensions must be checked on site and not scaled from this drawing.
2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
3. All levels shown on this drawing are relative to Agreed Topographic survey
4. This drawing is to be read in conjunction with 29348/100 Series Drawings.
5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.

- Site Red Line Boundary
- Clean Surface Water Sewer
- Clean Surface Water Chamber
- Clean Surface Water Headwall
- Clean Surface Water Drainage Channel
- Clean Surface Water Rainwater Pipe
- Clean Surface Water Rising Main
- Contaminated Surface Water Sewer
- Contaminated Surface Water Chamber
- Contaminated Surface Water Drainage Channel
- Contaminated Surface Water Rising Main
- Bund Surface Water Sewer
- Bund Surface Water Chamber
- Bund Surface Water Channel Drain
- Foul Water Sewer
- Foul Water Chamber
- Soil Vent Pipe

All pipes to be encased in concrete.

All Clean manholes to be double sealed

Rev	Date	Description	DR	CH
EA1	26/02/24	ISSUED FOR COMMENT	WS	JHC

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Client: acorn

Job Title
AD Plant.
Three Maids

Drawing Title
Proposed Drainage Layout

Status: EA Permit

Scale: 1:750 @ A0
Date: DEC' '23

Drawn By: W.GRANT
Checked: JHC
Approved: JHC

Drg. No.: 29348/C/110
Rev: EA1

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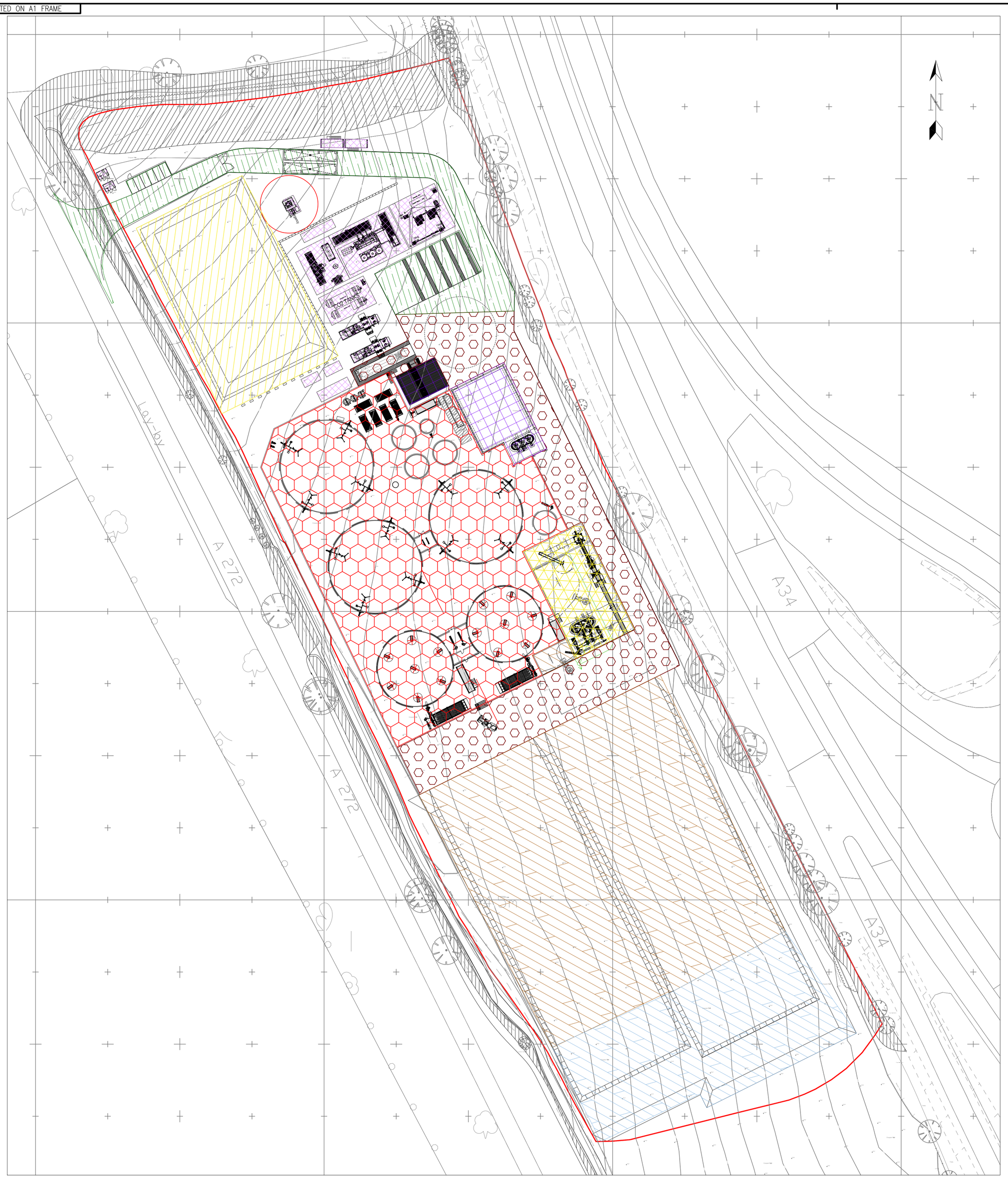

SITE PLAN
Scale: 1:750 @ A1

FOR EA PERMIT

NOTES:-

1. All dimensions must be checked on site and not scaled from this drawing.
2. The Contractor shall make a survey of the site and shall be responsible for obtaining all dimensions and levels necessary for the proper fabrication of the structure as indicated.
3. All levels shown on this drawing are relative to Agreed Topographic survey
4. This drawing is to be read in conjunction with 29348/100 Series Drawings.
5. All existing invert levels are to be confirmed by contractor prior to construction. Connection subject to approval.

Site Red Line Boundary

Denotes Digestate Lagoon Area – 3,042m²

Denotes Clean w/Petrochemicals Hardstanding Runoff Area – 2,461m²

Denotes Clean Equipment Runoff Area – 1,457m²

Denotes Clean/Contaminated Bund Runoff Area – 8,323m²

Denotes Dirty Silage Clamp Runoff Area – 9,220m²

Denotes Contaminated Hardstanding Runoff Area – 3,745m²

Denotes Clean Roof Runoff Area – 804m²

Denotes Clean Silage Clamp Cover Runoff Area – 3,696m²

Denotes Clean Runoff Straw Building – 956m²

Rev	Date	Description	DR	CH
EA1	26/02/24	EA PERMIT	WG	JHC

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Client: acorn bioenergy

Job Title
AD Plant.
Three Maids

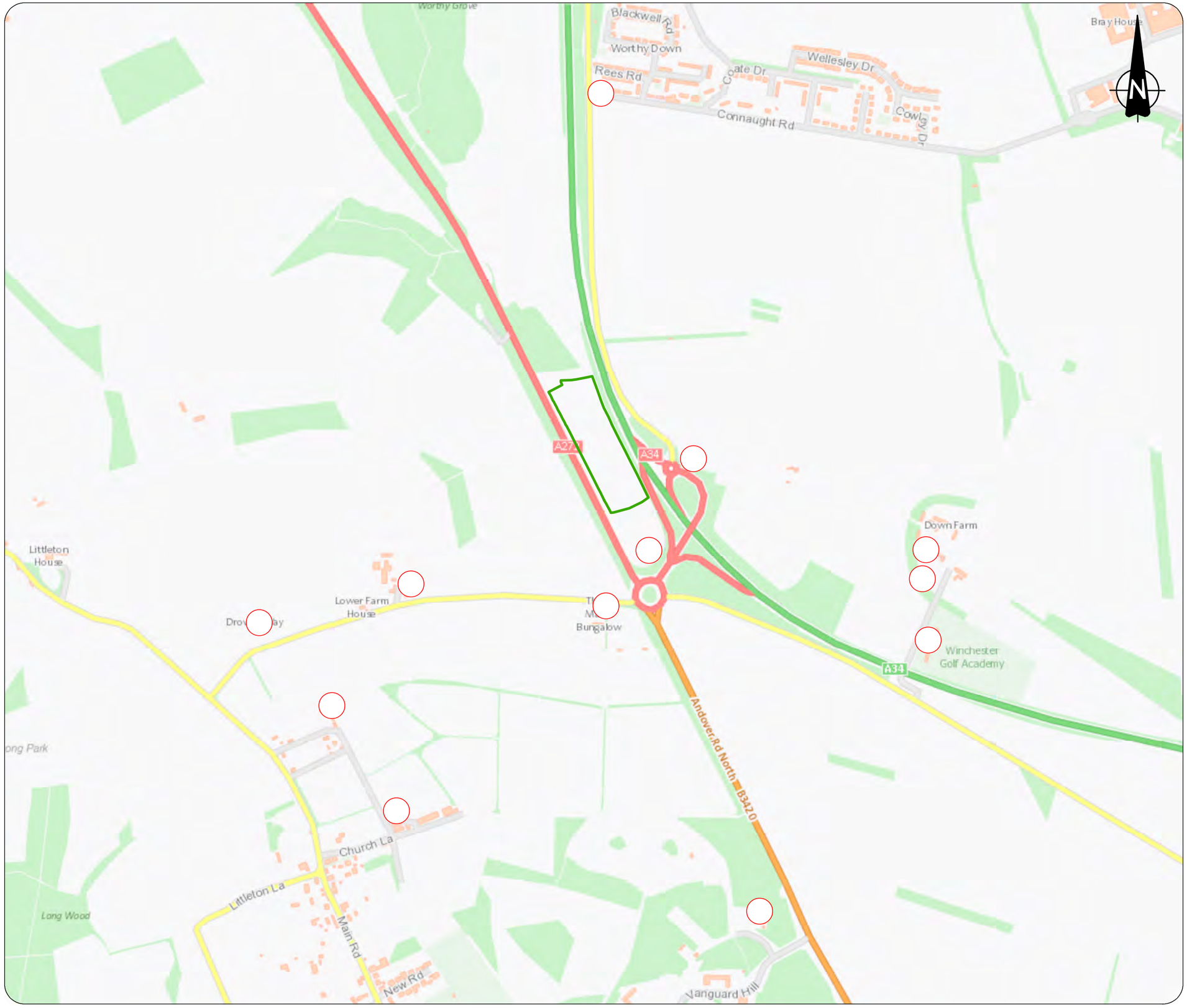
Drawing Title
Drainage Catchment Plan

Status: EA PERMIT

Scale: AS NOTED @ A1 | Date: DEC' '23

Drawn By: WG | Checked: JHC | Approved: JHC

Drg. No.: 29348/C/103 | Rev: EA1



Earthcare
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Appendix A – Medium Combustion Plant Information

Item of plant	MCP specific identifier (serial number)	12 digit grid reference	Size (MWth) (rated thermal input)	Type of MCP (technology such as diesel engine, gas turbine, other engine or other MCP)	Type of fuel used	Date first put into operation	Nomenclature of Economic Activities (NACE) code	Expected operating hours
CHP1	**To be confirmed**	446014 134089	2.830	Other MCP	Biogas	Not yet commissioned	35.21 Manufacture of gas	7,500
CHP2	**To be confirmed**	446010 134097	2.857	Other MCP	Natural gas	Not yet commissioned	35.21 Manufacture of gas	7,500
Emergency boiler	**To be confirmed**	445996 134080	647*	Other MCP	Natural gas & biogas	Not yet commissioned	35.21 Manufacture of gas	1,314
Emergency generator	**To be confirmed**	446018, 134109	1,867	Diesel engine	Diesel	Not yet commissioned	35.21 Manufacture of gas	Emergency use only

* at 85% efficiency

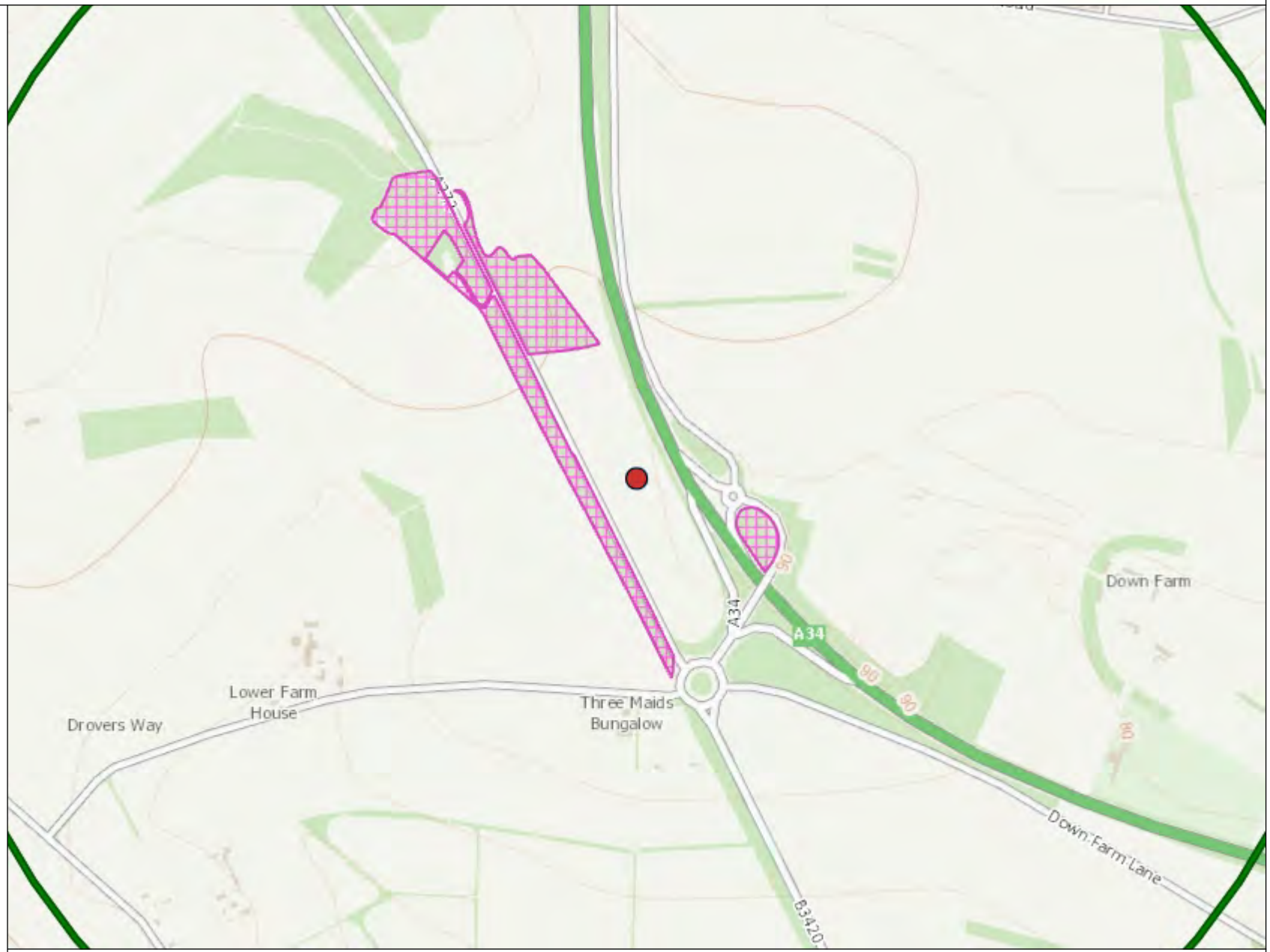
Appendix B - Nature and Heritage Conservation Screening Report & Maps

Protected Habitats

Environment Agency

Legend

Protected Habitats screened for Env Permits



1: 10,000

0 250

Metres

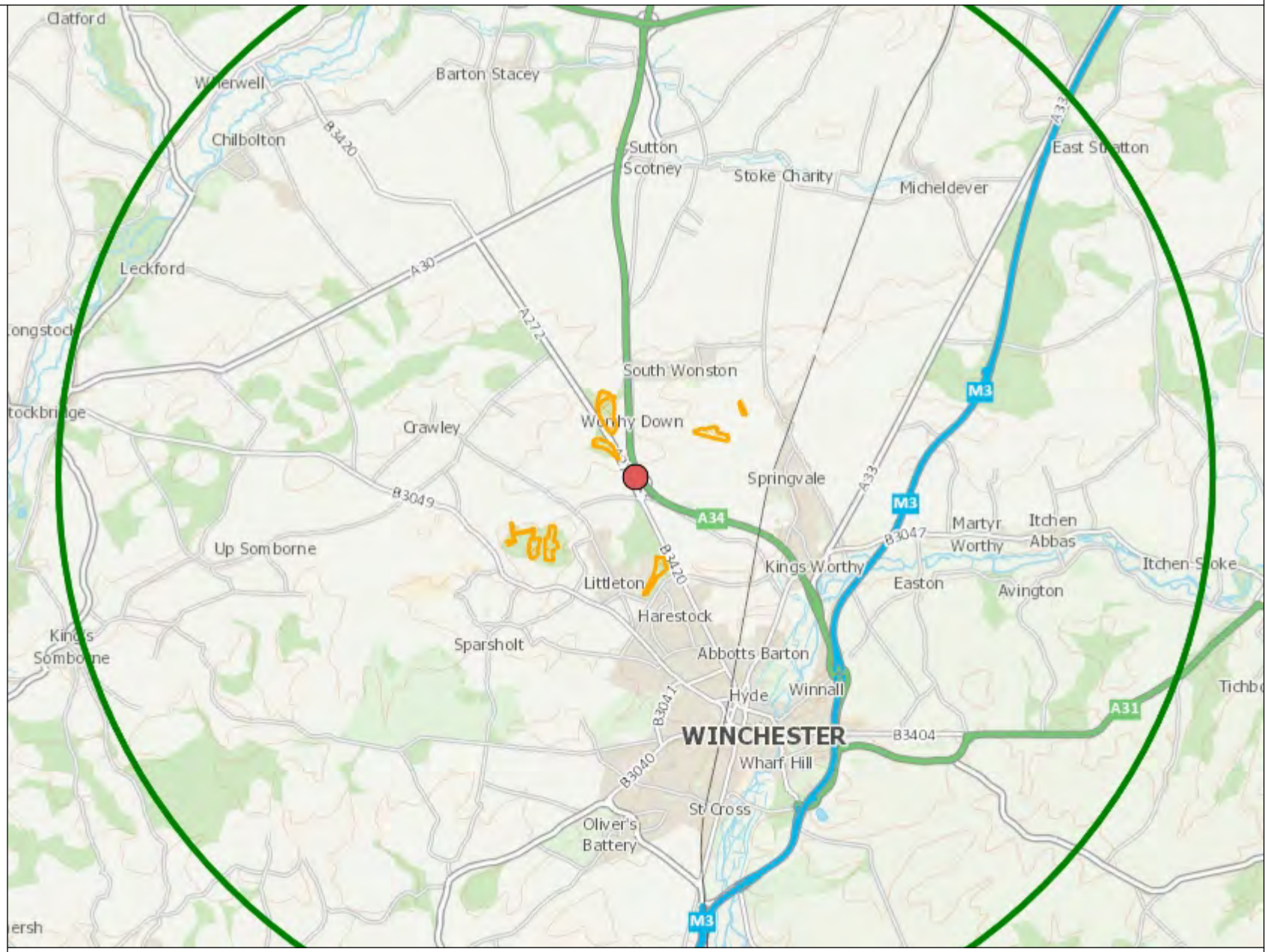
N W E S

LWS

Environment Agency

Legend

Local Wildlife Sites



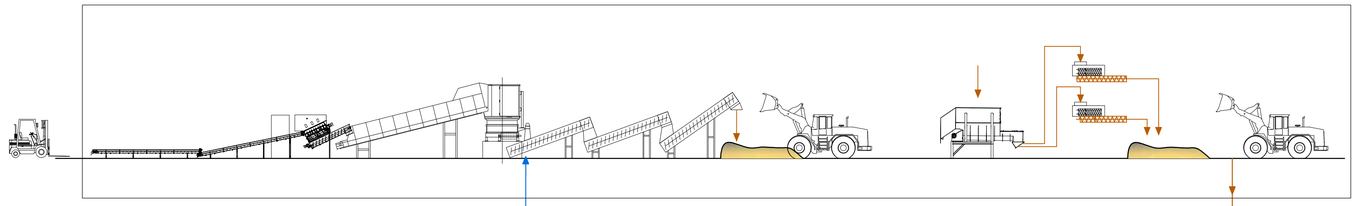
1: 100,000

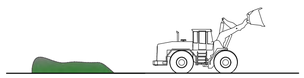
0 2,500

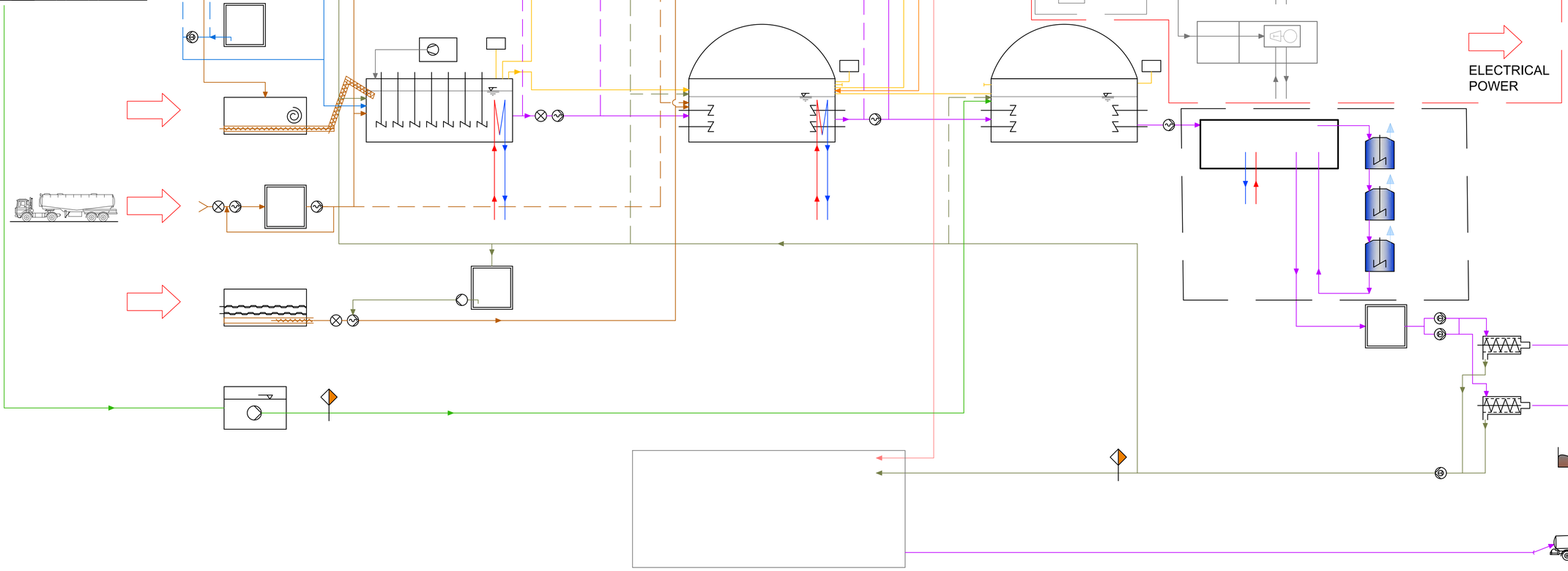
Metres

N W E S

Appendix C - Process Flow Diagram







REV.	DATE	REVISION DETAILS	DRAWN	CH'K	APP'D
A	-	-	-	-	-

agraferm Germany

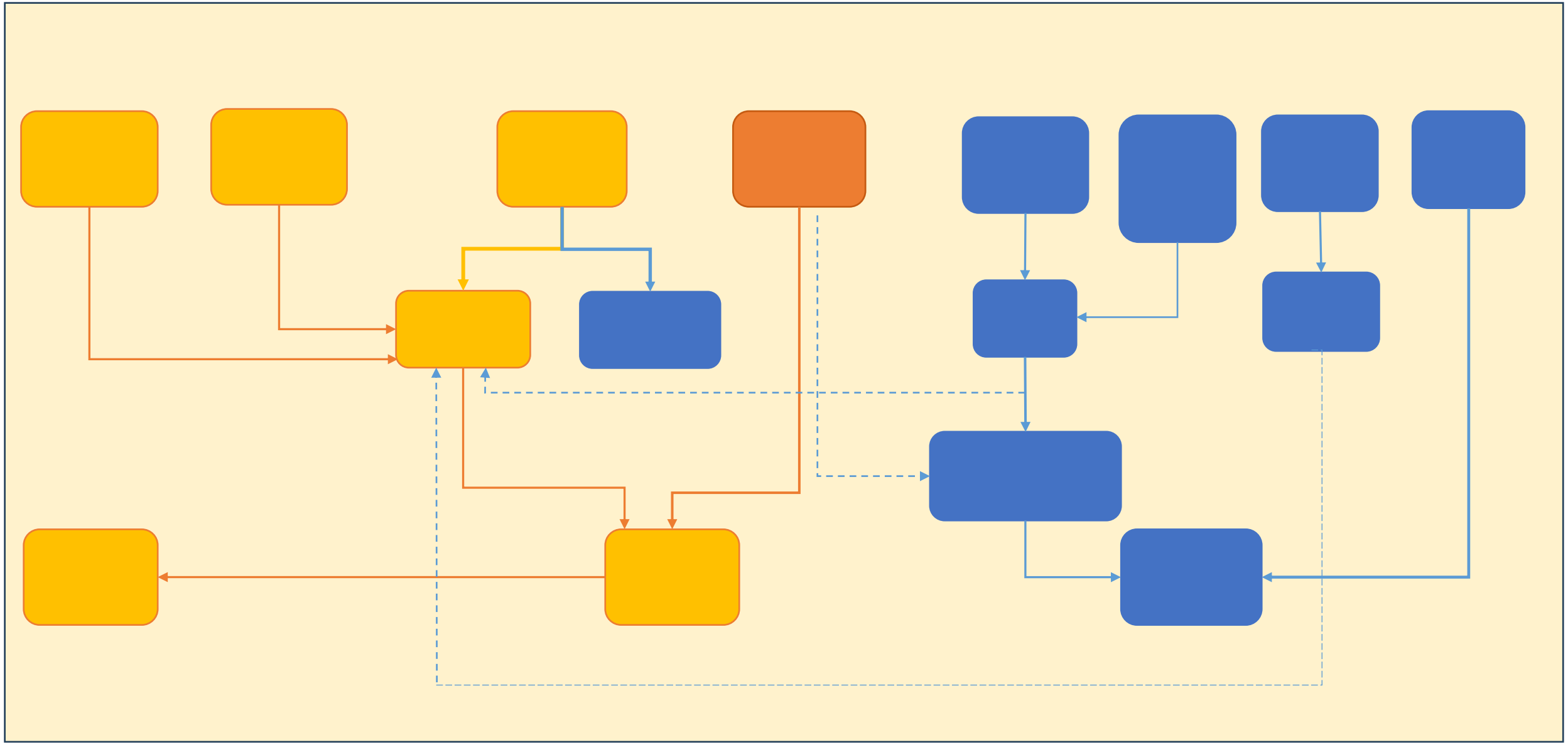
PROJECT: Three Maids				ORDER NO.: A2878UK	
TITLE: Process Flow Diagram					
DATE: 09.01.2024	DRAWN: SKa	CH'K: -		APP'D: -	
DRAWING NO.:		REVISION: -	VERSION: 01	SHEET: A1	SCALE: -	PAGE: -
DOCUMENT NO.:					

SIGNED:

A1

Appendix D - Drainage Process Flow Diagram

THR-OD-04 Three Maids AD, Drainage Process Flow Diagram V1.0, March 2024



THR-OD-10 Three Maids AD, Staff Organogram V1.0, March 2024