

FLOOD RISK ASSESSMENT

PROPOSED GREENHOUSE & ANCILLARY BUILDINGS
DECOY FARM
POSTLAND ROAD
CROWLAND
LINCS.
PE6 0LX



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Contents

INTRODUCTION	3
APPLICATION SITE.....	3
Table 1: Flood Zones Definition (Ignoring the presence of defences)	4
Table 2: Flood Risk Vulnerability Classification	5
Site Levels.....	5
DRAINAGE AUTHORITIES	5
Environment Agency	5
Flood Zones	5
Risk of Flooding from Rivers & Sea	6
Fluvial Defences.....	6
River Welland.....	6
SOUTH HOLLAND DISTRICT COUNCIL	8
NORTH LEVEL INTERNAL DRAINAGE BOARD.....	8
FLOODING FROM OTHER SOURCES	9
SURFACE WATER FLOODING	10
HISTORIC FLOODING	10
DRAINAGE STATEMENT	12
Surface Water Drainage.....	12
Infiltration.....	12
Watercourse.....	13
Public Sewer	14
Foul Drainage.....	14
CLIMATE CHANGE	14
FLOOD PROTECTION	15
CONCLUSION	16

Figures

- Map 1 Environment Agency Flood Map.
- Map 2 Risk of Flooding from Rivers & Sea Map.
- Map 3 South Holland SFRA Residual Flood Hazard District Present Day 1% fluvial and 0.5%Tidal Event Map
- Map 4 South Holland SFRA Residual Peak Depth District Present Day 1% fluvial and 0.5%Tidal Event Map
- Map 5 South Holland SFRA Residual Peak Velocity District Present Day 1% fluvial and 0.5%Tidal Event Map
- Map 6 South Holland SFRA Residual Flood Hazard District 2115 1% fluvial and 0.5%Tidal Event Map
- Map 7 South Holland SFRA Residual Peak Depth District 2115 1% fluvial and 0.5%Tidal Event Map
- Map 8 South Holland SFRA Residual Peak Velocity District 2115 1% fluvial and 0.5%Tidal Event Map
- Map 9 Surface Water Flood Map
- Map 10 Historic Flood map
- Plan 1 Location Plan
- Plan 2 Site Layout Plan
- Plan 3 Packhouse Floor Plans & Elevations
- Plan 4 Greenhouses Elevations
- Plan 5 Topographical Survey
- Document 1 Wallingford Greenfield Run-of Rates for Sites
- Document 2 Wallingford Surface Water Storage Requirements for Sites

FLOOD RISK ASSESSMENT PROPOSED GREENHOUSE & ANCILLARY BUILDINGS, DECOY FARM, POSTLAND ROAD, CROWLAND. PE6 0LX

INTRODUCTION

The Government has placed increasing priority on the need to take full account of the risk associated with flooding at all stages of the planning and development process. This seeks to reduce the future damage to property and the risk to life from incidents of flooding. Their expectations relating to flooding are contained in the National Planning Policy Framework Feb 2019, (NPPF), which identifies how the issue of flooding is dealt with in the drafting of planning policy and the consideration of planning applications by avoiding inappropriate development in areas at risk from flooding and to direct development away from areas at highest risk.

The NPPF provides that development in areas at risk of flooding should be avoided and seeks to direct development away from areas at highest risk. There is a sequential, risk-based approach to the location of development avoiding where possible, flood risk to people and property managing any residual risk and taking account of the impacts of climate change.

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APPLICATION SITE

The site is located on land at Decoy Farm, Postland Road Crowland, Lincolnshire, PE6 0LX, and lies within the administrative area of South Holland District Council. The National Grid Reference for the site is TF 26159 12785.

Plan 1

This application essentially replaces the expired permission for 5.3ha of glasshouses and associated infrastructure that was granted permission on the same site in April 2016 (H02-0161-16).

The Site would be classed as Major Development applying the Town & Country Planning (Consultation) (England) Direction 2009 as the site is to be developed for more than 1 hectare.

This flood risk assessment has been prepared for a planning permission for the erection of commercial designed greenhouses 5.3Ha, together with a Packhouse Building 90m x 20m incorporating staff welfare, offices, cold store dispatch etc. The greenhouses comprise of a steel galvanised structure with clear horticultural glass with aluminium glazing bars to both roof and sides. The packhouse building is a steel portal frame with profiled steel sheeting cladding to the roof and sides. An additional area of impervious service road (2850m²) will also be constructed to serve the proposed development. The staff car park will consist of a stone chip surface on a pervious hardcore base. **Plans 2,3 & 4**

The site is adjacent to an existing AD Plant, it is intended that the heat generated by the AD Plant will be used to heat the greenhouses.

The National Planning Policy Framework Guidance NPPG defines three levels of flood risk depending upon the annual probability of fluvial flooding occurring.

Zone 1 – Low Probability (<0.1%)

Zone 2 – Medium Probability (0.1 – 1.0%)

Zone 3 – High Probability (>1.0%)

The proposed development site is shown to be within Flood Zone 3 ‘High Probability’, as detailed on the Environment Agency’s Flood Zone Maps **without defences**.

Table 1: Flood Zones Definition (Ignoring the presence of defences)

Flood Zone 3- High Probability
Definition Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. The water-compatible and less vulnerable uses of land are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone. The more vulnerable and essential infrastructure uses should only be permitted in this zone if the Exception Test is passed. Essential Infrastructure permitted in this zone should be designed and constructed to remain operational and safe for uses in times of flood Flood Risk Assessments requirements All proposals in this zone should be accompanied by a Flood Risk Assessment. Policy aims Developers and local authorities should seek opportunities to: • reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; • relocate existing development to land with a lower probability of flooding; • create space for flooding to occur by allocating and safeguarding open space for flood storage.

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPG, the proposed development use for the site is considered to be ‘Less Vulnerable’. Table 2 of NPPG states that such uses are permitted in these zones.

Table 2: Flood Risk Vulnerability Classification

Less Vulnerable
• Police ambulance and fire stations that are not required to be operational during flooding • Buildings used for shops, financial, professional, and other services, restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in “more vulnerable” and assembly and leisure. • Land and buildings used for agricultural and forestry. • Waste treatment (except land fill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment works that do not need to remain operational during times of flood. • Sewage treatment works (if adequate measures to control pollution and manage sewage during flood events are in place).

Site Levels

From the topographical survey the land levels at the site of the new greenhouse vary from 0.85 – 1.30mODN with the average ground level being 1.05mODN. **Plan**

DRAINAGE AUTHORITIES

Environment Agency

The Environment Agency has permissive powers for reducing the risk of flooding from designated main rivers and from the sea.

The following potential sources of flooding affecting the development site has been identified as:

- From the River Welland and the Crowland Washlands
- North Level IDB watercourses

Flood Zones

The Flood Zone Map indicates the area at risk of flooding, **assuming no flood defences exist**, for a flood event with a 0.5% chance of occurring in any year for flooding from the sea, or a 1% chance of occurring for fluvial (river) flooding. It also shows the extent of the Extreme Flood Outline which represents the extent of a flood event with a 0.1% chance of occurring in any year, or the highest recorded historic extent if greater. In some locations, there are many kilometres of raised flood defences. To meet the requirements of the National Planning Policy Framework, these defences are removed in their entirety to produce the Flood Map for Planning (Rivers and Sea). The map therefore shows the full extent of areas that would be at risk of flooding if no defences existed and water could spread out across the floodplain.

In some locations, such as around the fens and the large coastal floodplains, showing the area at risk of flooding assuming no defences may give a slightly misleading picture in that if there were no flood defences, water would spread out across these large floodplains. This flooding could cover large areas of land but to relatively shallow

depths and could leave pockets of locally slightly higher land as isolated dry islands. In fenland areas, such as Crowland, this can give a slightly misleading picture in that if there were no flood defences the fens would revert to their natural wetland state, with water spreading out across the whole fens. This flooding would cover large areas of land but to relatively shallow depths and would leave the slightly higher land as isolated dry islands.

In fenland areas, such as Crowland, this can give a slightly misleading picture in that if there were no flood defences the fens would revert to their natural wetland state, with water spreading out across the whole fens. This flooding would cover large areas of land but to relatively shallow depths and would leave the slightly higher land as isolated dry islands.

Flood defences are, however, present throughout the fenlands and these do reduce the risk of flooding. Whilst the flood defences are generally in a good condition there is always a chance they can be overtopped or fail during extreme floods. With the water level in the river being above the adjacent ground level a failure of the defence could lead to flooding spreading further than identified on the flood map.

The Flood Map represents areas at risk of flooding for present day only and does not take account of climate change. In this area the main risk of flooding is from a breach to the tidal defences along the coastline that could affect the site. These maps show that the majority of the proposed development site is considered at no risk from flooding as it is all located within an area zoned as Flood Zone 1. **Map 1**

[Risk of Flooding from Rivers & Sea](#)

The Risk of Flooding from Rivers and Sea Map shows that the site is at Low risk of flooding. Low means that each year, this area has a chance of flooding of less than 1 in 100 (1%) but greater than or equal to 1 in 1000 (0.1%). This takes into account the effect of any flood defences that may be in this area. Flood defences reduce, but do not completely stop the chance of flooding as they can be overtopped or fail. **Map 2**

[Fluvial Defences](#)

In this particular area, the main risk of flooding is from a breach to the Crowland washlands embankment which lies some 1700m west of the site with the River Welland lies some 575m further to the west.

The fluvial defences protecting the site consist of Crowland-Cowbit Washes and embankment. They are in fair condition and reduce the risk of flooding to a 1% (1 in 100) chance of occurring in any year. The Environment Agency inspect these defences routinely to ensure potential defects are identified.

[River Welland.](#)

The site is located approximately 1700m from the River Welland Crowland Washes, a controlled flood storage area on the River Welland. Flood levels in the Washes are governed by the level in the River Welland and the structures which control flow of water between them. The Wash lands are located to the east of the River

Welland and the right bank is lower than the left bank any over topping on this stretch of river will therefore be into the Wash lands

Breach Analysis to Welland Washes Defences

Taking the precautionary approach, the Hazard Rating following a breach which in Flood Risk Assessment (FD 2320) Guidance for New Development Phase 2 R& D Technical Report these are classified as low <0.75, moderate 0.75 - 1.25, significant 1.25 - 2.00 and extreme >2.0 based upon an empirical measure of velocity and depth.

$$HR = d \times (v + 0.5) + DF$$

Where V = Flood flow velocity (m/sec) D = Flood depth (m)

DF = A debris factor included to represent the greater damage, or risk of injury to people, that can occur if debris is swept along with the water. = 0.5 for depths <0.25 or 1.0 for depths.

For the degree of Flood Hazard to be classified as low HR must be <0.75

Flood Hazard			Description
	<0.75	Low	Caution – Flood Zone with shallow flowing water or deep standing water.
	0.75 – 1.25	Moderate	Danger for Some - (i.e. children) Danger Flood Zone with deep or fast flowing water.
	1.25 – 2.0	Significant	Danger for Most – Danger Flood Zone with deep fast flowing water.
	>2.0	Extreme	Danger for All – Extreme Danger Flood Zone with deep fast flowing water.

The 2017 Update to SHDC, SFRA has carried out a Tidal & Fluvial Hazard Mapping, for the district, following a breach to the defences. The present day 1% Fluvial and 0.5% tidal event Probability Maps District show that the site where the proposed development is to be located is partly within a hazard rating area of 1.25 – 2.0 (Danger for Most) the remainder in a hazard rating area Greater than 2.0 (Danger for All) with a depth of between 1.0m – 2.0m and a velocity of 0 -0.3m/sec. **Maps 3, 4 & 5**

The Hazard, Velocity and Depth Maps, for year 2115, shows that the site is partly within an hazard rating area of 1.25 – 2.0 (Danger for Most) the remainder in a hazard rating area Greater than 2.0 (Danger for All) with a depth of between 1.0m – 2.0m and a velocity of 0 -1.0m/sec. **Maps 6, 7 & 8**

The Environment Agency standing advice recommends that for “Less Vulnerable” developments in Flood Zone, the floor level of buildings should be raised as high as practicable. For operational needs and the nature of the development the FFL for the greenhouse will be at ground level and the packhouse 150mm higher, this level will provide a gradient from the glasshouse into the packhouse building suitable for the automated trolley system. The packhouse has at first floor level, facilities for staff welfare and this will provide a safe haven for the staff if required.

A flood warning and evacuation plan will be prepared.

SOUTH HOLLAND DISTRICT COUNCIL

In order to inform the process of risk assessment and site selection the District Council commissioned Haskoning UK Ltd Consultants to prepare a Strategic Flood Risk Assessment in December 2002. They have carried out an update of this report and this report was published in January 2010 and this was further updated in February 2017.

This Flood Risk Assessment has taken the results of the (2017) updated South Holland Strategic Flood Risk Assessment (SHSFRA) into account in its findings.

The whole of the tidal flooding information has been replaced by the mapping from the latest Environment Agency Tidal Hazard mapping. Where the mapping for an area contains both fluvial and tidal components, the more severe of the two has been presented.

NORTH LEVEL INTERNAL DRAINAGE BOARD

The site lies within the administrative area of the North Level Internal Drainage Board who has powers under the Land Drainage Act to carry out measures to alleviate flooding in Districts with special drainage needs other than Main River.

The site is within the Postland drainage area No 7, which drains to Postland Pumping Station constructed in 1973 as part of the North Level Major Improvement Scheme, originally designed to evacuate surplus water from an agricultural area of 2567 hectare. In more recent years with the residential expansion of Crowland, 6.5 hectares of urban run-off now discharges directly into the drainage system. To accommodate this extra flow, the drainage channel has been increased in size to store surplus water without increasing pump capacity.

The Board's drain No 702 Brotherhouse Bar Drain runs alongside the eastern boundary of the site

The Board's prior written consent will be required for any of the following works:

- No person without the previous consent of the Board shall erect any building or structure, whether temporary or permanent, or plant any tree, shrub, willow or other similar growth within 9 metres of the landward toe of the bank where there is an embankment or wall or within 9 metres of the top of the batter where there is no embankment or wall, or where the watercourse is enclosed within 9 metres of the enclosing structure.
- No person shall, without the previous consent of the Board, for any purpose, by means of any channel, siphon, pipeline or sluice or by any other means whatsoever, introduce any water into the District or, whether directly or indirectly, increase the flow or volume of water in any watercourse in the District.

- The erection or alteration of any mill dam, weir or other like obstruction to the flow, or erection or alteration of any culvert within the channel of a riparian watercourse.

When planning approval has been obtained an application to discharge the attenuated surface water into the Drain will be submitted to the Board.



North Level IDB Drainage Map

FLOODING FROM OTHER SOURCES

Flooding is a natural process and can happen at any time from sources other than watercourses and the sea.

- Flooding from land can occur from intense rainfall, often over short duration of time that is unable to soak into the ground or enter the drainage system. However, with the natural topographic nature of the ground having no high ground around the site. With the proposed ground floor levels being set above the existing ground floor level this will not cause any rapid inundation of the site.
- The area is not known to suffer from any groundwater problems.
- Flooding from sewers can occur from over loading from heavy rainfall caused by blockages or having inadequate capacity. There are no public sewers in the proximity of the site.
- Non-natural or artificial sources of flooding such as reservoirs, lakes, or canals where water is stored above natural ground level could cause flooding if the structure fails or is over topped. There are no known sources within the vicinity of the site.

SURFACE WATER FLOODING

The majority of the site for the proposed units is not shown on the Low Risk scenario Surface Water flood maps, for the 1 in 1000-year event, to be affected from surface water flooding. This type of flooding is usually short lived and associated with heavy downpours of rain, thunderstorms etc. **Map 9**

The maps for surface water and revised maps for river and sea flooding define the risk as High, Medium, Low and Very Low. The chance of flooding for the area defined in any given year is shown below:

- **High:** greater than 1 in 30 (3.3%).
- **Medium:** between 1 in 100 (1%) and 1 in 30 (3.3%).
- **Low:** between 1 in 1000 (0.1%) and 1 in 100 (1%).
- **Very Low:** less than 1 in 1000 (0.1%)

Unlike the fluvial mapping, which is based on a detailed hydraulic model, this mapping is based purely on applying rainfall to a digital terrain model. As such this mapping serves to represent a worst-case scenario which may well overstate the actual probability of flooding in this area.

There is a caveat on the Defra Data website, as to the use of these maps and that they are not to be used to identify that an individual property will flood. Because of the way they have been produced and the fact that they are indicative, these maps are not appropriate to act as the sole evidence for any specific planning or regulatory decision or assessment of risk in relation to flooding at any scale without further supporting studies or evidence.

HISTORIC FLOODING

Information received from the Environment Agency regarding historic flooding shows that the site was affected from the March 1947 River Welland near Cowbit flood event. **Map 10**

SEQUENTIAL APPROACH

When applying the sequential approach for flood risk in accordance NPPF the site would fall into Zone 1 (Low Probability) as shown on the Environment Agency's Flood Map without defences in place.

The Environment Agency categorise land into one of three Flood Zones.

- Flood Zone 1 is Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
- Flood Zone 2 is Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding: or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)

- Flood Zone 3a is Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPG, the proposed use is classified as, “Less Vulnerable” use, Table 1 of NPPG states that such uses are appropriate in this zone (as summarised in Table 3 NPPG)

TABLE 3: Flood risk vulnerability and flood zones ‘compatibility’

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Flood Zone 1	✓	✓	✓	✓	✓
	Flood Zone 2	✓	✓	Exception Test Required	✓	✓
	Flood Zone 3a	Exception Test Required	✓	✗	Exception Test Required	✓
	Flood Zone 3b Functional Floodplain	Exception Test Required	✓	✗	✗	✗

Sequential & Exception Test

NPPF Guidance Paragraphs 155 - 165 requires development within high areas of flood risk be determined using a sequential risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account the impacts of climate change.

The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. The NPPF states that development should not be permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. It is important to note that the Sequential Test does not specifically mean that sites such as this cannot be developed, rather that sites at less risk should be developed first. The whole of the surrounding area is shown on the Flood Map for Planning to be in Flood Zone 3 and there are no other suitable sites in a lower flood zone.

Planning Practice Guidance states: - When applying the Sequential Test, a pragmatic approach on the availability of alternatives should be taken. For example, in considering planning applications for extensions to existing business premises it might be impractical to suggest that there are more suitable alternative locations for that development elsewhere.

In this case, the existing business is centred on the land owned and operated by the applicant and to consider areas outside the holding would not be practical.

The Greenhouses cannot be located elsewhere, as the heat generated by the existing onsite AD plant is to be used to heat the greenhouses.

Therefore, the Sequential Test is passed

With the application being for a Less Vulnerable use, the Exception Test is not required.

DRAINAGE STATEMENT

The following is the drainage strategy which was proposed and excepted for the previous application

Surface Water Drainage

This drainage statement, for the site, proposes to utilise attenuation techniques to reduce the storm water discharge from the proposed development and to minimise the impact of the development on the surrounding area and to comply with guidelines, which require at least one workable solution for managing surface water.

In accordance with the House of Commons Written Statement (HCWS161 – 18th December 2014) there is a requirement for SuDS to be incorporated in all developments of over 1 hectare (major developments) unless demonstrated to be inappropriate.

Furthermore, in accordance with recognised guidance, Part H of the Building Regulations 2010, there is a hierarchy of where surface water should discharge. This hierarchy should be followed where practicable, and is as follows:

- 1) Infiltration
- 2) Watercourse
- 3) Public sewer

Any proposed surface water drainage system will need to be designed to account for the effects of climate change over the lifetime of the development, the proposed drainage systems should be sized to allow for a higher central 20% increase in rainfall intensity.

The nature of the development, for growing crops, water is a valuable asset meaning that rainwater harvesting is vital in order to provide a sustainable water supply for crop watering instead of relying on a potable water supply from the mains.

The anticipated water usage for watering the crops for 8 weeks is 2.5litres/day thus $2.5 \times 53000\text{m}^2 \times 7 \times 8 = 7420\text{m}^3$. The proposed rainwater storage lagoon will provide approximately 61% of the water required to water the crops over an 8-week cycle without any top up.

Infiltration

The site is located on clayey soils which are slowly permeable, infiltration methods, for dealing with the large area of run-off and the need to capture water for reuse, have been discounted for this site.

Watercourse

At present the majority of the development area is agricultural land and the proposed development will result in an increase in impermeable area. This will need to be drained and the surface water managed to ensure that the increased run-off does not increase the risk of flooding to the development or adjacent properties.

Area of greenhouse 53000m² and packhouse buildings 1800m² total 54800m².

Area of concrete access road and circulation area is 2850m².

Surface water runoff and storage calculations have been undertaken using a software tool developed by HR Wallingford and the summary are included below with the full results included in which is edited to suit the site conditions.

The rational to be adopted for the safe disposal of surface water from the site will be as follows

- Surface water run-off from the glasshouses roof will be collected in the valleys of the glasshouse roof, which are 6.0m above ground level, falling into a hopper at the gable end. The down pipes from these will discharge into a sealed horizontal piped distribution system which will outfall into the storage lagoon by rising up and over the lagoon embankment. The distribution pipes will therefore be surcharged by over a 3.0m head of water above the crest of the lagoon. then to overflow to discharge into the final attenuation lagoon by hydrostatic head and then to discharge via a hydrobrake set at Qbar (9.32litres/sec) into the Brotherhouse Bar drain.
- The surface water run-off from the extended concrete area will discharge direct to the attenuation lagoon.

Existing green field runoff values, calculated in accordance with the H R Wallingford greenfield runoff estimation for sites in accordance with DEFRA / Environment Agency Report SC030219 rev E and Interim National Procedure Principle 17, confirm the following: **Document 1**

Q bar = 7.99 l/sec

1-year = 6.95l/s

30-year = 19.58 l/s

100-year= 28.45 l/s

The total volume for the attenuation pond, to serve the greenhouses and packhouse and concrete area, has been calculated in accordance with the HR Wallingford Surface Water Storage Tool, in accordance with the Environment Agency guidance 'Preliminary Rainfall Run-off Management for Developments W5-074/A/TR1, rev E (2012) and CIRIASUDS Manual (2007), as **5848 m³** for the 1 in 100-year return period plus a 20% allowance for the Higher Central climate change in accordance with NPPF guidance. **Document 1.**

The volume of storage will be achieved by excavating the attenuation pond with 1.5 -1.0 side slopes with a top

water level with a 300mm freeboard. The overflow will discharge into the North Level Internal Drainage Board watercourse known as Brotherhouse Drain ID 702 which runs alongside the eastern boundary and will be designed to deal with a surface run-off up to the critical 1 in 100-year event plus an allowance of 20% for the Higher Central climate change. The discharge to the watercourse will be controlled by a hydrobrake to limit the discharge to 2 l/sec/Ha or Qbar 7.99 l/sec

The staff car park will consist of a stone chip surface on a pervious hardcore base

Public Sewer

There are no proposals to discharge to the sewer.

The Site owner will be responsible for maintaining the proposed drainage system serving the site. All site drainage will be inspected regularly for blockages, silting and functionality, and appropriate remedial works undertaken when detected by the inspection.

Foul Drainage

Due to the remoteness of the site with no public sewers close by the foul drainage arising from the development will be discharge to an appropriately sized package treatment unit.

As there is a positive drainage system capable of receiving flows from the development there is no likely impact on neighbouring property.

CLIMATE CHANGE

Global warming is now recognised that it is likely to affect the frequency and severity of extreme events as both tidal and fluvial flooding. The Climate change allowances in the NPPF Guidance was updated on the 19th February 2016 and again on the 17th December 2019.

The site is located within the Anglian River Basin, for sites within Flood Zone 3a and for “Less Vulnerable” land uses the Higher Central and Central river flow allowances figures in Table 1 should be used.

Table 1 Peak river flow allowances by river basin district (1961 to 1990 baseline)				
River basin District	Allowance category	Total potential change anticipated for '2020s' (2015 to 2039)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2115)
Anglian	Upper End	25%	35%	65%
	Higher Central	15%	20%	35%
	Central	10%	15%	25%

The effect of global warming on peak rainfall allowances is given in Table 2.

Table 2 Peak rainfall intensity allowance in small and urban catchments (1961 to 1990 baseline)			
Applies across all of England	Total potential change anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	10%	20%	40%
Higher Central	5%	10%	20%

The annual sea rise due to climate change is given in NPPF and the recommended contingency allowances are stated in Table 3

Table 3 Peak sea level allowance for each epoch in (mm) per year with cumulative sea level rise for each epoch in brackets (use 1981 to 2000 baseline)						
Area of England) (Use River Basin	Allowance	2000 to 2035	2036 to 2065	2066 to 2095	2096 to 2125	Cumulative Rise 2000 to 2125 (m)
Anglian	Higher Central	5.8 (203mm)	8.7 (261mm)	11.6 (348mm)	13 (390mm)	1.20m
Anglian	Upper End	7 (245mm)	11.3 (339mm)	15.8 (474mm)	18.1 (543mm)	1.6m

The site is not affected by tidal flooding.

FLOOD PROTECTION

Any impact of damage to the properties can be foreseen and mitigated against by relatively simple design and construction techniques. There are two forms of flood protection works: -

- **Flood-resistance or proofing works:** - these try to reduce the amount of water entering a building.
- **Flood-resilient works:** - these reduce the amount of damage caused by water entering the building.

The proposed amenity building will have the following resilient measures incorporated in the construction in accordance with "Improving the flood performance of new buildings" CLG (2007).

- The FFL for the greenhouse will be at ground level and the packhouse 150mm higher, this level will provide a gradient from the glasshouse into the service building suitable for the automated trolley system. The packhouse has at first floor level, facilities for staff welfare and this will provide a safe haven for the staff if required.
- Arrange for all service circuits to be routed at high level and where practical socket outlets and switchgear. to be a minimum of 1.0m above the raised ground floor level.
- The construction of the packhouse building is a steel portal frame with PVC coated steel sheeting with a

solid concrete floor which will make a quick recovery after a flood event.

- As this site is in an area that can receive flood alerts from the Environment Agency Floodline Warning Direct system. It is recommended that the site Owner contact the Environment Agency's Floodline on **0345 988 1188** to register the property to receive warnings of flooding by telephone, mobile, fax, SMS text, email or pager. The Environment Agency aim to issue a 'severe flood warning' approximately 2 hours before existing defences are overtopped.

CONCLUSION

- o The site does have the protection of fluvial flood defences which are well maintained by the Environment Agency.
- o The proposed site is shown to be within Flood Zone 3 'High Probability' as detailed on the Environment Agency's Flood Zone Maps without defences.
- o The 2017 Update to SHDC, SFRA Tidal & Fluvial Hazard Mapping, for District following a breach to the defences, show that the site where the proposed development is to be located is within an area partly within an hazard rating area of 1.25 – 2.0 (Danger for Most) the remainder in a hazard rating area Greater than 2.0 (Danger for All) with a depth of between 1.0m – 2.0m and a velocity of 0 - 1.0m/sec.
- o The Flood Risk Vulnerability Classification in Table 2 of NPPG shows that the proposals are classified as "Less Vulnerable", with Table 1 of NPPG stating that such uses are appropriate in this zone.
- o Any impact of damage to the property can be foreseen and mitigated against by relatively simple design and construction techniques. They will be constructed using materials which are flood resilient construction as outlined in the report.
- o Flooding from other sources is unlikely to affect the site.
- o No obvious constraints have been identified that may impact the proposed development and the type of mitigation measures that can be used to reduce the flood risk, there is no increase in the flood risk to others. Following the guidelines contained within the NPPF, the proposed development is considered to be suitable assuming appropriate mitigation is maintained for the lifetime of the development.
- o Any impact of damage to the properties can be foreseen and mitigated against by relatively simple design and construction techniques. They will be constructed using materials which are flood resilient construction as stated in the report.
- o A Flood Warning and Evacuation plan will be prepared for the site.

Flood map for planning

Your reference
Decoy Farm

Location (easting/northing)
526083/312701

Created
30 Sep 2020 17:15

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Map 1



Flood map for planning

Your reference

Decoy Farm

Location (easting/northing)

526083/312701

Scale

1:2500

Created

30 Sep 2020 17:15

-  Selected point
-  Flood zone 3
-  Flood zone 3: areas benefiting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

0 20 40 60m

Page 2 of 2

Flood risk

Extent of flooding



Location

Decoy Farm

Map 2



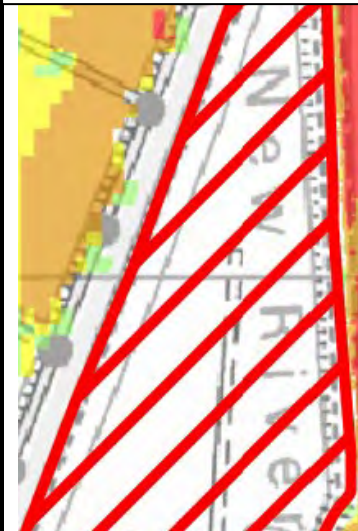
Extent of flooding from rivers or the sea

High Medium Low Very low

Map 3

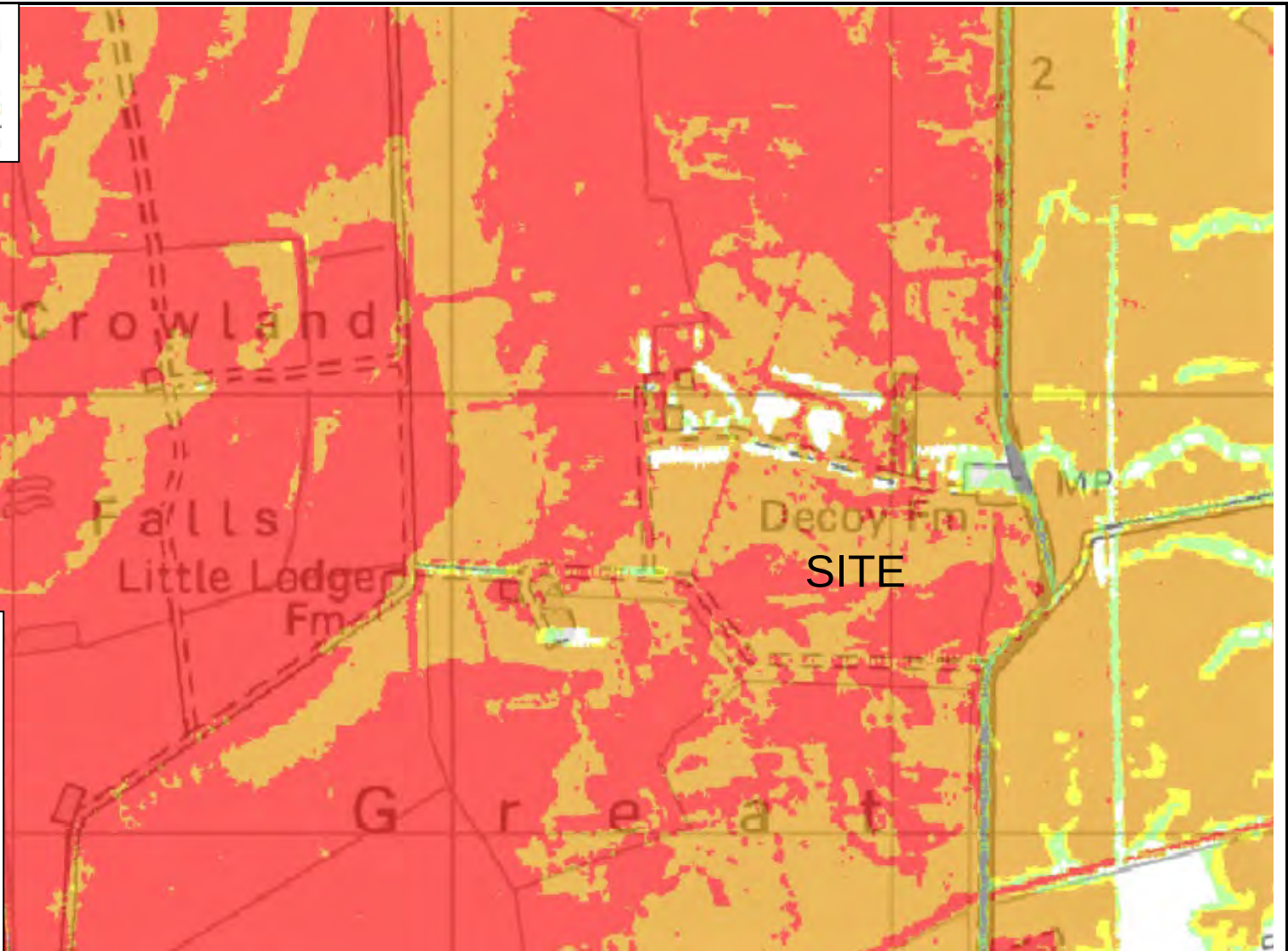
**UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT**
Residual Flood Hazard
District - Present Day
1% Fluvial / 0.5% Tidal Event Probability

DATE OF ISSUE: Feb 2017 REV NO: 2



Map Legend

Max Hazard (Flood Risk to People : FD2320)	
Less than 0.75 (Low Hazard)	
Between 0.75 and 1.25 (Danger for Some)	
Between 1.25 and 2.0 (Danger for Most)	
Greater than 2.0 (Danger for All)	
Functional Floodplain	
South Holland District Boundary	

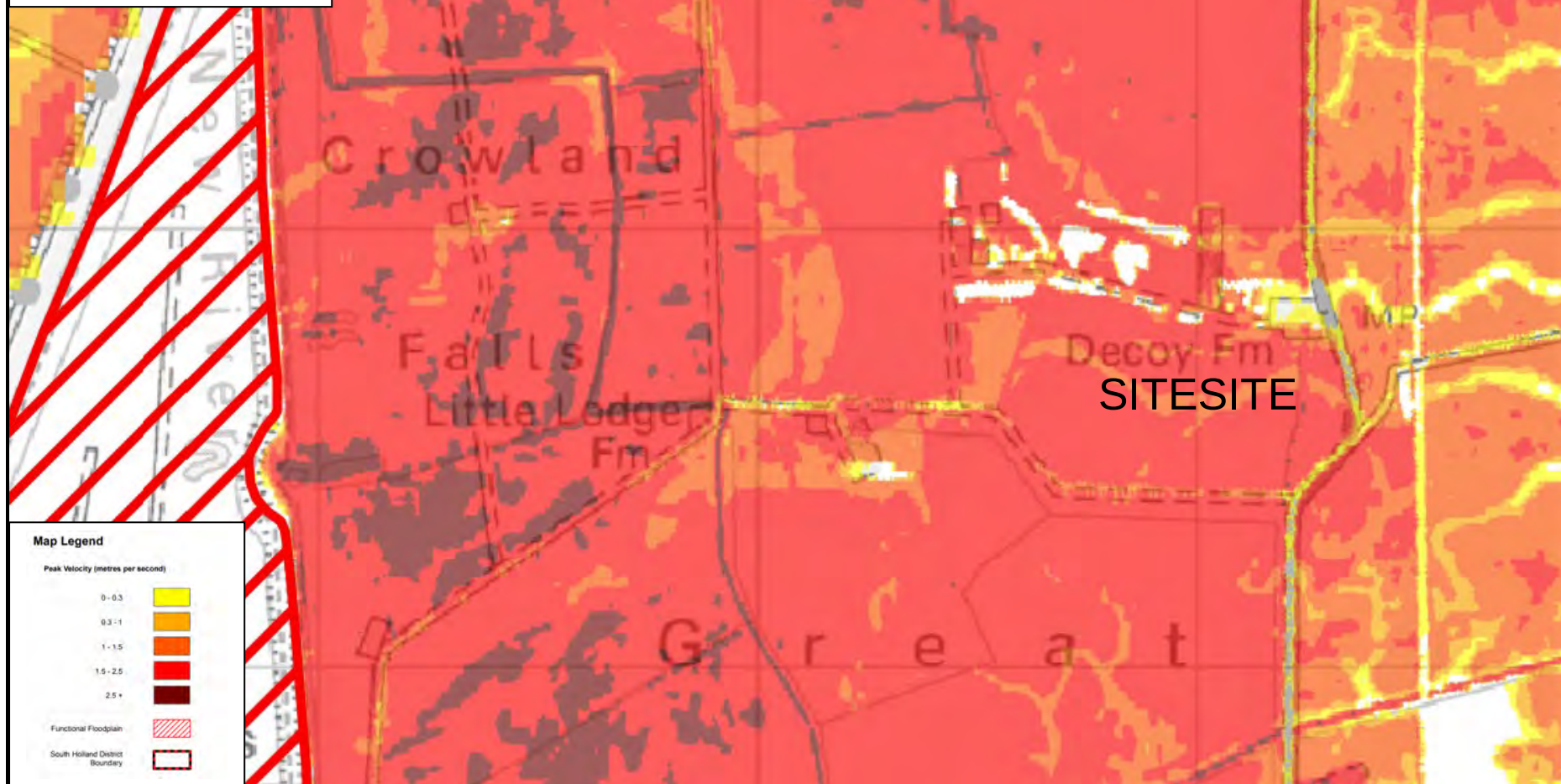


Map 4

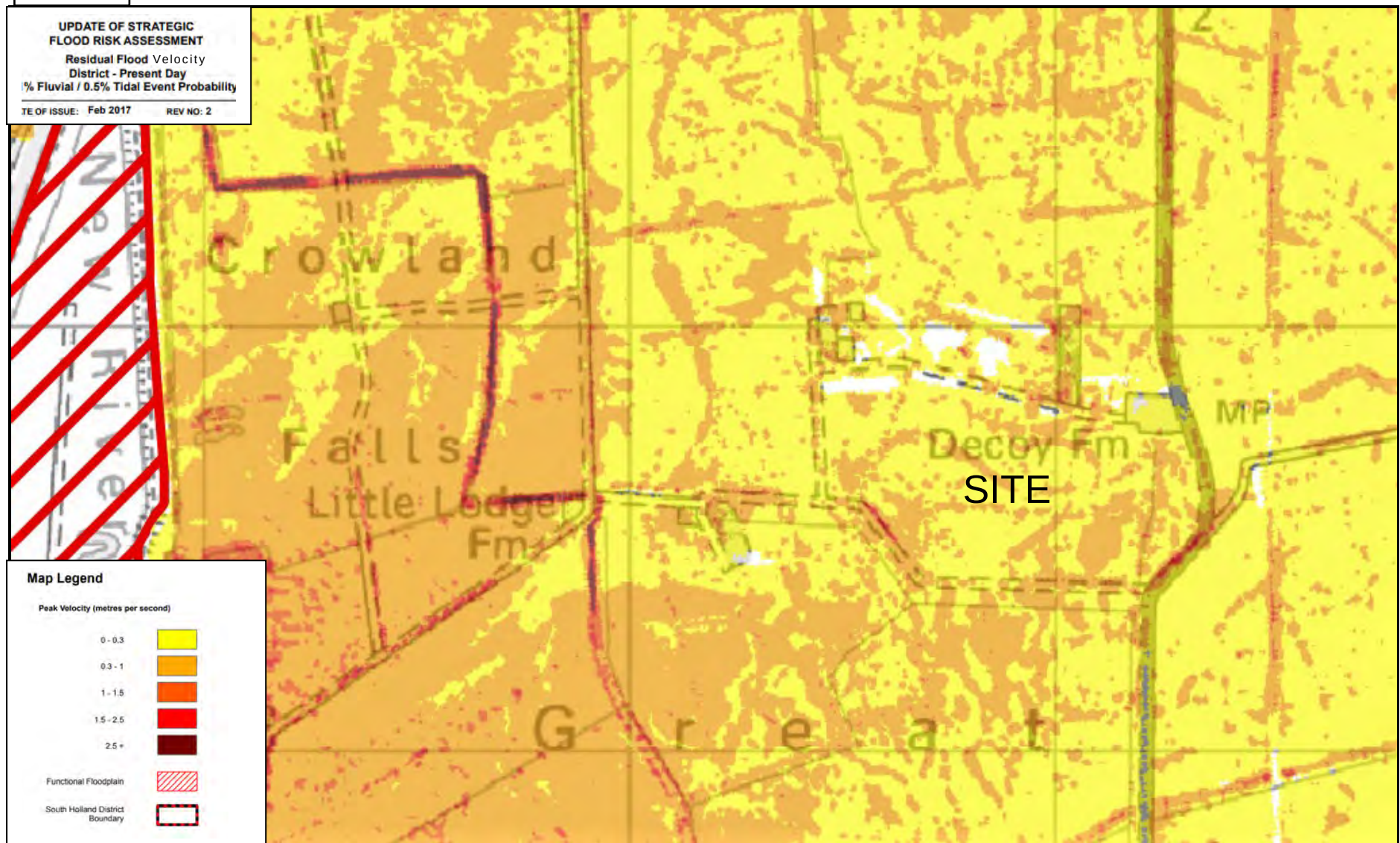
UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Peak Depth
District - Present Day
1% Fluvial / 0.5% Tidal Event Probability

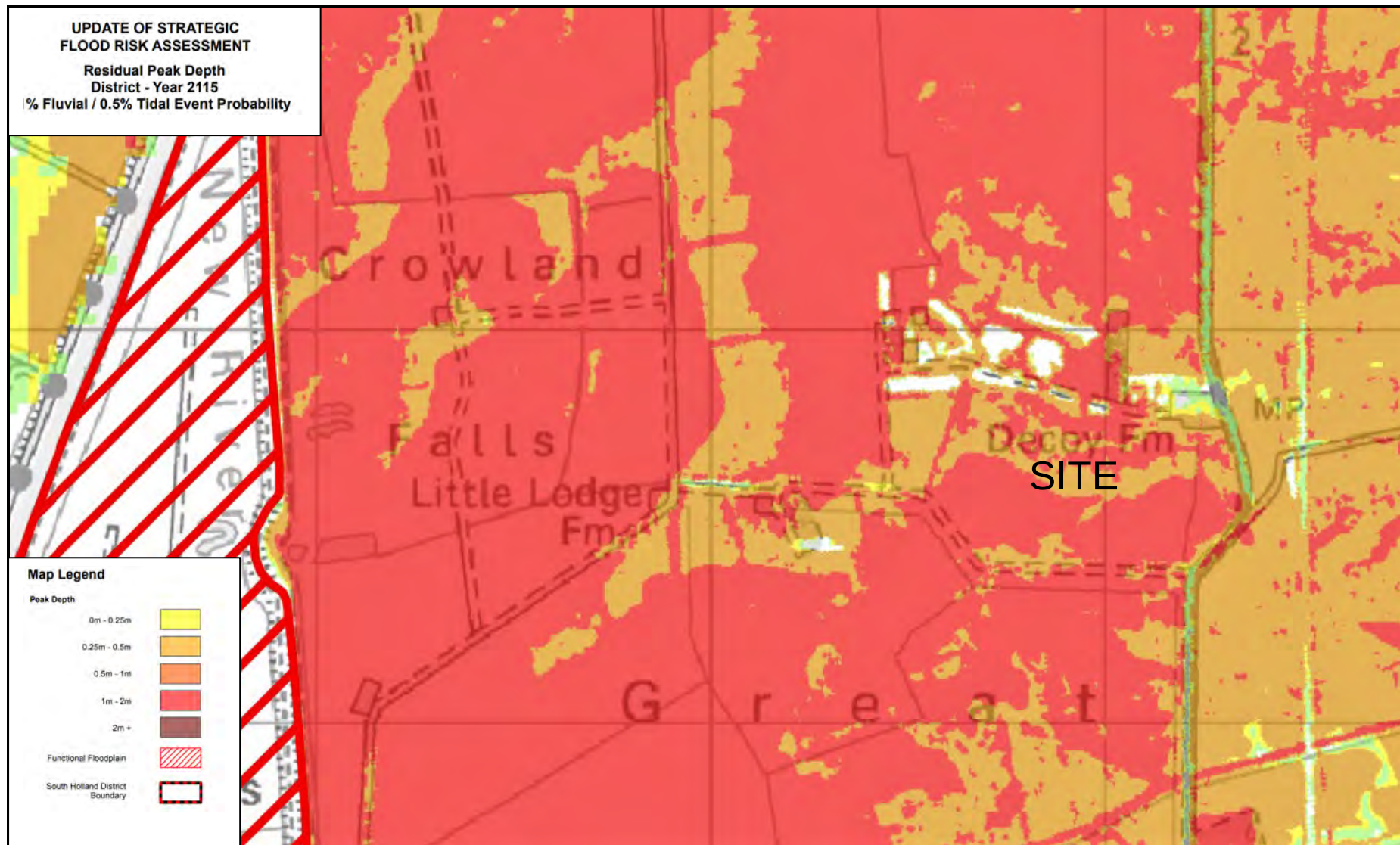
DATE OF ISSUE: Feb 2017 REV NO: 2



Map 5



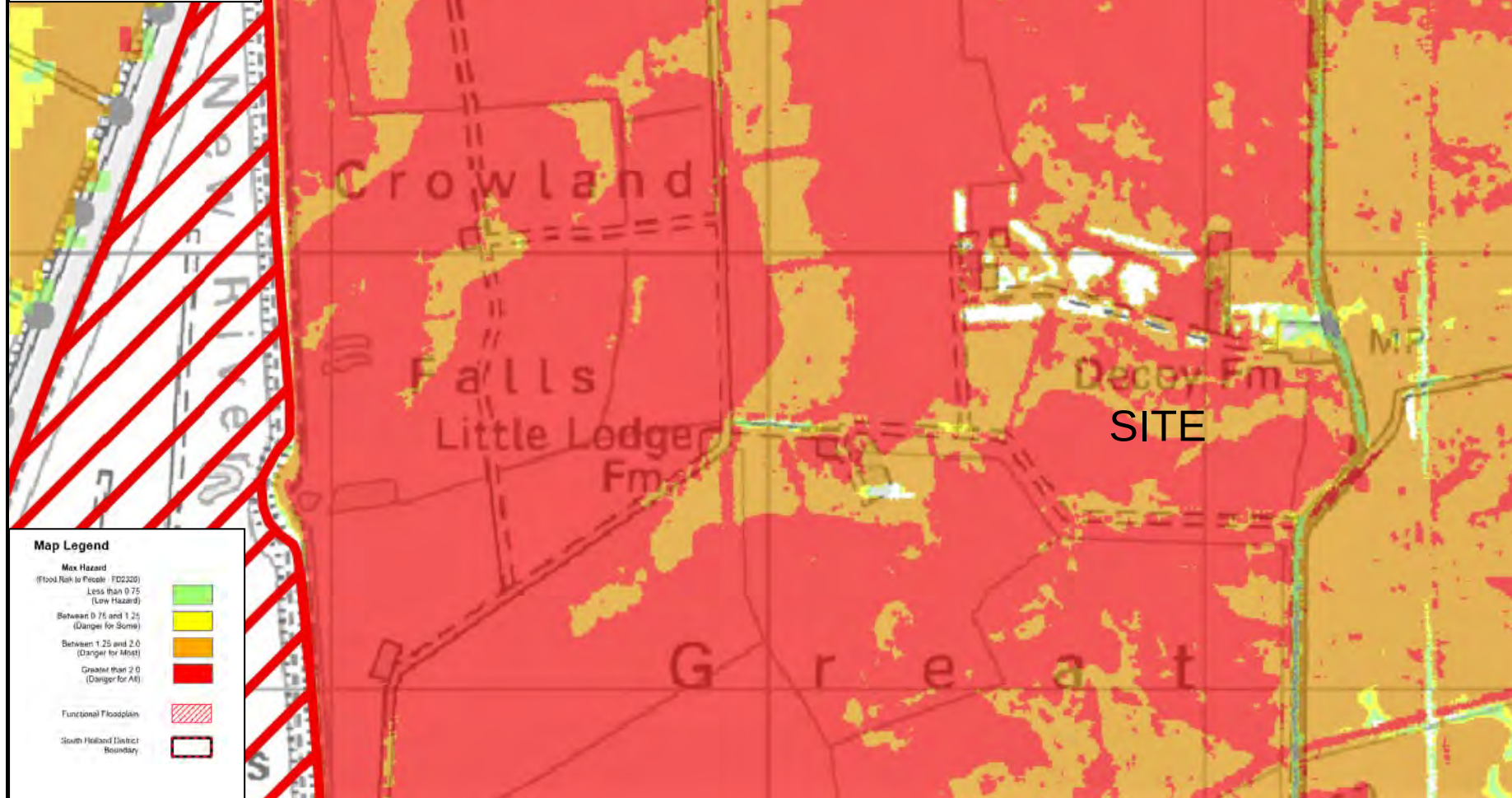
Map 6



Map 7

UPDATE OF STRATEGIC
FLOOD RISK ASSESSMENT
Residual Flood Hazard
Spalding - Year 2115
1% Fluvial / 0.5% Tidal Event Probability

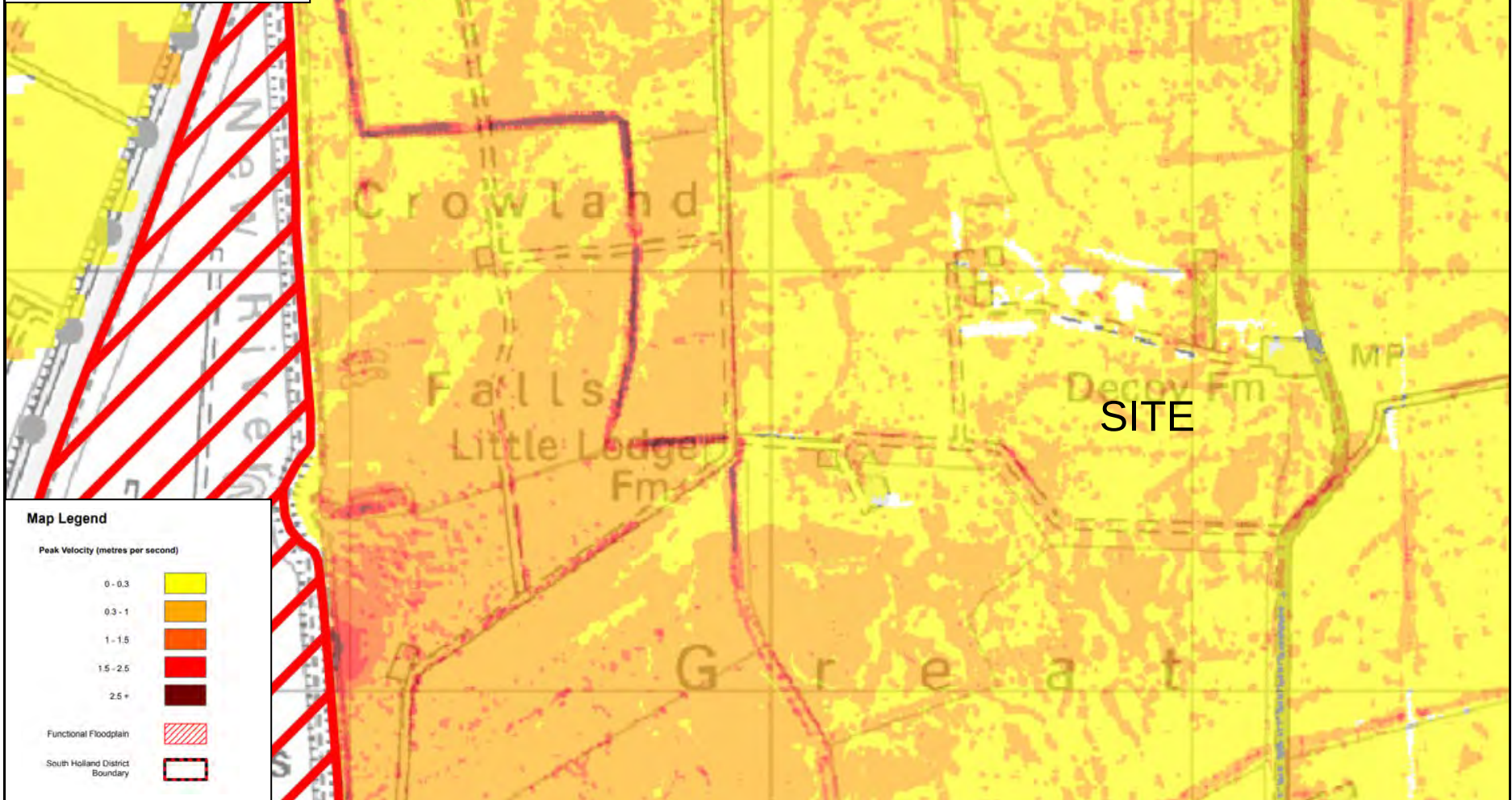
TE OF ISSUE: Feb 2017 REV NO: 2



Map 8

UPDATE OF STRATEGIC FLOOD RISK ASSESSMENT

Residual Peak Depth
District - Year 2115
% Fluvial / 0.5% Tidal Event Probability



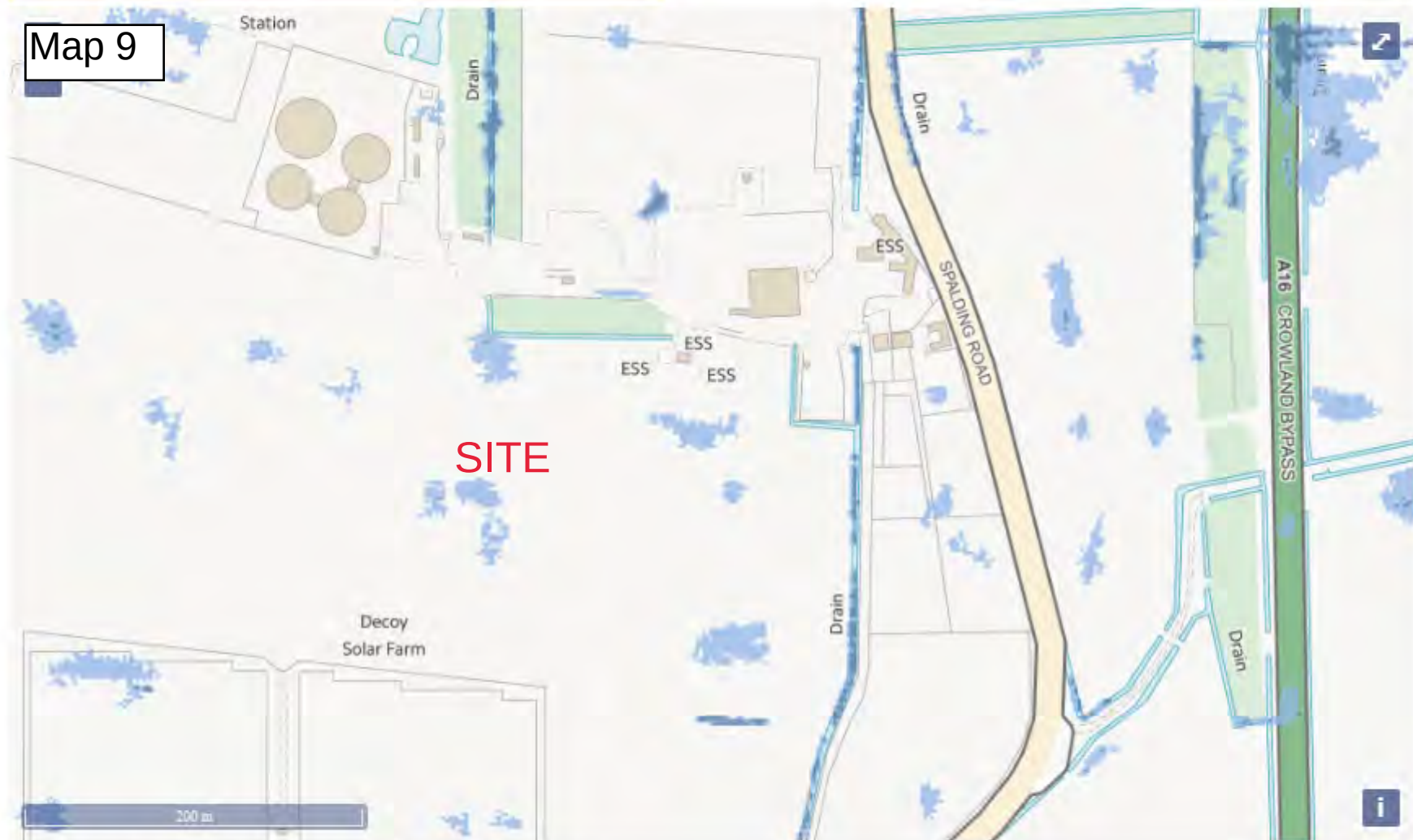
Flood risk

Low risk: depth

Location

Decoy Farm

Map 9



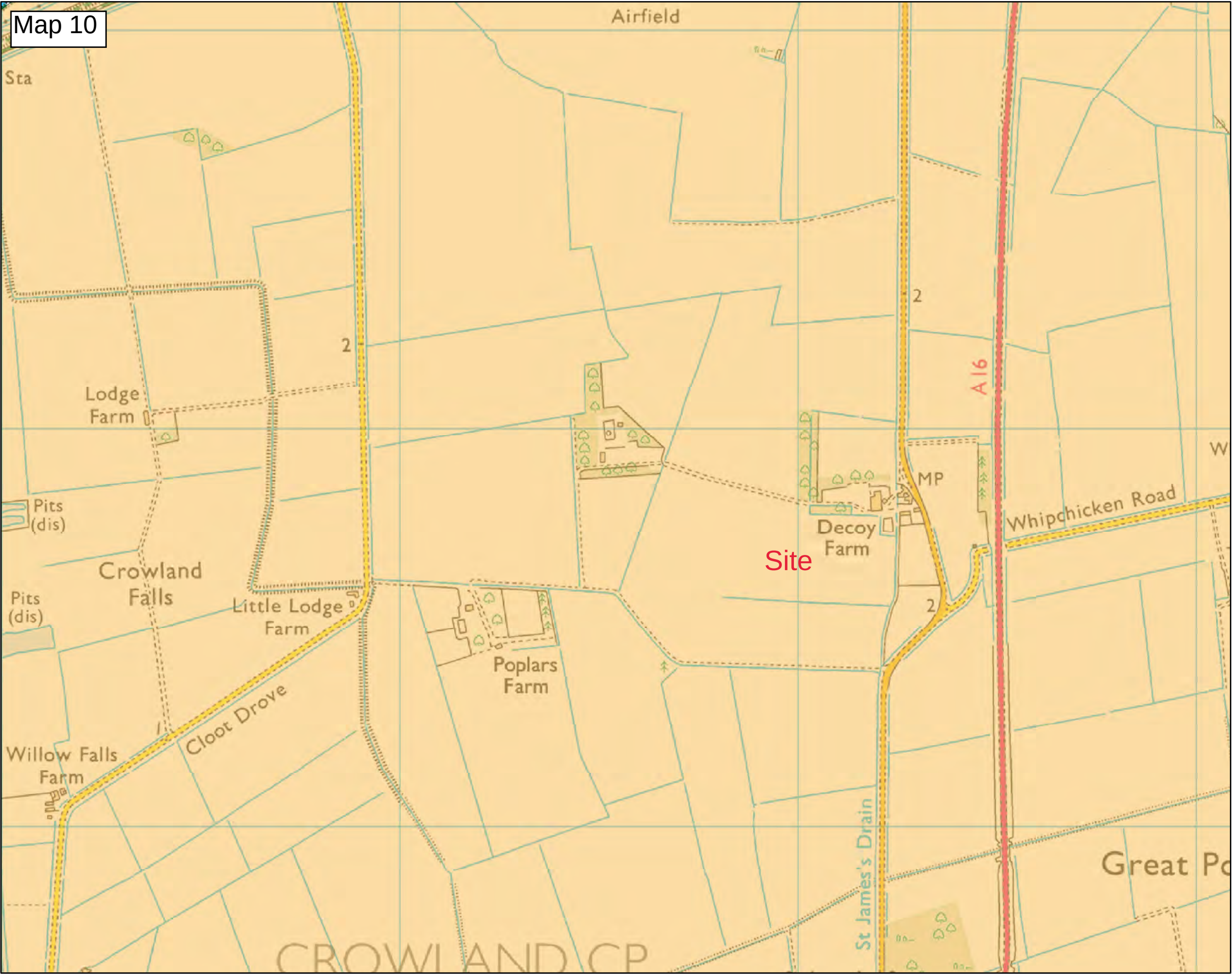
Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

● Over 900mm ● 300 to 900mm ● Below 300mm

Historic Flood Map centred on TF 25543 12851

Map 10

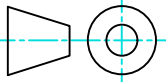


Scale 1:10,000



- Main River
- March 1947 on the River Welland near Cowbit

Created by the Partnerships and Strategic Overview Team, Kettering



General Tolerances: Dim to no DP = +/-1mm
Dim to 1 DP = +/-0.5mm
Dim to 2 DP = +/-0.1mm



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General Notes:

Revisions				
rev	date	description		drawn
B	01-10-20	Scale bar added, customer detail changed		MK
A	23-09-20	Initial issue		MC

Client
Decoy Farm Power Limited
The Watring Farm
Creeping St. Mary
Ipswich
England
IP6 8ND

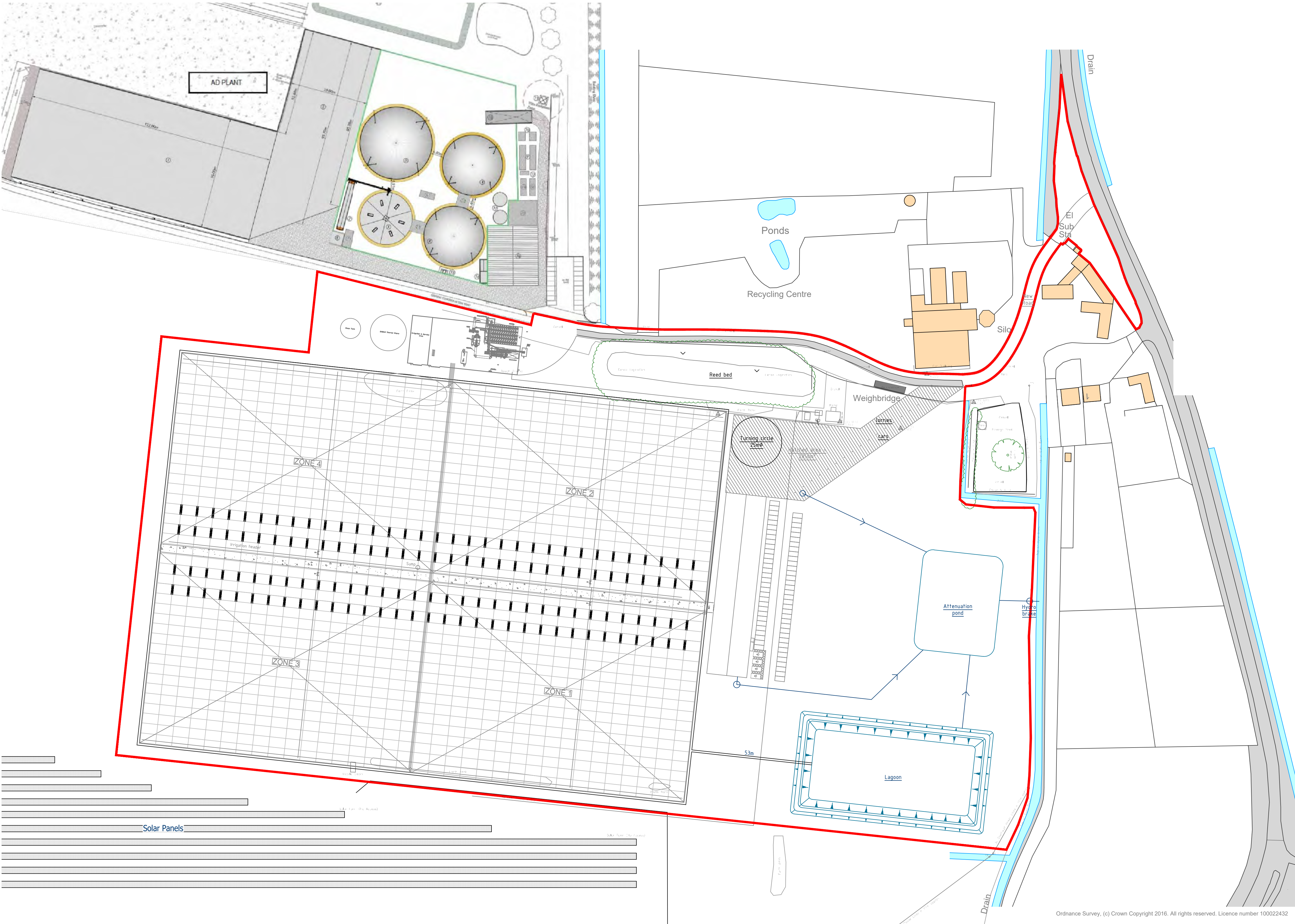
Project
Decoy Farm Power Limited

Drawing Title
Location Plan

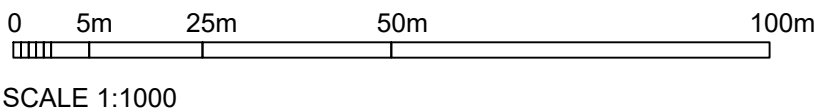
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B	1:1000	23-09-20	MC	JH

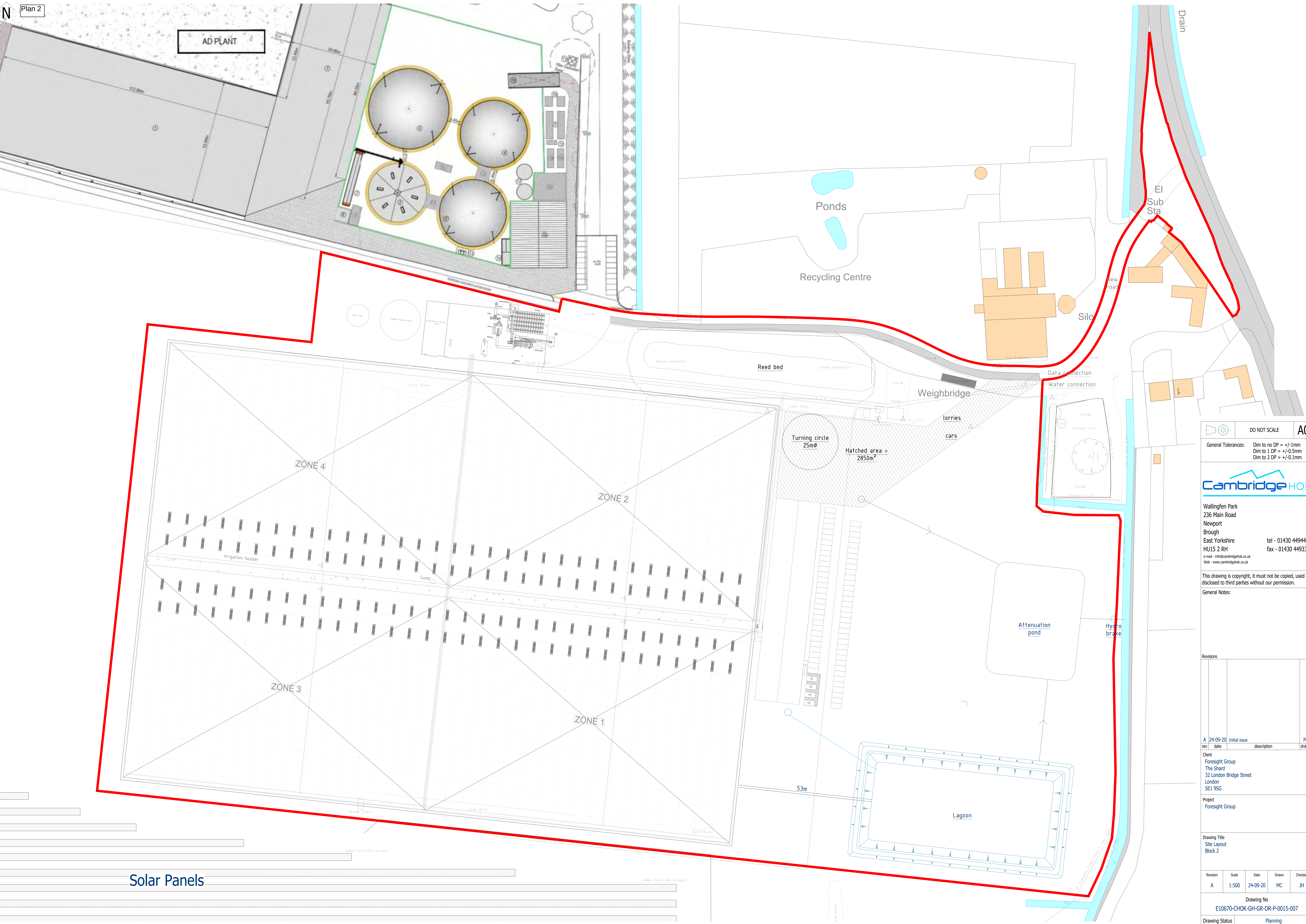
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E10670-CHOK-GH-GR-DR-P-0015-005

Drawing Status
Planning



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DO NOT SCALE

A0

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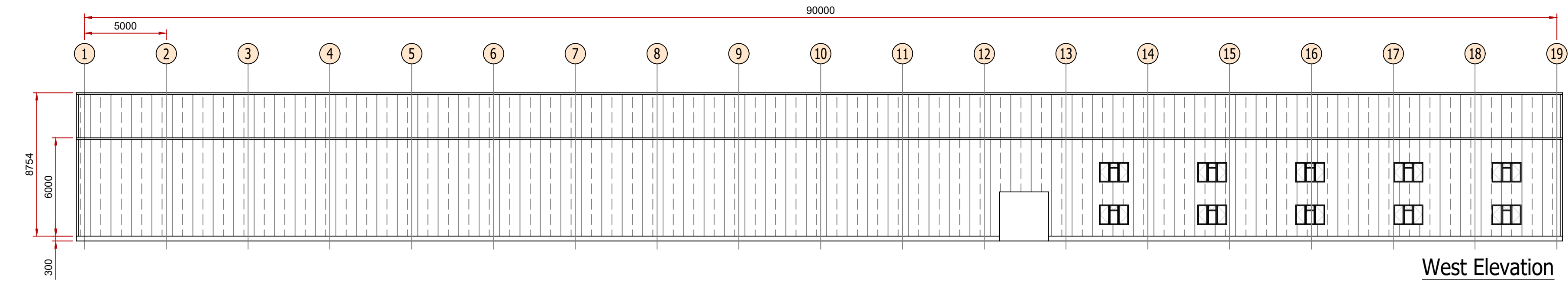
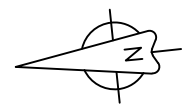
Revisions			
rev	date	description	MC drawn
A	24-09-20	Initial issue	MC

Client
Foresight Group
The Shard
32 London Bridge Street
London
SE1 9SG

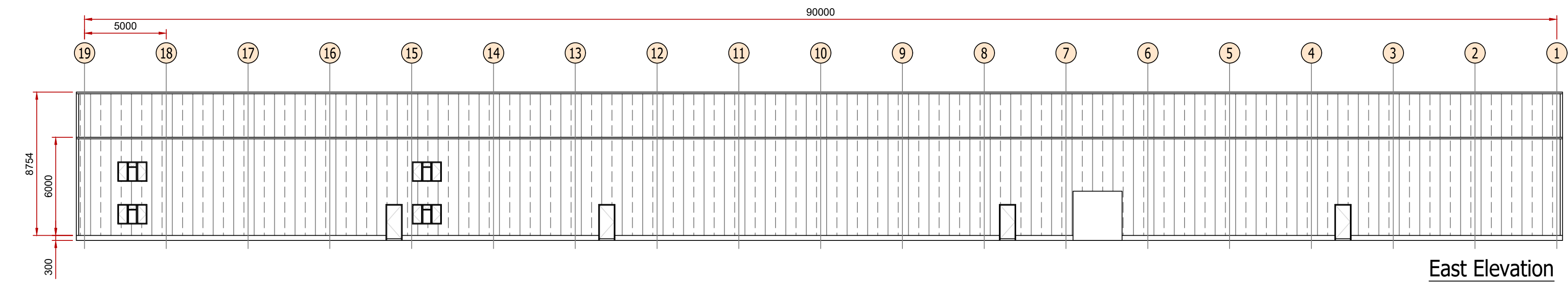
Project
Foresight Group

Drawing Title
Site Layout
Block 2

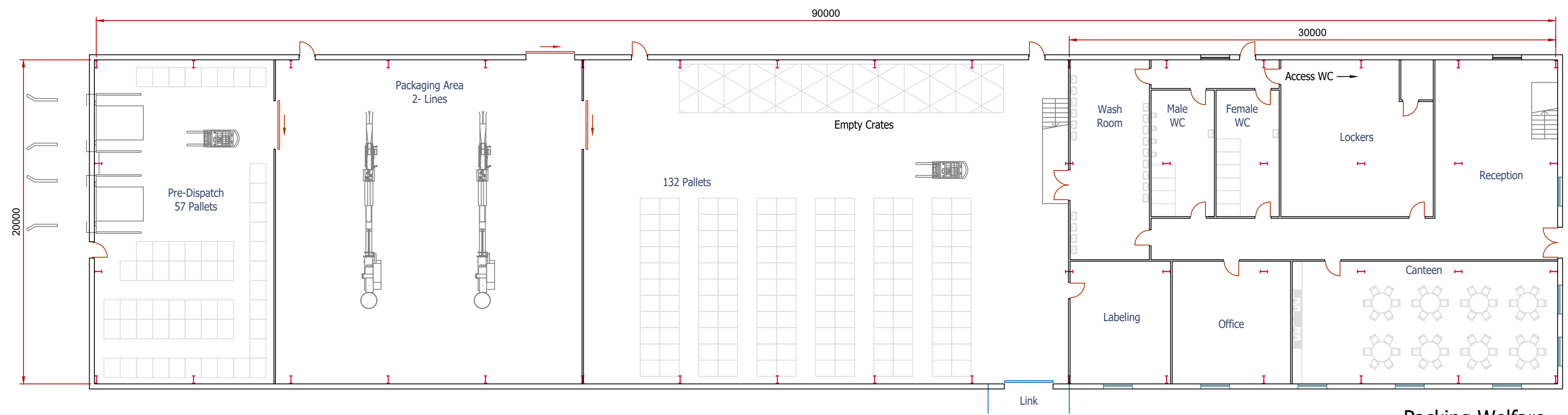
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A	1:500	24-09-20	MC	JH



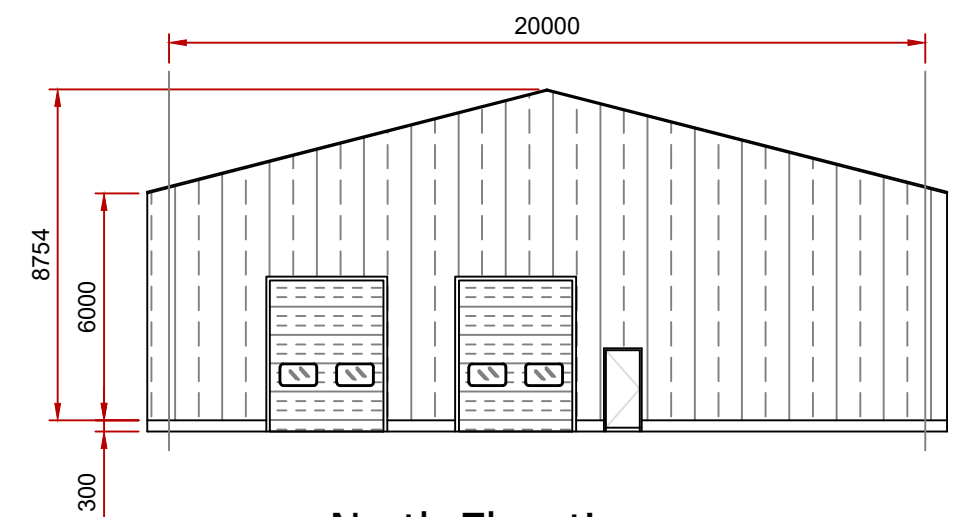
West Elevation



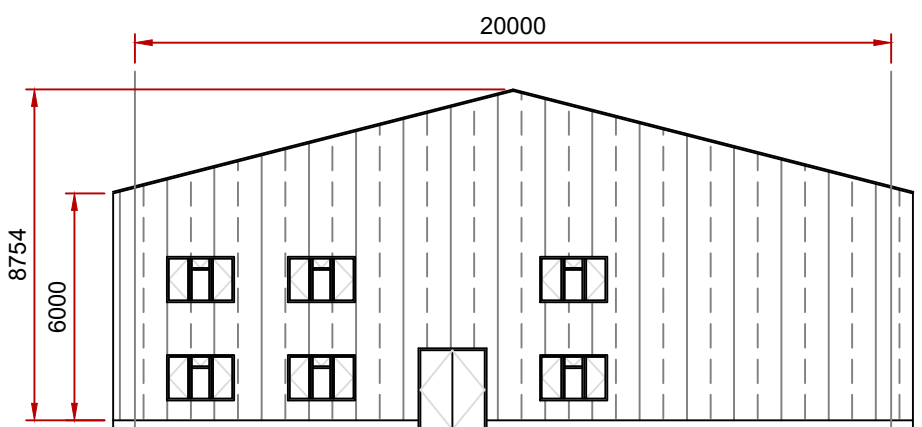
East Elevation



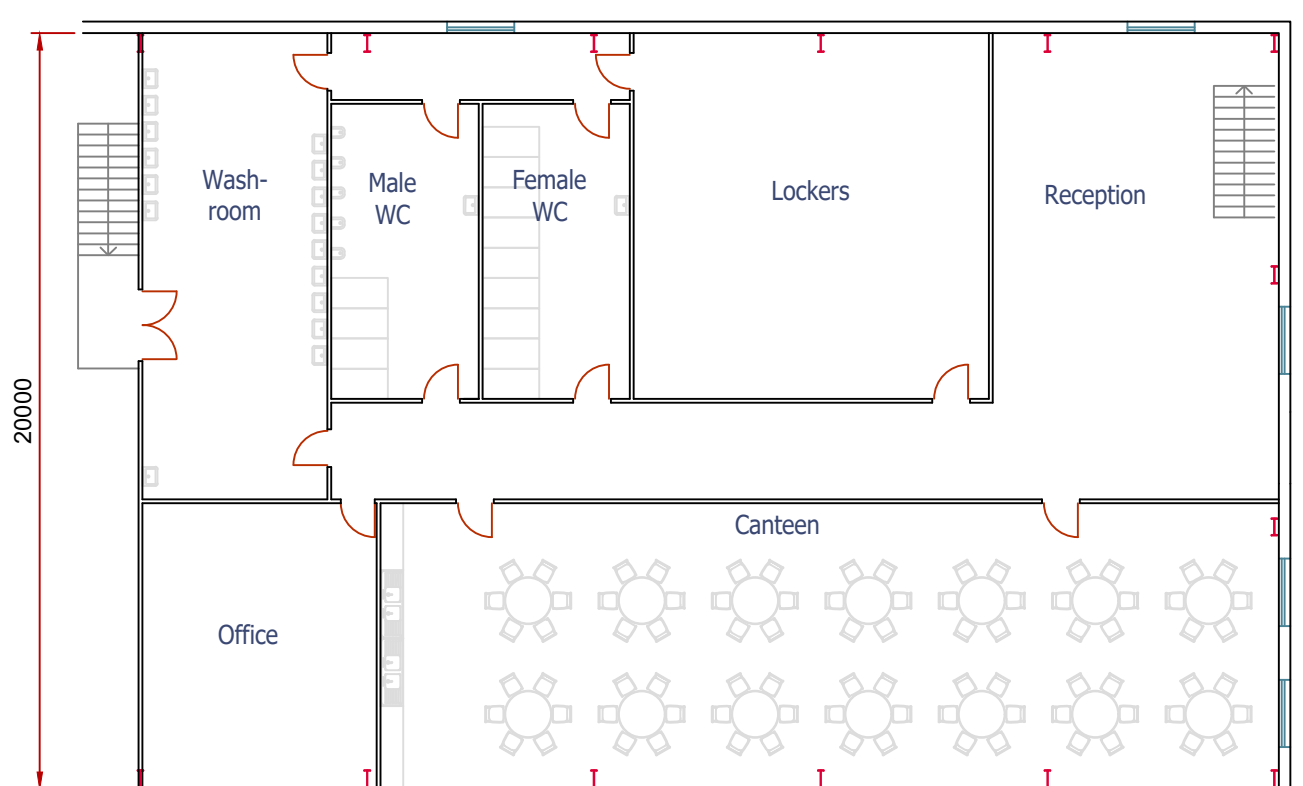
Packing Welfare



North Elevation

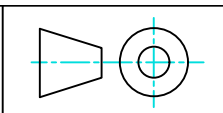
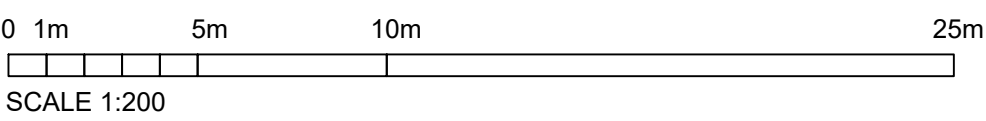


South Elevation



Picking Welfare

KEY		
LOAD CASES	AXIAL	SHEAR
Deadload	...	4.7.6
R. Imp.	13.3	92.5
Wind 0	5.6	10.1
Wind 90	15.8	1.1
Wind 180	-3.2	-5.9
Wind 270	-14.2	0.9



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Dim to 2 DP = +/-0.1mm



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Revisions			
rev	date	description	drawn
B	01-10-20	Scale bar added, window subtracted, customer detail changed	MK
A	23-09-20	Initial issue	MC

Client
Decoy Farm Power Limited
The Watering Farm
Creeping St. Mary
Ipswich
England
IP6 8ND

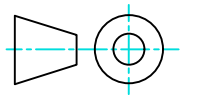
Project
Decoy Farm Power Limited

Drawing Title
Proposed Packhouse

Revision	Scale	Date	Drawn	Checked
B	1:200	23-09-20	MC	JH

Drawing No
E10670-CHOK-GH-GR-DR-P-0015-001

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General Notes:

Revisions

rev	date	description	drawn
B	01-10-20	Scale bar added, customer detail changed	MK
A	23-09-20	Initial issue	MC

Client
Decoy Farm Power Limited
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IP6 8ND

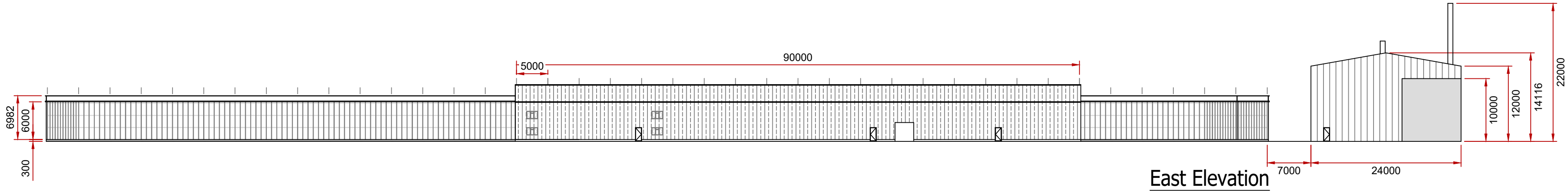
Project
Decoy Farm Power Limited

Drawing Title
Proposed Elevations

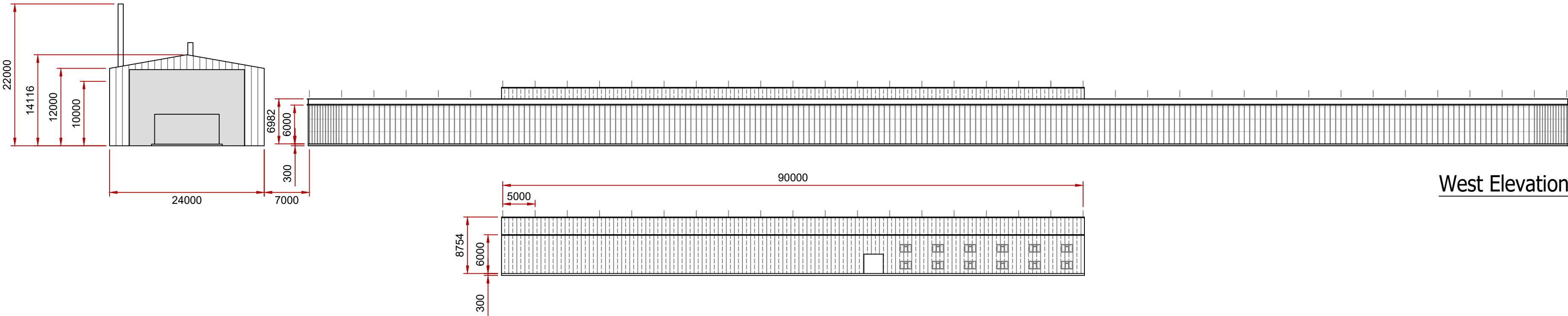
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Drawing No
E10670-CHOK-GH-GR-DR-P-0015-002

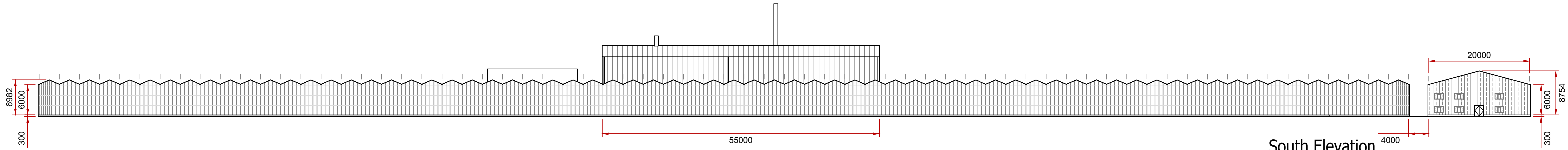
Drawing Status
Planning



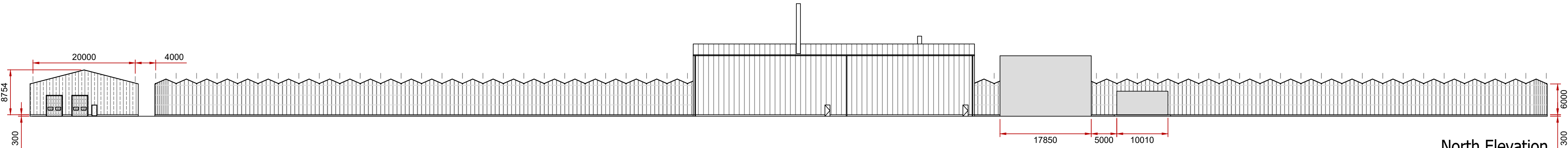
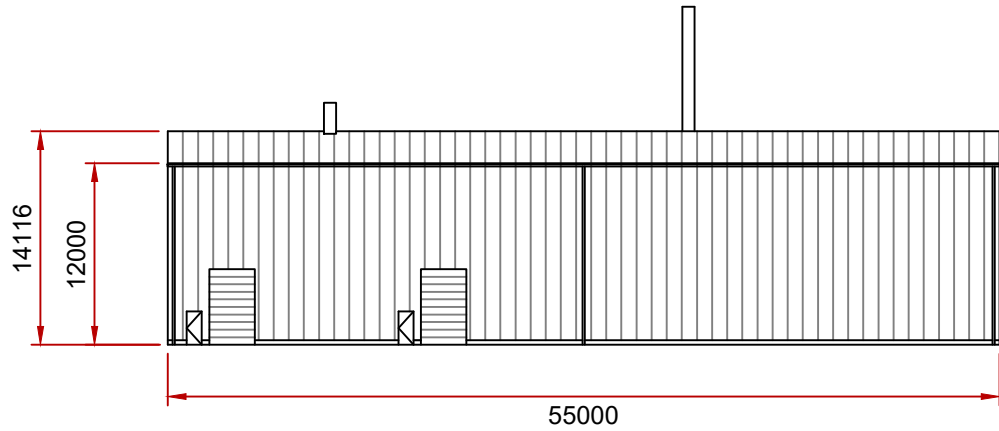
East Elevation



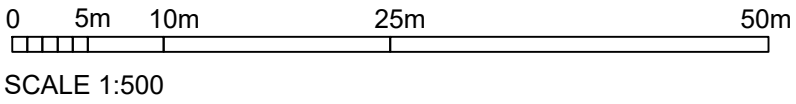
West Elevation

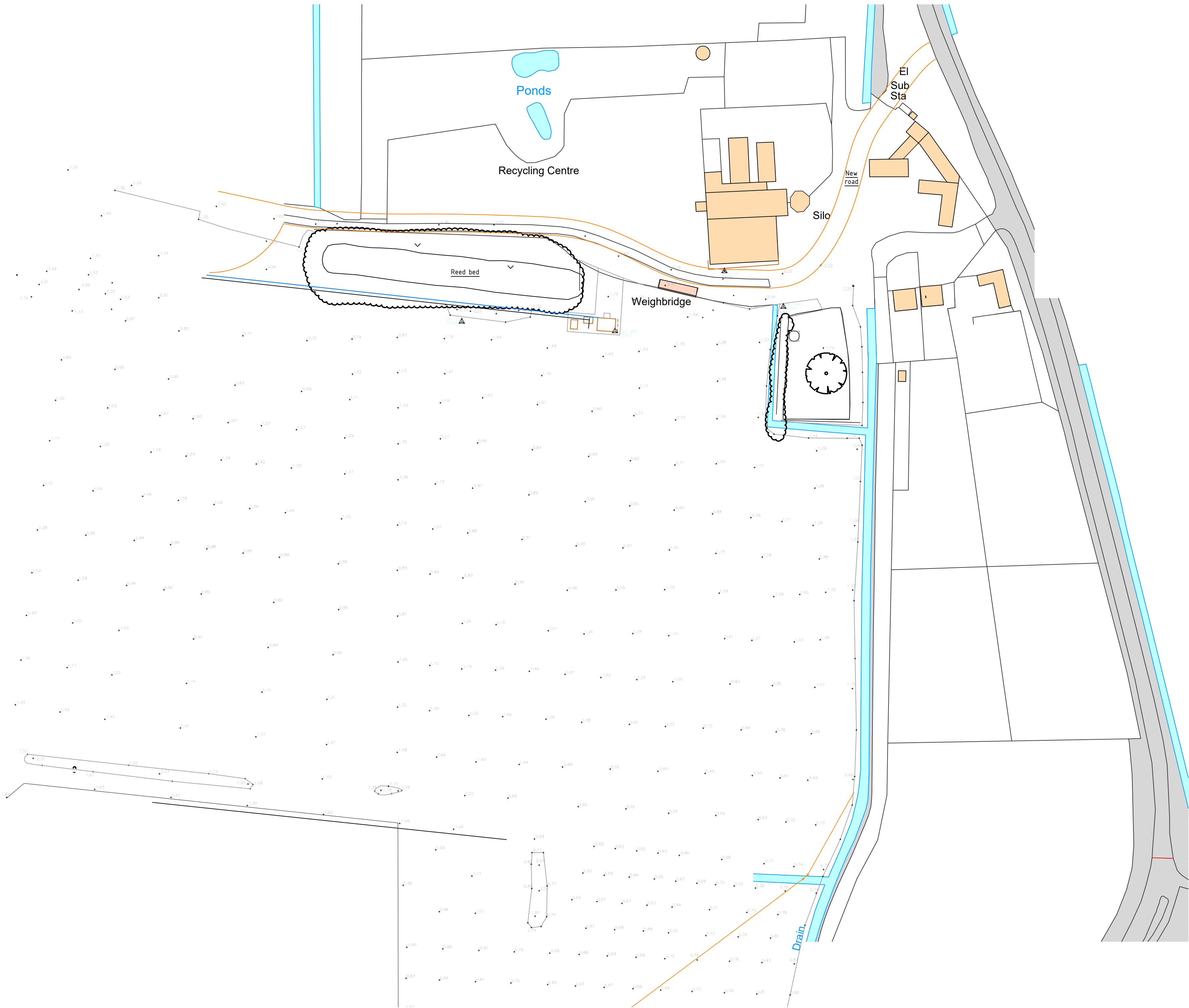


South Elevation



North Elevation



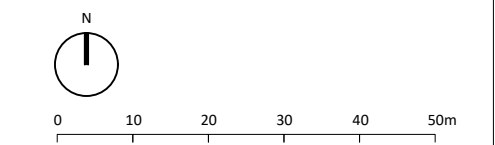


Notes

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Rev	Description	Date
rdc Robert Doughty Consultancy 32 High Street, Helpringham Sleaford, Lincolnshire, NG34 0RA Tel: 01529 421646 Email: admin@rdc-landplan.co.uk Web: www.rdc-landplan.co.uk		
Client Decoy Farm Power Limited		
Project Glasshouse Development Decoy Farm, Crowland		
Drawing Base plan		
Scale @ A2 1: 1000		Date 29/09/20
Drawn By WW		Checked By LMS
Job Number 1427-1	Status SK	Purpose of Issue Discussion
Drawing No. 1427-1_SK_SP01		Rev -

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: Raymond morgan

Site name: Decoy farm

Site location: Crowland

Site Details

Latitude: 52.69730° N

Longitude: 0.13627° W

Reference: 2052886224

Date: Sep 30 2020 16:04

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 5.765

Notes**(1) Is $Q_{BAR} < 2.0$ l/s/ha?**

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

Methodology Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

Hydrological characteristics

	Default	Edited
SAAR (mm):	554	554
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	7.99	7.99
1 in 1 year (l/s):	6.95	6.95
1 in 30 years (l/s):	19.58	19.58
1 in 100 year (l/s):	28.45	28.45
1 in 200 years (l/s):	33.64	33.64

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.



Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by: Raymond morgan

Site name: Decoy Farm

Site location: Crowland

Site Details

Latitude: 52.69741° N

Longitude: 0.13641° W

Reference: 4225439605

Date: Sep 30 2020 16:19

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site characteristics

Total site area (ha):	5.765
Significant public open space (ha):	0
Area positively drained (ha):	5.765
Impermeable area (ha):	5.765
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	5.77
Net impermeable area for storage volume design (ha):	5.77
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.2
Urban creep allowance factor:	1.1
Volume control approach	Flow control to max of 2 l/s/ha or Q_{BAR}
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	5

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	4
SPR:	0.3	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	96.25
FEH / FSR conversion factor:	1.25	1.25
SAAR (mm):	554	554
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 10 year:	1.65	1.65
Growth curve factor 30 year:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Q_{BAR} for total site area (l/s):	7.99	21.17
Q_{BAR} for net site area (l/s):	7.99	21.17

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	11.5	18.4
1 in 30 years (l/s):	11.5	21.2
1 in 100 year (l/s):	11.5	21.2

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	5842	5039
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	5842	5039

This report was produced using the storage estimation tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.