Green Hill Solar Farm
EN010170

Hydraulic Modelling Technical Note
Lavendon Flood Alleviation Study

Prepared by: Arthian

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Hydraulic Modelling Technical Note Lavendon Flood Alleviation Study

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Site: Green Hill Solar

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Reference of Terms

Annual Exceedance Probability (AEP)

The AEP is the chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually and is usually expressed as a percentage.

Aquifers[1]

- Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.
- Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.
- Secondary B Aquifers are 'predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.
- Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.
- Unproductive Strata are 'rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow'.

Canal Failure

Canal failure can occur due to high-intensity rainfall or structural failure and can be dangerous due to the rapid release of large volumes of water. It is typically limited to raised canal reaches and can result in a rapid peak in flow followed by a gradual reduction.

Climate Change (CC)

A change in global or regional climate patterns. For flood risk, CC are assessed in terms of allowances which are predictions of anticipated change for peak river flow, peak rainfall intensity, sea level rise and offshore wind speed and extreme wave height. CC scenario data exists across different epochs (time periods) to determine the needs for climate resilience measures. CC data is requested as part of an EAPD request. If a separate ESG Flood Risk and CC Assessment is needed, additional CC data will be required.

Environment Agency (EA) and EA Product Data (EAPD)

The EA is the lead organisation for providing flood and coastal risk management and warnings of flooding from Main Rivers and on the coast. For sites within or in close elevational proximity to Flood Zone 2 or Flood Zone 3, EAPD is ordered to obtain more detailed flood risk data such as flood depths, breach and overtopping mapping and fluvial/tidal risks associated with CC.

Fluvial Flooding

Fluvial flooding typically occurs when a river's capacity is exceeded, and the excess water overtops the riverbanks. It can also occur when the watercourse has a high level downstream, perhaps due to structures or blockage, thus limiting conveyance. This creates a backup of water which can overtop the banks. Typical

[1] Groundwater protection: Principles and practice (GP3) Version 1.1 (published August 2013, Environment Agency / Department for Environment, Food & Rural Affairs)

flooding issues occur when the natural floodplain has been urbanised and the river has been confined. EA mapping defines three zones of different flood risk, the third of which is subdivided into two categories:

- Zone 1 "Low probability of flooding" – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%);
- Zone 2 "Medium probability of flooding" – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year;
- Zone 3a "High probability of flooding" – This zone comprises 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; and
- Zone 3b "Functional floodplain" – A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national Flood Map for Planning and is calculated where necessary using detailed hydraulic modelling.

Groundwater Flooding

Groundwater flooding is caused by the emergence of water from beneath the ground at either point or diffuse locations when the natural level of the water table rises above ground level. This can result in deep and long-lasting flooding of low-lying or below-ground infrastructure such as underpasses and basements. Groundwater flooding can cause significant damage to property, especially in urban areas, and can pose further risks to the environment and ground stability.

Sewer Flooding

Flooding from sewers primarily occurs when flow entering a system exceeds available capacity or if the network capacity has been reduced through blockage or collapse. In the case of surface water sewers that discharge to watercourses, the same effect can be caused as a result of high-water levels in the receiving watercourse. As a result, water can begin to surcharge the sewer network, emerging at ground level through gullies and manholes and potentially causing flooding to highways and properties. If this occurs flooding can represent a significant hazard to human health due to the potential for contaminants in flood water.

Source Protection Zones

Source Protection Zones (SPZs) are areas of land through which water infiltrates into a groundwater borehole, well or spring that is used for public drinking water supply. These zones show the risk of contamination from potential pollution. SPZs have been created as public facing boundaries where discrete groundwater bodies within SPZs have been dissolved on zone number where common boundaries and overlaps have been removed. SPZs are defined around large and public potable groundwater abstraction sites. The purpose of SPZs is to provide additional protection to safeguard drinking water quality through constraining the proximity of an activity that may impact upon a drinking water abstraction.

- Zone 1 (Inner Protection Zone) is defined by a travel time of 50-days or less from any point within the zone at, or below, the water table. Additionally, the zone has as a minimum a 50-metre radius.
- Zone 2: (Outer Protection Zone) - This zone is defined by the 400-day travel time from a point below the water table. Additionally, this zone has a minimum radius of 250 or 500 metres, depending on the size of the abstraction.
- Zone 3: (Total catchment) - This zone is defined as the total area needed to support the abstraction or discharge from the protected groundwater source. A further Zone 4, or 'Zone of Special Interest' was previously defined for some groundwater sources.

Surface Water Runoff

Surface water runoff is defined as water flowing over the ground that has not yet entered a drainage channel or similar. It usually occurs because of an intense period of rainfall which exceeds the infiltration capacity of the ground. Typically, runoff occurs on sloping land or where the ground surface is relatively impermeable. The ground can be impermeable either naturally due to the soil type or geology, or due to development which places impervious material over the ground surface (e.g. paving and roads).

Tidal Flooding

Tidal flooding is caused by high tides coinciding with a low-pressure storm system which raises sea and tidal water levels, overwhelming coastal and river defences. This may be made worse by gale-force winds blowing the raised body of water up tidal river basins some distance from the coast, due to floodwater being forced up the tidal reaches of rivers and estuaries. Such flooding may become more frequent in future years due to rising sea levels.

Reservoirs Failure

Reservoir failure can be a particularly dangerous form of flooding as it results in the sudden release of large volumes of water that can travel at high velocity, causing deep and widespread flooding. The likelihood of this occurring is low as large reservoirs are managed in accordance with the Reservoirs Act 1975. The EA's online reservoir inundation map illustrates the maximum flood extents that could occur in the event of a reservoir.

1. Introduction

1.1 Acknowledgement

1.1.1 This report has been prepared for the sole and exclusive use of Island Green Power UK Ltd (the Client) in accordance with the scope of work presented via email by Arthian, dated 06/12/2024. This report is based on information and up-to-date data collected by Arthian following instruction to proceed. Should any of the information be incorrect, incomplete, or subject to change, Arthian may wish to revise the report accordingly.

1.1.2 Arthian has been instructed to provide hydraulic modelling to assess whether the proposed Green Hill Solar Farm in Northamptonshire could incorporate measures that deliver local flood-risk benefits for Lavendon.

1.2 Project Understanding

1.2.1 The proposed Green Hill Solar Farm development comprises a number of fields (the "Site" or "Sites") described as Green Hill A, A.2, B, C, D, E, F, G for the solar arrays, grid connection infrastructure and Battery Energy Storage Systems (BESS), and the Cable Route Corridor (CRC). Green Hill "G" covers fields north of Lavendon, a village and civil parish in the unitary authority area of the City of Milton Keynes, Buckinghamshire. The location of Green Hill G and Lavendon is presented in Figure 1.

1.2.2 Lavendon has a documented history of significant flooding, with notable events in 2012, 2015, December 2020, and September 2024. These incidents have contributed to ongoing concerns around flood management and community resilience.

Key Flood Events

- **2012**: Heavy rainfall in July led to severe flooding, triggering formal investigations into flood mechanisms and impacts in the village.
- **2015**: Further flooding occurred, adding to long-standing concerns raised by the community.
- **December 2020**: Intense rainfall of 28.6mm resulted in widespread flooding along Castle Road and Olney Road, affecting multiple properties.
- **September 2024**: More recent flooding caused internal property flooding and prompted a formal flood investigation by Milton Keynes City Council.

1.2.3 The aim of this hydraulic modelling exercise is to understand the flood mechanisms affecting Lavendon and to assess whether any flood-alleviation measures located at Green Hill G or elsewhere within the catchment could meaningfully reduce flooding in the village. This assessment is separate from, and hydraulically independent of, the Scheme's drainage strategy. The Scheme's drainage design has been developed to ensure no increase in flood risk to Lavendon or to any third parties.

1.3 Project Limitations

1.3.1 The wider Arthian limitations are contained within Appendix A.

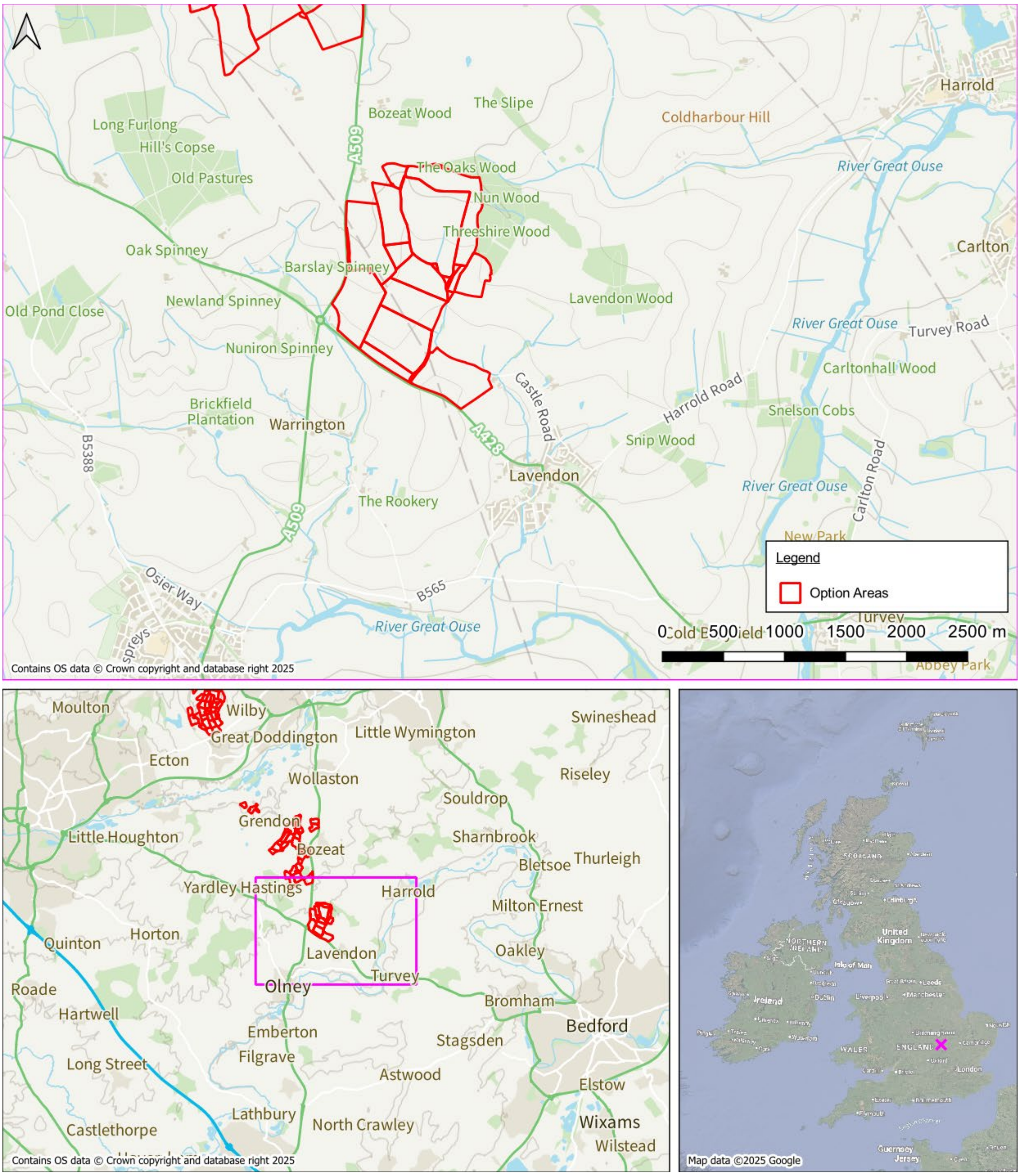

Figure 1: BESS Site location and key watercourses

2. Model Build

2.1 Model Setup and Updates

Table 1: Model details, methodology, and parameters

Arthian Model Reference and Version:	313532_Lavendon_v3
Simulation Type:	Pluvial
Model Type:	2D (1D elements embedded)
Software Builds:	TUFLOW 2025.2.2 *(latest build available at the time of simulation)*
Model Extent:	The extent of the model is shown in Figure 2.
Data Sources:	Net rainfall hyetographs generated using the ReFH2 method – discussed in detail later in this table. Full coverage of Environment Agency (EA) LiDAR data at 1m resolution – detailed later in this table. Topographic survey undertaken by Arthian in February 2025 used to verify the channel details and structure sizing.
DTM Data Sources:	EA LiDAR coverage preferred over topographic survey due to point spacing and a good agreement between the two datasets. The LiDAR data was flown in March 2020.
Cell Size:	4m base cell size, with Quadtree used to reduce the cell size along channels and in key areas down to 1m – suitable to represent flood mechanisms without negatively impacting simulation run times. Sub-grid sampling has been enabled to ensure the detail within the underlying 1m LiDAR grid is considered.
Existing Flood Defences:	No formal flood defences are present within the catchment draining towards Lavendon.
Boundary Conditions:	Catchment descriptors were obtained directly from the FEH Web Service, ensuring that parameters reflect the current FEH dataset and remain consistent with EA practice. Using these descriptors, the ReFH2 method was applied to generate net rainfall hyetographs for a range of storm events. This provides a proportionate and robust means of assessing flood risk to Lavendon and offer an appropriate level of detail for evaluating the hydraulic response of the shortlisted options.

Roughness Approach and Values:	Manning's n based on Chow (1959)[2], survey, photographs, and aerial imagery. Land use based on OS MasterMap data. Land Use Type ... Roughness (s/m$^{1/3}$) General surface ... 0.030 Industrial land ... 0.030 Land/gardens ... 0.060 Rough ground/scrub ... 0.080 Roads, tracks, and paths ... 0.020 Buildings ... 0.500 Inland waters ... 0.030
Structures:	All hydraulically significant structures encountered along the channel during the February 2025 channel survey have been modelled based on survey measurements.
Timestep:	Initial timestep set to 1s. TUFLOW HPC uses an adaptive timestepping process to maintain model stability. The control number factor has been left at the default value of 1.0.
Initial Conditions:	The simulations were initiated from a dry starting condition. Although not fully representative of all antecedent states, this approach is well suited to a 2D direct-rainfall model, where surface runoff and routing dominate the response. As a result, beginning the model dry is expected to have only a negligible influence on the hydraulic behaviour being assessed.
Non-Default Parameters:	Cell Wet/Dry Depth set to 0.2mm – standard for direct rainfall modelling. No further parameter changes required.
Further Comments:	-

[2] Chow, V.T. (1959) Open Channel Hydraulics. McGraw-Hill, New York.

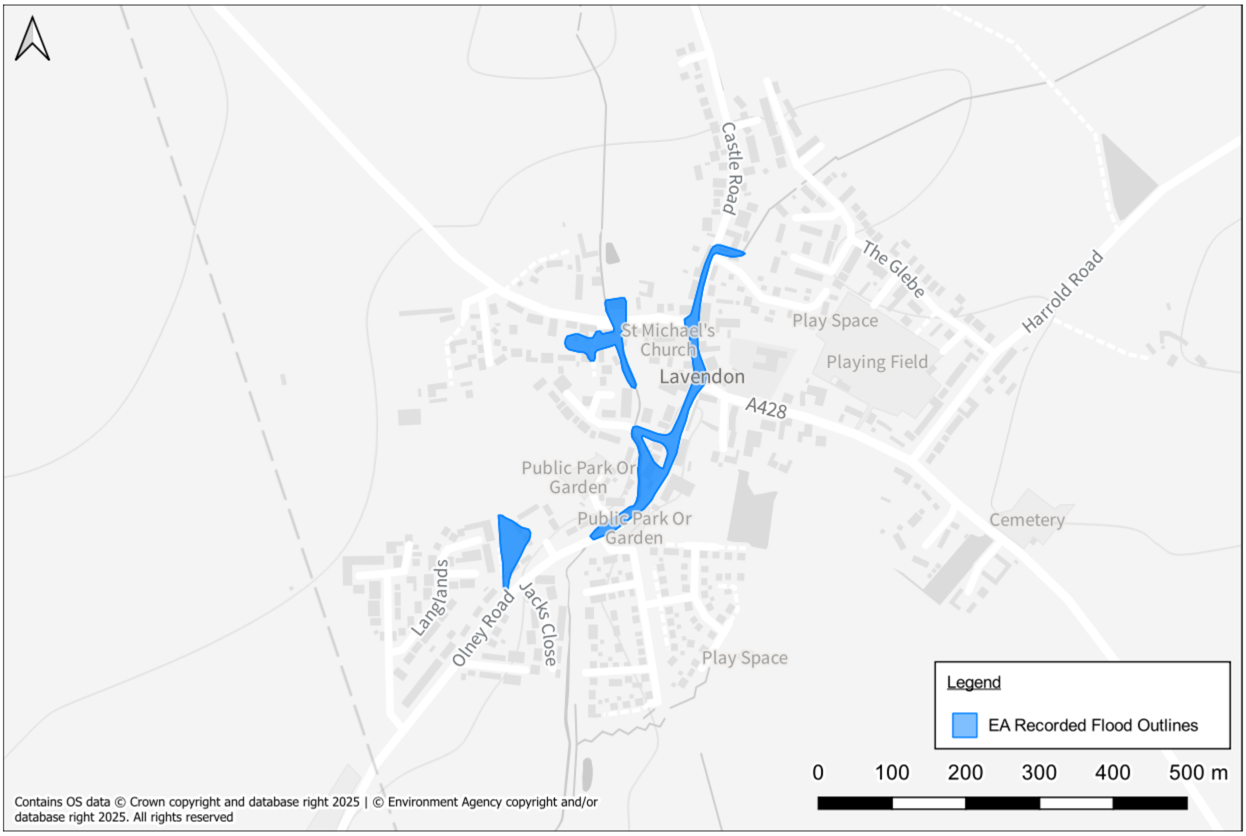

Figure 2: Model extent

2.2 Simulated Flood Events and Scenarios

2.2.1 The model was used to simulate a range of future rainfall events: 50%, 20%, 10%, 5%, 3.3%, 2%, 1.3% 1%, 0.5% and 0.1% AEP. Each event was also simulated with a climate change uplift of between 25-40% in line with the EA 2070s central and upper end allowances. Peak rainfall rates are listed in Table 2.

Table 2: Modelled peak rainfall rates

AEP	50%	20%	10%	5%	3.3%	2%	1.3%	1%	0.5%	0.1%
Return Period (years)	2	5	10	20	30	50	75	100	200	1000
CC Uplift (central / upper)	+25% "	+25% "	+25% "	+25% "	+25% "	+35% +40%	+35% +40%	+35% +40%	+35% +40%	+35% +40%
Peak Rainfall Rate (mm)	2.13	3.05	3.69	4.34	4.72	5.65 5.86	6.12 6.35	6.47 6.71	7.46 7.74	11.10 11.51

2.3 Model Assumptions and Limitations

2.3.1 The hydraulic model has been developed using industry-standard methods in accordance with current EA guidance [3]. Nevertheless, all models are simplifications of real-world systems, and several assumptions and limitations apply.

- **Rainfall Inputs:** Rainfall inputs have been derived using ReFH2 net rainfall hyetographs generated from FEH Web Service catchment descriptors. This approach aligns with current EA and FEH guidance and provides a proportionate basis for representing design storm conditions across a 2D domain. Spatially uniform rainfall has been applied, which is standard practice for direct-rainfall modelling of this scale and is not expected to materially affect predicted flow pathways or peak depths.
- **Drainage/Infiltration:** Net rainfall hyetographs derived using ReFH2 have been applied directly to the 2D domain. This approach incorporates the effects of losses such as interception, infiltration and initial soil moisture within the hydrological calculation, removing the need for detailed modelling of site-specific drainage networks or soil permeability. For a catchment-scale assessment of this type, the use of net hyetographs provides a proportionate and consistent means of representing effective rainfall without materially influencing the hydraulic outcomes.
- **Initial Conditions:** The model has been initialised from a dry starting condition. While this does not represent all possible antecedent states, the dominance of direct rainfall and surface-runoff processes in a 2D model means that antecedent water levels exert limited influence on peak flood extents or flow routing. A dry start is therefore considered appropriate and is not expected to meaningfully influence the results.
- **Downstream Boundary:** The downstream boundary is represented using an open-slope condition derived from the underlying terrain. This provides a stable and hydraulically reasonable control for the downstream extent of the model and is typical for local catchment-scale 2D rainfall modelling where the downstream interaction with larger watercourses sits outside the study scope. Sensitivity testing has been completed to quantify any model behaviour within the area of interest due to the boundary choice.
- **Topographic Representation:** The 2D model is based on filtered LiDAR data at a resolution consistent with EA best practice, with channel form incorporated through targeted refinement along the watercourse to ensure that key conveyance pathways are appropriately represented. While the cell size naturally limits the depiction of fine-scale bed features and small structural elements, the combination of high-quality LiDAR and focused channel refinement provides a proportionate representation of the system for assessing surface-water and fluvial interactions. The selected cell size and sub-grid sampling enable the model to capture relative changes in flow routing and floodplain connectivity with confidence, ensuring that the assessment remains robust for the purposes of this study.
- **Surface Roughness:** Manning's 'n' values have been assigned using standard land-use classifications, representing typical resistance for arable land, grassland, hedgerows and track surfaces. These values are applied consistently across all flow depths, which aligns with common 2D practice; while roughness can vary under very shallow or deeper conditions, such effects are minor at the scale of this assessment. Sensitivity tests have been undertaken to quantify the impact of adjusting the roughness coefficients.

[3] Hydraulic modelling: best practice (model approach) - GOV.UK

2.4 Model Health and Verification

2.4.1 A review of the 2D log files shows that whilst there are comments and warnings generated during the model initialisation process, all are pre-existing, and many are located a significant distance from the Site. There are no comments, warnings, or errors warranting attention.

2.4.2 Mass balance error statistics show the 2D mass balance error remains at 0.00% for all simulations including sensitivity tests as expected for a healthy TUFLOW HPC simulation.

2.4.3 Several simulations reported 1-2 instances of "*WARNING 2550 - [X] instability timestep corrections recorded at cell [X].*" One of the sensitivity tests reported 101 instances of this warning. This represents a tiny fraction of the total timesteps and simply reflects the solver occasionally trimming the timestep to ride out sharp local hydraulic gradients rather than any sustained or systemic instability in the model.

2.4.4 Comparison of the EA recorded flood outlines and the modelled 3.3% AEP +25%CC flood extent shows very good agreement, with similar flow routes and extents, particularly along Olney Road, providing confidence in the model outputs. The comparison is presented in Figures 3 and 4.

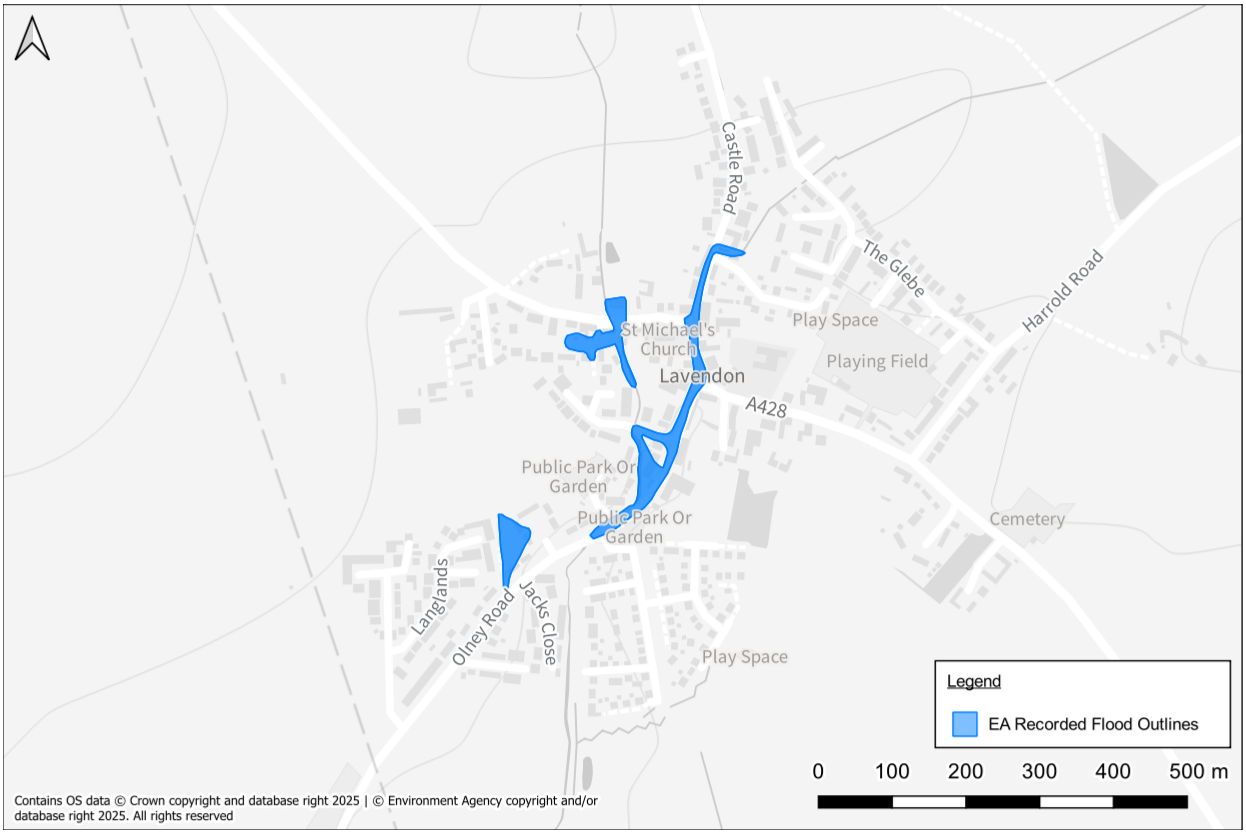

Figure 3: EA recorded flood outlines through Lavendon

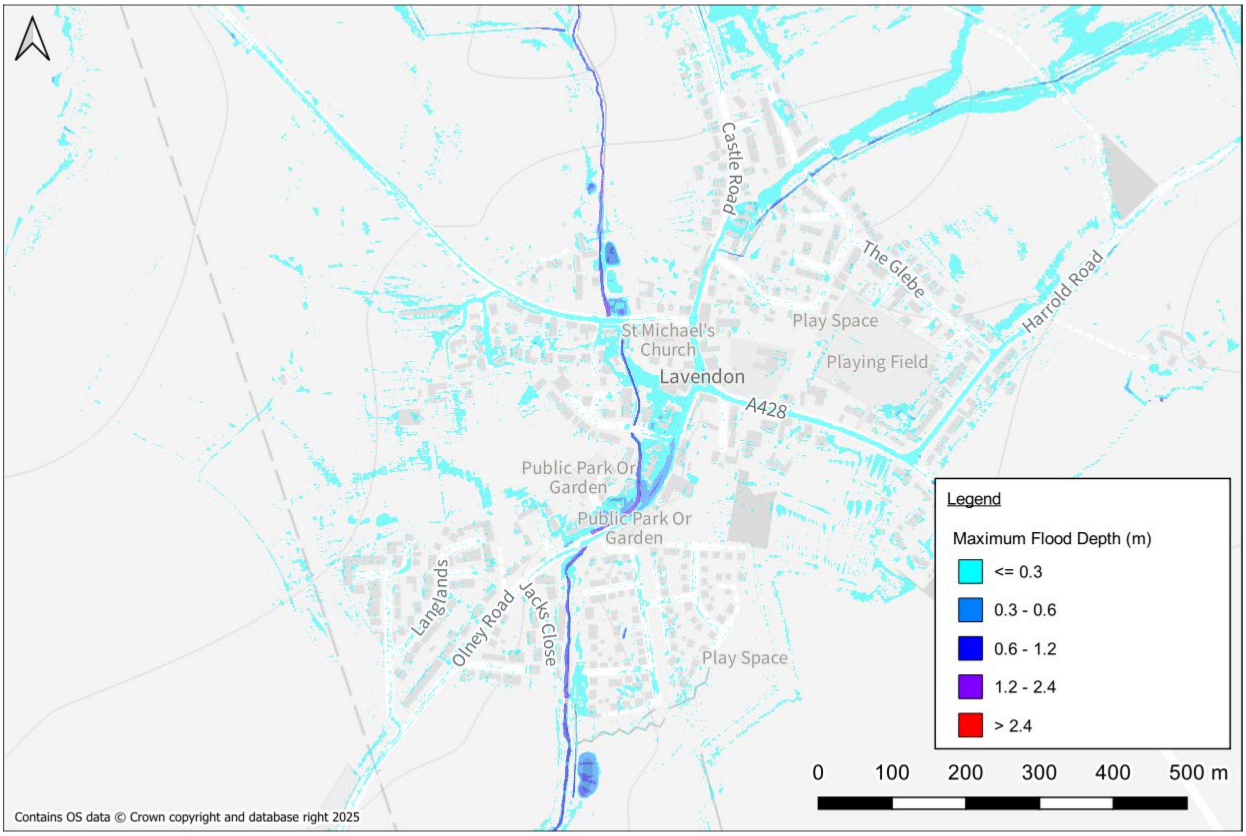

Figure 4: Maximum flood depth, 3.3% AEP +25%CC event, existing catchment layout

2.5 Results Summary - Baseline

2.5.1 Model results show sections of Lavendon to experience shallow depth flooding during the 50% AEP +25%CC event, with flood extents and depths increasing through the village as the event return period increases as expected. Maximum flood depths through Lavendon during the 50% AEP +25%CC, and 1% AEP +40%CC events are presented in Figures 5 and 6 respectively. Full model results are provided electronically with the model files.

2.5.2 Flooding through Lavendon remains generally contains to properties adjacent to the watercourse and along roads such as Olney Road, Castle Road, and the A428.

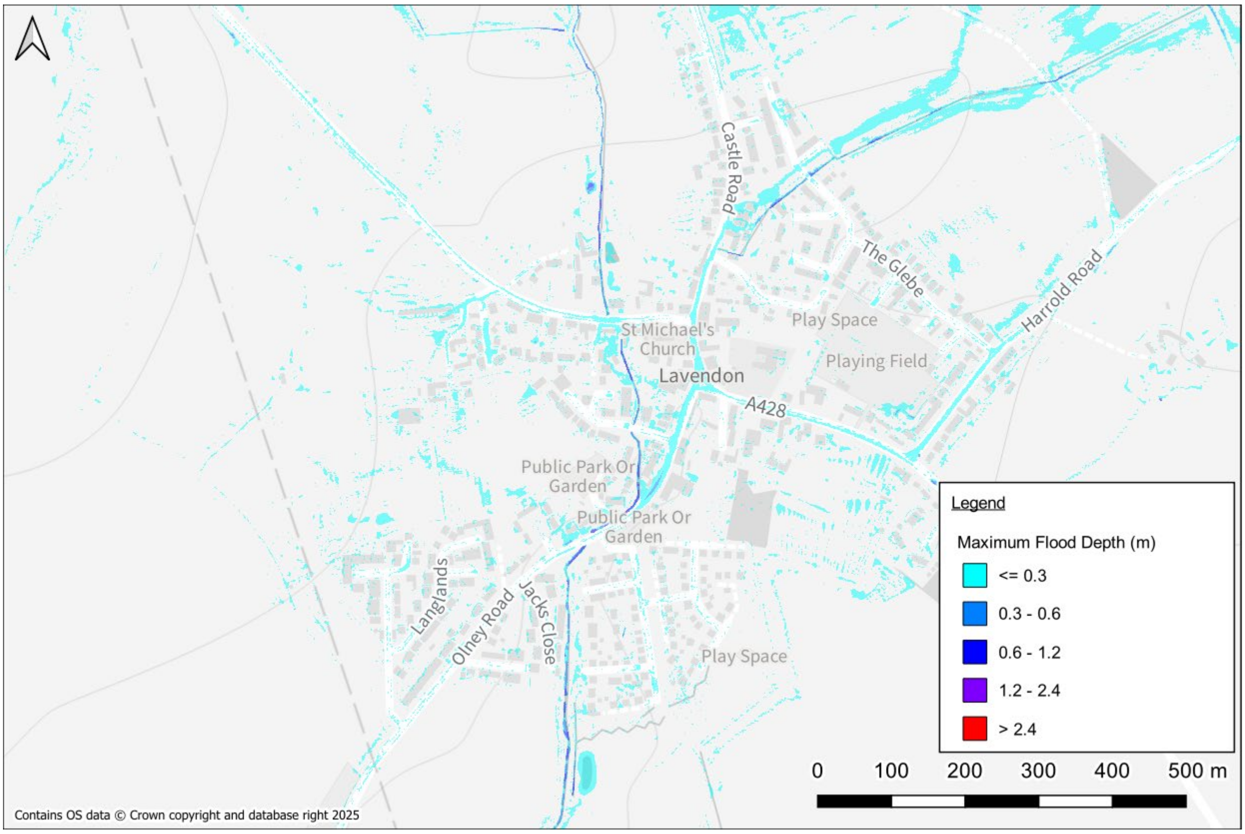

Figure 5: Maximum flood depth, 50% AEP +25%CC event, existing catchment layout

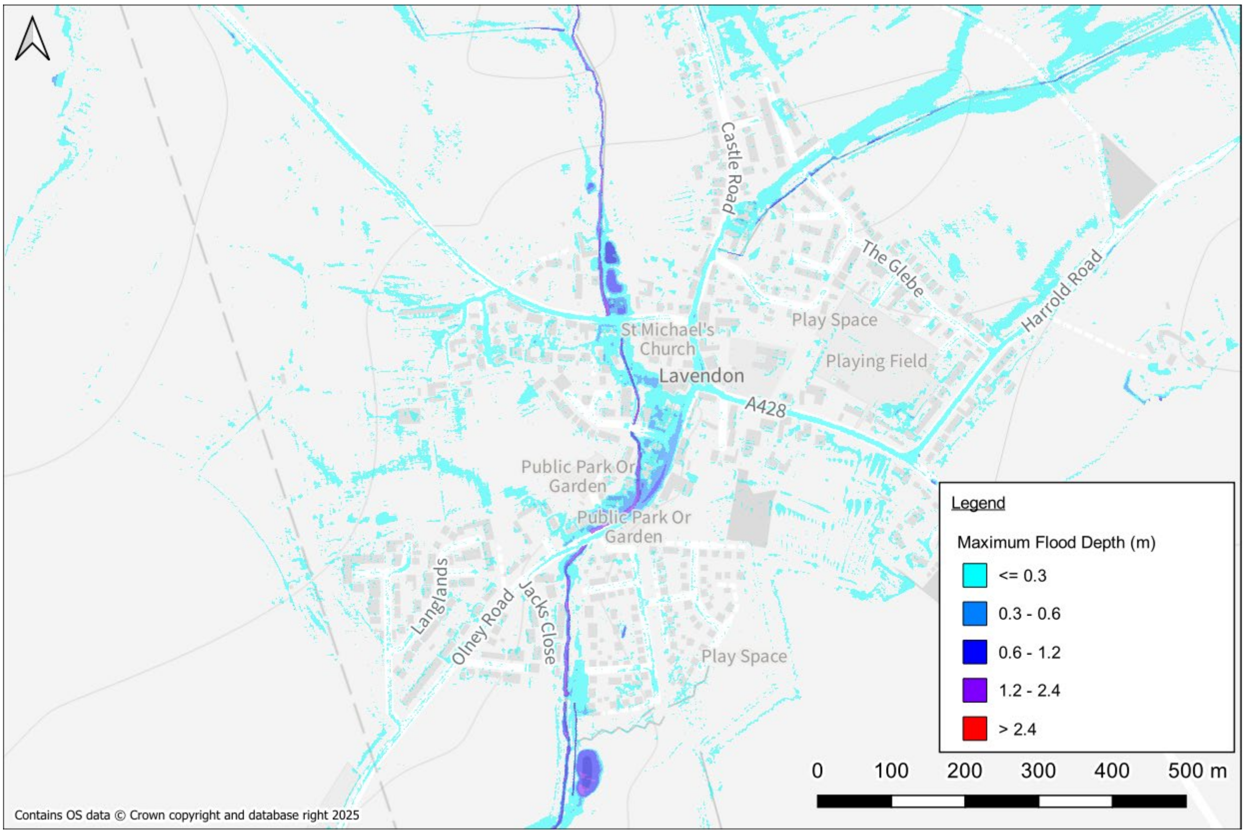

Figure 6: Maximum flood depth, 1% AEP +40%CC event, existing catchment layout

2.6 Results Summary – Options Testing

2.6.1 Following a review of the baseline model results, the first option tested comprised bunds placed along key field boundaries to attempt to contain and slow overland flows before they reached the main channel. The arrangement of these bunds is shown in Figure 7.

2.6.2 A second option introduced offline storage areas positioned along principal flow routes identified in the baseline simulations, with the intention of temporarily attenuating runoff and reducing peak flows within the channel. The configuration for this option is shown in Figure 8.

2.6.3 A third option applied a series of 200mm high, contour-aligned bunds across Green Hill G fields to promote greater redistribution and containment of surface flows. This option is presented in Figure 9.

2.6.4 Following initial simulations, none of the three options produced a meaningful reduction in flood levels within Lavendon. Across all events tested, options 1 and 2 reductions in peak depths were typically less than 20mm throughout the model with similar flood extents and flooded property counts. The maximum reduction noted was 170mm to a single property north of the A428 adjacent to the watercourse, reducing flood depths during the 3.3% AEP +25%CC event from 700mm to 530mm.

2.6.5 Option 3 had a slightly more noticeable impact, reducing flood depths at the single property north of the A428 by up to 320mm, to a maximum depth of 380mm. Whilst flood depths were reduced in places, similar flood extents were noted and flooded property counts remained similar.

2.6.6 Whilst these reductions indicate some localised improvement, the model continued to show that a similar group of affected properties would still flood regularly, and as much of the damage incurred during a flood occurs during the initial wetting, the overall benefits of the options would be minimal.

2.6.7 Detailed review of model outputs across the wider catchment shows that flooding in Lavendon was arising from multiple converging flowpaths, several of which originate outside Green Hill G and do not pass through it. Given this, measures located solely within Green Hill G are unable to address the full set of flood mechanisms affecting Lavendon, and any meaningful mitigation for the village would require offsite interventions.

2.6.8 A fourth option was assessed to quantify the impact of a potential flood storage area (FSA) east of Lavendon along another key flood flow route. The storage area comprised a bund across the floodplain with a 450mm diameter culvert, sized approximately using the Darcy-Weisbach equation to convey a "typical" flow based on baseline model results. The height of the bund would be determined by the maximum water levels behind the bund should the option prove to be successful. This option was combined with the previous option that had shown best performance – option 3. The option 4 layout is shown in Figure 10.

2.6.9 Despite inclusion of the additional FSA, the option 4 layout continued to show significant flooding throughout Lavendon, with flood depths of up to 620mm experienced along Olney Road during a 3.3% AEP +25%CC event, a reduction of just 60mm, and less than 10mm lower than option 3 (no FSA).

2.6.10 Maximum flood depths during the 3.3% AEP +25%CC event for each option are shown in Figures 11 to 14.

2.6.11 The options assessed in this section are conceptual and were developed to understand where, within the wider catchment, flood flows would need to be intercepted to produce a meaningful reduction in flooding within Lavendon. They were therefore tested at a theoretical level to examine hydraulic influence rather than practical deliverability. In particular, Option 3 involving extensive contour-aligned bunding across Green Hill G provided only modest localised reductions and is not technically feasible or deliverable. Option 4, which combined Option 3 with a potential flood storage area outside the Scheme's order limits, also delivered only minor reductions and is likewise unlikely to be deliverable.

2.6.12 These interventions were included solely to test whether interception at these locations, regardless of practicality, could materially alter flood behaviour. **Despite this deliberately optimistic and, in places, unbuildable approach, none of the options tested produced a meaningful improvement in flooding within Lavendon.** The modelling outcomes therefore provide diagnostic insight into the flood frequency and mechanisms affecting Lavendon rather than viable schemes for implementation.

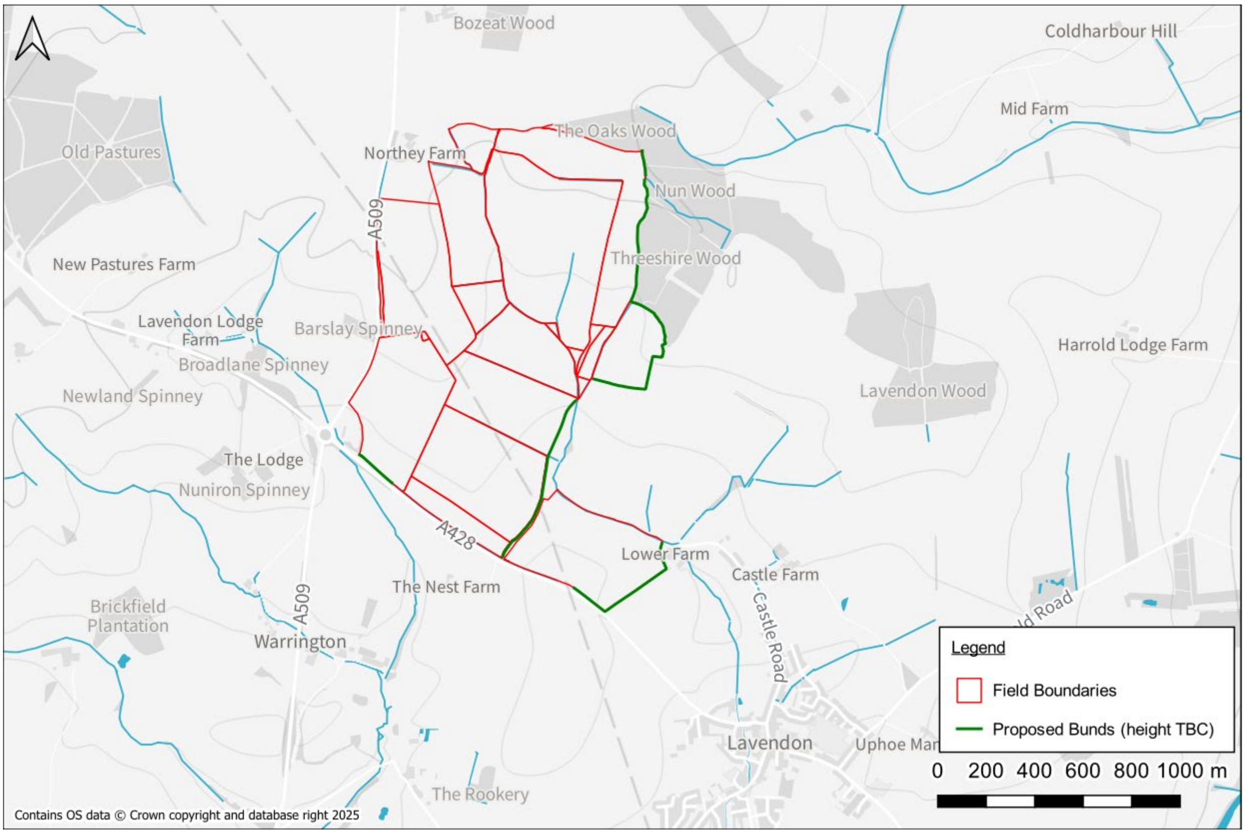

Figure 7: Option 1 site layout – bunds along field boundaries

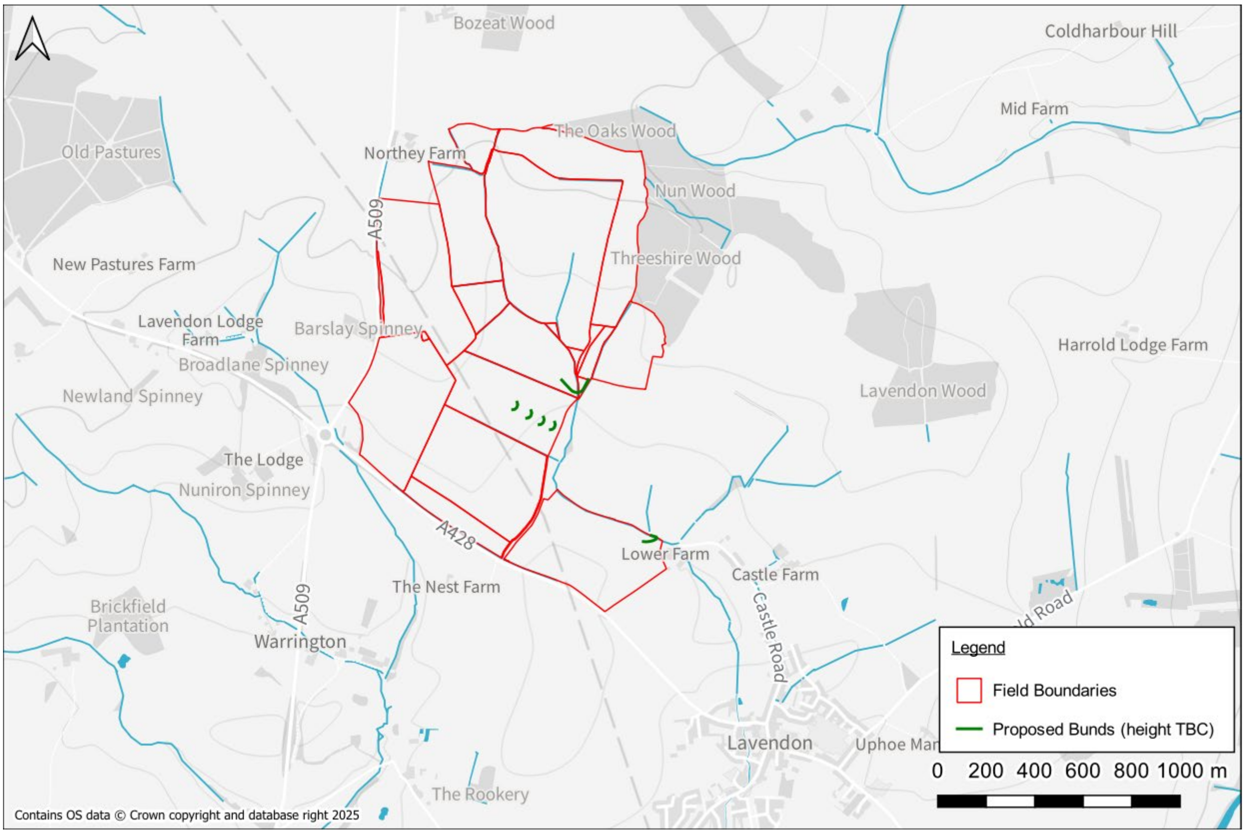

Figure 8: Option 2 site layout – strategically positioned bunding

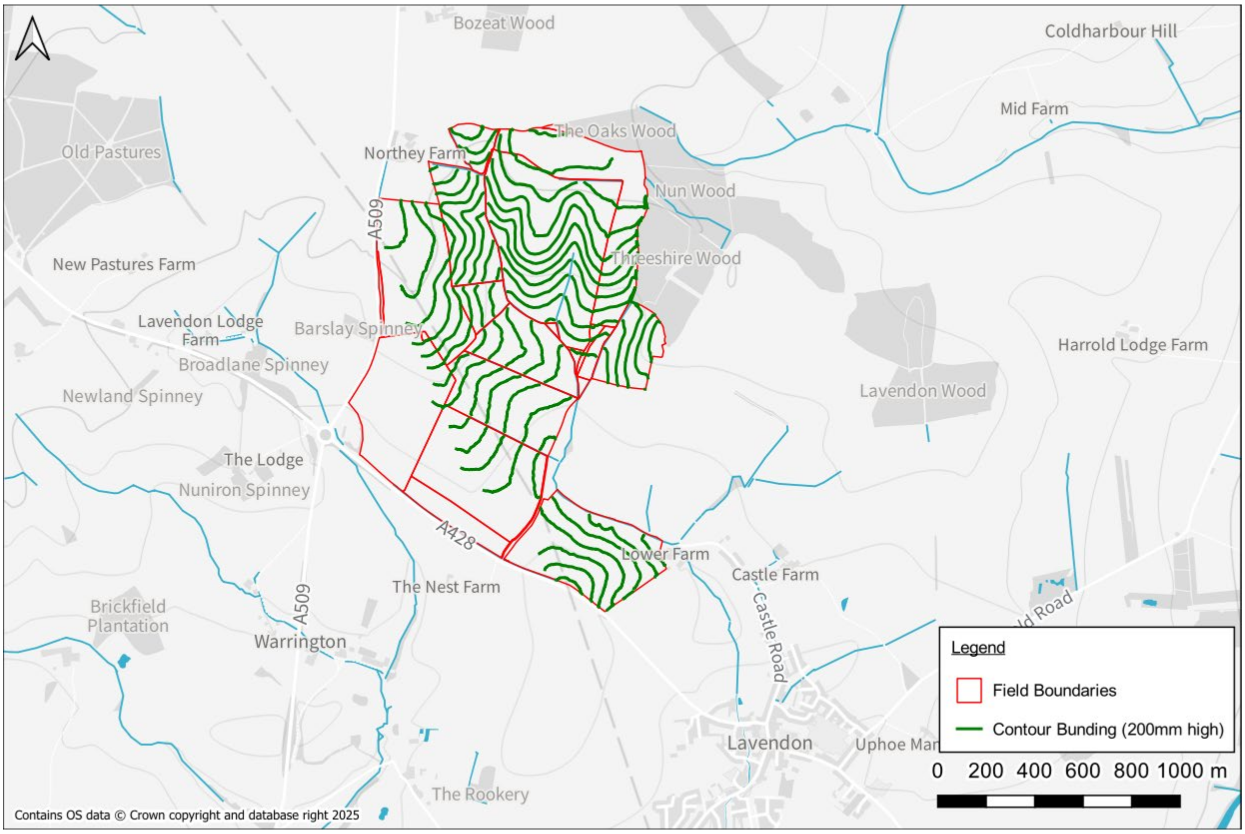

Figure 9: Option 3 site layout – contour bunding

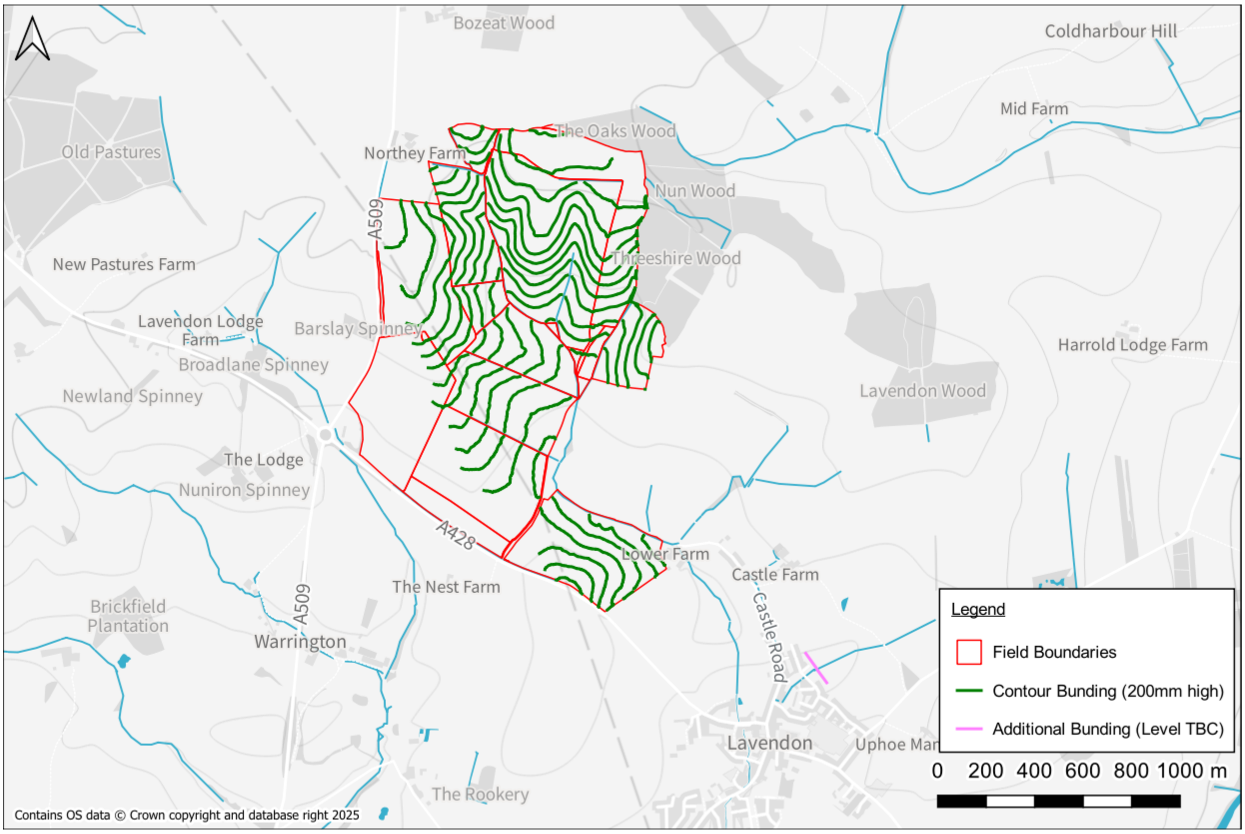

Figure 10: Option 4 site layout – contour bunding plus offsite bunding to the east

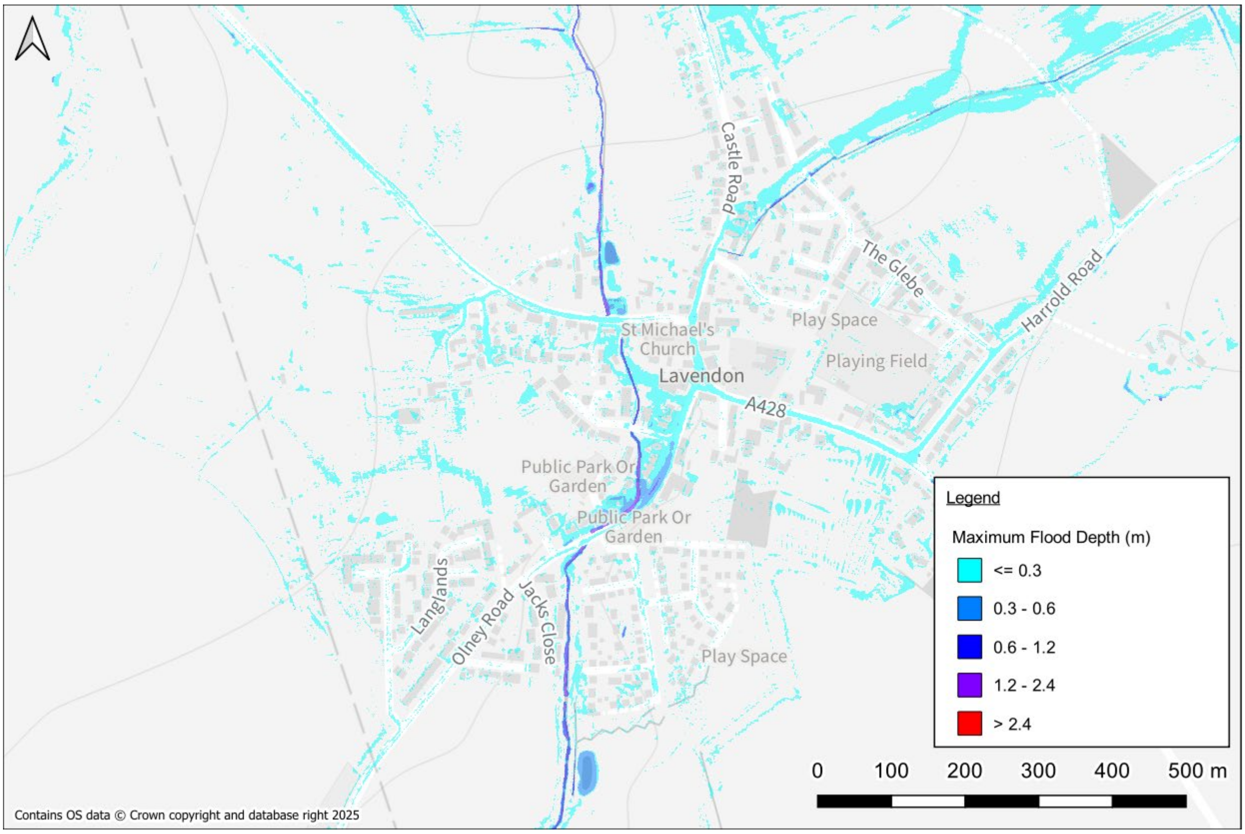

Figure 11: Maximum flood depth, 3.3% AEP +25%CC event, option 1

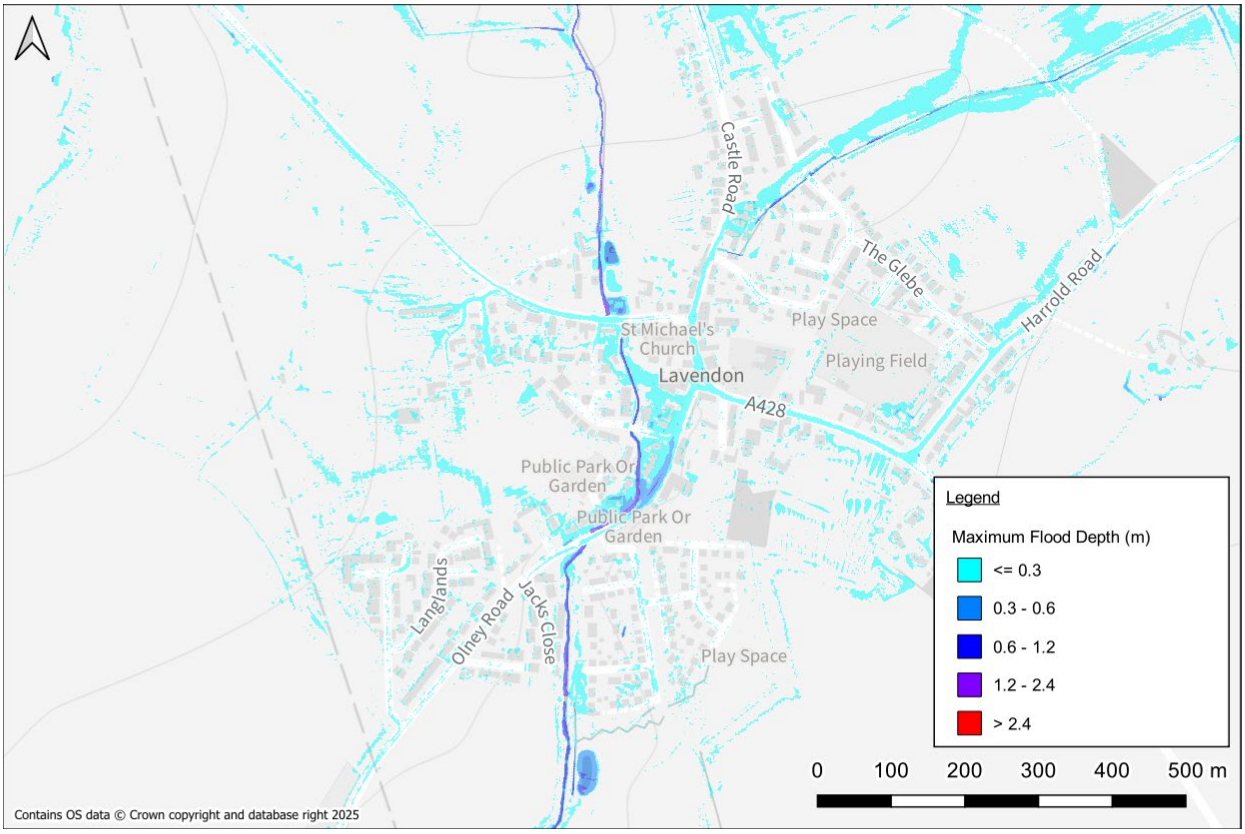

Figure 12: Maximum flood depth, 3.3% AEP +25%CC event, option 2

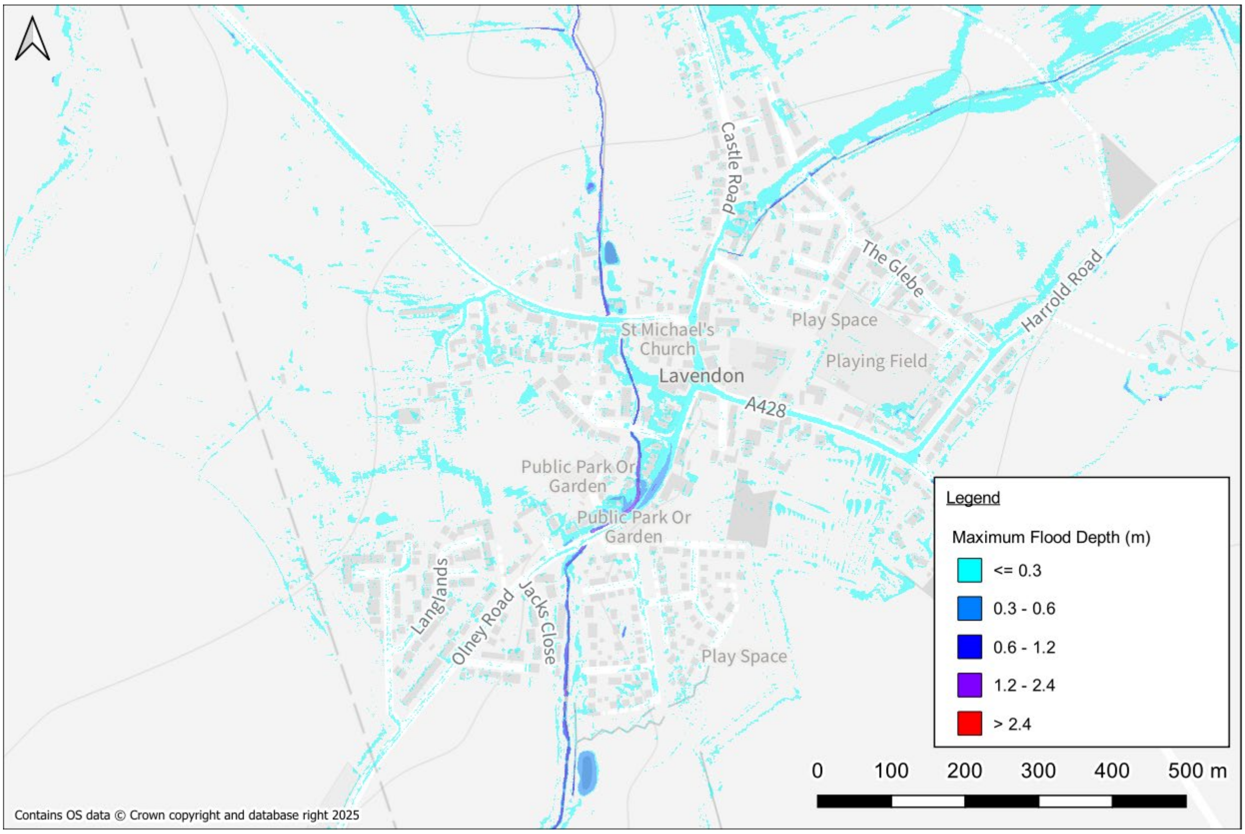

Figure 13: Maximum flood depth, 3.3% AEP +25%CC event, option 3

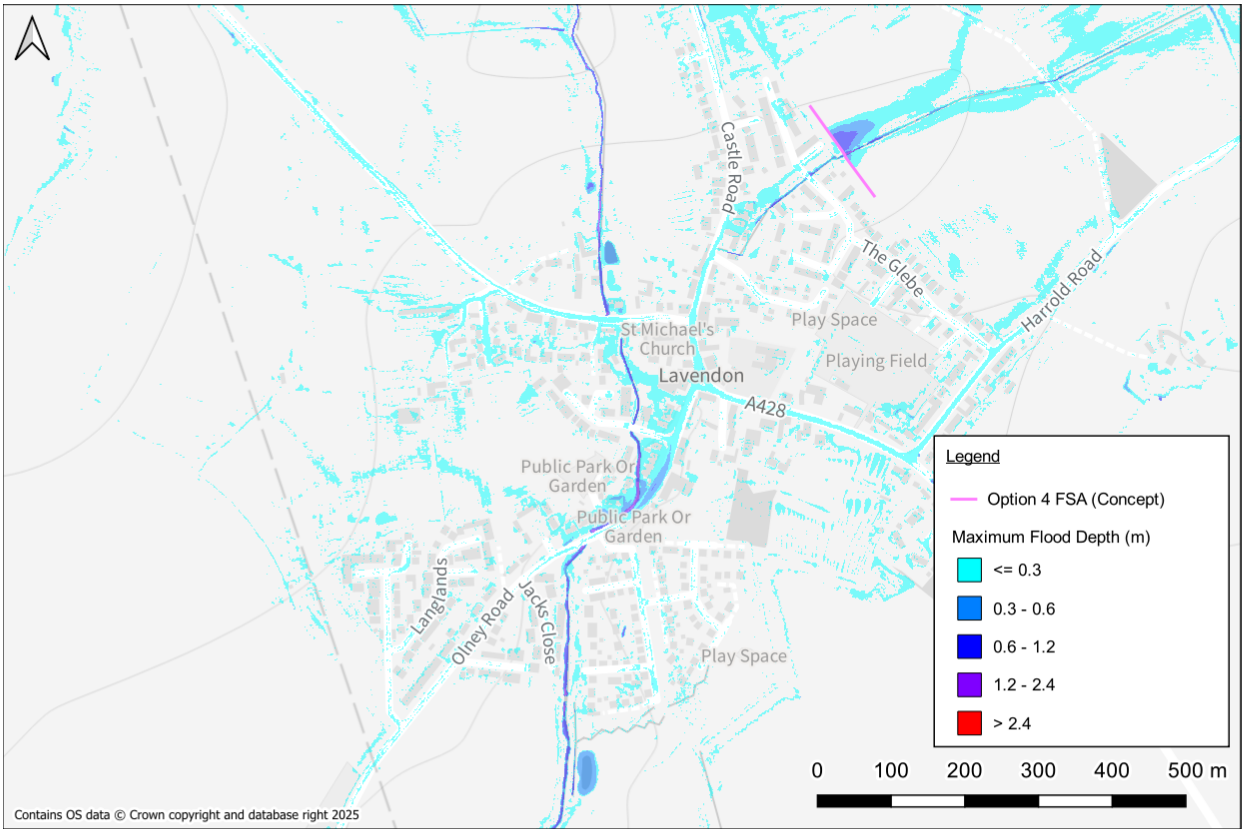

Figure 14: Maximum flood depth, 3.3% AEP +25%CC event, option 4

2.7 Results Summary – Further Testing

2.7.1 Four additional test simulations were undertaken to verify that flooding in Lavendon is driven by the interaction of several independent flowpaths. In each test, large impermeable "walls" were introduced within the model to isolate and fully contain flows from selected contributing areas. This allowed the remaining, unblocked flowpaths to be assessed individually and demonstrated whether or not flooding persists when individual sources are removed. The layout of the impermeable walls within the model tests is presented in Figure 15.

- Test 1 – Fully captures flows from leaving Green Hill G, leaving other flow routes unaffected
- Test 2 – Fully captures all flows north of Lavendon
- Test 3 – Fully captures all flows north and east of Lavendon
- Test 4 – Fully captures all flows east of Lavendon (Green Hill G and other northern flow routes unaffected)

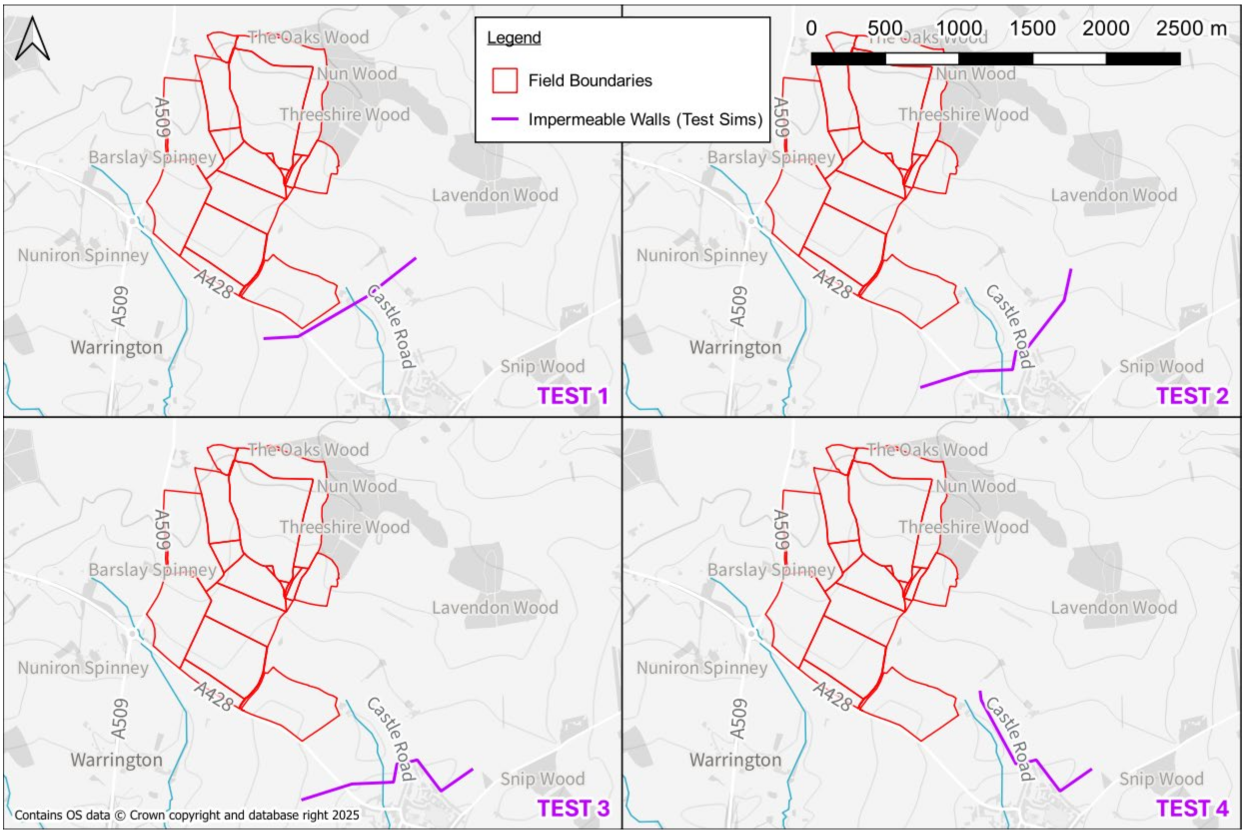

Figure 15: Impermeable wall test layouts

2.7.2 Blocking flows from the western channel flowing through Green Hill G (Test 1) does not prevent flooding through Lavendon, confirming that no amount of testing or tweaking of mitigation options within Green Hill G would fully address the flooding issues. Including the central channel within the area contained results in similar flooding through Lavendon. Including all flows to the north (Test 2) results in similar flooding through Lavendon verifying that the flood mechanisms are complex.

2.7.3 Blocking the eastern channel in conjunction with the western and central channels and leaving only minor surface water flow routes (Test 3) still results in flood depths of 400mm in places along Olney Road This flood extent is shown in Figure 16.

2.7.4 Blocking only the eastern flow route (Test 4) demonstrates the least impact, suggesting that the northern flow routes contribute the most to flooding, but also that any solution would involve extensive catchment-wide mitigation potentially coupled with hard engineering solutions through Lavendon.

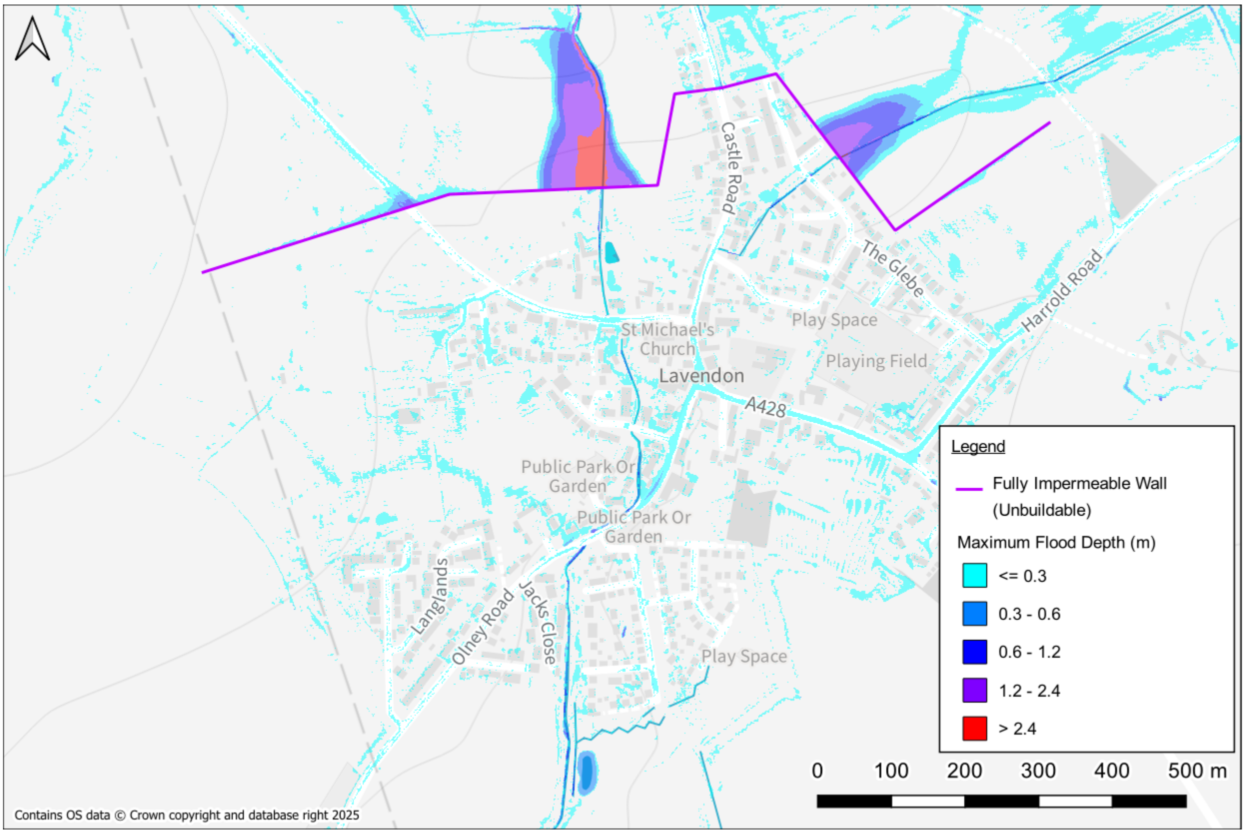

Figure 16: Maximum flood depth, 3.3% AEP +25%CC event, "Test 3" catchment layout

2.8 Sensitivity Testing

2.8.1 Sensitivity testing (ST) was undertaken on key model parameters to assess the robustness of results. The following variations were applied to the 1% AEP +13%CC simulation:

- ST1 and ST2 – Roughness (global): ±20%
- ST3 and ST4 – Rainfall intensity: ±20%
- ST5 and ST6 – Downstream boundary slope: ±20%
- ST7 and ST8 – Channel bed levels: ±300mm
- ST9 and ST10 – Control number factor: ±20%

2.8.2 The model shows limited sensitivity to all parameters tested, providing confidence in the model outputs. Maximum variations in peak water levels through Lavendon remained below ±150mm for all simulations, typically less than ±50mm.

3. Conclusions and Recommendations

3.1 Conclusions

3.1.1 A bespoke 2D direct-rainfall hydraulic model has been developed to investigate the flood mechanisms affecting Lavendon and to assess whether the proposed Green Hill Solar Farm could incorporate measures within Green Hill G that deliver local flood-risk benefits.

3.1.2 Baseline simulations show that flooding within Lavendon is driven by several converging flowpaths draining from the north, northeast and east of the village. These flowpaths interact across a broad area of the catchment, with flooding occurring along Olney Road, Castle Road and adjacent properties during events of increasing severity. Model validation against recorded outlines demonstrates good agreement and provides confidence in the representation of the key processes.

3.1.3 Three on-site mitigation options were tested within Green Hill G, including field-boundary bunds, targeted offline storage, and contour-aligned low bunding. None produced a meaningful reduction in flood depths or extents through Lavendon, with changes typically remaining below 20mm. A fourth option, incorporating an offsite storage area to the east of the village, similarly resulted in negligible benefit.

3.1.4 Further diagnostic simulations isolating individual contributing flowpaths confirm that flooding in Lavendon cannot be mitigated by measures located solely within Green Hill G. Even when major flow routes are fully contained within the model, significant flooding persists due to contributions from other parts of the catchment and from rainfall landing directly in Lavendon. The flood mechanisms affecting Lavendon are therefore catchment-wide rather than isolated to a single land parcel. Flood risk through Lavendon is likely to only be resolvable through extensive catchment-wide measures, potentially coupled with hard engineering solutions along the channel through Lavendon.

3.1.5 Sensitivity testing demonstrates that the model is robust to uncertainty in roughness, rainfall, channel levels, and boundary conditions. Variations in peak water levels through the village remained within ±150mm across all tests, supporting confidence in the overall conclusions.

3.1.6 Based on the modelling undertaken, it is concluded that the proposed solar development cannot feasibly incorporate on-site measures within Green Hill G that would provide a measurable reduction in flood risk to Lavendon.

3.2 Recommendations

3.2.1 The modelling undertaken for this assessment provides an appropriate technical basis for understanding the mechanisms driving flooding in Lavendon and the likely influence of potential interventions. The findings of this assessment could be used to inform wider strategic discussions regarding future flood-risk management in the catchment, acknowledging that effective mitigation for Lavendon would need to extend beyond the footprint of the proposed solar development.

Appendices

Appendix A – Limitations

Limitations

Client: The organisation identified on the report cover after "For", being the commissioning party.

This report contains recommendations from Arthian, which are based on the information listed in the report and reflect the professional opinions of an experienced Environmental Consultant. Arthian obtained, reviewed, and evaluated information from the Client and others to prepare this report. The conclusions, opinions, and recommendations presented in this report are based on this information. However, Arthian does not guarantee the accuracy of the information provided and will not be held responsible for any opinions or conclusions reached based on information that is later proven to be inaccurate.

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