Lime Down D – Natural Flood Management Viability Report

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Lime Down D – Natural Flood Management Viability Report

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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

- 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

A change in global or regional climate patterns. For flood risk, climate change is 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. Climate change scenario data exists across different epochs (time periods) to determine the needs for climate resilience measures. Climate change data is requested as part of an EAPD request. If a separate Environmental, Social, and Governance (ESG) Flood Risk and Climate Change Assessment is needed, additional climate change 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 climate change.

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 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. SPZ’s have been created as public facing boundaries where discrete groundwater bodies within SPZ’s 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 Lime Down Solar Park Ltd in accordance with the scope of work presented via email by Arthian, dated 24/04/2026. This report is based on information and data collected by Arthian. Should any of the information be incorrect, incomplete, or subject to change, Arthian may wish to revise the report accordingly.

1.2 Project Understanding

1.2.1 The development comprises solar PV sites, battery energy storage systems (BESS), and the associated cable route corridor. It is divided into five areas (Lime Down A–E) plus the cable route corridor, with the BESS located within Lime Down D.

1.2.2 For Lime Down A, B, C and E, the developable areas have been positioned using relevant strategic Environment Agency (EA) datasets, including the Flood Map for Planning (FMfP) and NaFRA2[1]. All development lies outside the current and future fluvial flood extents indicated by these datasets, and strategic mapping is considered sufficient to assess fluvial flood risk. Detailed hydraulic modelling is therefore not required for these parts of the site.

1.2.3 In contrast, the developable area within Lime Down D extends into Flood Zones 2 and 3 under both the current and future Flood Map for Planning, principally within the eastern part of the site associated with Gauze Brook, an EA Main River. The proposed BESS has been sequentially located within Flood Zone 1, outside the modelled design flood extent.

1.2.4 This report should be read in conjunction with the Lime Down D Hydraulic Modelling Note (HMN) **[EN010168/EXAM/9.32]** (Rev 2) submitted at Deadline 5 of Examination. The purpose of this assessment is to evaluate the technical viability of Natural Flood Management (NFM) options within Lime Down D and to quantify their hydraulic effectiveness in mitigating flood risk downstream through the village of Corston, located approximately 850m east of the site boundary.

1.2.5 This study directly utilises the baseline model setup and topographic/hydrological datasets established in the HMN without introducing new baseline data. This report takes into account the following guidance documents:

- https://www.gov.uk/guidance/using-modelling-for-flood-risk-assessments - Using modelling for flood risk assessments (2023);
- TUFLOW manual (2026)[2].

1.3 Project Limitations

[1] EA National Flood Risk Assessment 2 – a significant update on national flood risk that delivers enhanced flood modelling, high-resolution mapping, and improved climate change projections.
[2] https://docs.tuflow.com/classic-hpc/manual/2026.0/

1.3.1 The wider Arthian limitations are contained within Appendix A.

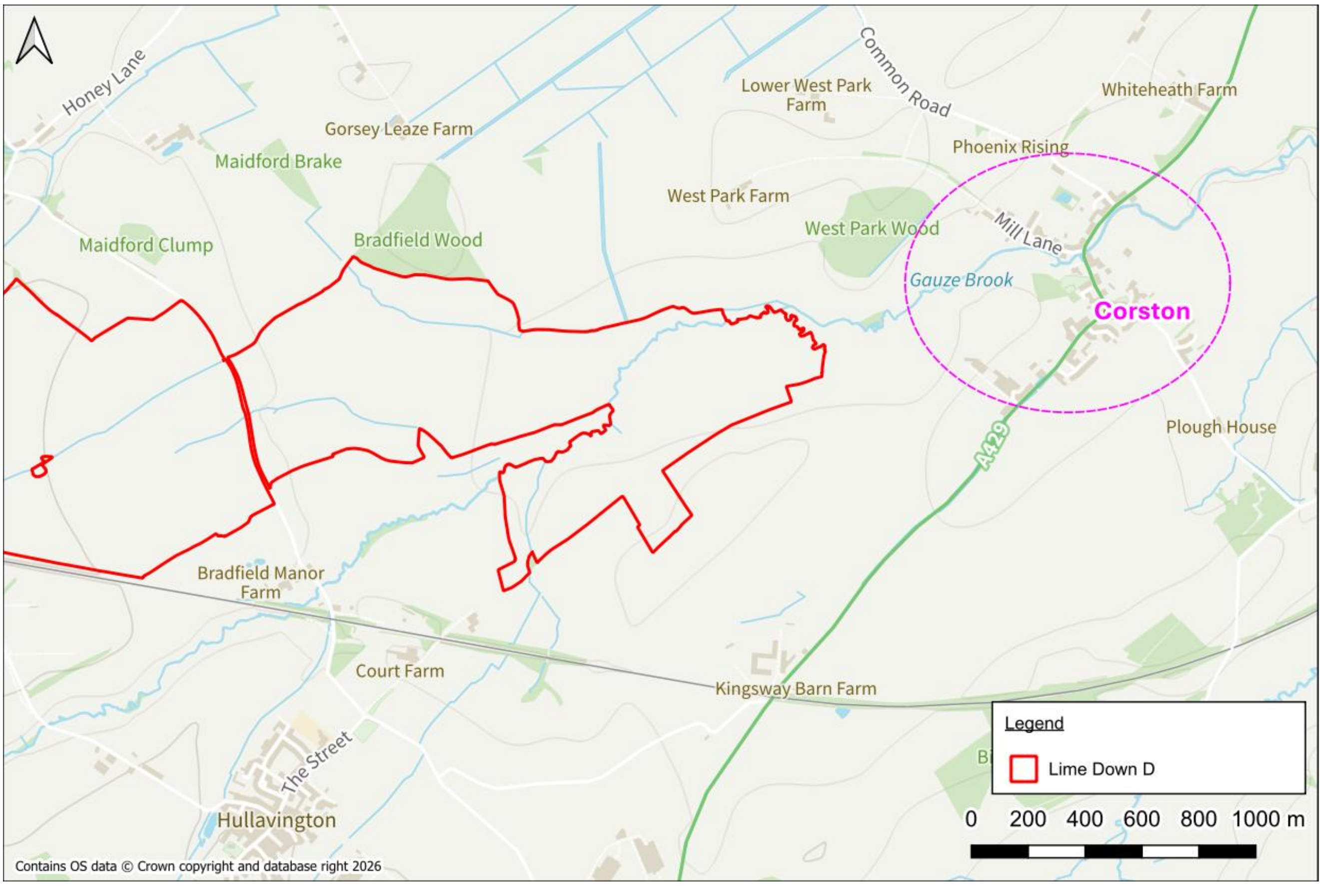

Figure 1: Lime Down D and its proximity to Corston

EA historical records confirm several instances of flooding across Lime Down D and through the village of Corston, primarily driven by Gauze Brook exceeding its channel capacity. A summary of these recorded incidents is presented in

1.3.2 Table 1, with the corresponding EA recorded flood outlines shown in Figure 2.

Table 1: Recorded flood incidents

Record ID	Date	Flood Source	Flood Cause	Data Quality
29535	1925	Gauze Brook	Other	Very Poor
19142	1932	Gauze Brook	Channel capacity exceeded (no raised defences)	-
29604	1960	Gauze Brook	Obstruction/blockage - culvert	Very Poor
29605	1960	Gauze Brook	Unknown	Very Poor
29606	1960	Gauze Brook	Unknown	Very Poor
29540	1968	Gauze Brook	Other	Very Poor
29725	1978	Drainage	Local drainage/surface water	Poor
29727	1978	Gauze Brook	Channel capacity exceeded (no raised defences)	Poor
29726	1996	Drainage	Local drainage/surface water	Very Poor
29728	1996	Gauze Brook	Channel capacity exceeded (no raised defences)	Very Poor
28666	2012	Unknown	Unknown	Very Poor

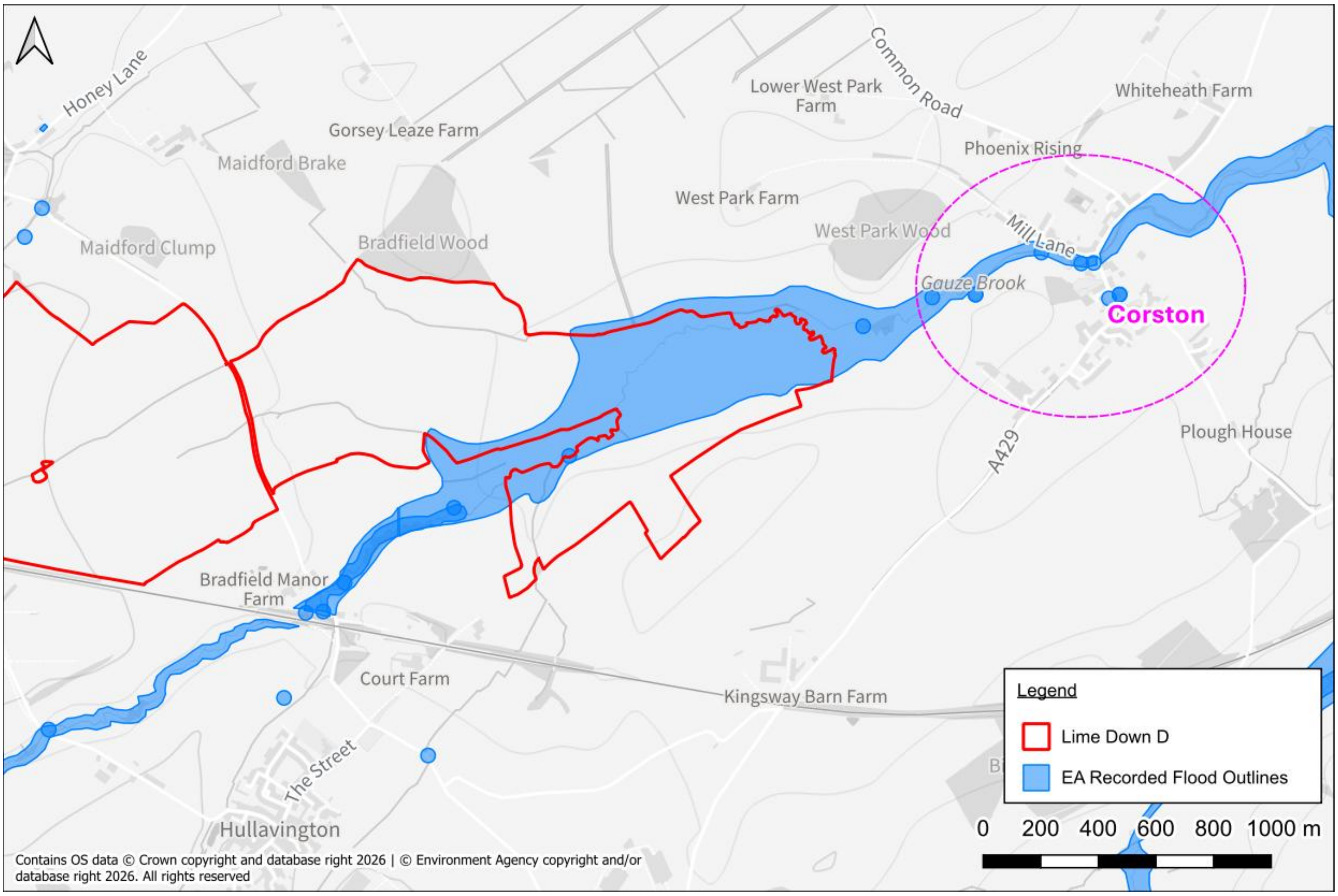

Figure 2: Environment Agency recorded flood outlines

2. Model Setup and Options Assessment

2.1 Baseline Model Framework

2.1.1 This assessment directly utilises the 2D TUFLOW HPC Quadtree baseline model setup and topographic/hydrological datasets established for Lime Down D without modification. The model provides the baseline hydraulic framework against which the viability of upstream NFM measures are evaluated. This technical note is submitted as an accompanying assessment to the **Lime Down D Hydraulic Modelling Report [EN010168/EXAM/9.32]** (Rev 2) submitted at Deadline 5 of Examination

2.2 Evaluation of NFM Measures Through Lime Down D

2.2.1 Screening of potential NFM interventions using SCALGO NatureInsight mapping identified that the most physically suitable options within the Lime Down D landholding comprise non-structural measures, primarily soil aeration/management techniques and riparian buffer strips. Extracts of the most suitable and second most suitable datasets are provided in Figure 3 and Figure 4 respectively.

2.2.2 SCALGO NatureInsight evaluates ten distinct nature-based solution (NbS) types across a 250m square gridded multi-criteria framework. This framework scores land suitability based on baseline land cover, soil texture, local slope, flow accumulation pathways, and flood extents. The tool screening ruled out structural or high-storage interventions within Lime Down D, such as runoff attenuation features, floodplain reconnection, or large woody debris, due to local slope, land use constraints, and limited upstream flow accumulation. Instead, NatureInsight prioritised non-structural interventions that focus on enhancing topsoil permeability, avoiding bare soil, and increasing surface roughness along agricultural boundaries to promote localised infiltration.

2.2.3 However, these measures operate exclusively by improving localised rainfall infiltration and increasing surface hydraulic roughness. They are only effective for surface runoff generated directly by rainfall landing within the site boundary itself. A catchment-scale volumetric review indicates that Lime Down D covers an area of approximately 2.1km^2, set within a total upstream contributing catchment to Corston of 26.3km^2. Because the development site comprises less than 8% of the total catchment area, the vast majority of peak flood flows reaching Corston originate from the wider upstream catchment outside the developer's control. The scale of Lime Down D relative to the Gauze Brook catchment draining towards Corston is presented in Figure 5.

2.2.4 Even if soil management and buffer strips were assumed to be 100% effective, completely absorbing or halting all surface runoff generated within Lime Down D, they would still exert a negligible influence on the overall catchment hydrograph reaching Corston. Non-structural NFM measures within the site boundary are fundamentally incapable of attenuating the high-volume, river-derived fluvial flood flows generated by the remaining 92% of the upstream catchment.

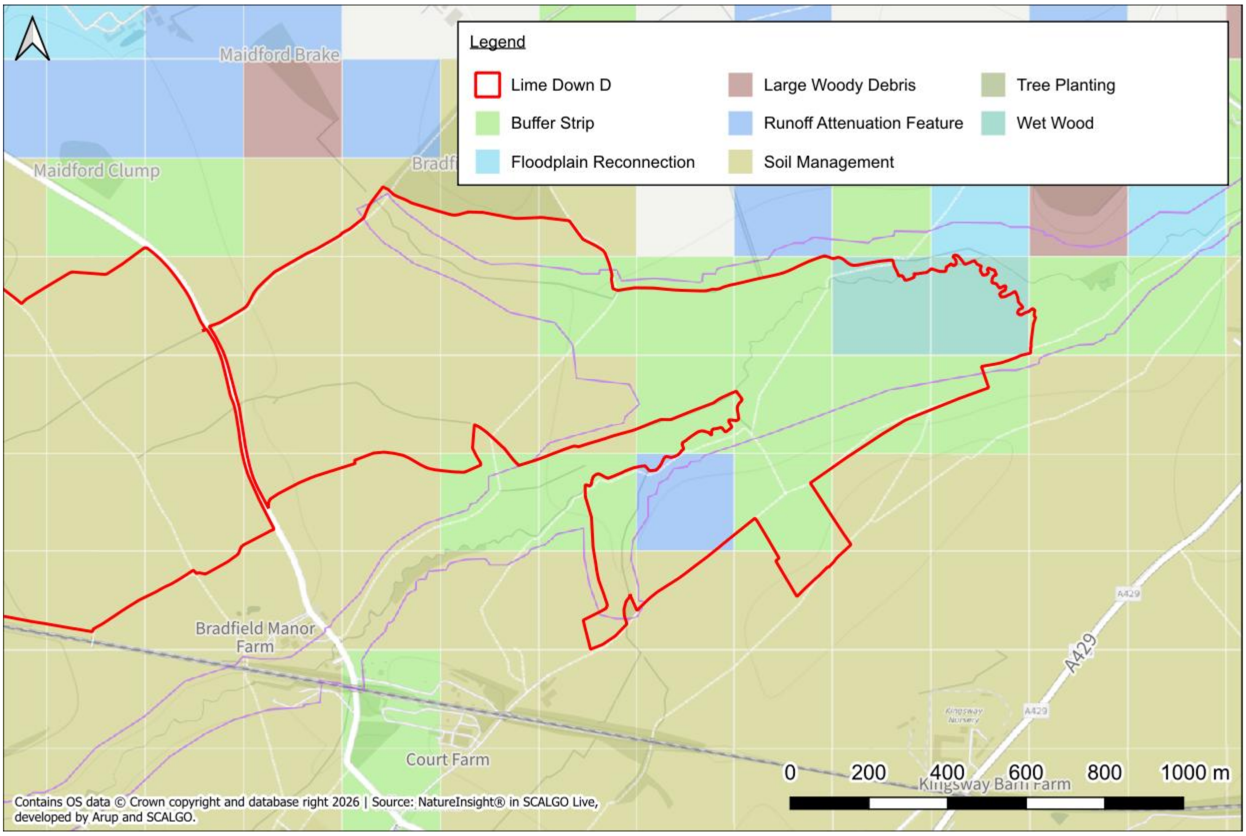

Figure 3: SCALGO NatureInsight mapping extract – "Most Suitable" option

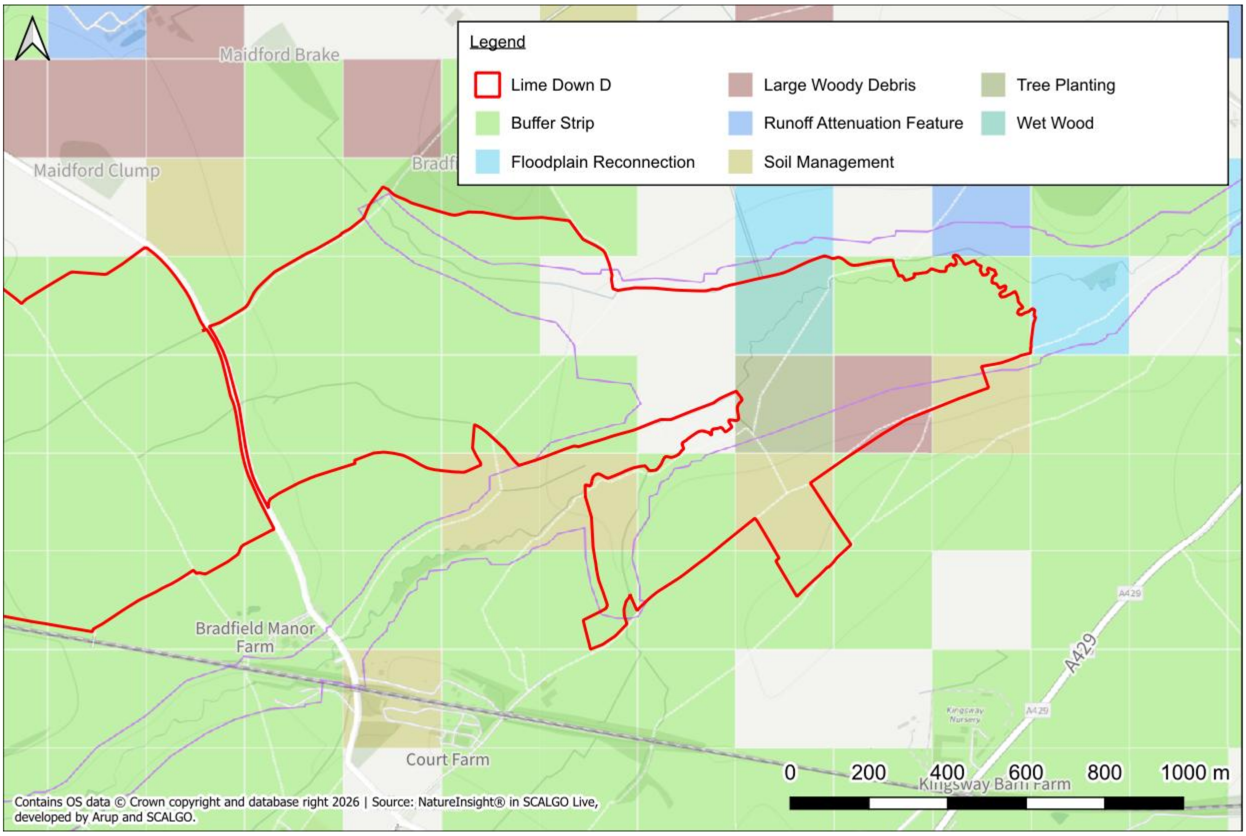

Figure 4: SCALGO NatureInsight mapping extract – "Second Most Suitable" option

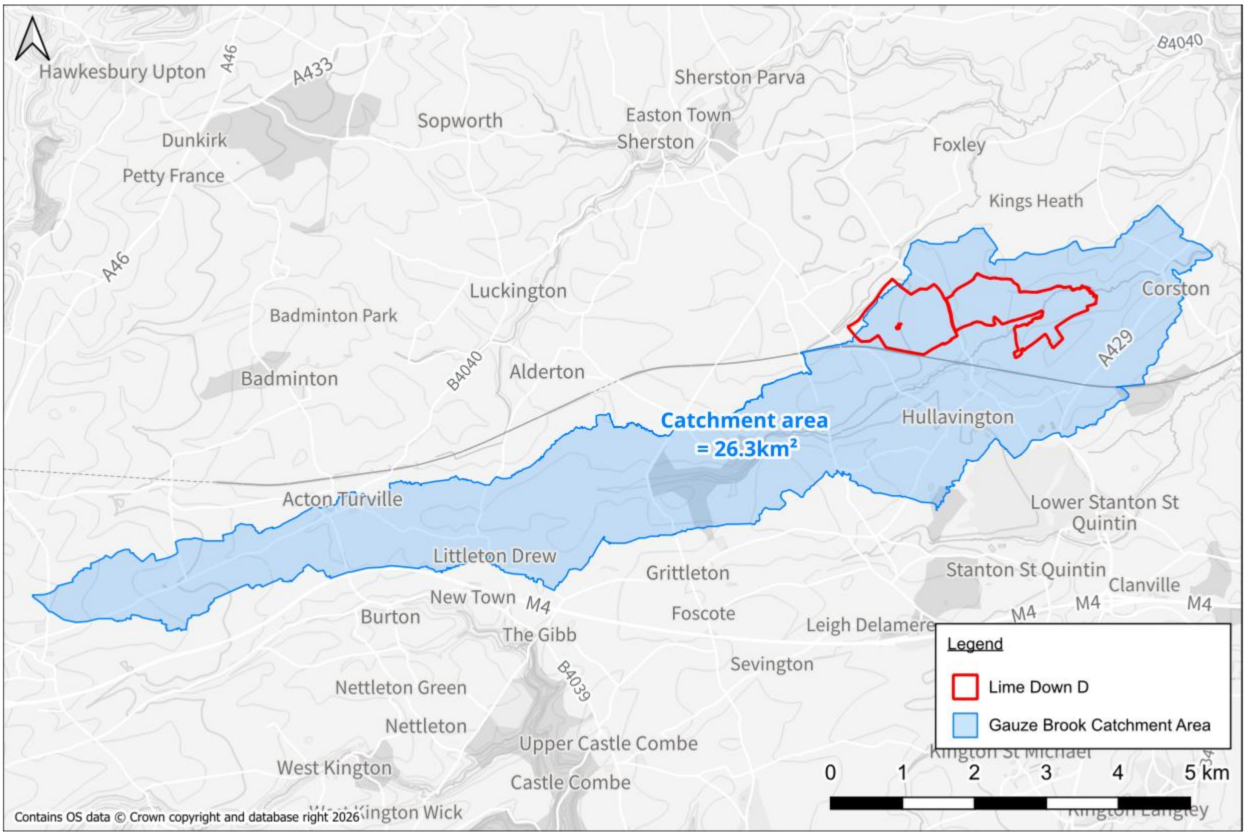

Figure 5: Lime Down D and the Gauze Brook catchment

2.2.5 Baseline hydraulic modelling demonstrates that during the 1% AEP +39% climate change design event, peak flows passing through Corston exceed 18.3m^3/s, whereas the threshold for the onset of out-of-bank flooding within the village is approximately 8.4m^3/s, less than half of the peak flow experienced. To completely prevent fluvial flooding in Corston solely through upstream flow attenuation, peak flow rates reaching the village would need to be capped at 8.4m^3/s. This would require a temporary flood storage volume of nearly 470,000m^3 (Figure 6), significantly greater than can be physically provided within the site boundary, and several orders of magnitude beyond the attenuation capacity of Natural Flood Management.

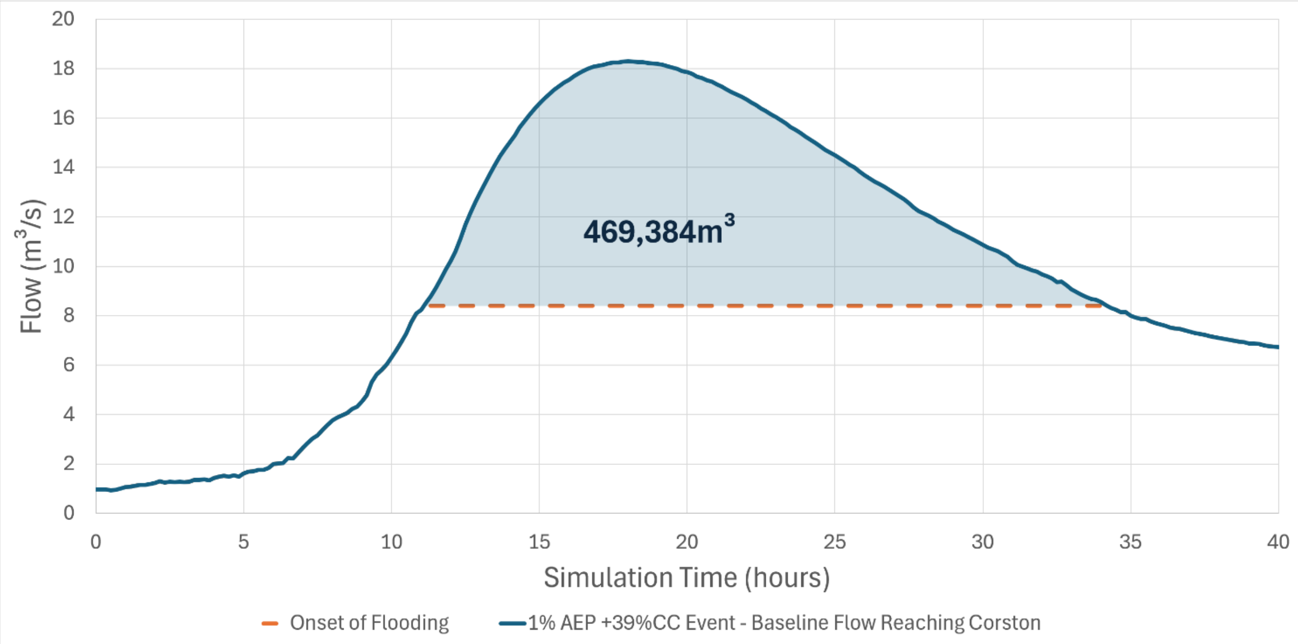

Figure 6: Flood Flows Through Corston and Storage Requirements

2.3 Evaluation of Site Attenuation & Online Storage

2.3.1 To rigorously test whether significant land modification on site could offer downstream flood relief, online storage options were simulated by representing localised land lowering across areas of Lime Down D that already experience baseline flooding from Gauze Brook. Two scenario simulations were configured:

- Option 1 (OPT1): 209,840m^2 of ground lowering by 0.3m across existing overbank flow paths.
- Option 2 (OPT2): 209,840m^2 of ground lowering by 0.6m across existing overbank flow paths.

2.3.2 The natural bund features were incorporated to control outlet discharges and encourage temporary floodplain retention. The proposed land lowering and natural bund features are presented in Figure 7.

2.3.3 To maintain environmental constraints and boundary integrity, an 8m buffer from the watercourse top-of-bank and a 10m buffer from adjacent third-party land boundaries were applied to the lowering extent. As this exercise represents an initial conceptual assessment to test physical viability, vertical excavation faces were assumed, with no allowance for side slopes included. The entire developable floodplain footprint within these buffer constraints was uniformly lowered by either 0.3m or 0.6m.

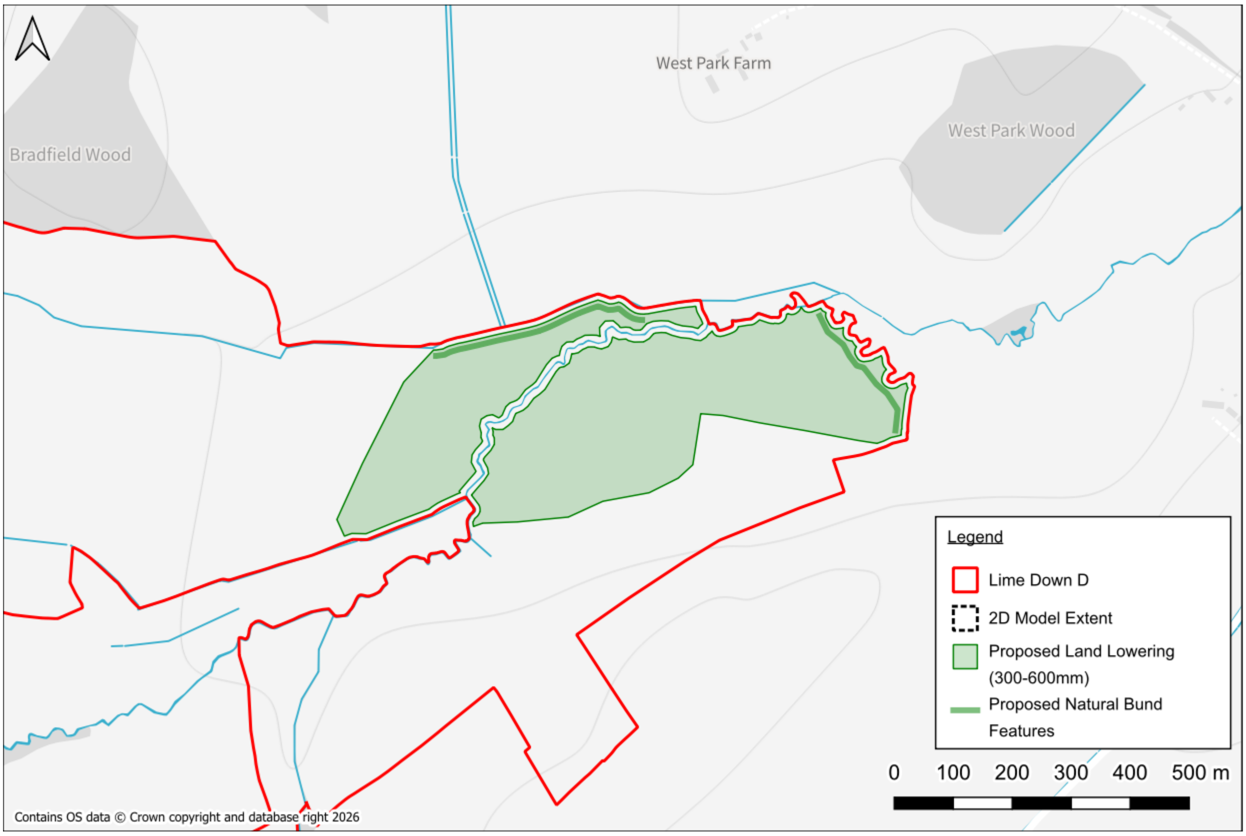

Figure 7: Proposed land lowering and natural bund features

2.3.4 Pre-simulation volumetric calculations confirmed that the additional storage volume created under these lowering scenarios is insufficient to achieve the required hydrograph attenuation. Scenarios 1 and 2 result in an additional storage volume of 62,950m^3 and 125,900m^3 respectively, representing around a quarter of the required 469,384m^3 attenuation capacity at most.

2.3.5 To store the hydrograph volume necessary to restrict downstream flows to 8.4m^3/s and prevent flooding through Corston, ignoring side slope requirements, assuming 100% volumetric efficiency, and simply lowering general ground levels across the available site floodplain, ground levels would need to be lowered by over 2.2m, which is physically and environmentally unfeasible.

2.3.6 Hydraulic model simulations confirmed these initial calculations. The introduction of localised land lowering and control bunds within Lime Down D produced no material reduction in peak flood levels or flow rates downstream through Corston, with modelled flood depths and peak discharges within the village remaining identical to baseline conditions. This is in part because the enforcement of the standard 8m watercourse buffer restricted direct hydraulic connectivity, preventing the lowered storage areas from effectively activating during the passing flood wave. Upstream NFM and online storage interventions within the site boundary are therefore demonstrably ineffective at mitigating downstream flood risk.

2.3.7 Flood depth mapping comparing the baseline catchment response and flood risk through Corston against the two simulated options, OPT1 and OPT2, is presented in Figure 8 and Figure 9.

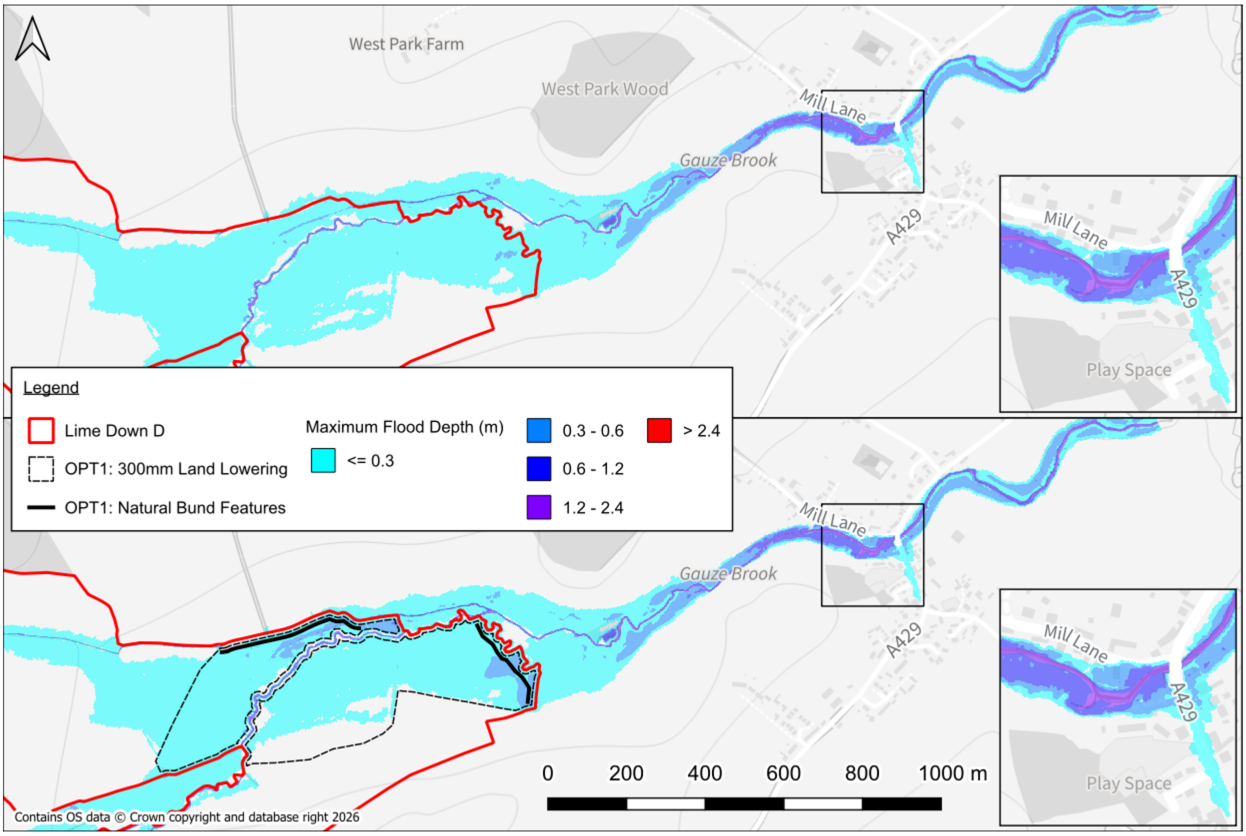

Figure 8: Comparison of OPT1 maximum flood depths vs baseline – 1% AEP +39%CC fluvial event

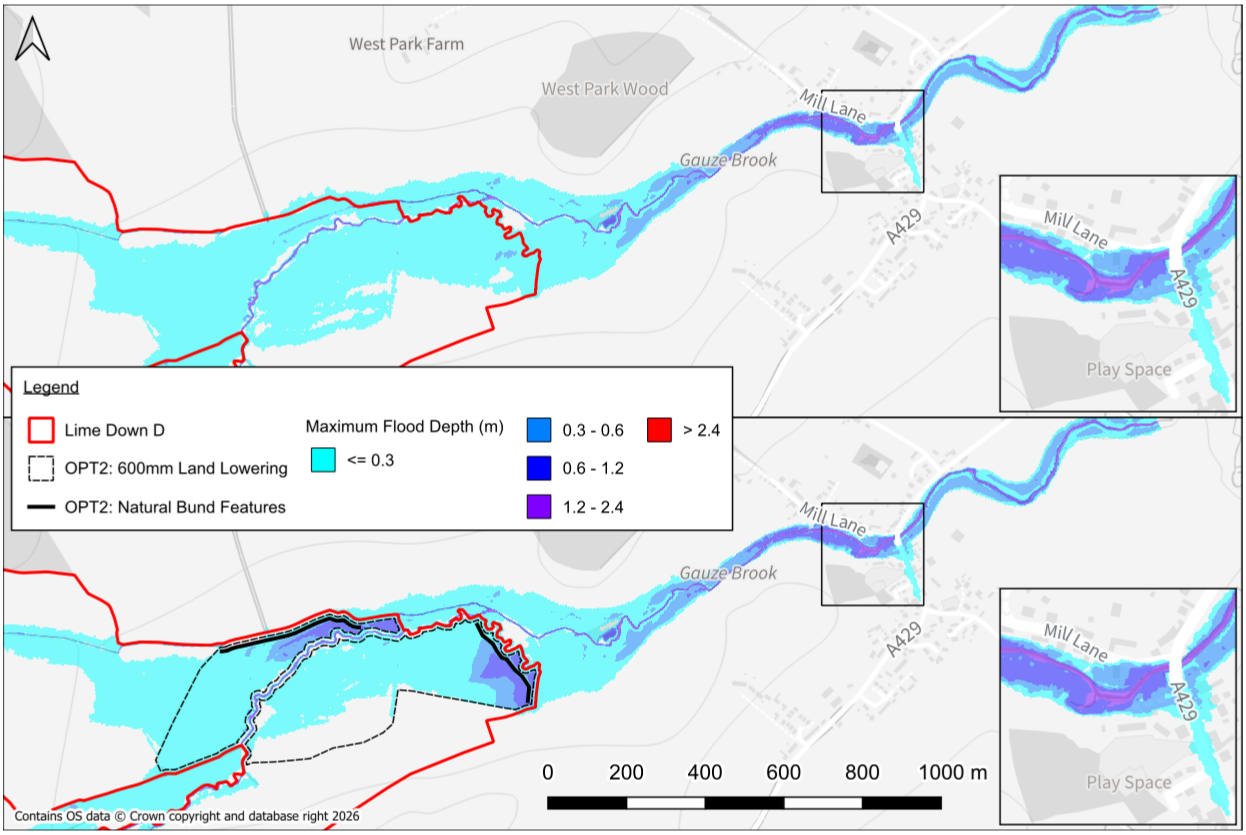

Figure 9: Comparison of OPT2 maximum flood depths vs baseline – 1% AEP +39%CC fluvial event

2.3.8 Physical Scale & Hydraulic Constraints

2.3.9 The fundamental physics of the catchment dictate that upstream storage within Lime Down D cannot alter flood risk outcomes in Corston. The volume of water required to bring peak hydrograph discharges below the out-of-bank threshold exceeds the physical capacity of the site by several orders of magnitude.

2.3.10 Because the development site accounts for less than 8% of the total upstream catchment, no amount of land management, NFM, or localised topographic modification within the site boundary can meaningfully attenuate the vast volume of floodwater generated by the wider 92% of the contributing watershed.

2.3.11 Furthermore, the hydraulic modelling exercise suggests that flooding within Corston is fundamentally a conveyance constraint rather than purely a catchment storage problem. Flow through the village moves along a tightly constrained channel flanked closely by residential properties. As shown by the modelled maximum water level mapping in Figure 10, a major hydraulic control and conveyance bottleneck occurs at the A429 road bridge crossing.

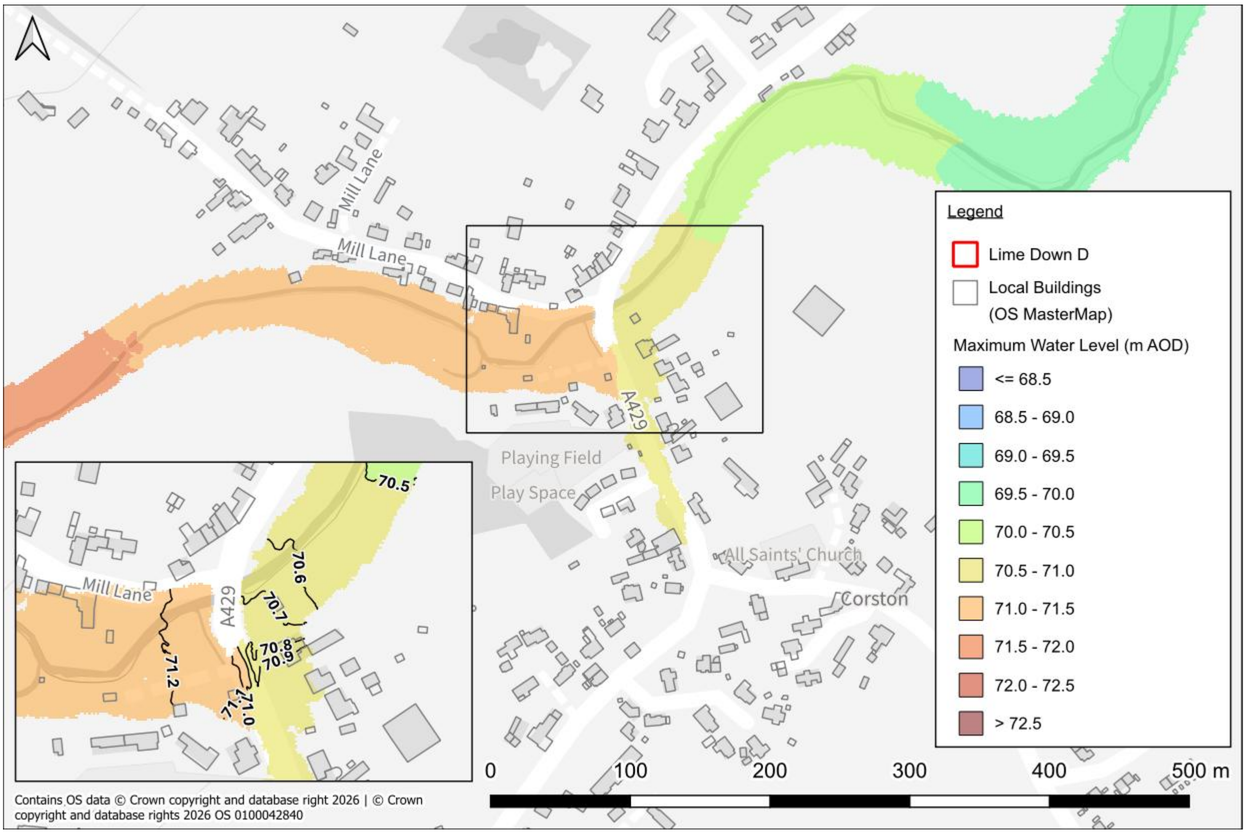

Figure 10: Maximum water levels through Corston, 1% AEP +39%CC fluvial event, baseline scenario

2.3.12 The constriction caused by the bridge opening creates a severe backwater effect during high-flow events, resulting in a pronounced head drop across the structure. Baseline peak water levels drop sharply from over 71.2m AOD directly upstream of the A429 bridge down to 70.6m AOD immediately downstream, a head drop of over 0.6m across the crossing itself. This significant head drop demonstrates how the bridge acts as a physical dam during flood conditions, forcing water to back up upstream and spill out-of-bank directly into adjacent residential properties along Mill Lane and through the core of the village.

2.3.13 Because the primary mechanism driving flood risk in Corston is this severe localised hydraulic constriction and head drop at the A429, minor variations in upstream peak flows have zero impact on flood outcomes in the village. Resolving flood risk through Corston cannot be achieved through upstream attenuation. It relies entirely on addressing localised conveyance limitations, structure capacity, and flood containment directly within the village corridor itself.

2.4 Localised Mitigation & Future Technical Support

2.4.1 While upstream attenuation within the proposed submission order limits cannot resolve downstream flood risk, hydraulic principles and professional experience indicate that flood risk within Corston is primarily governed by localised, in-channel conveyance bottlenecks and low-lying bank profiles within the village itself.

2.4.2 Addressing the long-standing flood risk through Corston would require direct, localised hard engineering measures within or immediately adjacent to the village. Such measures typically include engineered flood containment walls, targeted embankment raising, channel re-profiling, or local flow-relief structures (such as addressing conveyance through the A429 crossing).

2.4.3 The hydraulic model constructed for this assessment provides an established, high-resolution computational baseline covering both the site and the downstream reach through Corston. To support the local community and relevant Risk Management Authorities, the developer (Island Green Power UK Ltd) will make the fully configured hydraulic model files freely available for any future flood alleviation studies or detailed option assessments.

2.4.4 With the baseline framework already built, tested, and ready for application, this technical asset can be leveraged by specialist hydraulic modelling consultants to rapidly test, optioneer, and quantify the benefit of targeted village defence schemes, should the residents or local authority choose to pursue direct flood relief options for Corston.

3. Conclusions and Recommendations

3.1 Conclusions

3.1.1 High-resolution, site-specific hydraulic modelling was undertaken to evaluate the technical viability of Natural Flood Management (NFM) options within Lime Down D and to quantify their hydraulic effectiveness in mitigating flood risk downstream through the village of Corston, located approximately 850m east of Lime Down D.

3.1.2 The site-specific hydraulic model utilises detailed baseline topographic and hydrological datasets established for Lime Down D.

3.1.3 Historical records confirm repeated flooding incidents driven by channel capacity exceedances along Gauze Brook both on site and downstream through Corston.

3.1.4 Multi-criteria screening using SCALGO NatureInsight demonstrated that non-structural NFM measures (soil aeration and riparian buffer strips) are most physically suitable within Lime Down D, with structural interventions ruled out mainly due to slope and land-use constraints.

3.1.5 Volumetric analysis reveals that Lime Down D accounts for only 2.1km^2 (less than 8%) of the total 26.3km^2 catchment draining to Corston. Because non-structural NFM measures only influence localised rainfall landing directly on site, they are fundamentally incapable of attenuating the fluvial flood flows generated by the remaining 92% of the upstream catchment.

3.1.6 Baseline simulations show that preventing out-of-bank flooding in Corston during the 1% AEP +39% climate change design event requires capping peak flows through Corston at 8.4m^3/s, down from a peak of 18.3m^3/s, requiring an attenuation volume of nearly 470,000m^3. Simulated online storage scenarios within the site (0.3m and 0.6m land lowering across 209,840m^2) yielded a maximum additional storage of 125,900m^3, around a quarter of the required capacity, and hydraulic model runs confirmed zero material reduction in peak flood depths or flow rates in Corston.

3.1.7 To store the required hydrograph volume within Lime Down D, site levels would need to be lowered by over 2.2m across the floodplain and the storage would need to be 100% effective at the peak of the event, which is physically and environmentally unfeasible.

3.1.8 Hydraulic model outputs confirm that flooding within Corston is fundamentally a localised conveyance constraint rather than a catchment storage issue. The A429 road bridge crossing creates a severe hydraulic constriction, generating a backwater effect and a head drop of over 0.6m across the structure (falling from 71.2m AOD upstream to 70.6m AOD downstream). This forces floodwaters out-of-bank directly into adjacent residential properties along Mill Lane. Because flood risk is governed by this localised structure bottleneck, minor variations in upstream peak flows have no impact on flood outcomes within the village.

3.2 Recommendations

3.2.1 Resolving flood risk through the village of Corston cannot be achieved through upstream storage or NFM within the solar park boundary. Instead, effective flood alleviation relies entirely on direct, localised hard engineering or conveyance relief measures within or immediately adjacent to the village corridor, such as addressing channel capacity, raised containment, or structure performance at the A429 crossing.

To support the local community and relevant Risk Management Authorities in pursuing future direct flood relief schemes, the Applicant- Lime Down Solar Park Limited- will make the fully configured 2D TUFLOW hydraulic model files freely available. This technical asset can be seamlessly leveraged by specialist hydraulic modelling consultants to rapidly test, optioneer, and quantify the hydraulic benefits of targeted village defence options. Further support, expertise and professional guidance would be accessible through the Scheme's Community Benefit Fund (CBF).

Appendices

Appendix A – Limitations

Limitations

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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