Bridge Inn Caravan Park

Flood Risk Assessment

Job Number: 1235

Date	Version	Notes/Amendments
December 2023	1	For Information

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Acronyms	
AOD	Above Ordnance Datum
EA	Environment Agency
SFRA	Strategic Flood Risk Assessment
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance

Executive Summary

I. The proposals are for the modification of Condition 6 approved under H02-0359-00, to allow permanent residential use throughout the year for 5 plots to be occupied by gypsy/travellers - an additional 6 weeks of the year compared to the existing situation.

II. According to the Environment Agency's information, the site resides in a defended region of Flood Zone 3 - reducing the risk of flooding from high to low/very low.

III. Although the site resides in Flood Zone 3, according to the Environment Agency's 'long term flood risk' classification, the site has a low to very low risk of flooding due to the current standards of flood defences. The site is not located within a Functional Floodplain of any 'main river'. The Environment Agency Flood Zone Maps have been produced irrespective of existing flood defences and standards of protection.

IV. According to the Environment Agency's information, the site has never flooded and there is no history of flooding.

V. According to the Environment Agency's information, the site will not flood in all fluvial/tidal modelled scenarios (up to and including the 1 in 1000 year return period plus an allowance for climate change) should the defences remain in place. According to the Environment Agency's flood model, there is no possibility of overtopping.

VI. The Environment Agency has not carried out any Breach Analysis of the region - only the local authority has provided Breach Analysis in their SFRA for both present and future scenarios.

VII. There is a *residual* risk[1] of flooding should a breach in defences ever occur.

VIII. To mitigate any residual risk in the event of a breach in defences, it is proposed to raise the mobile homes in permanent occupation 1.00m above the surrounding ground levels. As an additional form of flood protection, the existing bund adjacent to the on-site ditch will be raised above the modelled breach flood depth (depths expected between 0.50m and 1.00m in the location of the permanent use) as shown on the breach modelling maps, ensuring site users remain fully protected in this eventuality.

IX. To further mitigate the residual risk in the event of a breach in defences, a Sequential Approach was also taken, ensuring the mobile homes in permanent occupation have been located in an area of lowest flood risk on site (western portion of the site, which has a lower depth of flooding in the event of a breach in defences).

[1] https://www.gov.uk/guidance/flood-risk-and-coastal-change#para41

X. Occupants of the site should be connected to the Environment Agency flood warning serve and take appropriate action as soon as possible in the event of a potential storm. The development will be able to provide safe refuge for occupants, or evacuation should be possible in the initial stages of the storm event, before the water depth creates a hazard.

XI. In accordance with NPPG, a comprehensive approach that combines avoidance, control, mitigation, and residual risk management measures has been implemented; addressing the residual risk of flooding resulting from a breach in defences for the gypsy traveller site.

Introduction

Flume Consulting Engineers have been appointed to undertake a Flood Risk Assessment (FRA) for the proposed development at Bridge Inn Caravan Park, Common Drove, Crowland PE6 0HJ.

This report has been carried out in accordance with the National Planning Policy Framework (NPPF) and the Planning Practice Guidance 'Flood Risk and Coastal Change' (PPG). This report also incorporates advice and guidance from the Environment Agency (EA), the Strategic Flood Risk Assessment (SFRA) produced by South Holland District Council and CIRIA documents.

The EA's indicative floodplain map shows that the site is located in Flood Zone 3, in an area which benefits from flood defences. This assessment will therefore focus on the flood risk to the site from watercourses from a breach in defences or from overtopping.

Site Description and Location

The existing site lies immediately adjacent to the River Welland, a designated main river, while immediately adjacent to the east of the river are the Crowland Washes.

The site postcode is PE6 0HJ and the OS grid reference is TF 22775 10603.

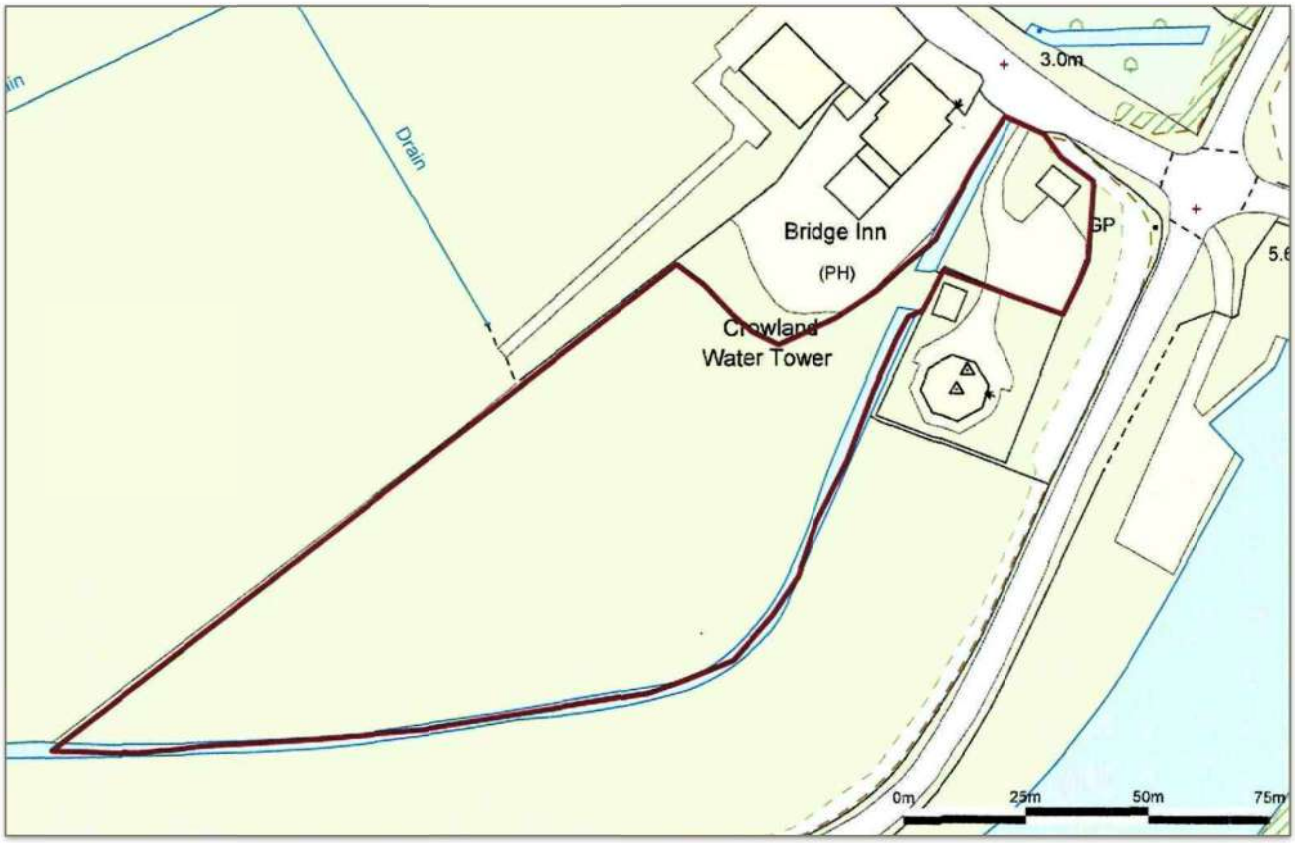


FIGURE 1. SITE LOCATION

Development Proposal

Modification of Condition 6 to the proposed static and touring caravan park including new toilet block and access road - approved under H02-0359-00, to allow permanent residential use throughout the year for 5 plots to be occupied by gypsy/travellers.



FIGURE 2. EXISTING AND PROPOSED PLANS



FIGURE 2.1. STREET VIEW FROM WELLAND ROAD ACTING AS FLOOD DEFENCE

Flood Risk Assessment

Flood Risk from Watercourses

The EA's indicative floodplain map shows that the site is located in Flood Zone 3 (High flood risk). Land in this flood zone is assessed as having annual probability of river flooding greater than 1%. However, the EA's Flood Zone classification has been produced irrespective of existing flood defences and standards of protection. The EA's indicative fluvial/tidal flood risk maps, Figure 3, suggest that the site is located in an area which benefits from flood defences - reducing the risk of flooding from rivers or the sea to *Very Low-Low*.

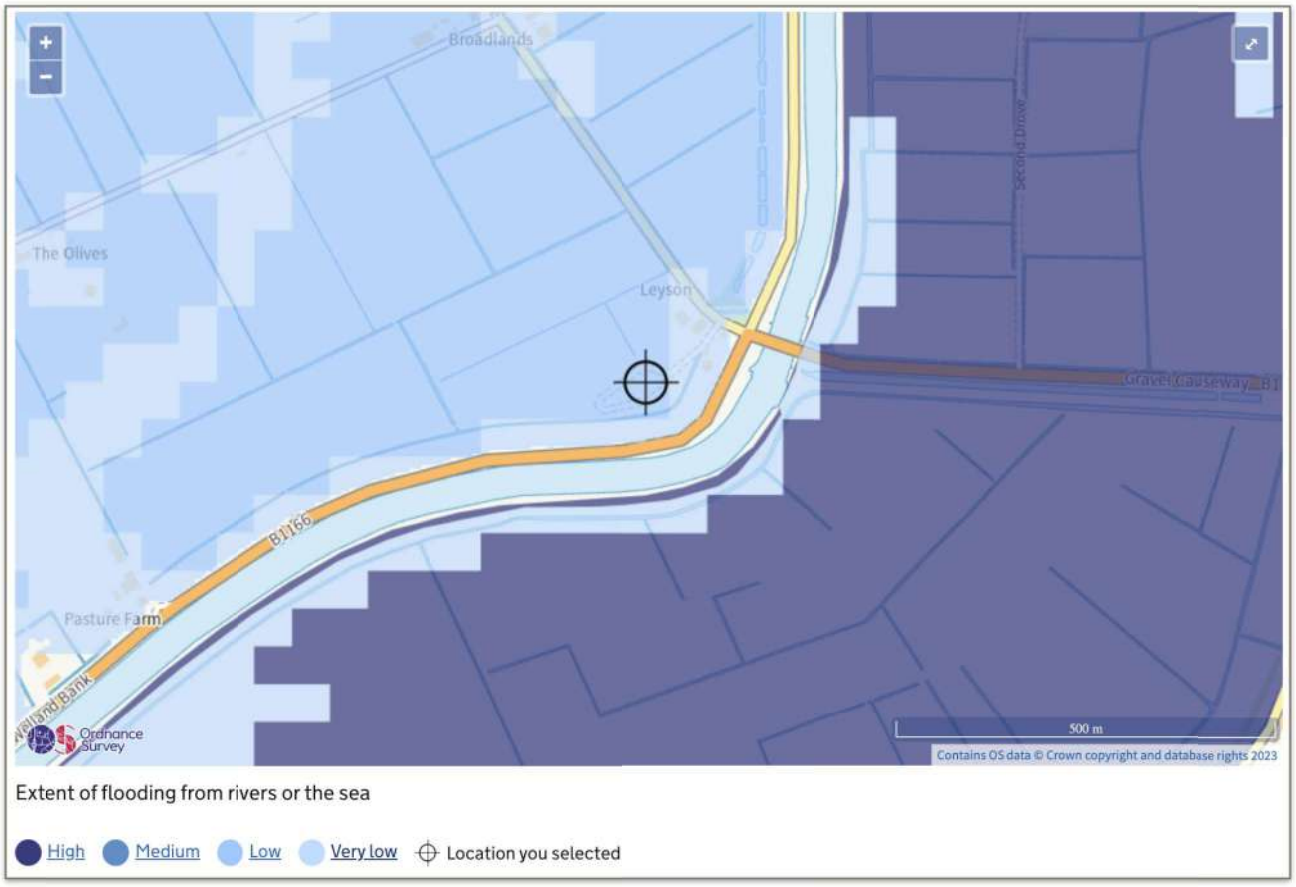


FIGURE 3. ENVIRONMENT AGENCY LONG-TERM FLOOD RISK MAP (GOV.UK, 2023)

The possible overtopping and breaching of the River Welland flood defences which may affect the site under extreme conditions is considered to be very low. The present standard of defence of 1 in 1000 year return period supports the site for this modelled flood level. If a breach, however, did occur, it is estimated that the floodwaters could affect the development site, and a precautionary approach accounting for the *residual risk* should be adopted to mitigate this remaining flood risk.

Although within Flood Zone 3 according to the EA's flood risk classification, the site has a very low risk of flooding due to the current standards of flood defence and defence levels. The site is not located within a Functional Floodplain of any 'main river'.

Recorded flood events

The Environment Agency's *'recorded flood outlines'* dataset has been reviewed (Figure 4). The site has never flooded in the past. The EA indicative outlines show only two records of flooding in the region, during the Spring of 1947 and during the Winter of 2013 – 2014. This also aligns with the flood modelling carried out by the EA in Figure 5 - both showing no inundation from flooding.

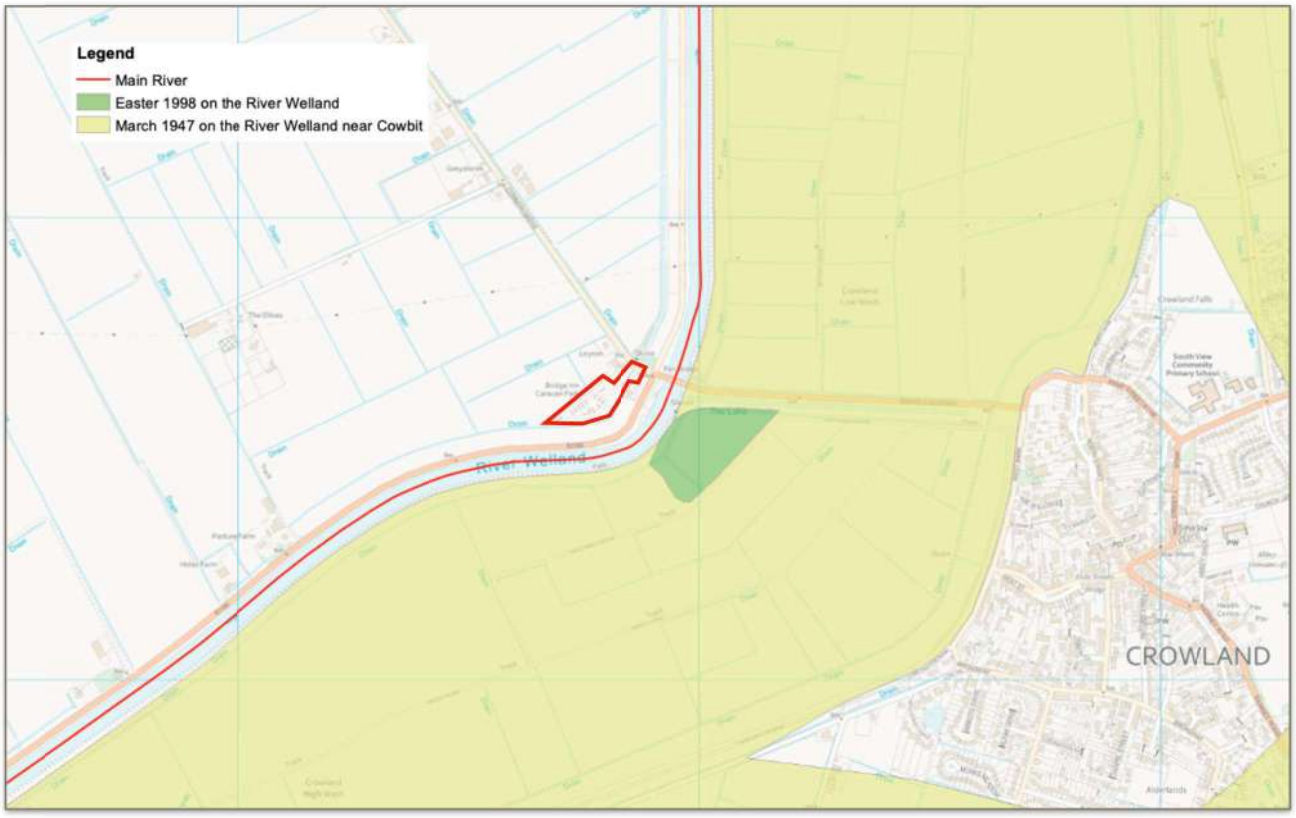


FIGURE 4. HISTORIC FLOOD EXTENTS (EA, 2023)

EA Flood Model and Flood Levels

Flume requested the latest 'Product 4' Flood Information from the EA, to assess more accurately the flood risk in relation to the development. The results from the Welland Catchment Strategic Modelling Study[2] have been reviewed. The flood modelling undertaken confirms that the site is protected by defences up to and including the 1 in 1000 year return period plus an allowance for climate change, Figure 5. Thus ensuring the site users remain safe at all times for the lifetime of the development.

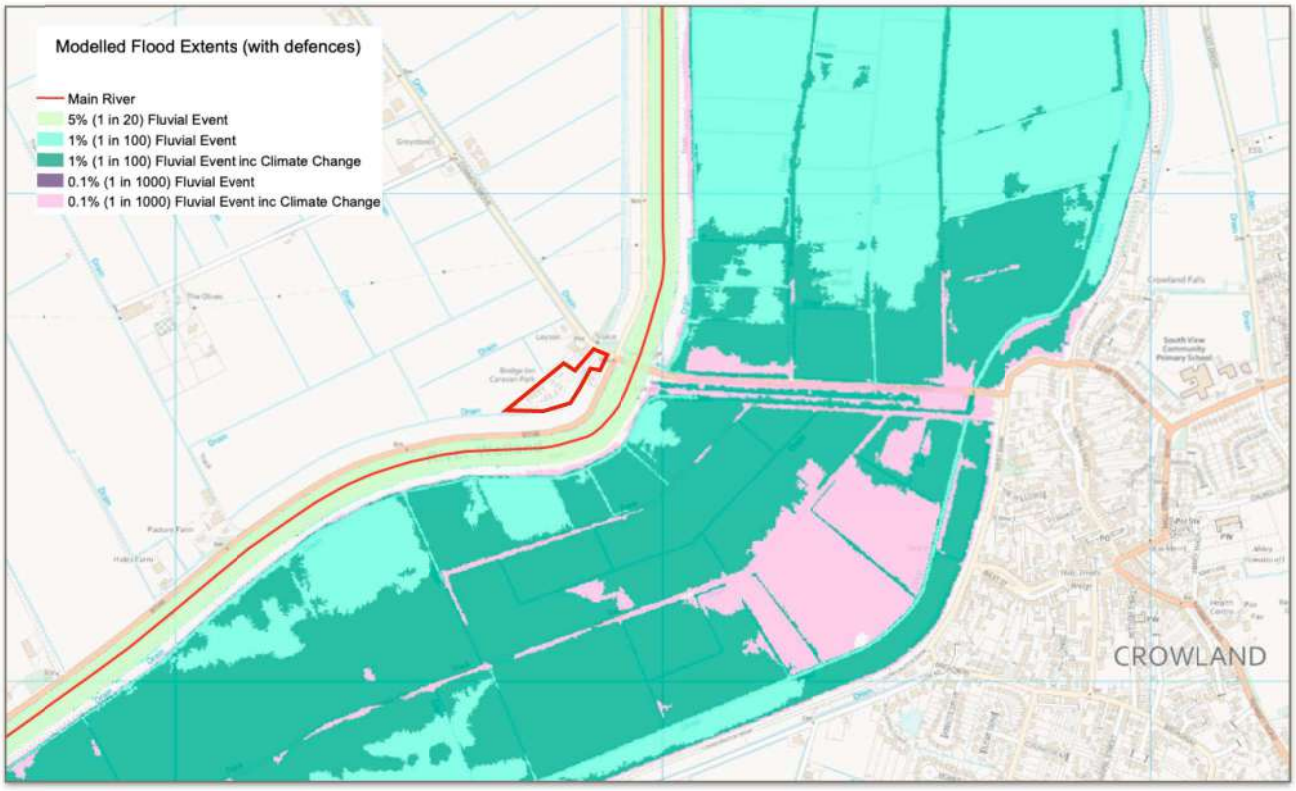


FIGURE 5. DETAILED FLOOD MODELLING EXTENTS (EA, 2023)

The development remains protected from flooding up to and including the 1 in 1000 year return period plus an allowance for climate change. Only a residual risk of flooding remains. It is accepted that, based on the flood model undertaken in the SFRA, that the flood levels as a result of a breach in defences are in the region of 0.5 to 1.0m deep at the location of the proposed caravans for the 2115 epoch. Refer to the chapter *Flood Mitigation Measures* for further information.

[2] Welland Catchment Strategic Modelling Study, 2016

Precedents for Development

Approved Planning Application: H09-0010-21 - 6 Rose View Drive Holbeach Spalding

Flood Risk

- **Comparative Flood Risk Assessment:** Like the 6 Rose View Drive development, the Bridge Inn Caravan Park development is situated in a defended area of Flood Zone 3, where the Environment Agency acknowledges a reduced risk of flooding. This mirrors the 6 Rose View Drive case, where the Environment Agency had no objections to the development due to its relatively lower flood hazard level ("danger for some") and satisfactory flood risk mitigation measures.
- **Flood Mitigation Measures:** In line with the flood risk management implemented in 6 Rose View Drive, the flood mitigation measures suggested in this report include raising the existing bund adjacent to the site, and also raising the mobile homes 1m above the surrounding ground levels, which is a more robust flood risk management measure the strategy of elevating floor levels in 6 Rose View Drive to manage potential flood risks. This precaution aligns with the Flood Risk Assessment measures outlined in the aforementioned development.
- **Sequential Approach:** The sequential approach in positioning the mobile homes in the lowest flood risk area of the site follows the example set in 6 Rose View Drive, where a strategic sequential approach on-site was used to minimise flood risk impacts on the development.

Addressing the Need for the Development

- **Extension of Use in Line with Precedent:** Our proposal for a modest extension of the residential use period mirrors the approach in 6 Rose View Drive, where a small-scale extension of an existing site was deemed acceptable despite being in Flood Zone 3. This precedent supports our proposal's viability and compliance with local planning policies.
- **Fulfilling a Specific Housing Need:** The Bridge Inn Caravan Park project, similar to 6 Rose View Drive, addresses an identified need for gypsy/traveller accommodation. The 6 Rose View Drive development successfully demonstrated compliance with local planning policies and government guidelines for traveller sites, we reinforce the necessity and appropriateness of our proposal.

Allowed Appeal Decision: APP/A2525/C/20/3258547 - Land on the east side of Baulkins Drove, Sutton St James

Flood Risk

- **Flood Zone Classification and Defences:** Both the appeal site and Bridge Inn Caravan Park are located in Flood Zone 3. However, in both cases, the specific flood risk assessments highlight that, due to existing flood defences, the residual flood risk is significantly reduced. The appeal decision site is within a Residual flood risk area, akin to the Bridge Inn Caravan Park site, which is defended and has a low risk of flooding.
- **Flood Risk Mitigation Measures:** In both cases, specific measures have been proposed or implemented to mitigate flood risk. For the appeal site, the defences are designed to protect against significant tidal and fluvial events, and maintenance strategies are in place to ensure their effectiveness. Similarly, for Bridge Inn Caravan Park, raising the existing bund by a maximum of 1 meter in the location of the permanent use is a proactive approach to mitigating any residual flood risk. In fact, the Bridge Inn Caravan Park development is only subject to a residual risk of a breach in defences from the adjacent watercourse. The appeal decision site is also subject to the following additional flood mechanisms:
- The local blockages to the Sea Dyke main drain
- A return period of 1 in 50 years being exceeded
- A failure of Lutton Leam Outfall Sluice

Comparison of the Need for Development

- **Addressing Specific Accommodation Needs:** The appeal decision underscores the importance of providing Gypsy and Traveller accommodation, a point that is also relevant for Bridge Inn Caravan Park. The appeal decision concluded that the need for such accommodation outweighed the concerns regarding flood risk, similar to the context of the Bridge Inn site where the need for additional accommodation for gypsy/travellers is a driving factor for the development.
- **Policy Compliance and Local Plan Considerations:** Both the appealed development and the Bridge Inn development aim to comply with local planning policies. The appeal decision noted that the development, despite being in a high flood risk area, was acceptable considering the management infrastructure in place and the need for Gypsy and Traveller sites.

Approved Planning Application: H16-0932-20 - Oak Tree Meadow, A16, Spalding

Flood Risk Management

- **Flood Zone Location:** Both the Oak Tree Meadow development and the Bridge Inn development are situated in Flood Zone 3, which is generally considered high-risk for flooding. However, both sites benefit from the defences outlined in the Environment Agency's Flood Map for Planning, indicating a residual flood risk due to existing infrastructure.
- **Flood Mitigation Measures:** The Oak Tree Meadow development includes specific flood mitigation measures, such as securing static caravans to the ground and setting the floor level of the caravans and dayroom at least 600mm above the existing ground level. This approach is similar to the Bridge Inn development, where two mitigating measures are suggested: raising the mobile homes by 1metre and the existing bund by 1metre is proposed to mitigate flood risk.

Development Nature and Need

- **Addressing Accommodation Needs:** The Oak Tree Meadow development was considered sustainable due to its contribution to the need for additional pitches within the Local Plan period, addressing a shortfall in accommodation. Similarly, the Bridge Inn development addresses the need for gypsy/traveller accommodation, underlining the necessity of the development in terms of social and health factors.
- **Sequential and Exception Tests:** The Oak Tree Meadow development underwent Sequential and Exception Tests, determining that despite being in Flood Zone 3, the site's existing use and the measures in place ensured residents' safety. This careful consideration of flood risk in planning is mirrored in the Bridge Inn development, where a similar approach to assessing and mitigating flood risk is evident.

Approved Planning Application: H06-0233-19 - Green Acres Park Ropers Gate Gedney Spalding

Flood Risk Management

- **Flood Zone Location:** Green Acres Park, like the Bridge Inn development, is located in Flood Zone 3, it and provides a Flood Risk Assessment outlining the associated flood risks and the implementation of mitigation measures to reduce those risks.
- **Flood Mitigation Strategies:** Both developments have incorporated flood mitigation measures into their design. Green Acres Park has raised floor levels of the residential dwellings by 1.00m above ground level to safeguard against flooding, which is similar to the Bridge Inn development, which includes raising the mobile homes 1m above the surrounding ground levels (the existing mobile homes appear to already be in the region of 800mm above the surrounding ground levels). In addition, the Bridge Inn proposals include a secondary flood defence measure; the bund within the development site will be raised by 1m.

Development Nature and Need

- **Addressing Housing or Accommodation Needs:** FRAs often accompany planning applications that aim to address specific housing or accommodation needs within a community. The Green Acres Park development likely addresses similar needs as the Bridge Inn development, which focuses on providing gypsy/traveller accommodation.
- **Compliance with Local Planning Policies:** Compliance with local planning policies, especially regarding development in flood-prone areas, is a critical aspect of getting planning approval. Both the Green Acres Park and Bridge Inn developments would have needed to demonstrate how they align with these policies.

The successful planning application 6 Rose View Drive, the Sutton Street James caravan site appeal decision, and the Oak Tree Meadow, and Green Acres development offer valuable comparisons for the Bridge Inn development. These cases underscore the significance of effective flood risk management, strategic planning, and addressing specific community needs. Like the Bridge Inn development, these approved developments are located in Flood Zone 3 but which benefits from flood defences and incorporates specific mitigation measures, aligning with the Bridge Inn's approach to flood risk management. These examples show the importance of managing flood risk effectively, planning strategically, and meeting specific community needs. These cases demonstrate that developments in Flood Zone 3 can work well when they have the right flood risk measures in place and serve a clear community need. This shows that the Bridge Inn development is both practical and necessary, meeting planning requirements and community needs.

Sequential and Exception Test

The Planning Practice Guidance (PPG) advises against permitting 'highly vulnerable development' in Flood Zones 3a or 3b. However, Paragraph 159 of the NPPF notes that necessary developments in high-risk flood areas should be made safe for their lifetime and not increase flood risk elsewhere, indicating some flexibility under specific circumstances.

The development proposal for Flood Zone 3 (defended) adheres to the guidance set out in the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG). We base the case on the following considerations:

1. **Reliable Flood Defences:** According to NPPF and PPG, development should be safe for its lifetime and not increase flood risk elsewhere. The development site's flood defences align with this, as evidenced by historical data, which indicates that the site has never flooded, and would categorise the site as low risk.
2. **Site-Specific Conditions:** PPG's Flood Risk Vulnerability Classification underlines the importance of site-specific assessments. The analysis reveals that unique site features significantly reduce the typical flood risks associated with Flood Zone 3.
3. **Detailed Risk Assessment:** In line with PPG's guidance on Flood Risk Assessments, we provide a detailed analysis that considers climate change impacts and extreme weather scenarios, focusing on flood depths and hazards provided in the local authority's SFRA.
4. **Precedents for Development:** Similar developments have been approved in high-risk areas due to effective flood defences. These cases support the viability of the proposal. According to previous appeal decisions within South Holland District Council (APP/A2525/C/20/3258547), it was accepted that there were no alternative sites in the district, and the local authority could not identify alternative site within the district, let alone in an area at lower risk of flooding.
5. **Compliance with NPPF Guidelines:** NPPF Paragraph 120 (Subsection c): This section urges giving substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs. The proposal ensures safety and minimal flood risk, adhering to NPPF Paragraph 167, which requires all developments to be appropriately safe and reduce flood risk. NPPF Paragraph 159, ensures that the development is safe for its lifetime and not increase flood risk elsewhere.
6. **Consultation with Stakeholders:** Reflecting PPG's emphasis on engagement (Paragraph 22), the proposal has been issued to the Environment Agency for pre-application review. This attempt at a consultations with local stakeholders, was refused as the Environment Agency did not consider a material change from the previous consultation at the previous planning appeal.

In conclusion, the proposal for development in Flood Zone 3 (defended) is in line with the stipulations of both the NPPF and PPG. It offers a well-considered, low-risk solution that brings significant benefits to the community, justifying its consideration and approval.

Sequential Test

In accordance with the NPPF, before planning permission can be granted, the risk-based Sequential Test should be applied and accepted. This needs to be carried out for those developments in Zone 2 or 3, and for all but minor developments. The Sequential Test does not have a specific format. However, it requires information of adequate quality and detail to determine whether there are suitable sites in areas less prone to flooding that could feasibly accommodate the proposed type of development or land use.

References is to be made to the Sequential Test Report carried out by ET Planning for the Sequential Test.

Exception Test

In accordance with the NPPF clause 102, both the following elements must be demonstrated to pass the Exception Test:

I. *"the proposed development provides wider sustainability benefits to the community that outweigh the flood risk"*; and
II. *"a site specific FRA has been carried out and can demonstrate that the development will be safe for its lifetime, taking account of the vulnerability of its users, without increasing flood risk elsewhere"*

In the chapter titled "Precedents for Development," the four approved gypsy traveller sites which are referenced, all located in Flood Zone 3, the planning officers have confirmed the sites to be a sustainable form of development, stating *"There is an identified need for the development, which is considered to be a sustainable form of development because of social, educational and health factors. The proposal satisfactorily complies with Policies C and H of the Government's Planning Policy for Traveller Sites (August 2015, published by DCLG) and Policy 20 of the South East Lincolnshire Local Plan, 2019. The planning balance is in favour of the proposal."*

A review of the South Holland District Council's GTAA by Dr Michael Bullock of Arc4, confirms that the GTAA's methodology and findings are significantly flawed and outdated, suggesting a higher need for Gypsy and Traveller sites than reported. This analysis supports the need for developments like the one proposed at Bridge Inn Caravan Park for permanent residential use by Gypsy/Travellers.

Furthermore, this development can achieve wider sustainability benefits that outweigh the flood risk by carefully considering and incorporating various design and planning strategies. The applicant and their design team have reviewed various options in order to meet this requirement:

1. Flood Resilience and Mitigation Measures:

The development's site layout was considered carefully to ensure that the mobile homes used throughout the year were positioned in the areas at lowest risk of flooding in the event of a breach. Furthermore, the mobile homes have been raised above the flood levels as a result of a breach in defences - thus, ensuring that residents remain safe at all times in all eventualities. Building materials and techniques were chosen to withstand flooding, minimising damage. On-site flood storage areas were established, capable of

accommodating excess water during heavy rainfall events. The development can be made safe for its lifetime through anchoring and raised floor levels.

2. Improved Infrastructure and Services:

The design approach is to incorporate more sustainable drainage measures on site with rainwater harvesting also proposed, reducing water demand. Drainage systems were strategically installed to mitigate flood risks, benefiting both the development and the surrounding areas. Permeable Paving will be introduced to reduce the impact of surface water run-off and facilitate groundwater recharge. By incorporating multifunctional Sustainable Drainage Systems (SuDS) that seamlessly merge with green infrastructure, the development meets the requirements set by the National Planning Policy Framework for SuDS (as highlighted in Planning Policy Guidance: Flood risk and coastal change, Paragraph: 036).

3. Biodiversity and Habitat Enhancement:

Natural landscaping and the use of native plant species will enhance local biodiversity while providing flood-resilient vegetation. Purposeful efforts were made to create wildlife habitats and establish green corridors, enriching ecological diversity within the site.

4. Effective, efficient use of an existing approved plot

The development will provide quality housing for the gypsy traveller community in a district that aims to address this need, encouraging more efficient use of land while protecting and enhancing the region and landscape quality by ensuring it's constructed in a sustainable and flood resilient way.

In conclusion, the development aims to protect and enhance the existing settlement, minimising the impact of new development on the amenity of the existing community and on existing land uses. The intention is to ensure the permanent development incorporate a sustainable drainage system with permeable paving and rainwater harvesting also proposed, reducing water demand and reducing the peak run-off rates of surface water to the sewer. The proposed development seeks to reduce the risk of flooding through design, whilst also aiming to achieve wider objectives for sustainable living and place-making, and it is therefore considered that the scheme can satisfy the first part of the Exception Test, having wider sustainability benefits to the community.

Therefore, the proposed development meets the first part of the Exception Test. The following FRA has been carried out to satisfy the second condition.

Flood Risk from Groundwater

Flooding from groundwater typically occurs following prolonged periods of wet weather within low laying areas underlain by permeable aquifers. When aquifers are fully saturated, flooding at surface level can occur from the sub-surface strata.

The susceptibility or vulnerability of the particular area, is highlighted on the groundwater vulnerability map (Figure 6), which indicates a *Unproductive* groundwater vulnerability in the area.

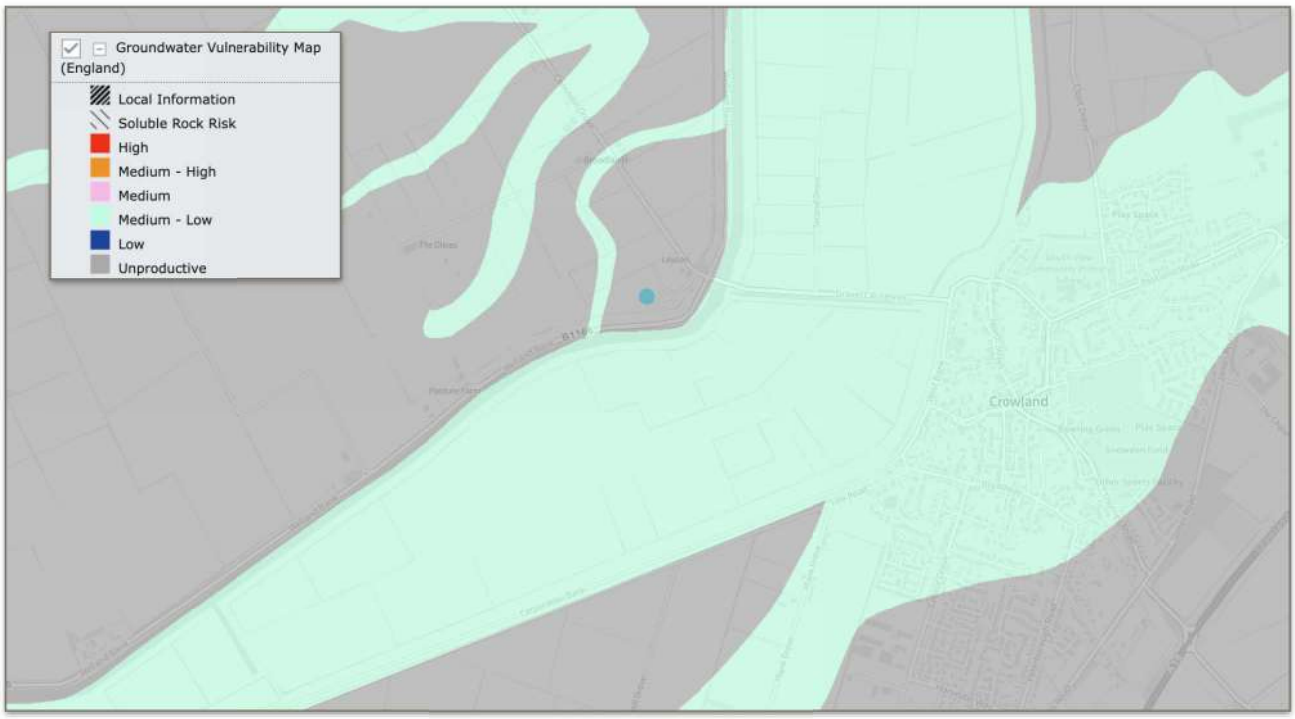


FIGURE 6. GROUNDWATER VULNERABILITY MAP (DEFRA, 2023)

Areas which are categorised as *Unproductive* are typically geological regions comprising of rocks that have low significance for water supply or baseflow to rivers, lakes and wetlands. They consist of bedrock or superficial deposits with a low permeability that naturally offer protection to any aquifers that may be present beneath; indicating a low risk of elevated groundwater in the area.

Properties subject to groundwater flooding are usually constructed below the ground level or include a basement. The flood risk from groundwater is considered low for the proposed building, as it will be raised above the existing ground levels.

The development has not experienced any history of flooding related to Groundwater. Furthermore, groundwater flooding is an important consideration for subterranean basements, but the development does not proposed any subterranean basements. Therefore, the likelihood of groundwater flooding is considered to be low risk.

Flood Risk from Surface Water and Overland Flows

Surface water flooding occurs when intense rainfall is unable to infiltrate into the ground or overwhelms the drainage system. This surface water runs across the surface of the ground causing flooding. The Environment Agency's Surface Water Flood Risk Map can also reflect surface water flooding along the line of small ordinary watercourses. Overland flows can also be generated by burst water mains, failed dams and any failure in a system storing or transferring water.

The EA's indicative Surface Water Flooding Map, Figure 7, shows that the site is at *Very low* risk of surface water flooding, occurring as a result of rainfall exceeding the 1 in 1000 (0.1%) chance in any given year.

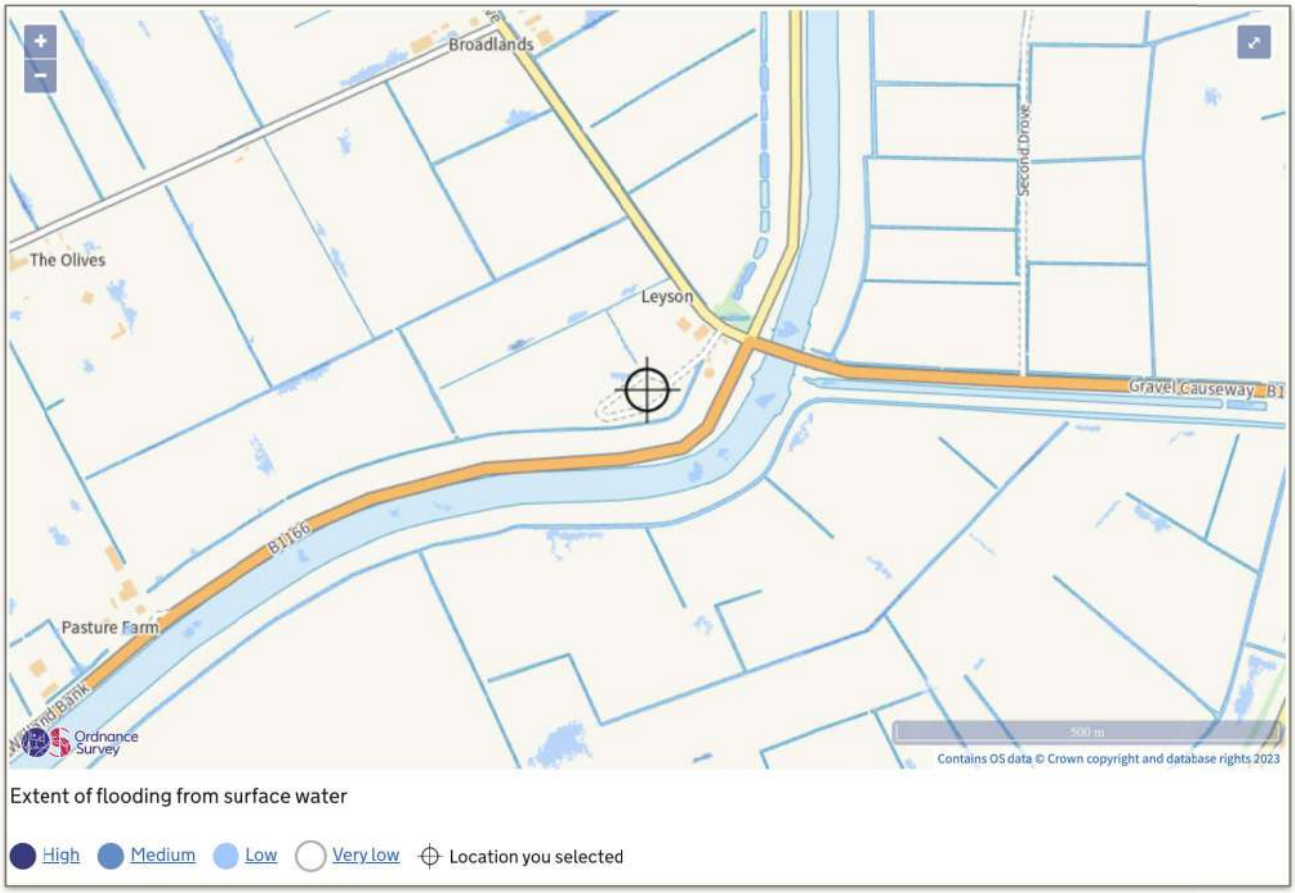


FIGURE 7. ENVIRONMENT AGENCY FLOOD RISK FROM SURFACE WATER MAP (GOV.UK, 2023)

External ground levels immediately outside of the building should fall away from the building thresholds, ensuring the minimisation of storm water ingress. This can be achieved by either reducing the external ground levels below internal floor levels, and/or incorporating channel drainage system along the entrance into the building to positively drain overland flows.

Furthermore, the it is intended to raise the ground floor level of the building above the 1 in 100 year return period plus an allowance for climate change (fluvial). These actions will also benefit the development in terms of reducing the surface water flood risk too (pluvial).

Therefore, the likelihood of surface water flooding is considered to be low risk.

Flood Risk from Reservoir Failure

The EA's information states that reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The Reservoir Act of 1975 ensures that reservoirs are inspected regularly and essential safety work is carried out.

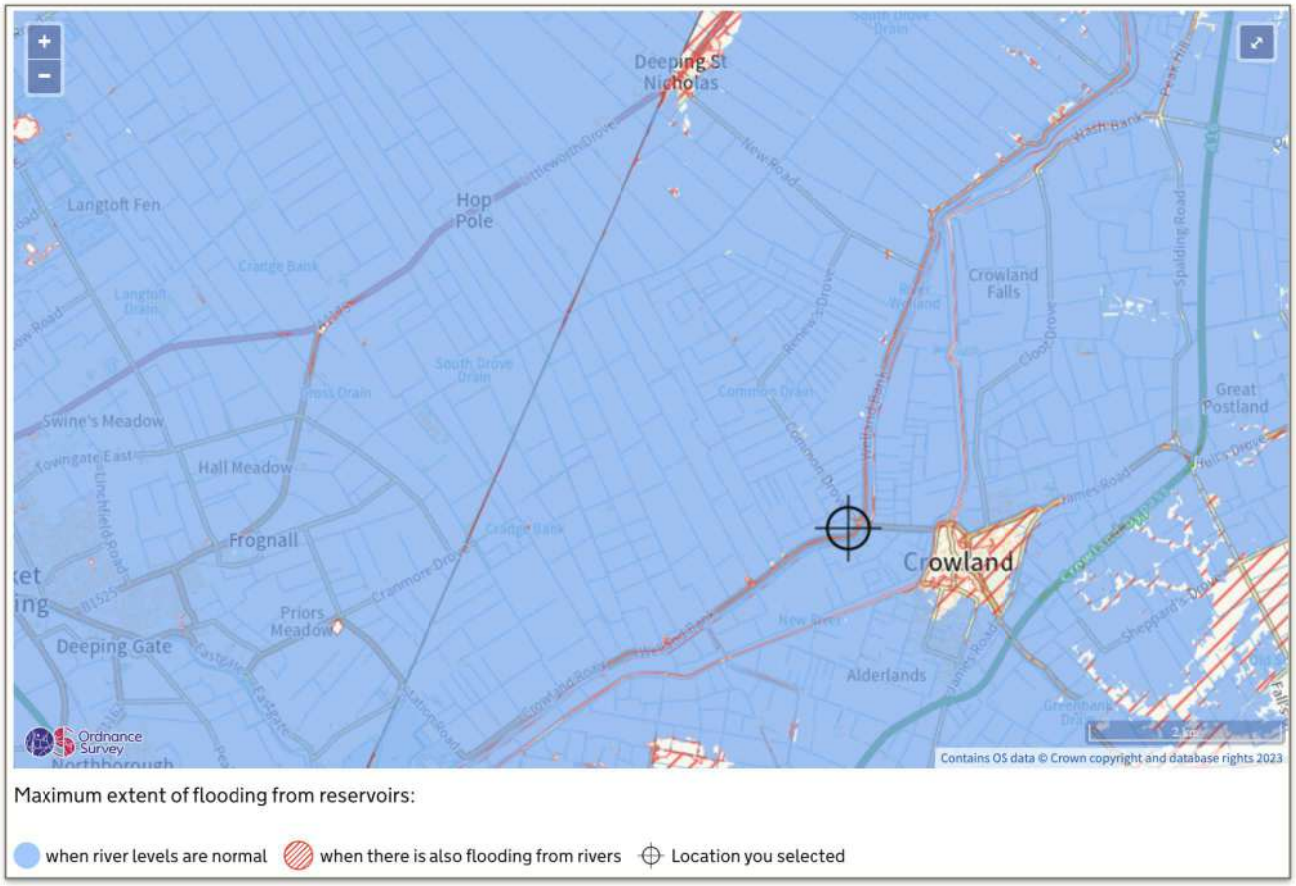


FIGURE 8. ENVIRONMENT AGENCY FLOOD RISK FROM RESERVOIRS MAP (GOV.UK, 2023)

The Environment Agency dataset 'Risk of Flooding from Reservoirs' identifies areas that could be flooded if a large reservoir was to fail and release the water it holds. The site is identified as having the potential to be inundated should a reservoir fail (Figure 8).

Reservoirs in the UK have an extremely good safety record. The Environment Agency is the enforcement authority for the Reservoirs Act 1975 in England and Wales. All large reservoirs must be inspected and supervised by reservoir panel engineers. It is assumed that these reservoirs are regularly inspected and essential safety work is carried out. These reservoirs therefore present a minimal risk.

Balancing risks and benefits

It is important to recognise the inherent tension between flood risk and the general context of the national and local policies, and its interpretation between the various permission givers, regulators, and duty holders. In the case of a defended region within Flood Zone 3, this tension emerges from the balance between the potential for flooding as a result of potential breach in defences (i.e the residual risk) and the long-term risk when protective measures are considered. The stakeholders, including government authorities, environmental agencies, and local communities, should consider that all risks cannot be removed entirely. This development aims to support important societal benefits, including improving the health and welfare advantages associated with a reduced flood risk, when it is compared to the existing case.

An undesirable result in the context of a defended region of Flood Zone 3 can be the approving authorities adopting an overly paternalistic approach. This may arise from a complex mix of factors, such as misunderstandings regarding flood risk assessments, fear of legal consequences or negligence claims, or using flood protection as a proxy for addressing other concerns, such as resource limitations. Striking the right balance is crucial to avoid overly cautious decisions that might hinder the region's development and growth or meeting its objectives relating to sustainable development. There is a need to accept that uncertainty is inherent in developing on any site (including flood risk areas) and this contains the possibility of adverse outcomes. The Royal Society for the Prevention of Accidents (RoSPA) sums up this approach: *We must try to make life as safe as necessary, not as safe as possible*.

There is a *residual* risk[3] of flooding should a breach in defences ever occur. Although these defences are highly unlikely to fail over the course of the development lifetime, additional flood mitigation measures have been included commensurate to the development proposals and associated residual risk. It should be noted that the decision to invest in flood defence infrastructure demonstrates a societal willingness to tolerate some residual risks in order to safeguard the quality of life for those living in the area. Just as we tolerate risks associated with other critical aspects of our daily lives, like road networks, the benefits of a well-designed flood defence system extend both locally and regionally.

The assessment of residual risks in a defended region of Flood Zone 3 should consider the unique local conditions and expectations. This includes factors like the effectiveness of the flood defence infrastructure, potential failure scenarios, the frequency and severity of extreme weather events, and site users preparedness and response capabilities. By taking a nuanced approach to risk evaluation and mitigation, decision-makers can ensure that the benefits of the defended region continue to outweigh the remaining risks, thereby creating a resilient development.

[3] https://www.gov.uk/guidance/flood-risk-and-coastal-change#para41

Flood Mitigation Measures

According to the *Planning Policy Guidance: Flood risk and coastal change (PPG)*, states that the preference should be to avoid flood risk but states that *"Where it is not possible, a building and its surrounds (at site level) may be constructed to avoid it being flooded (eg by raising it above the design flood level)"*.
The development resides in a defended region of Flood Zone 3, protected from the River Welland by the Deeping High Bank located along the southern boundary.

The latest 'Product 4' Flood Information from the EA was reviewed to assess more accurately the flood risk in relation to the development, including the results from the Welland Catchment Strategic Modelling Study along with the South Holland Strategic Flood Risk Assessment (SFRA). The flood levels extracted from this model confirm that the site is protected by defences up to and including the 1 in 1000 year return period plus an allowance for climate change. Thus, ensuring the site users remain safe at all times for the lifetime of the development. Furthermore, there is no history of flooding as a result of a breach or overtopping in defences.

The South Holland Strategic Flood Risk Assessment has carried out breach analysis of the combined effect of the 1 in 100 year fluvial and 1 in 200 year tidal events inclusive of climate change up to 2115.
The site is identified as being liable to flooding if a breach of the defences occurred up to a depth between 0.5m - 1.0m. Furthermore, according to the South East Lincolnshire SFRA Breach Hazard Map, the extents of the breached scenario in the 1 in 1000 year return period remains at a depth between 0.5m - 1.0m ('Danger for Most') in the proposed locations of the 5no. pitches to the western edge of the site. There is an area in the middle of the site which suggests depths of 1-2m - however, the proposed pitches are to be located away from this region.

To specifically address the residual risk of flooding resulting from a breach in defences for the gypsy traveller site:

- Enhanced Site Design and Strategic Layout: The site's design situates the most vulnerable components of the development within areas of minimal flood risk. The proposals include the elevation of finished floor and ground levels, in conjunction with the utilisation of flood-resistant building methods.
- Flood Resistance Measures: Flood-resistant construction techniques and materials will be used in the design of structures on the site. The mobile homes will feature elevated floor levels, situated on a raised plinth positioned 1.0 meters above the surrounding ground level. This plinth will be securely anchored to the ground, fortified with flood-resistant and resilient elements seamlessly integrated into the design and construction of the development. Additional measures include elevated foundations, flood barriers, waterproofing, and elevated utilities.
- Resilient Infrastructure: The existing bund / embankment that surrounds the perimeter of the site will be raised above the modelled depth (1.0m) of flooding in the event of a breach in defences[4]. This strategic integration ensures that in the event of a breach in defences to the River Welland, an additional secondary

[4] https://www.gov.uk/guidance/flood-risk-and-coastal-change#para49

flood barrier is presented to ensure the residual risk is mitigated further for all flood scenarios including the 1 in 1000 year flood event.

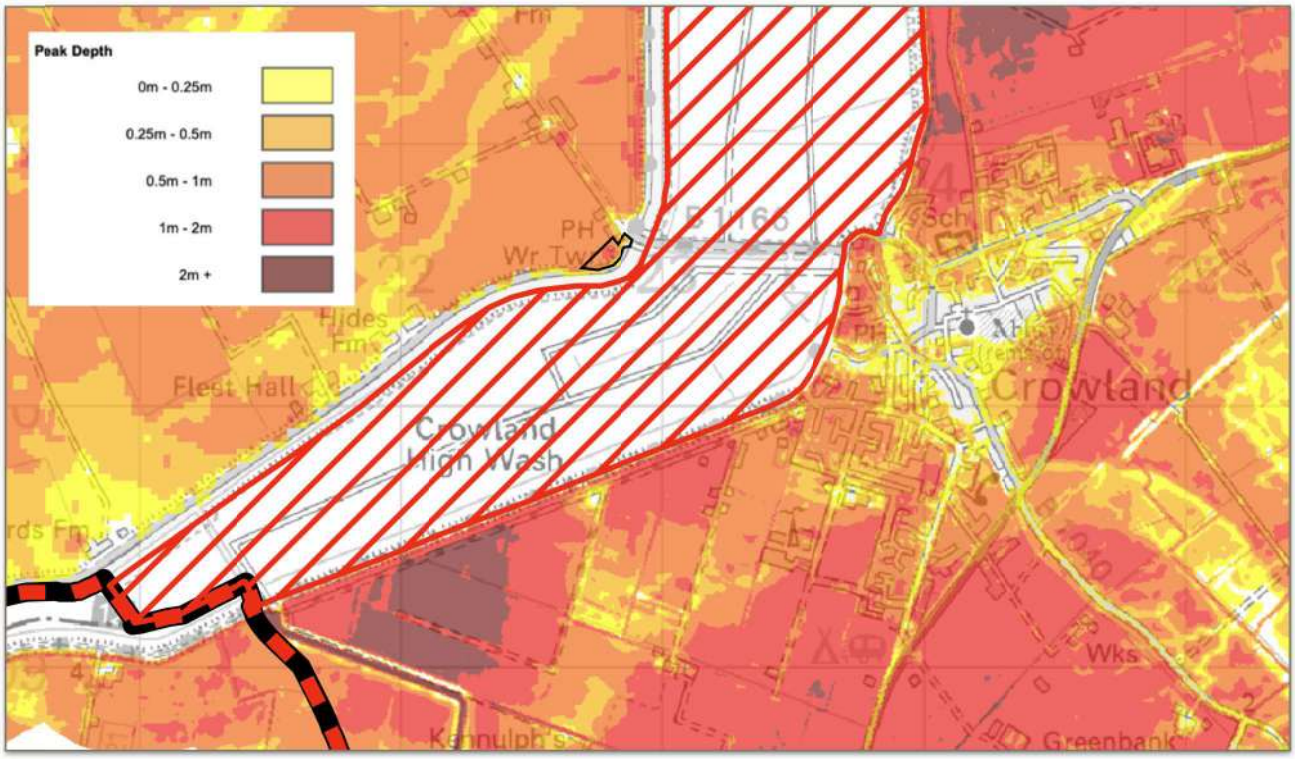
- Comprehensive Flood Warning System: A robust flood warning system that provides timely alerts to site residents in case of potential flooding will be established. This system will include multiple communication channels and clearly defined evacuation procedures.
- Emergency Response Plan: An effective emergency response plan that outlines roles, responsibilities, and actions to be taken in the event of a breach in defences will be developed. This plan will encompass evacuation routes, assembly points, and coordination with local authorities.

By adhering to the principles of avoidance, control, mitigation, and residual risk management outlined in NPPG[5], the gypsy traveller site can significantly reduce the potential impact of a breach in defences and enhance the overall safety and preparedness of its residents.



FIGURE 9. PROPOSED FLOOD MITIGATION MEASURES / SECONDARY FLOOD DEFENCE ENHANCEMENTS

[5] https://www.gov.uk/guidance/flood-risk-and-coastal-change#para4



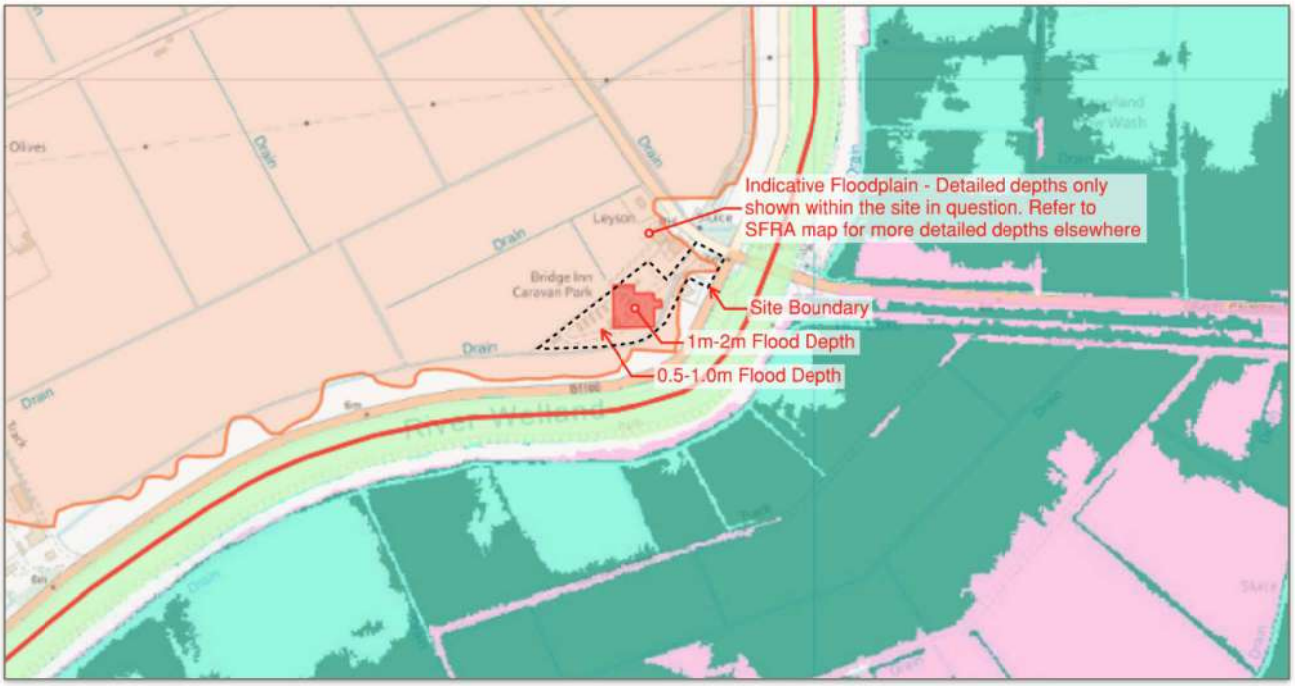


FIGURE 10. 1 IN 200 YEAR RETURN PERIOD FLOOD DEPTHS AS A RESULT OF A BREACH OF FLOOD DEFENCES INCLUDING CLIMATE CHANGE - 2115 EPOCH (SFRA, 2017) {MAGNIFIED IN THE IMAGE BELOW}

If not already listed, it is recommended that the development is registered with the EA's Flood Warning Service. If you are unsure and/or you wish to register for this free service please contact Floodline Warning Service. Floodline is a free service operated by the EA that provides flood warnings direct to occupants by telephone, mobile phone etc. The EA is responsible for monitoring flood events and for issuing warnings to people in properties and businesses at risk of flooding. A Flood Warning and Evacuation procedure with safe access and egress will also be implemented - Refer to separate document: "Flood Response and Evacuation Plan".

As part of the works, permeable paving and other SuDS features should be promoted within the design. External ground levels immediately outside of the building will fall away from the building thresholds, ensuring the minimisation of storm water ingress. This can be achieved by either reducing the external ground levels below internal floor levels, and/or incorporating channel drainage system along the entrance into the building to positively drain overland flows. Finally, all drainage systems should be routinely maintained to reduce the risk of blockage and surface water flood risk.

The development remains protected from flooding up to and including the 1 in 1000 year return period plus an allowance for climate change. Only a residual risk of flooding remains. It is accepted that, based on the flood model undertaken in the SFRA, that the flood levels as a result of a breach in defences are in the region of 0.5 to 1.0m deep at the location of the proposed caravans for the 2115 epoch. However, the proposed caravans will be raised a minimum of 1.0m above the surrounding ground levels, mitigating any outstanding residual risk of flooding. It's also worth bearing in mind that the modelling data uses larger cell-size/resolution for these regional flood models, and a site-specific review of the levels should be undertaken in tandem with the modelling review.

Emergency Flood Response to the Residual Risk

Taking into account the considerations outlined above, the gypsy traveller site has incorporated a range of safe evacuation and flood response procedures to ensure the safety of its residents to account for the potential residual flood risk. These measures encompass both emergency planning and site enhancements:

1. Comprehensive Emergency Plans:

The gypsy traveller site has formulated and secured emergency plans, which include detailed strategies for flood response and evacuation. Occupants of the site should be connected to the Environment Agency flood warning serve and take appropriate action as soon as possible in the event of a potential storm. The development will be able to provide safe refuge for occupants, or evacuation should be possible in the initial stages of the storm event, before the water depth creates a hazard.

Refer to separate document *"Flood Response and Evacuation Plan"*.

2. Climate Change Adaptation:

The site's emergency plans are designed to account for the anticipated impacts of climate change. This includes factors such as increased water depths and their potential influence on escape routes. By proactively addressing these considerations, the emergency plans remain adaptable and effective in evolving flood scenarios.

3. Elevated Access and Escape Routes:

Access and escape routes have been thoughtfully designed to ensure safety during various flood conditions. These routes prioritise the voluntary and free movement of occupants during a design flood, considering potential evacuation before more extreme flood events. They are situated above design flood levels and avoid flow paths to minimise risk.

4. Internally Accessible Place of Safety:

In instances where a failure of flood risk management infrastructure might lead to rapid flooding, the site has provided an internally accessible place of safety. This area is equipped to accommodate the expected number of occupants or users during an extreme flood event, considering factors such as duration of flooding and vulnerability.

Refer to separate document *"Flood Response and Evacuation Plan"*.

5. Mitigation Measures and Off-Site Works:

Recognising the potential consequences of flooding, the gypsy traveller site has taken measures to mitigate impacts. These include design considerations that enhance resistance and resilience to floods (raising the floor levels of the mobile homes and providing a secondary flood defence bund etc.).

This framework ensures that residents are well-prepared and protected, regardless of potential flood events, aligning with the highest standards of safety and resilience.

Conclusions

Although the site is in Flood Zone 3, the actual risk of site flooding from watercourses is very low due to the presence of formalised flood defences.

According to the Environment Agency's information, the site does not flood up to the 1 in 200 year return period including an allowance for climate change in the future (2115 epoch) - this also includes the 1000 year return period. Furthermore, the site has never flooded and there is no history of flooding to the site.

A Sequential Approach has been implemented on-site, positioning the proposed 5no. pitches/mobile homes within the site's western edge – a zone characterised by lower depth of flooding in the event of a breach.

The existing bund / embankment that surrounds the perimeter of the site will be raised above the modelled depth (1.0m) of flooding in the event of a breach in defences, ensuring an additional secondary form of defences to further mitigate any residual risk as a result of a breach in defences. Furthermore, the mobile homes will feature elevated floor levels, situated on a raised plinth positioned 1.0 meters above the surrounding ground level. This plinth will be securely anchored to the ground, fortified with flood-resistant and resilient elements integrated into the design and construction of the development.

Occupants of the site should be connected to the Environment Agency flood warning serve and take appropriate action as soon as possible in the event of a potential storm. The development will be able to provide safe refuge for occupants, or evacuation should be possible in the initial stages of the storm event, before the water depth creates a hazard. A Flood Warning and Evacuation procedure with safe access and egress will be implemented. Refer to separate document: “Flood Response / Emergency Plan”.

Note:

This report has been prepared for the purposes of submitting for planning to the local planning authority for review in relation to the associated Flood Risk for the proposed development, and uses the most up-to-date information available to us at the time. It should not be relied upon by anyone else or used for any other purpose. This report is confidential to our Client; it should only be shown to others with their permission. We retain copyright of this report which should only be reproduced with our permission.

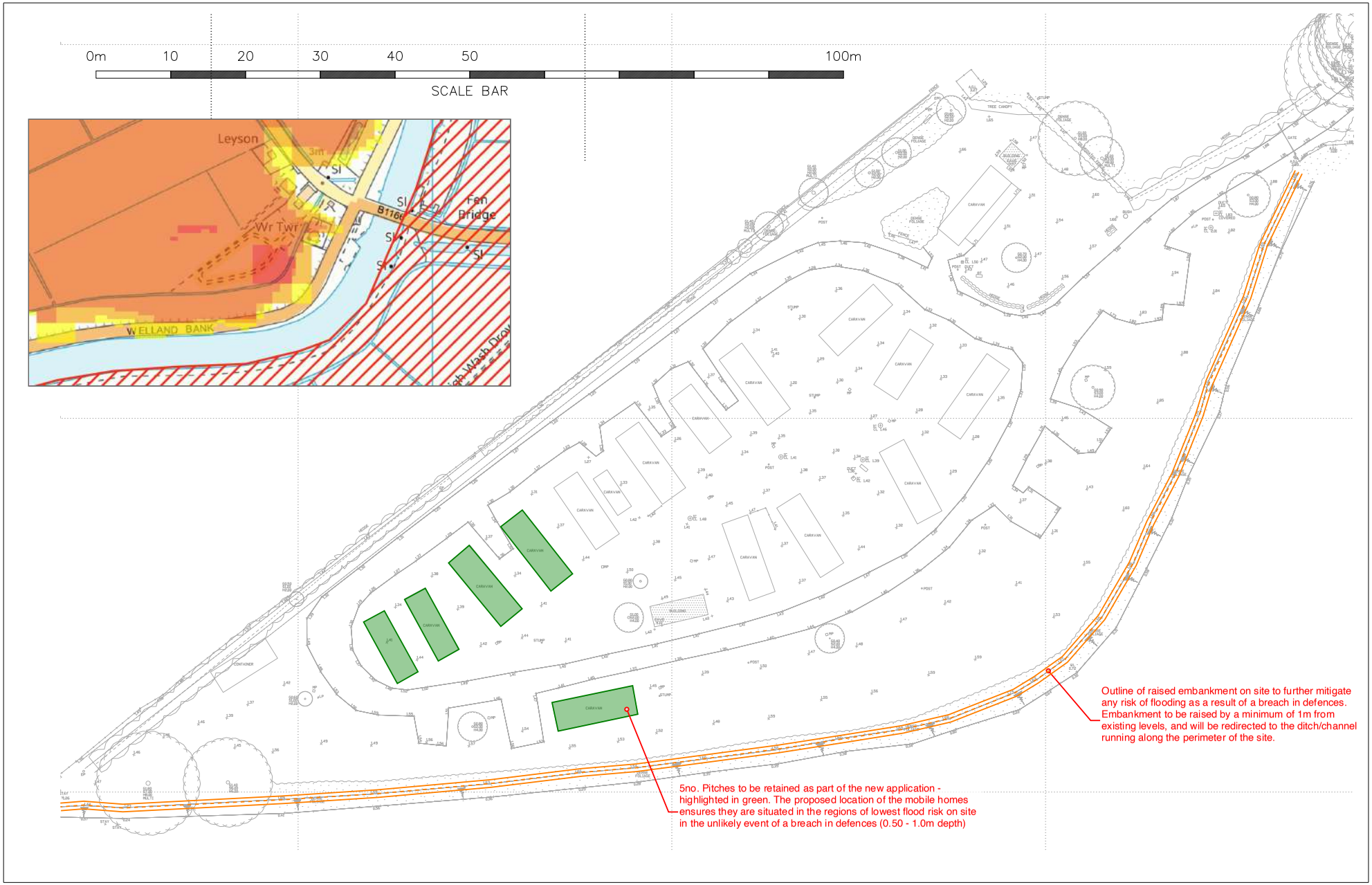
	Prepared By	Checked By	Approved for issue
Name	Tom Quigg BSc MSc CEng MICE	Magaly Sedeño BA	Tom Quigg BSc MSc CEng MICE
Signature	TQ	MST	TQ
Date	11 December 2023	11 December 2023	11 December 2023

Appendix A - Flood Mitigation / Flood Defence Enhancements

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Job No.	1235	Page	SK 100	Rev	1
Date	15/08/2023	Eng	TQ	Chd	

Job: Bridge Inn Caravan Park - Flood Mitigation Measures and Flood Defence Enhancements



Appendix B - Topographical Survey



DRAWING KEY

STANDARD BOUNDARIES

- FENCE
- BF BOARDED
- CF CHESTNUT
- CP CHESTNUT
- BWF BARBED WIRE
- PF POST & RAIL
- PWF POST & WIRE
- HF HEDGE
- RF RAILINGS
- IR IRON RAILING
- GATE
- PT

SURFACES

- ROAD EDGE (NON KERBED)
- FOOTPATH
- DK DROP KERB
- KO KERB OUTLET
- TK TRACK
- 0.621 KERB

FEATURES

- BV BRICK WALL
- BG BUILDING
- SV STONE WALL
- SW STONE WALL
- BLW BLOCK WALL
- RW RETAINING WALL
- EARTH BANK
- 5.55 GROUND LEVEL IS 5.55M
- BM BENCH MARK
- ETN ELECTRICITY STATION
- 2.15 TREE WITH GIRTH 2.15M
- S 2.5 SPREAD RADIUS 2.5M
- H 10 HEIGHT 10M
- G 2.15 GIRTH 2.15M
- STUMP STUMP GIRTH TO SCALE

EDGE

- EDGE
- FOLIAGE OUTLINE
- RANKING

STREET SERVICES

- LP LAMPPOST
- NAME SIGN/PLATE
- MS MAST SIGNAL
- TS TRAFFIC SIGNAL
- RS ROAD SIGN
- BCN BELISHA BEACON
- BO BOLLARD
- GD GUIDE POST
- CB CRASH BARRIER
- BENCH BENCH
- BUS BUS STOP
- BT BT BOX
- BTBX BT ABOVE GROUND BOX
- TCHA BT CHAMBER
- BT TELEGRAPH POLE
- CATV CABLE TELEVISION
- EP ELECTRICITY POLE
- ELMH ELECTRICITY MANHOLE
- ETN ELECTRICITY ROD
- SAS SAS
- FH FIRE HYDRANT
- WMP WATER HYDRANT %POST
- WM WATER METER
- WSV WATER STOP VALVE
- WV WATER VALVE
- SVMP STOP VALVE %POST
- MTR METER
- UP UNIDENTIFIED SERVICE
- TSCB TRAFFIC SIGNAL CNTL BOX
- MH MANHOLES
- MHC MHC
- CP CATCH PIT
- GP GD%PIPE
- GM GUIDE POST
- VE VISIBILITY EYE
- CL COVER LEVEL
- IL INVERT LEVEL
- SL SOFFIT LEVEL
- RL CILL LEVEL
- 7364 DAILY

The depiction of a wall, fence or hedge does not necessarily represent a legal boundary. It is the clients responsibility to confirm legal boundaries with the vendor.

Unless previously agreed, all services existing on site have been surveyed apart from where access is restricted by vehicles or other significant obstructions.

If applicable, manhole covers will be lifted unless this significantly obstructs the flow of traffic or vehicular access.
Manhole will not be lifted if this were to present any health & Safety risk to staff or the public. Irreplaceable or cracked covers will not be lifted.
All pipe directions are indicative only and have not been proved unless specifically instructed.
For safety reasons, pipe sizes and directions are estimated from above ground and are therefore approximate values.

All drawing units, levels and dimensions are in metres, unless otherwise stated.

The data used for the computation of the horizontal and vertical control for this survey was recorded using our survey grade GNSS receivers.
This data was provided by Leica Geosystems Smartnet RTK correction service.
Therefore primary survey control is based on OSGB36(15)

A scale factor of 1 has been applied to this survey which has been based on station 1 and referenced to station 2 therefore this grid should be treated as arbitrary.

Plotting on paper may lead to a variety of scaling risks/errors due to paper stretching or inaccurate plotter settings etc.
Therefore any dimensions scaled from a paper reproduction of this survey should be treated with caution.
This drawing must be used in conjunction with all other relevant documentation.

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LAND SURVEYS
THE SURVEY PEOPLE
www.ratcliffandsurveys.co.uk ~ info@tlesurveys.co.uk ~ Tel: 01733 269782

JOB TITLE
THE COMMON,
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CROWLAND,
PE6 0HJ.

SHEET SIZE & SCALE	DATE SURVEYED
A0 @ 1:200	JUL 23
DRAWING NUMBER	DRAWN BY
9813-1	JRL

CLIENT
FLUME CONSULTING.