GeoSmart Information

FloodSmart Technical

Floodplain Storage

Site Address

Holden Clough Nurseries
Bolton by Bowland
Lancashire
BB7 4PF

Grid Reference

377384, 449484

Report Prepared for

John Metcalfe
Holden Clough Nurseries
Bolton-by-Bowland
Lancashire
BB7 4PF

Date

2022-05-27

Report Status

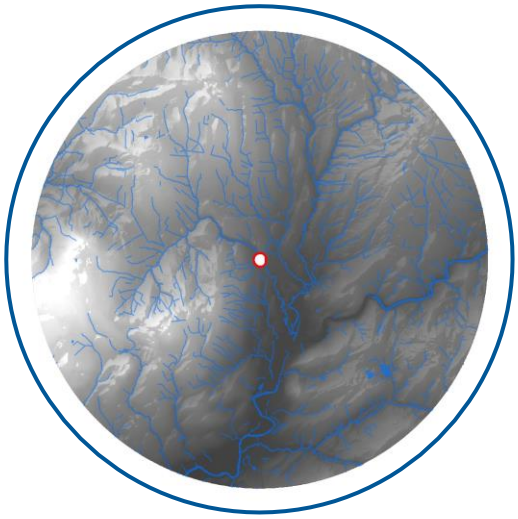
FINAL

Site Area

0.1443 ha

Report Reference

76707.02R1



Flood Risk Summary

Development proposals comprise the construction of three building extensions (total area of approximately 450 m^2), of which approximately 105 m^2 is affected by the maximum 100 year plus climate change flood level of 106 mAOD.

The area affected by the flood level of 106 mAOD will be a void beneath the extension and raised terrace, but this void will be used for storage and so is not considered to be floodable. Therefore, it could displace flood water.

Level for level floodplain storage is possible on Site through the lowering of an area of approximately 130 m^2 to the north of the Site boundary, within land owned by the developer.

A Flood Risk Assessment (FRA) has been prepared separately (ref: 76707) along with a Flood Warning and Evacuation Plan (FWEP) (ref: 76707.02)(2022).

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1. Introduction

Objective

GeoSmart Information Limited has been commissioned by Mr. John Metcalfe. to undertake an assessment of the floodplain storage requirements for the proposed development at Holden Clough Nurseries, Bolton by Bowland, Lancashire BB7 4PF.

Report Limitations

The findings presented in this report are based on information supplied by third parties. Whilst we assume that all information is representative of past and present conditions, we can offer no guarantee as to its validity and have taken the data presented at face value. No Site visit has been undertaken, and Site-specific modelling has not been undertaken.

This report excludes consideration of potential hazards arising from any activities at the Site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities.

Summary of findings

An area in the northeast of the Site is located with fluvial Flood Zone 3 (High probability). The Flood Risk Assessment prepared by GeoSmart (ref: 76707) confirms the modelled flood level on Site during a 1% (annual chance) + 36% climate change allowance event is 106.0 mAOD. An area in the north east of the Site, proposed for development would be affected by flooding in this event.

The proposed development results in an increased building footprint of approximately 450m^2 through the construction of three extension buildings. Approximately 105m^2 of the proposed extension is affected by the 1% (annual chance) + 36% climate change allowance event (106mAOD). The development proposes an increase in building footprint, within the fluvial floodplain of the Mear Gill River, and consequently may displace flood waters and must compensate for this.

The preferred method of providing floodplain compensation and which has been assessed within this report is to lower an area of approximately 130 m^2 to the north of the Site boundary (within an area of land owned by the developer) to 104.8 mAOD to create a floodable compensation area. Ground levels in between the river channel and the floodable area would also need to be re-graded to allow flood water to flow into the floodplain compensation area.

Calculations confirm this method of ground lowering would be successful in providing level for level floodplain compensation.

2. Site Context

Site information

The Site is located in Holden, Bolton by Bowland in a setting of commercial and residential land use at National Grid Reference SD 77384 49484. Site plans and drawings are provided in Appendix A.

Figure 1. Site Location Mapping (GeoSmart, 2021).

Existing Site Arrangement

The Site is currently used within a commercial capacity, as an area within an established garden centre.

Figure 2. Existing Site Arrangement and Layout

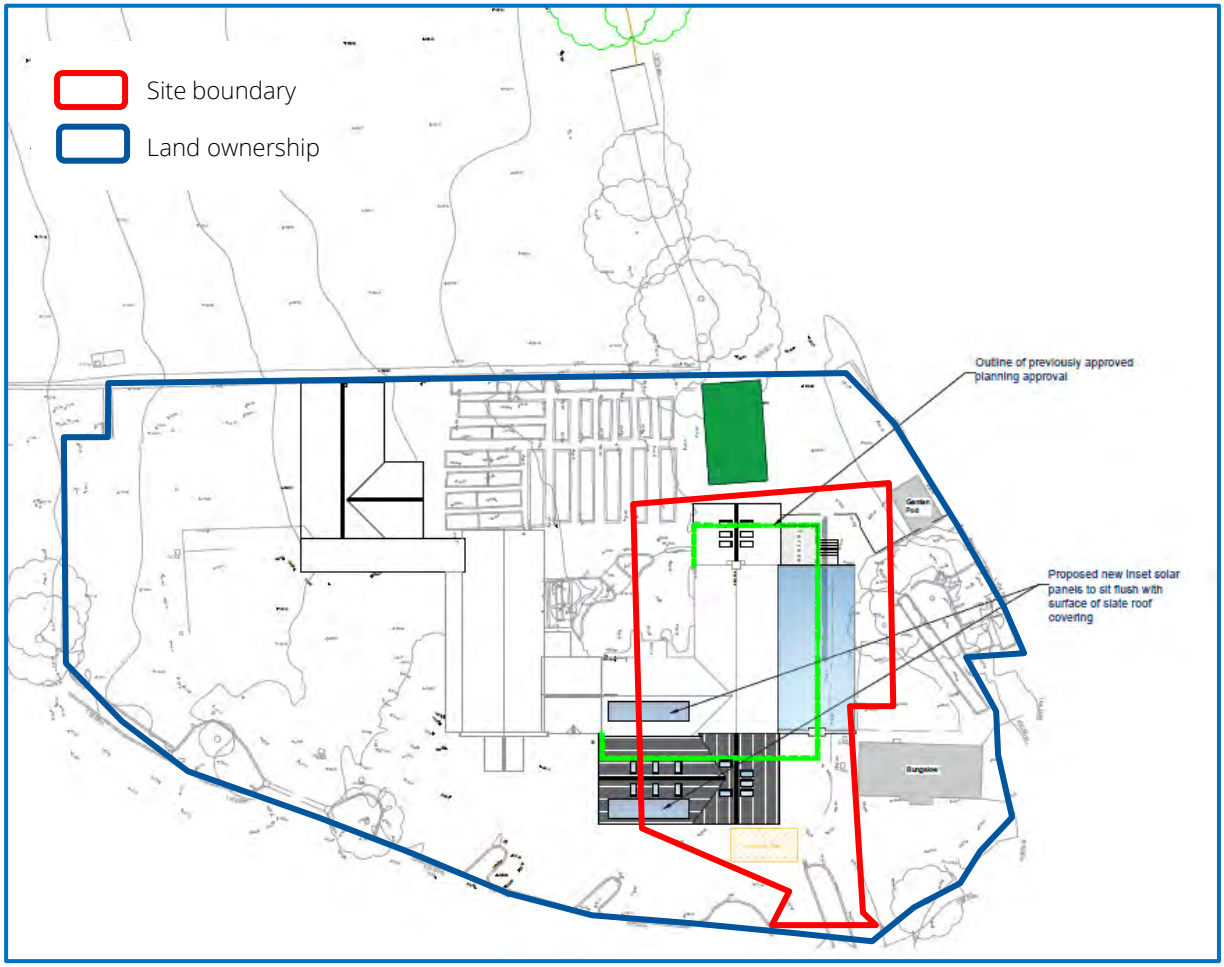
Proposed Development

Development proposals comprise a two-storey extension to the south of the existing building and a single storey extension to the east of the existing building to create additional storage space, a kitchen, café dining area, retail space and an exterior terrace with storage below.

Existing access and landscaping will be retained. Finished floor levels of the proposed buildings are 107.79mAOD. There will be a void beneath the eastern most building extension, with ground levels retained but this area will be used for storage and is not considered to be floodable. Site plans are included within Appendix A.

The development area, herein known as 'the Site', is illustrated in more detail in Figure 3. The development is proposed to be built in the north east and south of the Site. It is noted that the owners of the Site (red line) also own the wider area indicated by the blue line boundary in Figure 3.

Figure 3. Proposed Development Plan



Taken from: Holden Landscaping Limited, 2020

The proposed extension in the north east of the Site will not be designed to be floodable and recommendations are to raise the Finished Floor Levels (FFL) above a void used for storage purposes. Its structure could therefore displace flood water, where the Site is inundated.

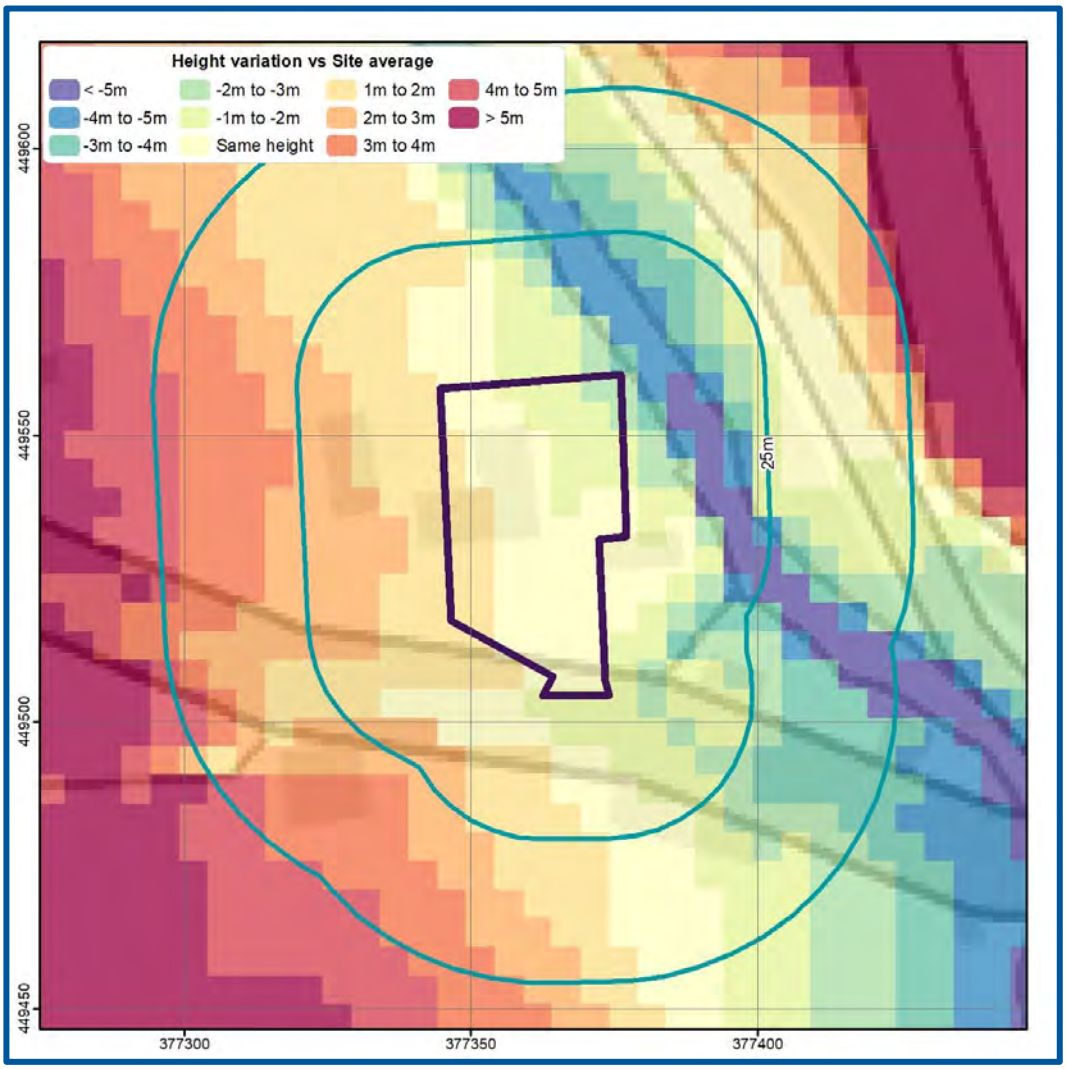
Table 1. Existing and proposed building footprints on the Site

Existing	Proposed	Increase
Main, garden centre building*	Existing, main building with north eastern and southern extensions*	Approximately 450m^2
Approximately 275 m^2	Approximately 725m^2	

*Building footprints have been calculated to include areas included within the Site boundary only. Adjoining building area is located to the south-west of the Site.

In order to confirm whether there are any other formal or informal structures which could be removed such as bunds and raised ground to provide additional floodplain storage at the Site, a Site-specific topographic survey has been consulted. This survey confirms the ground levels on the Site are generally between 105.01 and 107.57 mAOD. There are no existing buildings proposed for removal as part of the development.

Figure 4. LiDAR Ground Elevation Map



3. FRA review & Policy

FRA review and summary

In accordance with the National Planning Policy Framework (NPPF) (2021) and National Planning Practice Guidance (NPPG) (2014), a site-specific FRA was produced by GeoSmart Information Ltd to assess the flood risk from all sources (ref: 76707).

The report confirms the Site is at fluvial flood risk from the Mear Gill River with the 1 in 100 year (plus 33% climate change allowance) event flood level of 106.0 mAOD and the 1 in 1000 of 106.2 mAOD, affecting the Site. These flood levels have been calculated by comparing ground levels on Site with the EA's fluvial floodplain extents (EA, 2022).

Ground levels on the Site are between 105.01 and 107.57 mAOD. The FRA report confirms flood depths during the 1 in 100 year (plus climate change allowance) event are expected to be up to 0.60 m in the areas proposed for development where ground levels are between 105.5 and 106.3 mAOD. The flood level of 106.0 mAOD would not affect all of the area proposed for development.

Finished Floor Levels (FFL) of the extensions are proposed to be set at 107.79 mAOD, above the expected 1 in 100 year (plus climate change allowance) flood level. A closed void is proposed beneath the extension to provide storage space and will not be floodable. Consequently, the void would displace flood water (in the areas where ground levels are less than 106 mAOD), the volume of which is discussed in the following section of the report.

Standard flood resilient design measures have been recommended alongside this to further minimise impacts.

The FRA report confirms that as there would be an increase in the proposed building footprint at the Site, floodplain storage analysis would be required to confirm the most appropriate method to prevent displacement of flood waters at the Site.

Whilst a topographic survey has bene undertaken on Site it was not possible to use its format in the calculation of floodplain compensation (Holden Limited, 2020). Consequently, the EA's LiDAR data (to a resolution of 1m and a vertical accuracy of ±0.15m) has been used.

In order to ground-truth the LiDAR with the topographic survey, 5 points on Site were used to compare the topographical survey values with those provide by the LiDAR. These are included in table 2 and confirm the average difference is approximately 0.118m.

Table 2. Existing and proposed building footprints on the Site

Topographical survey (mAOD)*	LiDAR (mAOD)	Difference (m)	Location on Site
105.42	105.41	0.01	Adjacent to terrace (north east)

Topographical survey (mAOD)*	LiDAR (mAOD)	Difference (m)	Location on Site
105.58	105.55	0.03	Adjacent to the terrace (north east)
104.51	104.85	0.34	North east
105.89	105.80	0.09	East
106.26	106.34	0.12	South east
Average Difference		0.118	As above

*Taken from Holden Limited, 2020

4. Floodplain Storage

Floodplain Storage

Floodable Area

An area of land that has the capacity to flood during a flood event, with minimal damage and disruption is considered to be 'floodable'. This typically comprises areas where no buildings are proposed such as driveways, patio and soft landscaping areas. In some cases, it may also include non-habitual buildings such as open sided barns, garages and outhouses.

Non-floodable area

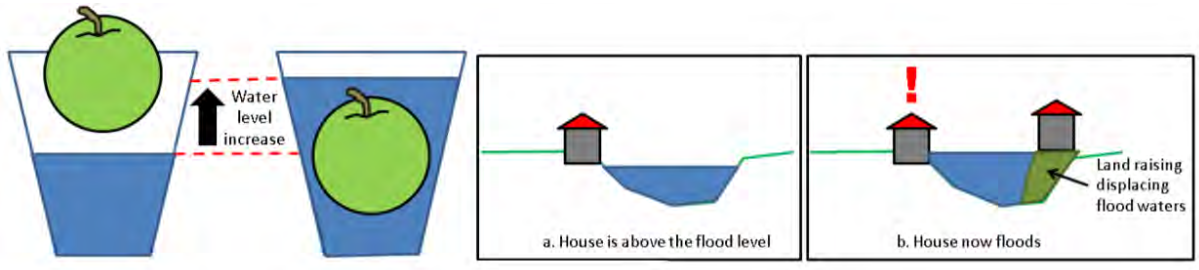
Non-floodable areas of development sites usually consist of buildings that are designed to keep flood waters out, or areas of raised ground and landscaping to achieve non-floodable access into a Site, which do not allow flood water to flow freely and take up a volume.

Floodplain displacement

An increase in non-floodable areas, through an increase in building footprint or raising of ground levels, will reduce the area and available storage volume, which is available to store flood water on-Site during an event.

This could potentially increase the extent, depth and alter the direction of flood flows, which could increase the risk of flooding off-Site. The following figure provides a simplified schematic to confirm the theory behind this.

Figure 5. Schematic to explain the theory behind the displacement of flood water[2][1]



[1] Excerpt image from Hart Technical Note 1: https://www.hart.gov.uk/sites/default/files/4_The_Council/Policies_and_published_documents/Planning_policy/Technical%20Note%201-Level%20for%20Level%20Flood%20Compensation.pdf access on 24/05/2021

Floodplain Compensation

Level for Level Storage Analysis

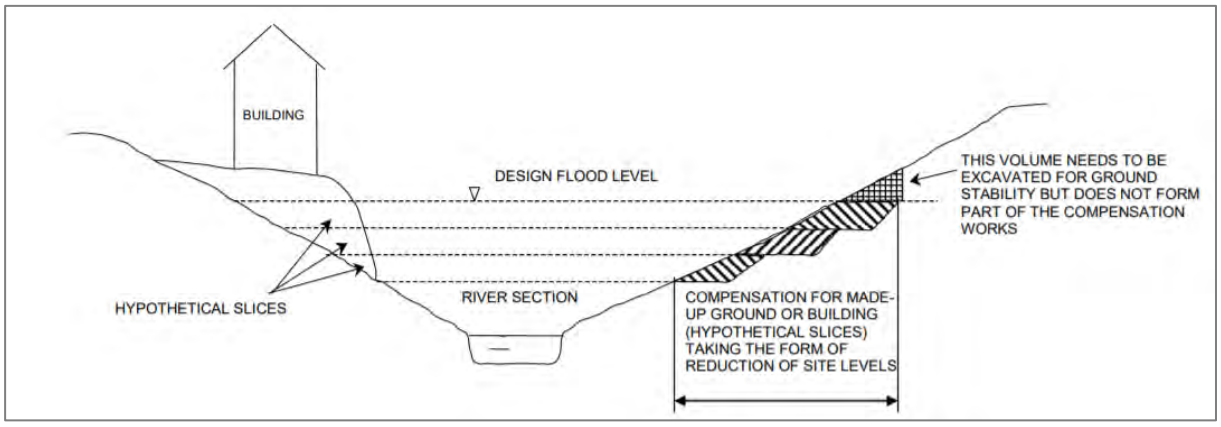
a. Removal of existing buildings

The removal of non-floodable building structures is normally the primary method in increasing the available volume of floodplain storage to offset the displacement of flood waters as a result of any development proposals.

b. Lowering of ground levels

The preferred method for providing floodplain compensation is to lower ground levels on-Site to ensure the same volume of flood storage is provided on a level for level basis.

Figure 6. Schematic of theory behind level for level floodplain storage



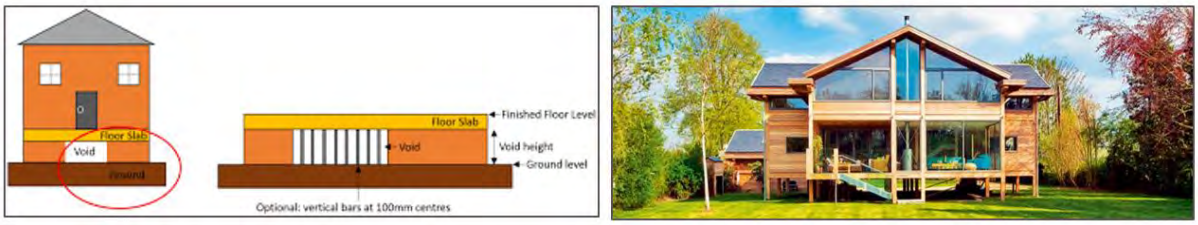
An area in the northeast of the Site is shown to be below the 1 in 100 year (+ 36% climate change allowance) flood level of 106.0 mAOD. Therefore, level for level flood plain compensation would be constrained by the existing ground levels but will be investigated further in this section.

c. Voids beneath the proposed building and access

Where ground levels and the removal of existing buildings do not provide sufficient floodplain storage to prevent the displacement of flood water, then voids can potentially be used beneath buildings and if required, access roads.

There are many construction methods to include a void, but where these features are used they will require protection to avoid blockages and not increase security risks and have to be designed to ensure flooding can flow into and out of the area so as not to alter flood flow routes or available storage volumes.

Figure 7. Schematic of theory behind the use of voids for floodplain storage



Calculations and Analysis

The following calculations have been undertaken at a high level and displayed in table 2 to summarise the volumes of floodplain storage and then refined within tables 3 and 4 to confirm whether floodplain storage can be provided on the Site.

High level analysis

Table 2 confirms the lowest flood level at which each development area would be impacted, and the maximum flood depth experienced within each area, this has initially been calculated on an approximate basis in table 3 but is refined in table 4.

Table 3. Lowest level to flood and depth of flooding associated with each development footprint area.

Development area (m^2)	Lowest level to flood (mAOD)	Maximum flood depth (m)	Approximate Volume displaced (m^3)
Existing 275m^{2*}	N/A	N/A	N/A
Proposed 725 m^{2*}	105.5	0.6	63.3
(Proposed) Total water displaced (m^2)			63.3

*Approximate values, within the designated site boundary. Additional building area is adjacent to the investigated boundary.

The above table indicates the proposed built footprint would reduce the volume of floodplain storage at the Site.

Refined level for level analysis

Level for level analysis has been undertaken below to confirm the volumetric loss within each of the flood level bands and to confirm the requirements to compensate for this. The preferred methods for providing floodplain compensation are to remove existing non-floodable structures and to lower ground levels on-Site to ensure the same volume of flood storage is provided on a level for level and volume for volume basis.

The total volume of water displaced by the development in tables 3 and 4 are different, because table 4 provides a more accurate analysis using detailed topographic ground

elevations in the areas of the proposed building footprints on the Site, whereas table 3 only provides the lowest ground level and confirms the 'worst-case' scenario.

The volumes calculated in Table 4 are the available floodplain storage volume in the existing and proposed scenarios. These are then subtracted from one another to confirm the volume of floodplain storage available at the Site. Where the number is (-) negative this means the proposed development would result in a loss in floodplain storage volume.

The volumes have been calculated using a 0.1m raster grid. The floodplain losses and gains have been calculated at 0.2m increments.

Figure 8 illustrates the respective areas of ground raising and ground lowering on Site.

Figure 8. Areas proposed for land raising and lowering on Site (Geosmart, 2022)

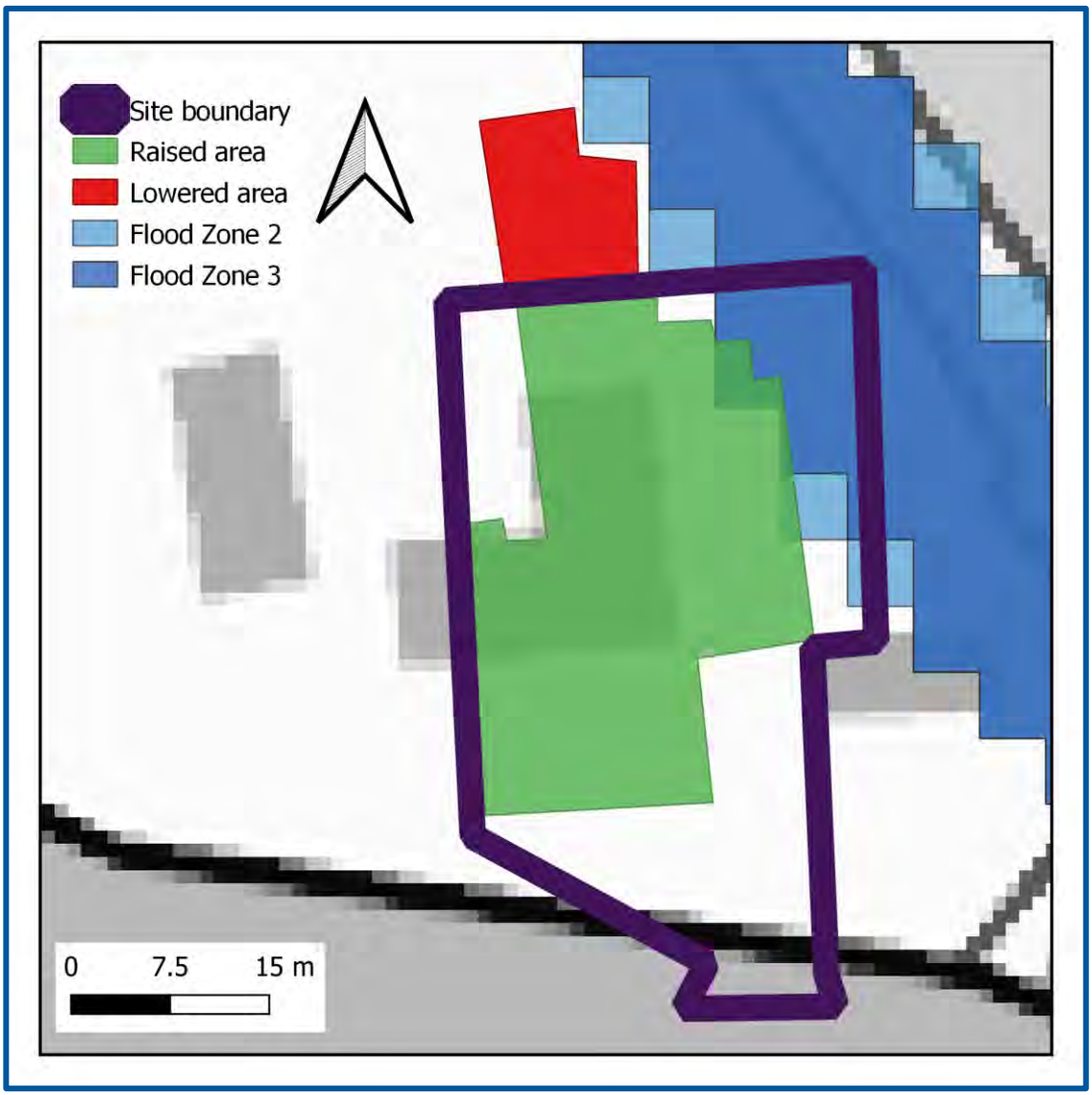


Figure 9. Development footprint and LiDAR elevation (Geosmart, 2022)

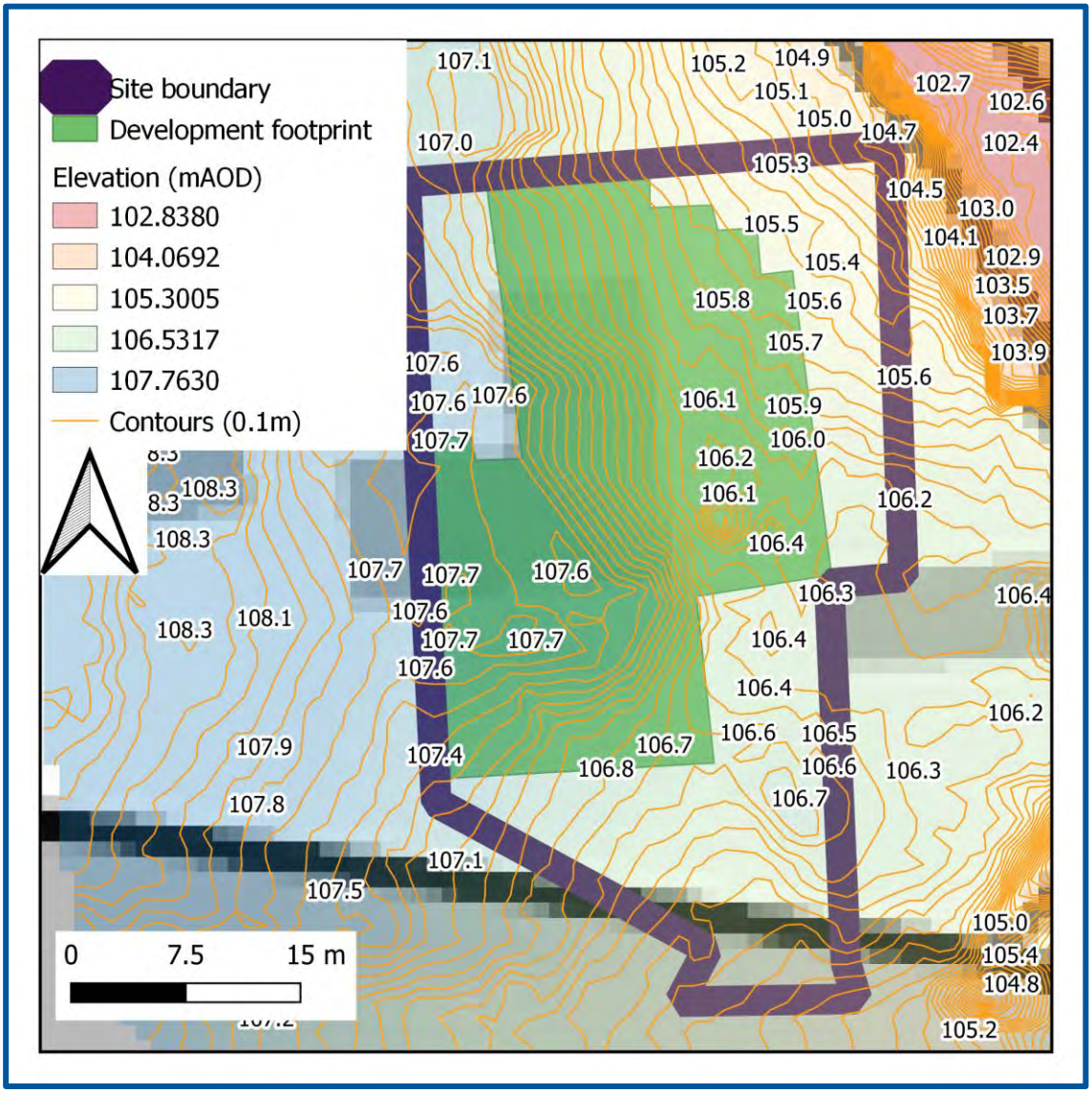


Table 4. Level increments of floodplain storage loss

Flood level at 0.2m increments (mAOD)	a. Available volume of floodplain storage in the existing Site (m^3)	b. Available volume of floodplain storage on the proposed Site (m^3)	c. Volume of floodplain storage available (m^3) (=a-b)
105.8-106.0	76.51	94.02	17.51
105.6-105.8	56.65	86.66	30.01

Flood level at 0.2m increments (mAOD)	a. Available volume of floodplain storage in the existing Site (m^3)	b. Available volume of floodplain storage on the proposed Site (m^3)	c. Volume of floodplain storage available (m^3) (=a-b)
105.4-105.6	39.35	74.59	35.25
105.2-105.4	25.44	61.16	35.72
105.0-105.2	14.84	50.77	35.93
104.8-105.0	24.32	56.58	32.26
Totals	237.11	423.78	186.67

Table 4 indicates that, by lowering an area of land to the north of the Site boundary (within the area of the wider Site) to create a floodplain compensation area, level for level floodplain storage is feasible.

In order to ensure the floodplain compensation area can be flooded in all events, levels between the FCA should be regraded to ensure this area can fill to an appropriate level.

5. Conclusions

The development requires the raising of approximately 450m^2 of ground levels to create the proposed non-floodable building footprint on Site. Of the building footprint, approximately 105m^2 is affected by the 1% (annual chance) + 36% climate change allowance flood event, comprising a raised extension and terrace in the north east of the Site. A closed void is proposed below the extension to provide storage space, this space is not designed to be floodable and would displace flood waters in the event of inundation.

Therefore, Ribble Valley Borough Council and the EA will require a corresponding volume of floodplain compensation. An area to the north of the Site boundary (within the wider Site) will be lowered to provide level for level floodplain compensation.

Floodplain analysis has been undertaken to confirm the losses in floodplain storage at 0.2m increments. Recommendations have been made to lower ground levels, on a level for level basis, to ensure that there would be no displacement of flood waters as a result of the development.

The proposed floodplain compensation has been compiled based on the flood risk identified at the Site in relation to the proposed development, as outlined in the FRA (ref: 76707, 2022).

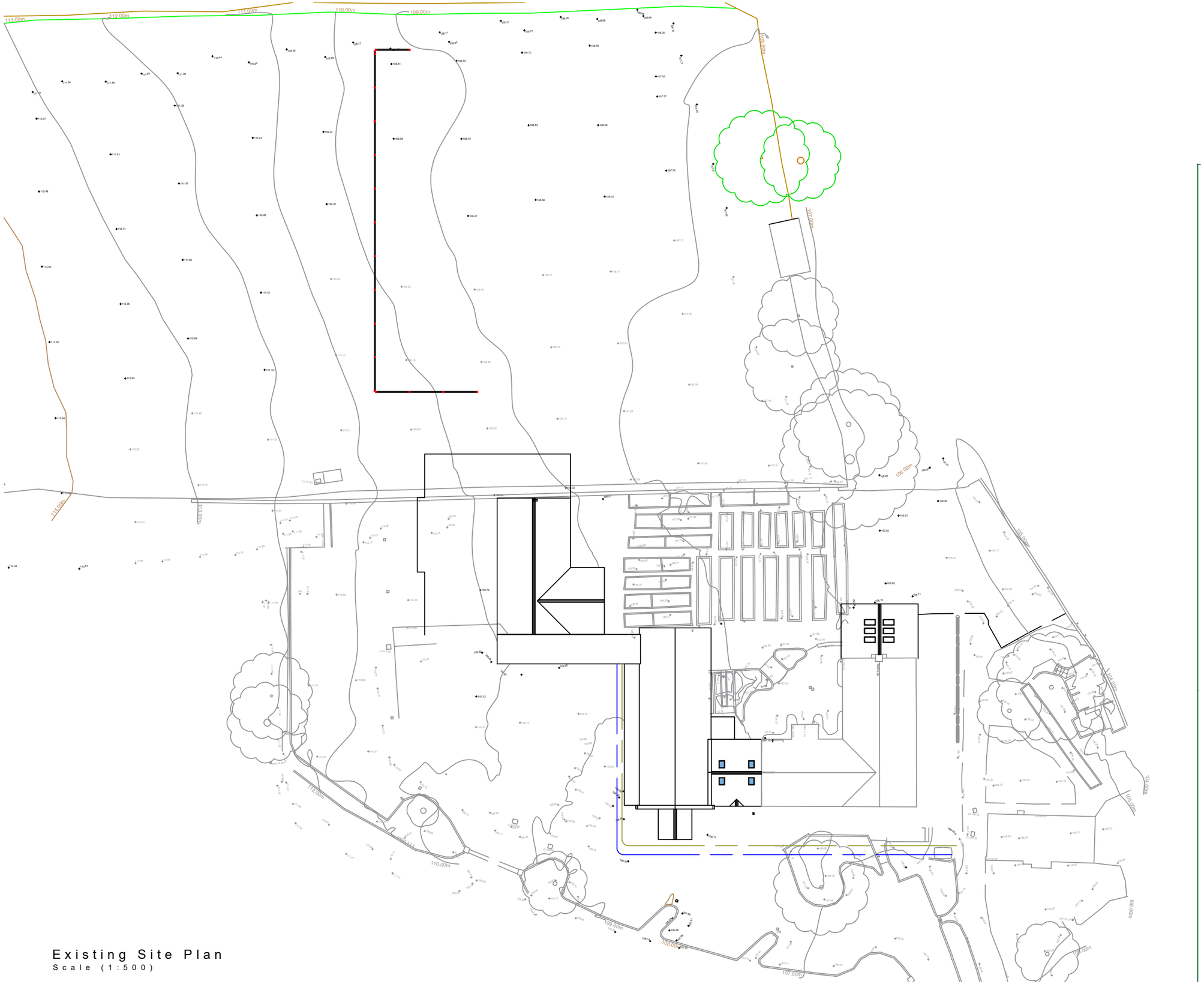
The proposed floodplain compensation scheme and mitigation measures discussed would protect occupants and property on-Site over the lifetime of the development and would ensure there is no increased risk off-site to third parties, in line with national (NPPF, 2021) and local policies (DME6: Water Management) and guidance (Ribble Valley Borough Council, 2008 and NPPG, 2014).

6. Appendices

GeoSmart Information

Appendix A

Site plans



Existing Site Plan

Scale (1:500)

Revision		Date

HOLDEN Lancashire LIMITED

83 Blackburn Road,
Rishton, BB1 4ER

Mob: 07738162386
Email : james@holdenlancs.com
Web: www.holdenlancs.com

Drawing Title:
Proposed Plan

Site Location:
Holden Clough Nurseries, Holden Lane, Holden, Bolton by Bowland, BB7 4PF

Drawing Status:
Existing Site Plan

Date: 07/07/20

Drawn by: JHolden

Scale: 1:500@ A3

Ref: 20-03

Revision: -.

Client:
Mr J. Foley

Outline of previously approved planning approval

Proposed new inset solar panels to sit flush with surface of slate roof covering

Garden Pod

Terrace

Bungalow

Loading Area

Proposed Site Plan

Scale (1:500)

D.	Amended at the request of the client	23/03/21
C.	Amended at the request of the client	02/03/21
B.	Additional information noted on plan	10/12/21
A.	Position of Glass extension relocated	27/10/21
Revision		Date

HOLDEN Lancashire Limited

83 Blackburn Road,
Rishton, BB1 4ER

Mob: 07738162386
Email : james@holdenlancs.com
Web: www.holdenlancs.com

Drawing Title:
Proposed Plan

Site Location:
Holden Clough Nurseries, Holden Lane, Holden, Bolton by Bowland, BB7 4PF

Drawing Status:
Proposed Site Plan

Date: 07/07/20

Drawn by: JHolden

Scale: 1:500@ A3

Ref: 20-02

Revision: D.

Client:
Mr J. Foley

GeoSmart Information

Appendix B

Floodplain Storage Calculations

Project ref: 76707.02
Development Holden Clough Nursery
Date 25/05/2022

1 in 100 year + CC event

Flood Level (mAOD)	Depth bands (mAOD)	Available Volume in existing scenario
106	105.8-106	237.11000
105.8	105.6-105.8	160.59800
105.6	105.4-105.6	103.94800
105.4	105.2-105.4	64.60300
105.2	105.0-105.2	39.16000
105	104.8-105.0	24.32000
TOTAL		

Volume avaliable at 200mm incriments	Available Volume in proposed scenario	Volume avaliable at 200mm incriments	Change in volume
76.51	423.78	94.02	17.51
56.65	329.76	86.66	30.01
39.35	243.10	74.59	35.25
25.44	168.51	61.16	35.72
14.84	107.35	50.77	35.93
24.32	56.58	56.58	32.26
237.11		423.78	186.67

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Email: info@geosmartinfo.co.uk

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GeoSmart Information

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Milford House

43-55 Milford Street

Salisbury

Wiltshire SP1 2BP

Tel: 01722 333306

Fax: 01722 332296

Email: admin@tpos.co.uk

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Martin Lucass

Commercial Director

GeoSmart Information Limited

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Tel: 01743 298 100

martinlucass@geomsartinfo.co.uk

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