



CREATED LIFE THREE BICESTER LTD

Land to the north of Skimmingdish Lane

Flood Risk Assessment

680020-R1(02)-FRA



JULY 2022





RSK GENERAL NOTES

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Client: Created Life Three Bicester Ltd
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1 INTRODUCTION

1.1 Context

RSK Land and Development Engineering Ltd (RSK) was commissioned to carry out a Flood Risk Assessment (FRA) for Created Life Three Bicester Ltd (the 'client'). The assessment is in support of the planning submission for a development on land to the north of Skimmingdish Lane (the 'site').

The assessment has been prepared in accordance with the National Planning Policy Framework (NPPF)¹ and its accompanying Planning Practice Guidance², the Interim Code of Practice for Sustainable Drainage³, BS 8533-2011 Assessing and Managing Flood Risk in Development Code of Practice⁴, BS 8582:2013 Code of practice for surface water management for development sites⁵ and the Non-statutory technical standards for sustainable drainage systems⁶, with site-specific advice from the Environment Agency, the Lead Local Flood Authority (LLFA), the Local Planning Authority (LPA), the architect and the client.

The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

The key definitions within the PPG are:

- "Flood risk" is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, directly from rainfall on the ground surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canals and lakes and other artificial sources; and,
- "Areas at risk of flooding" means areas at risk from all sources of flooding. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the Environment Agency has notified the local planning authority as having critical drainage problems.

For this site, the key aspects that require the assessment are:

- The Environment Agency's indicative flood zone map shows that the site is located within flood zone 1, with some flood zone 2 and 3 to the east of the site, **Figure 1.1**; and,
- The site area exceeds 1ha and therefore surface water drainage should be considered.

¹ Communities and Local Government, 'National Planning Policy Framework', February 2019.

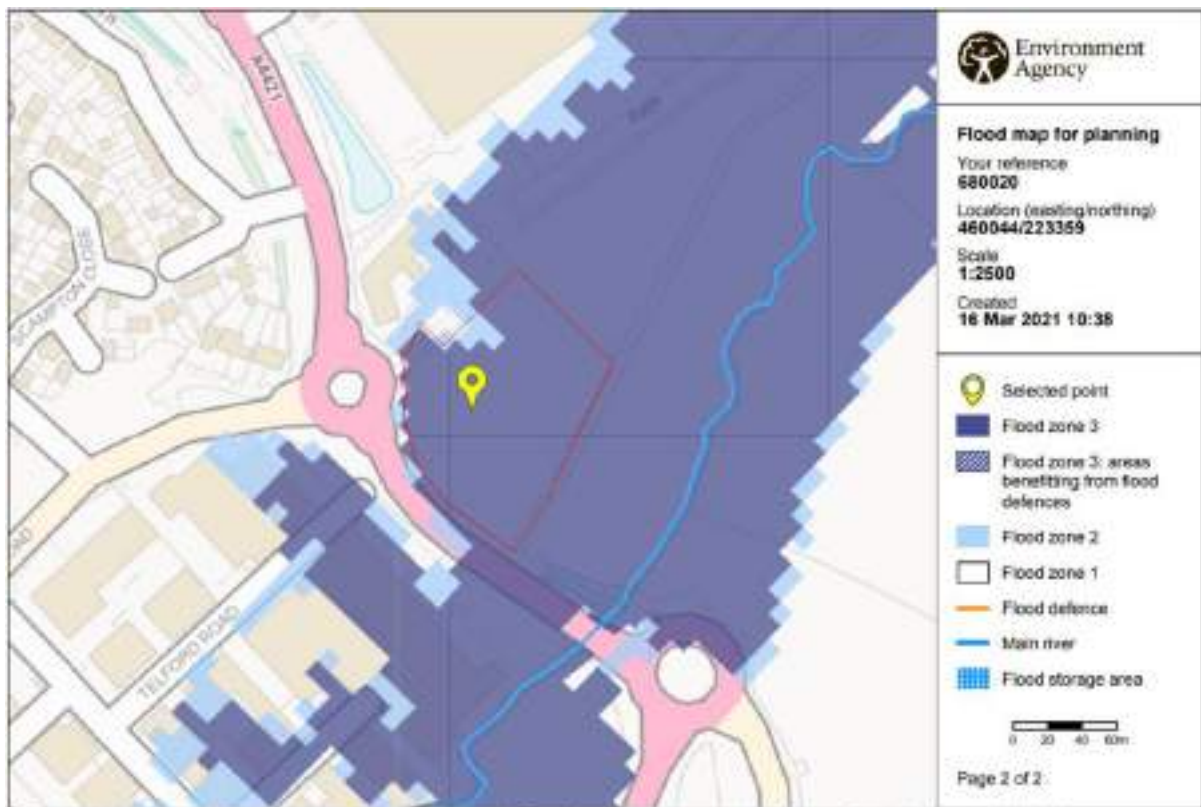
² Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', March 2014. <http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/>

³ DEFRA, 'Interim Code of Practice for Sustainable Drainage Systems' National SUDS Working Group, July 2004.

⁴ BSI, 'BS 8533-2011 Assessing and managing flood risk in development Code of practice', October 2011.

⁵ BSI, 'BS 8582:2013 Code of practice for surface water management for development sites', November 2013.

⁶ DEFRA, 'Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems', March 2015.



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Figure 1.1: Environment Agency Flood Zone Map

1.2 Scope of work

A key element of project development is to prepare a FRA to establish the flood risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the risk to a more acceptable level.

The scope of work relating to a FRA is based on the guidance provided in Section 14 of the NPPF and its accompanying Planning Practice Guidance.

A site-specific FRA must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The scope of this assessment therefore comprises the following elements:

- To review architect plans, planning information and other studies to determine existing site conditions;
- To obtain information on the hydrology and hydrological regime in and around the site;
- To obtain the views of the Environment Agency/LLFA including scope, location and impacts;
- To determine the extent of new flooding provision and the influence on the site;
- To assess the impact on the site from climate change effects and anticipated increases in rainfall over a 25 years lifetime;
- To review site surface water drainage based on the proposed layout and, if necessary, to determine the extent of infrastructure required;



- To prepare a report including calculations and summaries of the source information and elements reviewed; and
- To provide a full summary of the consultation responses received since the application was submitted.

Reliance has been placed on factual and anecdotal data obtained from the sources identified. RSK cannot be held responsible for the scope of work, or any omissions, misrepresentation, errors or inaccuracies with the supplied information. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

2 SITE DESCRIPTION

2.1 Existing site

2.1.1 Location

Site Name and Address: Land to the north of Skimmingdish Lane, Bicester

Site National Grid Reference: (E) 460020, (N) 223381

The application site is approximately 1.18Ha in size off the junction of Skimmingdish Lane and Launton Road.



Figure 2.1: Site location map

2.1.2 Hydrology

There are no known water features on the site, the nearest surface water feature is the Langford Brook located approximately 75m to the east of the site. This watercourse is an Environment Agency designated Main River and flows in a southerly direction towards the centre of Bicester.

Along the eastern boundary of the site is a small drainage ditch taking overland flows in a southerly direction towards Skimmingdish Lane where it turns direction and flows towards Longford Brook.

2.1.3 Geology

According to British Geological Surveying mapping, the underlying geology on the site can be described as the following:

- Superficial Geology: None recorded
- Bedrock Geology: Cornbrash Formation - Limestone. Sedimentary Bedrock formed approximately 164 to 168 million years ago in the Jurassic Period. Local environment previously dominated by shallow carbonate seas.

2.1.4 Hydrogeology

According to the Government's online Magic Map the site is not located within a Source Protection Zone.

2.2 Development proposals

The proposed development is a commercial end use with associated parking, access and green space. The latest development plans included as **Appendix B** with an existing site survey included as **Appendix C**.

3 SOURCES OF FLOOD RISK

3.1 Criteria

In accordance with the NPPF and advice from the Environment Agency, a prediction of the flood sources and levels is required along with the effects of climate change from the present for the design life of the development (in this case assumed to be 25 years).

Changes to climate change guidance in February 2016 (and subsequent changes in May 2022) indicate that increased allowances in peak river flow and rainfall intensity should now be incorporated within any assessment. The appropriate allowance for peak river flow is based on the location of the site in the country, the lifetime of development, the relevant flood zone and the vulnerability of the proposed end use.

- Flooding from Rivers (fluvial flood risk);
- Flooding from the Sea (tidal flood risk);
- Flooding from the Land;
- Flooding from Groundwater;
- Flooding from Sewers (sewer and drain exceedance, pumping station failure etc), and;
- Flooding from Reservoirs, Canals and other Artificial Structures.

The following section reviews each of these in respect of the subject site.

3.2 Definitions of Risk

Table 3.1: Flood Map for Planning Risk Zoning

Flood Zone	Description
Flood Zone 1	Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
Flood Zone 2	Flood Zone 2 - 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
Flood Zone 3	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.
Flood Zone 3b	Land having the potential to flood for storm events up to the 1 in 20 year return period (>5% annual probability of flooding occurring). It is classified as 'functional floodplain'

Table 3.2: Flood Risk from Rivers or the Sea and Flood Risk from Surface Water

Flood Zone	Description
High	High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.
Medium	Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.
Low	Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.
Very Low	Means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.

Table 3.3: Flood Risk category matrix from Reservoirs, Groundwater, sewers and other artificial sources

Threat Probability	Low Impact	Medium Impact	High Impact
High	Medium	Medium	High
Medium	Low	Medium	Medium
Low	Low	Low	Medium
Negligible	Very Low		

3.3 Flooding from rivers (fluvial flood risk)

3.3.1 Main river

The Environment Agency Flood Zone mapping study for England and Wales is available on their website at: <https://flood-map-for-planning.service.gov.uk>.

The latest Environment Agency published flood zone map (**Figure 1.1**), taking into account the presence of flood defences, shows the site to be mainly located in Flood Zone 3, with small areas in Zones 1 & 2.

In December 2013, the Environment Agency released an additional form of mapping 'Risk of Flooding from Rivers and Sea', which is available at:

<https://flood-warning-information.service.gov.uk/long-term-flood-risk>

The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 3.1**), which shows the Environment Agency's assessment of the likelihood of flooding from rivers and the sea at any location and is based on the presence and effect of all flood defences, predicted flood levels, and ground levels, indicates that the developable area of the site is considered to be at **'high'** risk of flooding.



Figure 3.1: Environment Agency 'Flooding from Rivers and Sea' Mapping

Further hydraulic modelling has been undertaken to confirm the flood risk to the site. A hydraulic modelling study was undertaken by RSK to determine flood levels for a range of scenarios. The methodology and full modelling study were updated through consultation with the Environment Agency via their model review process, prior to the eventual sign off of the modelling.

The Environment Agency's flood data (**Appendix D**) shows the site to lie in Flood Zone 3 (**Figure 1.1** and reproduced as **Figure 3.2** below), and following early meetings with the Environment Agency, it was required that for the site to move forwards, it should be proven at a site specific level that the site lies outside of the 20 year flood extent. The results of the flood modelling undertaken shows that the site does lie outside of the 1 in 20 year flood extent (**Figure 3.3 and 3.4**). Further assessment of the modelling concluded that the site is shown to lie within the 100 year (onsite flood levels range from 69.59mAOD to 69.64mAOD) and 100 year plus 35% climate change (onsite flood levels range from 69.73mAOD to 69.75mAOD) outlines (**Figures 3.5 and 3.6**).

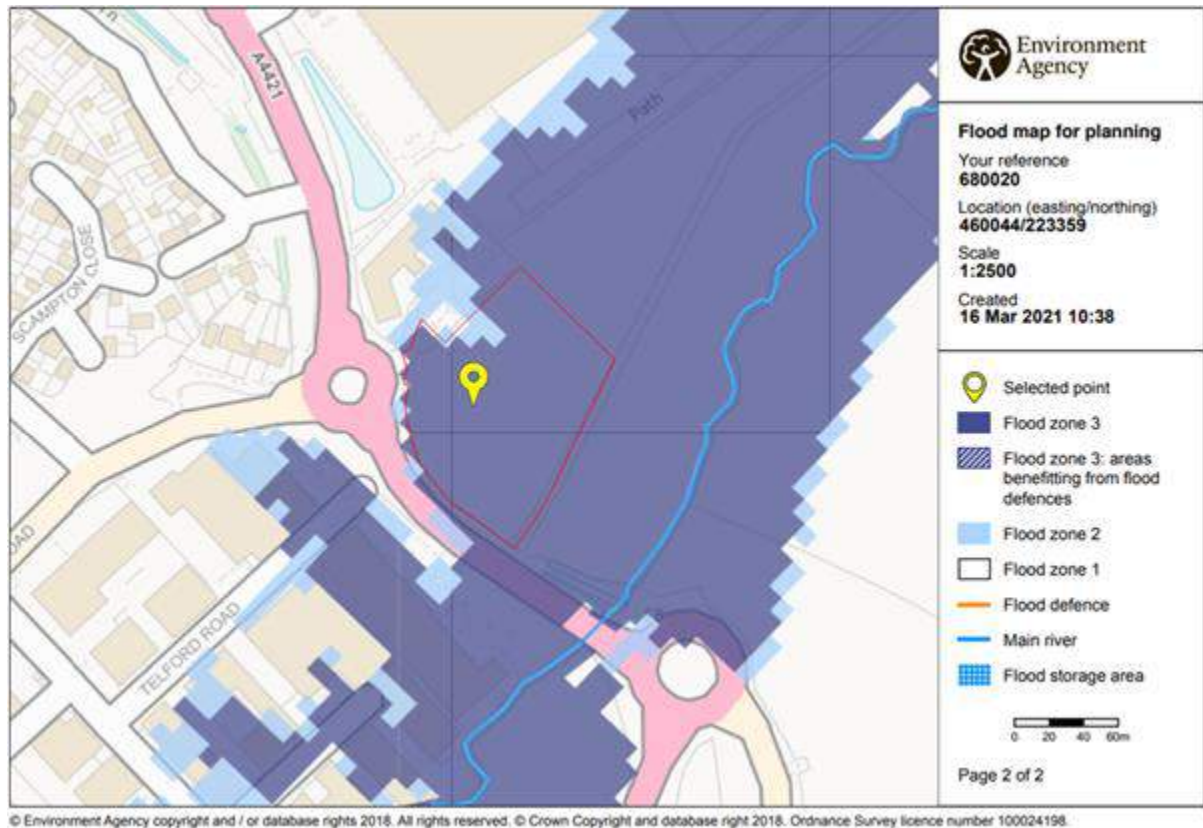


Figure 3.2: Environment Agency Flood Map for Planning

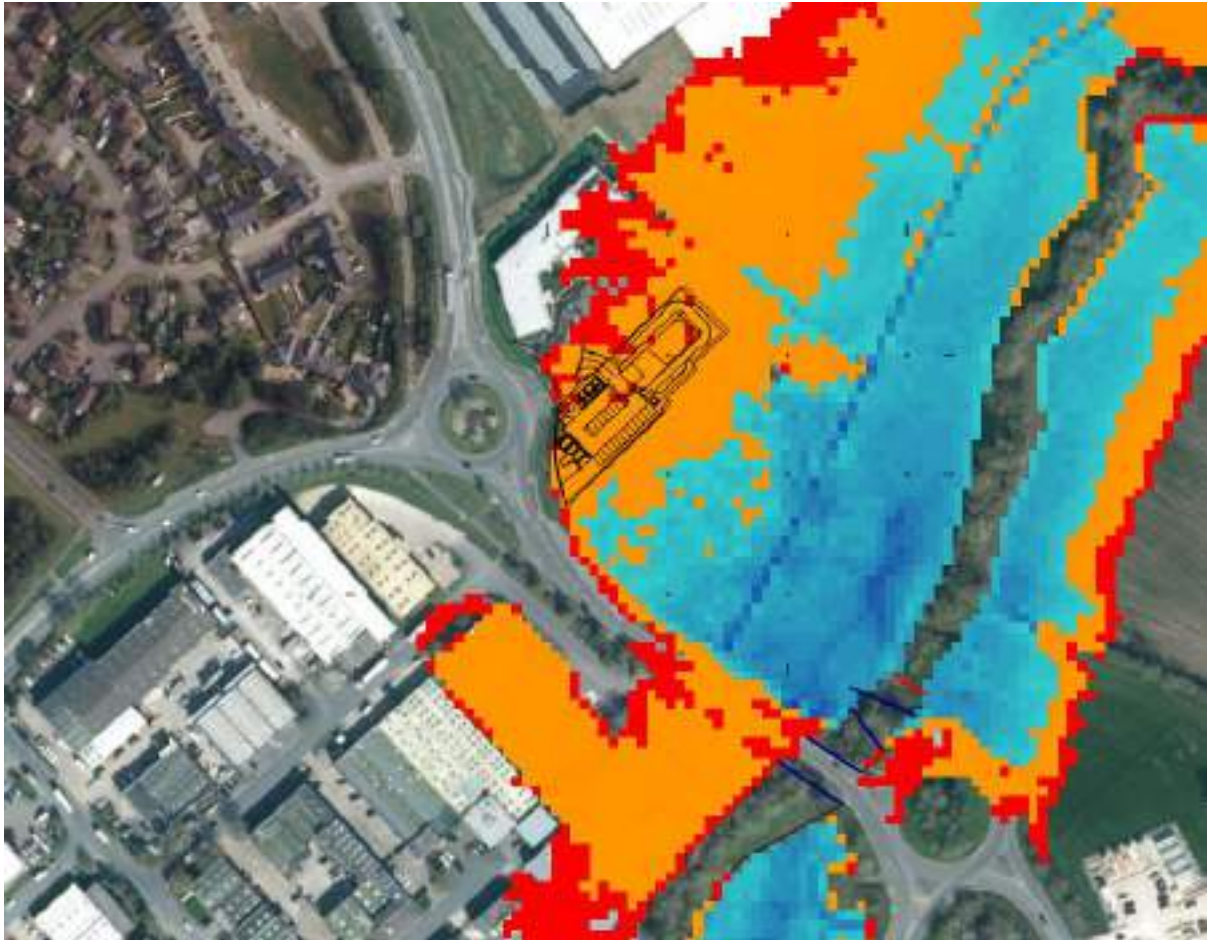


Figure 3.3: Modelled flood extents (blue 20 year, orange 100 year, red 100 year plus 35% CC)

*35% climate change based on pre-app advice prior to application submission



Figure 3.4: 20 year flood outline focussed on site.

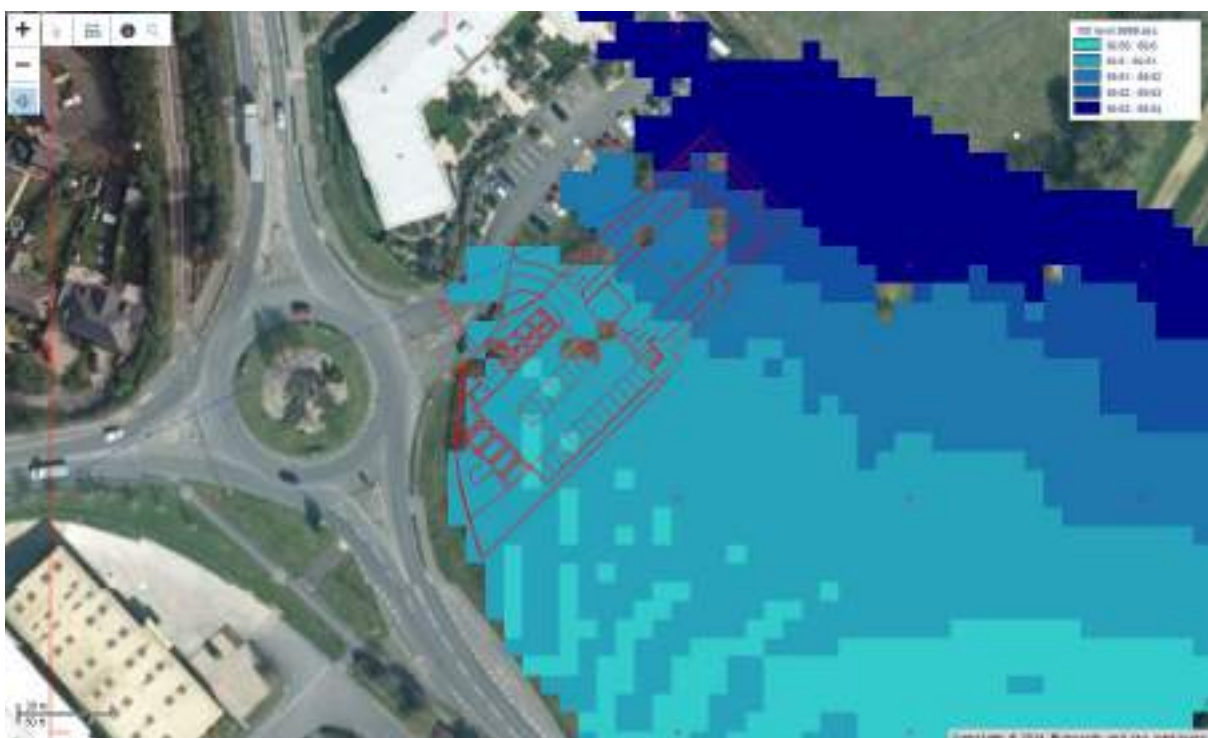


Figure 3.5: 100 year flood outline focussed on site.

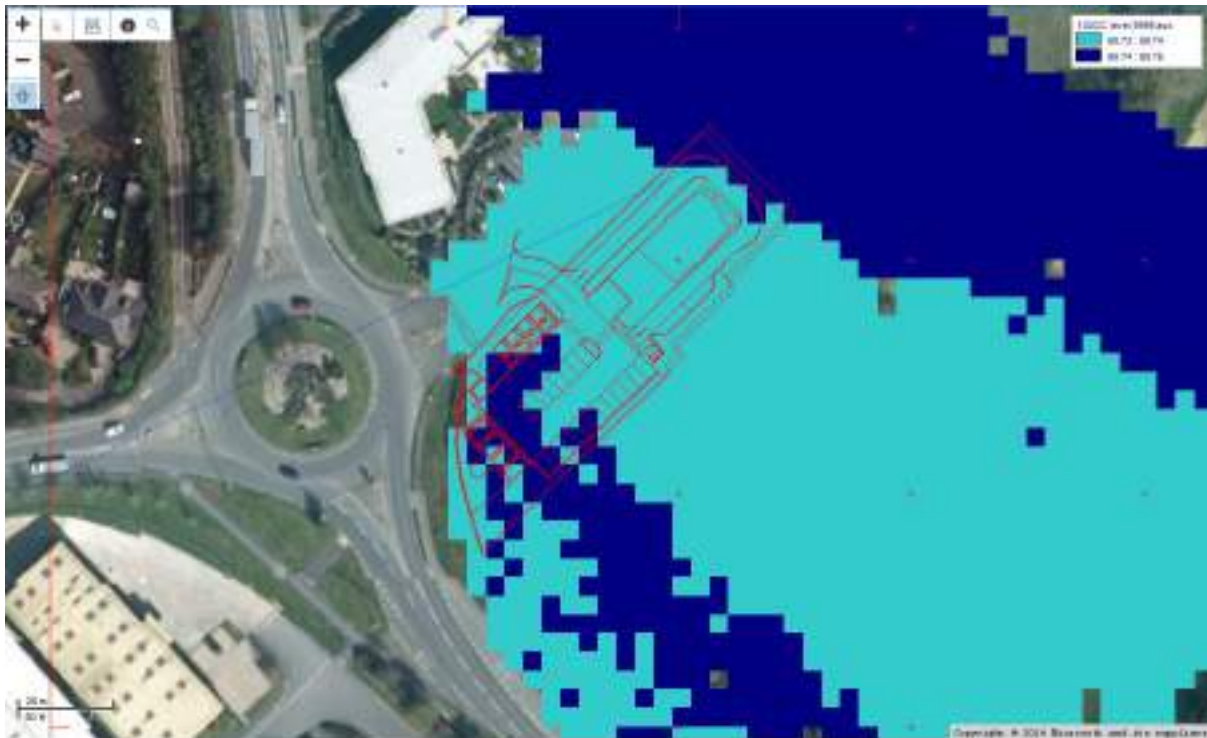


Figure 3.6: 100 year plus 35% climate change flood outline focussed on site.

*35% climate change based on pre-app advice prior to application submission

In their final response to the modelling, Environment Agency signed off the model and stated it as fit for purpose to include in a flood risk assessment for the development of the site (**Appendix F**).

3.3.2 Climate change

Fluvial flooding is likely to increase as a result of climate change. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks. The National Planning Policy Framework (NPPF) sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change.

Climate change was considered as part of the modelling submitted to the Environment Agency. Based on the Environment Agency's original comments, a fluvial flows for the 100 year event were increased by a factor of 35% in line with the Climate Change Allowance Guidelines. Since this initial agreement with the Environment Agency in 2019, the climate change allowances have been revised in line with updated scientific advice.

In July 2021 the revised allowances were published and should be used for all planning applications. According to the guidance published by the Environment Agency, the appropriate and central allowance to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas. Given the lifetime of the development is expected to be less than 25 years (the Tenant has committed to a 15 year lease), the 2050 allowance has been used. For the Cherwell and Ray catchment, the central allowance for the 2050 epoch is a 4% increase in river flows

The mapping results for the 100 year plus 35% climate change event are shown in **Figure 3.6** and 4% increase shown as **Figure 3.7**.

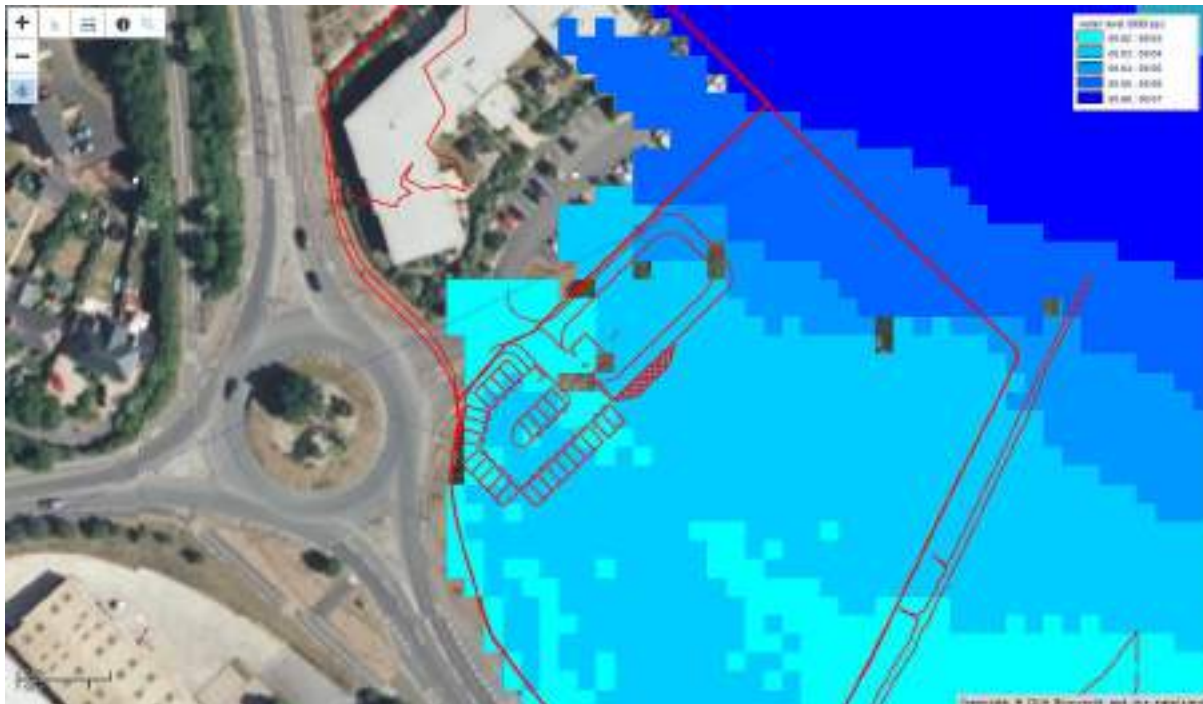


Figure 3.7: 100 year plus 4% climate change flood outline focussed on site.

3.4 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk from tidal flooding due to its inland location and elevated position, indicating a **'Very Low'** risk of flooding.

3.4.1 Climate change

Climate change is not considered to result in an increased risk of tidal flooding to the site.

3.5 Flooding from the land (overland pluvial flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff can occur. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration.

The Environment Agency's surface water flood map (**Figure 3.8**) shows that surface water flooding is possible within the confines of the site boundary.



Figure 3.8: Environment Agency ‘Flood risk from surface water’ map (accessed March 2021)

Based on the anticipated lifetime of the development (25 years), further mapping is available from the Environment Agency. This mapping provides a further assessment of the likely depths and velocities of the potential flooding (**Figure 3.9**).

This map show that the estimate flood depth during a 30 year rainfall event could be up to 300mm in depth towards the eastern extends of the site boundary. The location of the developed area is to the west of the application site and located in an area of low risk. This mapping does not take into account drainage facilities on the site and the proposed development will consider surface water runoff and ensure flood risk from this source has been duly considered.



Figure 3.9: 'Flood risk from surface water - water depth' map (accessed March 2021)

The risk of surface water flooding at the site is considered to be **Very Low – High**.

3.5.1 Climate change

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow. Climate change guidance for rainfall intensity has recently (latest update May 2022) been updated by the Environment Agency. Whilst climate change is expected to result in increased intensity of rainfall, the relatively short lifetime of the proposals negate the impacts expected over a longer period of time, as such the impacts of climate change are expected to remain minor and are considered in the surface water management put forward for the development.

3.6 Flooding from groundwater

Groundwater flooding tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

BGS borehole records from an area to the south and east of the site did not record groundwater strikes with the boreholes going to approximately 5m bgl. From the above and due to the sporadic nature of groundwater flooding, the design of the development

and the possibility of groundwater emergence at the site, it is unlikely that groundwater flooding would affect the development.

The resultant groundwater flood risk is considered to be **low**.

3.6.1 Climate change

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. If winter rainfall becomes more frequent and heavier, groundwater levels may increase. Higher winter recharge may however be balanced by lower recharge during the predicted hotter and drier summers. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. It is probable that any locally perched aquifers may be more affected, but these are likely to be isolated. The change in flood risk is likely to be low.

3.7 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes.

Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption⁷. One of the design parameters is that sewer systems be designed such that no flooding of any part of the site occurs in a 1 in 30 year rainfall event. By definition a 1 in 100 year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage.

When exceeded, the surcharged pipe work could lead to flooding from backed up manholes and gully connections. This could lead to immediate flooding within highways surrounding the site.

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure.

To ensure that sewer and surface water flooding is not exacerbated; surface water must be considered within the design of the site. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area. The proposed surface water network on the site should be designed to ensure exceedance of the network has been considered.

An as-built survey of the sewer network surrounding the site has been provided by the client, a copy of this is included in **Appendix E**. These records show the adjacent care home is drained via a pump station and rising main which passes to the north of the application site. Should the pump station fail, any excess flow would be located on lower ground than the site, as such the risk is considered to be **very low**.

⁷ WRC, 'Sewers for Adoption' 8th Edition, August 2018

3.7.1 Climate change

The impact of climate change is likely to be negative regarding flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of local sewer flooding but will not impact the site.

3.8 Other sources of flooding

Flood events can occur from a sudden release of large volumes of water from reservoirs, canals and artificial structures.

3.8.1 Reservoirs

Reservoir flooding is also extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to ensure reservoirs are maintained.

The Environment Agency reservoir flood map (reproduced as **Figure 3.10**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large. According to the Environment Agency Reservoir flood maps the site nor the surrounding areas are at potential risk of flooding from reservoirs.

The resultant flood risk to the proposed dwellings is considered to be **Very Low**.



Figure 3.10: Environment Agency 'Flood risk from reservoirs' map (accessed March 2021)

3.8.2 Climate change

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site.

3.8.3 Canals

There are no canals in close proximity to the site.

3.8.4 Blockages of artificial drainage systems

There is a possibility that flooding may result due to culverts and/or sewers being blocked by debris or structural failure. This can cause water to backup and result in localised flooding, as well as placing areas with lower ground levels at risk. There are no known artificial drainage systems on site that could impact the development.

The risk of flooding from artificial drainage systems is considered to be **very low**.

Climate change is unlikely to affect the flooding risk to the site from such blockages.

4 ENVIRONMENT AGENCY CONSULTATION

4.1 Overview – Pre App

The Environment Agency were engaged at an early stage of the design proposals to establish the principals for the design in terms of mitigating and managing flood risk. The main point of contact was Jack Moeran. During this process the modelling described above was reviewed and analysed by the Environment Agency model review team and considered fit for purpose (Email dated 27th March 2020, **Appendix F**). In addition the details for the requirements for the FFL's for the development were agreed to be set above the 1 in 100 year plus 35% flood level (69.750m AOD) and that the access road, parking areas and the FFL's of the store will be set at either the existing ground level or below. Given the proposed use of this building, the Environment Agency deemed this to be satisfactory (Environment Agency Ref: ENVPAC/1/THM/00288 WA/2019/127024/07-L01). It was also agreed with the Environment Agency that the use of a flood compensation tank would be considered, subject to further details and information being provided (See Section 5.3).

4.2 27th March 2020 (Appendix F)

As stated above, the hydraulic model to be used in the flood risk assessment was submitted to the Environment Agency for a formal review. The model submitted included the 20, 100 and 1000 year return periods in addition, the 100 year plus 35% climate change inflow model was submitted.

On the 27th March 2020, the model was deemed fit for purpose and suitable for use in support of a planning application. It was this model that formed the basis for the setting of the FFL's and the initial flood compensation calculations.

4.3 13th September 2021 (Appendix G)

Following the submission of the planning application, the Environment Agency were formally consulted in their role as statutory consultees on flood risk issues. An objection letter was issued on the 13th September 2021 (Environment Agency Ref: WA/2021/129266/01-L01). The principal point for the objection was that the submitted FRA fails to 'Provide appropriate mitigation for the loss of flood storage to ensure the development does not increase the risk of flooding to the site and the surrounding area.'

A letter response to this objection was issued on the 13th October 2021 (RSK Ref: P680020-FRA L01). This letter provided further details of the flood compensation scheme based on the principles previously agreed with the Environment Agency. The revised floodplain compensation volumes as detailed in this letter are based on the previously agreed modelling results and the development plans for the site at the time of the submission. As a result the floodplain volume to be provided in the underground attenuation tanks was revised to be 36.5m³ (previously agreed volume with the Environment Agency was 30m³) whilst offering **a total floodplain volume increase of 105.16m³ to offer a reduction in flood risk as a result of the development based on the 100 year plus climate change event.**

Environment Agency Comment	RSK Response
Provide appropriate mitigation for the loss of flood storage to ensure the development does not increase the risk of flooding to the site and the surrounding area.	Details of the revised flood compensation scheme were submitted in the RSK response letter 13 th October 2021 (RSK Ref: P680020-FRA L01)
Proposes a method of compensation storage in tanks which is inappropriate to the storage size required;	The underground attenuation tanks was revised to be 36.5m ³ (previously agreed volume with the Environment Agency was 30m ³) whilst offering a total floodplain volume increase of 105.16m ³ to offer a reduction in flood risk as a result of the development based on the 100 year plus climate change event.
Fails to demonstrate that storage tanks can be adequately maintained (free of silt and debris) and thus fulfil the flood storage requirement over the lifetime of the development;	Details for the maintenance of the tanks will be provided and will be delivered by a management company. It is requested that this point is secured through an appropriately worded planning condition once the exact tanks specification and management company have been determined.
Fails to demonstrate on a level for level basis that sufficient compensation storage has been provided;	As stated above, the underground attenuation tanks was revised to be 36.5m ³ (previously agreed volume with the Environment Agency was 30m ³) whilst offering a total floodplain volume increase of 105.16m ³ to offer a reduction in flood risk as a result of the development based on the 100 year plus climate change event.
Fails to provide sufficient information comparing existing and proposed levels across the site to demonstrate where flood storage is lost;	Cross sectional details were provided to the Environment Agency: Drawing 220029/FV100 revision P1, FLOOD VOLUMES SECTION LAYOUT PLAN. Drawing 220029/FV101 revision P3, FLOOD VOLUMES SECTIONS 1 OF 3 Drawing 220029/FV102 revision P3, FLOOD VOLUMES SECTIONS 2 OF 3 Drawing 220029/FV103 revision P3, FLOOD VOLUMES SECTIONS 3 OF 3
Fails to provide details of the ground lowering required to provide the 11.3m ³ compensation storage element within the higher ground to the east of the development as mentioned in Section 4.3 of the FRA.	Cross sectional details were provided to the Environment Agency: Drawing 220029/FV100 revision P1, FLOOD VOLUMES SECTION LAYOUT PLAN.

Environment Agency Comment	RSK Response
	<p>Drawing 220029/FV101 revision P3, FLOOD VOLUMES SECTIONS 1 OF 3</p> <p>Drawing 220029/FV102 revision P3, FLOOD VOLUMES SECTIONS 2 OF 3</p> <p>Drawing 220029/FV103 revision P3, FLOOD VOLUMES SECTIONS 3 OF 3</p>

4.4 9th December 2021 (Appendix H)

Following the submission of the rebuttal to the Environment Agency objection issued on the 13th October, a subsequent objection letter was issued from the Environment Agency (Environment Agency Ref: WA/2021/129266/02-L01) dated 9th December. The reason of the objection was an increase of floodplain attenuation from that previously agreed and they were unable to interpret the submitted cross section plans for the proposed attenuation volume tanks and groundworks.

A response to the objection letter was issued on the 24th December (RSK Ref: P680020-FRA L02). Based on the requirement to set the FFL's above the flood level and the level access arrangements to the store, the flood tank compensation volumes could not be reduced from that previously discussed and agreed in principle with the Environment Agency. The scheme and the proposals have been worked up over a period of time with the flood levels set based on the agreed submitted model and climate change allowances at the time of the pre-app discussions. Since this and prior to the submission of the planning application, the fluvial climate change allowances have been revised based on updated scientific evidence. The Environment Agency were informed that RSK would be revisiting the model files and update these based on the latest climate change allowances. Whilst the setting of the FFL's would still be based on the previous climate change allowance, the flood compensation calculations would be based on the revised model results, this offers some additional reassurance that the store would remain flood free during the 100 year + revised climate change allowance. The letter response submitted details the findings of the updated modelling and floodplain compensation results and provides further detail on the drawings and cross sections as required by the Environment Agency to allow easier interpretation.

The results show that, when using the Environment Agency's latest climate change allowances (at the time of submission - July 2021), the level of flood compensation required to be provided in the tanks is **reduced to 17.58m³, below that previously agreed and required with the Environment Agency. Notwithstanding this fact, the flood compensation to be offered by the scheme will include a tank with a capacity of 30m³ (this is in excess of that required), thereby offering a reduction / betterment of 12.42m³ in offsite flood risk on 1 in 100 year plus revised climate change. There is also a considerable flood storage betterment of 99.163m³ in the 1 in 100 year flood risk.**

Environment Agency Comment	RSK Response
<p>The revised details have reduced the underground storage tank requirement to 36.5m³. While this is less than previously proposed, it is still substantially more than we agreed with the applicant during pre-application discussions and we are not satisfied that this method in this volume is acceptable.</p>	<p>The revised scheme based on the latest climate change allowances has reduced the volume to be provided in the tanks to 17.58m³ as detailed in the letter response issued 24th December (RSK Ref: P680020-FRA L02).</p> <p>Therefore, the level of flood compensation required to be provided in the tanks is reduced to 17.58m³, below that previously agreed and required with the Environment Agency. Notwithstanding this fact, the flood compensation to be offered by the scheme will include a tank with a capacity of 30m³ (this is in excess of that required), thereby offering a reduction / betterment of 12.42m³ in offsite flood risk on 1 in 100 year plus revised climate change. There is also a considerable flood storage betterment of 99.163m³ in the 1 in 100 year flood risk.</p>
<p>The excavation required to provide the proposed floodplain compensation area is detailed only on cross sections. Without a plan it is hard to establish whether the information shown on the sections is practical and achievable. It will be necessary for the applicant to submit a plan showing the floodplain compensation storage area and detail the ground levels required for the area, consistent with the sections</p>	<p>A plan has been provided as part of the letter response issued 24th December (RSK Ref: P680020-FRA L02). Drawing Ref: 220029_FV100_P4</p>
<p>It was agreed that flood storage for the tank system would equate to 30m³. While the tanked storage now required is significantly less than previously proposed, a system of 36.5m³ is a 20% increase over the agreed proposal. We consider this to be inappropriate for this level of compensation. We have previously advised on the use of open voids within the design of the building as a possible solution, however the applicant has discounted this due to other constraints. Therefore, additional land suitable for level for level flood storage should be sought or the development revised to reduce the amount of flood storage being lost.</p>	<p>As stated above, the revised scheme based on the latest climate change allowances has reduced the volume to be provided in the tanks to 17.58m³ as detailed in the letter response issued 24th December (RSK Ref: P680020-FRA L02).</p> <p>Therefore, the level of flood compensation required to be provided in the tanks is reduced to 17.58m³, below that previously agreed and required with the Environment Agency. Notwithstanding this fact, the flood compensation to be offered by the scheme will include a tank with a capacity of 30m³ (this is in excess of that required), thereby offering a reduction / betterment of 12.42m³ in offsite flood risk on 1 in 100 year plus revised climate change. There is also a considerable flood storage betterment of 99.163m³ in the 1 in 100 year flood risk.</p>

4.5 6th April 2022 (Appendix I)

A response from the Environment Agency was issued on the 6th April 2022 (Environment Agency Ref: WA/2021/129266/03-L01) maintaining the objection asking for the model files to be submitted for a formal review and additional details on the drawings and floodplain calculations).

The model files were submitted to the Environment Agency on the 7th April in anticipation of a prompt review and acceptance from the Environment Agency. As previously stated, the only variation to the previously approved model files is the inflows which have been updated to reflect the latest allowances for climate change. Whilst a formal response (as of 06.07.22) from the Environment Agency has still not been formally issued, it is understood that they are challenging the model. Further comments cannot be made until a formal response from the Environment Agency has been received.

Environment Agency Comment	RSK Response
The applicant has now carried out their own modelling work to determine the expected flood level for this epoch. We will need to carry out a detailed review of the fluvial modelling in order to verify the results being relied upon to assess the risk of flooding and to design the flood mitigation scheme. Details of how to share the modelling with us has been provided separately.	<p>The model files were uploaded to the Environment Agency system on the 7th April 2022, a formal response to the model review is overdue</p> <p>As the model is an existing EA model and it's only the inflows which have been adjusted to reflect the latest allowances for climate change, we are expecting this to be approved fit for purpose.</p> <p>NOTE the model being "fit for purpose" approval by the EA has been provided under separate cover.</p>
The flood compensation being provided through tanked storage has now been reduced to less than 30m ³ . This will be acceptable providing we are able to accept the modelling that is being used.	Noted – although based on the submitted model files and revised calculations (attached) show that 18.47m ³ is now required to offset the level for level flood compensation requirements. Whilst the requirement for level for level required attenuation is now 18.47m ³ , there are plans to offer 30m ³ to show a further benefit of the scheme in terms of flood risk (see below point for further info)
<p>However, in our previous response, we requested additional details in relation to the proposed flood compensation area being proposed through alterations of ground levels.</p> <p>The detail provided in drawing number 220029/FV100 (version P4, dated 23 December 2021) identifies some ground level changes but does not show</p>	<p>Drawing reference 220029_FV100_P5 and 220029_FV107_P2 show the site and the wider area floodplain loss and gain. The blue areas show where additional floodplain volume is created and the red where levels have been raised and volume is lost. It can be seen from the spreadsheet that for each 100mm increment between 69.16m AOD and 69.56m AOD there is additional floodplain storage, once the flood level reaches 69.56m AOD, there is a loss of floodplain for this 100mm increment, hence the requirement for additional attenuation at this level – in the form of the storage tanks.</p> <p>The level for level compensation is being provided in the underground tanks with the inlets set at the required level to</p>

Environment Agency Comment	RSK Response																												
<p>floodplain compensation storage areas. A site plan that shows the proposed changes for the whole site, not just certain points, should be provided. This is often demonstrated by shading in areas of the site where land is being raised and lowered, as well as showing the final ground levels. This should demonstrate that the compensation scheme is hydraulically connected to the floodplain and that flows are not impeded.</p>	<p>provide the level for level compensation and allows for hydraulic connectivity to the floodplain when the flood levels reach these inlets. It can also be seen from the cross sections that the flood levels enter the car park, so whilst there is some lost floodplain volume in some areas, there remains a hydraulic connectivity between all sections of the site and the flood zone, therefore the plans and associated calculations show a true representation of the situation.</p> <p>It can be seen from the spreadsheet and the associated additional attention tanks that at all flood level increments, there is an increase in floodplain volume as a result of the development.</p>																												
<p>In addition, the submitted letter sets out that the floodplain storage compensation required for levels above 69.55m AOD has been reduced to 17.58m3 following a revision in the climate change allowance. However, it is not clear how this was calculated. Whilst there is some information in the three 'Flood Volumes Sections' drawings, it would be helpful for this to be summarised within the FRA. The tables provided in the submitted letter seem to only show the change in flood volume once compensation (through ground level changes) has been provided. For clarity, a table should be included that clearly shows for each 0.1m slice the total: volume of flood storage lost, the volume of flood storage gained, and the volume difference (this appears to have been provided in the first table within the submitted letter).</p>	<p>The attached spreadsheet details the volumes lost and created at 0.1m 'segments'.</p> <p>It can be seen from the attached drawings and the associated spreadsheet that the level for level volume of flood water lost due to the development, if unmitigated, is 18.470m³. The previous lost volume between levels 69.650 and 69.550 was 17.572m³. This is a net increase of 0.898m³. It is this volume (18.470m³) that will be attenuated in the tank system, offering the required level for level flood compensation as previously agreed. As stated above , the scheme will offer 30m3, of attenuation in the tanks, thus offering additional flood risk benefits of the scheme.</p> <p>Whilst the EA's requirement is for level for level compensation, there is an additional floodplain volumetric benefit from the scheme where there is a net gain in floodplain volume by 94.745m³ (see table below) and it's when the flood levels reach 69.56m AOD that the attenuation tanks are available to provide the required level for level compensation.</p> <p><u>Total loss/increase of flood plain volume.</u></p> <table><tr><th colspan="2">Levels</th><th colspan="2"></th></tr><tr><th>Top (m)</th><th>Bottom (m)</th><th>Height (m)</th><th>Total loss of volume(m³)</th></tr><tr><td>69.660</td><td>69.560</td><td>0.1</td><td>+18.470</td></tr><tr><td>69.560</td><td>69.460</td><td>0.1</td><td>-2.440</td></tr><tr><td>69.460</td><td>69.360</td><td>0.1</td><td>-51.865</td></tr><tr><td>69.360</td><td>69.260</td><td>0.1</td><td>-37.113</td></tr><tr><td>69.260</td><td>69.160</td><td>0.1</td><td>-3.327</td></tr></table> <p>Positive figures indicate a reduction in flood volume. Negative indicate an increase in flood volume.</p>	Levels				Top (m)	Bottom (m)	Height (m)	Total loss of volume(m³)	69.660	69.560	0.1	+18.470	69.560	69.460	0.1	-2.440	69.460	69.360	0.1	-51.865	69.360	69.260	0.1	-37.113	69.260	69.160	0.1	-3.327
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69.360	69.260	0.1	-37.113																										
69.260	69.160	0.1	-3.327																										

Environment Agency Comment	RSK Response
	Note – the above table does NOT include the volume offered by the flood attenuation tanks and the 18.470m ³ shown above is compensated in a 30m ³ attenuation tank
Further, if the highest climate change flood level is agreed to be 69.66m AOD as stated in the submitted letter from RSK (dated 24 December 2021), then the tables within the letter should be updated to include this flood level (currently the tables only go up to 69.65mAOD).	See above, the tables on the spreadsheet and section drawings have been revised to reflect this.
To overcome our objection, the applicant should submit a revised FRA which addresses the points highlighted above. If this cannot be achieved, we are likely to maintain our objection.	This FRA has been produced in response to this point.

5 FLOOD MITIGATION MEASURES

5.1 Location of development

To facilitate the development of the site considering the risk from fluvial flooding, the developable areas of the site are limited to the west in the modelled Flood Zone 1 and 2.

5.2 Finished floor levels

Finished Floor Levels for the development have been agreed with the Environment Agency and will be set no lower than 69.750m AOD. Finished levels of the development should reflect the existing levels, where possible.

5.3 Flood compensation

Substantial work has taken place to confirm the requirements for the flood compensation for the application. The latest proposals are detailed in (**Appendix I**) with the flood levels based on the 1 in 100 year plus latest climate change allowances.

When using the Environment Agency's latest climate change allowances, the minimum volume of flood compensation to be provided by the tanks is 17.58m³, the remaining volume required to offer true level for level compensation will be provided through the proposed groundworks. Notwithstanding this fact, **the flood compensation to be offered by the scheme will include a tank with a capacity of 30m³ (this is in excess of that required), thereby offering a reduction / betterment of 12.42m³ in offsite flood risk on 1 in 100 year plus climate change flood event. There is also a considerable flood storage betterment of 99.163m³ in the 1 in 100 year event.**

5.4 Surface Water Drainage

Surface Water runoff generated from the development site is to be managed in an isolated system to the flood compensation tank described above. Surface water drainage from the developed site has been considered by Paul Owen Associates (Report Ref: 220029 DS/01 Rev P2, June 2021), which should be read in conjunction with this report.

6 PLANNING CONTEXT

6.1 Application of planning policy

Section 14 of the NPPF includes measures specifically dealing with development planning and flood risk using a sequential characterisation of risk based on planning zones and the Environment Agency Flood Map. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

6.2 Land use vulnerability

Planning Practice Guidance (PPG) includes a list of appropriate land uses in each flood zone dependent on vulnerability to flooding. In applying the Sequential Test, reference is made to Table 6.1 below, reproduced from Table 3 of PPG.

Table 6.1: Flood risk vulnerability and flood zone ‘compatibility’

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to Table 2 of the PPG, the proposed development, based on its commercial use, is classed as ‘Less Vulnerable’. This classification of development is appropriate for areas within Flood Zone 1,2 and 3.

6.3 Sequential and Exception Test

The Sequential Test is required to assess flood risk and the PPG recommends that the test be applied at all stages of the planning process to direct new development to areas with the lowest probability of flooding (Flood Zone 1). As the site is allocated through the local plan for employment uses and the site has been through the planning process with a resolution to grant has been through Planning Committee, the sequential test is deemed to be passed.

6.4 Local Plan Flood risk Policy

The adopted local plan Strategic Development: Bicester 11 – Employment Land at North East Bicester states that 'No built development will be located in Flood Zone 3b and the principle set out in Policy ESD 6 will be followed.' As part of this assessment the flood envelope associated with the functional flood zone has been assessed. It has been confirmed that all forms of built development are located outside of the functional flood zone.

7 CONCLUSIONS AND RECOMMENDATIONS

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The site lies in an area designated by the Environment Agency as Flood Zone 1, 2 and 3. Additional hydrological modelling work has further quantified the flood risk from fluvial sources and proposed mitigation to ensure the proposals are safe for the lifetime of the development. The modelling work carried out has been deemed fit for purpose by the Environment Agency.

Based on the outputs of the modelling and following consultation with the Environment Agency the following requirements have been placed on the site:

- Floor levels need to be set above the 1 in 100 plus 35% flood level (69.750m AOD) - based on pre-app advice.
- Floodplain compensation for any loss of flood storage needs to be level for level up to the 1 in 100 plus climate change flood level (latest drawings included as **Appendix I**).
- Where possible external finished levels will be retained as close to existing ground levels as possible (latest drawings included as **Appendix I**).

The mitigation of rising the site levels have been considered with flood mitigation measures being proposed which would offer compensatory floodwater storage, and therefore will ensure no increase in flood risk elsewhere.

Surface water generated by the development has been considered and will attenuate the required flows in a suitably designed system.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. As the site is allocated through the local plan for employment uses and council have resolved to grant planning permission, the sequential test is deemed to be passed, subject to confirmation that there is no development within the functional floodplain.

This flood risk assessment has considered multiple sources of flooding and concluded the following:

Table 7.1: Flood risk summary

Source	Level of risk	Mitigation
Fluvial	Low - High	The latest Environment Agency published flood zone map, shows the site to be located in Flood Zone 1, 2 and 3. Modelling work has further quantified the fluvial flood risk and proposed suitable mitigation to ensure the proposals are safe for the lifetime of the development.
Tidal	Very Low	The site is inland and elevated.

Source	Level of risk	Mitigation
Surface water	Very Low - High	The location of the developed area is to the west of the application site and located in an area of low risk. This mapping does not take into account drainage facilities on the site and the proposed development will consider surface water runoff and ensure flood risk from this source has been duly considered.
Groundwater	Low	BGS borehole records from an area to the south and east of the site did not record groundwater strikes with the boreholes going to approximately 5m bgl. From the above and due to the sporadic nature of groundwater flooding, the design of the development and the possibility of groundwater emergence at the site, it is unlikely that groundwater flooding would affect the development.
Reservoirs	Very Low	The site is not in an area shown to be at risk from reservoir flooding.
Sewers	Very Low	There are no know sewers located within the development area of the site, adjacent drainage infrastructure is located on lower ground and therefore any excessive flows would not impact on the development.
Artificial sources	Very Low	There are no known artificial drainage systems on site that could impact the development.

7.1 Environment Agency consultation

Following extensive and ongoing consultation with the Environment Agency the remaining issue is to gain approval from the model review team that the previously agreed and accepted model using the latest climate change allowances. Once this has been agreed the drawings submitted on the 11th May (**Appendix I**) has addressed the remaining comments from the Environment Agency and there is no basis for objection on flood risk grounds.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds.



APPENDIX A

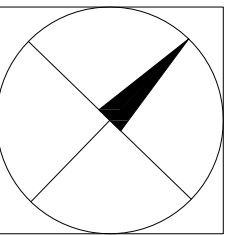
RSK GROUP SERVICE CONSTRAINTS

1. This report and the drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for Created Life Three Bicester Ltd (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable civil engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.
2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.
3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.
4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.
5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.
6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.
7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.
8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.
9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are not drawn to scale but are centred over the appropriate location. Such features should not be used for setting out and should be considered indicative only.



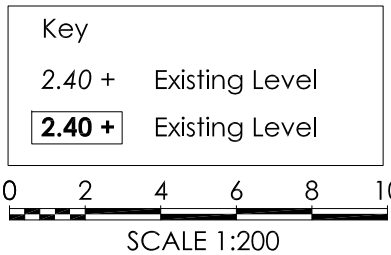
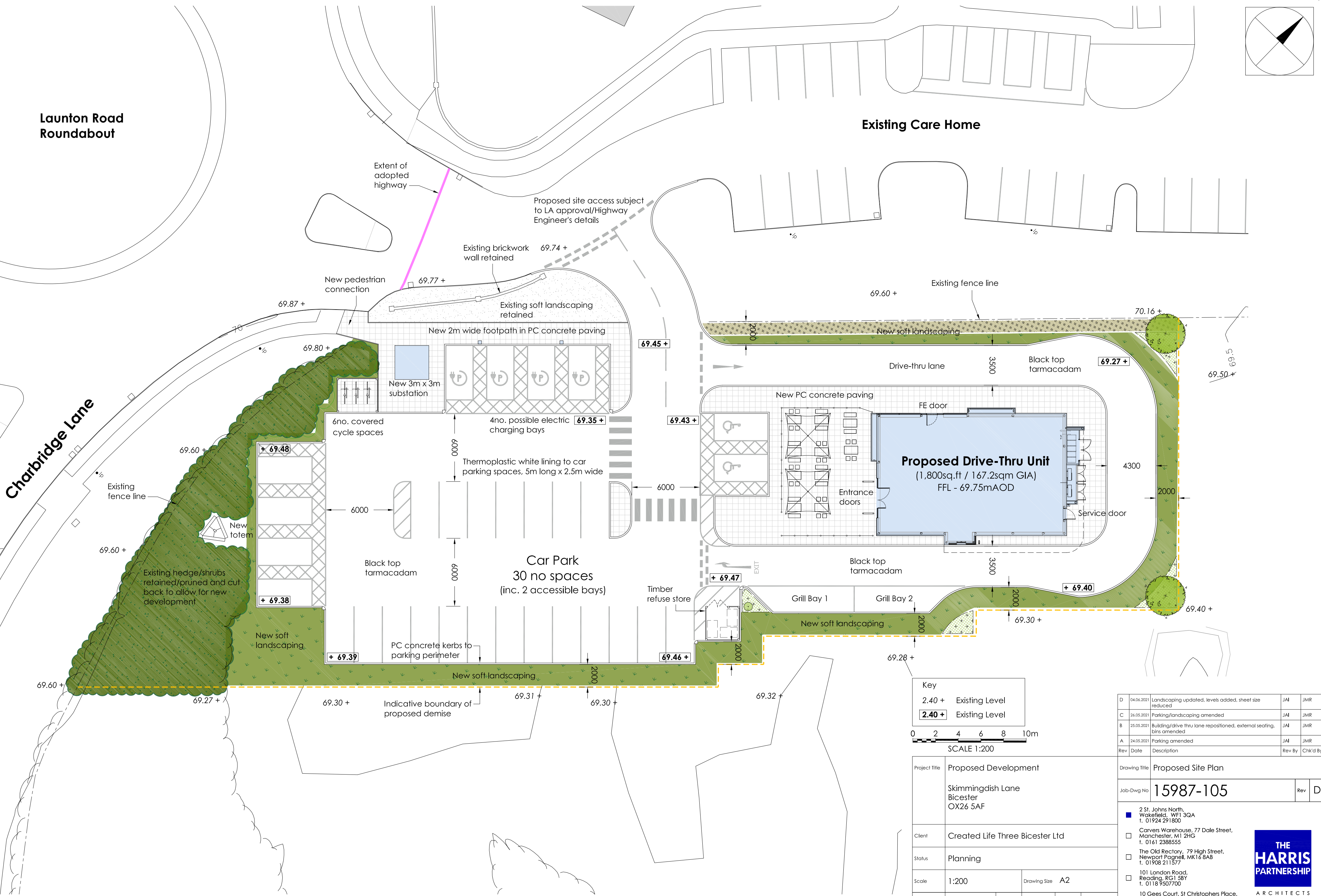
APPENDIX B

DEVELOPMENT PROPOSALS



Launton Road
Roundabout

Existing Care Home



D	04.06.2021	Landscaping updated, levels added, sheet size reduced	JAI	JMR
C	26.05.2021	Parking/landscaping amended	JAI	JMR
B	25.05.2021	Building/drive thru lane repositioned, external seating, bins amended	JAI	JMR
A	24.05.2021	Parking amended	JAI	JMR
Rev	Date	Description	Rev By	Chk'd By

Project Title	Proposed Development			Drawing Title	Proposed Site Plan		
	Skimmingdish Lane Bicester OX26 5AF			Job-Dwg No	15987-105		
Client	Created Life Three Bicester Ltd					Rev	D
Status	Planning			<div>2 St. Johns North, Wakefield, WF1 3QA t. 01924 291800</div> <div><input type="checkbox"/> Carvers Warehouse, 77 Dale Street, Manchester, M1 2HG t. 0161 2388555</div> <div><input type="checkbox"/> The Old Rectory, 79 High Street, Newport Pagnell, MK16 8AB t. 01908 211577</div> <div><input type="checkbox"/> 101 London Road, Reading, RG1 5BY t. 0118 9507700</div> <div><input type="checkbox"/> 10 Gees Court, St Christophers Place, London, W1U 1JJ t. 0207 4091215</div> <div>THE HARRIS PARTNERSHIP ARCHITECTS www.harrispartnership.com</div>			
Scale	1:200	Drawing Size	A2				
Date	18/05/2021	Drawn By	James I	Checked	JMR		



APPENDIX C

EXISTING SITE SURVEY



APPENDIX D

ENVIRONMENT AGENCY DATA

Product 4 (Detailed Flood Risk) for Skimmingdish Lane, Bicester, OX26 5AF

Our Ref: THM134195

Product 4 is designed for developers where Flood Risk Standing Advice FRA (Flood Risk Assessment) Guidance Note 3 Applies. This is:

- i) "all applications in Flood Zone 3, other than non-domestic extensions less than 250 sq metres; and all domestic extensions", and
- ii) "all applications with a site area greater than 1 ha" in Flood Zone 2.

Product 4 includes the following information:

Ordnance Survey 1:25k colour raster base mapping;
Flood Zone 2 and Flood Zone 3;
Relevant model node locations and unique identifiers (for cross referencing to the water levels, depths and flows table);
Model extents showing *defended* scenarios;
FRA site boundary (where a suitable GIS layer is supplied);
Flood defence locations (where available/relevant) and unique identifiers; (supplied separately)
Flood Map areas benefiting from defences (where available/relevant);
Flood Map flood storage areas (where available/relevant);
Historic flood events outlines (where available/relevant, not the Historic Flood Map) and unique identifiers;
Statutory (Sealed) Main River (where available within map extents);

A table showing:

- i) Model node X/Y coordinate locations, unique identifiers, and levels and flows for *defended* scenarios.
- ii) Flood defence locations unique identifiers and attributes; (supplied separately)
- iii) Historic flood events outlines unique identifiers and attributes; and
- iv) Local flood history data (where available/relevant).

Please note:

If you will be carrying out computer modelling as part of your Flood Risk Assessment, please request our guidance which sets out the requirements and best practice for computer river modelling.

This information is based on that currently available as of the date of this letter. You may feel it is appropriate to contact our office at regular intervals, to check whether any amendments/ improvements have been made. Should you re-contact us after a period of time, please quote the above reference in order to help us deal with your query.

This information is provided subject to the enclosed notice which you should read.

This letter is not a Flood Risk Assessment. The information supplied can be used to form part of your Flood Risk Assessment. Further advice and guidance regarding Flood Risk Assessments can be found on our website at:

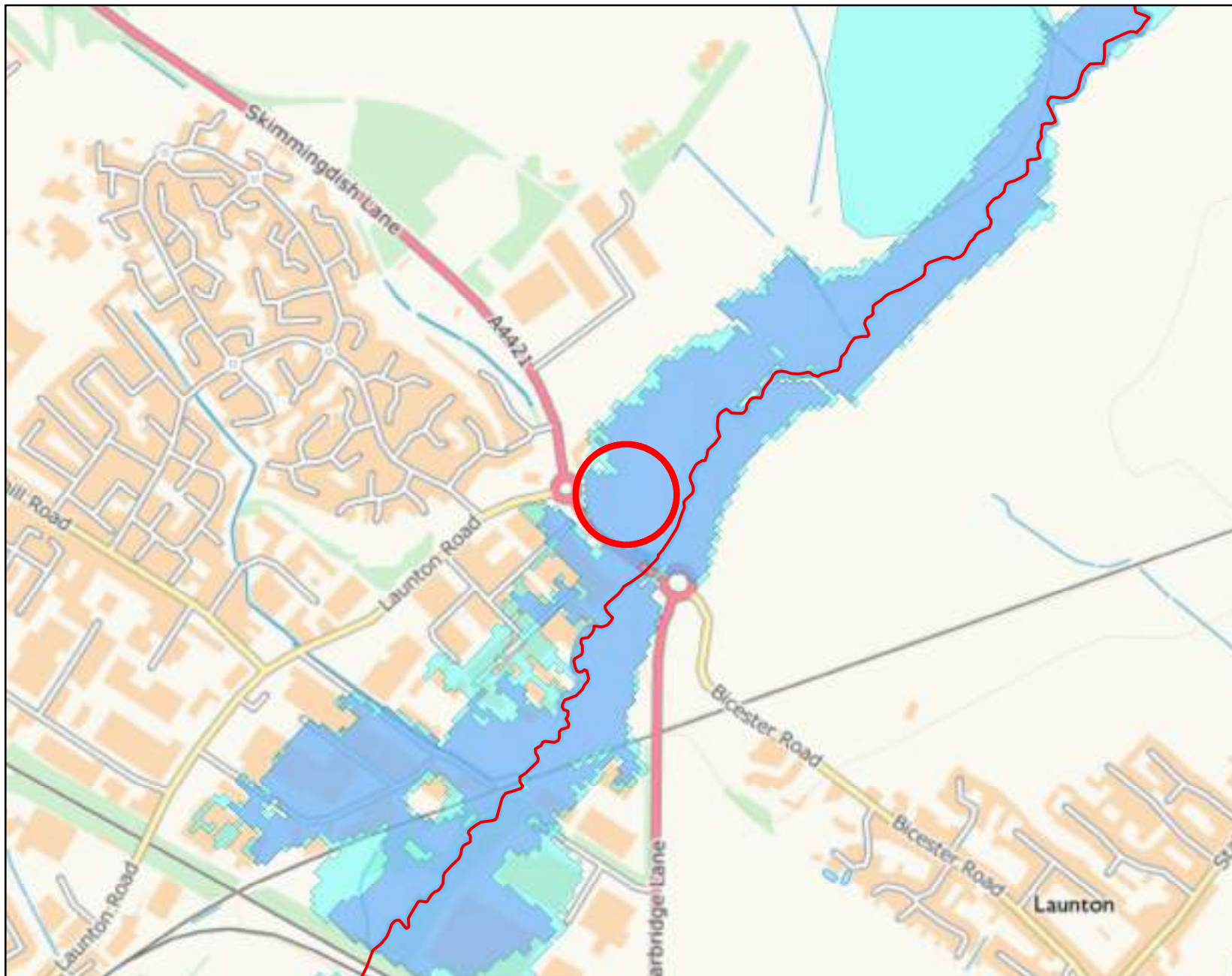
<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

If you would like advice from us regarding your development proposals you can complete our pre application enquiry form which can be found at:

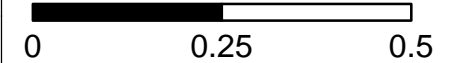
<https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion>

Flood Map for Planning centred on Skimmingdish Lane, Bicester, OX26 5AF

Created on 11/07/2019 REF: THM134195



Kilometres



Legend

- Main River
- Flood defences
- Areas benefiting from flood defences
- Flooding from rivers or sea (FZ3)
- Extent of extreme flood (FZ2)
- Flood Map - flood storage areas

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

Defence information

THM134195

Defence Location: No defences on Main River

Description: This location is not currently protected by any formal defences and we do not currently have any flood alleviation works planned for the area. However we continue to maintain certain watercourses and the schedule of these can be found on our internet pages.

Model information

THM134195

Model: Langford Brook (Bicester) & Pingle-Back-Bure 2010

Description: The information provided is from the Langford Brook (Bicester) & Pingle-Back-Bure 2010 detailed mapping project. The study was carried out using 2D modelling software (ISIS-Tuflow).

Model design runs:

1 in 5 / 20% Annual Exceedance Probability (AEP); 1 in 20 / 5% AEP; 1 in 50 / 2% AEP; 1 in 100 / 1% AEP; 1 in 100+20% / 1% AEP plus 20% increase in flows and 1 in 1000 / 0.1% AEP

Mapped Outputs:

1 in 5 / 20% AEP; 1 in 20 / 5% AEP; 1 in 50 / 2% AEP; 1 in 100 / 1% AEP and 1 in 1000 / 0.1% AEP

Model accuracy:

Levels \pm 250mm

Modelled in-channel flood flows and levels

THM134195

The modelled flood levels and flows for the closest most appropriate model node points for your site that are within the river channel are provided below:

Node label	Model	Easting	Northing	Flood Levels (mAOD)							
				20% AEP	5% AEP	1% AEP	1% AEP (+20% increase in flows)	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
061_14_2010_00106114MN_2009001_LA.3	Langford Brook (Bicester) & Pingle-Back-Bure 2010	459805	222774	67.60	67.77	67.86	68.00	0.00	0.00	0.00	68.29
061_14_2010_00106114MN_2009001_LA.4	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460006	223028	68.42	68.79	69.15	69.20	0.00	0.00	0.00	69.25
061_14_2010_00106114MN_2009001_LA.4	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460144	223266	69.01	69.30	69.50	69.56	0.00	0.00	0.00	69.63
061_14_2010_00106114MN_2009001_LA.5	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460466	223619	69.81	70.03	70.13	70.18	0.00	0.00	0.00	70.24
061_14_2010_00106114MN_2009001_LA.5	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460717	223877	70.37	70.39	70.43	70.45	0.00	0.00	0.00	70.50

Node label	Model	Easting	Northing	Flood Flows (m3/s)							
				20% AEP	5% AEP	1% AEP	1% AEP (+20% increase in flows)	1% AEP (+25% increase in flows)	1% AEP (+35% increase in flows)	1% AEP (+70% increase in flows)	0.1% AEP
061_14_2010_00106114MN_200900	Langford Brook (Bicester) & Pingle-Back-Bure 2010	459805	222774	3.39	5.15	7.12	8.03	0.00	0.00	0.00	8.91
061_14_2010_00106114MN_200900	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460006	223028	2.90	2.34	2.29	2.34	0.00	0.00	0.00	2.33
061_14_2010_00106114MN_200900	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460144	223266	2.73	2.71	2.66	2.70	0.00	0.00	0.00	2.65
061_14_2010_00106114MN_200900	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460466	223619	2.29	2.39	2.41	2.41	0.00	0.00	0.00	2.39
061_14_2010_00106114MN_200900	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460717	223877	1.44	1.67	1.91	2.08	0.00	0.00	0.00	2.39

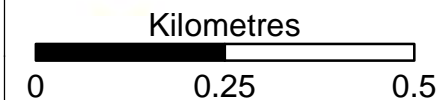
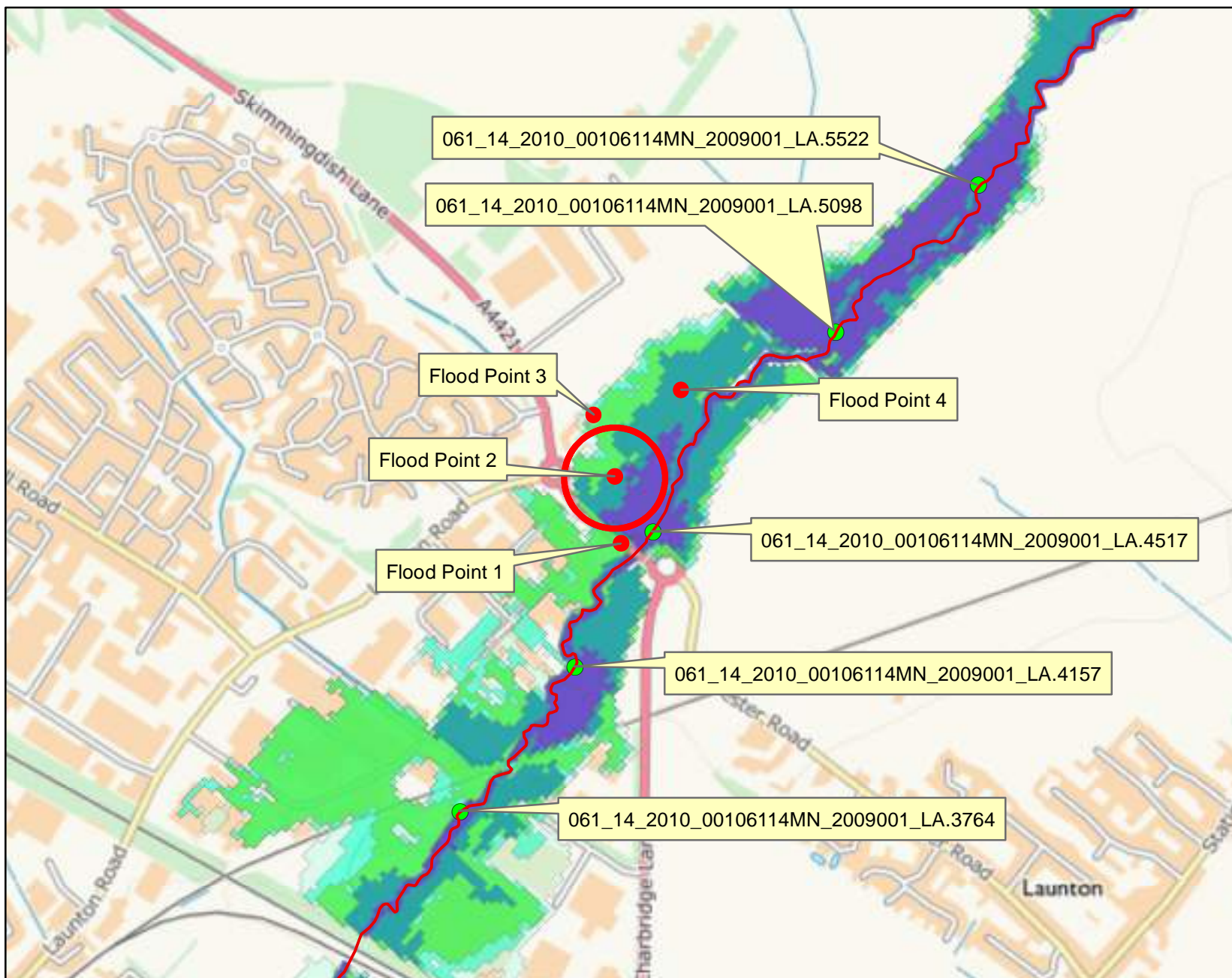
Note:

Due to changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit
<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Detailed FRA Map centred on Skimmingdish Lane, Bicester, OX26 5AF

Created on 11/07/2019 REF: THM134195



Legend

- Main River
- Model Nodes
- 20% AEP Flood Outline
- 5% AEP Flood Outline
- 1% AEP Flood Outline
- 1%+20% Flood Outline
- 0.1% AEP Flood Outline

AEP = Annual Exceedance Probability
The probability of a flood of a particular magnitude, or greater, occurring in any given year

Where available climate change extents have been calculated with an additional flow added to an AEP event. An example of how this is written is 1%+20% AEP.

Modelled floodplain flood levels

THM134195

The modelled flood levels for the closest most appropriate model grid cells for your site are provided below:

2D grid cell reference	Model	Easting	Northing	flood levels (mAOD)				
				20% AEP	5% AEP	1% AEP	1% AEP (+20% increase in flows)	0.1% AEP
Flood Point 1	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460,087	223,246	No Data	No Data	69.53	69.58	69.64
Flood Point 2	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460,076	223,364	No Data	69.36	69.56	69.62	69.70
Flood Point 3	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460,040	223,472	No Data	No Data	69.62	69.69	69.77
Flood Point 4	Langford Brook (Bicester) & Pingle-Back-Bure 2010	460,194	223,516	No Data	69.39	69.64	69.72	69.81

This flood model has represented the floodplain as a grid.
The flood water levels have been calculated for each grid cell.

Note:

Due to changes in guidance on the allowances for climate change, the 20% increase in river flows should no longer to be used for development design purposes. The data included in this Product can be used for interpolation of levels as part of an intermediate level assessment.

For further advice on the new allowances please visit

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Historic Flood Map centred on Skimmingdish Lane, Bicester, OX26 5AF

Created on 11/07/2019 REF: THM134195



Kilometres

0 0.25 0.5

Legend

— Main River

year

1992

Flooding from rivers or sea without defences (Flood Zone 3) shows the area that could be affected by flooding:

- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

The Extent of an extreme flood (Flood Zone 2) shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

THM134195

Our records show that the area of your site has been affected by flooding. Information on the floods that have affected your site is provided in the table below:

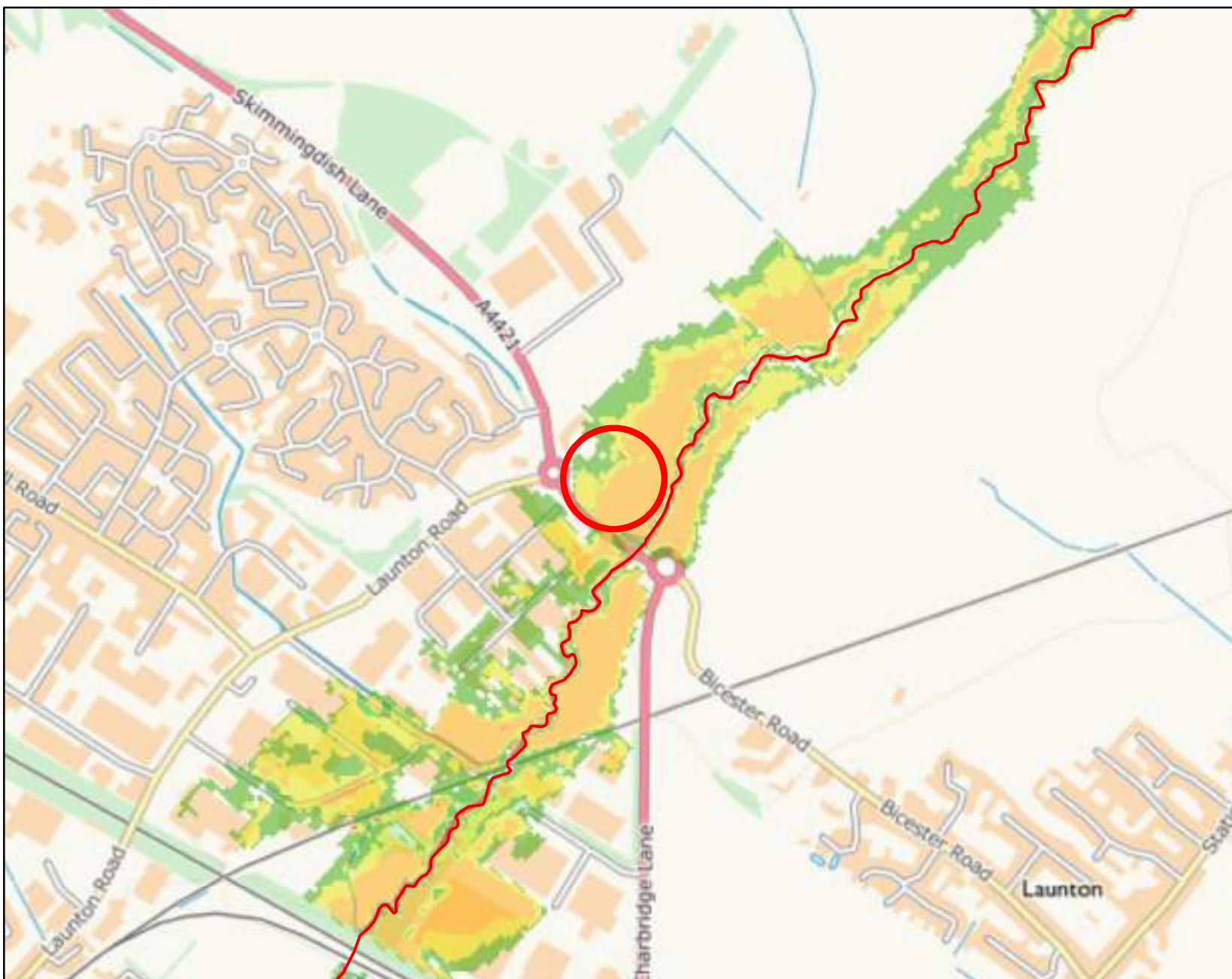
[illegible]

Please note the Environment Agency maps flooding to land not individual properties. Floodplain extents are an indication of the geographical extent of a historic flood. They do not provide information regarding levels of individual properties, nor do they imply that a property has flooded internally.

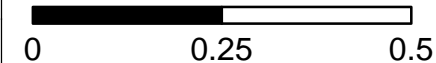
Start and End Dates shown above may represent a wider range where the exact dates are not available.

Hazard Map centred on Skimmingdish Lane, Bicester, OX26 5AF

Created on 11/07/2019 REF: THM134195



Kilometres



Legend

- Main River
- Low hazard
- Danger for some
- Danger for most
- Danger for all

For hazard and debris factor we used HR Wallingford and Environment Agency (May 2008) supplementary note on flood hazard ratings and thresholds for development planning and control purpose. The following calculation is used:

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

HR = flood hazard rating
d = depth of flooding (m)
v = velocity of floodwaters (m/sec)
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

Hazard Mapping

Hazard Mapping methodology:

To calculate flood hazard with the debris factor we have used the supplementary note to Flood Risk to People Methodology (see below).

The following calculation is used:

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

Where HR = flood hazard rating

d = depth of flooding (m)

v = velocity of floodwaters (m/sec)

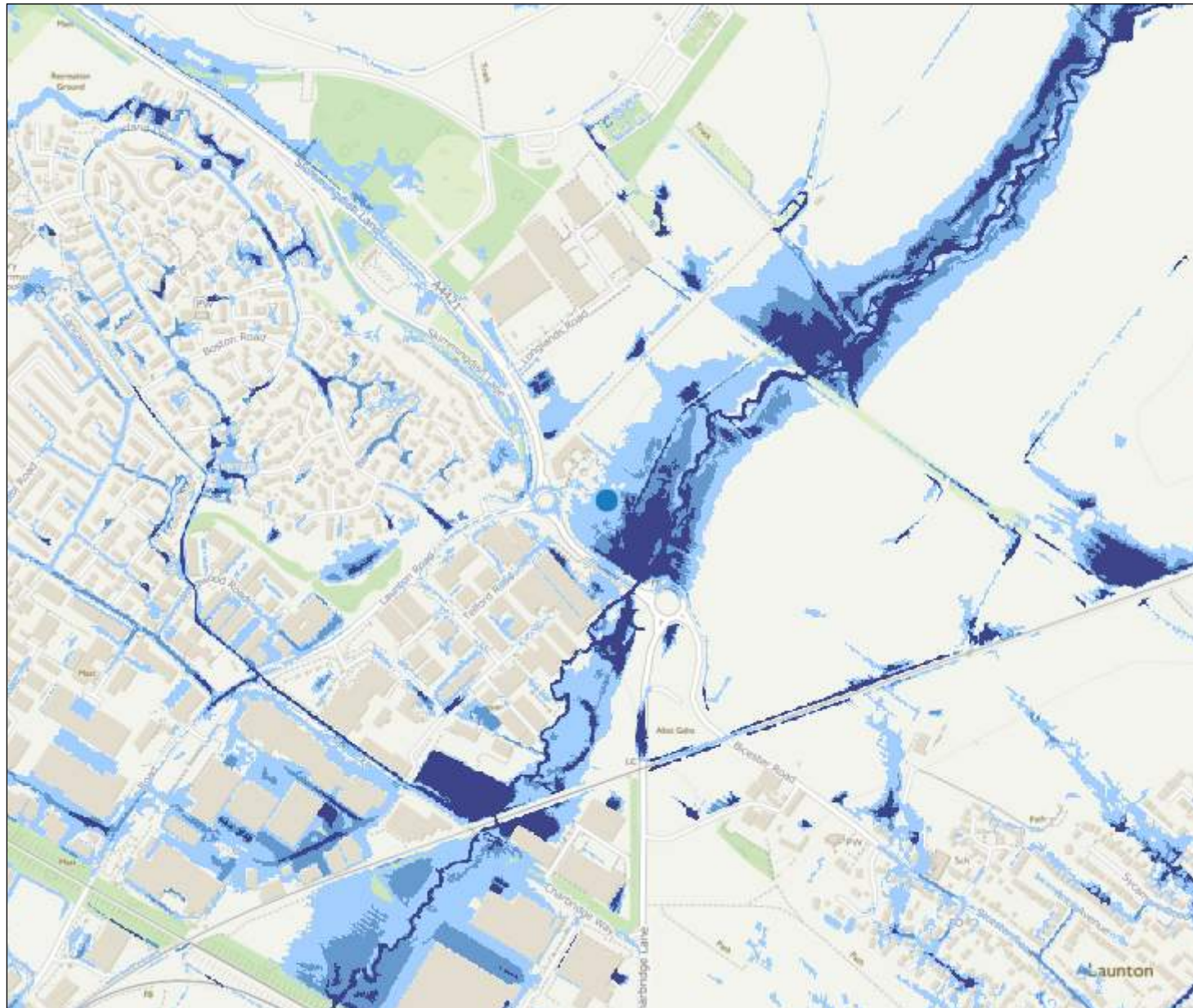
DF = debris factor calculated (0, 0.5, 1 depending on probability that debris will lead to a hazard)

The resultant hazard rating is then classified according to:

Flood Hazard	Colour	Hazard to People Classification
Less than 0.75	Green	Very low hazard - Caution
0.75 to 1.25	Yellow	Danger for some - includes children, the elderly and the infirm
1.25 to 2.0	Orange	Danger for most - includes the general public
More than 2.0	Red	Danger for all - includes the emergency services

REF: HR Wallingford and Environment Agency (May 2008) Supplementary note of flood hazard ratings and thresholds for development planning and control purpose – Clarification of the Table 113.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1

Risk of flooding from Surface Water centred on Skimmingdish Lane, Bicester, OX26 5AF (SM-11/07/2019)



Scale 1:10,000



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium ($3.3\% - 1\%$)
- Low ($1\% - 0.1\%$)
- Very Low

Likelihood of flooding from Surface Water

- High:** Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium:** Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low:** Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low:** Less than 0.1% (1 in 1,000) chance in any given year

This information is shown on the Risk of Flooding from Surface Water map on our website.

Thames Area Climate Change Allowances

Guidance for their use in flood risk assessments

Jan 2017

We recently updated our national guidance on climate change allowances for Flood Risk Assessments. The following information provides additional local guidance which applies to developments within our Thames area boundary.

Climate change allowances - overview

The National Planning Practice Guidance refers planners, developers and advisors to the Environment Agency to our guidance on considering climate change in Flood Risk Assessments. We updated this guidance in February 2016 and it should be read in conjunction with this document to inform planning applications, local plans, neighbourhood plans and other projects. It provides:

- Climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height
- A range of allowances to assess fluvial flooding, rather than a single national allowance
- Advice on which allowances to use for assessments based on vulnerability classification, flood zone and development lifetime

Updated climate change allowances guidance:

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

National Planning Practice Guidance:

<http://planningguidance.communities.gov.uk/>

Assessing climate change impacts on fluvial flooding

Table A below indicates the level of technical assessment of climate change impacts on fluvial flooding appropriate for new developments depending on their scale and location (flood zone). Please note that this should be used as a guide only. Ultimately, the agreed approach should be based on expert local knowledge of flood risk conditions, local sensitivities and other influences.

Applicants and consultants may contact the Environment Agency at the pre-planning application stage to confirm the assessment approach on a case-by-case basis. We provide standard guidance free of charge or bespoke advice for a fee for developments for which we are a statutory consultee. If your development is instead covered by Flood Risk Standing Advice, we recommend you contact the relevant Local Planning Authority for their guidance and confirmation of the assessment approach. Flood Risk Standing Advice can be found here:

<https://www.gov.uk/flood-risk-assessment-local-planning-authorities>

Table A defines three possible approaches to account for flood risk impacts due to climate change in new development proposals:

1. **Basic** - Developer can add an allowance to the 'design flood' (i.e. 1% annual probability) peak levels to account for potential climate change impacts. The allowance should be derived and agreed locally by Environment Agency teams.
2. **Intermediate** - Developer can use existing modelled flood and flow data to construct a stage-discharge rating curve, which can be used to interpolate a flood level based on the required peak flow allowance to apply to the 'design flood' flow.
3. **Detailed** - Perform detailed hydraulic modelling, through either re-running Environment Agency hydraulic models (if available) or construction of a new model by the developer.

Table A – Indicative guide to assessment approach

Vulnerability classification	Flood zone	Assessment by development type		
		Minor	Small-Major	Large-Major
Essential infrastructure	Zone 2	Detailed		
	Zone 3a	Detailed		
	Zone 3b	Detailed		
Highly vulnerable	Zone 2	Intermediate/Basic	Intermediate/Basic	Detailed
	Zone 3a	Not appropriate development		
	Zone 3b	Not appropriate development		
More vulnerable	Zone 2	Basic	Basic	Intermediate/Basic
	Zone 3a	Basic	Detailed	Detailed
	Zone 3b	Not appropriate development		
Less vulnerable	Zone 2	Basic	Basic	Intermediate/Basic
	Zone 3a	Basic	Basic	Detailed
	Zone 3b	Not appropriate development		
Water compatible	Zone 2	None		
	Zone 3a	Intermediate/Basic		
	Zone 3b	Detailed		

Definitions of terms in Table A

Minor

1-9 dwellings/less than 0.5 ha; office/light industrial under 1ha; general industrial under 1 ha; retail under 1 ha; travelling community site between 0 and 9 pitches.

Small-Major

10 to 30 dwellings; office/light industrial 1ha to 5ha; general industrial 1ha to 5ha; retail over 1ha to 5ha; travelling community site over 10 to 30 pitches.

Large-Major

30+ dwellings; office; light industrial 5ha+; general industrial 5ha+; retail 5ha+; gypsy/traveller site over 30+ pitches; any other development that creates a non-residential building or development over 1000 sqm.

Further info on vulnerability classifications:

<http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-2-flood-risk-vulnerability-classification/>

Further info on flood zones:

<http://planningguidance.communities.gov.uk/blog/guidance/flood-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-2-flood-risk-vulnerability-classification/>

Specific local considerations

Where the Environment Agency and the applicant or their consultant has agreed that a basic level of assessment is appropriate, the figures in Table B below can be used as an allowance for potential climate change impacts on peak design (i.e. 1% annual probability) fluvial flood level rather than undertaking detailed modelling.

Table B – Local allowances for potential climate change impacts

Watercourse	Central	Higher central	Upper
Thames	500mm	700mm	1000mm

Use of these allowances will only be accepted after discussion with the Environment Agency.

Fluvial food risk mitigation

Please use the [national guidance](#) to find out which allowances to use to assess the impact of climate change on flood risk.

For planning consultations where we are a statutory consultee and our [Flood Risk Standing Advice](#) does not apply, we use the following benchmarks to inform flood risk mitigation for different vulnerability classifications.

These benchmarks are a guide only. We strongly recommend you contact us at the pre-planning application stage to confirm this on a case-by-case basis. Please note you may be charged for pre-planning advice.

For planning consultations where we are not a statutory consultee or where our Flood Risk Standing Advice does apply, we recommend local planning authorities and developers use these benchmarks but we do not expect to be consulted.

Essential Infrastructure

For these developments, our benchmark for flood risk mitigation is for it to be designed to the **upper end** climate change allowance for the epoch that most closely represents the lifetime of the development, including decommissioning.

Highly Vulnerable

For these developments in flood zone 2, the **higher central** climate change allowance is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **upper end** allowance.

More Vulnerable

For these developments in flood zone 2, the **central** climate change allowance is our minimum benchmark for flood risk mitigation. In flood zone 3 the **higher central** climate change allowance is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **higher central** (in flood zone 2) and the **upper end** allowance (in flood zone 3).

Water Compatible or Less Vulnerable

For these developments, the **central** climate change allowance for the epoch that most closely represents the lifetime of the development is our minimum benchmark for flood risk mitigation. In sensitive locations it may be necessary to use the **higher central** to inform built in resilience, particularly in flood zone 3.

Further info on our Flood Risk Standing Advice:

<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case we may want to check this data and how you propose to use it.

For more information

Please contact our Thames area Customers and Engagement team:

[Enquiries THM@environment-agency.gov.uk](mailto:Enquiries_THM@environment-agency.gov.uk)



SITE LOCATION

LATERAL FLUX

SKIMMINGDISH LANE
BICESTER



THE UNIVERSITY OF

注：本表为初步统计数，仅供参考。



APPENDIX E

AS-BUILT SEWER SURVEY

1. These notes are intended to augment drawings and specifications. Where conflict of requirements exists the order of precedence shall be as shown in the specifications. Otherwise the strictest provision shall govern.
2. This drawing is to be read in conjunction with all other relevant Engineers and Architects drawings.
3. Drawings not to be scaled.
- All dimensions to be checked on site by the Contractor. Any discrepancies to be notified to the Engineer and further instructions obtained before work is commenced.

DRAINAGE

1. All building drainage works shall be carried out in accordance with the current British/European standards BS EN752, (which supports BS 8301 'building drainage'), the current building regulations and the local authority building control or other specifications and requirements.
2. This drawing to be read in accordance with all other relevant drawings, third party drawings, specifications and supporting documentation.
3. Position size and depth of all existing sewers and services shall be established prior to commencement on site.
4. The contractor shall allow for the protection, temporary and permanent support, and temporary and permanent diversion works, as necessary to all existing services.
5. The contractor shall allow for all traffic management in connection with road and sewer works.
6. The contractor shall allow for keeping sewer trenches and excavations as dry as practicable by pumping from temporary sumps, dewatering and well pointing as appropriate. The point and method of discharge to be agreed with the drainage authority.
7. In situ and precast concrete units shall have sulphate resisting Portland cement to BS 4027, unless agreed otherwise with the adopting authority.
8. Precast concrete products shall comply with the relevant provisions of BS 5911 and be kitemarked. Concrete pipes to be class M unless noted otherwise.
9. Verified clay pipes and fittings shall comply with the relevant provisions of BS EN286 and be kitemarked. All pipes shall be extra strength or equivalent BS EN 286 pipe crushing strength.
10. Manhole covers and frames shall comply with the relevant provisions of BS EN 24, have minimum 600 x 600 clear openings with 150 deep frames unless otherwise specified. Manhole covers and frames to be of a non-rocking design with cushion inserts and kitemarked. Load class D400 in vehicular trafficked areas class C250 in areas subject to light slow moving traffic, and load class B125 in footways and pedestrian areas.
11. Gully grates and frames shall comply with the relevant provisions of BS EN 124 and be of a non-rocking design with captive hinge access and be kitemarked. Load class D400 for roads regularly carrying fast moving heavy vehicles. Class C250 to be used in lesser trafficked areas eg. estate roads, cul-de-sacs, residential car parking areas etc. Class B125 used in footways and pedestrian areas.
12. Class 2 bedding detail shall be provided where cover to the pipe barrel is less than 1.2m in vehicular trafficked areas and 0.3m elsewhere, to all road gully connections and within areas of deep rooting vegetation. Where class 2 trench bedding detail is used, the concrete bed and surround shall be discontinued at each pipe joint over the full cross section by means of a shaped compressible filler. (See table)
13. Granular type 1 sub-base to be in accordance with CL 803 of DTP specification for highway works 1991 and laid in accordance with CL 802. No mechanical compaction within 300mm of crown of pipe. Granular type 1 sub-base within 300mm of crown of pipe to be 40mm down.
14. Selected excavated material shall be of a uniform nature free from stones larger than 40mm, clay lumps larger than 75mm, tree roots, organic matter and frozen soil. Mechanically compacted selected excavated material to be compacted in layers with a vibratory roller complying with method 2 of table 6.4 of DTP specification for highway works 1991.
15. Backfill in proposed trafficked areas:-
To be type 1 as note 12.
Backfill in non-trafficked external areas:-
To be selected excavated material as note 13, if regarded as suitable by the contract administrator.
16. Backfilling and reinstatement to trenches in existing public highways shall be in accordance with the requirements and specifications of the highway authority, or, in the absence of such, in accordance with the requirements of 'The street works regulations 1992' and relevant provisions of the U.K. 'specification for the reinstatement of openings in highways' June 1992, both under section 71 of the new roads and street works act 1991.
17. Contractor to take measures to protect his operatives with respect to the presence of gas in sewer trenches and manholes through the use of gas monitoring equipment and breathing apparatus as required.
18. Contractor to apply for sewer permits and road opening permits as necessary from the appropriate authorities, prior to commencing works.

KEY:	
150mm DIA	FOUL WATER PIPE (PRIVATE)
150mm DIA	SURFACE WATER PIPE (PRIVATE)
BACKDROP	BACKDROP
BD	SURFACE WATER MANHOLE
S10	FOUL WATER MANHOLE
PPIC	INSPECTION CHAMBER

SERVICE DUCT KEY:	
ELECTRIC	ELECTRIC
GAS (STEEL COATED UNDER SLAB)	GAS
WATER	WATER
BT	BT

RWP	RAINWATER PIPE
G	GULLY
CHANNEL	DRAINAGE CHANNEL
RE	RODDING EYE

LAYOUT SUBJECT TO:

1. DETAILED HYDRAULIC MODELLING.
 2. ABOVE GROUND DRAINAGE DESIGN LAYOUT AND FLOWRATES.
- NOTE: FURTHER SITE PERCOLATION TESTS TO DETERMINE SOIL INFILTRATION RATES.

FOUL WATER MANHOLE SCHEDULE										CO-ORDINATES	
MANHOLE REF.	DEPTH TO INVERT (m)	COVER LEVEL (m)	INVERT LEVEL (m)	CHAMBER TYPE	CHAMBER SIZE (mm)	COVER TYPE	COVER SIZE (mm)	COMMENTS		EASTING	NORTHING
PPIC 1	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 2	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 3	0.800m	70.000m	69.200m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 4	0.710m	69.850m	69.140m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 5	0.675m	69.850m	69.175m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 6	0.800m	69.850m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 7	0.855m	70.000m	69.145m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 8	0.630m	69.800m	69.170m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 9	0.450m	69.600m	69.150m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 10	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 11	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 12	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
FW01	0.630m	69.500m	69.870m	PC CONC	1050 Ø	CLASS A15	600 Ø			-m	-m
FW02	1.435m	70.000m	68.565m	PC CONC	1050 Ø	CLASS A15	600 Ø			-m	-m
FW03	1.680m	69.500m	67.820m	PC CONC	1200 Ø	CLASS A15	600 Ø			-m	-m
FW04	2.200m	69.600m	67.400m	PC CONC	1200 Ø	CLASS A15	600 Ø			-m	-m
FW05	2.365m	69.600m	67.235m	PC CONC OR BY PUMP MANUFACTURER	1350 Ø	CLASS A15	600 Ø	PUMP CHAMBER		-m	-m

NOTE: MANHOLE CLASS MAY NEED TO BE INCREASED TO D400 IF THEY ARE TO BE TRAFFICED OVER BY HEAVY PLANT DURING CONSTRUCTION

DRAINAGE LAYOUT
SCALE 1:100

!! NOTE !!
"WATERPROOF GEOMEMBRANE TO BE SINGLE LAYER COLD APPLIED ROBUST WELDED FLEXIBLE MEMBRANE AS PER SPECIFICATION SUITABLE FOR WATERPROOFING TO STRUCTURES AND FOR WATER CONTAINMENT. MEMBRANE TO BE NOMINAL 1MM THICK LAID WITH MINIMUM 120MM LAPS AND WELDED SEAMS".

E	AS BUILT ISSUE	JE	01.06.15
D	SERVICE DUCTS SHOWN, FWD5 MOVED TO DRAWING S501	AC	09.05.14
C	SURFACE WATER DRAINAGE UPDATED	AR	13.02.14
B	UPDATED TO NEW ARCHITECT FLOOR PLAN, MANHOLE DETAILS ADDED, SURFACE WATER LAYOUT AMENDED, NOTES ADDED WHERE SHOWN.	AC	24.01.14
A	INITIAL ISSUE	AC	17.09.13
-	DETAILS	AC	09.08.13
REV	DETAILS	BY	DATE

NATURAL ISSUE BASED ON ARCHITECTS DRAWING - OMNI ARCHITECTS C-L-01

arcengineers
CONSULTING STRUCTURAL AND CIVIL ENGINEERS
602 CITY MILLS, PEEL STREET, LEEDS, LS27 8OL
Phone: 0113 253 3904 Fax: 0871 714 6751
www.arc-engineers.co.uk

CLIENT:	MMCG
PROJECT:	PROPOSED 60 NURSING HOME SKIMMINGDISH LANE, BICESTER

TITLE
DRAINAGE LAYOUT

DRAWING STATUS
AS BUILT

DRAWN:	AC	DATE:	AUGUST 2013
CHECKED:	LF	DATE:	AUGUST 2013
SCALE & SIZE:	1:100 @ A0		

DRAWING No.	13 105 -S 500	REV	E
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DO NOT SCALE

GENERAL

- These notes are intended to augment drawings and specifications. Where conflict of requirements exists the order of precedence shall be as shown in the specifications. Otherwise the strictest provision shall govern.
- This drawing is to be read in conjunction with all other relevant Engineers and Architects drawings.
- Drawings not to be scaled.
All dimensions to be checked on site by the Contractor. Any discrepancies to be notified to the Engineer and further instructions obtained before work is commenced.

DRAINAGE

- All building drainage works shall be carried out in accordance with the current british/european standards BS EN752, (which supports BS8301 "building drainage"), the current building regulations and the local authority building control or rhibc specifications and requirements.
- This drawing to be read in accordance with all other relevant drawings, third party drawings, specifications and supporting documentation.
- Position size and depth of all existing sewers and services shall be established prior to commencement on site.
- The contractor shall allow for the protection, temporary and permanent, support, and temporary and permanent diversion works, as necessary to all extg services.
- The contractor shall allow for all traffic management in connection with road and sewer works.
- The contractor shall allow for keeping sewer trenches and excavations as dry as practicable by pumping from temporary sumps, dewatering and well pointing as appropriate. The point and method of discharge to be agreed with the drainage authority.
- In situ and precast concrete units shall have sulphate resisting portland cement to BS 4027, unless agreed otherwise with the adopting authority.
- Precast concrete products shall comply with the relevant provisions of BS 5911 and be kitemarked. concrete pipes to be class m unless noted otherwise.
- Vitrified clay pipes and fittings shall comply with the relevant provisions of BS EN286 and be kitemarked. all pipes shall be extra strength or equivalent BS EN 286 pipe crushing strength.
- Manhole covers and frames shall comply with the relevant provisions of BS EN124, have minimum 600 x 600 clear openings with 150 degree frames unless otherwise specified. Manhole covers and frames to be of a non-rocking design with cushion inserts and kitemarked. Load class D400 in vehicular trafficked areas class C250 in areas subject to light slow moving traffic, and load class B125 in footways and pedestrian areas.
- Gully grates and frames shall comply with the relevant provisions of BS EN 124 and be of a non-rocking design with captive hinge access and be kitemarked. Load class D400 for roads regularly carrying fast moving heavy vehicles. Class C250 to be used in lesser trafficked areas eg. estate roads, cul-de-sacs, residential car parking areas etc. Class B125 used in footways and pedestrian areas.
- Class 2 bedding detail shall be provided where cover to the pipe barrel is less than 1.2m in vehicular trafficked areas and 0.9m elsewhere, to all road gully connections and within areas of deep rooting vegetation. Where class 2 trench bedding detail is used, the concrete bed and surround shall be discontinued at each pipe joint over the full cross section by means of a shaped compressible filler. (See table)
- Granular type 1 sub base to be in accordance with CL 803 of DTP specification for highway works 1991 and laid in accordance with CL 802. No mechanical compaction within 300mm of crown of pipe. Granular type 1 sub base within 300mm of crown of pipe to be 40mm down.
- Selected excavated material shall be of a uniform nature free from stones larger than 40mm, clay lumps larger than 75mm, tree roots, organic matter and frozen soil. Mechanically compacted selected excavated material to be compacted in layers with a vibratory roller complying with method 2 of table 6/4 of DTP specification for highway works 1991.
- Backfill in proposed trafficked areas:-
To be type 1 as note 12.
Backfill in non-trafficked external areas:-
To be selected excavated material as note 13, if regarded as suitable by the contract administrator.
- Backfilling and reinstatement to trenches in existing public highways shall be in accordance with the requirements and specifications of the highway authority, or, in the absence of such, in accordance with the requirements of "the street works regulations 1992" and relevant provisions of h.a.u.c. "specification for the reinstatement of openings in highways" June 1992, both under section 71 of the new roads and street works act 1991.
- Contractor to take measures to protect his operatives with respect to the presence of gas in sewer trenches and manholes through the use of gas monitoring equipment and breathing apparatus as required.
- Contractor to apply for sewer permits and road opening permits as necessary from the appropriate authorities, prior to commencing works.

- KEY:
- 150mm DIA FOUL WATER PIPE (PRIVATE)
 - 150mm DIA SURFACE WATER PIPE (PRIVATE)
 - BACKDROP
 - BD
 - S10 SURFACE WATER MANHOLE
 - F9 FOUL WATER MANHOLE
 - PPIC INSPECTION CHAMBER

SERVICE DUCT KEY:

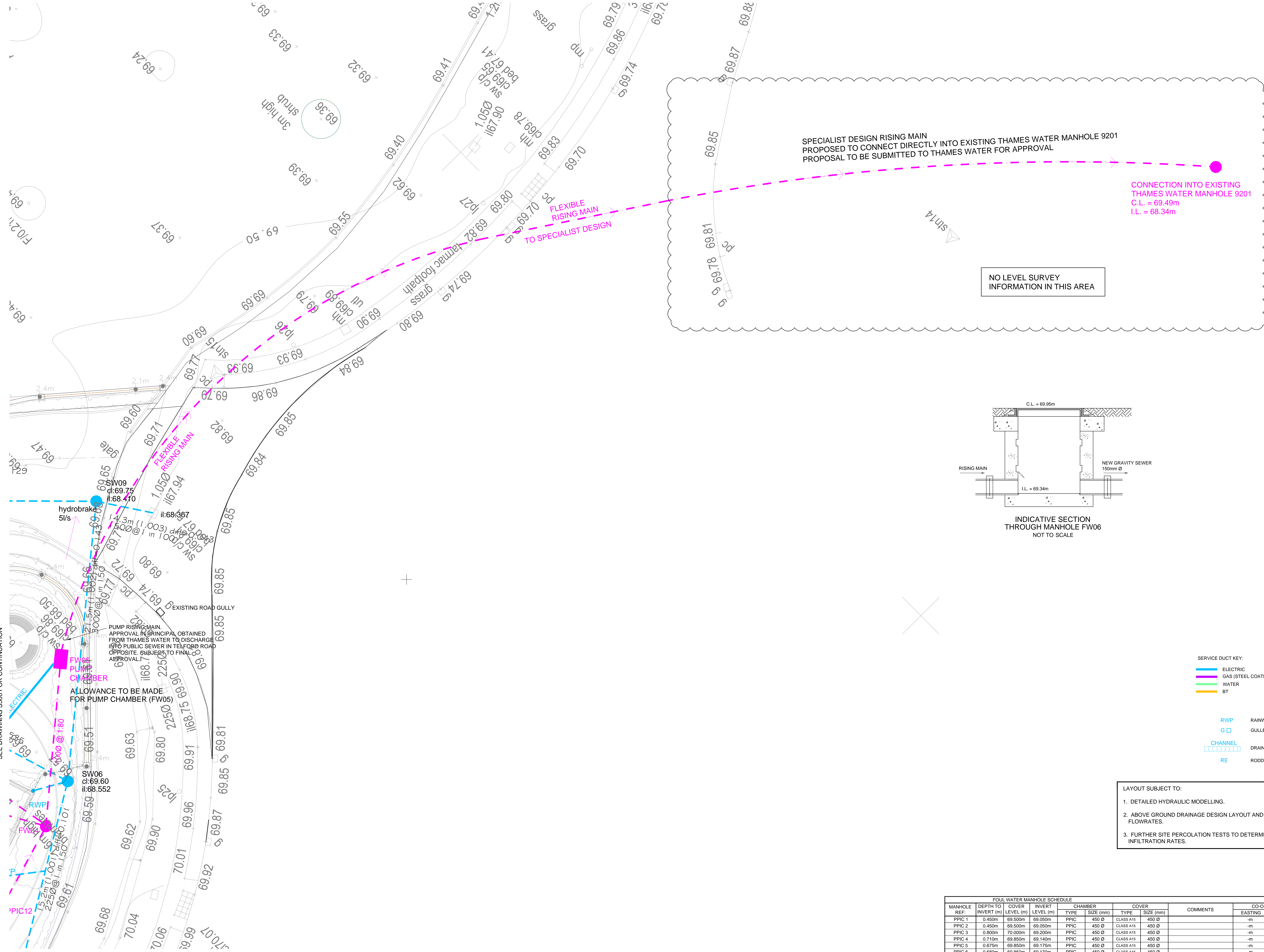
- ELECTRIC
- GAS (STEEL COATED UNDER SLAB)
- WATER
- BT
- RWP RAINWATER PIPE
- G GULLY
- CHANNEL DRAINAGE CHANNEL
- RE RODDING EYE

LAYOUT SUBJECT TO:

- DETAILED HYDRAULIC MODELLING.
- ABOVE GROUND DRAINAGE DESIGN LAYOUT AND FLOWRATES.
- FURTHER SITE PERCOLATION TESTS TO DETERMINE SOIL INFILTRATION RATES.

FOUL WATER MANHOLE SCHEDULE										CO-ORDINATES	
MANHOLE REF:	DEPTH TO INVERT (m)	COVER LEVEL (m)	INVERT LEVEL (m)	CHAMBER TYPE	SIZE (mm)	COVER TYPE	SIZE (mm)	COMMENTS		EASTING	NORTHING
PPIC 1	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 2	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 3	0.800m	70.000m	69.200m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 4	0.710m	69.850m	69.140m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 5	0.675m	69.850m	69.175m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 6	0.680m	69.850m	69.170m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 7	0.855m	70.000m	69.145m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 8	0.630m	69.800m	69.170m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 9	0.450m	69.600m	69.150m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 10	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 11	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
PPIC 12	0.450m	69.500m	69.050m	PPIC	450 Ø	CLASS A15	450 Ø			-m	-m
FW01	0.630m	69.500m	69.870m	PC. CONC	1050 Ø	CLASS A15	600 Ø			-m	-m
FW02	1.435m	70.000m	68.565m	PC. CONC	1050 Ø	CLASS A15	600 Ø			-m	-m
FW03	1.680m	69.500m	67.820m	PC. CONC	1200 Ø	CLASS A15	600 Ø			-m	-m
FW04	2.290m	69.500m	67.210m	PC. CONC	1200 Ø	CLASS A15	600 Ø			-m	-m
FW05	2.365m	69.500m	67.135m	PC. CONC	1500 Ø	CLASS A15	600 Ø	PUMP CHAMBER		-m	-m

NOTE:
MANHOLE CLASS MAY NEED TO BE INCREASED TO D400 IF THEY ARE TO BE TRAFFICKED OVER BY HEAVY PLANT DURING CONSTRUCTION



SEE DRAWING S500 FOR CONTINUATION

SEE DRAWING S500 FOR CONTINUATION

DRAINAGE LAYOUT
SCALE 1:100

!! NOTE !!
"WATERPROOF GEOMEMBRANE TO BE SINGLE LAYER COLD APPLIED ROBUST WELDED FLEXIBLE MEMBRANE AS PER SPECIFICATION SUITABLE FOR WATERPROOFING TO STRUCTURES AND FOR WATER CONTAINMENT. MEMBRANE TO BE NOMINAL 1MM THICK LAID WITH MINIMUM 120MM LAPS AND WELDED SEAMS".

B	AS BUILT ISSUE	JE	01.06.15
A	FWG OMITTED - CONNECTION INTO EXISTING TBC BY THAMES	LF	20.02.15
-	INITIAL ISSUE	AC	09.05.14
REV	DETAILS	BY	DATE

NATURAL ISSUE BASED UPON ARCHITECT'S DRAWING - OMNI ARCHITECTS C-L-01

arcengineers
CONSULTING STRUCTURAL AND CIVIL ENGINEERS
GF 02 CITY MILLS, PEEL STREET, LEEDS, LS27 8QL
Phone: 0113 253 3904 Fax: 0871 714 6751
www.arc-engineers.co.uk

CLIENT: **MMCG**

PROJECT: **PROPOSED 60 NURSING HOME
SKIMMINGDISH LANE, BICESTER**

TITLE: **DRAINAGE LAYOUT
SHEET 2**

DRAWING STATUS: **AS BUILT**

DRAWN: AC DATE: MAY 2014
CHECKED: PW DATE: MAY 2014
SCALE & SIZE: 1:100 @ A0

DRAWING No: 13 105 -S 501
REV: B



APPENDIX F

27TH MARCH 2021 ENVIRONMENT AGENCY

CORRESPONDENCE

Mr Colin Whittingham - Associate
Director BSc (Hons) MSc MCIWEM
C.WEM AIEMA
RSK Ltd
14 Beecham Court
Wigan
WN3 6PR

Our ref: ENVPAC/1/THM/00288
WA/2019/127024/07-L01

Date: 21 July 2020

Dear Mr Whittingham

Flood Risk Advice

Skimmingdish Lane, Bicester

Thank you for consulting us. We have reviewed the following document:

- Email from Colin Whittingham (RSK), dated 03 June 2020 with following attached drawings:
 - Drawing – Site Levels
- Email from Colin Whittingham (RSK), dated 01 July 2020 with following attached drawings:
 - Drawing – Site Levels (with compensation details)

We are pleased to see that your email dated 03 June 2020 confirms that the FFL of the new building will be set above the 1 in 100 year plus 35% flood level. You have stated that the access road, parking areas and the FFL's of the store will be set at either the existing ground level or below. Given the proposed use of this building we find this to be satisfactory. However, please note that the LPA is responsible for making an assessment as to whether safe access/egress is acceptable.

Your email dated 01 July 2020 outlines how you propose to compensate for the loss of flood storage. As stated previously, we expect compensation to be provided on a level for level basis up to the 1 in 100 plus 35% flood level.

You have stated that you intend to provide compensation via two approaches:

- 1) Underground Tank Storage (Compensation - 30m3)
- 2) Lowering of high ground to the east of the site (Compensation – 11.3m3)

As stated in previous correspondence, the underground tank approach is not something we would normally accept. An engineering solution such as this raises maintenance

Cont/d..

issues and is unlikely to operate as effectively as other approaches in maintaining the existing flood mechanisms.

For example, if the tank was to fill with silt and/or not be maintained properly then it would stop acting as effective storage.

However, given that the flood volumes the tank is mitigating for is not huge we are willing to consider it as a solution but we need to see much more detail of how it will function before we can sign it off as acceptable.

From the information provided we can't at this stage fully understand how it's going to function and also whether it provides true level for level compensation up to the 1 in 100 plus 35% flood level. Therefore, I can't at this stage provide any guarantees that it will be acceptable.

We suggest that a detailed technical note is provided for the tank and this is submitted for us to review. This needs to include detailed design drawings of the tank and how it sits within the development. This technical note could also include details of the land in the east of the site that is to be lowered.

One final thing to note is that the emails and drawings you submitted contradict themselves in relation to levels. Your email states that FFL will be set at or above the 1 in 100 plus 35% flood level. However, *Drawing – Site Levels (with compensation details)* states that the 1 in 100 year level is 69.750 metres AOD which is the same as your FFL. This is either a typo or the FFL is set at the 1 in 100 year level and needs to be raised higher.

All the above information will eventually have to be compiled within a detailed Flood Risk Assessment (FRA) to support any future planning submission.

Yours sincerely,

Mr Jack Moeran
Planning Specialist

Direct dial 02030259655

Direct e-mail planning-wallington@environment-agency.gov.uk

Disclaimer

Please note that the views expressed in this report by the Environment Agency, is a response to a pre-application enquiry only and **does not represent our final view in relation to any future statutory consultations made in relation to this site**. We reserve the right to change our position in relation to any such application. You should seek your own expert advice in relation to technical matters relevant to any conditions before submission.

Mr Colin Whittingham - Associate
Director BSc (Hons) MSc MCIWEM
C.WEM AIEMA
RSK Ltd
14 Beecham Court
Wigan
WN3 6PR

Our ref: ENVPAC/1/THM/00288
WA/2019/127024/08-L01

Date: 09 September 2020

Dear Mr Whittingham

Flood Risk Advice

Skimmingdish Lane, Bicester

Thank you for consulting us. We have reviewed the following document:

- Email from Colin Whittingham (RSK), dated 18 August 2020

The email provides design details of the tank. We have the following comments:

You have stated the level of the inlet will be set 25mm below the level of 69.750m AOD (the 1 in 100+35% flood level). If the inlet is set at this level then it won't be providing any compensation in lower order events. It will only provide compensation during the most extreme event.

The problem as highlighted previously is that mitigation in the form of tanked systems tend to not to provide true level for level compensation as required. The compensation you are proposing won't be compensating for lower order flood events.

I think you need to carry out some further work to try to more accurately mimic the natural filling of the floodplain using the tank system. For example, compartmentalising the tanks and filling each at a different inlet level. Thus replicating better the natural filling of the floodplain.

We are pleased to see that you have confirmed that the FFL's of the building will be set at 69.750m (100 year plus 35% climate change level).

In our previous correspondence we requested that a detailed technical note is provided for the tank and this is submitted for us to review. This needs to include detailed design drawings of the tank and how it sits within the development. This drawing you provided includes some of this detail but I would expect a short technical note to accompany it which clearly explains how it will function, be maintained etc.

Cont/d..

Therefore, whilst the email and attached drawing improves are understanding we will still need further detailed design drawings of the tank to be in position to give a view on its acceptability.

Thanks,

Mr Jack Moeran
Planning Specialist

Direct dial 02030259655

Direct e-mail planning-wallingford@environment-agency.gov.uk

Disclaimer

Please note that the views expressed in this report by the Environment Agency, is a response to a pre-application enquiry only and **does not represent our final view in relation to any future statutory consultations made in relation to this site**. We reserve the right to change our position in relation to any such application. You should seek your own expert advice in relation to technical matters relevant to any conditions before submission.

Colin Whittingham

To: Colin Whittingham
Subject: FW: Cost Recovered Advice: Skimmingdish Lane, Bicester : ENVPAC/1/THM/00288 Ver 4

From: Planning_THM <Planning_THM@environment-agency.gov.uk>
Sent: 27 March 2020 08:00
To: Kristian Jackson <KJackson@rsk.co.uk>
Subject: RE: Cost Recovered Advice: Skimmingdish Lane, Bicester : ENVPAC/1/THM/00288 Ver 4

Hi Kris,

I'm please to confirm that the information you have provided has now addressed our final concern.

We now deem the model as fit for purpose and suitable for use in support of a planning application.

Please see updated review document attached.

Thanks,

Jack Moeran

[FCRM Planning Specialist](#)

PSO - Thames Area

ext: 02030259655

Speak to us early about environmental issues and opportunities - We can provide a free pre-application advice note or for more detailed advice / meetings / reviews we can provide a project manager to coordinate specialist advice / meetings which costs £100 per hour plus VAT. For more information email us at planning_THM@environment-agency.gov.uk



APPENDIX G

13TH SEPTEMBER 2021 ENVIRONMENT

AGENCY CORRESPONDENCE

Cherwell District Council
Planning & Development Services
Bodicote House White Post Road
Bodicote
Banbury
OX15 4AA

Our ref: WA/2021/129266/01-L01
Your ref: 21/02286/F
Date: 13 September 2021

Dear Sir/Madam

Construction of a coffee unit with drive-thru facility and indoor seating with associated access, car parking, landscaping and servicing parking

Land North West of Launton Road roundabout adjoining Skimmingdish Lane, Caversfield

Thank you for consulting us on the above application on 09 August 2021. Please accept my apologies for the delay in responding.

Environment Agency position

The development site is at risk of flooding and in the absence of an acceptable Flood Risk Assessment (FRA) we **object** to this application and recommend that planning permission is refused.

Reason

The submitted FRA does not comply with the requirements for site-specific flood risk assessments, as set out in paragraphs 30 to 32 of the Flood Risk and Coastal Change section of the planning practice guidance. The FRA does not therefore adequately assess the flood risks posed by the development and the development as proposed will increase the risk of flooding. In particular, the FRA fails to:

- Provide appropriate mitigation for the loss of flood storage to ensure the development does not increase the risk of flooding to the site and the surrounding area.

The application is contrary to paragraph 163 of the National Planning Policy Framework and Local Plan Policy ESD6

Overcoming our objection

To overcome our objection, the applicant should amend the proposal and submit a revised FRA which addresses the points highlighted above.

If this cannot be achieved, we are likely to maintain our objection. Please re-consult us on any revised FRA submitted and we'll respond within 21 days of receiving it.

In this instance, the applicant proposes to provide flood storage compensation for the loss of flood storage as a result of the development through the use of storage tanks in combination with some lowering of ground levels. The detail presented within the FRA is insufficient for the following reasons:

- Proposes a method of compensation storage in tanks which is inappropriate to the storage size required;
- Fails to demonstrate that storage tanks can be adequately maintained (free of silt and debris) and thus fulfil the flood storage requirement over the lifetime of the development;
- Fails to demonstrate on a level for level basis that sufficient compensation storage has been provided;
- Fails to provide sufficient information comparing existing and proposed levels across the site to demonstrate where flood storage is lost;
- Fails to provide details of the ground lowering required to provide the 11.3m³ compensation storage element within the higher ground to the east of the development as mentioned in Section 4.3 of the FRA.

Our letter reference ENVPAC/1/THM/00288, WA/2019/127024/07-L01 dated 21st July 2020, as presented in Appendix F of the Flood Risk Assessment (FRA) states:

'As stated in previous correspondence, the underground tank approach is not something we would normally accept. An engineering solution such as this raises maintenance issues and is unlikely to operate as effectively as other approaches in maintaining the existing flood mechanisms.'

For example, if the tank was to fill with silt and/or not be maintained properly then it would stop acting as effective storage.'

However, given that the flood volumes the tank is mitigating for is not huge we are willing to consider it as a solution but we need to see much more detail of how it will function before we can sign it off as acceptable'

At that time the assessment of the compensation storage required for the tank system was 30m³. We note that that requirement has now more than doubled to 66m³. We consider tanks to be inappropriate for this size of compensation storage. We would prefer a void undercroft to the proposed building/development and we urge the applicant to re-consider the proposed design.

The underground tank approach is not something we would normally accept. In cases such as this, where there is limited space to provide land level adjustment to provide the necessary level for level flood storage compensation volumes, we would normally only considered an open void beneath the building appropriate so long as it met our criteria and was acceptable to the local planning authority.

If the development can be arranged such that the tanked storage required is much smaller, more akin to what was previously proposed, then we could consider it further. However, the applicant needs to demonstrate that it can be easily inspected to determine if silt is present in the tanks and accessed to allow any silt accumulation to be removed such that the tanks can be adequately maintained to provide effective flood

storage over the lifetime of the development. The present details within the FRA are insufficient, they do not show any access for maintenance/inspection to the tanks or any method of removing silt accumulation from the tanks.

Details have not been provided of the ground lowering proposed outside the 1% Annual Exceedance Probability (AEP) flood outline, including a 35% allowance for climate change, to provide the 11.3m³ element of floodplain compensation storage to the east of the development, as described in Section 4.3 of the FRA. This has not therefore been demonstrated to be achievable.

The FRA has not presented calculations to demonstrate, on a level for level basis, that the flood storage lost to the development is mitigated by the flood compensation proposed. Level for level compensation is the matching of volumes lost to the floodplain, through increases in built footprint, with new floodplain volume by reducing ground levels or in this case also providing tanks. Please note for reducing ground levels to be achievable it requires land on the edge of the floodplain and above the 1% climate change extent to be available. A comparison of ground levels (topographical survey) with modelled flood levels will show land which may be available above this level.

In this instance, due to the relatively narrow band of flood levels for a range of annual probabilities, the applicant should consider the floodplain storage lost and gained in vertical level increments of 0.1m between the lowest existing ground level and the 1% AEP (1 in 100 year) flood level, including an appropriate allowance for climate change. Where tanks are proposed as providing compensation storage, within the level for level calculation, their volume is effective in the level increment in which they start to fill. For the mitigation to be successful it should be demonstrated that there is no net loss of floodplain storage in any 0.1m level increment. Advice on our requirements is provided below together with those for voids beneath buildings.

We note also that the Drainage Strategy incorrectly states that the site lies in Flood Zone 1.

Floodplain Compensation

The flood storage lost to the increased building footprint or raised ground levels could be mitigated by the provision of compensation storage. Such mitigation could take the form of level for level floodplain compensation storage (preferable) or an undercroft (void) under the proposed building. Both have to meet specific Environment Agency requirements to be acceptable:

Level for Level Floodplain Compensation Storage (Preferable)

Level for level compensation is the matching of volumes lost from the floodplain due to increases in built footprint or raised ground levels, with new floodplain volume by reducing ground levels elsewhere. Analysis should be presented in the FRA as a table showing the volumes lost to the development in approximately 100mm increments of level and the volumes gained by the mitigation proposed in the same level increments. It should be demonstrated that there is no loss of floodplain volume in any increment of level, and preferably a net gain (see attached diagram).

Please note for this to be achievable, it requires land on the edge of the floodplain and above the 1% AEP, including an appropriate allowance for climate change, flood extent.

The FRA should consider whether level for level compensation is possible and if not explain why and detail how any associated risks from the chosen form of mitigation can

be minimised.

Undercroft (To be used only when level for level floodplain compensation storage has been demonstrated not to be possible)

If the applicant proposes voids under the building to mitigate the loss of floodplain storage, the design of the voids should adhere to the following guidance:

If voids under the dwelling are proposed, they should extend from the ground level, with the underside of the void (soffit) at or above the 1% annual probability (1 in 100 year) flood level with a 35% allowance for climate change. There should be a 1 metre wide void opening in every 5 metre length of wall on all sides of the building. Void openings should extend vertically from existing ground level to at least the 1% annual probability (1 in 100 year) flood level with a 35% allowance for climate change. The void should be open and maintained as such in perpetuity. If the void openings are a security risk, then vertical steel bars placed at 100mm centres can be installed. Louvres or slats, as an alternative to bars, are not permitted over the openings due to the increased risk of debris blockage.

The LPA must also be satisfied that they can enforce a condition to maintain the voids as designed and that an adequate maintenance plan is in place to ensure the voids remain open for the life time of the development.

Advice to Planning Authority/applicant

Sequential test

In accordance with the National Planning Policy Framework (paragraph 158), development should not be permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding.

It is for the local planning authority to determine if the sequential test has to be applied and whether or not there are other sites available at lower flood risk. Our flood risk standing advice reminds you of this and provides advice on how to apply the test.

Car parking

This development has been proposed within an area identified as being at risk of flooding, and includes the provision of car parking. The applicant should be aware that vehicles can start to float in flood depths of less than 60cm – less if it is fast-flowing. The applicant must satisfy themselves that any relevant building will be constructed in such a way that vehicles floating or displaced as a result of flooding, would not jeopardise its structural stability.

In addition, the applicant should ensure that any sensitive infrastructure such as gas and water pipes or electrical cabling are located and designed to withstand the potential impacts of floating or displaced vehicles.

Safety

The following issues are not within our direct remit or expertise, but nevertheless are important considerations for managing flood risk for this development. Prior to deciding this application we recommend that consideration is given to the issues below. Where necessary, the advice of relevant experts should be sought.

- Adequacy of rescue or evacuation arrangements
- Details and adequacy of an emergency plan
- Details and adequacy of flood proofing and other building level resistance and resilience measures
- Details and calculations relating to the structural stability of buildings during a flood

- Whether insurance can be gained or not
- Provision of an adequate means of surface water disposal such that flood risk on and off-site isn't increased

Closing comments

If you are minded to approve the application contrary to our objection, please contact us to explain why material considerations outweigh our objection. This will allow us to make further representations. Should our objection be removed, it is likely we will recommend the inclusion of a condition/conditions on any subsequent approval.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

Yours faithfully

Miss Sarah Green
Sustainable Places - Planning Advisor

Direct dial 0208 474 9253

Direct e-mail planning_THM@environment-agency.gov.uk

Colin Whittingham

From: Colin Whittingham
Sent: 06 October 2021 16:15
To: Planning_THM@environment-agency.gov.uk
Cc: Kristian Jackson
Subject: FW: CONSULTATION RESPONSE : 21/02286/F Our ref : WA/2021/129266/01
Attachments: 129266.pdf; Floodplain compensation (level-for-level guidance).pdf

Follow Up Flag: Follow up
Flag Status: Flagged

We have worked up a slightly different scheme for this site based on the attached comments

Whilst I appreciate you will need to see the details of the scheme (currently still being worked up), I would like to keep you informed that we have reworked the ground levels on the site and made some adjustments to closer reflect the current levels. This has resulted in a reduced requirement for the flood compensation.

The results area as follows:

(Net volumes

+ figures show volume loss and

– figures show volume gain)

69.750-69.650 18.92m³

69.650-69.550 17.58m³

69.550-69.450 -17.38m³

69.450-69.350 -52.31m³

69.350-69.250 -33.10m³

69.250-69.150 -2.37m³

It can be seen from this that during the lower flood depth events, the reworked scheme will actually offer an increased floodplain volume (in the region of 105.16m³). Once the flood level reaches 69.550m AOD and above there will be a requirement to offer the flood compensation in the tanked based system as previously discussed. With the revised scheme the total volume requirement will be 17.58 + 18.92 = 36.5m³. This will be provided in an underground tank with inlets at the required levels to make sure this offers the volume requirement at the level it is lost.

This volume of 36.5m³ is a little more than previously agreed, but significantly down from the previous proposals. It also offers upto 105.16m³ of additional volume in the lesser events which should certainly be seen as a benefit.

If you have any concerns about the above could you please let me know ASAP

Colin Whittingham

Associate Director BSc (Hons) MSc MCIWEM C.WEM PIEMA

RSK

Land & Development Engineering

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Before printing think about your responsibility and commitment to the ENVIRONMENT!

From: Planning_THM <Planning_THM@environment-agency.gov.uk>
Sent: 13 September 2021 13:33
To: rebekah.morgan@cherwell-dc.gov.uk; Cherwell <planning@cherwell-dc.gov.uk>
Cc: Kristian Jackson <KJackson@rsk.co.uk>
Subject: CONSULTATION RESPONSE : 21/02286/F Our ref : WA/2021/129266/01

Thank you for consulting the Environment Agency, our response is attached.

If you would like to discuss this further, please contact me directly on the number below or by email.

Please quote our reference number in any future correspondence.

Kind regards,

Sarah Green

Planning Advisor, Thames Sustainable Places Team

Environment Agency, Red Kite House, Wallingford, OX10 8BD

Planning_THM@environment-agency.gov.uk

Tel : 0208 474 9253

Normal working hours:

MON/TUE/WED/FRI 10am – 2pm

THUR 10am – 5pm

Speak to us early about environmental issues and opportunities – We can provide a free pre-application advice note or for more detailed advice or meetings we can provide a project manager to co-ordinate specialist advice which costs £100 per hour + VAT. For more information, please email us at planning_THM@environment-agency.gov.uk



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APPENDIX H

9TH DECEMBER 2021 ENVIRONMENT AGENCY CORRESPONDENCE

Cherwell District Council
Planning & Development Services
Bodicote House White Post Road
Bodicote
Banbury
OX15 4AA

Our ref: WA/2021/129266/02-L01
Your ref: 21/02286/F
Date: 09 December 2021

Dear Sir/Madam

Construction of a coffee unit with drive-thru facility and indoor seating with associated access, car parking, landscaping and servicing parking

Land north west of Launton Road roundabout adjoining Skimmingdish Lane, Caversfield

Thank you for consulting us on the above application on 22 October 2021, following the submission of additional details.

We have considered the following details in making this response:

- Letter, reference P680020-FRA L01, dated 13th October 2021 from RSK LDE LIMITED to Cherwell District Council.
- Drawing 220029/FV100 revision P1, FLOOD VOLUMES SECTION LAYOUT PLAN.
- Drawing 220029/FV101 revision P3, FLOOD VOLUMES SECTIONS 1 OF 3
- Drawing 220029/FV102 revision P3, FLOOD VOLUMES SECTIONS 2 OF 3
- Drawing 220029/FV103 revision P3, FLOOD VOLUMES SECTIONS 3 OF 3

These revised details have reduced the underground storage tank requirement to 36.5m³. While this is less than previously proposed, it is still substantially more than we agreed with the applicant during pre-application discussions and we are not satisfied that this method in this volume is acceptable.

In addition, we note that the excavation required to provide the proposed floodplain compensation area is detailed only on cross sections. Without a plan it is hard to establish whether the information shown on the sections is practical and achievable. It will be necessary for the applicant to submit a plan showing the floodplain compensation storage area and detail the ground levels required for the area, consistent with the sections.

The submitted detail is not sufficient to address our earlier concerns. We therefore **maintain our objection** as set out in our response dated 13 September 2021.

Overcoming our objection

To overcome our objection, the applicant should amend the proposal and submit a revised FRA which addresses our concerns. If this cannot be achieved, we are likely to maintain our objection.

Please re-consult us on any revised FRA submitted and we'll respond within 21 days of receiving it.

During pre-application discussion with the applicant, it was agreed that flood storage for the tank system would equate to 30m³. While the tanked storage now required is significantly less than previously proposed, a system of 36.5m³ is a 20% increase over the agreed proposal. We consider this to be inappropriate for this level of compensation. We have previously advised on the use of open voids within the design of the building as a possible solution, however the applicant has discounted this due to other constraints. Therefore, additional land suitable for level for level flood storage should be sought or the development revised to reduce the amount of flood storage being lost.

Closing comments

If you are minded to approve the application contrary to our objection, please contact us to explain why material considerations outweigh our objection. This will allow us to make further representations. Should our objection be removed, it is likely we will recommend the inclusion of a condition/conditions on any subsequent approval.

Please refer to our previous response dated 13 September 2021 for additional advice.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

Yours faithfully

Miss Sarah Green
Sustainable Places - Planning Advisor

Direct dial 0208 474 9253

Direct e-mail planning_THM@environment-agency.gov.uk



Our ref: P680020-FRA L02
Your ref: 21/02286/F

14, Beecham Court,
Pemberton Business Park,
Wigan,
WN3 6PR
UK

24th December 2021

Telephone: +44 (0)1942 493255
www.rsk.co.uk

Cherwell District Council
Planning & Development Services
Bodicote House White Post Road
Bodicote
Banbury
OX15 4AA

Re: Construction of a coffee unit with drive-thru facility and indoor seating with associated access, car parking, landscaping and servicing parking. Land North West of Launton Road roundabout adjoining Skimmingdish Lane, Caversfield

I refer to the recent Environment Agency consultation response (EA Ref: WA/2021/129266/02-L01 dated 9th December 2021) to the above application. This response maintains the objection to the application on the grounds that the latest proposals for the flood compensation provided by the scheme is not in line with the previous consultation and agreements with the Environment Agency.

The flood compensation previously being offered was 36.5m³, while the initially agreed (subject to further detail) was 30m³. This additional 6.5m³ is negligible given the extent of the floodplain in the area, but the proposals have been reviewed to remove the objection from the Environment Agency.

Since this project commenced in 2019 substantial work has been carried out on the scheme to reduce the flood compensation as far as practically feasible and has been in line with the previous discussions with the EA. This includes the scheme being designed to the 1 in 100 year +35% modelled flood level of 69.750m AOD. Since this initial agreement with the Environment Agency in 2019, the climate change allowances have been revised in line with updated scientific advice.

In July 2021 the revised allowances were published and should be used for all planning applications. According to the guidance published by the Environment Agency, the appropriate and central allowance to assess off-site impacts and calculate floodplain storage compensation depends on land uses in affected areas. Given the lifetime of the development is expected to be less than 25 years (the Tenant has committed to a 15 year lease), the 2050 allowance has been used. For the Cherwell and Ray catchment, the central allowance for the 2050 epoch is a 4% increase in river flows (See extract below).



RSK Land & Development Engineering Ltd

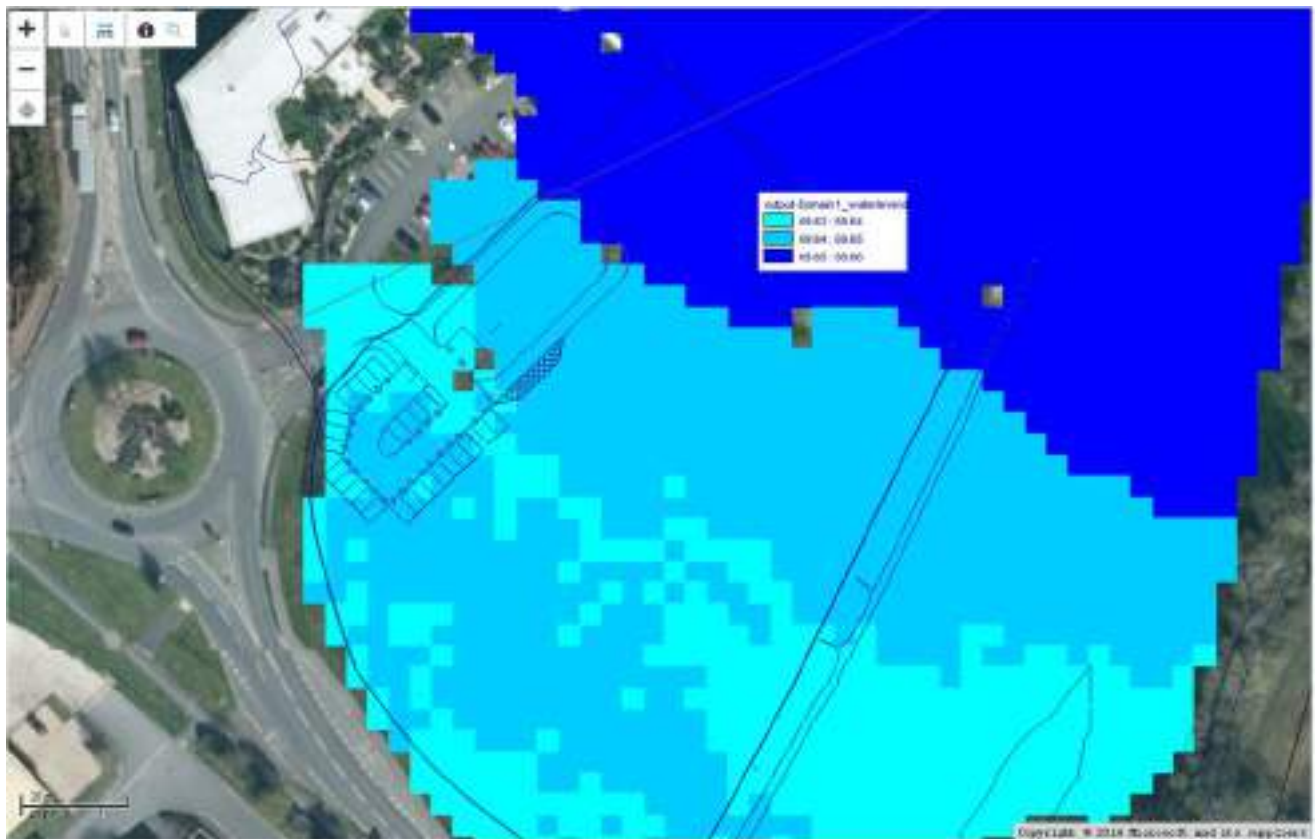
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The previously agreed hydraulic model (as provided by the Environment Agency) has been re-run using this revised climate change allowance. The results of the model re-run, using the latest climate change guidance, include top water as displayed on the image below. It can be seen from this image that the water levels are generally level across the site from a peak of 69.66m AOD in the very north of the site, to 69.63m AOD in the south west across the proposed car parking area.





Using the latest guidance, these revised levels have been used to re-assess the flood compensation requirement. As a result of the reassessment the required flood compensation has been reduced to 17.58m³, a 41.4% a reduction on the previously agreed 30m³.

Total Volume Difference by level			
Levels			Volume Difference (m ³)
Top (m)	Bottom (m)	Height (m)	
69.65	69.55	0.1	17.58
69.55	69.45	0.1	-17.38
69.45	69.35	0.1	-52.31
69.35	69.25	0.1	-33.10
69.25	69.15	0.1	-2.37

*A positive number indicates a loss of floodplain volume, a negative figure indicates a gain in floodplain volume

The principle for the flood compensation is, as previously agreed with the Environment Agency. The details are provided in the enclosed drawings (Drawing Ref: 220029/100P6). However, due to the revised flood level using the latest climate change guidance, the attenuation can now be provided in a single tank with two chambers, with inlets set at 69.625mm 69.525m AOD. As the previous pre-app agreement with the Environment Agency was for tank storage at 30m³ split into 3 independent compartments with inlets set at 25mm and 100mm below flood level, the volume of flood compensation required at 17.58m³ using the latest guidance must be deemed to be acceptable.

Whilst the required level of flood compensation required to ensure there is no net loss of floodplain has been reduced to 17.58m³, it is proposed to offer the full 30m³ of tank storage on the site, previously agreed with the Environment Agency which provides a betterment of 12.42m³ in floodplain volume in the area and therefore have the potential to reduce flood risk.

It can be seen from the drawings (Drawing Refs: 220029/100P6 / FV100P2 / FV101P4 / FV102P4 / FV103P4 / FV104P1 / FV105P1 / FV106P1 / FV107P1) and the associated tabulated data (where the flood compensation provided offers additional floodplain volume over the pre-development situation.

Difference by level			
Levels			Volume Difference (m ³)
Top (m)	Bottom (m)	Height (m)	
69.65	69.55	0.1	21.43
69.55	69.45	0.1	-9.59
69.45	69.35	0.1	-39.95
69.35	69.25	0.1	-26.39
69.25	69.15	0.1	-2.06



Difference by level			
Levels			Volume Difference (m ³)
Top (m)	Bottom (m)	Height (m)	
69.65	69.55	0.1	-3.85
69.55	69.45	0.1	-7.79
69.45	69.35	0.1	-12.36
69.35	69.25	0.1	-6.71
69.25	69.15	0.1	-0.31

Overall, there is a net increase of 99.163m³ in floodplain volume over the range of flood depths with the ground works proposed and the use of the storage tanks.

In addition to the reinvestigation into the flood compensation tanks, the option of lifting the footprint of the building via the use of stilts was reconsidered. With the ramped access to the store and the levels required for the drive thru lane (which could not be raised on stilts) this option remains impractical due to the fact we have endeavoured to maintain existing ground levels within the wider finished levels for the new development site including the drive thru lane. Putting the building on stilts would raise the wider levels and be impracticable where the drive thru lane has to be raised to meet the height of the building.

The current letter from the Environment Agency also noted that: *'the excavation required to provide the proposed floodplain compensation area is detailed only on cross sections. Without a plan it is hard to establish whether the information shown on the sections is practical and achievable. It will be necessary for the applicant to submit a plan showing the floodplain compensation storage area and detail the ground levels required for the area, consistent with the sections.'* The plan was provided with the cross sections (plan referenced 220029/FV100P2) as listed in the letter.

However, to further explain and in light of current guidance on flood levels, the cross sections and plans have been re-worked and part of this process has involved making the detail clearer, to hopefully better explain our proposals. Three sections have been taken as an example (4a, 5 and 13). These sections have been chosen to show how the levels change through the removal of high points on the wider site (4a), through the building (5) and through a typical section of the car park (13). These sections clearly show the existing (based on the latest topographical survey levels) ground levels, the post development levels and the modelled flood levels.

On the 22 sections, the volume of flood storage lost is coloured in RED and the volume of flood storage gained is in GREEN. Note also, the horizontal scale has been compressed by a factor of 5 times in order to allow the sections to be shown on a single drawing.

In addition to the cross sections, a larger scale general arrangement plan FV107P1 has been provided which shows the existing levels (BLACK) and proposed levels (GREEN) to clearly provide information on where, and by how much levels have been affected.

In terms of how the works will be carried out, this will be detailed by the contractor appointed to do the works and should not form the basis of an objection on flood risk grounds from the Environment Agency.



It is proposed to maintain the previously approved FFL's for the building of 69.750m AOD which now provides a level of freeboard above the modelled 1 in 100 year plus the latest guidance on climate change flood level.

Based on the above and the enclosed cross sections, it can be clearly seen that, when using the Environment Agency's latest climate change allowances, the level of flood compensation required to be provided is reduced to 17.58m³ to below that previously agreed with the Environment Agency during extensive pre-app discussions. Notwithstanding this fact, the flood compensation to be offered by the scheme will include a tank with a capacity of 30m³ (this is in excess of that required), thereby offering a reduction / betterment of 12.42m³ in offsite flood risk on 1:100 plus climate change. There is also a considerable flood storage betterment of 99.163m³ in the 1:100 flood risk. This should therefore be supported by the Environment Agency as seen as an opportunity to offer wider flood risk benefits.

We trust this information is sufficient for your immediate needs, however please do not hesitate to contact the undersigned if you require any further information.

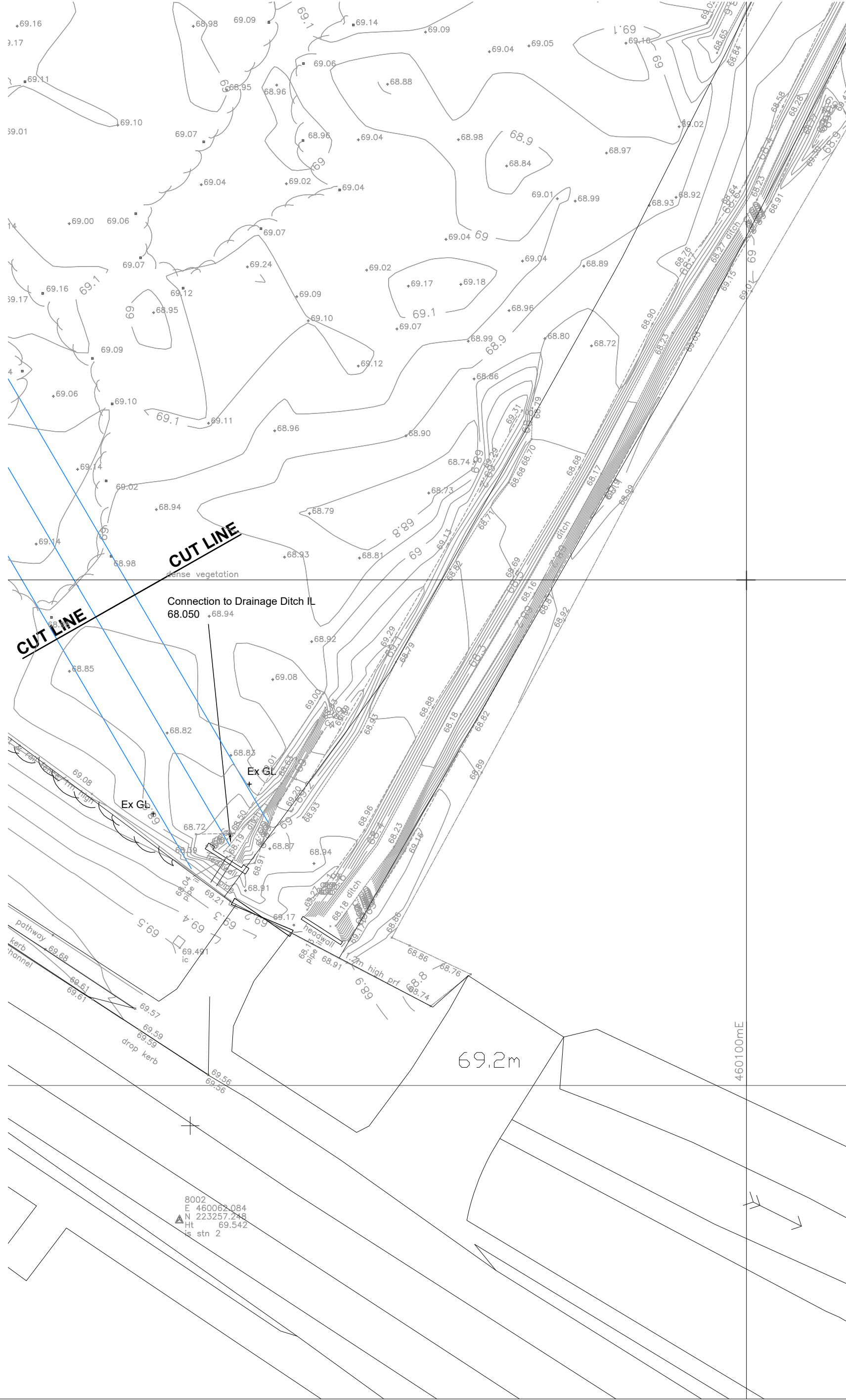
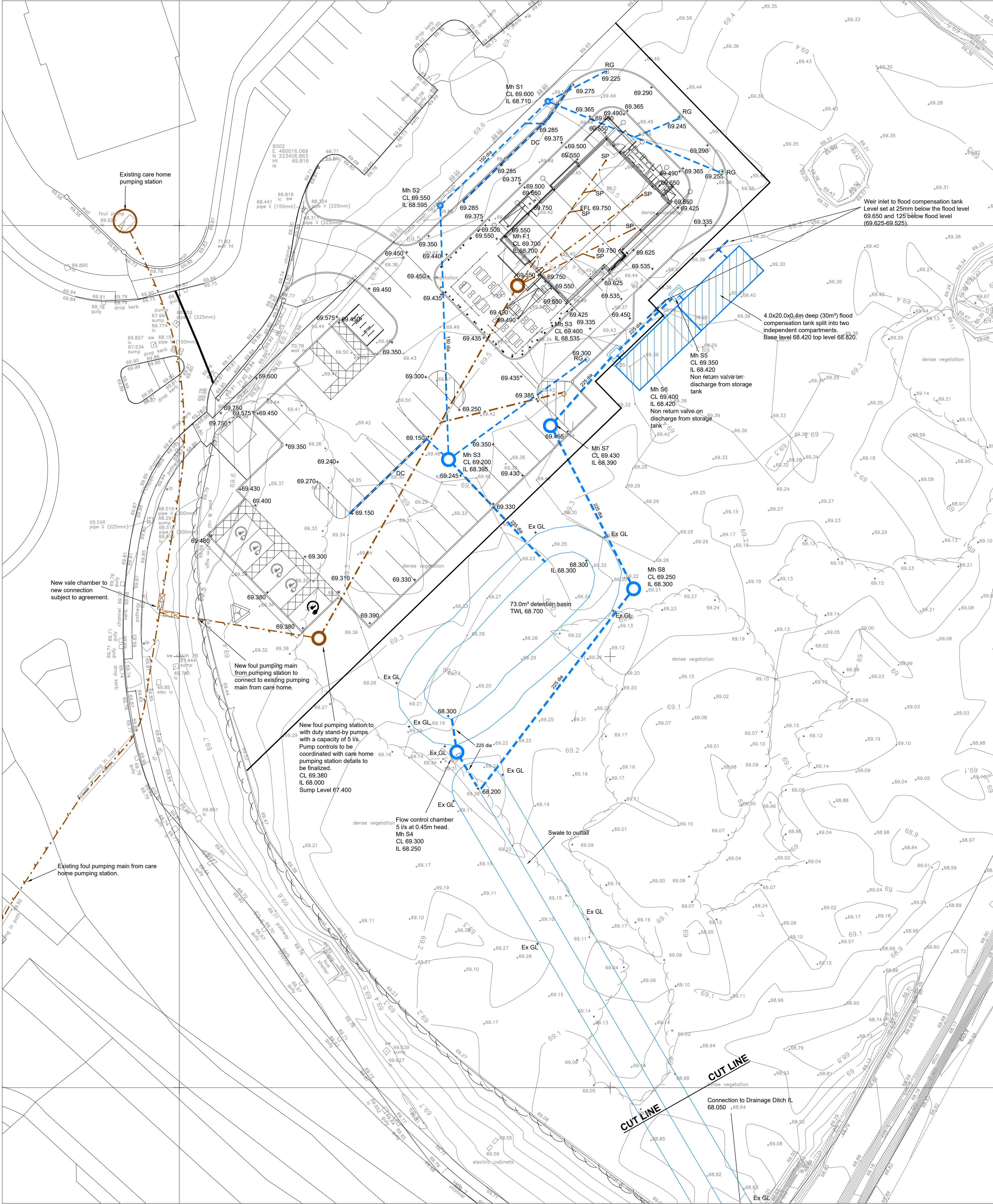
Yours sincerely

RSK LDE LIMITED

A handwritten signature in black ink, appearing to read 'Colin Whittingham', is written over a light grey rectangular background.

Colin Whittingham

Associate Director BSc (Hons) MSc MCIWEM C.WEM PIEMA



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DRAINAGE

1. INVERT LEVELS AND POSITIONS OF EXISTING DRAINS / CHAMBERS / SEWERS WHERE NEW CONNECTIONS ARE TO BE MADE MUST BE CHECKED AND CONFIRMED TO THE ENGINEER PRIOR TO THE COMMENCEMENT OF ANY WORKS.
2. THE CONTRACTOR IS MAKE APPLICATION TO THE WATER AUTHORITY FOR THE DIRECT OR INDIRECT CONNECTIONS FOR THE FOUL AND SURFACE WATER TO THE PUBLIC SEWERS.
3. ALL DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL AUTHORITY AND IN CONJUNCTION WITH ALL RELEVANT BRITISH STANDARDS, CODES OF PRACTICE AND 'SEWERS FOR ADOPTION' AS APPROPRIATE.
4. ALL DRAINAGE SHALL COMPLY WITH THE TYPICAL DETAILS AND THE REQUIREMENTS OF BS EN 752.
5. FOR SETTING-OUT DIMENSIONS OF SV/PS, RWP/S ETC. REFER TO ARCHITECTS OR MECHANICAL ENGINEER'S DRAWINGS.
6. SEWERS UP TO 300mm DIAMETER TO BE VITRIFIED CLAY. EXTRA STRENGTH TO BS EN 295 OR BS 65 WITH PLAIN ENDED SLEEVED OR SOCKETED FLEXIBLE JOINTS OR PLASTIC TO BS 4660 AND BS EN 1401-1. ALL SEWERS OF 375mm DIAMETER AND OVER, TO BE SULPHATE RESISTING CONCRETE CLASS M WITH SOCKETED FLEXIBLE JOINTS. ALL PLASTIC PIPEWORK SHALL BE CAPABLE OF DEMONSTRATING A JETTING RESISTANCE OF 4000psi (280bar) WITHOUT DAMAGE WHEN TESTED IN ACCORDANCE WITH WITH SECTION 6.10 OF WIS 4-35-01.
7. INVERTS OF INCOMING BRANCHES SHALL BE AT SPRINGING LEVEL TO THE MAIN PIPE AND FORMED GENERALLY USING CHANNEL PIPES AND SLIPPER BENDS, CUT TO SUIT.
8. ALL PRECAST CONCRETE UNITS USED IN THE DRAINAGE WORKS SHALL BE MANUFACTURED USING SULPHATE RESISTING CEMENT.
9. EPDM JOINTS ARE TO BE USED IN AREAS WHERE CONCENTRATED COCO COLA WILL BE USED.
10. MANHOLE COVERS AND FRAMES IN VEHICULAR AREAS SHALL BE CAST IRON TO BS EN 124, GRADE D400 AND IN PEDESTRIAN AREAS GRADE B125. COVERS AND FRAMES IN BLOCK PAVED AREAS SHALL BE RECESSED FABRICATED STEEL AS MANUFACTURED BY DRAINAGE SYSTEMS, LIST NO. 6333, OR SIMILAR APPROVED.
11. COVER LEVELS ARE TO ADJUSTED LOCALLY TO SUIT FINISHED GROUND LEVELS.
12. DRAINAGE CHANNELS SHALL BE LAID STRICTLY IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS WITH PARTICULAR CARE BEING TAKEN TO PREVENT DAMAGE DURING INSTALLATION. PAVEMENT CONSTRUCTION OR SURFACING ETC.
13. ALL ROAD GULLY AND DRAINAGE CHANNEL CONNECTIONS SHALL BE 150MM DIAMETER UNLESS OTHERWISE SPECIFIED.
14. ALL FOUL AND RAIN WATER PIPE CONNECTIONS SHALL BE 100MM DIAMETER UNLESS OTHERWISE SPECIFIED.
15. INTERNAL DRAINAGE SHOWN IS INDICATIVE. FINAL DESIGN SUBJECT TO FINAL INTERNAL LAYOUT.
16. ALL PUMPING APPARATUS, EQUIPMENT AND MATERIALS SUPPLIED, TOGETHER WITH ALL WORK UNDERTAKEN SHALL COMPLY WITH THE APPROPRIATE BRITISH STANDARDS. SPECIFICATIONS, BS 7671, THE IEE REGULATIONS FOR ELECTRICAL INSTALLATIONS. THE ELECTRICITY AT WORK REGULATIONS 1989 AND THE REQUIREMENTS OF THE ELECTRICITY COMPANY.
17. PUMPS AND ELECTRICAL EQUIPMENT WITHIN THE WET WELL SHALL BE DESIGNED FOR HAZARDOUS ZONE 1 PROTECTION.
18. PUMPING MAINS SHALL BE ADEQUATELY RESTRAINED AT CONNECTIONS AND BENDS AGAINST THRUSTS PRODUCED BY INTERNAL WATER PRESSURE AND VELOCITY.

P7	23/12/21	NOTES AMENDED	GHB	TS
P6	20/12/21	FLOOD COMPENSATION WEIR LEVELS AMENDED	GHB	TS
P5	03/11/21	DETENTION BASIN AND SWALE ADDED	GHB	TS
P4	23/06/21	FLOOD COMPENSATION TANK AMENDED	GHB	TS
P3	21/06/21	ISSUED FOR COMMENT	GHB	TS
P2	08/06/21	ISSUED FOR COMMENT	GHB	TS
P1	19/05/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Dm	Chkd

Revisions

Drawing Originator

PAUL OWEN ASSOCIATES CONSULTING ENGINEERS - TECHNICAL ADVISERS
Studio D128, 62 Triton Road, West Dulwich,
London SE21 8DE
t 020 3176 7726 www.paulowen.co.uk

Drawing Status

PRELIMINARY

Project Name

BICESTER

Drawn by	GHB	Drawn Date	19/05/21	Checked by	TS	Scale	1/250
Title	Original drawing sheet is A1						

DRAINAGE LAYOUT



LEGEND

EXISTING LEVELS +69.31

PROPOSED LEVELS + 69.290

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Volume Difference between Proposed and Existing by level Sections 1-17

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.650	69.550	0.1	+21.430
65.550	69.450	0.1	-9.593
69.450	69.350	0.1	-39.950
69.350	69.250	0.1	-26.393
69.250	69.150	0.1	-2.057

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.650	69.550	0.1	-3.858
65.550	69.450	0.1	-7.787
69.450	69.350	0.1	-12.360
69.350	69.250	0.1	-0.710
69.250	69.150	0.1	-0.313

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Total loss/increase of flood plain volume.

Levels			
Top (m)	Bottom (m)	Height (m)	Total loss of volume(m³)
69.650	69.550	0.1	17.572
65.550	69.450	0.1	-17.380
69.450	69.350	0.1	-52.310
69.350	69.250	0.1	-27.103
69.250	69.150	0.1	-2.370

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Rev	Date	Description	Dm	Chkd
P4	23/12/21	FLOOD LOSS/INCREASE TABLE AMENDED	GHB	TS
P3	21/12/21	FLOOD LOSS/INCREASE TABLE ADDED	GHB	TS
P2	20/12/21	PROPOSED LEVELS COLOUR CHANGED LEGEND ADDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS

Revisions

Drawing Originator

PAUL OWEN
ASSOCIATES

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Drawing Status

PRELIMINARY

Project Name

BICESTER

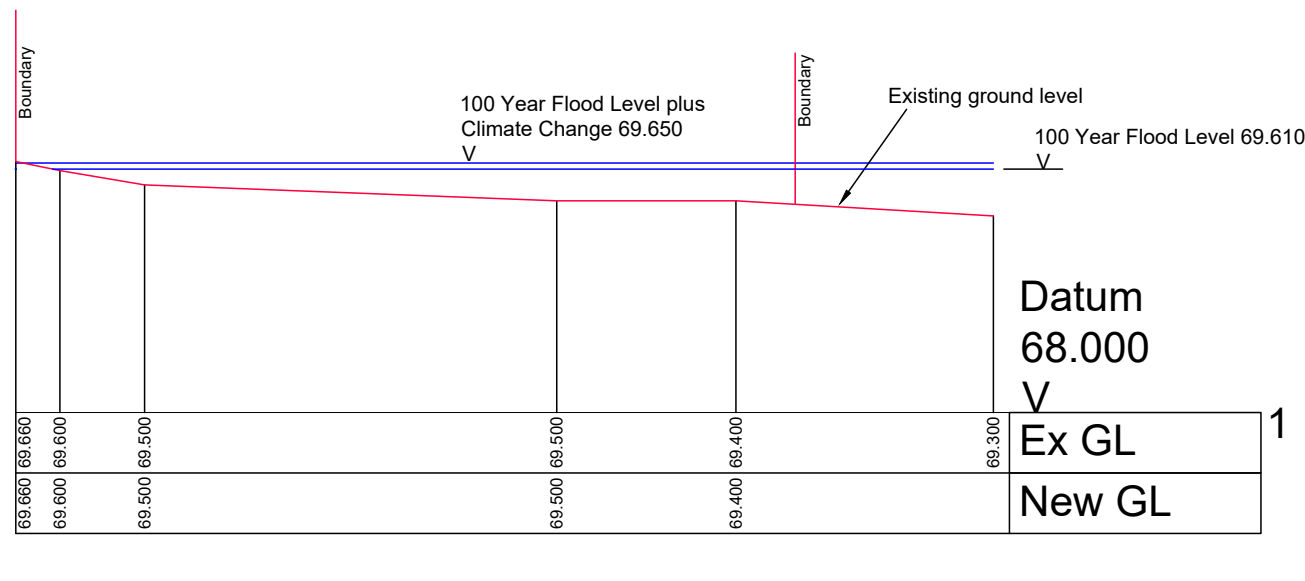
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Title							Original drawing sheet is A1

FLOOD VOLUMES SECTION LAYOUT PLAN

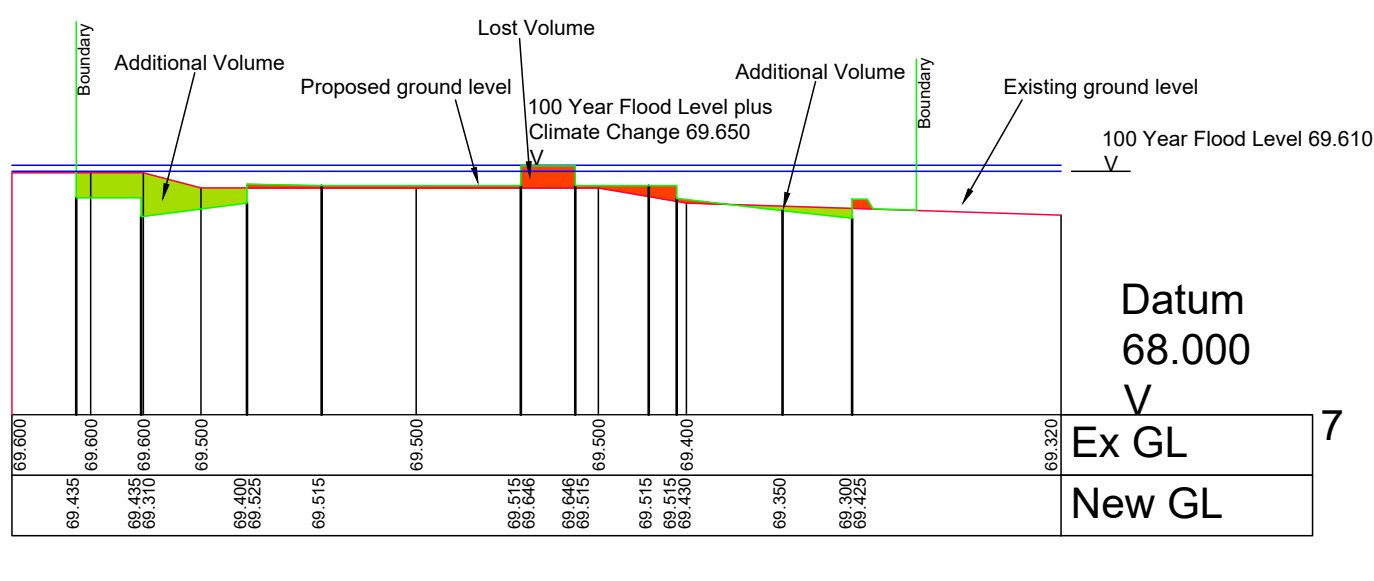
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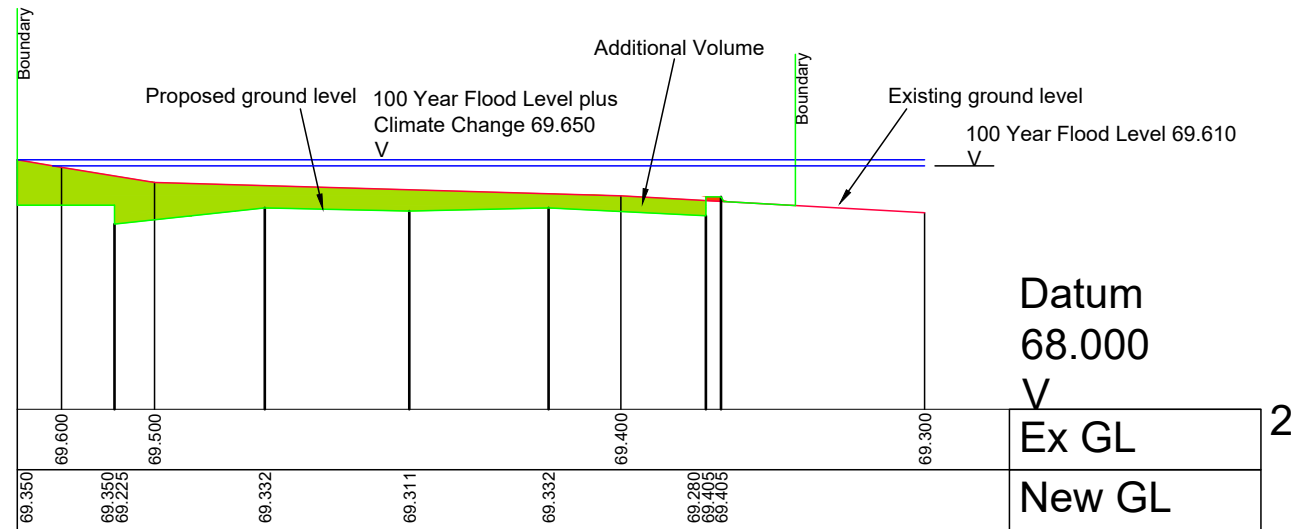


Proposed/Existing Levels	Areas m²
69.650-69.550	2.425
69.550-69.450	1.982
69.450-69.350	0.587
69.350-69.250	0.000
69.250-69.150	0.000



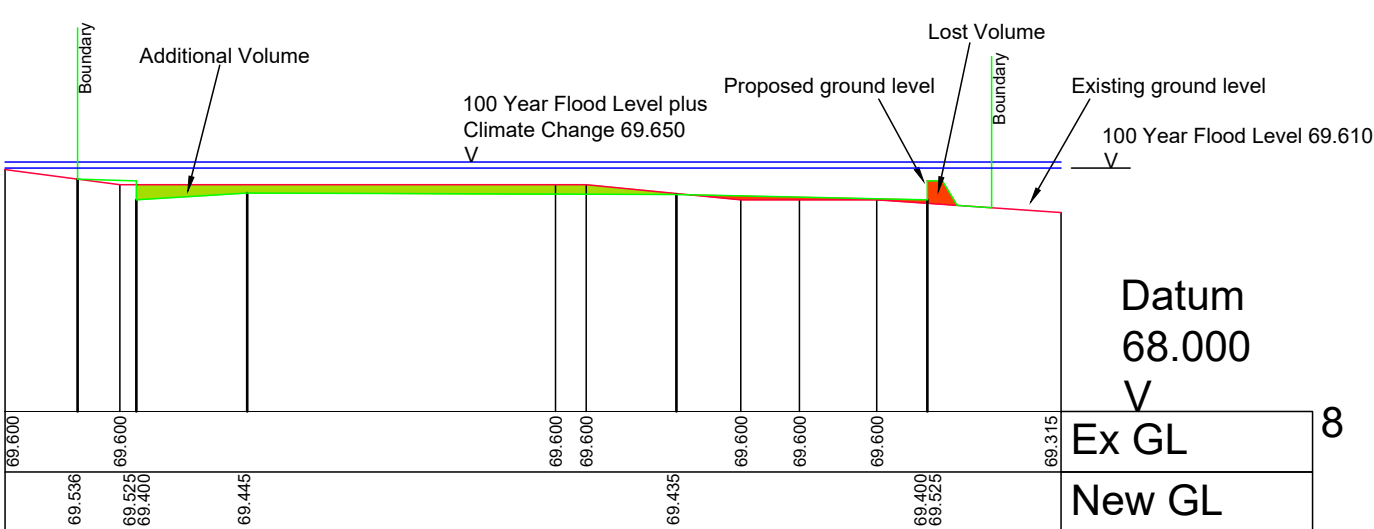
Proposed Levels	Areas m²
69.650-69.550	2.605
69.550-69.450	1.746
69.450-69.350	0.930
69.350-69.250	0.031
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.643
69.550-69.450	1.696
69.450-69.350	0.603
69.350-69.250	0.000
69.250-69.150	0.000



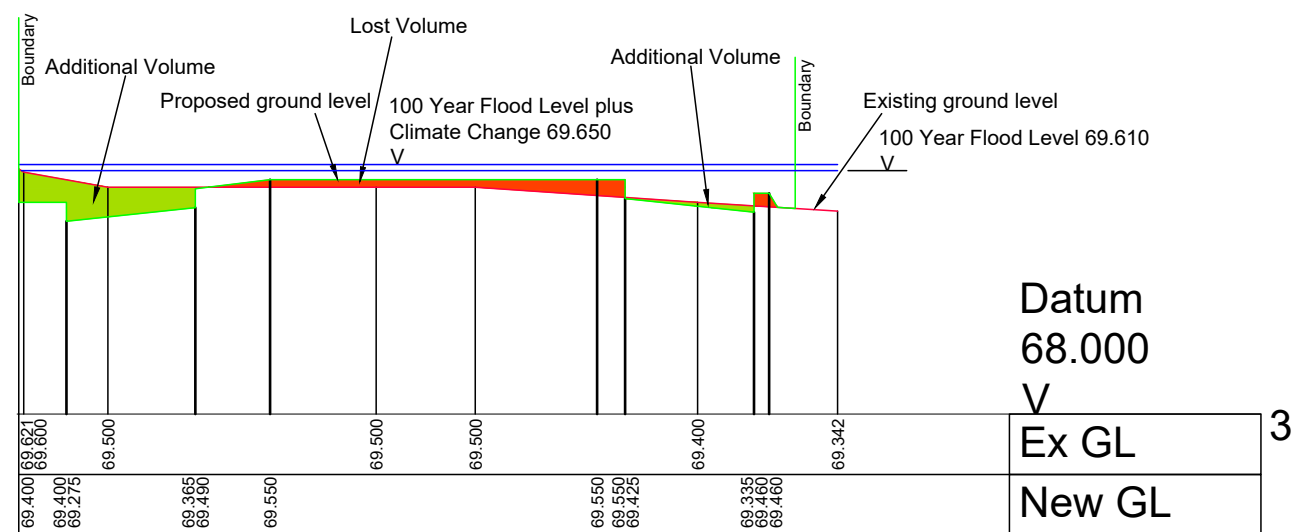
Proposed Levels	Areas m²
69.650-69.550	2.573
69.550-69.450	2.573
69.450-69.350	2.514
69.350-69.250	0.838
69.250-69.150	0.015

EXISTING LEVELS	Areas m²
69.650-69.550	2.424
69.550-69.450	1.939
69.450-69.350	0.535
69.350-69.250	0.000
69.250-69.150	0.000



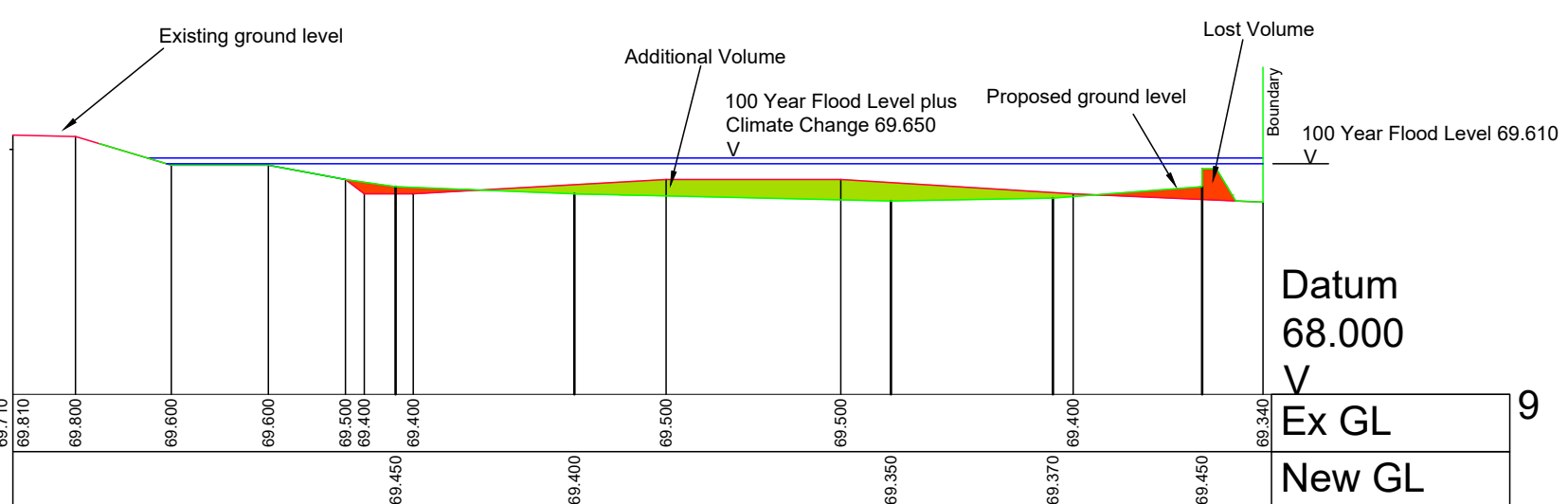
Proposed Levels	Areas m²
69.650-69.550	3.022
69.550-69.450	2.819
69.450-69.350	0.632
69.350-69.250	0.000
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	3.022
69.550-69.450	2.090
69.450-69.350	0.578
69.350-69.250	0.000
69.250-69.150	0.000



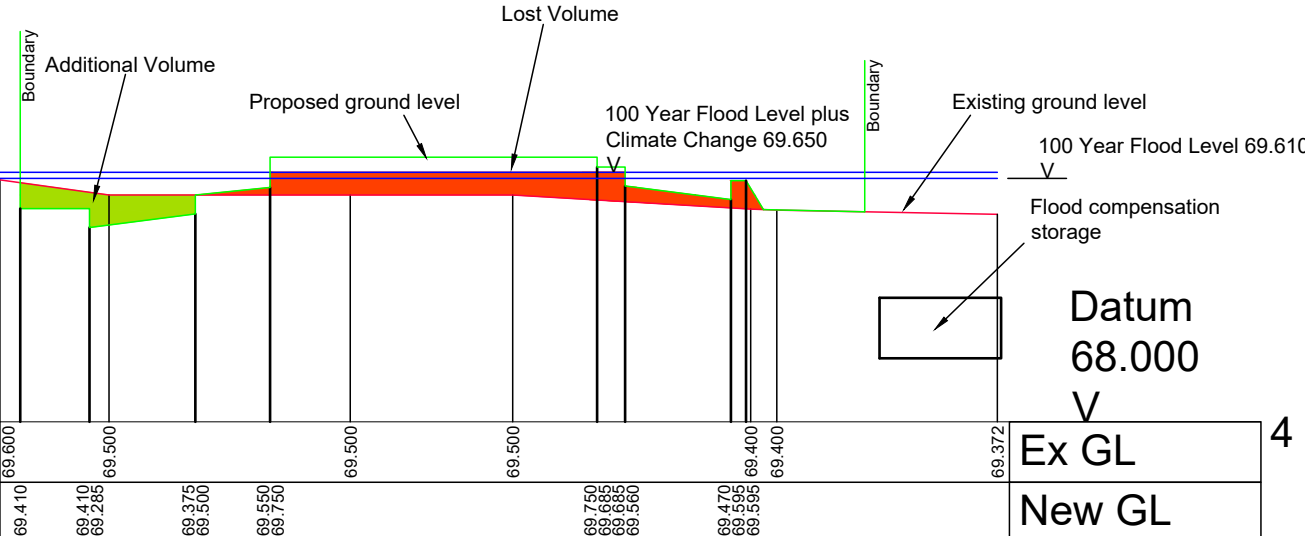
Proposed Levels	Areas m²
69.650-69.550	2.568
69.550-69.450	1.215
69.450-69.350	0.854
69.350-69.250	0.139
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.522
69.550-69.450	1.808
69.450-69.350	0.318
69.350-69.250	0.000
69.250-69.150	0.000



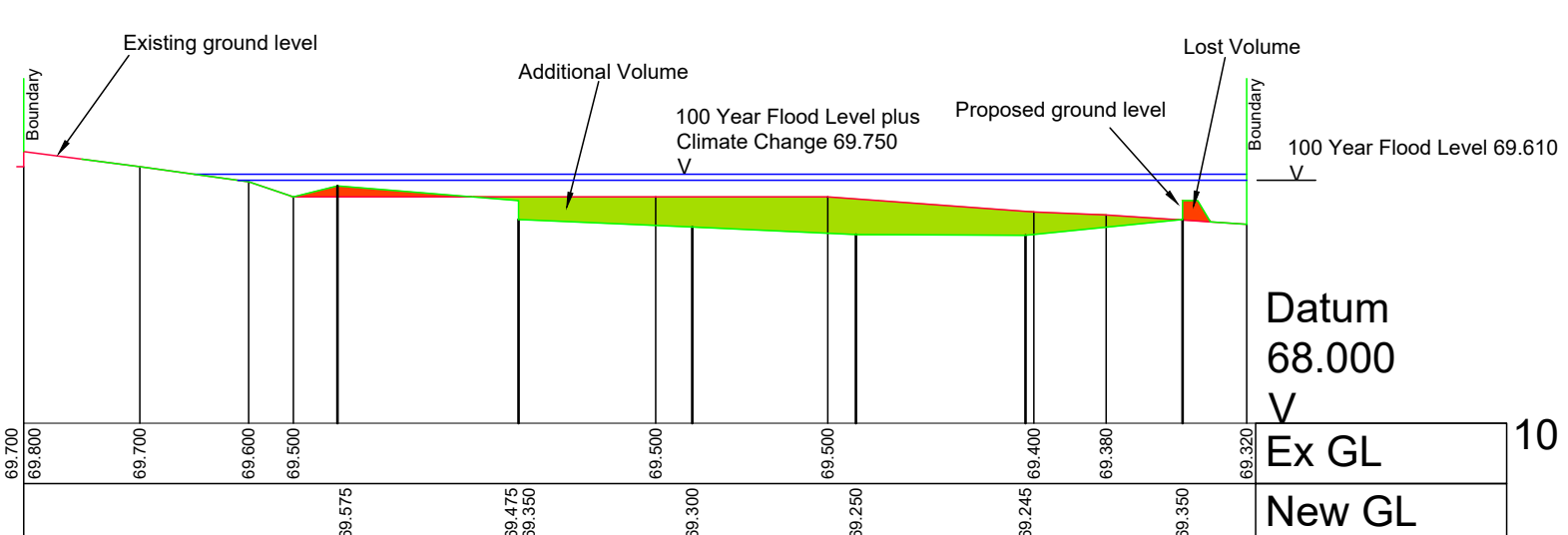
Proposed Levels	Areas m²
69.650-69.550	3.615
69.550-69.450	3.110
69.450-69.350	1.812
69.350-69.250	0.000
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	3.628
69.550-69.450	2.711
69.450-69.350	0.826
69.350-69.250	0.000
69.250-69.150	0.000



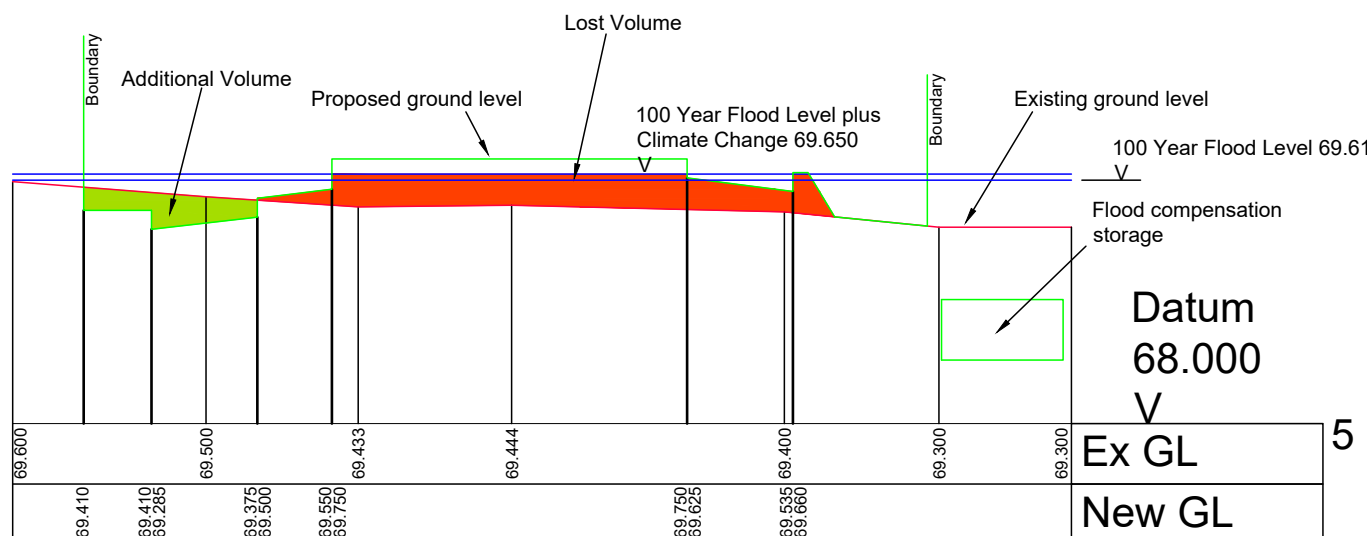
Proposed Levels	Areas m²
69.650-69.550	1.591
69.550-69.450	1.129
69.450-69.350	0.613
69.350-69.250	0.082
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.774
69.550-69.450	0.836
69.450-69.350	0.280
69.350-69.250	0.000
69.250-69.150	0.000



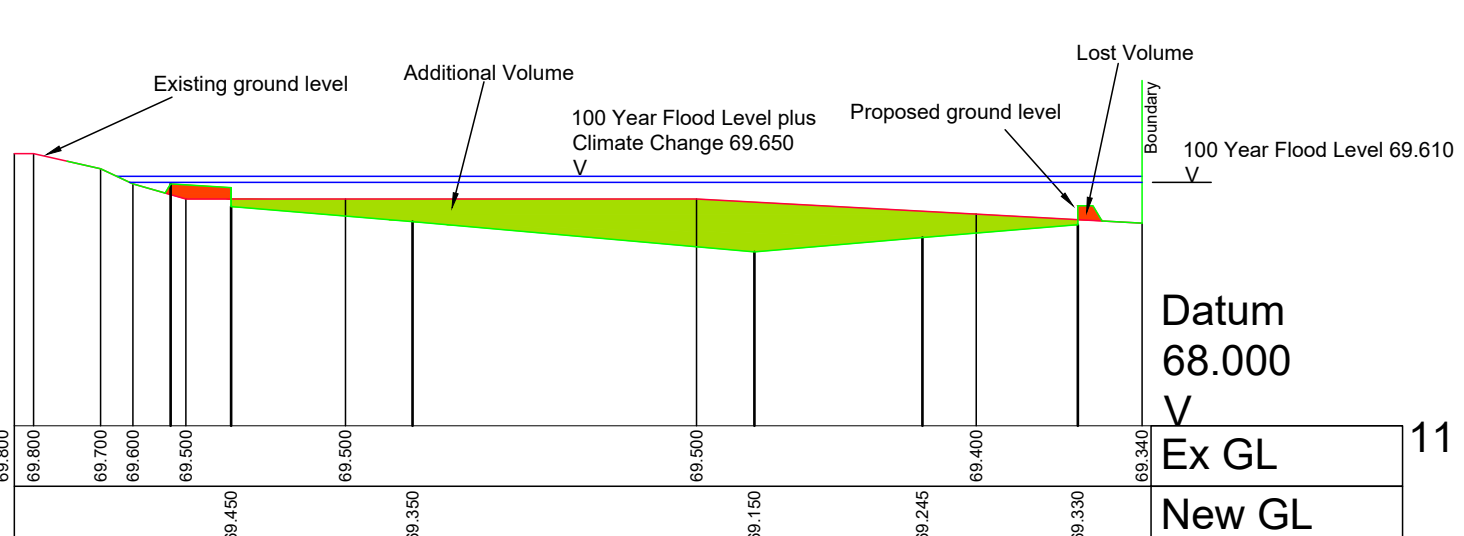
Proposed Levels	Areas m²
69.650-69.550	3.339
69.550-69.450	2.616
69.450-69.350	2.340
69.350-69.250	1.414
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	3.328
69.550-69.450	2.206
69.450-69.350	0.660
69.350-69.250	0.038
69.250-69.150	0.000



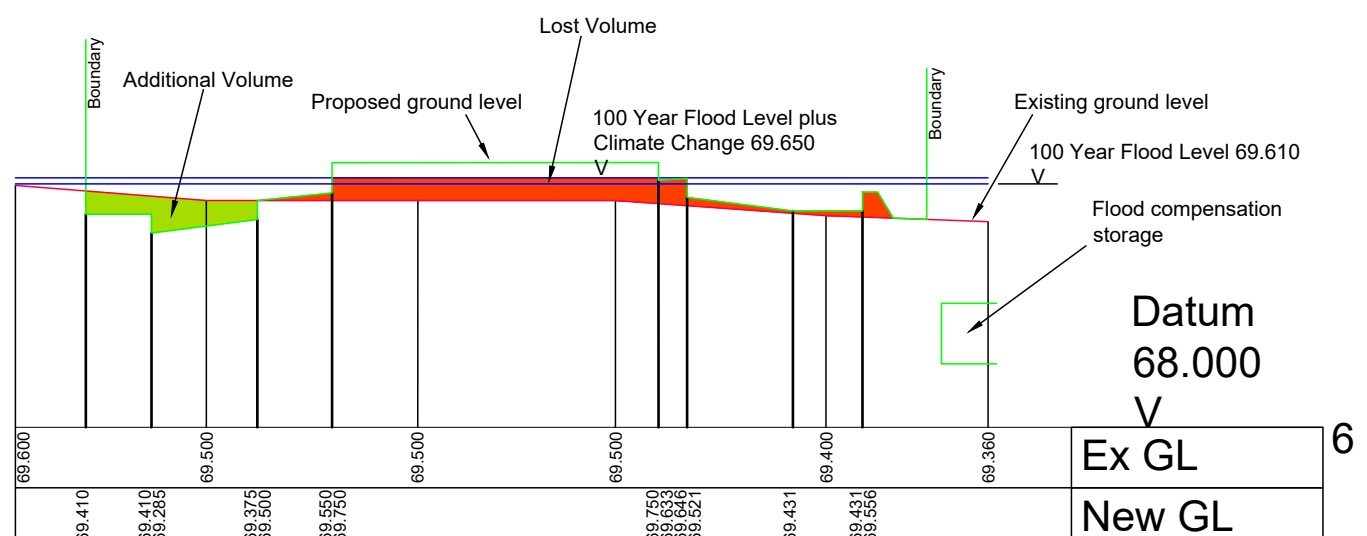
Proposed Levels	Areas m²
69.650-69.550	1.438
69.550-69.450	0.999
69.450-69.350	0.744
69.350-69.250	0.141
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.784
69.550-69.450	2.371
69.450-69.350	0.731
69.350-69.250	0.048
69.250-69.150	0.000



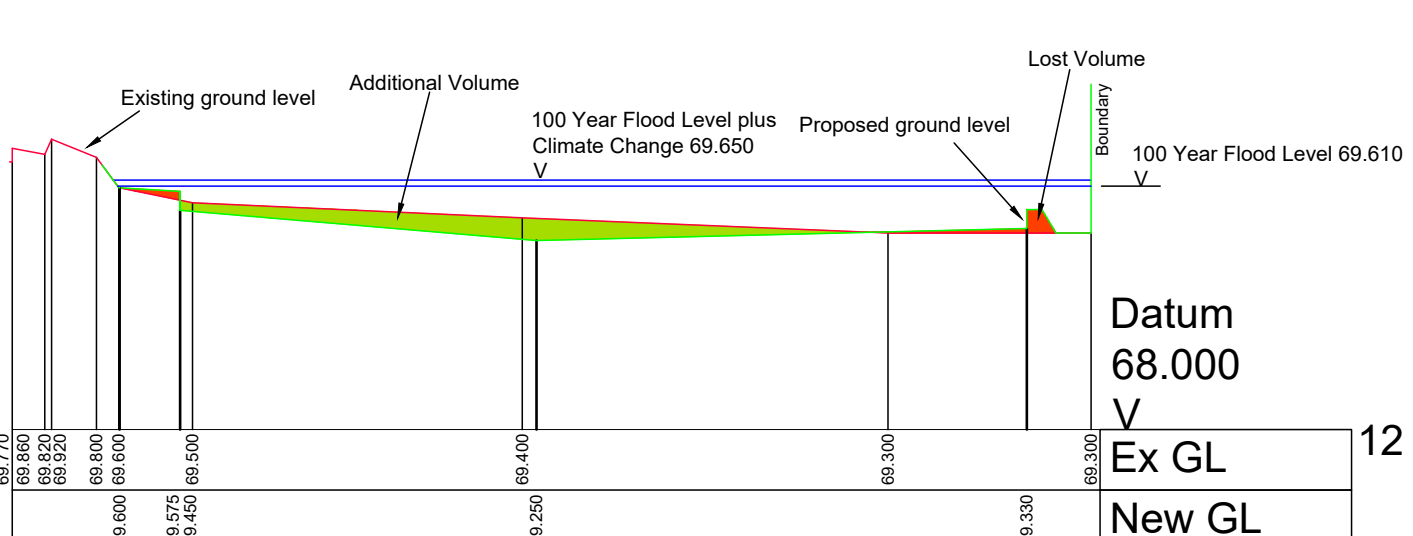
Proposed Levels	Areas m²
69.650-69.550	3.241
69.550-69.450	3.010
69.450-69.350	2.645
69.350-69.250	1.730
69.250-69.150	0.575

EXISTING LEVELS	Areas m²
69.650-69.550	3.328
69.550-69.450	2.223
69.450-69.350	0.549
69.350-69.250	0.004
69.250-69.150	0.000



Proposed Levels	Areas m²
69.650-69.550	1.614
69.550-69.450	1.257
69.450-69.350	0.564
69.350-69.250	0.079
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.775
69.550-69.450	1.697
69.450-69.350	0.295
69.350-69.250	0.000
69.250-69.150	0.000



Proposed Levels	Areas m²
69.650-69.550	3.145
69.550-69.450	3.010
69.450-69.350	2.651
69.350-69.250	1.329
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	3.189
69.550-69.450	2.865
69.450-69.350	1.866
69.350-69.250	0.486
69.250-69.150	0.000

Volume Difference between Proposed and Existing by level Sections 1-17

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.650	69.550	0.1	+21.430
65.550	69.450	0.1	-9.593
69.450	69.350	0.1	-39.950
69.350	69.250	0.1	-26.393
69.250	69.150	0.1	-2.057

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.650	69.550	0.1	-3.858
65.550	69.450	0.1	-7.787
69.450	69.350	0.1	-12.360
69.350	69.250	0.1	-0.710
69.250	69.150	0.1	-0.313

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

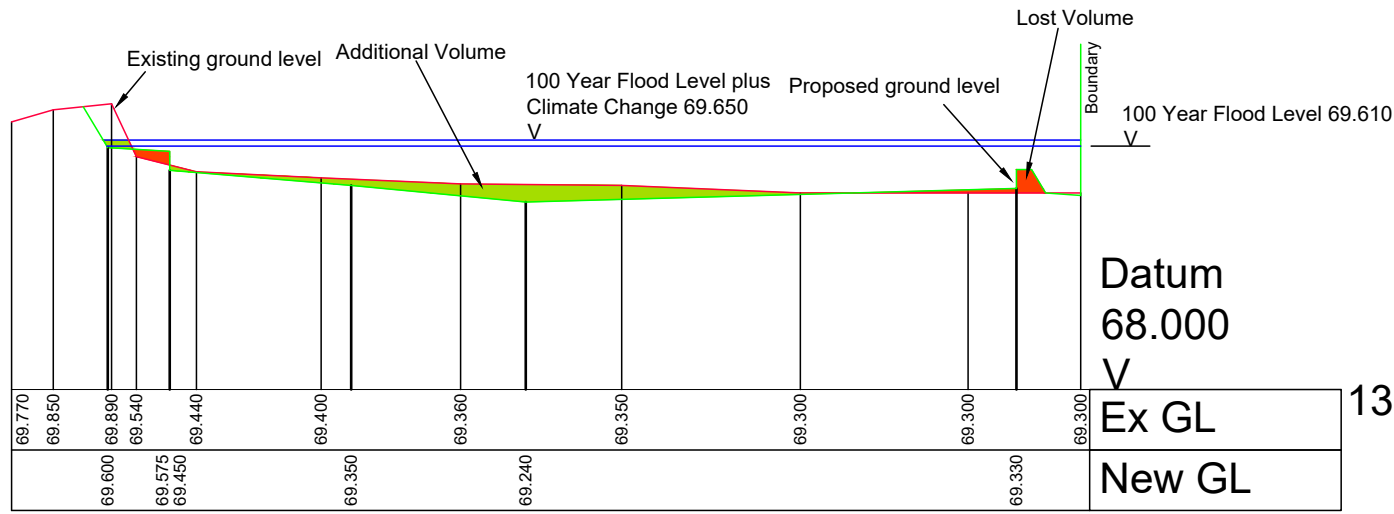
Total loss/increase of flood plain volume.

Levels			
Top (m)	Bottom (m)	Height (m)	Total loss of volume(m³)
69.650	69.550	0.1	17.572
65.550	69.450	0.1	-17.380
69.450	69.350	0.1	-52.310
69.350	69.250	0.1	-27.103
69.250	69.150	0.1	-2.370

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

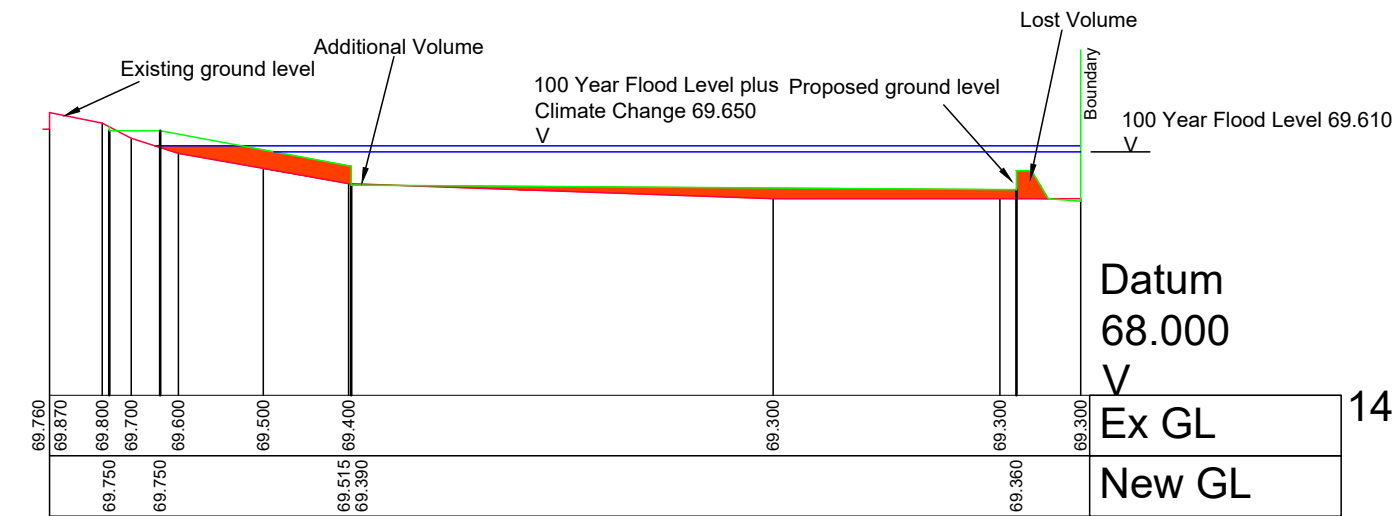
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P5	21/12/21	FLOOD LOSS/INCREASE TABLE AND FLOOD COMPENSATION STORAGE ADDED	GHB	TS
P3	20/10/21	FLOOD LEVELS AMENDED	GHB	TS
P2	12/10/21	HATCHING AND NOTES ADDED	GHB	TS
P2	12/10/21	COLOUR OF SECTION AMENDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Dm	Chkd

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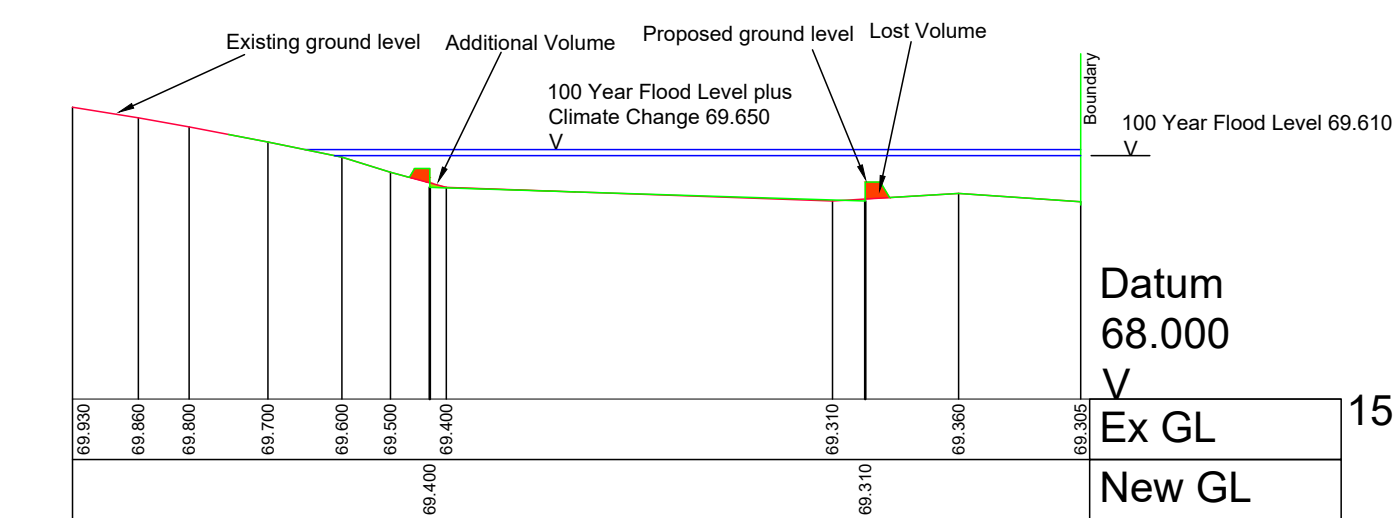
Proposed Levels	Areas m²
69.650-69.550	3.144
69.550-69.450	3.010
69.450-69.350	2.646
69.350-69.250	1.432
69.250-69.150	0.012

EXISTING LEVELS	Areas m²
69.650-69.550	3.136
69.550-69.450	3.042
69.450-69.350	2.471
69.350-69.250	0.611
69.250-69.150	0.000



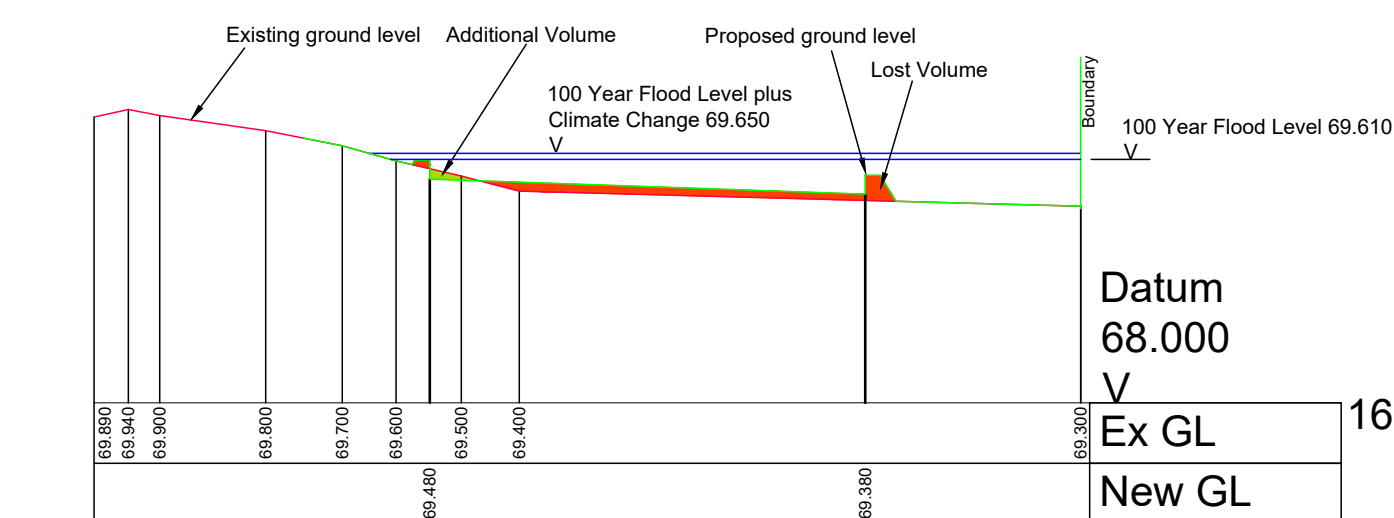
Proposed Levels	Areas m²
69.650-69.550	2.641
69.550-69.450	2.410
69.450-69.350	1.787
69.350-69.250	0.066
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.968
69.550-69.450	2.701
69.450-69.350	2.280
69.350-69.250	0.684
69.250-69.150	0.000



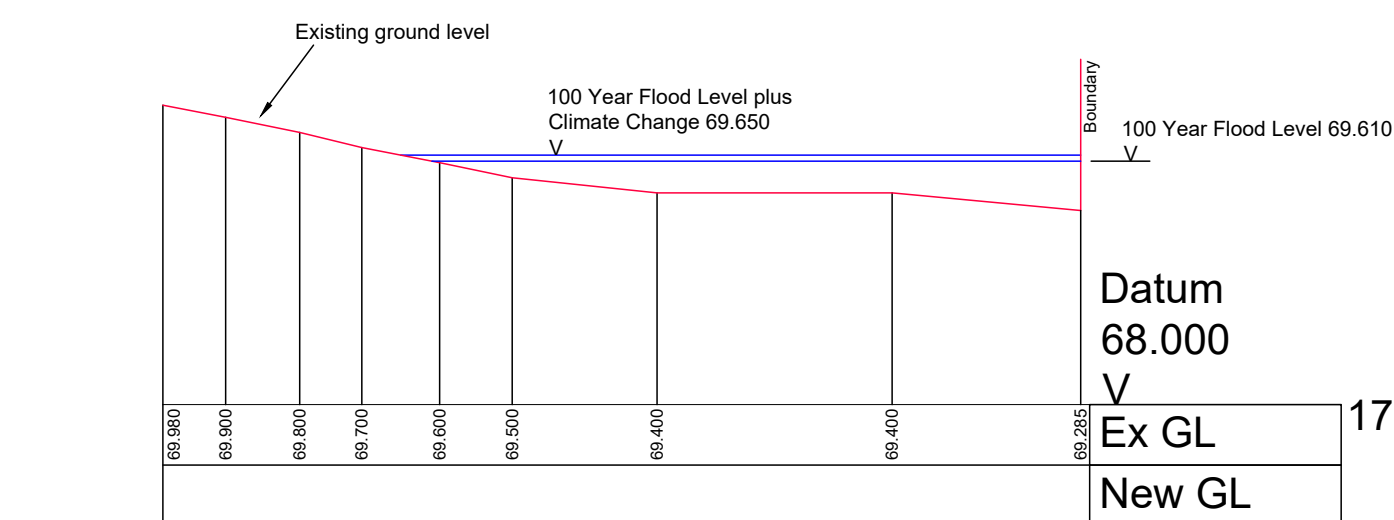
Proposed Levels	Areas m²
69.650-69.550	2.464
69.550-69.450	2.234
69.450-69.350	1.891
69.350-69.250	0.216
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.453
69.550-69.450	2.279
69.450-69.350	1.935
69.350-69.250	0.254
69.250-69.150	0.000



Proposed Levels	Areas m²
69.650-69.550	2.314
69.550-69.450	2.013
69.450-69.350	0.989
69.350-69.250	0.205
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	2.259
69.550-69.450	2.051
69.450-69.350	1.648
69.350-69.250	0.232
69.250-69.150	0.000



Proposed/Existing Levels	Areas m²
69.650-69.550	2.124
69.550-69.450	1.850
69.450-69.350	1.005
69.350-69.250	0.118
69.250-69.150	0.000

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Volume Difference between Proposed and Existing by level Sections 1-17

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.650	69.550	0.1	+21.430
65.550	69.450	0.1	-9.593
69.450	69.350	0.1	-39.950
69.350	69.250	0.1	-26.393
69.250	69.150	0.1	-2.057

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.650	69.550	0.1	-3.858
65.550	69.450	0.1	-7.787
69.450	69.350	0.1	-12.360
69.350	69.250	0.1	-0.710
69.250	69.150	0.1	-0.313

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Total loss/increase of flood plain volume.

Levels			
Top (m)	Bottom (m)	Height (m)	Total loss of volume(m³)
69.650	69.550	0.1	17.572
65.550	69.450	0.1	-17.380
69.450	69.350	0.1	-52.310
69.350	69.250	0.1	-27.103
69.250	69.150	0.1	-2.370

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Rev	Date	Description	Drm	Chkd
P6	23/12/21	FLOOD LOSS/INCREASE TABLE AMENDED	GHB	TS
P5	21/12/21	FLOOD LOSS/INCREASE TABLE ADDED	GHB	TS
P4	20/12/21	FLOOD LEVELS AMENDED	GHB	TS
P3	12/10/21	HATCHING AND NOTES ADDED	GHB	TS
P2	12/10/21	COLOUR OF SECTION AMENDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS

Revisions

Drawing Originator

PAUL OWEN ASSOCIATES CONSULTING ENGINEERS - TECHNICAL ADVISERS
Studio D128, 62 Triton Road, West Dulwich,
London SE21 8DE
t 020 3176 7726 www.paulowen.co.uk

Drawing Status

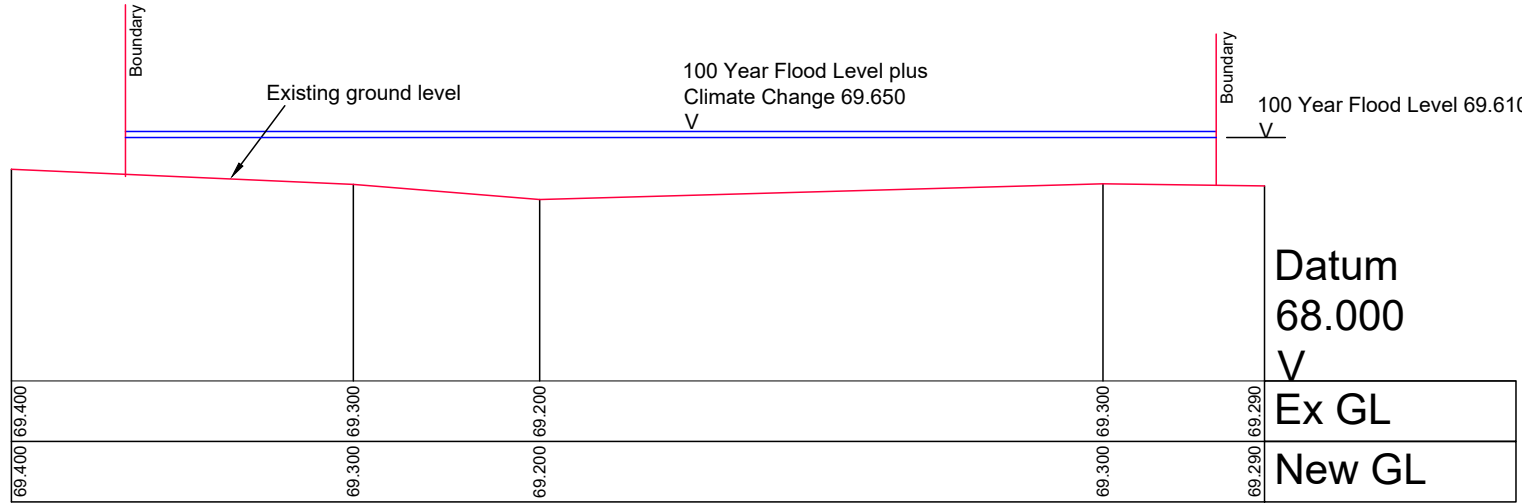
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Project Name

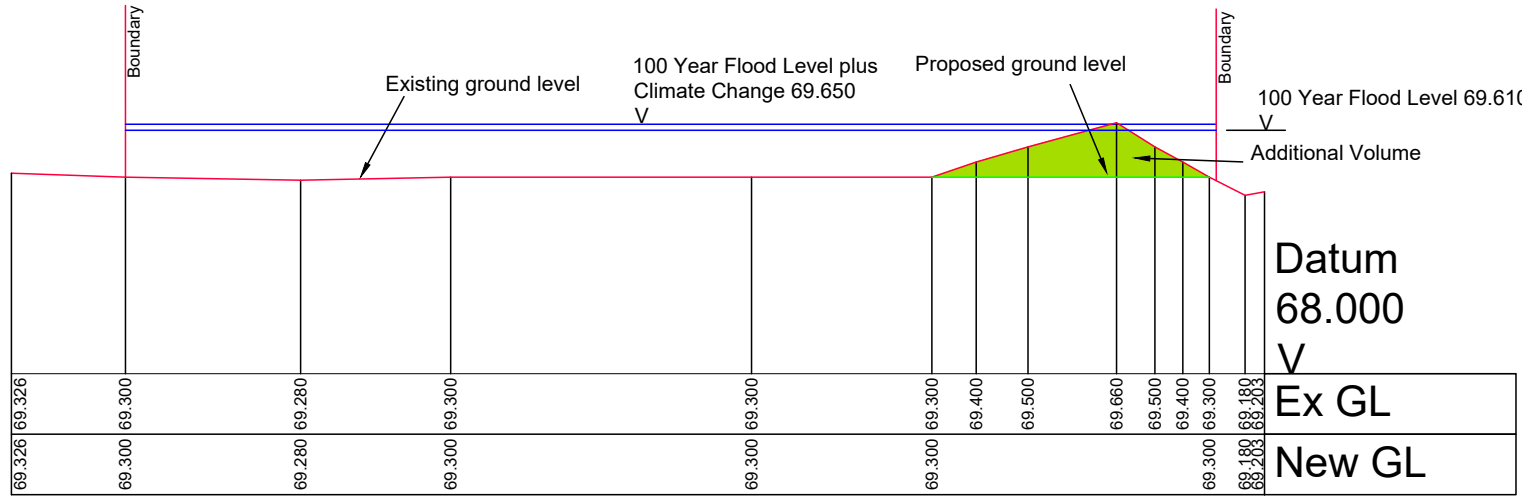
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Drawn by	GHB	Drawn Date	07/10/21	Checked by	TS	Scale	H 1/250 V 1/50
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Title FLOOD VOLUMES SECTIONS 2 OF 3

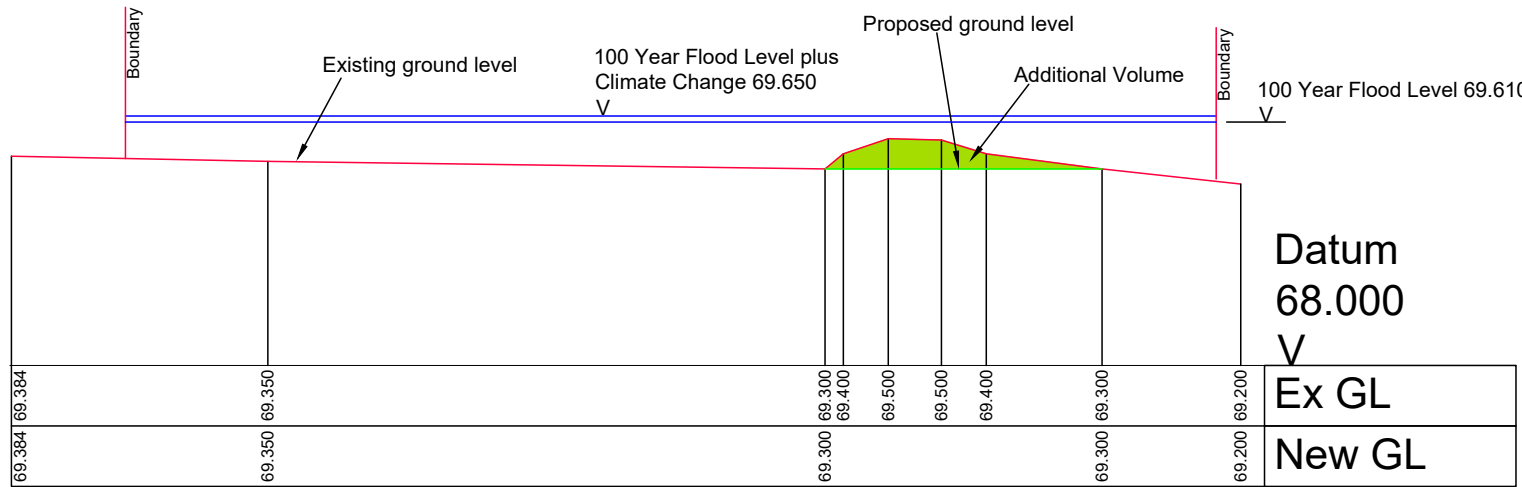


Proposed/Existing Levels	Areas m²
69.650-69.550	3.607
69.550-69.450	3.607
69.450-69.350	3.591
69.350-69.250	2.473
69.250-69.150	0.301



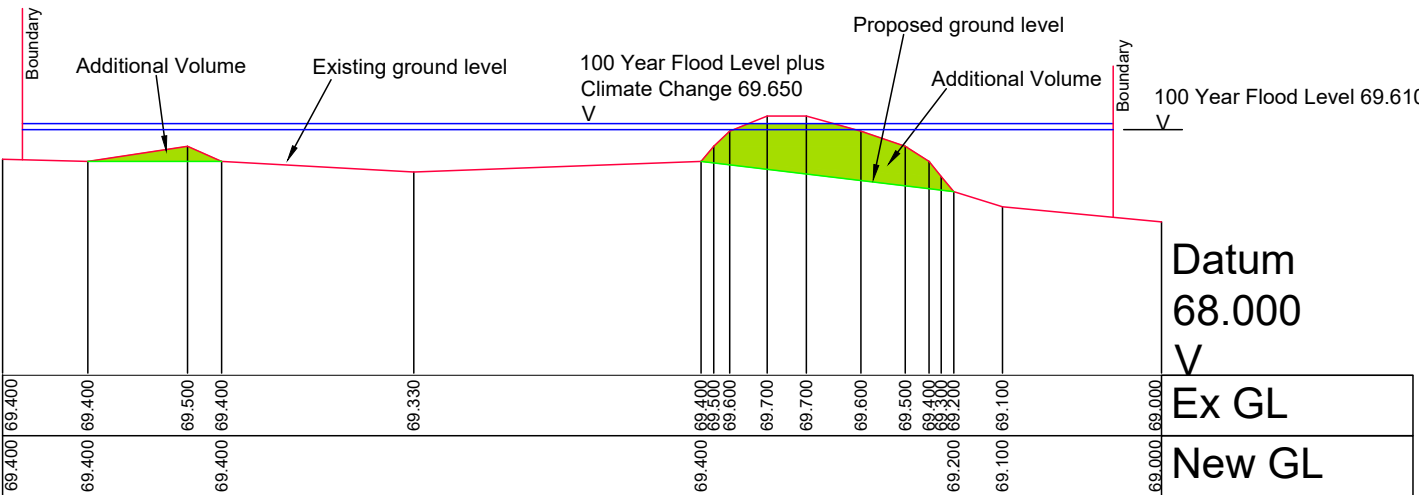
Proposed Levels	Areas m²
69.650-69.550	3.607
69.550-69.450	3.607
69.450-69.350	3.607
69.350-69.250	1.913
69.250-69.150	0.000

EXISTING LEVELS	Areas m²
69.650-69.550	3.450
69.550-69.450	3.189
69.450-69.350	2.927
69.350-69.250	1.484
69.250-69.150	0.000



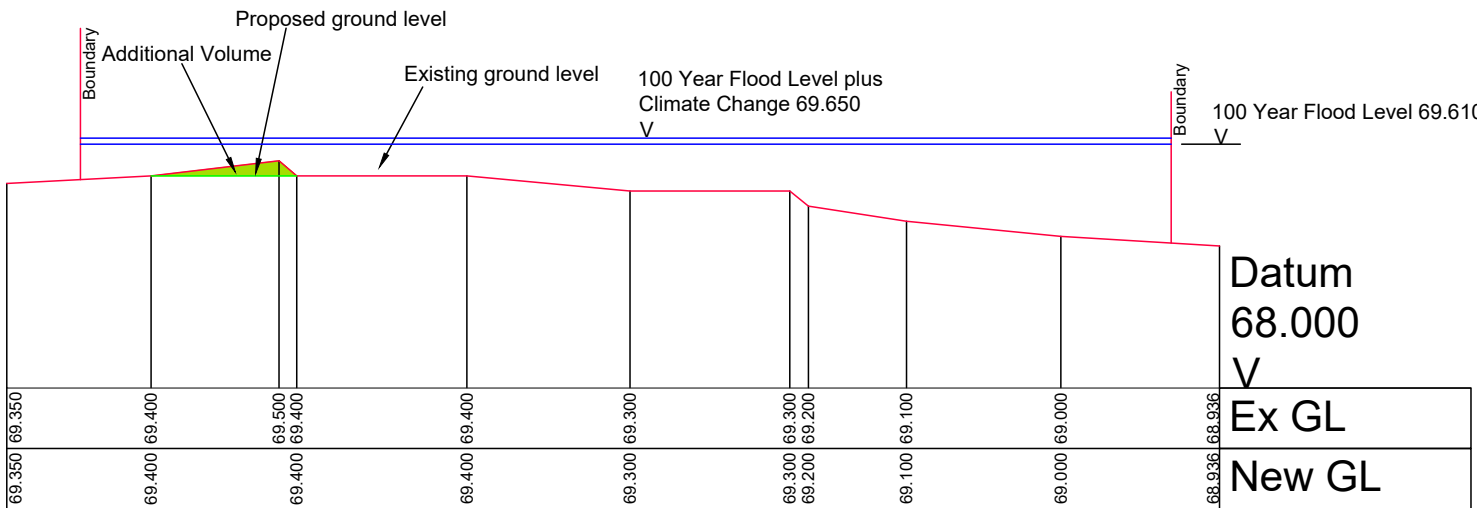
Proposed Levels	Areas m²
69.650-69.550	3.607
69.550-69.450	3.607
69.450-69.350	3.563
69.350-69.250	1.239
69.250-69.150	0.024

EXISTING LEVELS	Areas m²
69.650-69.550	3.607
69.550-69.450	3.495
69.450-69.350	3.073
69.350-69.250	0.836
69.250-69.150	0.024



Proposed Levels	Areas m²
69.650-69.550	3.607
69.550-69.450	3.607
69.450-69.350	2.930
69.350-69.250	0.945
69.250-69.150	0.559

EXISTING LEVELS	Areas m²
69.650-69.550	3.186
69.550-69.450	2.928
69.450-69.350	2.073
69.350-69.250	0.569
69.250-69.150	0.512



Proposed Levels	Areas m²
69.650-69.550	3.607
69.550-69.450	3.607
69.450-69.350	3.037
69.350-69.250	1.595
69.250-69.150	1.166

EXISTING LEVELS	Areas m²
69.650-69.550	3.607
69.550-69.450	3.547
69.450-69.350	2.749
69.350-69.250	1.595
69.250-69.150	1.166

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SITE IS TO VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION. THIS DRAWING IS NOT TO BE SCALED IN HARD FORMAT AND/OR ELECTRONIC FORMAT.

Volume Difference between Proposed and Existing by level Sections 1-17

Levels		Height (m)	Volume Difference (m³)
Top (m)	Bottom (m)		
69.650	69.550	0.1	+21.430
65.550	69.450	0.1	-9.593
69.450	69.350	0.1	-39.950
69.350	69.250	0.1	-26.393
69.250	69.150	0.1	-2.057

Positive figures indicate a reduction in flood volume. Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels		Height (m)	Volume Difference (m³)
Top (m)	Bottom (m)		
69.650	69.550	0.1	-3.858
65.550	69.450	0.1	-7.787
69.450	69.350	0.1	-12.360
69.350	69.250	0.1	-0.710
69.250	69.150	0.1	-0.313

Positive figures indicate a reduction in flood volume. Negative indicate an increase in flood volume.

Total loss/increase of flood plain volume.

Levels		Height (m)	Total loss of volume(m³)
Top (m)	Bottom (m)		
69.650	69.550	0.1	17.572
65.550	69.450	0.1	-17.380
69.450	69.350	0.1	-52.310
69.350	69.250	0.1	-27.103
69.250	69.150	0.1	-2.370

Positive figures indicate a reduction in flood volume. Negative indicate an increase in flood volume.

Rev	Date	Description	Drn	Chkd
P6	23/12/21	FLOOD LOSS/INCREASE TABLE AMENDED	GHB	TS
P5	21/12/21	FLOOD LOSS/INCREASE TABLE ADDED	GHB	TS
P4	20/12/21	FLOOD LEVELS AMENDED	GHB	TS
P3	12/10/21	HATCHING AND NOTES ADDED	GHB	TS
P2	12/10/21	COLOUR OF SECTION AMENDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS

Revisions

Drawing Originator

PAUL OWEN ASSOCIATES CONSULTING ENGINEERS - TECHNICAL ADVISERS
Studio D128, 62 Triton Road, West Dulwich, London SE21 8DE
t 020 3176 7726 www.paulowen.co.uk

Drawing Status

PRELIMINARY

Project Name

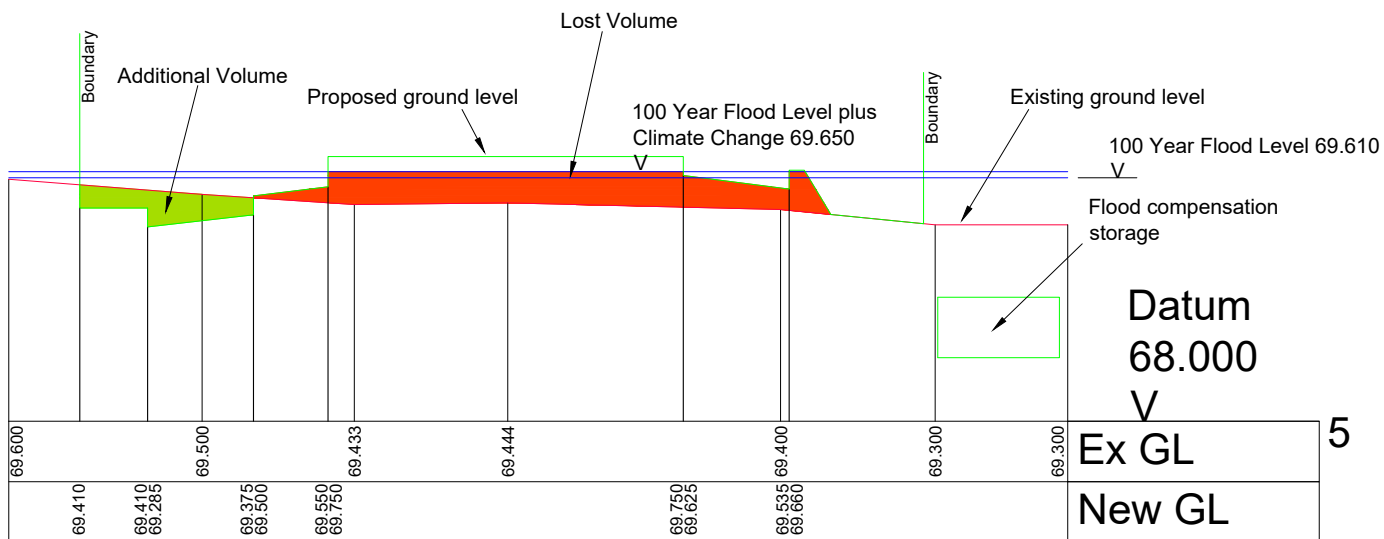
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Drawn by	GHB	Drawn Date	07/10/21	Checked by	TS	Scale	H 1/250 V 1/50
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Title FLOOD VOLUMES SECTIONS 3 OF 3

Drawing Number 220029/FV103

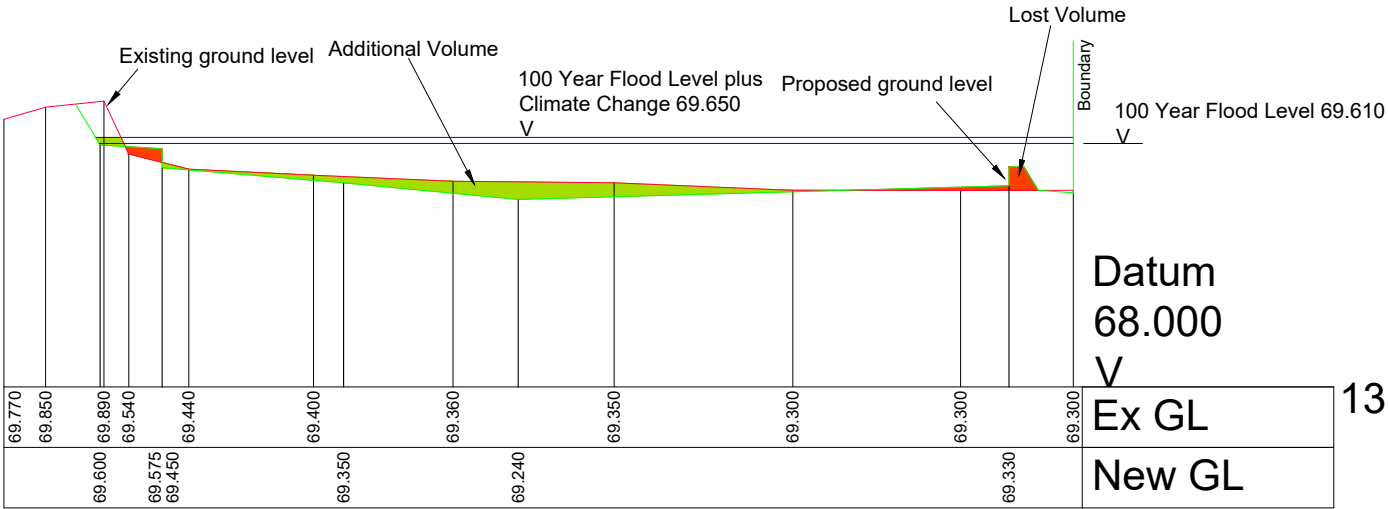
Revision P6



P2	21/12/21	FLOOD COMPENSATION STORAGE ADDED	GHB	TS
P1	20/12/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Dm	Chkd

Revisions

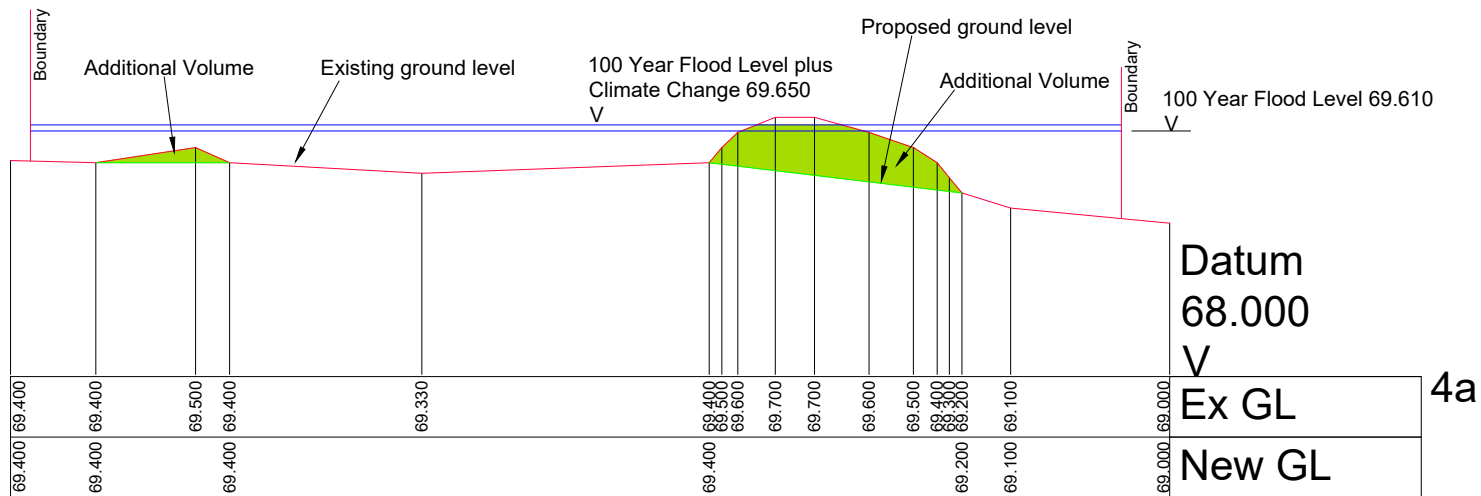
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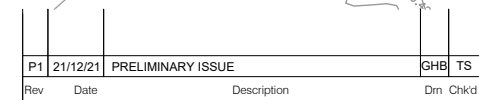
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Rev	Date	Description	Dm	Chkd	

Revisions



P1	20/12/21	PRELIMINARY ISSUE			GHB TS
Rev	Date	Description			Drm Chkd

Revisions



Drawn by GHB	Drawn Date Dec 21	Checked by TS	Scale NTS
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Revision
P1



APPENDIX I

6TH APRIL 2022 ENVIRONMENT AGENCY

CORRESPONDENCE

Cherwell District Council
Planning & Development Services
Bodicote House White Post Road
Bodicote
Banbury
OX15 4AA

Our ref: WA/2021/129266/03-L01
Your ref: 21/02286/F
Date: 06 April 2022

Dear Sir/Madam

Construction of a coffee unit with drive-thru facility and indoor seating with associated access, car parking, landscaping and servicing parking

Land north west of Launton Road roundabout adjoining Skimmingdish Lane,

Thank you for re-consulting us on the above application following the submission of additional details.

We have considered the following details in order to provide this response:

- RSK letter of response to Environment Agency objection ref. P680020-FRA L02 dated 24 December 2021.
- Drawing ref. 220029/100 Rev P7 – drainage layout
- Drawing ref. 220029/FV100 Rev P4 – flood volumes section layout
- Drawing ref. 220029/FV101 Rev P6 – flood volumes sections 1 of 3
- Drawing ref. 220029/FV102 Rev P6 – flood volumes sections 2 of 3
- Drawing ref. 220029/FV103 Rev P6 – flood volumes sections 3 of 3
- Drawing ref. 220029/FV104 Rev P2 – section 5
- Drawing ref. 220029/FV105 Rev P1 – section 13
- Drawing ref. 220029/FV106 Rev P1 – section 4a
- Drawing ref. 220029/FV107 Rev P1 – site plan

The letter and submitted drawings reference above do not satisfactorily address our concerns. We therefore **maintain our objection** to this application.

The letter states that the consideration of future flood risk based on the most current climate change allowances has now been undertaken. Based on an expected lifespan of the development being less than 25 years, a reduced climate change allowance from 35% to 4% has been considered.

The applicant has now carried out their own modelling work to determine the expected flood level for this epoch. We will need to carry out a detailed review of the fluvial modelling in order to verify the results being relied upon to assess the risk of flooding and to design the flood mitigation scheme. Details of how to share the modelling with us has been provided separately.

The flood compensation being provided through tanked storage has now been reduced to less than 30m³. This will be acceptable providing we are able to accept the modelling that is being used.

However, in our previous response, we requested additional details in relation to the proposed flood compensation area being proposed through alterations of ground levels.

The detail provided in drawing number 220029/FV100 (version P4, dated 23 December 2021) identifies some ground level changes but does not show floodplain compensation storage areas. A site plan that shows the proposed changes for the whole site, not just certain points, should be provided. This is often demonstrated by shading in areas of the site where land is being raised and lowered, as well as showing the final ground levels. This should demonstrate that the compensation scheme is hydraulically connected to the floodplain and that flows are not impeded.

In addition, the submitted letter sets out that the floodplain storage compensation required for levels above 69.55m AOD has been reduced to 17.58m³ following a revision in the climate change allowance. However, it is not clear how this was calculated. Whilst there is some information in the three 'Flood Volumes Sections' drawings, it would be helpful for this to be summarised within the FRA. The tables provided in the submitted letter seem to only show the change in flood volume once compensation (through ground level changes) has been provided. For clarity, a table should be included that clearly shows for each 0.1m slice the total: volume of flood storage lost, the volume of flood storage gained, and the volume difference (this appears to have been provided in the first table within the submitted letter).

Further, if the highest climate change flood level is agreed to be 69.66m AOD as stated in the submitted letter from RSK (dated 24 December 2021), then the tables within the letter should be updated to include this flood level (currently the tables only go up to 69.65mAOD).

Overcoming our objection

To overcome our objection, the applicant should submit a revised FRA which addresses the points highlighted above. If this cannot be achieved, we are likely to maintain our objection.

Please re-consult us on any revised FRA submitted and we'll respond within 21 days of receiving it.

Level for Level Floodplain Compensation Storage (Preferable)

Level for level compensation is the matching of volumes lost from the floodplain due to increases in built footprint or raised ground levels, with new floodplain volume by reducing ground levels elsewhere. Analysis should be presented in the FRA as a table showing the volumes lost to the development in approximately 100mm increments of level and the volumes gained by the mitigation proposed in the same level increments. It should be demonstrated that there is no loss of floodplain volume in any increment of level, and preferably a net gain (see attached diagram).

Please note for this to be achievable, it requires land on the edge of the floodplain and above the 1% AEP, including an appropriate allowance for climate change, flood extent.

The FRA should consider whether level for level compensation is possible and if not explain why and detail how any associated risks from the chosen form of mitigation can be minimised.

Undercroft (To be used only when level for level floodplain compensation storage has been demonstrated not to be possible)

If the applicant proposes voids under the building to mitigate the loss of floodplain storage, the design of the voids should adhere to the following guidance:

If voids under the dwelling are proposed, they should extend from the ground level, with the underside of the void (soffit) at or above the 1% annual probability (1 in 100 year) flood level with a 35% allowance for climate change. There should be a 1 metre wide void opening in every 5 metre length of wall on all sides of the building. Void openings should extend vertically from existing ground level to at least the 1% annual probability (1 in 100 year) flood level with a 35% allowance for climate change. The void should be open and maintained as such in perpetuity. If the void openings are a security risk, then vertical steel bars placed at 100mm centres can be installed. Louvres or slats, as an alternative to bars, are not permitted over the openings due to the increased risk of debris blockage.

Closing comments

If you are minded to approve the application contrary to our objection, please contact us to explain why material considerations outweigh our objection. This will allow us to make further representations. Should our objection be removed, it is likely we will recommend the inclusion of a condition/conditions on any subsequent approval.

Please refer to our previous response dated 13 September 2021 for additional advice.

Should you require any additional information, or wish to discuss these matters further, please do not hesitate to contact me on the number below.

Yours faithfully

Miss Sarah Green
Sustainable Places - Planning Advisor

Direct dial 0208 474 9253

Direct e-mail planning_THM@environment-agency.gov.uk

Colin Whittingham

From: Colin Whittingham
Sent: 11 May 2022 10:15
To: Planning_THM
Cc: 'Hugh Colville'; Simon Berry - Life Property (simon@lifeproperty.com); Tim Sheath; Gavin Bayes; Shane Rowe
Subject: Drive-thru - Launton Rd planning application 21/02286/F
Attachments: 220029_FV100_P5.pdf; 220029_FV101_P7.pdf; 220029_FV102_P7.pdf; 220029_FV104_P3.pdf; 220029_FV105_P2.pdf; 220029_FV106_P2.pdf; 220029_FV107_P2.pdf; Bicester Flood Volume Calculations Flood level 69.66.xlsx; 220029_FV103_P7.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Sarah,

I hope you are keeping well?

Many thanks for the previous comments which we have considered. Please find attached a series of drawings based on these comments and some accompanying narrative below. These are based on the results of the submitted flood model, which is currently undergoing a review from the EA.

EA Comment	RSK Response
The applicant has now carried out their own modelling work to determine the expected flood level for this epoch. We will need to carry out a detailed review of the fluvial modelling in order to verify the results being relied upon to assess the risk of flooding and to design the flood mitigation scheme. Details of how to share the modelling with us has been provided separately.	<p>The model files have been uploaded and confirmation of the amendments issued to the EA.</p> <p>As the model is an existing EA model and it's only the inflows which have been adjusted to reflect the latest allowances for climate change, we are expecting this to be approved fit for purpose.</p> <p>NOTE the model being "fit for purpose" approval by the EA has been provided under separate cover.</p>
The flood compensation being provided through tanked storage has now been reduced to less than 30m ³ . This will be acceptable providing we are able to accept the modelling that is being used.	Noted – although based on the submitted model files and revised calculations (attached) show that 18.47m ³ is now required to offset the level for level flood compensation requirements. Whilst the requirement for level for level required attenuation is now 18.47m ³ , there are plans to offer 30m ³ to show a further benefit of the scheme in terms of flood risk (see below point for further info)
However, in our previous response, we requested additional details in relation to the proposed flood compensation area being proposed through alterations of ground levels.	Drawing reference 220029_FV100_P5 and 220029_FV107_P2 show the site and the wider area floodplain loss and gain. The blue areas show where additional floodplain volume is created and the red where levels have been raised and volume is lost. It can be seen from the spreadsheet that for each 100mm increment between 69.16m AOD and 69.56m AOD there is additional floodplain storage, once the flood

The detail provided in drawing number 220029/FV100 (version P4, dated 23 December 2021) identifies some ground level changes but does not show floodplain compensation storage areas. A site plan that shows the proposed changes for the whole site, not just certain points, should be provided. This is often demonstrated by shading in areas of the site where land is being raised and lowered, as well as showing the final ground levels. This should demonstrate that the compensation scheme is hydraulically connected to the floodplain and that flows are not impeded.

level reaches 69.56m AOD, there is a loss of floodplain for this 100mm increment, hence the requirement for additional attenuation at this level – in the form of the storage tanks.

The level for level compensation is being provided in the underground tanks with the inlets set at the required level to provide the level for level compensation and allows for hydraulic connectivity to the floodplain when the flood levels reach these inlets. It can also be seen from the cross sections that the flood levels enter the car park, so whilst there is some lost floodplain volume in some areas, there remains a hydraulic connectivity between all sections of the site and the flood zone, therefore the plans and associated calculations show a true representation of the situation.

It can be seen from the spreadsheet and the associated additional attention tanks that at all flood level increments, there is an increase in floodplain volume as a result of the development.

In addition, the submitted letter sets out that the floodplain storage compensation required for levels above 69.55m AOD has been reduced to 17.58m³ following a revision in the climate change allowance. However, it is not clear how this was calculated. Whilst there is some information in the three 'Flood Volumes Sections' drawings, it would be helpful for this to be summarised within the FRA. The tables provided in the submitted letter seem to only show the change in flood volume once compensation (through ground level changes) has been provided. For clarity, a table should be included that clearly shows for each 0.1m slice the total: volume of flood storage lost, the volume of flood storage gained, and the volume difference (this appears to have been provided in the first table within the submitted letter).

The attached spreadsheet details the volumes lost and created at 0.1m 'segments'.

It can be seen from the attached drawings and the associated spreadsheet that the level for level volume of flood water lost due to the development, if unmitigated, is 18.470m³. The previous lost volume between levels 69.650 and 69.550 was 17.572m³. This is a net increase of 0.898m³. It is this volume (18.470m³) that will be attenuated in the tank system, offering the required level for level flood compensation as previously agreed. As stated above, the scheme will offer 30m³, of attenuation in the tanks, thus offering additional flood risk benefits of the scheme.

Whilst the EA's requirement is for level for level compensation, there is an additional floodplain volumetric benefit from the scheme where there is a net gain in floodplain volume by 94.745m³ (see table below) and it's when the flood levels reach 69.56m AOD that the attenuation tanks are available to provide the required level for level compensation.

Total loss/increase of flood plain volume.

Levels			
Top (m)	Bottom (m)	Height (m)	Total loss of volume(m ³)
69.660	69.560	0.1	+18.470
69.560	69.460	0.1	-2.440
69.460	69.360	0.1	-51.865
69.360	69.260	0.1	-37.113
69.260	69.160	0.1	-3.327

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

	Note – the above table does NOT include the volume offered by the flood attenuation tanks and the 18.470m ³ shown above is compensated in a 30m ³ attenuation tank
Further, if the highest climate change flood level is agreed to be 69.66m AOD as stated in the submitted letter from RSK (dated 24 December 2021), then the tables within the letter should be updated to include this flood level (currently the tables only go up to 69.65mAOD).	See above, the tables on the spreadsheet and section drawings have been revised to reflect this.
To overcome our objection, the applicant should submit a revised FRA which addresses the points highlighted above. If this cannot be achieved, we are likely to maintain our objection.	Once we have received a favourable response from the EA, an updated FRA addendum will be produced with the above points addressed.

I look forward to a response from you.

Colin Whittingham

Associate Director BSc (Hons) MSc MCIWEM C.WEM PIEMA

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Registered number: 4723837

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LEGEND

- EXISTING LEVELS +69.31
- PROPOSED LEVELS + 69.290
- LOST VOLUME
- ADDITIONAL VOLUME

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Volume Difference between Proposed and Existing by level Sections 1-17

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.660	69.560	0.1	+21.977
69.560	69.460	0.1	+4.800
69.460	69.360	0.1	-39.980
69.360	69.260	0.1	-29.393
69.260	69.160	0.1	-2.880

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.660	69.560	0.1	-3.507
69.560	69.460	0.1	-7.240
69.460	69.360	0.1	-11.885
69.360	69.260	0.1	-7.720
69.260	69.160	0.1	-0.447

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Total loss/increase of flood plain volume.

Levels			
Top (m)	Bottom (m)	Height (m)	Total loss of volume(m³)
69.660	69.560	0.1	+18.470
69.560	69.460	0.1	-2.440
69.460	69.360	0.1	-51.865
69.360	69.260	0.1	-37.113
69.260	69.160	0.1	-3.327

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

P5	05/05/22	FLOOD LEVEL AMENDED AND FLOOD VOLUMES RECALCULATED	GHB	TS
P4	23/12/21	FLOOD LOSS/INCREASE TABLE AMENDED	GHB	TS
P3	21/12/21	FLOOD LOSS/INCREASE TABLE ADDED	GHB	TS
P2	20/12/21	PROPOSED LEVELS COLOUR CHANGED LEGEND ADDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Dm Chkd	

Revisions

Drawing Originator

PAUL OWEN
ASSOCIATES

CONSULTING ENGINEERS - TECHNICAL ADVISERS
Studio D128, 62 Triton Road, West Dulwich,
London SE21 8DE
t: 020 3176 7726 www.paulowen.co.uk

Drawing Status

PRELIMINARY

Project Name

BICESTER

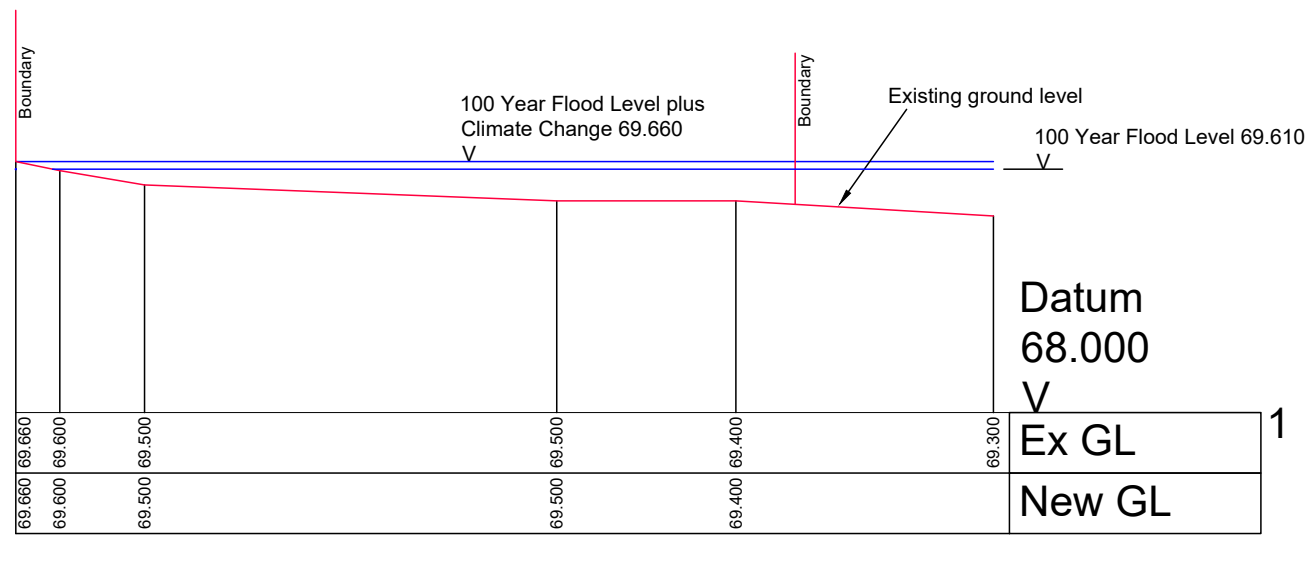
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Title							Original drawing sheet is A1

FLOOD VOLUMES SECTION LAYOUT PLAN

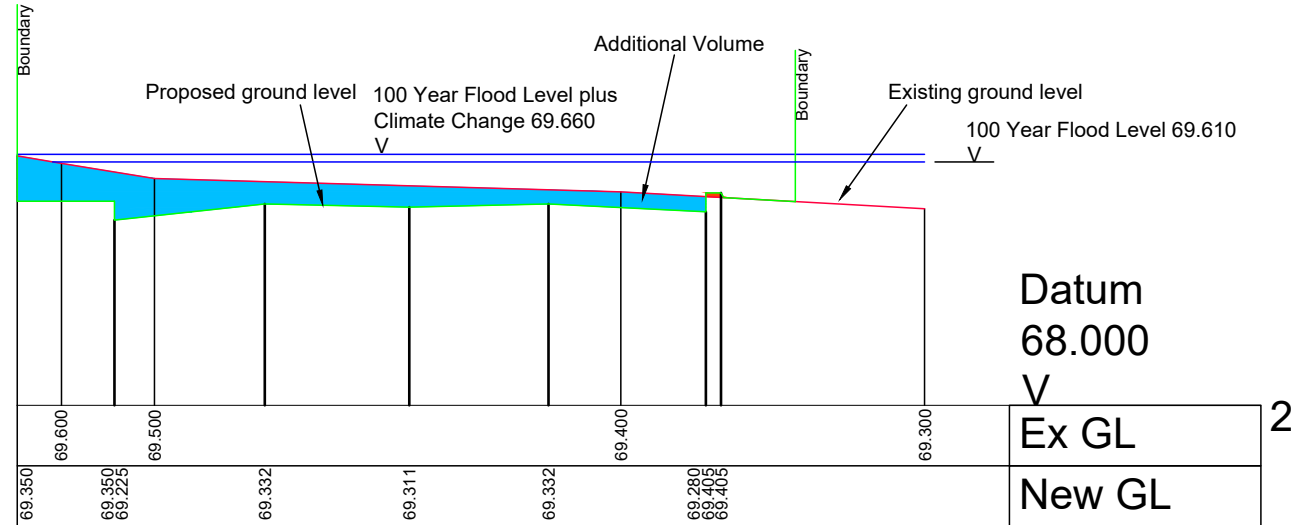
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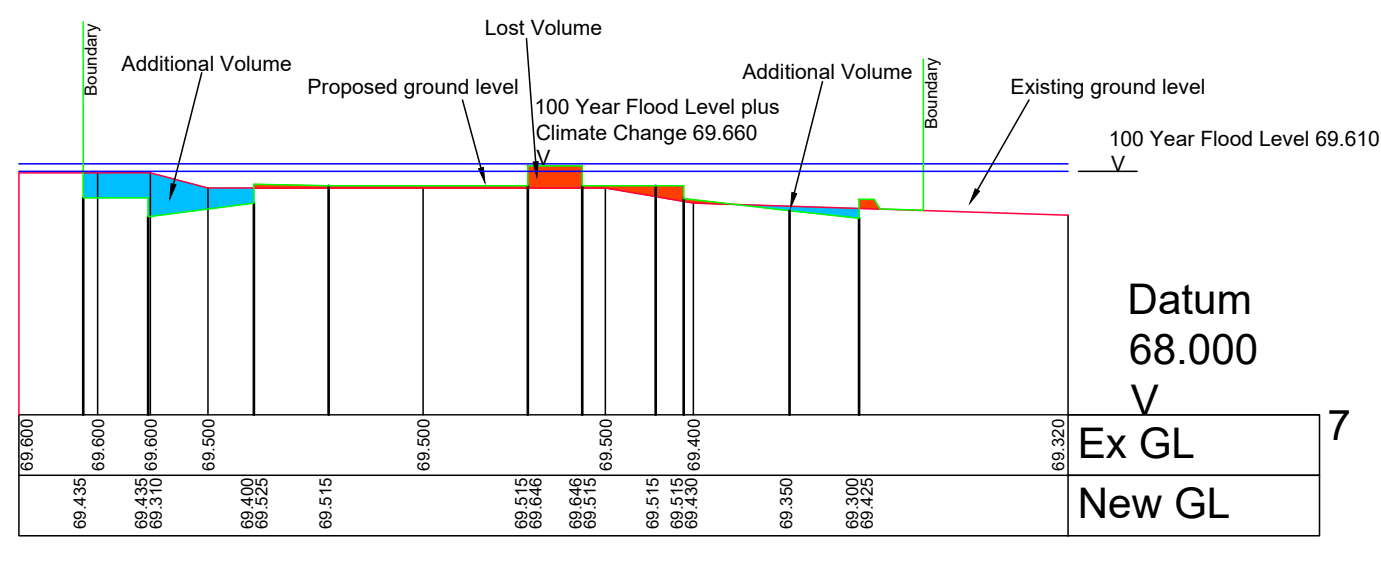


Proposed/Existing Levels	Areas m²
69.660-69.560	2.452
69.560-69.460	2.062
69.460-69.360	0.728
69.360-69.260	0.000
69.260-69.160	0.000



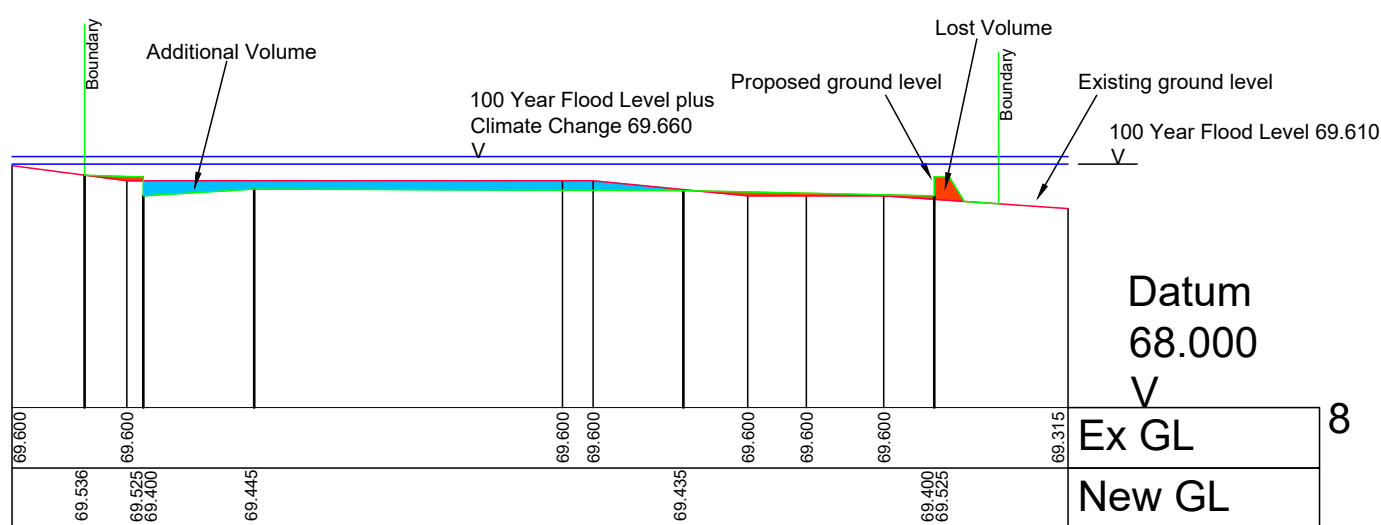
Proposed Levels	Areas m²
69.660-69.560	2.573
69.560-69.460	2.573
69.460-69.360	2.539
69.360-69.260	1.060
69.260-69.160	0.029

EXISTING LEVELS	Areas m²
69.660-69.560	2.453
69.560-69.460	2.035
69.460-69.360	0.662
69.360-69.260	0.007
69.260-69.160	0.000



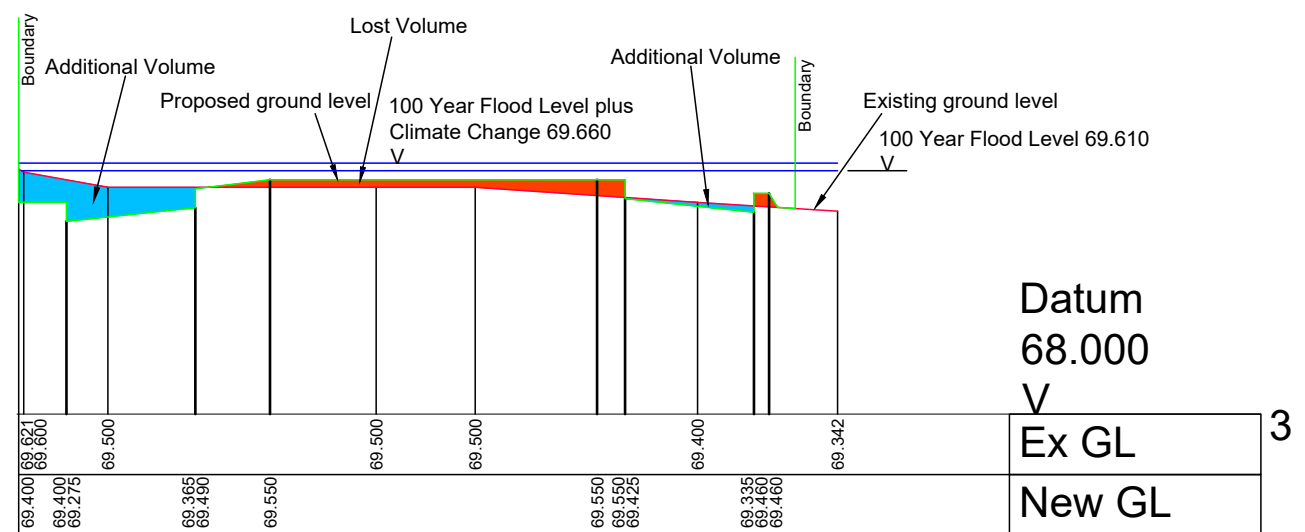
Proposed Levels	Areas m²
69.660-69.560	2.623
69.560-69.460	1.903
69.460-69.360	1.019
69.360-69.260	0.136
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.674
69.560-69.460	1.851
69.460-69.360	0.689
69.360-69.260	0.005
69.260-69.160	0.000



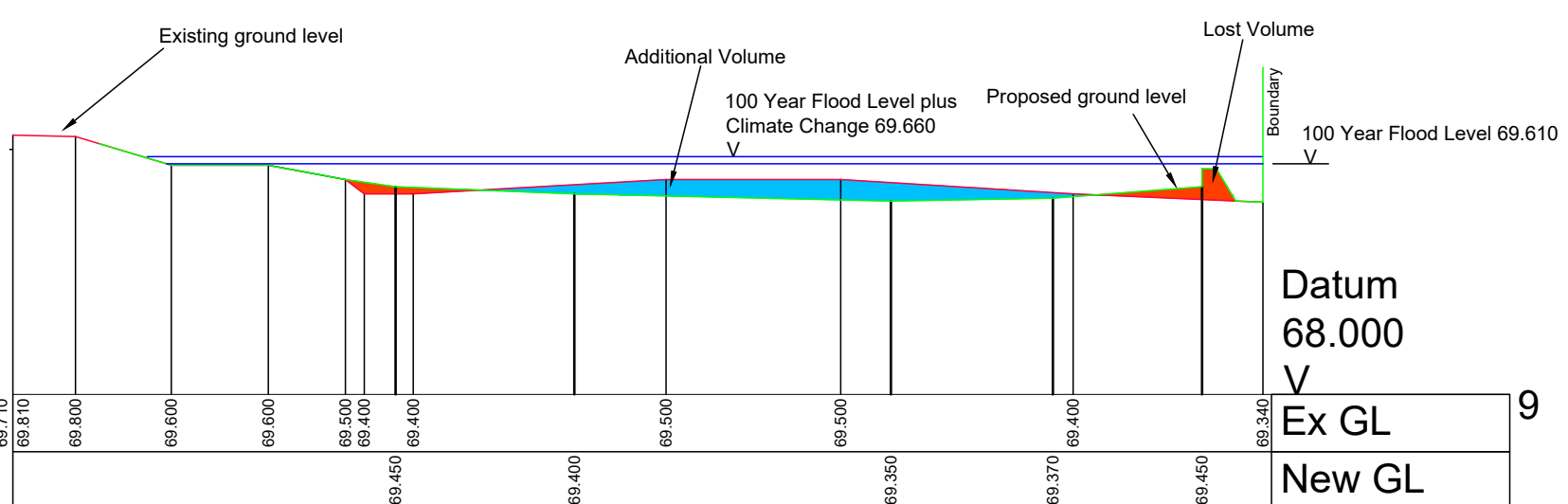
Proposed Levels	Areas m²
69.660-69.560	3.022
69.560-69.460	2.813
69.460-69.360	0.902
69.360-69.260	0.005
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	3.022
69.560-69.460	2.283
69.460-69.360	0.684
69.360-69.260	0.005
69.260-69.160	0.000



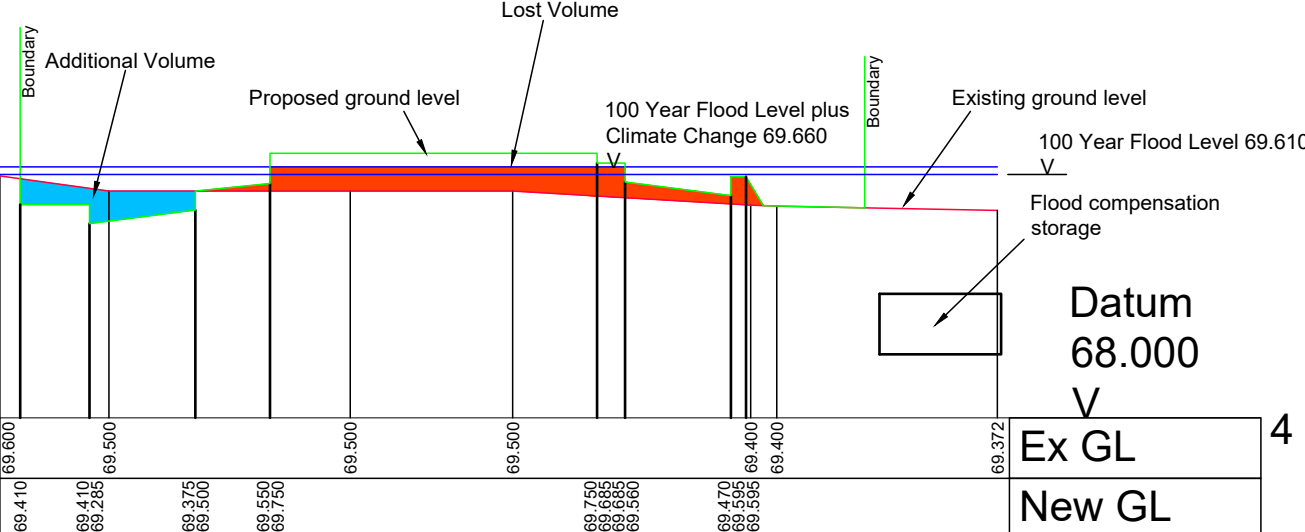
Proposed Levels	Areas m²
69.660-69.560	2.568
69.560-69.460	1.363
69.460-69.360	0.916
69.360-69.260	0.186
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.537
69.560-69.460	1.778
69.460-69.360	0.391
69.360-69.260	0.000
69.260-69.160	0.000



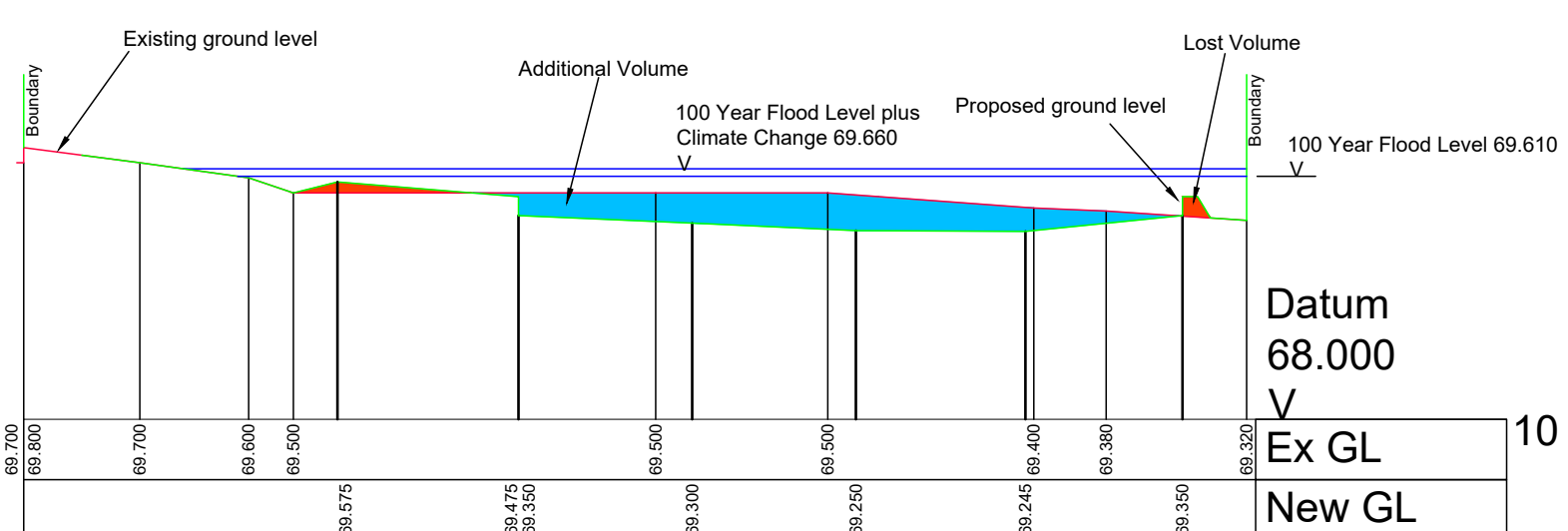
Proposed Levels	Areas m²
69.660-69.560	3.676
69.560-69.460	3.153
69.460-69.360	2.073
69.360-69.260	0.039
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	3.683
69.560-69.460	2.886
69.460-69.360	0.991
69.360-69.260	0.019
69.260-69.160	0.000



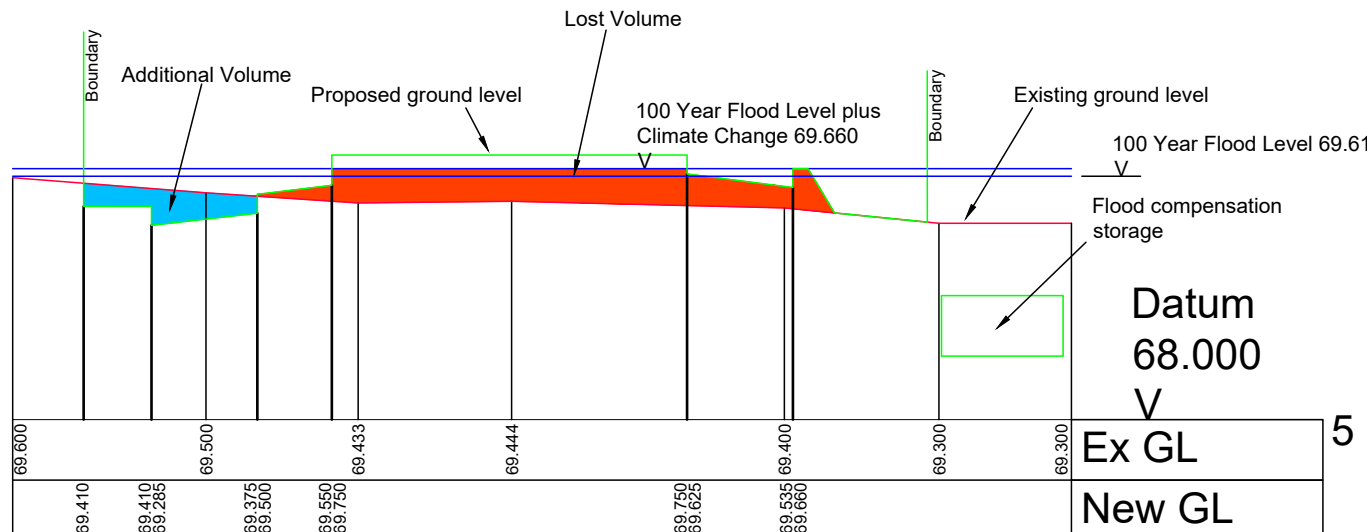
Proposed Levels	Areas m²
69.660-69.560	1.599
69.560-69.460	1.190
69.460-69.360	0.675
69.360-69.260	0.109
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.784
69.560-69.460	1.963
69.460-69.360	0.356
69.360-69.260	0.000
69.260-69.160	0.000



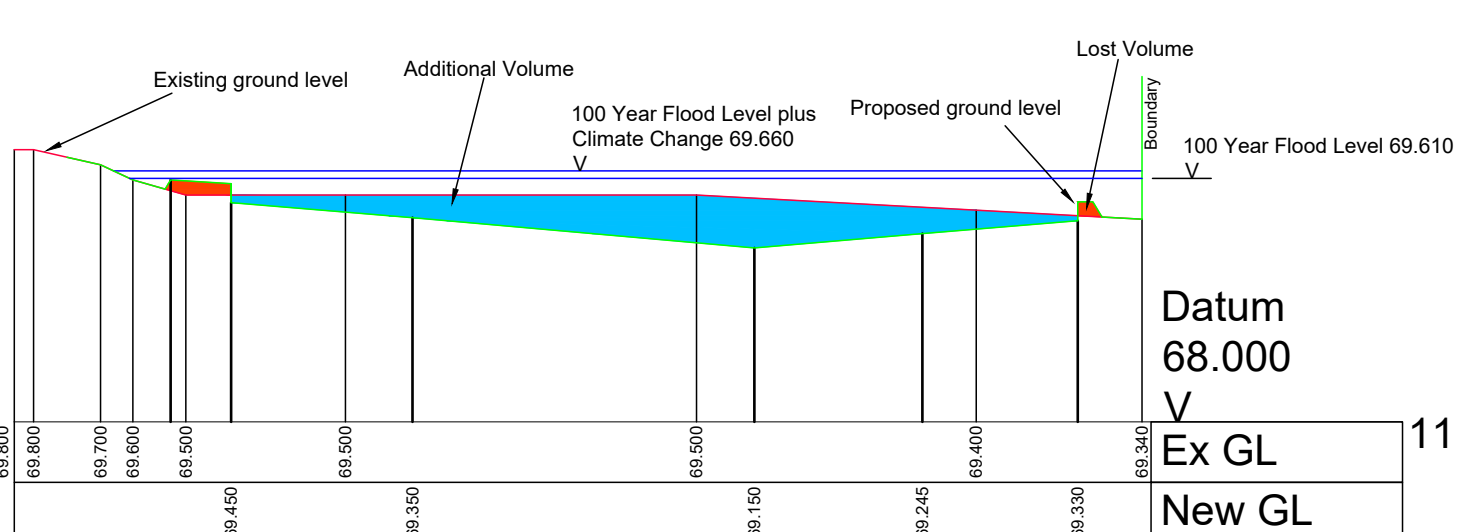
Proposed Levels	Areas m²
69.660-69.560	3.353
69.560-69.460	2.690
69.460-69.360	2.343
69.360-69.260	1.587
69.260-69.160	0.081

EXISTING LEVELS	Areas m²
69.660-69.560	3.360
69.560-69.460	2.422
69.460-69.360	0.741
69.360-69.260	0.066
69.260-69.160	0.000



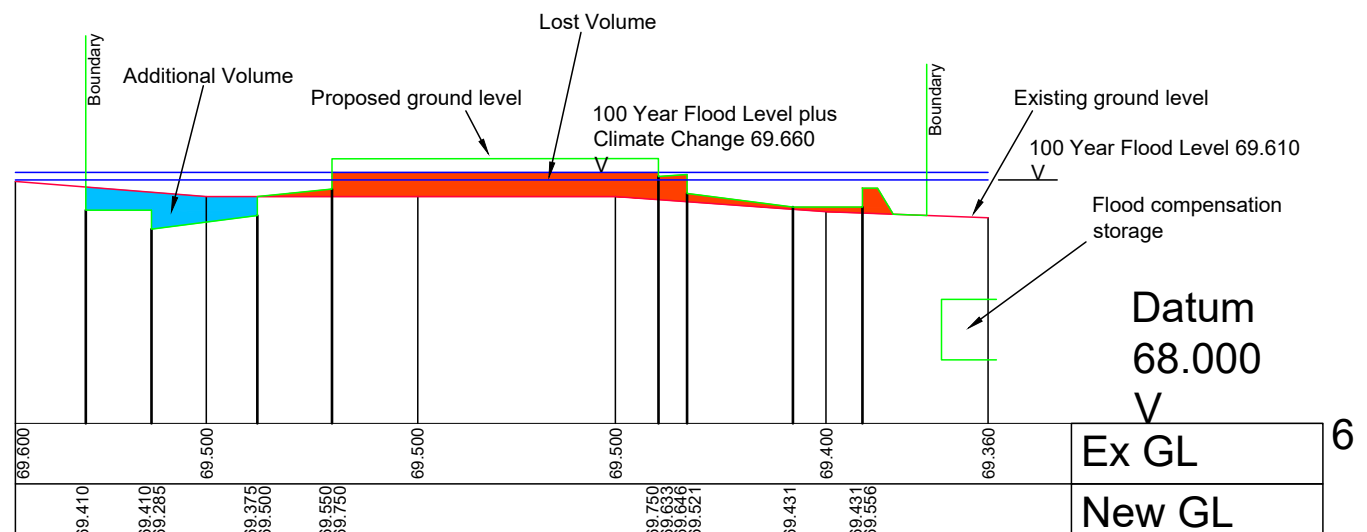
Proposed Levels	Areas m²
69.660-69.560	1.468
69.560-69.460	1.034
69.460-69.360	0.780
69.360-69.260	0.196
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.790
69.560-69.460	2.440
69.460-69.360	0.912
69.360-69.260	0.073
69.260-69.160	0.000



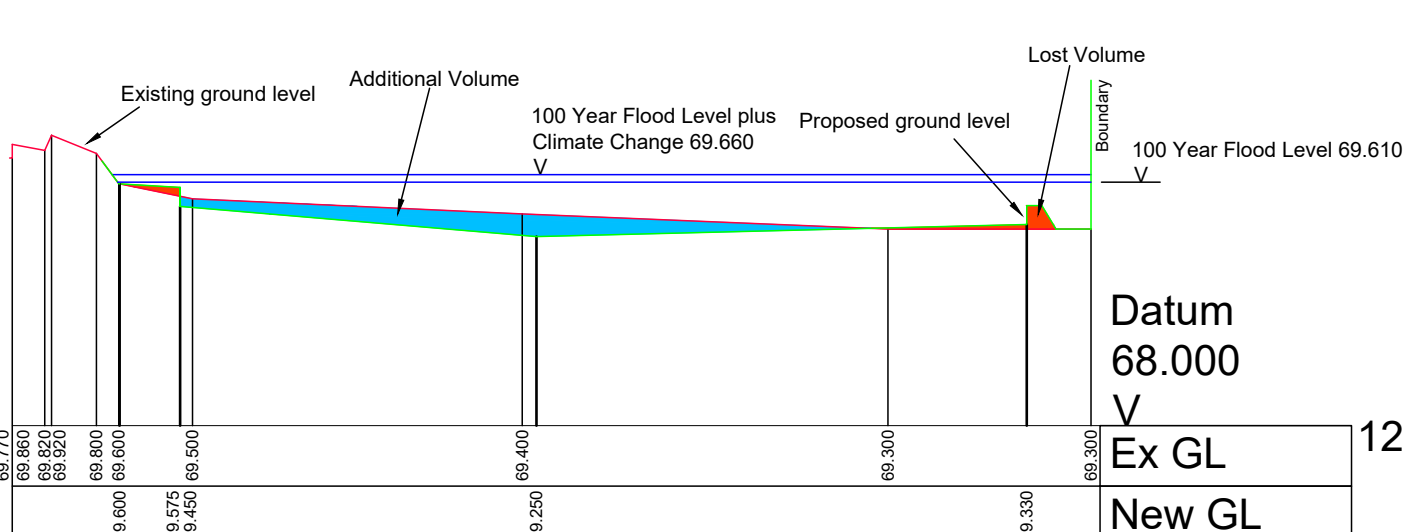
Proposed Levels	Areas m²
69.660-69.560	3.285
69.560-69.460	3.009
69.460-69.360	2.708
69.360-69.260	1.843
69.260-69.160	0.697

EXISTING LEVELS	Areas m²
69.660-69.560	3.342
69.560-69.460	2.444
69.460-69.360	0.642
69.360-69.260	0.018
69.260-69.160	0.000



Proposed Levels	Areas m²
69.660-69.560	1.626
69.560-69.460	1.312
69.460-69.360	0.635
69.360-69.260	0.109
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.781
69.560-69.460	1.899
69.460-69.360	0.367
69.360-69.260	0.000
69.260-69.160	0.000



Proposed Levels	Areas m²
69.660-69.560	3.166
69.560-69.460	3.012
69.460-69.360	2.713
69.360-69.260	1.553
69.260-69.160	0.013

EXISTING LEVELS	Areas m²
69.660-69.560	3.202
69.560-69.460	2.928
69.460-69.360	1.981
69.360-69.260	0.621
69.260-69.160	0.000

Volume Difference between Proposed and Existing by level Sections 1-17

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.660	69.560	0.1	+21.977
69.560	69.460	0.1	+4.800
69.460	69.360	0.1	-39.980
69.360	69.260	0.1	-29.393
69.260	69.160	0.1	-2.880

Positive figures indicate a reduction in flood volume. Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.660	69.560	0.1	-3.507
69.560	69.460	0.1	-7.240
69.460	69.360	0.1	-11.885
69.360	69.260	0.1	-7.720
69.260	69.160	0.1	-0.447

Positive figures indicate a reduction in flood volume. Negative indicate an increase in flood volume.

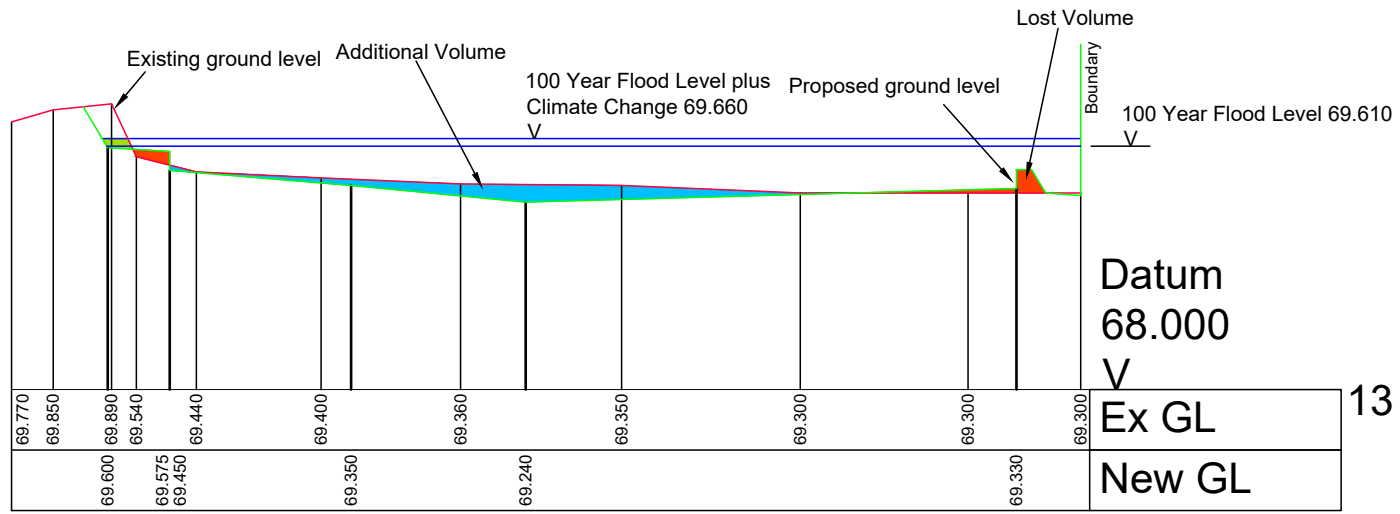
Total loss/increase of flood plain volume.

Levels			
Top (m)	Bottom (m)	Height (m)	Total loss of volume(m³)
69.660	69.560	0.1	+18.470
69.560	69.460	0.1	-2.440
69.460	69.360	0.1	-51.865
69.360	69.260	0.1	-37.113
69.260	69.160	0.1	-3.327

Positive figures indicate a reduction in flood volume. Negative indicate an increase in flood volume.

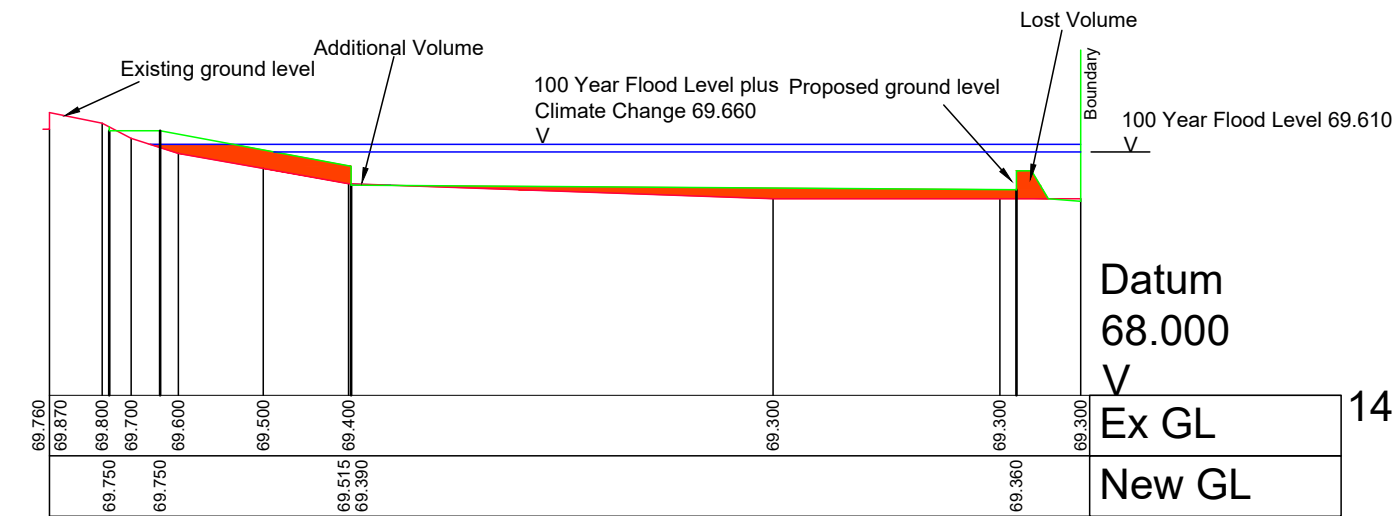
P7	05/05/22	FLOOD LEVEL AMENDED AND FLOOD VOLUMES RECALCULATED	GHB	TS
P6	23/12/21	FLOOD LOSS/INCREASE TABLE AMENDED	GHB	TS
P5	21/12/21	FLOOD LOSS/INCREASE TABLE AND FLOOD COMPENSATION STORAGE ADDED	GHB	TS
P4	20/12/21	FLOOD LEVELS AMENDED	GHB	TS
P3	12/10/21	HATCHING AND NOTES ADDED	GHB	TS
P2	12/10/21	COLOUR OF SECTION AMENDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Dm	Chkd

Revisions



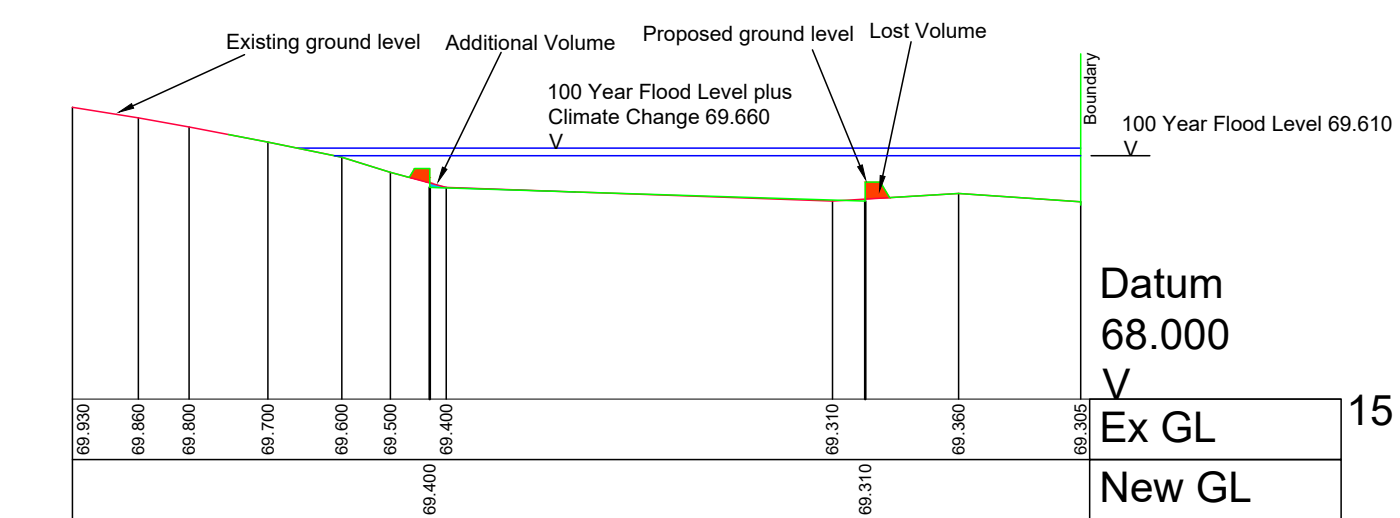
Proposed Levels	Areas m²
69.660-69.560	3.186
69.560-69.460	3.012
69.460-69.360	2.708
69.360-69.260	1.624
69.260-69.160	0.047

EXISTING LEVELS	Areas m²
69.660-69.560	3.139
69.560-69.460	3.060
69.460-69.360	2.598
69.360-69.260	0.790
69.260-69.160	0.000



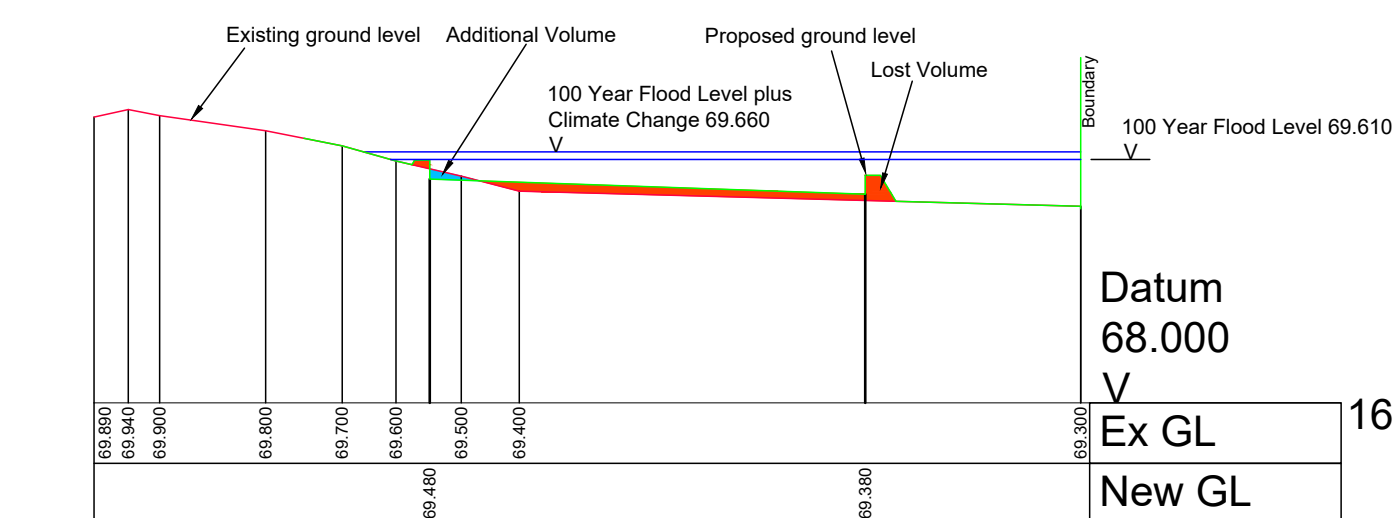
Proposed Levels	Areas m²
69.660-69.560	2.868
69.560-69.460	2.426
69.460-69.360	2.010
69.360-69.260	0.078
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.989
69.560-69.460	2.730
69.460-69.360	2.359
69.360-69.260	0.863
69.260-69.160	0.000



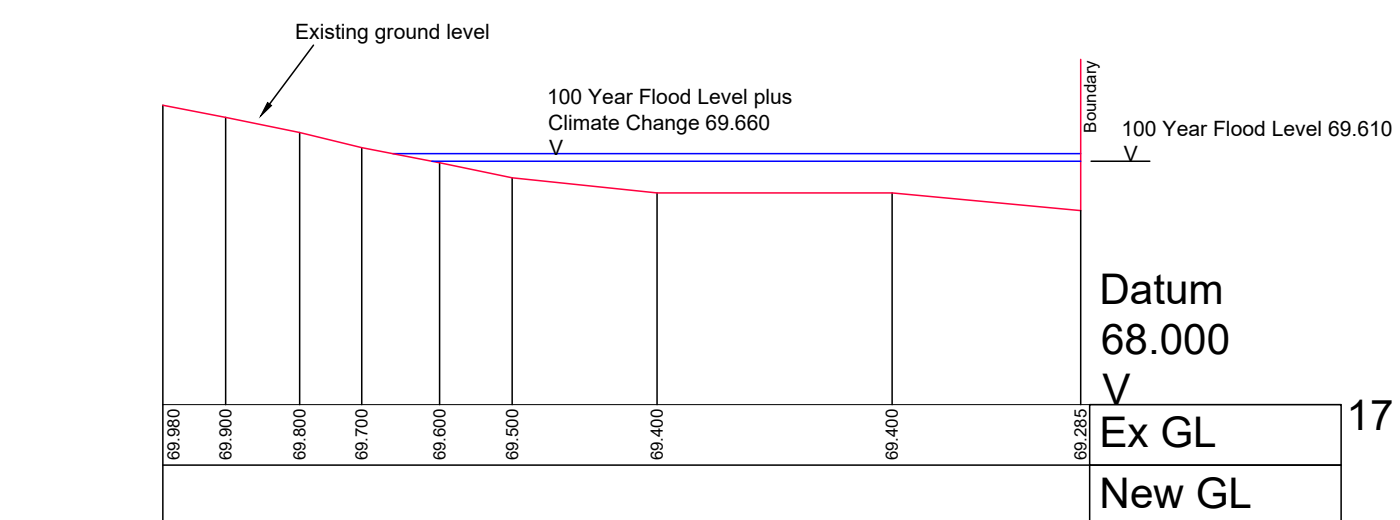
Proposed Levels	Areas m²
69.660-69.560	2.474
69.560-69.460	2.258
69.460-69.360	1.979
69.360-69.260	0.344
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.474
69.560-69.460	2.297
69.460-69.360	2.014
69.360-69.260	0.389
69.260-69.160	0.000



Proposed Levels	Areas m²
69.660-69.560	2.256
69.560-69.460	2.098
69.460-69.360	1.095
69.360-69.260	0.267
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	2.279
69.560-69.460	2.072
69.460-69.360	1.743
69.360-69.260	0.334
69.260-69.160	0.000



Proposed/Existing Levels	Areas m²
69.660-69.560	2.147
69.560-69.460	1.885
69.460-69.360	1.133
69.360-69.260	0.157
69.260-69.160	0.000

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Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.660	69.560	0.1	+21.977
69.560	69.460	0.1	+4.800
69.460	69.360	0.1	-39.980
69.360	69.260	0.1	-29.393
69.260	69.160	0.1	-2.880

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m³)
69.660	69.560	0.1	-3.507
69.560	69.460	0.1	-7.240
69.460	69.360	0.1	-11.885
69.360	69.260	0.1	-7.720
69.260	69.160	0.1	-0.447

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Total loss/increase of flood plain volume.

Levels			
Top (m)	Bottom (m)	Height (m)	Total loss of volume(m³)
69.660	69.560	0.1	+18.470
69.560	69.460	0.1	-2.440
69.460	69.360	0.1	-51.865
69.360	69.260	0.1	-37.113
69.260	69.160	0.1	-3.327

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

P7	05/05/22	FLOOD LEVEL AMENDED AND FLOOD VOLUMES RECALCULATED	GHB	TS
P6	23/12/21	FLOOD LOSS/INCREASE TABLE AMENDED	GHB	TS
P5	21/12/21	FLOOD LOSS/INCREASE TABLE ADDED	GHB	TS
P4	20/12/21	FLOOD LEVELS AMENDED	GHB	TS
P3	12/10/21	HATCHING AND NOTES ADDED	GHB	TS
P2	12/10/21	COLOUR OF SECTION AMENDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Drn	Chkd

Revisions

Drawing Originator

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Drawing Status

PRELIMINARY

Project Name

BICESTER

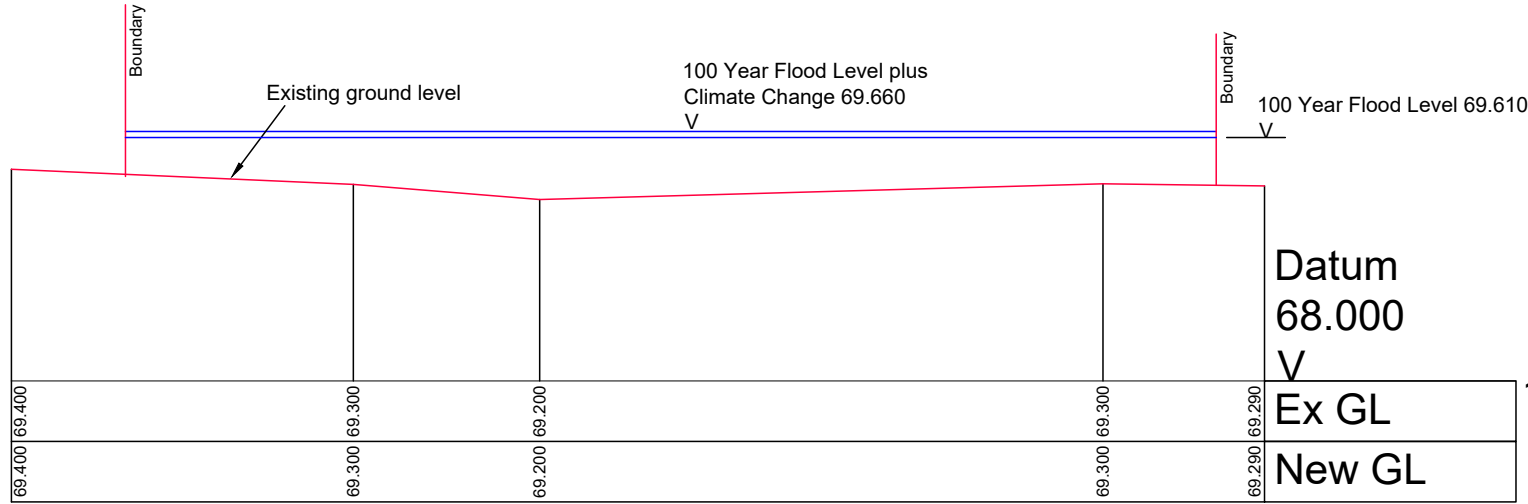
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Title FLOOD VOLUMES SECTIONS 2 OF 3 Original drawing sheet is A1

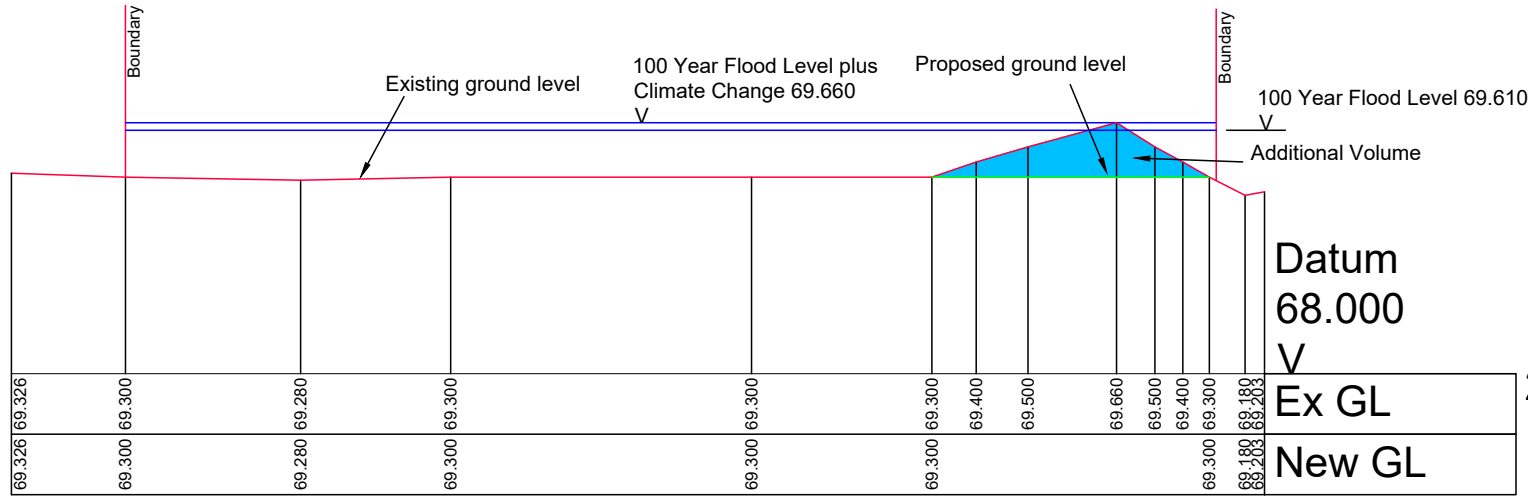
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SITE IS TO VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION. THIS DRAWING IS NOT TO BE SCALED IN HARD FORMAT AND/OR ELECTRONIC FORMAT.

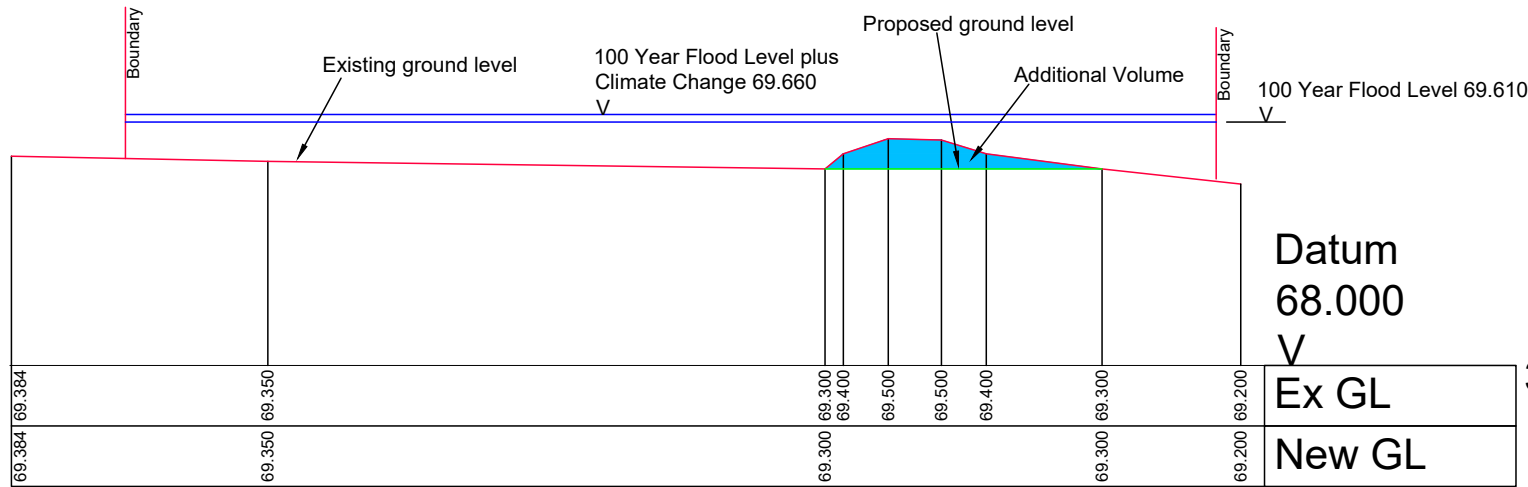


Proposed/Existing Levels	Areas m²
69.660-69.560	3.607
69.560-69.460	3.607
69.460-69.360	3.605
69.360-69.260	2.688
69.260-69.160	0.433



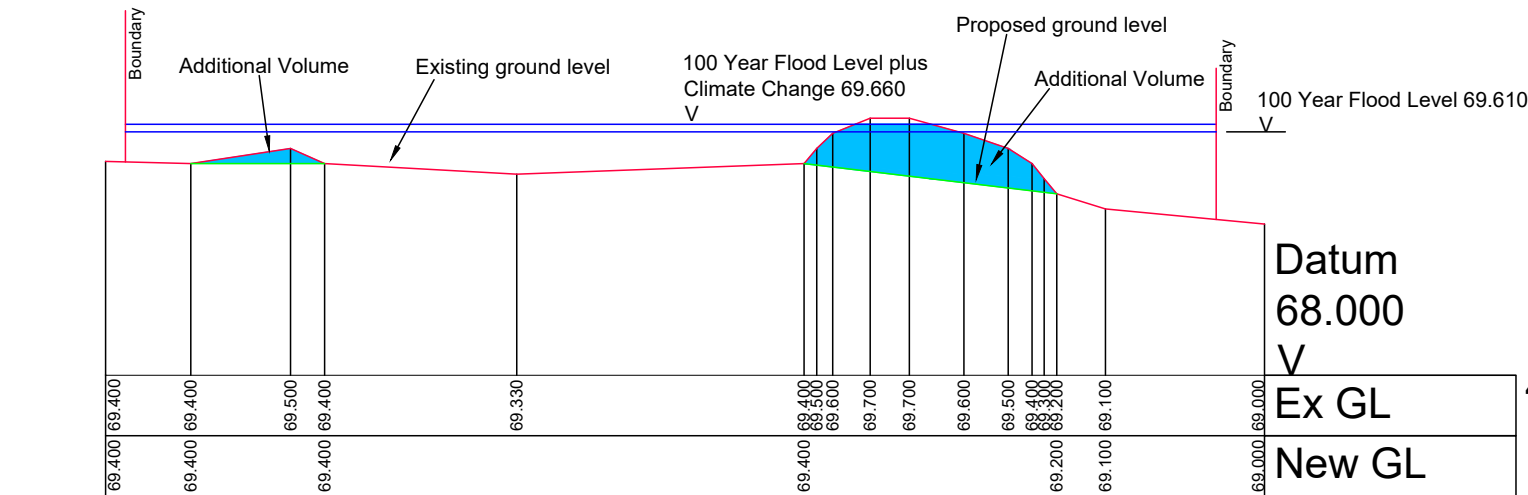
Proposed Levels	Areas m²
69.660-69.560	3.607
69.560-69.460	3.607
69.460-69.360	3.607
69.360-69.260	2.274
69.260-69.160	0.000

EXISTING LEVELS	Areas m²
69.660-69.560	3.476
69.560-69.460	3.214
69.460-69.360	2.952
69.360-69.260	1.765
69.260-69.160	0.000



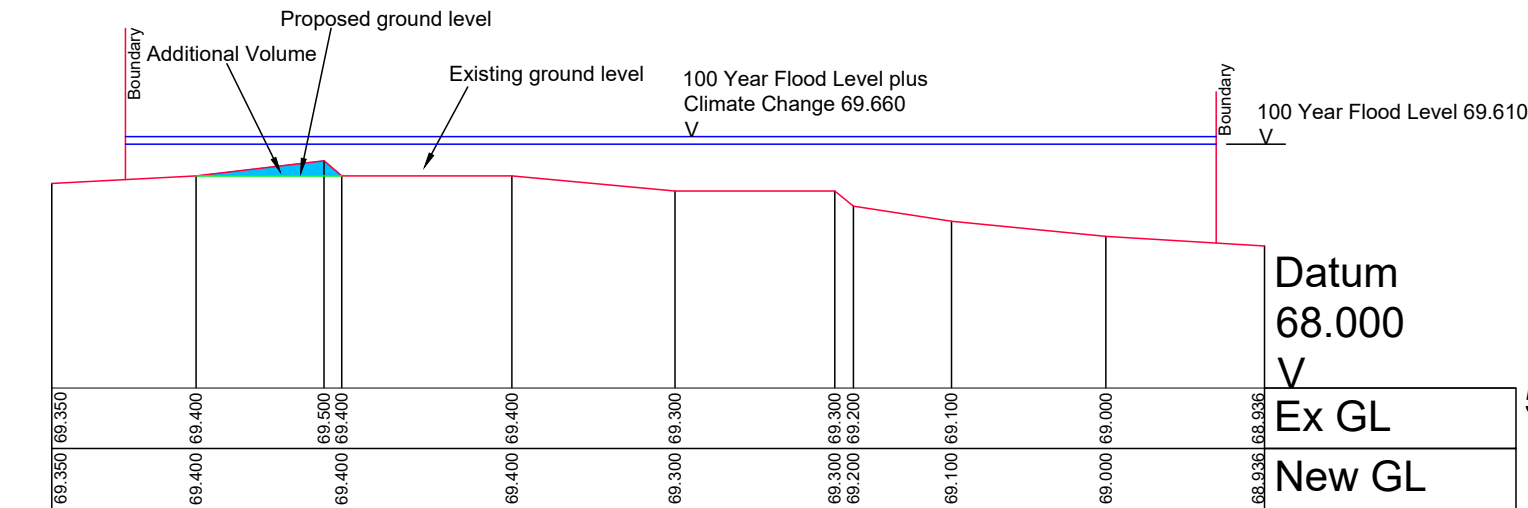
Proposed Levels	Areas m²
69.660-69.560	3.607
69.560-69.460	3.607
69.460-69.360	3.597
69.360-69.260	1.548
69.260-69.160	0.041

EXISTING LEVELS	Areas m²
69.660-69.560	3.607
69.560-69.460	3.525
69.460-69.360	3.145
69.360-69.260	1.078
69.260-69.160	0.041



Proposed Levels	Areas m²
69.660-69.560	3.607
69.560-69.460	3.607
69.460-69.360	3.117
69.360-69.260	1.069
69.260-69.160	0.589

EXISTING LEVELS	Areas m²
69.660-69.560	3.212
69.560-69.460	2.965
69.460-69.360	2.229
69.360-69.260	0.675
69.260-69.160	0.522



Proposed Levels	Areas m²
69.660-69.560	3.607
69.560-69.460	3.607
69.460-69.360	2.935
69.360-69.260	1.732
69.260-69.160	1.123

EXISTING LEVELS	Areas m²
69.660-69.560	3.607
69.560-69.460	3.569
69.460-69.360	2.880
69.360-69.260	1.732
69.260-69.160	1.123

Volume Difference between Proposed and Existing by level Sections 1-17

Levels		Height (m)	Volume Difference (m³)
Top (m)	Bottom (m)		
69.660	69.560	0.1	+21.977
69.560	69.460	0.1	+4.800
69.460	69.360	0.1	-39.980
69.360	69.260	0.1	-29.393
69.260	69.160	0.1	-2.880

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Volume Difference between Proposed and Existing by level Sections 1a-5a

Levels		Height (m)	Volume Difference (m³)
Top (m)	Bottom (m)		
69.660	69.560	0.1	-3.507
69.560	69.460	0.1	-7.240
69.460	69.360	0.1	-11.885
69.360	69.260	0.1	-7.720
69.260	69.160	0.1	-0.447

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

Total loss/increase of flood plain volume.

Levels		Height (m)	Total loss of volume(m³)
Top (m)	Bottom (m)		
69.660	69.560	0.1	+18.470
69.560	69.460	0.1	-2.440
69.460	69.360	0.1	-51.865
69.360	69.260	0.1	-37.113
69.260	69.160	0.1	-3.327

Positive figures indicate a reduction in flood volume.
Negative indicate an increase in flood volume.

P7	05/05/22	FLOOD LEVEL AMENDED AND FLOOD VOLUMES RECALCULATED	GHB	TS
P6	23/12/21	FLOOD LOSS/INCREASE TABLE AMENDED	GHB	TS
P5	21/12/21	FLOOD LOSS/INCREASE TABLE ADDED	GHB	TS
P4	20/12/21	FLOOD LEVELS AMENDED	GHB	TS
P3	12/10/21	HATCHING AND NOTES ADDED	GHB	TS
P2	12/10/21	COLOUR OF SECTION AMMENDED	GHB	TS
P1	07/10/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Drn	Chkd

Revisions

Drawing Originator

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Drawing Status

PRELIMINARY

Project Name

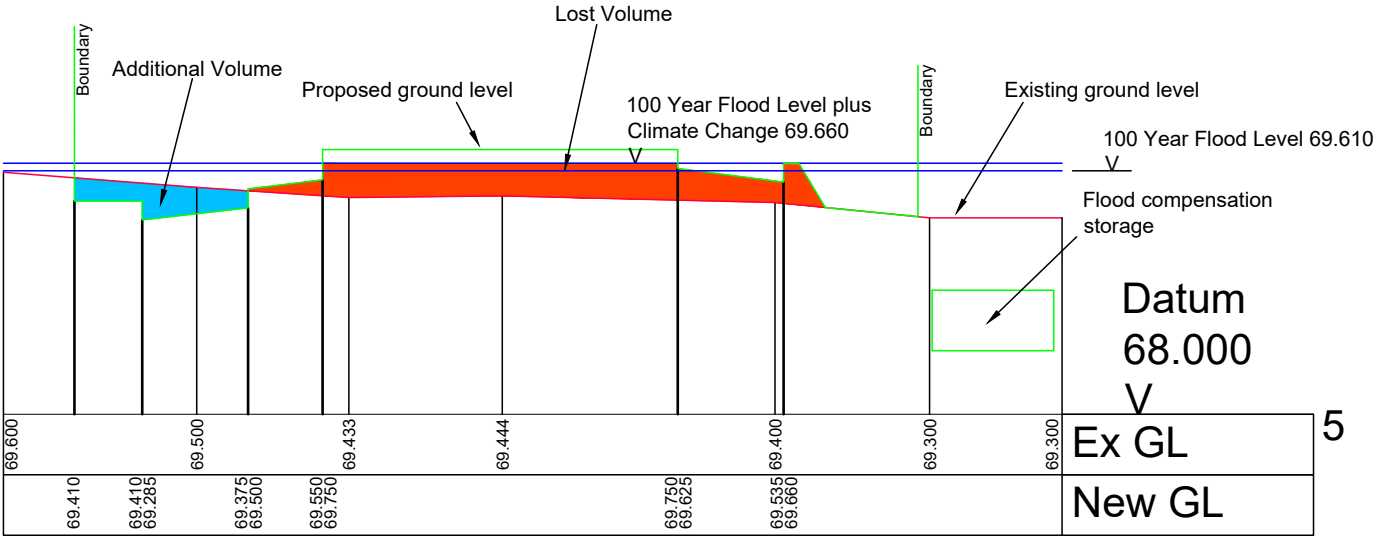
BICESTER

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Title FLOOD VOLUMES SECTIONS 3 OF 3

Drawing Number
220029/FV103

Revision
P7



P3	05/05/22	FLOOD LEVEL AMENDED	GHB	TS	
P2	21/12/21	FLOOD COMPENSATION STORAGE ADDED	GHB	TS	
P1	20/12/21	PRELIMINARY ISSUE	GHB	TS	
Rev	Date	Description	Drn	Chkd	

Revisions

PAUL OWEN
ASSOCIATES

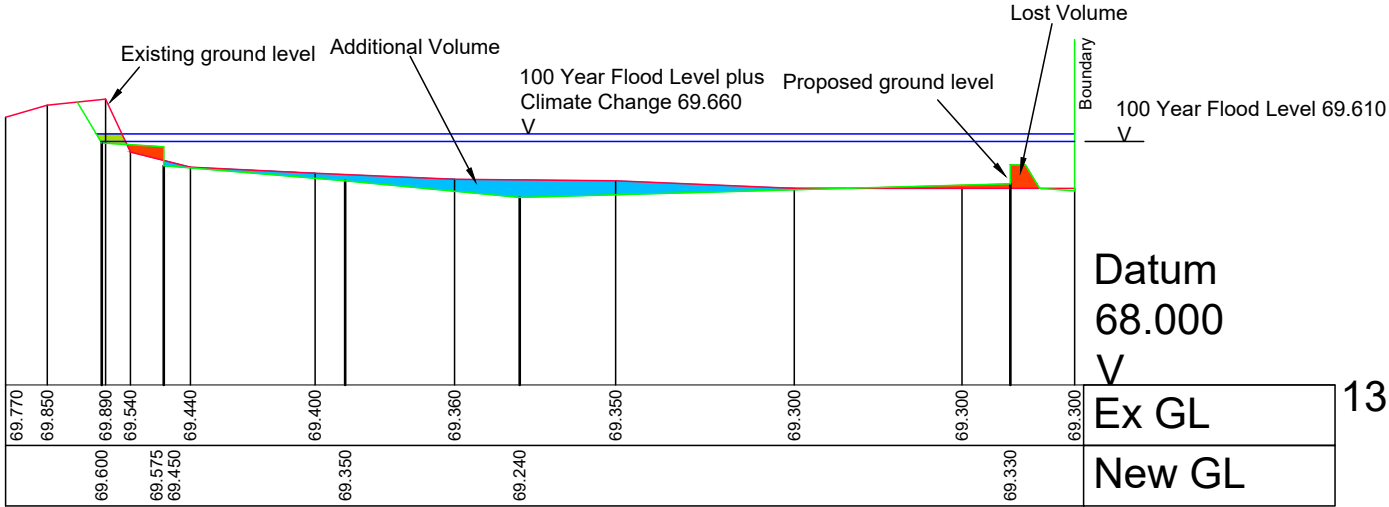
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Project Name
BICESTER

Title
SECTION 5

Original drawing sheet is A3

Drawn by	GHB	Drawn Date	Dec 21	Checked by	TS	Scale	H 1:250 V 1:50
Drawing Number	220029/FV104						Revision P3



P2	05/05/22	FLOOD LEVEL AMENDED	GHB	TS
P1	20/12/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Drm	Chkd

Revisions

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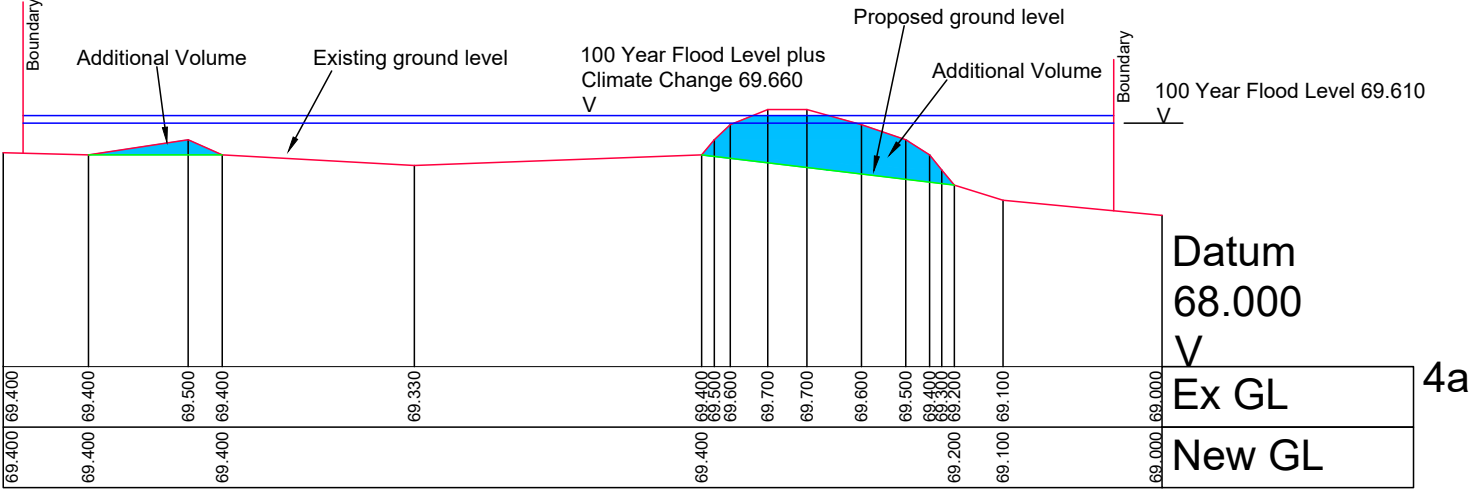
Project Name
BICESTER

Title
SECTION 13

Original drawing sheet is A3

Drawn by	GHB	Drawn Date	Dec 21	Checked by	TS	Scale	H 1:250 V 1:50
Drawing Number	220029/FV105						Revision P2

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P2	05/05/22	FLOOD LEVEL AMENDED	GHB	TS
P1	20/12/21	PRELIMINARY ISSUE	GHB	TS
Rev	Date	Description	Drn	Chkd

Revisions

Bicester Flood Compensation volumes

Drive-thru site and car park

Distance between sections

5 m

Existing Levels																			
Levels			Section Areas (m ²)																
Top (m)	Bottom (m)	Height (m)	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17
69.66	69.56	0.1	2.452	2.453	2.537	2.784	2.79	2.781	2.674	3.022	3.683	3.36	3.342	3.202	3.139	2.989	2.474	2.279	2.147
69.56	69.46	0.1	2.062	2.035	1.778	1.963	2.44	1.899	1.851	2.283	2.866	2.422	2.444	2.928	3.06	2.73	2.297	2.072	1.885
69.46	69.36	0.1	0.728	0.662	0.391	0.356	0.912	0.367	0.689	0.684	0.991	0.741	0.642	1.981	2.588	2.359	2.014	1.743	1.133
69.36	69.26	0.1	0	0	0.007	0	0	0.073	0	0.005	0.005	0.019	0.066	0.018	0.621	0.79	0.863	0.389	0.334
69.26	69.16	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
																			Total
																			520.53333 m ³

Proposed Levels																			
Levels			Section Areas (m ²)																
Top (m)	Bottom (m)	Height (m)	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17
69.66	69.56	0.1	2.452	2.573	2.568	1.599	1.468	1.626	2.623	3.022	3.676	3.353	3.285	3.166	3.166	2.668	2.474	2.256	2.147
69.56	69.46	0.1	2.062	2.573	1.363	1.19	1.034	1.312	1.903	2.813	3.153	2.69	3.009	3.012	3.012	2.426	2.258	2.098	1.885
69.46	69.36	0.1	0.728	2.539	0.916	0.675	0.78	0.635	1.019	0.902	2.073	2.343	2.708	2.713	2.708	2.01	1.979	1.095	1.133
69.36	69.26	0.1	0	1.06	0.186	0.109	0.196	0.109	0.136	0.005	0.039	1.587	1.843	1.553	1.624	0.078	0.344	0.267	0.157
69.26	69.16	0.1	0	0.029	0	0	0	0	0	0	0	0.018	0.697	0.013	0.047	0	0	0	2.88
																			Total
																			566.01 m ³

Volume difference -45.47667 m³

Difference by level			
Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m ³)
69.66	69.56	0.1	21.97666667
69.56	69.46	0.1	4.8
69.46	69.36	0.1	-39.98
69.36	69.26	0.1	-29.39333333
69.26	69.16	0.1	-2.88

Mounded earth on site

Distance between sections

5 m

Existing Levels							
Levels			Section Areas (m ²)				
Top (m)	Bottom (m)	Height (m)	S01A	S02A	S03A	S04A	S05S
69.66	69.56	0.1	3.607	3.476	3.607	3.212	3.607
69.56	69.46	0.1	3.607	3.214	3.525	2.965	3.567
69.46	69.36	0.1	3.605	2.952	3.145	2.229	2.88
69.36	69.26	0.1	2.688	1.765	1.078	0.675	1.732
69.26	69.16	0.1	0.433	0	0.041	0.522	1.123
							Total
							222.8017 m ³

Distance between sections

5 m

Proposed Levels							
Levels			Section Areas (m ²)				
Top (m)	Bottom (m)	Height (m)	S01A	S02A	S03A	S04A	S05S
69.66	69.56	0.1	3.607	3.607	3.607	3.607	3.607
69.56	69.46	0.1	3.607	3.607	3.607	3.607	3.607
69.46	69.36	0.1	3.605	3.607	3.597	3.117	2.935
69.36	69.26	0.1	2.688	2.274	1.548	1.089	1.732
69.26	69.16	0.1	0.433	0	0.041	0.589	1.123
							Total
							253.6 m ³

Volume difference -30.79833 m³

Difference by level			
Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m ³)
69.66	69.56	0.1	-3.506666667
69.56	69.46	0.1	-7.24
69.46	69.36	0.1	-11.885
69.36	69.26	0.1	-7.72
69.26	69.16	0.1	-0.446666667

Total Volume Difference by level			
Levels			
Top (m)	Bottom (m)	Height (m)	Volume Difference (m ³)
69.66	69.56	0.1	18.47
69.56	69.46	0.1	-2.44
69.46	69.36	0.1	-51.865
69.36	69.26	0.1	-37.11333333
69.26	69.16	0.1	-3.326666667

Total loss of volume between 69.56 and 69.66m = 18.47 m³