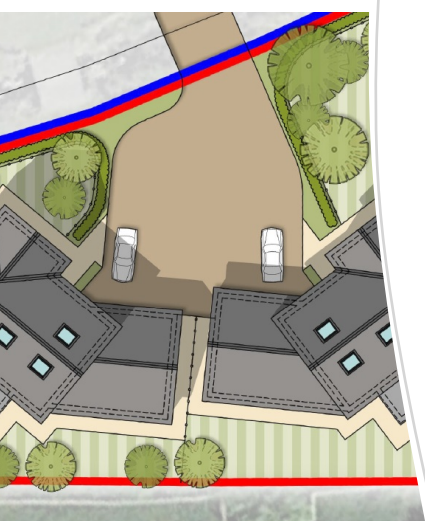


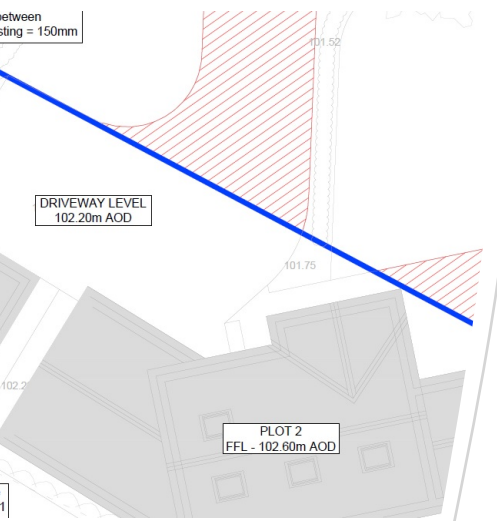
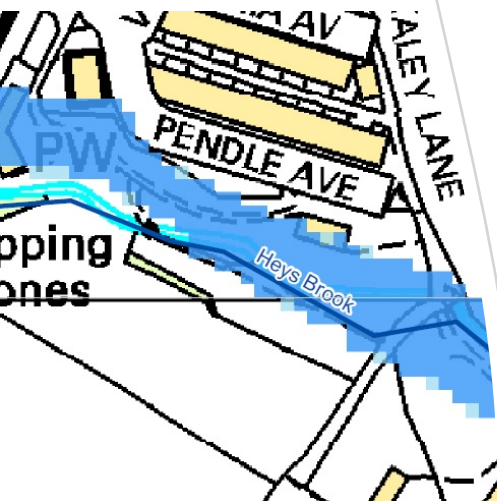
Earth Environmental
& Geotechnical



Phase 2 Residential Development
at
Glencroft, Pendle Avenue,
Chatburn, Clitheroe,
Lancashire, BB7 4AX

Flood Risk Assessment

February 2021
Revision A



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CONTENTS

1.	Introduction	1
2.	Site Setting and Description	2
3.	National Policy and Water Management Guidance	3
4.	Sources of Flooding	4
5.	Sourced Data	5
6.	Probability of Flooding	8
7.	Flood Risk and Vulnerability	9
8.	The Sequential Test and Exception Test	12
9.	Residual Risk	15

APPENDICES

Appendix A	Topographical Survey
Appendix B	Proposed Site Plan
Appendix C	Landmark Envirocheck Flood Maps
Appendix D	Environment Agency Flood Zone Map
Appendix E	Flood Mitigation Layout

FIGURES

Figure 1	EA Flood Zone Map	5
Figure 2	EA Fluvial Flood Map	5
Figure 3	EA Pluvial Flood Map	5
Figure 4	EA Flood Zone Map	7
Figure 5	Flood Zone 3 Extent in Topographical Survey	7

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1. Introduction

Earth Environmental and Geotechnical Ltd have prepared a Flood Risk Assessment for Phase 2 development at Glencroft, Pendle Avenue, Chatburn, Clitheroe, Lancashire, that will consist of 2 new detached dwellings.

The Environment Agency (EA), Lancashire County Council (LCC) and Ribble Valley Borough Council (RVBC) need to be satisfied that the granting of planning permission will address the risk of flooding to the residential development, and that the proposals will not in turn increase the risk of flooding to neighbouring land and property.

This Flood Risk Assessment (FRA) has been prepared to the national guidance and requirements set out in the National Planning Policy Framework, 2019 (NPPF), National Planning Practice Guidance (NPPG), which sets out the guidance for preparation of site specific FRA's and reducing flood risk in general by using Sustainable drainage systems (SuDS).

The FRA has also been prepared to the local guidance and requirements set out in the Ribble Valley Borough Council Strategic Flood Risk Assessment (May 2010); Ribble Valley Local Development Scheme (October 2017); Ribble Valley District Flood Report (February 2017); and Environment Agency Ribble Catchment Flood Management Plan (December 2009).

The report will look at a surface water management strategy for the proposed new development to establish constraints and design requirements and to promote the use of Sustainable Drainage Systems (SuDS) as per the requirements set out in Principles of Sustainable drainage systems (SuDS) set out by DEFRA (2011); Ciria SuDS Manual C753 (2015); Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015);

This flood risk assessment has therefore been prepared to identify and evaluate the various possible sources of flood risk to which the proposed site might be subjected to; to identify any mitigation, protection or compensation measures deemed necessary or feasible; and to manage the surface water so it sustainable, and does not increase the probability of flooding within, or near the site.

2. Site Setting and Description

2.1. Site Location

The development site is in a residential / rural area of Chatburn; is located to the south east of the centre of Chatburn; and is bound by Heys Brook directly to the north; an access road and agricultural fields to the east; and further agricultural fields to the south and west.

The address of the site being Glencroft, Pendle Avenue, Chatburn, Clitheroe, Lancashire, BB7 4AX, and the co-ordinates of the centre of the site are: Easting: 377135, Northing: 444400.

2.2. Existing Site

As detailed on the topographical survey in Appendix A, the existing site is currently undeveloped and consists of tough grass only.

2.3. Proposed Development

The proposed site is shown on the development plan in Appendix B, with a full description of the development being stated by the Architect. In brief, and in relation to this flood risk assessment, the proposal is to build two new detached dwellings, with an access road / driveway from the north, and garden / soft landscape areas to the south, east and west.

2.4. Topography

Also, as detailed on the topographical survey in Appendix A, the levels on the development site have a general fall from south to north, with the high points of the site being at the southern boundary at approximately 102.72m AOD and the low points being along the northern boundary (adjacent to Heys Brook) at approximately 99.80m AOD.

The ground, for most of the site, falls towards in a northerly direction to the top of an embankment with levels ranging from approximately 102.46m AOD to 101.82m AOD, and falling steeply to Heys Brook to levels ranging from approximately 100.20m OAD to 99.80m AOD.

2.5. Coast / Rivers / Canals / Artificial Waterbodies

As stated above, the nearest waterbody to the development site is Heys Brook located directly north of the site, along the northern Boundary. The nearest main river to the site is the River Ribble, which is located approximately 1km to the north west. There are no other known canals or artificial waterbodies near to the development site.

2.6. Drains and Sewers

The exact location of the water main or drains within the development site are to be confirmed. However, as the site is undeveloped it is assumed that no water main or drains are present.

2.7. Ground Conditions

On-site ground investigations to establish the ground strata are yet to take place. However, the ground conditions for the site can be determined via the British Geological Survey (BGS) website, where it identifies the site have superficial deposits of River Terrace Deposits (sands and gravels), over bedrock layer consisting of Chatburn Limestone Formation (limestone).

3. National Policy and Water Management Guidance

3.1. National Planning Policy Framework (NPPF) and National Planning Practice Guidance (NPPG)

NPPF 2019 set out the Government's national policy on development and flood risk, and seeks to provide clarity on what is required at regional and local levels, to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk.

NPPF Paragraphs 149 to 150 provide guidance for developments for the plans to take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk.

NPPF Paragraphs 155 to 165 provides guidance for planning and flood risk, where are plans should apply a sequential, risk-based approach to the location of development taking into account current and future impacts of climate change; to ensure that flood risk is not increased elsewhere due to the development; and to incorporate sustainable drainage systems.

NPPG, Paragraph 030, outlines that the objectives of this FRA are to establish whether a proposed development is likely to be affected by current or future flooding from any source; whether it will increase flood risk elsewhere; whether the measures proposed to deal with these effects and risks are appropriate; whether the evidence for the local planning authority to apply (if necessary) the Sequential Test; and whether the development will be safe and pass the Exception Test, if applicable.

3.2. Flood and Water Management Act

The Flood and Water Management Act takes forward some of the proposals from three previous strategy documents published by the UK Government - Future Water (2008), Making Space for Water (2008) and the UK Government's response to the Sir Michael Pitt's Review of the summer 2007 floods. In doing so it gives the EA a strategic overview role for flood risk, and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

4. Sources of Flooding

In accordance with the NPPF, flood risk must be assessed for all sources of flooding and development of the site should be carried out in such a way as to mitigate any potential flood risk to both the site and third parties and their property. This section identifies all possible sources of flooding.

4.1. Fluvial Flooding

Fluvial flooding results from watercourses / rivers surcharging and flooding the surrounding areas.

4.2. Coastal Flooding

Coastal flooding results from high tides from the sea.

4.3. Pluvial Flooding

'Pluvial' flooding is that which results from rainfall generated overland flow before the run-off enters any watercourse, drain or sewer. It is more often linked to high intensity rainfall events (typically in excess of 30mm per hour). However, it can also result from lower intensity rainfall or melting snow where the ground is saturated, frozen, developed or has low permeability. This results in overland flow and ponding in depressions in the topography. In urban areas 'pluvial' flows are likely to follow the routes of highways and other surface connectivity to low spots where flooding can occur. In some cases, it can deviate from this route into adjacent developments via dropped kerbs (either for access to driveways or disability access).

4.4. Groundwater Flooding

Groundwater flooding is caused by the emergence of water from sub-surface permeable strata. Fluctuations in the groundwater table can cause flooding should the table rise above the existing ground level. Groundwater flooding events tend to have long durations, lasting days or weeks.

4.5. Flooding from Drains and Sewers

Flooding from drains and sewers is caused when the capacity of the drains and sewers is exceeded, and will result in flooding from the manholes.

4.6. Canals, Reservoirs and Other Artificial Sources

Flooding from canals, reservoirs and artificial sources is caused when the capacity of the sources is exceeded, or if there is, an infrastructure failure.

5. Sourced Data

Data from the Environment Agency; local strategic flood risk assessments; and information from other parties are to be studied to establish which sources of flooding are at the site.

5.1. Environment Agency Flood Maps for Planning



Figure 1 – EA Flood Zone Map

The Environment Agency (EA) fluvial flood map shown in Figure 1, indicates that the northern (lower) areas of the development site is in Flood Zone 3, which is deemed to be a high probability of flooding, with the southern areas being in Flood Zone 1, which is deemed to be a low probability of flooding.



Extent of flooding from rivers or the sea

● High
 ● Medium
 ● Low
 ● Very low
 ⊕ Location you selected

Figure 2 – EA Fluvial Flood Map

The EA fluvial flood map shown in Figure 2, indicates that the northern areas of the site have a high probability of fluvial flooding, and the southern areas having a better than very low probability of fluvial flooding.



Extent of flooding from surface water

● High
 ● Medium
 ● Low
 ○ Very low
 ⊕ Location you selected

Figure 3 – EA Pluvial Flood Map

The EA pluvial flood map shown in Figure 3, indicates that all the north east areas of the site has a low probability of flooding, a small area adjacent to Heys Brook having a high probability of flooding, and the remaining areas having a very low probability of pluvial flooding.

5.2. Landmark Envirocheck Data Maps

Refer to Appendix C for Landmark Envirocheck flood map data. The data shown on the maps have been sourced from studies by JBA Consulting and the Environment Agency (EA). The summary of each of the maps are as follows:

Flood Data Map

The EA/NRW flood data map, also indicates that the northern (lower) areas of the development site is in Flood Zone 3, which is deemed to be a high probability of flooding, with the southern areas being in Flood Zone 1, which is deemed to be a low probability of flooding.

Pluvial, Fluvial and Coastal Flooding

The Envirocheck (JBA) 75-year return period flood map indicates that in an undefended scenario, there is no pluvial, fluvial or coastal flooding within the development site.

The Envirocheck (JBA) 100-year return period flood map indicates that in an undefended scenario, there is no fluvial or coastal flooding within the development site.

The Envirocheck (JBA) 200-year return period flood map indicates that in an undefended scenario, there is no fluvial or coastal flooding within the development site, but fluvial flood to depth of between 0.1m to 0.3m to a small area north west of the site (adjacent to Heys Brook).

The Envirocheck (JBA) 1000-year return period flood map indicates that in an undefended scenario, there is no fluvial or coastal flooding within the development site, but fluvial flood to depth of between 0.3m to 1.0m to a small area north west of the site (adjacent to Heys Brook).

Surface Water (Pluvial) Flood Depths

The Envirocheck (EA/NRW) 30-year return period flood map indicates that there are no surface water / rainfall flood depths within the development site.

The Envirocheck (EA/NRW) 100-year return period flood map indicates that there are no surface water / rainfall flood depths within the development site.

The Envirocheck (EA/NRW) 1000-year return period flood map indicates that there are no surface water / rainfall flood depths to the south and western areas of the development site, with surface water / rainfall flood depths between 0.15m to 0.30m at the northern and eastern areas of the development.

Canal Failure

The Envirocheck (JBA) canal failure map indicates that the development site is not within the canal coverage area, but is not in the canal failure area.

Ground Water Flooding

The Envirocheck / BGS flood data map indicates that there is limited risk of groundwater flooding the development site, and the ESI groundwater flood map indicates that there is a negligible risk of groundwater flooding at the development site area.

Historic Flood Map

The Envirocheck historic flood map indicates that there has been no history of flooding at the site from any source.

5.3. Environment Agency Product 4 Data

A Product 4 flood level data request was issued to the EA for Heys Brook, to determine the model flood levels for each storm event, with the inclusion of climate change. However, in response to the request the EA have stated (in an email on 4th May 2020):

We hold no detailed modelling for this area; Please see attached a Flood Zones map of the site (as Figure 4 below and Appendix D);

The Flood Zones in this location are based upon the original 2004 Jflow Data (national generalised modelling);

The Environment Agency has no record of previous flooding in this area.



Figure 4 – EA Flood Zone Map (via Product 4 Request – See Appendix D for full Plan)

Based in the response from the EA, the modeled flood levels for the 1% and 0.1% AEP, with the inclusion off climate change for the development site are not known.

Therefore, the extent of flooding at the site can only be determined by the extent of the flood zones as shown on Figures 1, 2, 4, the EnviroCheck data, the EA Flood Zone plan in Appendix D, and as demonstrated topographical survey showing the flood zone 3 extent line on Figure 5 below.

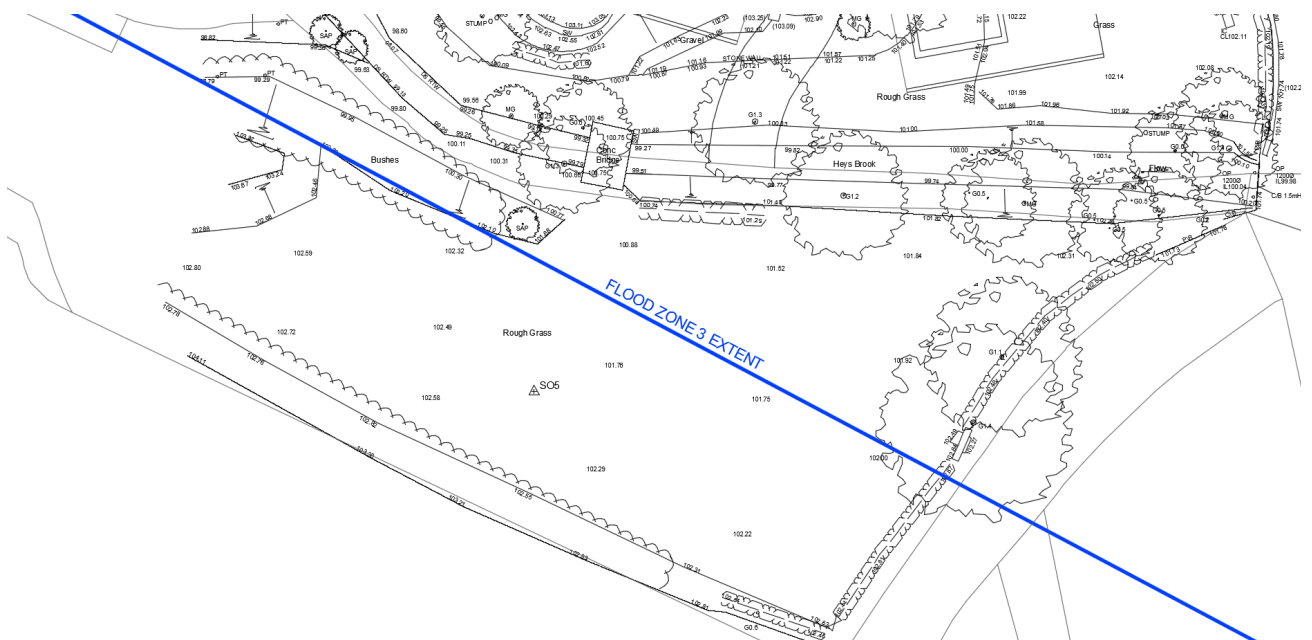


Figure 5 – Flood Zone 3 Extent in Topographical Survey

6. Probability of Flooding

Now that the extents of the sources of flooding are known from the above data, an assessment is to be made of the probability of flooding from each of the sources.

6.1. Fluvial Flooding (Sea and River) - *Probability: High (northern areas) to Low (southern areas)*

The source of the fluvial flooding appears to be from Heys Brook that flows along the northern boundary of the site. The assessed flood maps indicate that the northern areas of the development site is in Flood Zone 3, which is deemed to be a high probability of flooding, with the southern areas being in Flood Zone 1, which is deemed to be a low probability of flooding.

It is proposed to build the new dwellings towards the southern areas of the site, and therefore most of new dwellings will be within Flood Zone 1 with a low probability of flooding. However, there will be small areas of the dwellings, the access road and footpaths within Flood Zone 3, and therefore suitable flood mitigation, resistance and resilience measures are required.

6.2. Pluvial Flooding - *Probability: Low*

The studied flood map indicates that there is no surface water / pluvial flooding at any area of the development site up to and including the 100-year return period, with the lower north western areas having a pluvial flooding of depths between 0.10m to 0.30m during the 200-year return period, and between 0.30m to 1.0m during the 1000-year return period.

As flooding at the north west areas of the development only occurs during the 200-year and 1000-year return period, the probability of pluvial flooding at the development site is deemed to be low. This concurs with the EA flood map as detailed in Figure 3. However, suitable flood mitigation, resistance and resilience measures are required, to ensure no pluvial occurs at the new dwelling.

6.3. Ground Water Flooding - *Probability: Low*

The Envirocheck / BGS flood data map indicates that there is limited risk of groundwater flooding the development site, and the ESI groundwater flood map indicates that there is a negligible risk of groundwater flooding at the development site area. Therefore, based on this data, the probability of ground water flooding is deemed to be low.

6.4. Flooding from Drains and Sewers - *Probability: Low*

As the site is undeveloped there are no water mains or sewers within or near the site. There has also been no history of flooding from any drains or sewers, and if flooding were to occur it would flow to the south of the site (away from the buildings), and in to Heys Brook. Therefore, based on this, the probability of flooding from drains and sewers is deemed to be low.

6.5. Canals, Reservoirs and Other Artificial Sources - *Probability: Low*

There are no known canals, reservoirs, or other artificial sources nearest the to the development site, with the development not being in the flood coverage area. Therefore, the flood probability from canals, reservoirs or other artificial sources is deemed to be low.

7. Flood Risk and Vulnerability

The NPPG Paragraphs 065 to 067 sets out the flood risk for a site by assessing the flood zones, flood risk vulnerability classification, and flood risk vulnerability and flood zone 'compatibility'.

7.1. Flood Zones

There are four classifications for flood zones, as defined in Table 1 of the NPPF and NPPG document.

Flood Zones	
Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water should flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

The EA flood map data has identified that the northern areas of the site being within Flood Zone 3.

7.2. Flood Risk Vulnerability Classification

NPPG Paragraph 066, Table 2 stated the flood risk vulnerability classifications as:

Flood Risk Vulnerability Classification
<p>Essential Infrastructure</p> <p>Essential transport infrastructure (including mass evacuation routes) which should cross the area at risk; Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood; Wind turbines.</p>
<p>Highly Vulnerable</p> <p>Police and ambulance stations; fire stations and command centers; telecommunications installations required to be operational during flooding; Emergency dispersal points; Basement dwellings; Caravans, mobile homes and park homes intended for permanent residential use; Installations requiring hazardous substances consent.</p>
<p>More Vulnerable</p> <p>Hospitals; Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels; Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels; Non-residential uses for health services, nurseries and educational establishments; Landfill* and sites used for waste management facilities for hazardous waste; Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.</p>
<p>Less Vulnerable</p> <p>Police, ambulance and fire stations which are not required to be operational during flooding; Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure; Land and buildings used for agriculture and forestry; Waste treatment (except landfill* and hazardous waste facilities); Minerals working and processing (except for sand and gravel working); Water treatment works which do not need to remain operational during times of flood.</p>
<p>Water-Compatible Development</p> <p>Flood control infrastructure; Water transmission infrastructure and pumping stations; Sewage transmission infrastructure and pumping stations; Sand and gravel working; Docks, marinas and wharves; Navigation facilities.</p>

The development is classed as a 'More Vulnerable' as the development is to have buildings used for dwelling houses.

7.3. Flood Risk Vulnerability and Flood Zone ‘Compatibility’

NPPG Paragraph 067 Table 3, gives guidance on flood risk vulnerability compared with flood zone, to determine the compatibility.

Flood Risk Vulnerability and Flood Zone ‘Compatibility’					
Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	† Exception Test required	✗	Exception Test required	✓	✓
Zone 3b*	* Exception Test required	✗	✗	✗	✓*

In accordance with Table 3 of the NPPF, if parts of the proposed development are in Flood Zone 3, and the development is classed as ‘More Vulnerable’, an exception test will be required.

8. The Sequential Test and Exception Test

8.1. Sequential and Exception Test Guidance

Paragraph 101 of the NPPG states that: The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. A sequential approach should be used in areas known to be at risk from any form of flooding.

Paragraph 102 of the NPPG states that: If, following application of the Sequential Test, it is not possible, consistent with wider sustainability objectives, for the development to be located in zones with a lower probability of flooding, the Exception Test can be applied if appropriate. For the Exception Test to be passed:

- *it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and*
- *a site-specific flood risk assessment 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.*

8.2. Exception Test

As stated above, for the Exception Test to be passed, it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment where one has been prepared; and a site-specific flood risk assessment 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.

8.3. Dwelling Locations

The developer currently owns the land and therefore new dwellings cannot be relocated to another site. However, the dwellings have been designed so that they are built in the most southern areas of the site, and subsequently **within Flood Zone 1 only**.

8.4. Safe Development

For the development to 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. There are several design principles appropriate for this development which include:

- Analysis of finished floor levels of proposed dwellings to ensure analyses the effect of the flood depths;
- Safe and access and egress from each of the new dwellings, where footpaths and roads are to be above the 0.1% AEP level;
- Ensuring no affect to flood water flows or the displacement of flood water;
- Sustainable surface water drainage methods to ensure the surface water run-off rates and volumes from the development are reduced to not increase flood risk elsewhere.

Each of the design principles to be applied for any development at the site are detailed below:

8.5. Finished Floor Level Analysis

The exact flood level across the development site is not known (no data from EA – Product 4 enquiry), but can be determined by analysing the extents of Flood Zone 3 against the known site levels as detailed in the topographical survey (as detailed in Figure 5 and drawing DR-101 in Appendix E).

The analysis shows that the approximate Flood Zone 3 flood level (0.1% AEP level) at the western dwelling location is 102.20m AOD, and approximately 102.00m AOD at the eastern dwelling location.

The NPPF states that to reduce the probability of flooding, the finished floor levels of the new dwellings should be a minimum of whichever is higher of:

- 300millimetres (mm) above the general ground level of the site;
- 600mm above the estimated 1% AEP river or sea flood level.

The estimated 1% AEP levels are not known, and therefore it is recommended that the finished floor level is 600mm above the assessed Flood Zone 3 extents / 0.1% AEP levels of 102.20m AOD and 102.00m AOD. Therefore, based on the NPPF guidance and the flood level assessment, the minimum finished floor levels for the dwellings are to be:

Plot 1 (Western Dwelling) - **102.80m AOD.**

Plot 2 (Eastern Dwelling) - **102.60m AOD.**

8.6. Safe Access and Egress

The access road driveways from the north of the site are to be higher than the assessed Flood Zone 3 / 0.1% AEP flood level, and therefore be at least 120.2m AOD, to ensure safe access and egress can be gained to and from the development site.

Current levels along the access road are below 120.20m AOD, and the access road will cross Heys Brook which is the source of the fluvial and pluvial flooding within the site.

Therefore, to ensure that the road is at suitable level, and to ensure that raising the road will not affect the flows of Heys Brook in a normal or flood scenario, the road is to be formed out of a bridge between existing levels at 120.20m AOD and above. This is demonstrated on drawing DR-101 in Appendix E.

8.7. Flood Flows / Water Displacement

As detailed on drawing DR-101, the site plan has been designed so that the new dwellings will be built outside Flood Zone 3, within Flood Zone 1, and subsequent outside any area of the site that has a probability (up to 0.1% AEP) of flooding.

The small areas of footpaths around the perimeter of the new dwellings, within Flood Zone 3, will be suspended to minimum level of 120.20m AOD. The levels below the suspended footpath will remain as existing, and therefore will not affecting the flood flows or displace any flood water.

As detailed in Section 8.6, the new access road will also be suspended to a level of 120.20m AOD, with the levels below the access road, and therefore will not affecting the flood flows or displace any flood water.

8.8. Surface Water Management Principles

The surface water for the new development is to be managed so that it adheres to the current regulations, and local authority requirements, where the principles of the surface water management will be as follows:

Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain or other drain;
- Discharge to combined sewer.

The Management Train

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run-off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are:

- Prevention - Prevention of run-off by good site design and reduction of impermeable areas;
- Source Control - Dealing with water where and when it falls (e.g. infiltration techniques);
- Site Control - Management of water in the local area (e.g. swales, detention basins);
- Regional Control - Management of run-off from sites (e.g. balancing ponds, wetlands).

Design Principles

The design principles for the surface water management of the development will be to:

- Ensure that people, property and critical infrastructure are protected from flooding;
- Ensure that the development does not increase flood risk off site;
- Ensure that SuDS can be economically maintained for the development.

Peak Surface Water Flow

The peak surface water flow from the post development site is not to exceed the pre-development rate. The post development surface water is to be restricted to the equivalent pre-development rates, as a minimum, with the aim to restrict to the equivalent greenfield run-off rates, with the consideration of future climate change as a minimum.

Flood Risk

The drainage system will be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur on any part of the site for a 1 in 30-year rainfall event. The drainage system will also be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur during a 1 in 100-year rainfall event in any part of a building (including a basement) or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development. The design of the site will ensure that flows resulting from rainfall more than a 1 in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

Climate Change

The NPPF makes it a planning requirement to account for climate change in the proposed design. The recommended allowances are taken from the Environment Agency guidance (Table 2) summarised in Table 4 below.

Applies across all of England	Total change anticipated for the 2020's	Total change anticipated for the 2050's	Total change anticipated for the 2080's
Upper End	10%	20%	40%
Central	5%	10%	20%

The baseline year is 1961 to 1990. It is anticipated the life span of the proposed buildings will be approximately 80 years, and therefore will fall at least into the 2080's and will have rainfall intensity increase of 40%.

This increase in rainfall is to be taken into consideration for the surface water management of the proposed development, to ensure that the probability of flooding remains low.

9. Residual Risk

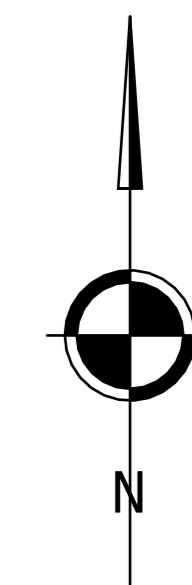
It is difficult to completely guard against flooding since extreme events greater than the design standard event are always possible, however, there are practicable ways to minimise the risk such as by allowing a freeboard (safety margin) and by using suitable construction and management techniques.

This flood risk assessment has been prepared in accordance with the NPPF, Local Planning Policy and the NPPG. Any recommendations regarding floor levels are based on the relevant British Standards (BS8533), the standing advice provided by the EA or based on common practice.

Earth Environmental and Geotechnical Ltd do not warrant that the advice in this report will guarantee the availability of flood insurance either now or in the future.

The owner/occupier of the property will be required to carry out maintenance on any SuDS devices within the site boundary. It will be the owner's /occupier's responsibility to regular upkeep the drainage network on site throughout the lifetime of the development to ensure that flood risk on and off site is managed effectively.

Appendix A - Topographical Survey

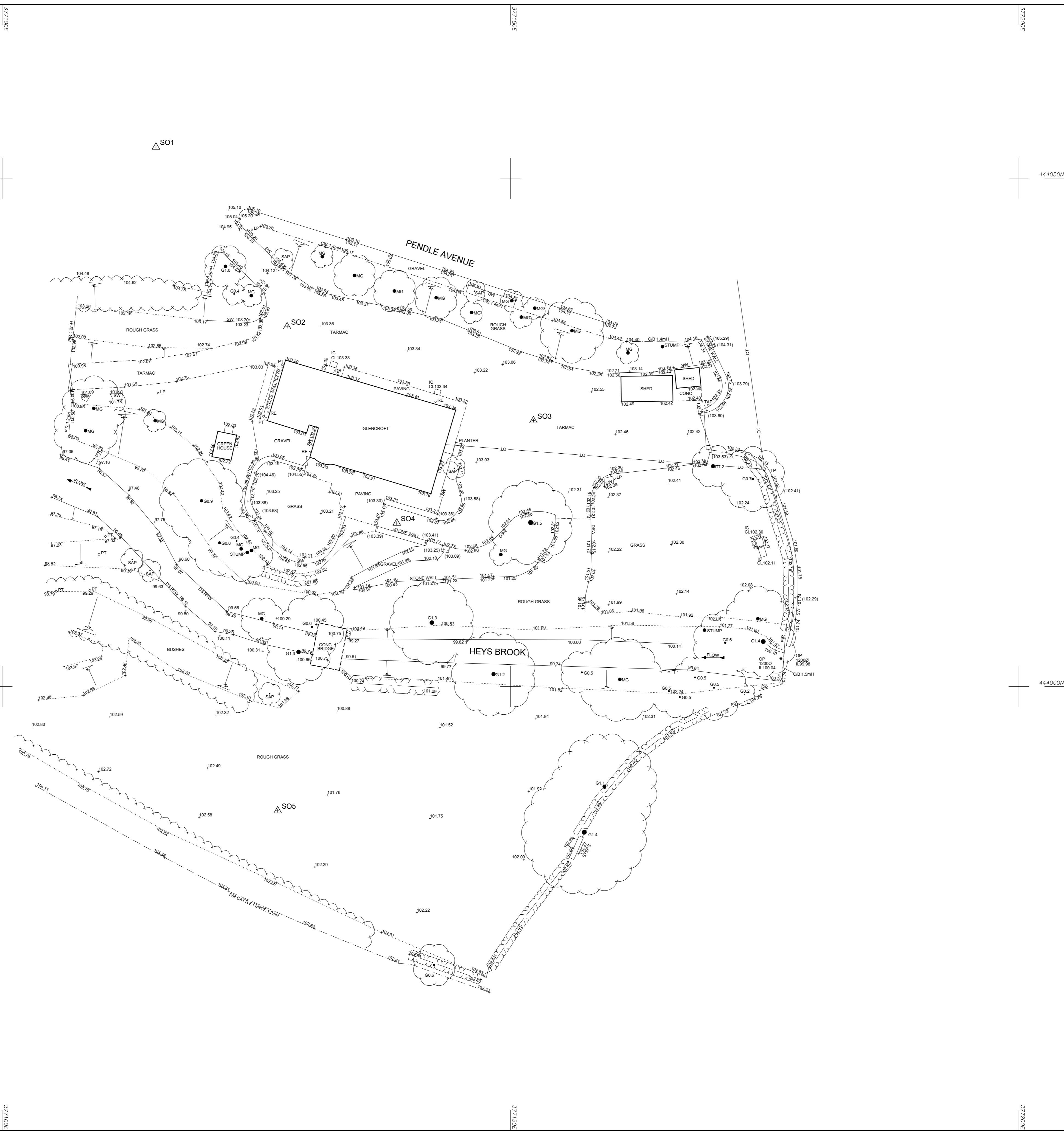


Note:
 The survey is plotted on a plane local Grid. Orientation to National Grid.
 All levels relate to Ordnance Datum, achieved using the OS National GPS Network.
 Survey Control Markers established for Mapping purposes only and should not be used for Construction without the written approval of Survey Operations Ltd.
 Levels in parenthesis indicate top of walls.

SURVEY STATIONS			
Name	Easting	Northing	Height
SO1	377115.13	444053.07	105.23
SO2	377128.03	444035.39	103.59
SO3	377152.25	444026.15	102.74
SO4	377138.81	444016.08	103.54
SO5	377127.10	443987.78	102.21

STANDARD REFERENCE & ABBREVIATIONS

- (AR).....Assumed Route
- AB.....Air Brick
- AV.....Air Valve
- AW.....Awn Socket
- BW.....Barbed Wire
- BAR.....Barrier
- LP.....Lamp Post
- BB.....Bellish Beacon
- BR.....Borehole
- BL.....Bed Level
- BDL.....Billiard
- MP.....Mooring Point
- BS.....Bus Stop
- BT.....British Telecom Box
- BTW.....British Telecom IC
- BRW.....Brick Retaining Wall
- BR.....Brick Wall
- C/B.....Close Boarded
- C/I.....Corrugated Iron
- C/P.....Chestnut Paving
- CB.....Control Box
- CBW.....Concrete Block Wall
- CCW.....Concrete Block Wall
- CCTV.....Closed Circuit TV
- CD.....Cable Duct
- CEL.....Cellar Light
- CHL.....Chain Link
- CHM.....Chimney
- CL.....Cover Level
- CR.....Cable Marker
- COL.....Column
- CONC.....Concrete
- CP.....Catch Pit
- CRW.....Concrete Retaining Wall
- CTV.....Cable Television
- CSL.....Culvert
- CK.....Concrete Block Wall
- DC.....Drainage Channel
- DPC.....Damp Proof Course
- DR.....Drain
- DRW.....Dry Stone Wall
- EEP.....Electricity Cable Pit
- EIC.....Electricity Inspection Cover
- EJ.....Expansion Joint
- EAB.....Electricity Junction Box
- ESB.....Electricity Sub Station
- EL.....Eave Level
- ELB.....Electricity Box
- EP.....Electricity Pole
- ER.....Earth Rod
- ETL.....Electricity Transmission Line
- FB.....Flower Bed
- FR.....Fire Hydrant
- FL.....Floor Level
- FP.....Flagpole
- G.....Gravel
- G/S.....Gravel (of trees)
- G.....Gully
- GAB.....Gibson
- GIP.....Gas Inlet Pipe
- GMR.....Gas Marker
- GST.....Gas Stop Tap (domestic)
- GWS.....Gas Stop Valve (Mains)
- HSE.....Housing
- HT.....Height
- HV.....High Voltage
- IR.....Iron Railing
- IC.....Inspection Cover
- IL.....Invert Level
- IP.....Inlet Pipe
- KS.....Kern Socket
- LS.....Letter Box
- LP.....Lamp Post
- MS.....Multi-Girth
- MSH.....Manhole
- MK.....Marker
- MP.....Mooring Point
- NP.....Street Name Plate
- O/W.....Overhead
- O/P.....Open Paving
- OE.....Overhead Electric Wire
- OP.....Outfall Pipe
- OSM.....Ordnance Survey Bench Mark
- OT.....Overhead Telecom Wire
- P/C.....Post & Chain
- P/B.....Post & Rail
- P/W.....Post & Wire
- P/W.....Paving
- P/B.....Pillar Box
- PC.....Pedestrian Crossing
- PP.....Petrol Pump
- PT.....Post or Pillar
- RE.....Roding Eye
- RS.....Road Sign
- RTW.....Retaining Wall
- RWP.....Rain Water Pipe
- SAP.....Sgpling
- SL.....Sump Level
- SOL.....Soffit Level
- SP.....Sign Post
- SPL.....Springing Level
- SRW.....Stone Retaining Wall
- SV.....Stop Valve (uncompressed)
- SVP.....Soil Vent Pipe
- SW.....Stone Wall
- TAC.....Tactile Paving
- TB.....Traffic Bollard
- TW.....Temporary Bench Mark
- TCP.....Telephone Call Box
- TFR.....Tree From Boundary
- TIE.....Anchor Point (Masts/Poles)
- TS.....Tree Screen
- U/C.....Under Construction
- U/S.....Underground
- UTL.....Unable to Lift (M, IC etc)
- UTS.....Unable to Survey
- VDP.....Vehicle Detector Pad
- VP.....Vent Pipe
- W/W.....Water Wash
- WL.....Water Level
- WM.....Water Meter
- WO.....Wash Out
- WP.....Waste Pipe
- WST.....Water Stop Tap (domestic)
- WSV.....Water Stop Valve (mains)



Smith Street, Skelmersdale, Lancs. WN8 8LN
 Tel: 01695 725662 Fax: 01695 51816
 Email: mail@survops.co.uk - www.survops.co.uk

Client
 Studio SDA

Drawing Title
 Topographical Survey of Land at:
 Glencroft, Pendle Avenue, Chatburn,
 Clitheroe, Lancashire, BB7 4AX

Scale(s)	1:200	Surveyor	PA
Date	June 19	Drawn	DIF
Job Number	19E234	Checked	MG

Sheet Size & Drg Number & Revision
A1 19E234/001

Appendix B - Proposed Site Plan

Appendix C - Landmark Envirocheck Flood Map Data

EANRW Flood Data Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

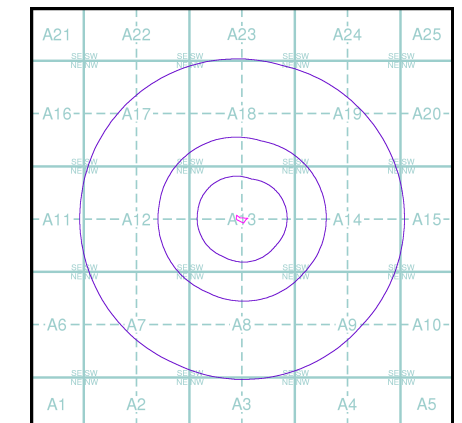
Flood Data

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Contours (height in metres)

- Standard Contour 105 MLW Mean Low Water
- Master Contour 100 MHW Mean High Water
- Spot Height *167.8

EANRW Flood Data Map - Slice A

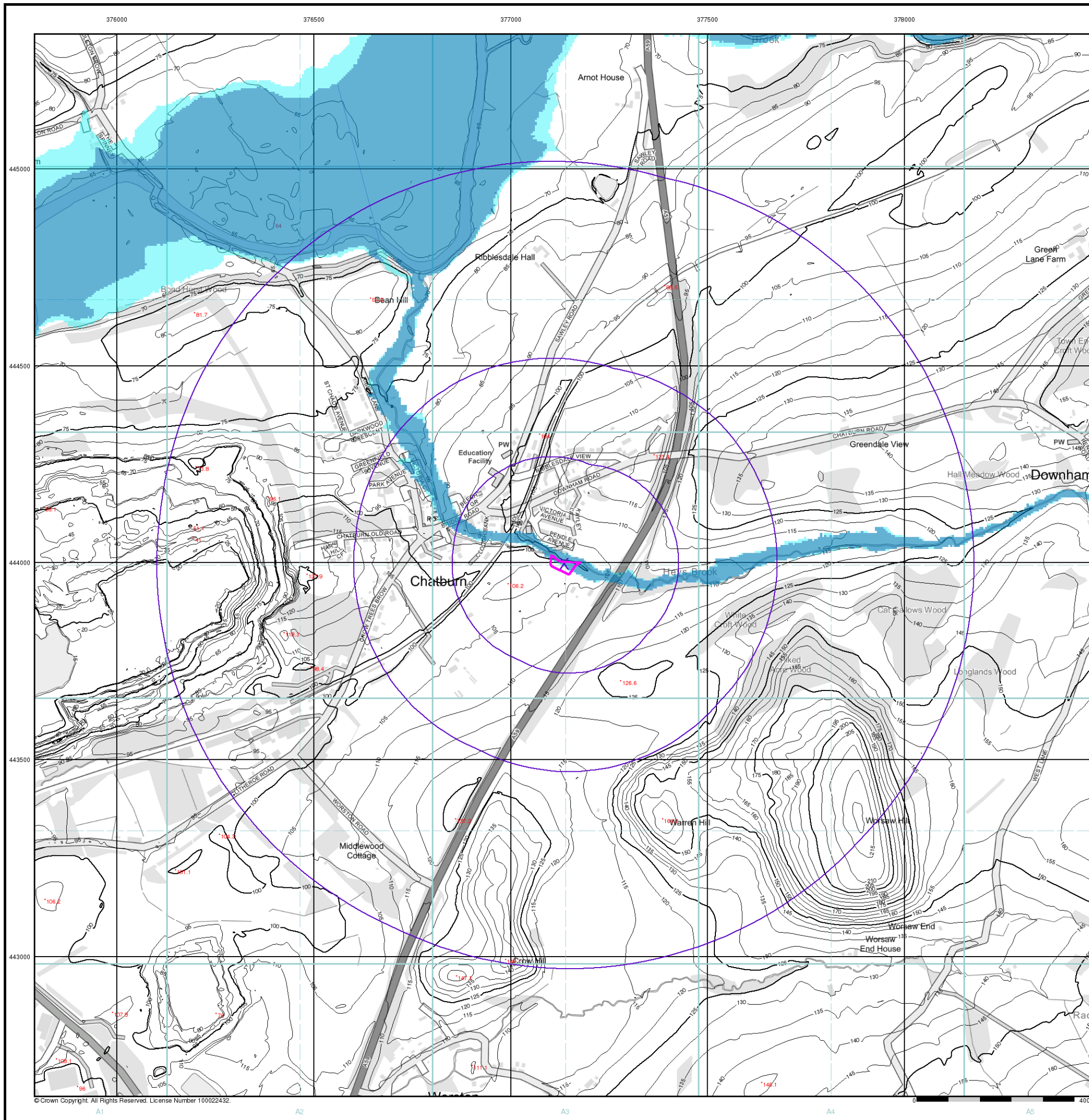


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020



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JBA 75 Year Return Flood Map (Undeferred) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

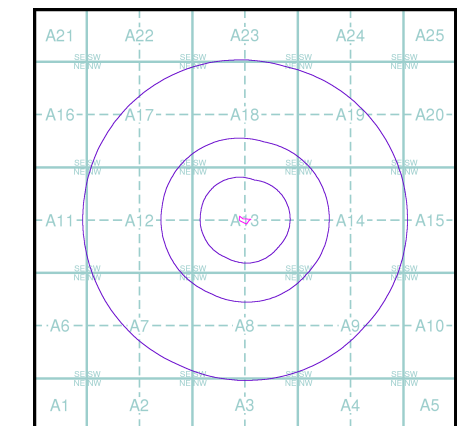
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

- Standard Contour 105
- Master Contour 100
- Spot Height 167.8
- MLW Mean Low Water
- MHW Mean High Water

JBA 75 Year Return Flood Map (Undeferred) - Slice A

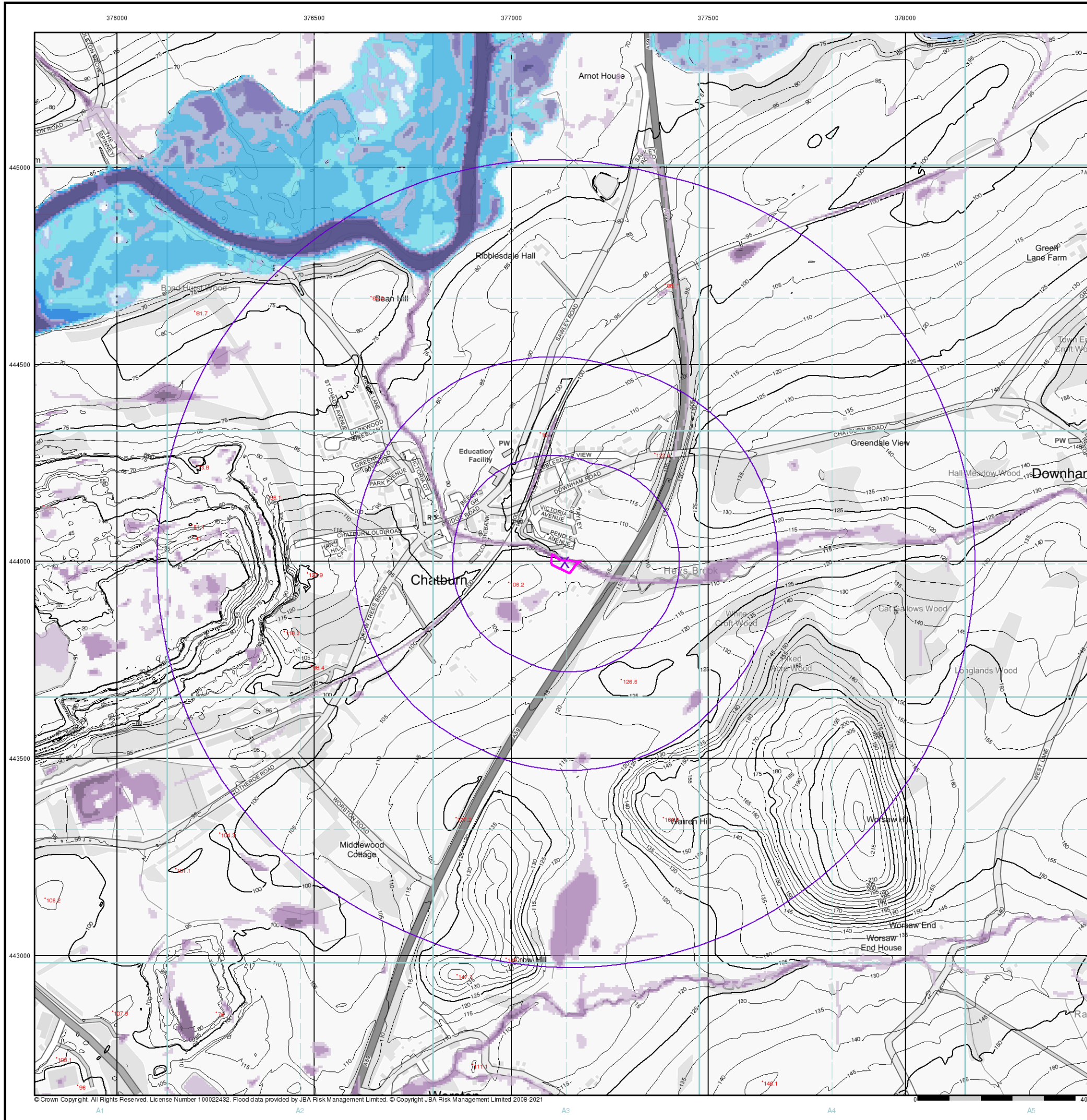


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020



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JBA 100 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- ✕ Bearing Reference Point

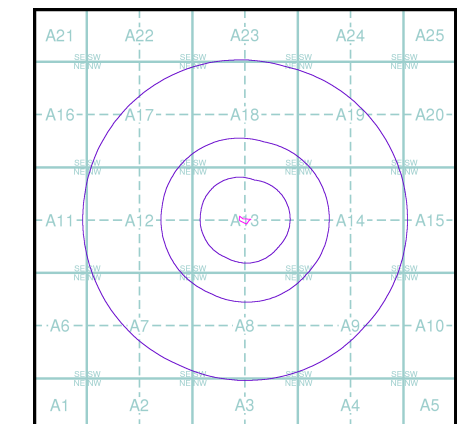
Modelled Flood Depth

Fluvial Depth	Coastal Depth
0.01m - 0.05m	0.01m - 0.05m
0.05m - 0.1m	0.05m - 0.1m
0.1m - 0.3m	0.1m - 0.3m
0.3m - 1m	0.3m - 1m
>1m	>1m

Contours (height in metres)

- Standard Contour -105 MLW Mean Low Water
- Master Contour -100 MHW Mean High Water
- Spot Height *167.8

JBA 100 Year Return Flood Map (Undefended) - Slice A

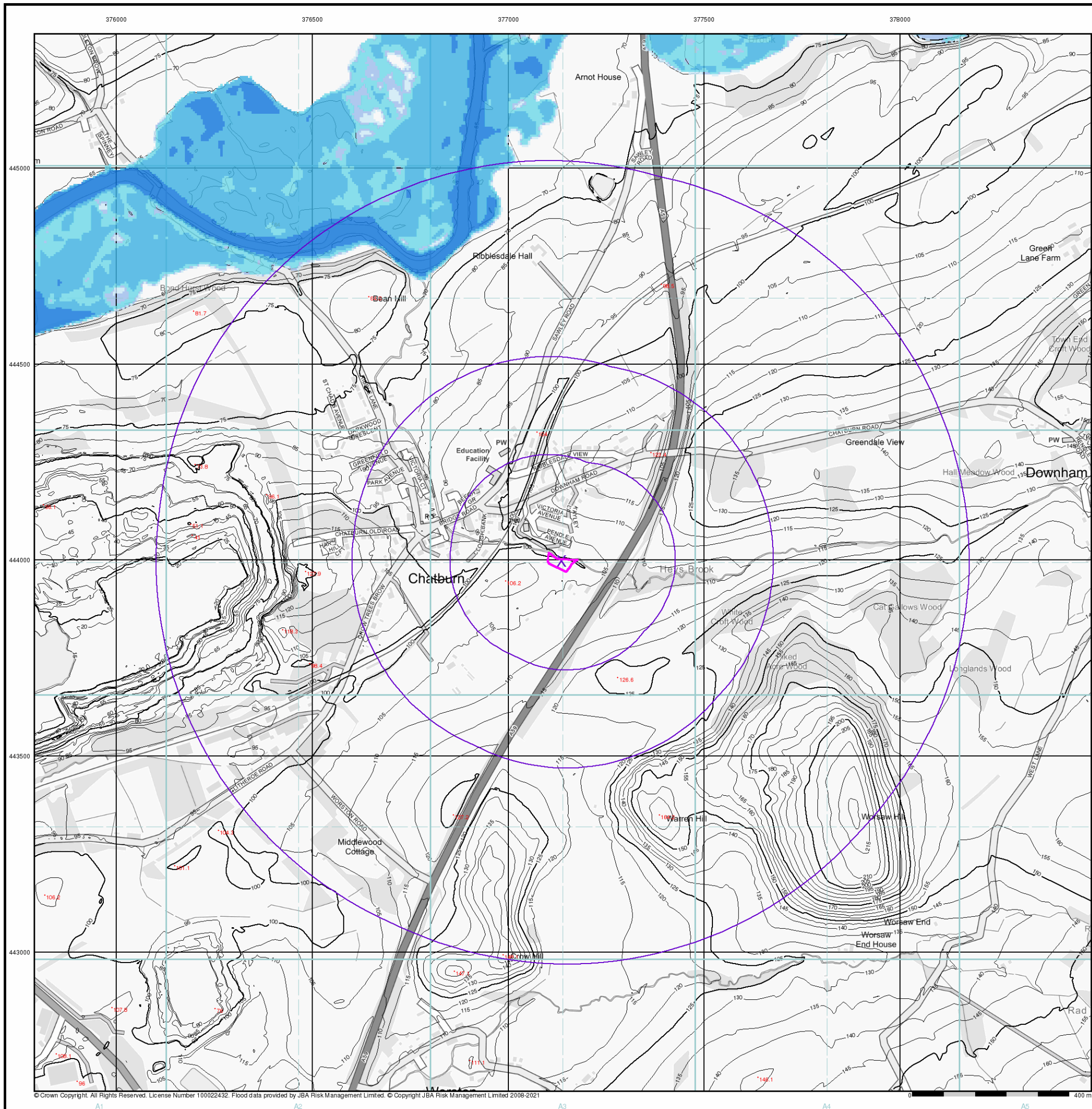


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020



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JBA 200 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

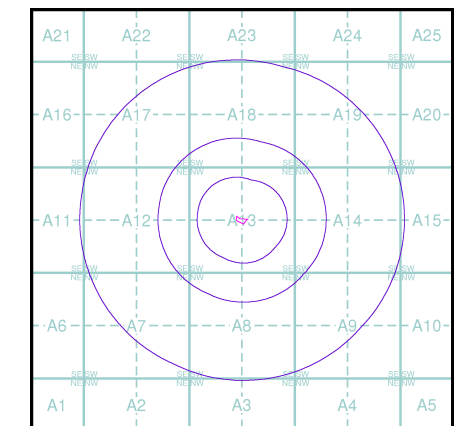
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

JBA 200 Year Return Flood Map (Undefended) - Slice A

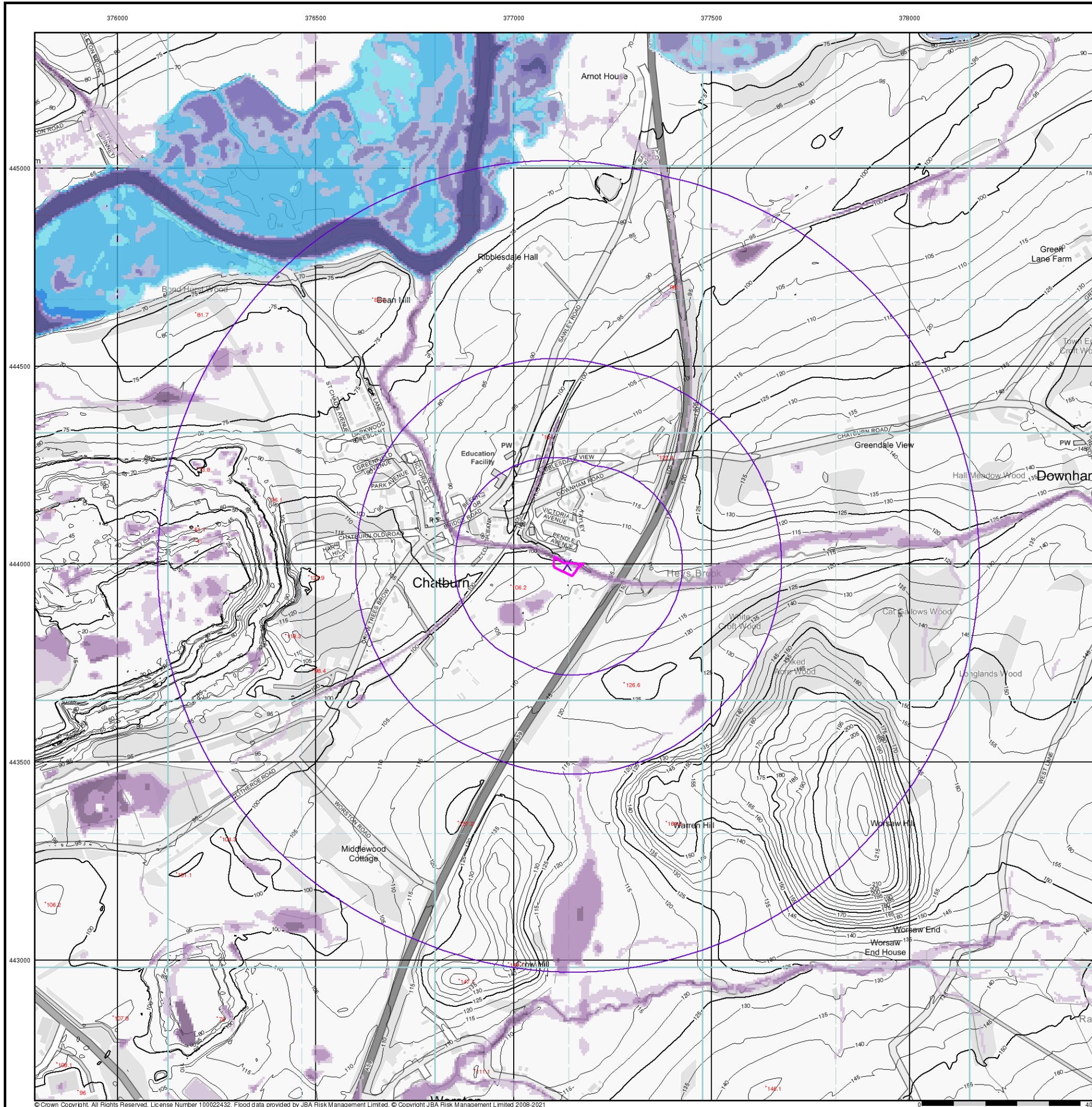


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020



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JBA 1000 Year Return Flood Map (Undeferred) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

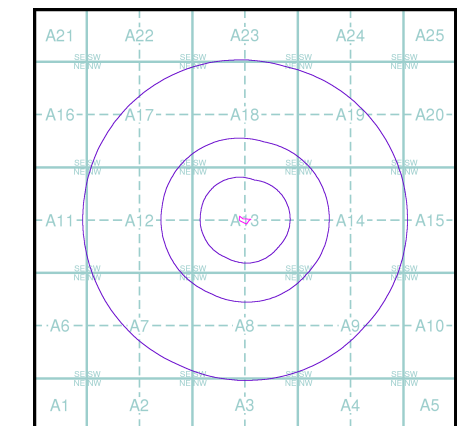
Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

- Standard Contour 105
- Master Contour 100
- Spot Height 167.8
- Mean Low Water
- Mean High Water

JBA 1000 Year Return Flood Map (Undeferred) - Slice A

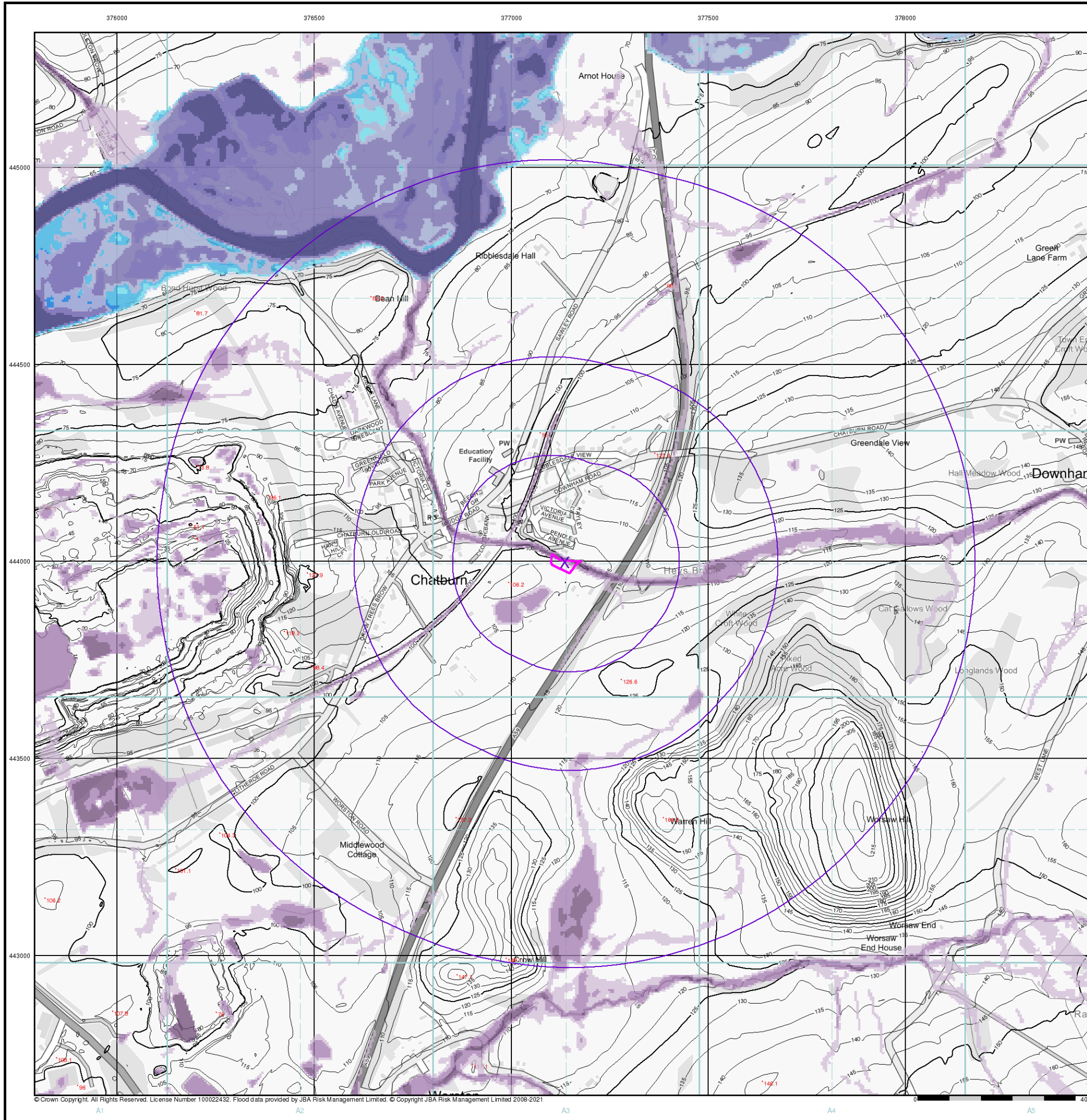


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020



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E/ANRW Surface Water 30 Year Return Depth Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Surface Water Depth

- 0 - 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- 0.90 - 1.20m
- > 1.20m

Contours (height in metres)

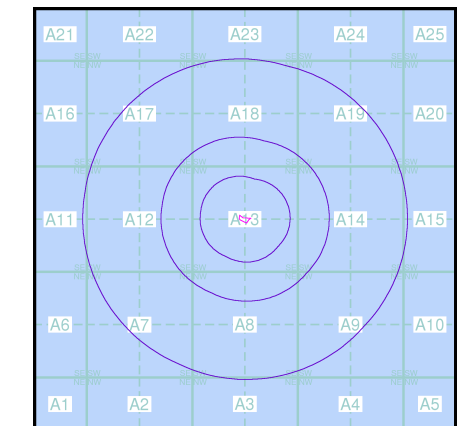
- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

E/ANRW Suitability Map - Slice A

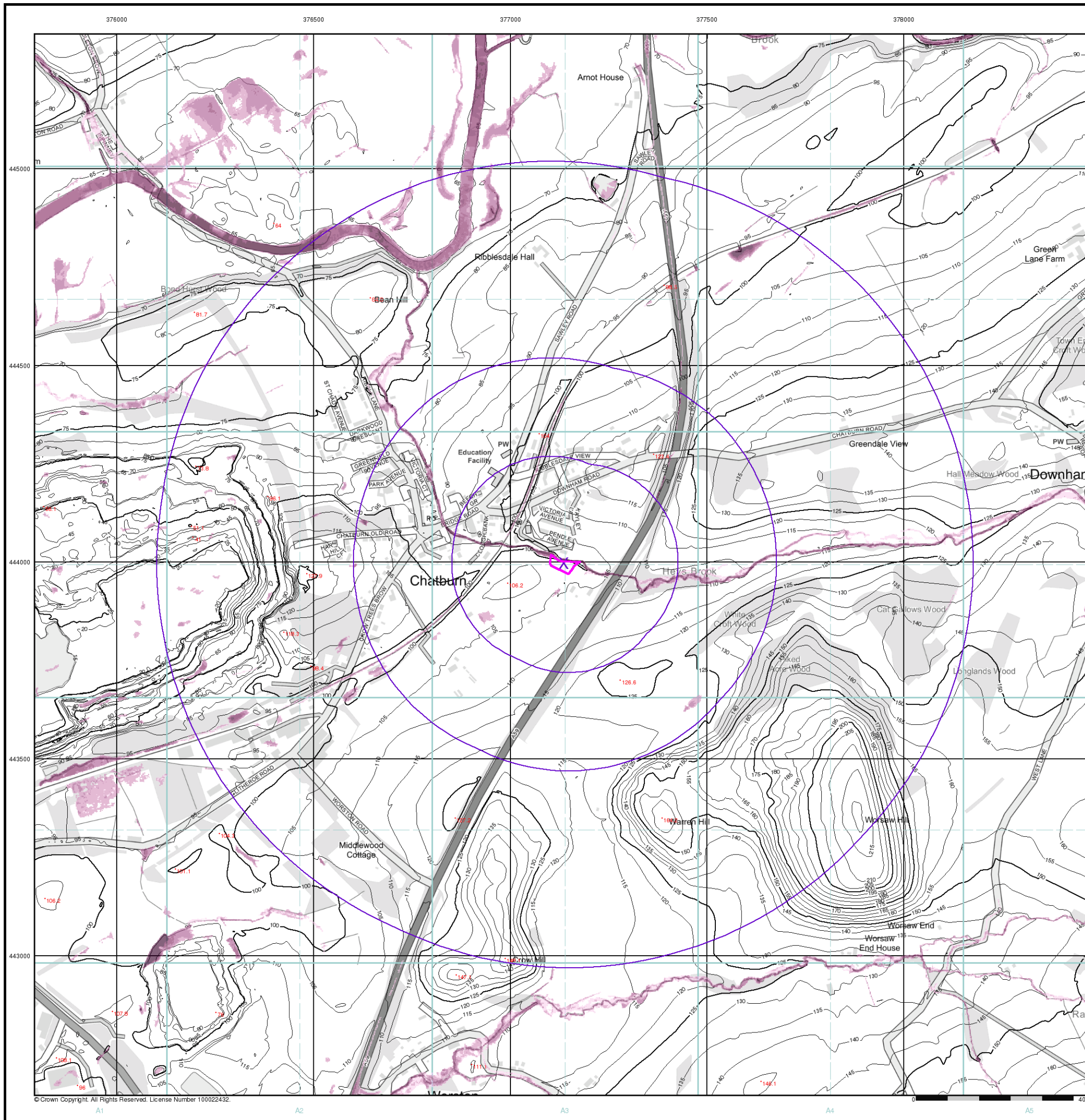


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020

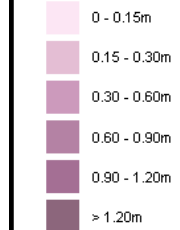


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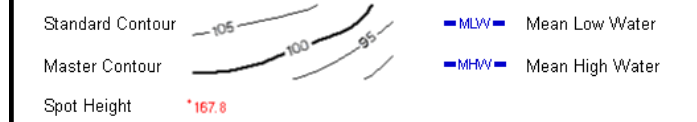
EANRW Surface Water 100 Year Return Depth Map

General
 Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Depth



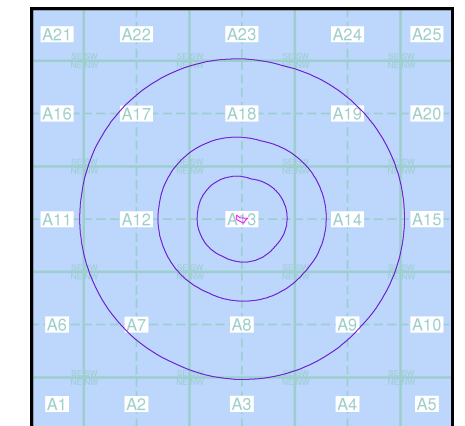
Contours (height in metres)



Suitability



EANRW Suitability Map - Slice A

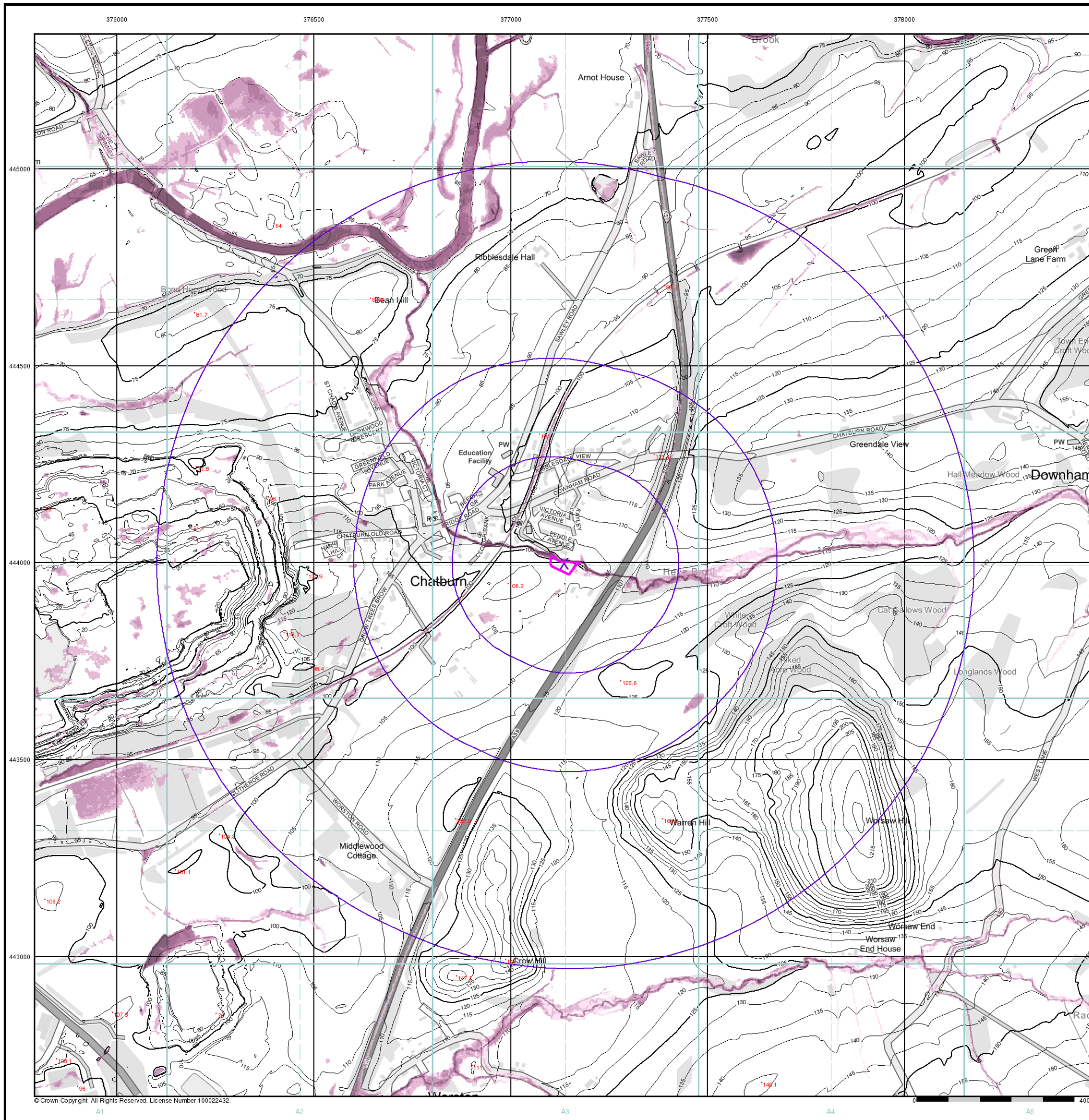


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020

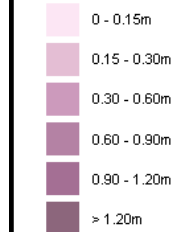


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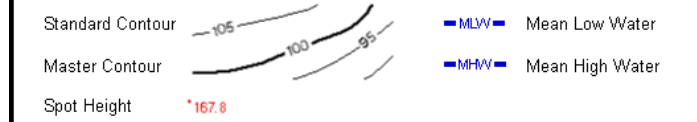
EANRW Surface Water 1000 Year Return Depth Map (1:10,000)

General
 Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Depth



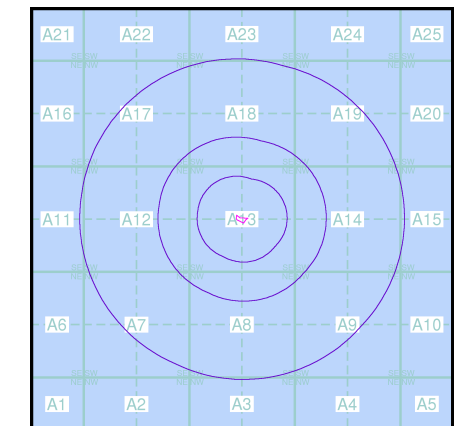
Contours (height in metres)



Suitability



EANRW Suitability Map - Slice A

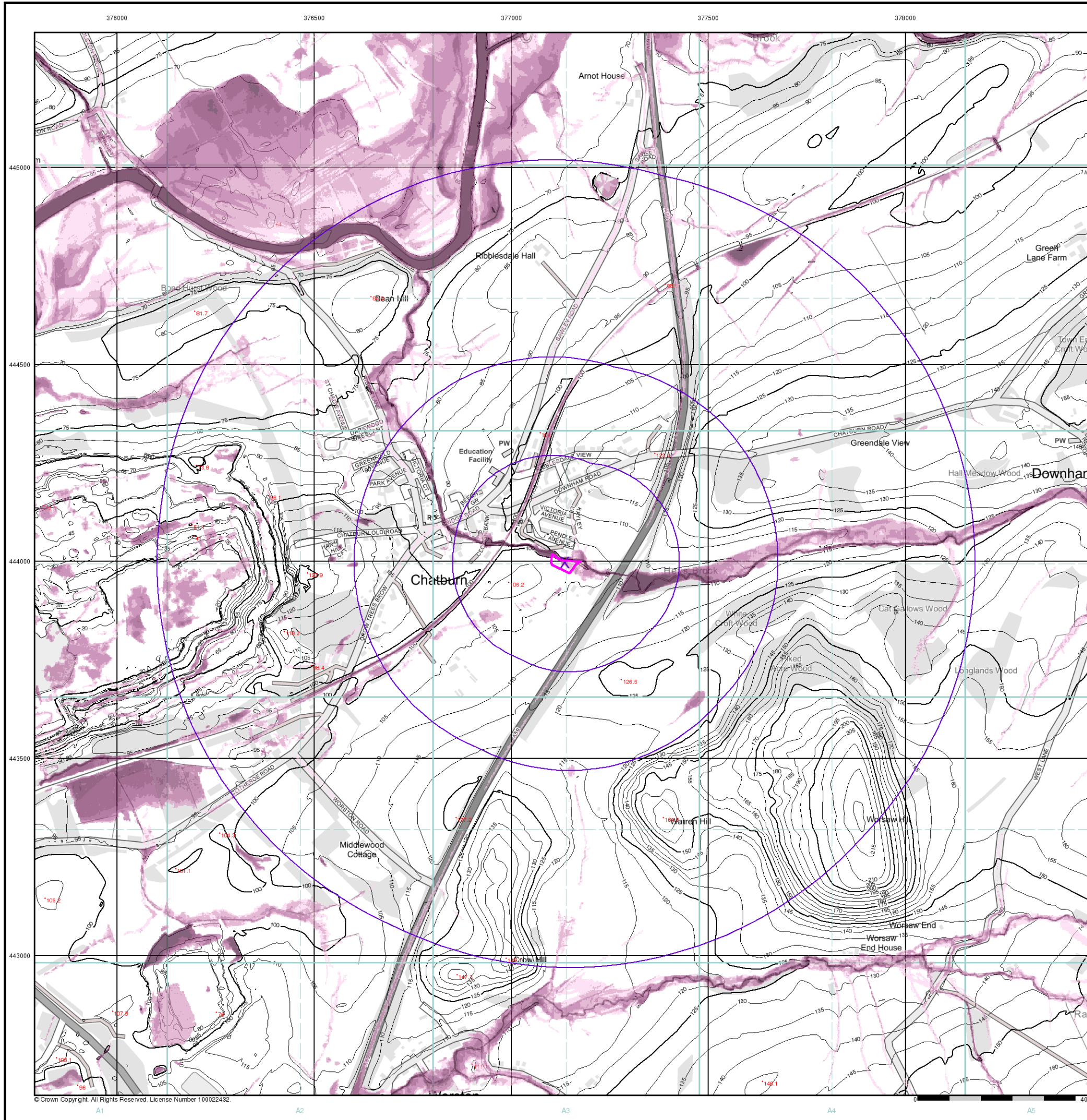


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020



JBA Canal Failure Map (1:10,000)

General

- ◻ Specified Site
- Specified Buffer(s)
- ✕ Bearing Reference Point

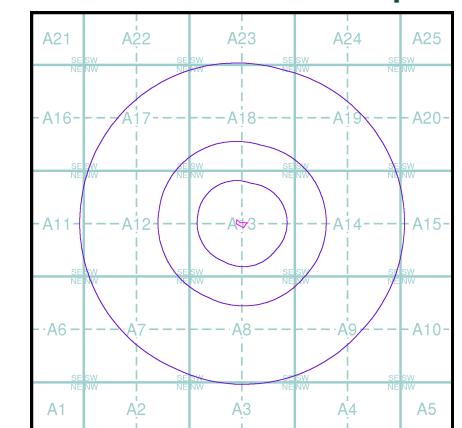
Flood Data

- Canal Failure
- ▣ Coverage

Contours (height in metres)

- Standard Contour 105
- Master Contour 100
- Spot Height 167.8
- Mean Low Water
- Mean High Water

JBA Canal Failure Flood Map - Slice A

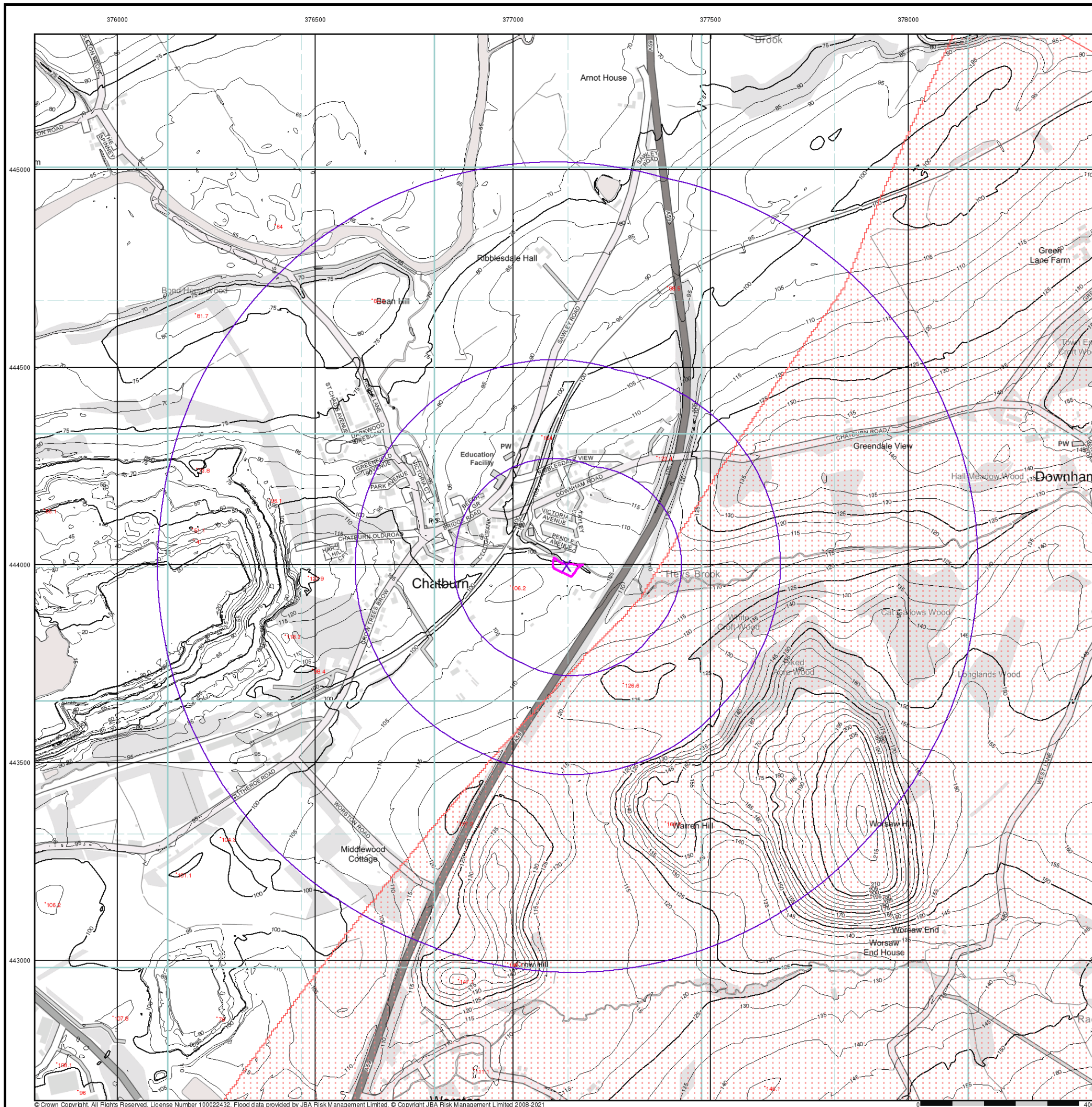


Order Details

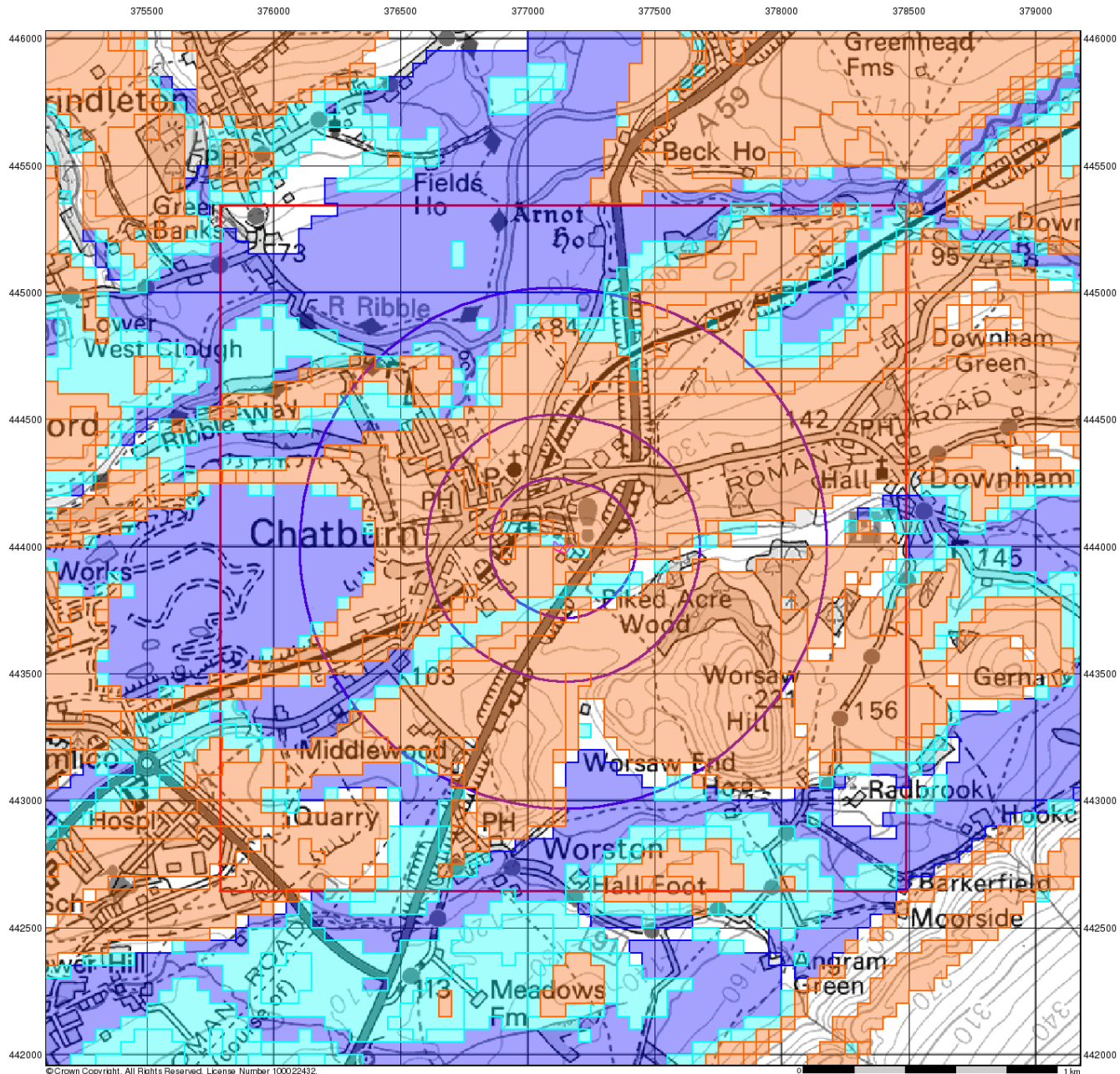
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 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020



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BGS Flood Data (1:50,000)

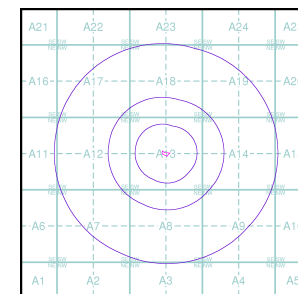
General

- ◇ Specified Site
- Specified Buffer(s)
- ✕ Bearing Reference Point
- Slice
- B Map ID

BGS Groundwater Flooding Susceptibility

- Potential for Groundwater Flooding to Occur at Surface
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Limited Potential for Groundwater Flooding to Occur

BGS Flood Data Map - Slice A



Order Details

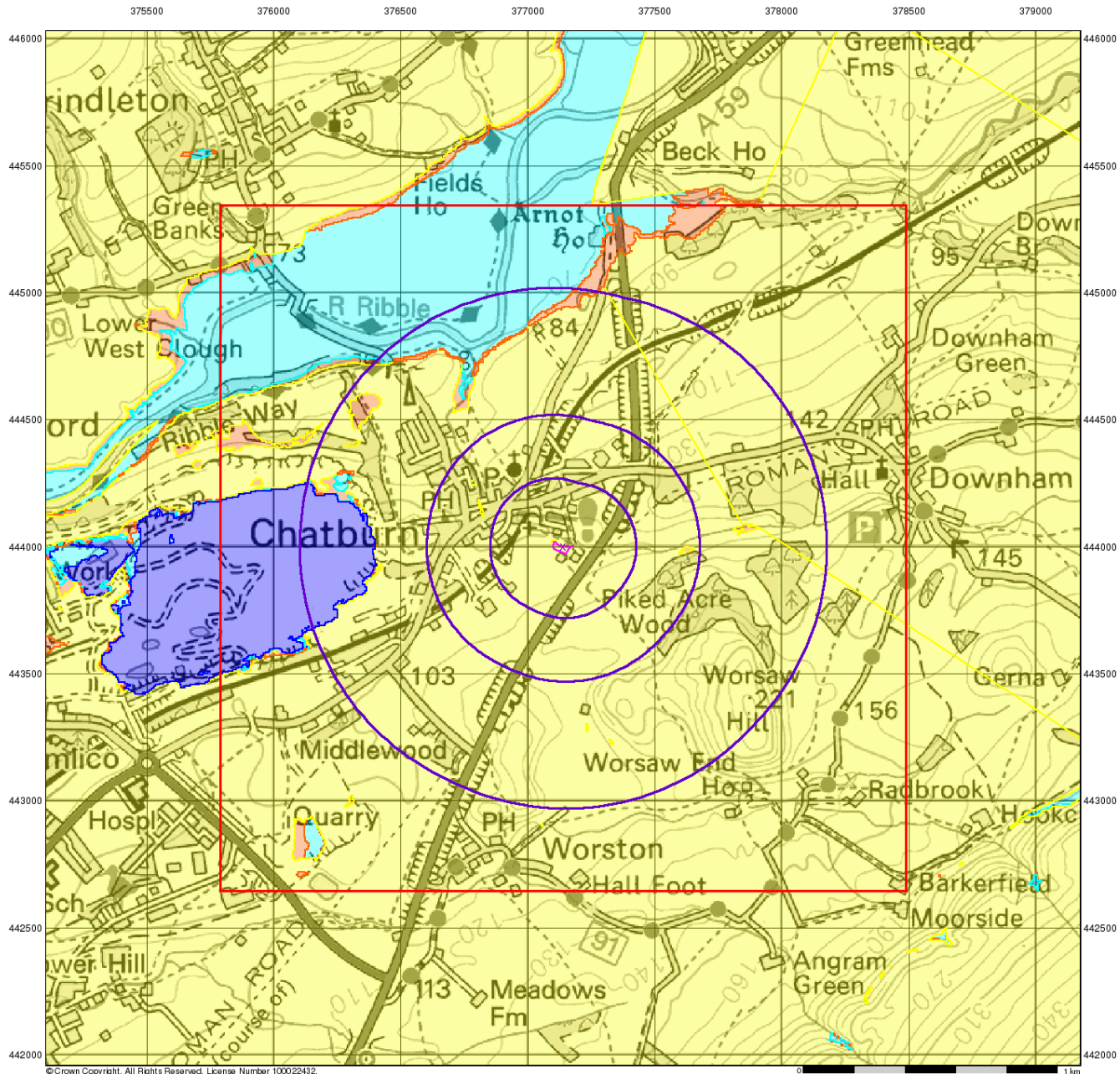
Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020

Landmark®
 ● LANDMARK INFORMATION GROUP

Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk



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GeoSmart Information Groundwater Flood Map (1:50,000)

General

○ Specified Site
 ○ Specified Buffer(s)
 X Bearing Reference Point

Slice

GeoSmart Information Groundwater Flooding Risk

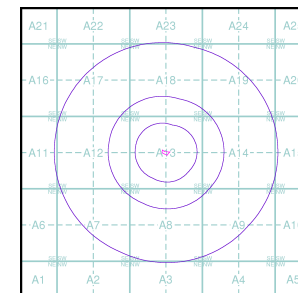
High Risk

Moderate Risk

Low Risk

Negligible Risk

GeoSmart Information Groundwater Flood Map - Slice A



Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020

Landmark®
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Tel: 0844 844 9952
 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk

EANRW Historic Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

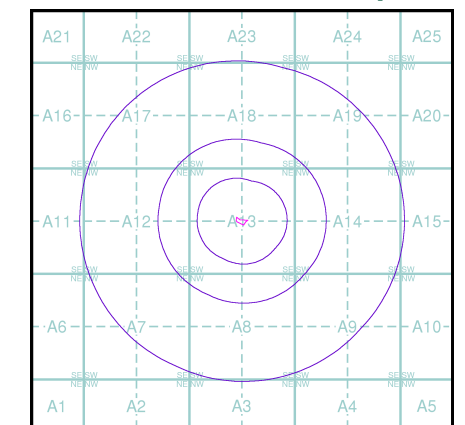
Historic Flood Events Data

- | | |
|--|---------------------------------------|
| Channel Capacity Exceeded (no raised defences) | Obstruction/Blockage - Culvert |
| Channel Capacity Exceeded /Surface Water | Obstruction/Blockage - Debris Screen |
| Groundwater/High Water Table | Operational Failure/Breach of Defence |
| Local Drainage/Surface Water | Other |
| Mechanical Failure | Overtopping of Defences |
| Obstruction/Blockage - Bridge | Surface Water |
| Obstruction/Blockage - Channel | Unknown |
| Historical Flood Liabilities | |

Contours (height in metres)

- Standard Contour 105 MLW - Mean Low Water
- Master Contour 100 MHW - Mean High Water
- Spot Height *167.8

EANRW Historic Flood Map - Slice A

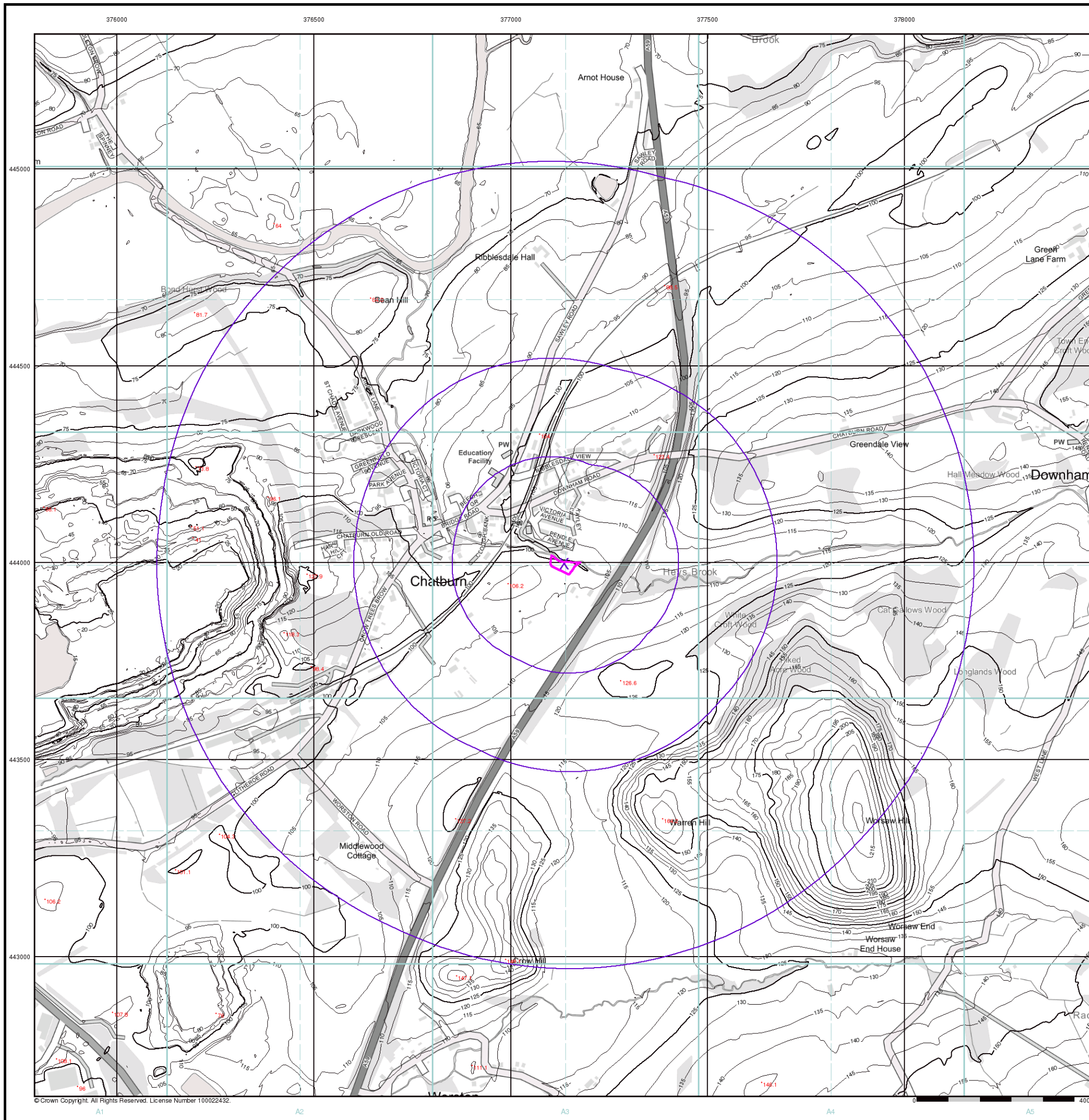


Order Details

Order Number: 272559173_1_1
 Customer Ref: 668
 National Grid Reference: 377140, 444000
 Slice: A
 Site Area (Ha): 0.16
 Search Buffer (m): 1000

Site Details

Site at 377140, 444020







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Appendix D - Environment Agency Flood Zone Map

Flood Zones Map:
 Site north of Heys Brook,
 Chatburn, Clitheroe, BB7 4AX
 Produced: 04 May 2020
 Our Ref: CL168084
 NGR: 377150,444000

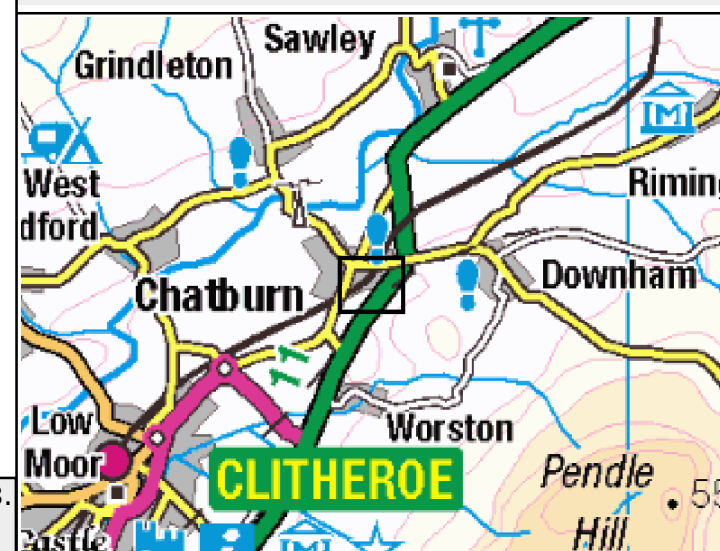
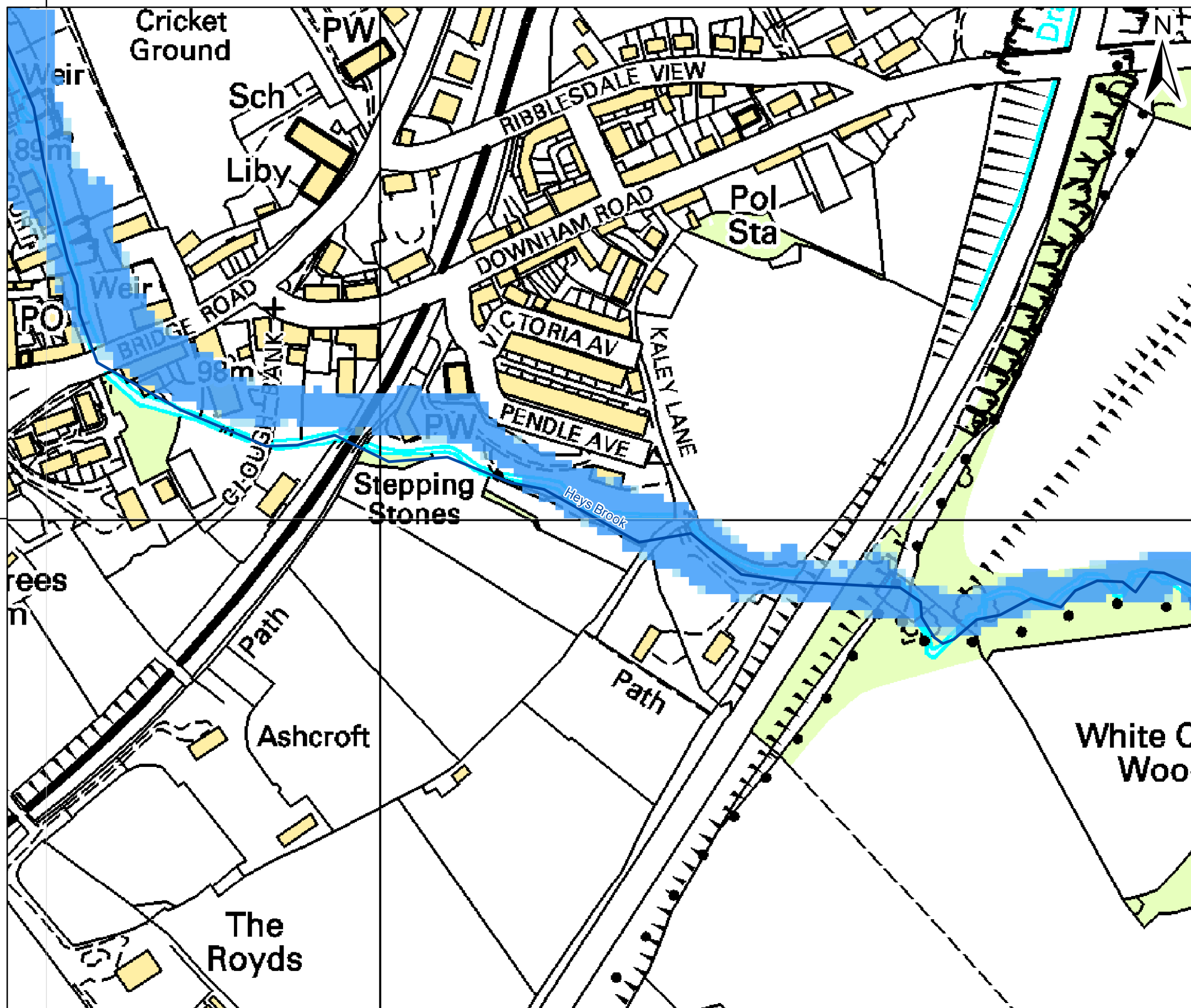
Key

-  Main River
-  Areas Benefitting from Defences
-  Flood Zone 3
-  Flood Zone 2

Flood Zone 3 shows the area that could be affected by flooding:
 - from the sea with a 0.5% or greater chance of happening each year
 - or from a river with a 1.0% or greater chance of happening each year.

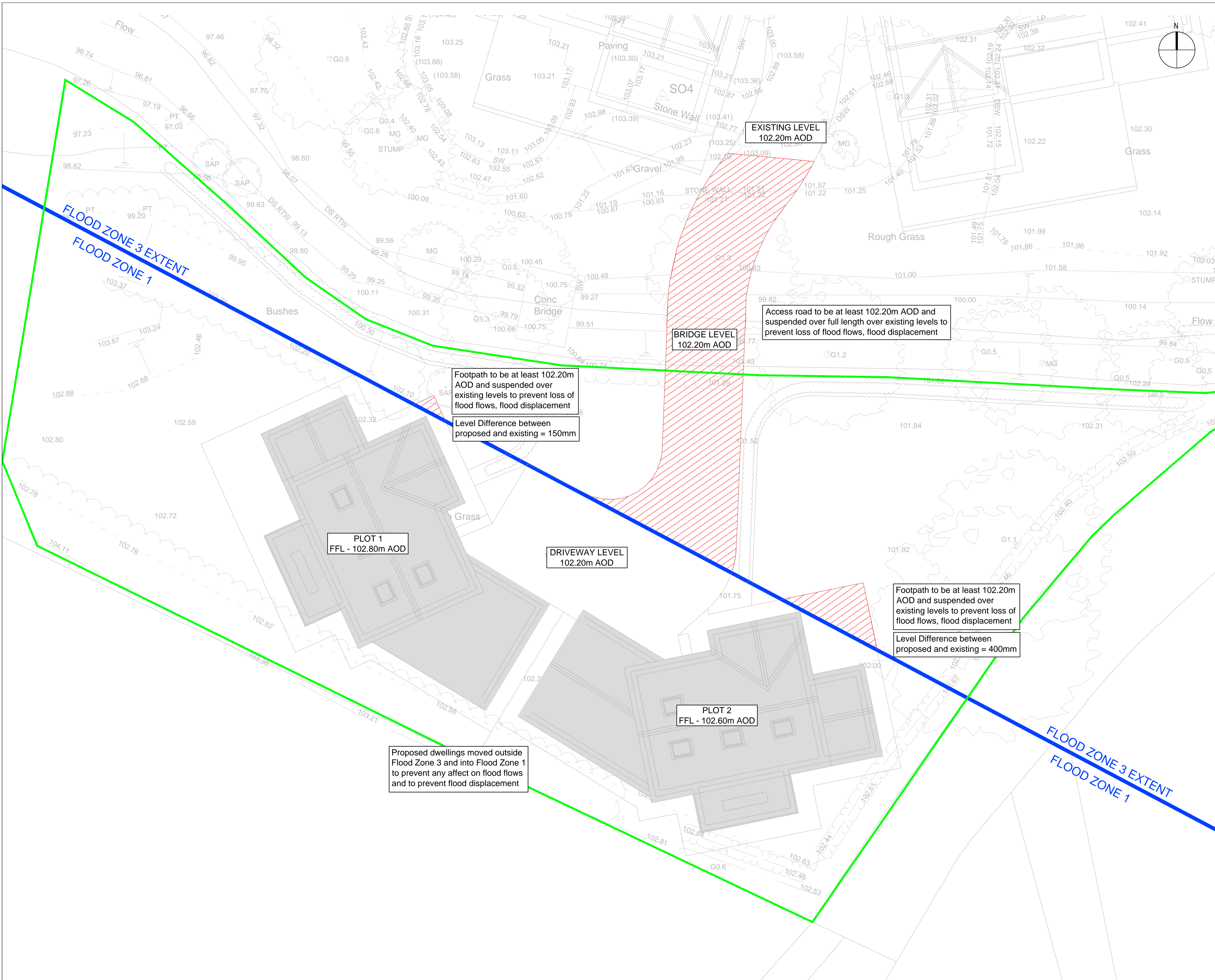
Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

ABDs (Areas Benefitting from Defences) show the area benefiting from defences during a 0.5% tidal, or 1.0% fluvial flood event.



376800

Appendix E - Flood Mitigation Layout



P1	Issued for Planning	MDS	NC	01.02.21
Rev	Description	Drm	Chk	Date

Client
SDA Architects

Project
Residential Development
Phase 2, Glencroft, Pendle Avenue
Chatburn, BB7 4AZ

Drawing
Flood Mitigation Layout

Scale	Date	Drawn by	Checked
1:100@A1	01.02.21	MDS	NC

Status
PLANNING



Job No.	Drng. No.	Rev
668	DR-101	P1