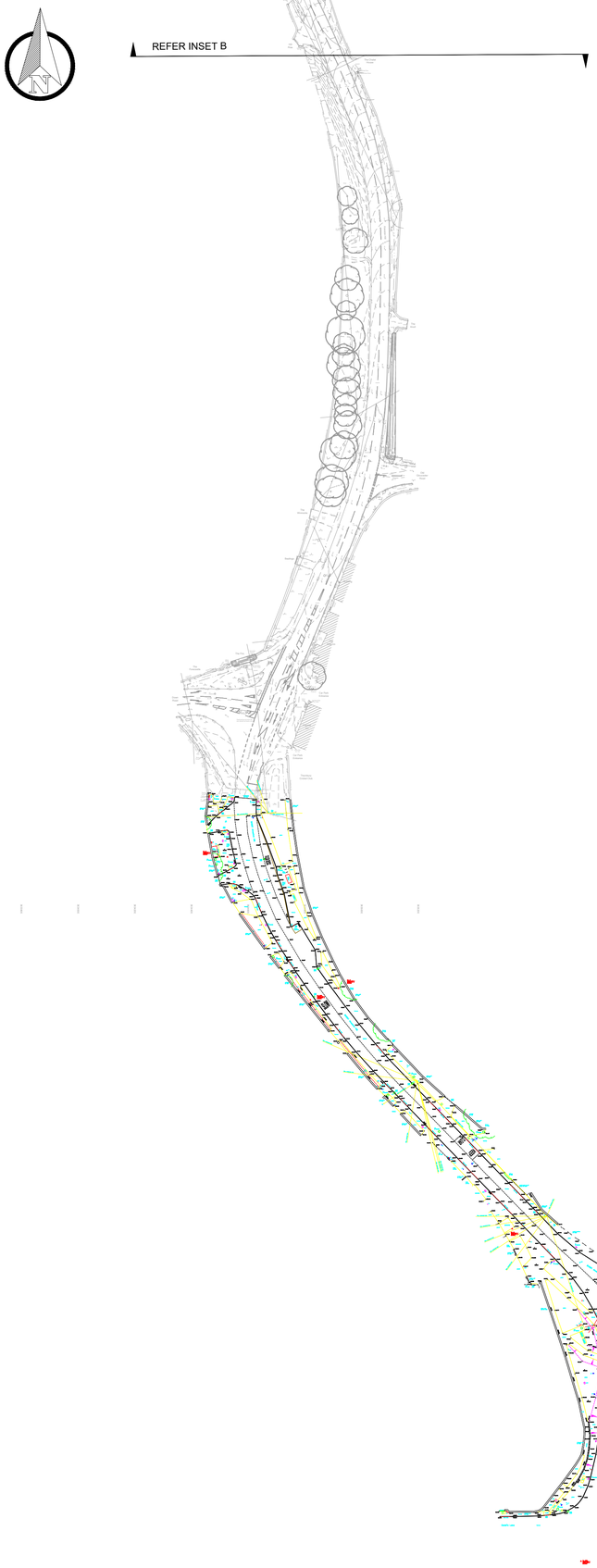
2. Topographical survey information



INSET A

INSET B

REFER INSET D

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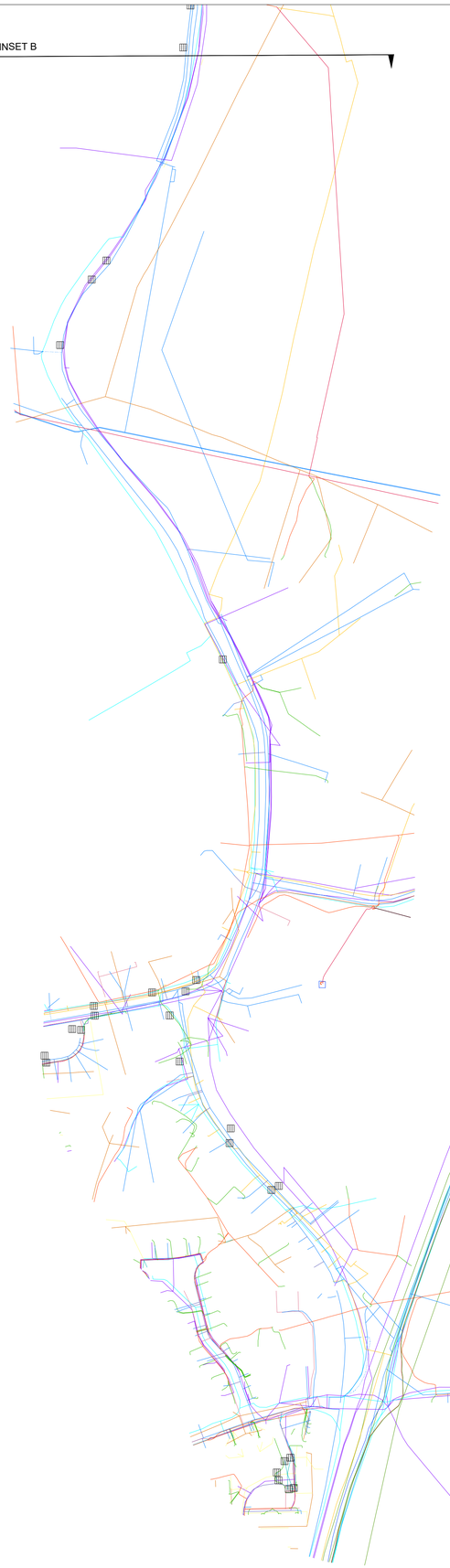
REFER INSET C

INSET D

3. Existing Utilities and Search Report

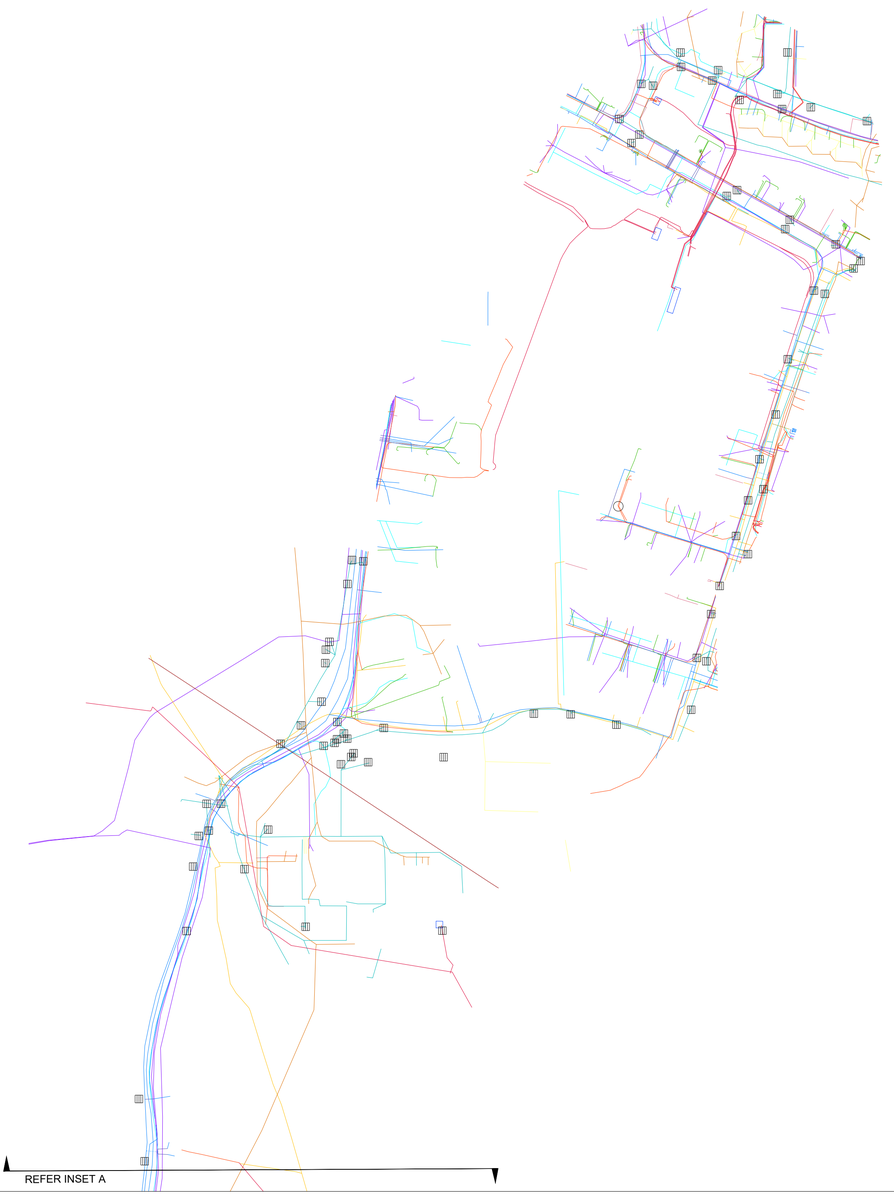
REFER INSET B



INSET A

KEY:

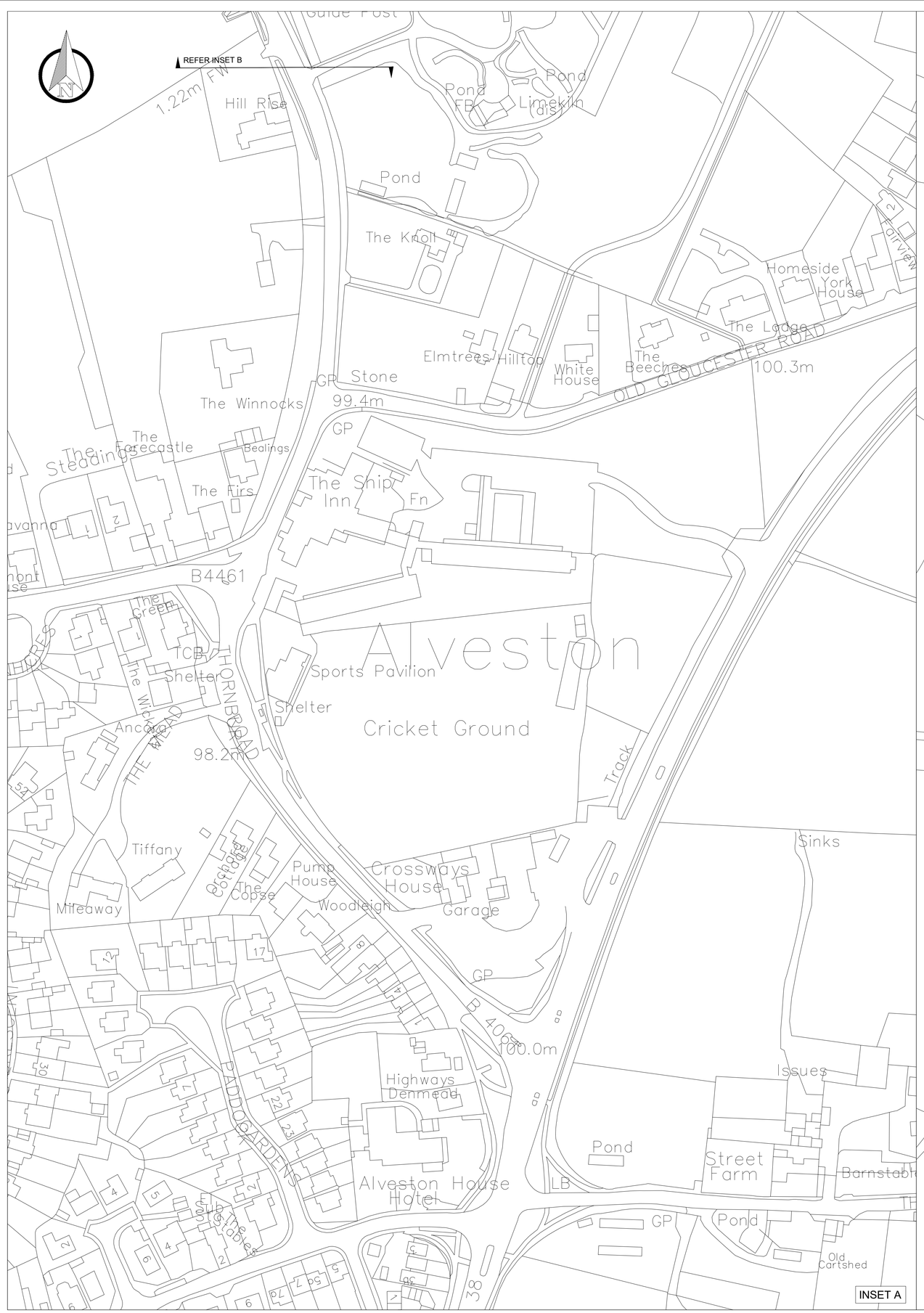
- BRITISH TELECOMMUNICATION (OPENREACH)
- VODAFONE
- VERGIN MEDIA
- NEOS NETWORKS
- BRISTOL WATER MAIN
- LOW PRESSURE GAS
- MEDIUM PRESSURE GAS
- WESSEX WATER SEWER SURFACE
- WESSEX WATER FOUL SEWER
- WESSEX WATER
- NATIONAL GRID ELECTRICITY DISTRIBUTION LOW VOLTAGE
- NATIONAL GRID ELECTRICITY DISTRIBUTION HIGH VOLTAGE
- NATIONAL GRID ELECTRICITY DISTRIBUTION SERVICE OVERHEAD
- NATIONAL GRID ELECTRICITY DISTRIBUTION SERVICE
- BRISTOL WATER COMMUNICATION PIPE
- SEWERAGE WESSEX WATER HIGHWAY DRAIN
- NATIONAL GRID ELECTRICITY DISTRIBUTION SUBSTATION
- GULLY



REFER INSET A

INSET B

4. Ordnance Survey Mapping


REFER INSET B
Guide Post
1.22m FW
Hill Rise
Pond
Pond
FB
Limekiln (dis)
Pond
The Knoll
Homeside
York House
Fairview
The Lodge
OLD GLOUCESTER ROAD
Elmtrees
Hilltop
White House
The Beeches
100.3m
GP
Stone
99.4m
The Winnocks
The Steadings
The Forecastle
Bealings
The Firs
GP
The Ship Inn
Fn
B4461
The Green
TCB
Shelter
Sports Pavilion
Shelter
Alveston
Cricket Ground
THORNBURY ROAD
Ancaster
THE MEAD
98.2m
Track
Tiffany
Orchard Cottage
The Copse
Pump House
Crossways House
Garage
Woodleigh
Mileaway
Sinks
GP
B 4061
100.0m
Highways Denmead
PADDOCK GARDENS
Issues
Pond
Street Farm
Barnstable
Alveston House Hotel
LB
Stone Lodge
GP
Pond
Old Cartshed
INSET A


REFER INSET C
60.4m
Inglenook
Hollytree Cottage
B 4061
THORNBURY ROAD
65.1m
Path (um)
South Lodge
Pond
Pond
Issues
82.4m
Slurry Tank
Def
FF
Ward Bdy
FW
1.22m RH
92.6m
The Chalet
Guide Post
The Cote
REFER INSET A
1.22m FW
Hill Rise
Pond
Pond
FB
Limekiln
INSET B

INSET C

INSET D

5. Geotechnical Investigation report

SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

Alveston Hill FBC

Ground Investigation Specification

South Gloucestershire Council

12 May 2023

5220316 Alveston Hill FBC

Notice

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This document has 60 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Author-ised	Date
1.0	Tender documents	NC	LT	LMc	GW	12 May 2023

Client signoff

Client	South Gloucestershire Council
Project	Alveston Hill FBC
Job number	5220316
Client signature / date	

Contents

PREAMBLE TO THE SPECIFICATION

1. The Specification referred to in the tender shall be the 'UK Specification for Ground Investigation, Second Edition' published by ICE Publishing on behalf of the Site Investigation Steering Group, modified and extended by any Substitute Clause or Additional or Cancelled Clause or Table listed in Schedules 4 and 5.
2. Insofar as any of the numbered Appendices, Additional or Amended Clauses may conflict or be inconsistent with any provision of the UK Specification for Ground Investigation then the numbered Appendices, Additional or Amended Clauses shall always prevail.
3. Any reference in the Contract to a Clause number or Appendix shall be deemed to refer to any amended version of that Clause or Appendix as listed in Schedule 1.
4. Reference to Clauses shall apply equally to Tables. Where a Clause is amended, any Tables referred to in the original Clause shall apply unless the Table is also amended. When a Table is amended any reference in a Clause to the original Tables shall apply to the amended Table.
5. Any Clauses in the Specification which relate to work or materials not required for the Investigation shall be deemed not to apply.
6. Any Schedules referred to in the Specification which are not used have been removed from this document and shall be deemed not to apply.

Schedule 1: Information and site-specific requirements

S1.1 Name of Contract

Alveston Hill FBC

S1.2 Investigation Supervisor

The *Investigation Supervisor* shall also mean the *Engineer* as defined in the ICC Conditions of Contract – Ground Investigation, as amended by the *Employer* unless otherwise informed or instructed by the *Engineer*.

The *Engineer* for the Contract shall be:

Atkins

The *Investigation Supervisor* shall be:

Natasha Crome

CDM Roles

The *Client* shall be:

South Gloucestershire Council

The *Principal Contractor* shall be:

The GI Contractor

The *Principal Designer* shall be:

Faithful and Gould

S1.3 Description of site

The proposed cycle path alignment joins the A38 in the south of the site and will run along the western side of the existing Alveston Hill road (B4061) for approximately 485 m before crossing to the eastern side for approximately 180 m and entering fields. The cycleway crosses through fields to the east of the B4061 for approximately 600 m until Thornbury leisure centre where the cycleway follows Vilner Lane off road via an existing pathway through Vilner Wood and across Midland Way. The cycleway ends on Streamleaze road in the town of Thornbury where the cycleway ties in with an existing footpath.

A plan of the alignment is displayed in Figure 1.

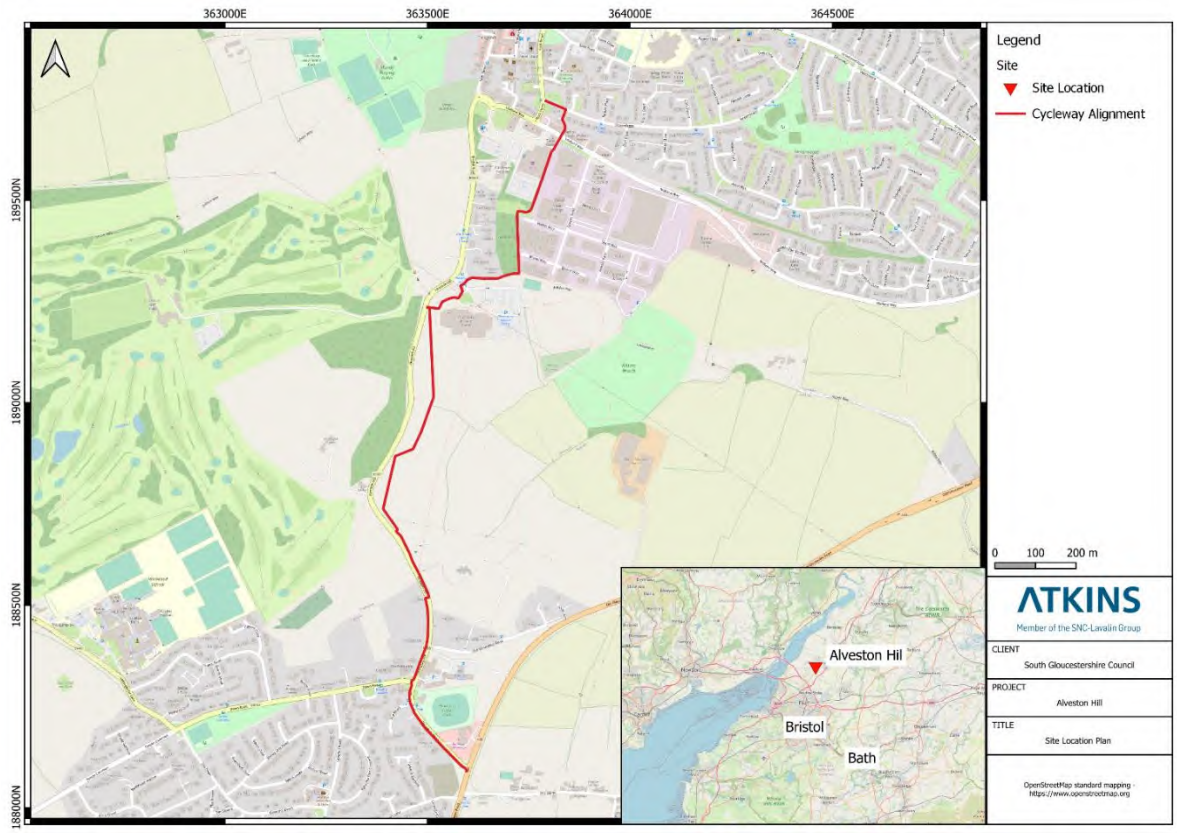


Figure 1 - Site location plan

S1.4 Main works proposed and purpose of this contract

The main works shall comprise the construction of a new cycleway between the town of Alveston and Thornbury along Alveston Hill road (B4061).

The purpose of the works proposed in this specification is to confirm the ground conditions to inform the design of the cycleway and de-risk the uncertainty over ground conditions on site. The GI will be used to collect samples of the underlying strata to determine the geotechnical and geo-environmental properties of the different lithologies encountered. This would determine the nature and thickness of strata and determine weathering profiles

S1.5 Scope of investigation

The aim of the ground investigation is to verify the existing ground conditions, to gather geotechnical data from those areas where provision of extra data reduces the geotechnical risks and, to assist in identifying the most suitable remedial solutions and to assess the contamination potential in regard to human health, controlled waters and other sensitive receptors.

The proposed ground investigation is anticipated to comprise the following; however, the scope of works may be revised depending on the findings of the GI as the works proceed:

- 33No. Machine Excavated Trial Pits;
- 30No. insitu California Bearing Ratio tests;
- 3No. infiltration (soakaway) tests;
- 2No. surface water samples;
- Sampling to Eurocode BS EN 1997-2:2007 and BS 10175;
- Provision of factual report including GPR report as an Appendix
- Provision of photographs.

S1.6 Geology and ground conditions

The following text provides a summary of the anticipated geology and ground conditions as inferred from review of published information. No assurance is given to its accuracy.

The geology varies across the site and therefore three different sequences of stratigraphy have been proposed for the expected ground conditions, these are displayed in Figure 2. All three ground models indicate Topsoil overlying bedrock. Ground Model 1 comprises Limestones / Mudstones from the Clifton Down Mudstone, Gully Oolite Formation and Black Rock Limestone subgroup. Ground Model 2 comprises the Mercia Mudstone Group (Marginal Facies) and Ground Model 3, the Tintern Sandstone Formation is anticipated. A map indicating the areas each Ground Model covers is displayed in Figure 2.

Table 1 – Ground Model 1

Formation	General Description	Expected top of strata (m bgl)
Topsoil	Firm medium brown very sandy slightly soily clay	0.0 m bgl
Limestone/Mudstone	Weathered Limestone / weathered Mudstone with bands of ironstone	0.5 to 1.0 m bgl
	Unweathered Limestone / Mudstone	Circa 1.0 m bgl

Table 2 - Ground Model 2

Formation	General Description	Expected Depths (m bgl)
Topsoil	Firm medium brown very sandy slightly soily clay	0.0 m bgl
Mercia Mudstone Group (Marginal Facies)	Conglomerate composed of limestone and dolomitized matrix.	Circa 0.5 m bgl

Table 3 - Ground Model 3

Formation	General Description	Expected Depths (m bgl)
Topsoil	Very sandy clayey soil	0.00 m bgl
Tintern Sandstone	Hard yellow, red sandstone	Circa 0.30 m bgl

Groundwater

The groundwater underlying the site in the Principal and Secondary aquifers (A and B) is of high vulnerability due to the absence of superficial geology and high leaching potential of soils. The site is also within a soluble rock risk zone. The high vulnerability classification is defined as "*areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits*".

The site is not located within a Source Protection Zone (SPZ) and there are no active or historical groundwater abstraction licenses within 250 m of the site.

Topography

The elevation generally increases from north to south, the section of cycleway around Thornbury Leisure Centre is at the lowest elevation of 52 m AOD and the highest elevation is 100 m AOD at the southern extent of the site.

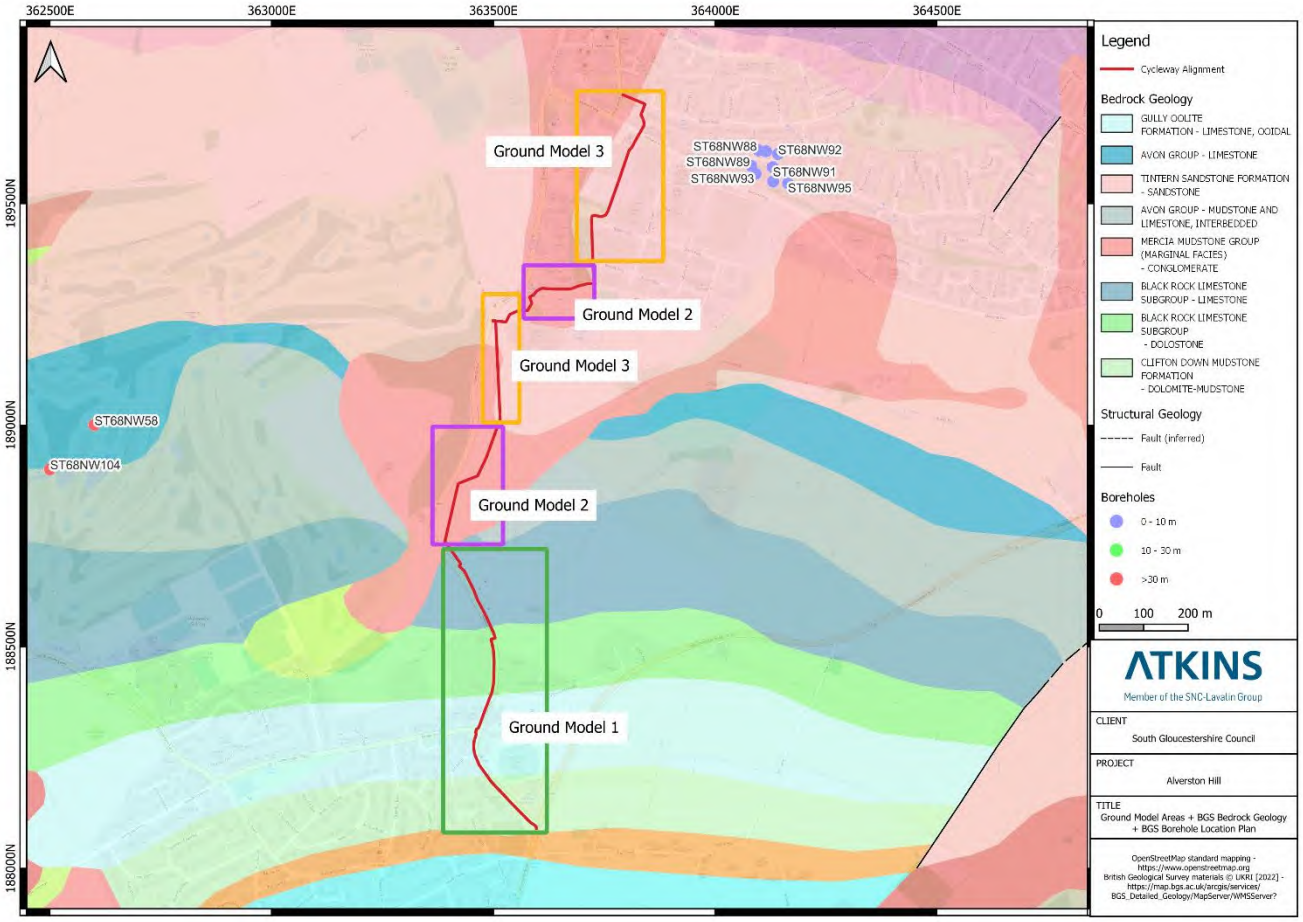


Figure 2 - Ground Model

S1.7 Schedule of drawing(s) and documents

The following appendices and documents should also be read in conjunction with this Specification:

- Appendix A: Proposed exploratory hole positions
- Appendix B: Risk Register
- Appendix C: Pre-Construction Information
- Appendix D: List of Professional Standards
- Bill of Quantities

S1.8 General Requirements (Specification Section 3) Particular restrictions/relaxations

S1.8.1 Quality management system (Clause 3.3)

The GI Contactor shall work in line with or follow the Standards set out in Appendix D of this Specification.

S1.8.2 Professional Attendance (Clause 3.5.2)

The GI Contractor shall provide an experienced geotechnical engineer or geologist full time on site for the supervision of all site activities, logging of exploratory holes, taking samples from the exploratory holes, taking videos and photographs and providing daily records and preliminary logs (except where daily records are for activities carried out by boring operatives).

The GI Contractor needs to satisfy themselves that staff are suitably experienced to undertake works to a high standard in the ground conditions outlined in S1.6.

The GI Contractor needs to satisfy themselves that staff are suitably qualified and trained to undertake works in potentially contaminated ground.

S1.8.3 Provision of ground practitioners and other personnel (Clauses 3.6.1 and 3.6.2)

General

All site personnel provided by the GI Contractor shall, as a minimum, have CSCS or similar accreditation. All personnel involved with the Contract shall have demonstrable competence and suitability for the tasks and duties they will be expected to perform. The Client reserves the right to exclude any worker from a role if it cannot be demonstrated that the worker has sufficient training, skills and experience in the role.

All drillers employed on the Contract shall hold a certificate of competence for percussion/dynamic boring and rotary drilling applicable to the work on which they are engaged, as issued by the British Drilling Association Limited under the Ground Investigation Drillers Accreditation Scheme or an equivalent body in a State of the European Economic Area.

At the time of tendering the GI Contractor shall submit the qualifications and details of the experience of the ground engineering professionals proposed to be employed on site.

S1.8.4 Hazardous ground, land affected by contamination and notifiable invasive weeds (Clauses 3.7.1 and 3.22)

Contaminated Land - General

The GI Contractor shall maintain clean drilling equipment between exploratory locations and maintain good personal hygiene, washing hands and exposed skin at all breaks in progress or drilling works as a minimum. Lace up safety boots, gloves, hard hats, high visibility jacket and trousers (in accordance with EN ISO 20471, Class 3) and safety glasses must be worn at all times during the intrusive works. The GI Contractor shall carry out their own Health and Safety risk assessment. The GI Contractor must determine whether any additional personal protective equipment is required.

Should material with suspect colour, fibre(s) or odour be encountered, the Investigation Supervisor shall be informed immediately. If asbestos containing material is suspected all works are to be stopped immediately, the area made safe, and measures to prevent asbestos fibres becoming airborne adopted in so far as possible. The Investigation Supervisor shall be informed, and a risk assessment shall be undertaken before works are to recommence.

Contaminated Land – Site Specific

The off-road section of the site has been occupied by agricultural land with residential and industrial land uses present within the surrounding area. The site has also been occupied by the B4061 from the earliest available mapping.

The following potential sources of contamination have been identified on-site:

- Made Ground associated with the construction, operation and maintenance of the B4061;
- Made Ground associated with the localised infilling of surface water features adjacent to Thornbury Leisure Centre; and,
- Made Ground associated with the general development and land use changes across the site and surrounding area.

Potential contaminants associated with the above sources include:

- Inorganics including metals, asbestos, cyanides, sulphate and ammonia;
- Organics including Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAHs), benzene, ethylbenzene, toluene and xylenes (BTEX), volatile and semi-volatile organic compounds (VOCs/SVOCs) and polychlorinated biphenyls (PCBs); and,
- Ground gases.

Invasive Species

This has not been covered as part of the Desk Study reports completed, it is recommended a separate Ecological Impact Assessment is to be undertaken for the site.

S1.8.5 Additional information on services not shown on Contract drawings (Clause 3.7.2)

Information on buried services, including mains and sewers etc. will be provided for information only by the Client and it is based upon available records and therefore may be incomplete.

It is the GI Contractor's responsibility to review the buried services plans and confirming the absence of recorded services at the location of the exploratory hole prior to commencement of the exploratory hole. The GI Contractor shall be responsible for implementing the permit to dig process on site.

The GI Contractor is to satisfy themselves that the risk from buried services and overhead cables has been mitigated through, but not limited to: ascertaining the location of the services at the site, use of cable avoidance equipment, risk assessments and any other means to mitigate potential risks.

S1.8.6 Known/suspected mine workings, mineral extractions, etc. (Clause 3.7.3)

None expected.

S1.8.7 Protected species (Clause 3.7.4)

Ecological input to be reviewed alongside the existing ecological information produced on the scheme.

S1.8.8 Archaeological remains (Clause 3.7.5)

Due to the potential presence of buried archaeology it is likely a scheme of archaeological monitoring will be required alongside the GI works, but this will require confirmation and agreement with South Gloucestershire's Archaeology and Historic Environment Record Officer

S1.8.9 Security of site (Clause 3.11)

General

None in excess of the minimum requirements.

Personnel will be required to sign in and out of the site each day.

Exploratory holes and equipment shall be fenced off and protected for the period of the works as may be required by the GI Contractor for security and to avoid injury to others.

S1.8.10 Traffic management measures (Clause 3.12)

The site may require traffic management including single lane closure and closure of the footpath. The GI contractor shall review and organise traffic management requirements.

S1.8.11 Restricted working hours (Clause 3.13)

Day Working

Fieldwork hours shall be discussed with and approved by the Project Manager and Investigation Supervisor through written submission and formal approval. For pricing purposes, the GI Contractor shall assume available working hours of between 8:00am to 6:00pm Monday to Friday.

The GI Contractor shall comply with the Standards specified in Appendix D of this Specification, together with the specific requirements contained in Clause 3.13.

S1.8.12 Trainee site operatives (Clause 3.14.1)

Trainee site operatives are permitted provided they are fully supervised by a suitably qualified and experienced person(s) and the GI Contractor has carried out a suitable risk assessment. Individual written requests are to be submitted to the Investigation Supervisor at least 7 days prior to the deployment of any trainees, to include details of proposed tasks and of the supervising staff member.

S1.8.13 Contamination avoidance and/or aquifer protection measures required (Clauses 3.15.2 and 3.15.3)

General

Asbestos awareness procedures shall be in place in case asbestos is encountered so as to minimise the risk of harm to human health. As a minimum, all supervisory staff shall be Category A Asbestos Awareness trained.

To minimise contamination, the GI Contractor shall provide a spill kit(s) (minimum 1 per drill rig/excavator/other plant) and personnel trained in their use. Drip trays shall be located beneath any static plant, such as generators, hydraulic power packs etc.

Containment of fluid for all works is to be suitably compounded.

Visual, olfactory or instrument-based evidence of potentially mobile or leachable solvent / hydrocarbon contamination should be reported to the Investigation Supervisor immediately. In such circumstances the progression of exploratory positions may need to be suspended or the drilling method altered so that vertical contaminant migration pathways are not created allowing contamination to migrate.

All equipment shall be thoroughly cleaned before being used on site. A clean stainless-steel trowel shall be used to sub-sample soil samples for chemical testing, which shall be cleaned between samples. When working on land affected by contamination the GI Contractor shall clean equipment (including wheels) before leaving the site and, where deemed necessary, between exploratory hole positions.

If significant contamination is encountered, sampling equipment and tools shall be cleaned between strata, specifically at the boundary between made ground and natural strata, in order to prevent cross contamination occurring.

The GI Contractor may only use vegetable oil-based lubricants.

S1.8.14 Maximum period for boring, pitting or trenching through hard material, hard stratum or obstruction (Clauses 2.8, 4.3 and 6.4)

One hour at which time instruction from the Investigation Supervisor shall be sought.

S1.8.15 Reinstatement requirements (Clause 3.16)

General

The GI Contractor shall confine their operations to the minimum area of ground required for the Works. Upon completion of the works, the GI Contractor shall reinstate each exploratory hole to its original condition to the satisfaction of the Investigation Supervisor. The GI Contractor shall make good any damage, whether in the vicinity of the hole or on the access route thereto to the satisfaction of the Investigation Supervisor and shall be responsible for any damage to property due to their failure to carry out such restoration.

The GI Contractor shall backfill and compact all exploratory holes in such a manner that no subsequent depression is formed at the ground surface due to settlement of the backfill.

The site shall be cleared of all rubbish and spoil associated with the ground investigation operations. The whole of the site and any ancillary works shall be left in a clean and tidy condition. There should be no spreading of excess material unless otherwise agreed with the Investigation Supervisor. All surplus arisings should be removed from site by transfer to authorised Contractors.

S1.8.16 Hygiene facilities required (Clauses 2.20 and 3.16.1)

Mobile Facilities

Due to the limited nature of the works, mobile welfare van(s) shall be provided on a shift by shift basis.

S1.8.17 Unavoidable damage to be reinstated by Contractor (Clause 3.16.1)

Reinstatement of damaged areas shall be in accordance with Client's instruction and/or with clause S1.8.15.

S1.8.18 Accuracy of exploratory hole locations (Clauses 3.19 and 3.20)

All exploratory hole locations are provisional and to be confirmed with the Investigation Supervisor prior to commencement.

Prior to forming the exploratory hole, the GI Contractor should check for the absence of services on plans and as per Schedule S1.11.1. Should the presence of buried services be suspected, the location shall be revised and the checking of the location of services shall be repeated.

The location of the exploratory holes is defined by means of reference to Ordnance Survey National Grid. The final position of all exploratory holes shall be agreed on site with the Investigation Supervisor. The final position of all exploratory holes shall be surveyed relative to Ordnance Survey National Grid and Ordnance Datum. Coordinates shall be to the nearest 0.5 m. Levels shall be to the nearest 0.05 m OD.

The location and depth of each exploratory hole shall be as described in Schedule 2. The Investigation Supervisor may, after consultation with the GI Contractor, vary the location and depth of any exploratory hole and the sequence or quantity of testing depending on the actual ground conditions encountered. When the position of an exploratory hole has been varied, the GI Contractor shall take all necessary measurements and shall inform the Investigation Supervisor of the revised coordinates and ground elevation or other measurements required to locate the exploratory hole.

S1.8.19 Photography requirements (Clause 3.25)

General

The GI Contractor shall provide a video recording of the site and sufficient digital photographs to show the condition of each exploratory hole location prior to the start of the investigation works and on completion of the investigation.

Digital copies of the videos and photographs shall be provided to the Investigation Supervisor within 48 hours of being taken.

Inspection Pits

All inspection pits shall be photographed to show a general view of the pit and excavation arisings plus separate views of each excavated face and any foundations exposed, as well as any noted contamination. Photographs shall include:

a) A colour chart and graduated scale in centimetres is provided; and
b) A clearly legible reference board identifying the project title, exploratory hole number, date and depth of the pit shall be included in each photograph.

Trial Pits

All trial pits shall be photographed to show a general view of the pit and excavation arisings plus separate views of each excavated face and any foundations exposed, as well as any noted contamination. Photographs shall include:

a) A colour chart and graduated scale in centimetres is provided; and
b) A clearly legible reference board identifying the project title, exploratory hole number, date and depth of pit shall be included in each photograph.

Further particular Contract restrictions/relaxations shall be entered below, using sequential numbers to those above

S1.8.20 Health, Safety and Security requirements

General

The GI Contactor shall work in line with or follow the Standards set out in Appendix D of this Specification.

The GI Contractor shall provide site-specific method statements and risk assessments for all activities to be undertaken during the fieldwork.

S1.8.21 Technical Standards and Guidance (Clause 3.2)

All works shall be undertaken in accordance with best practice and relevant technical guidance, including (but not limited to) the Standards set out in Appendix D of this Specification.

S1.8.22 Unexploded ordnance

Based on the information in Appendix C, the site is categorised as being at low risk of encountering unexploded ordnance (UXO).

The GI Contractor is to satisfy themselves that UXO risk has been mitigated and where necessary employ a UXO specialist during the works.

S1.11 Pitting and trenching (Specification Section 6) Particular restrictions/relaxations

S1.11.1 Indirect detection of buried services and inspection pits (Clauses 3.8.3 and 6.1)

General

The GI Contactor shall work in line with or follow the Standards and guidance set out in Appendix D of this Specification.

The GI Contractor shall select the specific location of the exploratory hole based on Schedule 2 and their own review of all available information relating to buried underground services. If services are indicated by the CAT and Genny scan prior to hand digging, a new location shall be agreed with the Investigation Supervisor. If services are indicated by the CAT and Genny scan after completion of the inspection pit, it shall be backfilled, and a new location shall be agreed with the Investigation Supervisor.

The work should be closely supervised by an experienced ground engineer. If any services are encountered, the work is to cease, the services shall be clearly marked on the ground service, photographs taken, and coordinates recorded and presented to the Investigation Supervisor. A new location shall be agreed with the Investigation Supervisor.

Machine Excavated Trial Pits

The exact locations of the trial pits are to be agreed on site with the Investigation Supervisor. Where there is a risk of below ground services close to the excavation it is recommended that a toothless bucket should be used, and the excavator operator instructed to dig slowly in thin layers (<100mm thick). After each thin layer is excavated, to a depth of 1.2m, a CAT and Genny shall be used to identify any buried services.

All trial pits shall be backfilled on the same day as excavation unless any scheduled in situ tests require the pit to be left open for more than one working day. In such cases appropriate safety measures should be implemented and the Investigation Supervisor notified.

S1.11.2 Restrictions on plant or pitting/trenching methods (Clauses 6.2 and 6.3)

Any encountered Topsoil is to be stockpiled separately from other excavation arisings.

S1.11.3 Entry of personnel (Clause 6.5)

Entry of personnel into any excavation is prohibited.

S1.11.5 Abstracted groundwater from land affected by contamination (Clause 6.9.2)

If contaminated groundwater is encountered, the Investigation Supervisor shall be immediately notified in order that appropriate action can be taken with respect to disposal. Provision shall be made for the storage and subsequent disposal of any groundwater arisings.

S1.11.6 Backfilling (Clause 6.10)

Machine Excavated Trial Pits

The Investigation Supervisor shall be consulted prior to the backfilling of any pits. Reinstatement shall be carried out as specified in Schedule S1.8.15.

Pits shall be backfilled using the arisings and placed in reverse order of excavation, in layers (measured on loose arisings) not more than 300mm thick (or 150mm for contaminated materials) and compacted. Backfilling should be placed to retain the ground level, pavement construction and surfacing present prior to trial pit construction. Backfilling of trial pits shall be carried out as soon as practicable after completion of excavation, logging, sampling and testing. Excess arisings shall be removed from site at the expense of the GI Contractor.

Compaction using the back of the bucket (or hydraulic compactor where instructed by the Investigation Supervisor) is required in all trial pit backfilling.

All trial pits shall be backfilled on the same day as excavation unless any scheduled in situ testing require the pit to be left open for more than one working day. In such cases appropriate safety measures should be implemented and the Investigation Supervisor notified.

S1.11.7 Photographic requirements (Clause 6.12)

See S1.8.19 of the Specification.

S1.11.8 Artificial lighting (Clause 6.12.2)

Battery powered lights shall be used to undertake the Works if natural daylight is insufficient to allow safe working or where there is a lack of detail in the photographs for logging. Photographs should account for any adequate artificial lighting.

S1.12 Sampling and monitoring during intrusive investigation (Specification Section 7) Particular restrictions/relaxations

S1.12.1 Address for delivery of selected geotechnical samples (Clause 7.6.1)

The GI Contractor will arrange transportation to the GI Contractor's premises for all samples and further transportation to the laboratory where necessary.

S1.12.2 Retention and disposal of geotechnical samples (Clause 7.6.2)

Retain samples for three months from the completion of the site works, unless otherwise agreed with the Investigation Supervisor.

S1.12.3 Frequency of sampling for geotechnical purposes (Clause 7.6.3-7.6.11)

Sampling frequency shall be that required to facilitate the exploratory hole logging, in accordance with Specification Clauses 7.6.4.

The Investigation Supervisor may instruct additional sampling.

Trial Pits

- Small disturbed samples shall be taken at every strata change or 0.5m interval in each excavation unless directed otherwise by the Investigation Supervisor.
- Large bulk disturbed samples shall be taken at a rate of one per stratum or 1m interval in each excavation unless directed otherwise by the Investigation Supervisor.

S1.12.5 Retention of cutting shoe samples (Clause 7.6.5)

As required for the GI Contractors logging purposes and as required by the Investigation Supervisor on site for check logging and review.

S1.12.7 Groundwater level measurements during exploratory hole construction (Clause 7.7)

When groundwater is struck, the groundwater level shall be recorded and again after 20 minutes before continuing the hole. If groundwater continues to rise after 20 minutes the Investigation Supervisor shall be notified. Groundwater level readings shall also be taken at the start and end of each shift.

S1.12.8 Special geotechnical sampling (Clause 7.8)

As instructed by the Investigation Supervisor.

S1.12.9 Address for delivery of selected samples (Clause 7.9.2)

The GI Contractor is to propose a suitable geotechnical laboratory for undertaking specialist soils testing at the time of Tender for approval by the Investigation Supervisor.

S1.12.10 Retention and disposal of contamination/WAC samples (Clause 7.9.3)

To be carried out by the laboratory undertaking the geo-environmental analysis in accordance with Clauses 7.9.1, 7.9.2 and 7.9.3.

The GI Contractor shall be responsible for disposal of all samples and arisings at a suitable location to the satisfaction of the Investigation Supervisor. Contaminated samples and arisings shall, where necessary, be disposed of at an appropriately permitted landfill site.

All untested samples and remaining sample portions shall be kept by the Contractor for a period of 28 days after submission of the approved final report. After this time the Investigation Supervisor's written permission shall be sought for their disposal.

S1.12.11 Frequency of sampling for Geo-environmental purposes (Clause 7.9.4)

Frequency of contamination sampling shall be as directed by the Investigation Supervisor. Samples shall be representative of the strata encountered and taken in compliance with BS 10175:2011+A2:2017. Samples shall be clearly labelled, protected, and stored in accordance with Eurocode 7 EN 1997-2. The frequency of sampling is summarised in the table below.

Table 4 - Sampling Frequency

Exploratory Hole Type	Sample Type (to be confirmed with and agreed with laboratory)	Frequency
All exploratory holes, including the starter/inspection pits.	2 x 500g plastic tub 1 x 250g amber glass jar 1 x 60ml amber vial Sufficient sample must be collected to allow for leachate and soil analysis (container types and sample volumes to be confirmed by lab). If visually identifiable asbestos is suspected approximately 10kg of soils will be sampled, weighed and subject to forensic description in accordance with SOBRA methodology. Matrix material will be weighed and subsampled in to 1 tub while suspected ACM will be separated, weighed and supplied to the laboratory within a separate tub.	In the inspection pit, one sample at the following frequency: • 0.1m – 0.3 m; • 0.5m – 0.7 m; and • 1.0 – 1.2 m, (depths to be adjusted depending on deposits encountered – must ensure a sample is obtained from each layer of Made Ground). Thereafter, samples should then be collected at 1 m intervals in Made Ground and one sample 0.5 m into natural strata, where possible. Additional samples to be collected where there is visual or olfactory evidence of contamination.

Samples should be representative of the strata encountered and taken in broad compliance with BS 10175:2011+A2:2017. Samples shall be collected from a depth range to not exceed 0.3 m (e.g. 0.5 - 0.7 m). Spot depths are not acceptable.

Surface Water Sampling

The Investigation Supervisor shall instruct the requirement for collection of two surface water samples by the GI contractor from upstream and downstream of site from the surface water course adjacent to the east of the off-road section of the site. The samples shall be recovered from a suitable safe access location with the location of each sample presented in Schedule 2.

The analytical suite will be confirmed by the Investigation Supervisor at the time of sample selection. A summary of the typical required analytical suite is provided in Section 1.20.3. The Contractor shall confirm the appropriate containers for the analytical suite with the selected laboratory.

The Contractor shall ensure that samples are stored in a cool box with frozen ice packs and transported in accordance with the analytical laboratories requirements in order to prevent samples being considered deviant at the laboratory. Samples shall be collected between Monday and Thursday only to ensure samples are not standing the courier's depot over the weekend.

Samples should be sent to the laboratory at the end of each working day; environmental samples must be delivered to the laboratory within 24 hours of having been taken. Adequate chain of custody information shall be maintained at all times.

The results of surface water sampling schedule must be submitted to the Investigation Supervisor within 24 hours of completion of the works.

S1.12.12 Sampling method (Clause 7.9.5)

Geo-environmental soil samples taken for chemical analysis shall be retrieved using a stainless-steel trowel and/or clean disposable gloves and placed in the sampling container during the logging. The trowel shall be cleaned prior to obtaining each sample in accordance with BS10175:2011+A1:2013. The GI Contractor shall take all steps necessary to avoid cross contamination of sampling points. The sampler should wear disposable gloves during sampling and change gloves between each sample.

Geo-environmental sample containers should be provided by/obtained from the laboratory and should hold sufficient samples for the testing outlined in Schedule 1.20.3. These shall be filled as full as possible and large air gaps avoided. These shall be clearly labelled with the project name, date, borehole name and the depth of the geo-environmental sample.

A sample collected for contamination testing shall comprise the following:

- Vial(s) for volatile hydrocarbon analysis;
- Amber glass jar(s) for hydrocarbon soil analysis (depending on size multiple jars may be required to achieve analysis); and
- Plastic tub(s) for inorganic, metals and WAC leachability soil analysis (depending on size and soil type multiple tubs may be required to achieve analysis).

The vial(s) for volatile hydrocarbon analysis shall be collected first, followed by the amber glass jar(s) and then the plastic tub(s). The amount of soil containers taken in each case should be sufficient to allow all the potential contaminants to be analysed as defined in in Schedule 1.20.3.

Adequate chain of custody information shall be maintained at all times. All geo-environmental samples (soil, soil-derived leachate, and water) for contamination testing should be stored and transported to the laboratory in line with standard protocols (i.e. cool box with frozen ice packs and bubble wrap to prevent breakage of glass storage containers) and within laboratory prescribed holding times. The laboratory shall record the temperature of the geo-environmental sample upon receipt of the sample. Geo-environmental samples should be sent to the laboratory at the end of each working day and must be delivered to the laboratory within 24 hours of having been taken.

The scheduling of the geo-environmental samples will be arranged by the Investigation Supervisor. Not all samples will be scheduled for laboratory analysis and it is intended that some should be kept in controlled laboratory storage in the event that subsequent analysis is required. No geo-environmental samples shall be destroyed or disposed of until written permission from the Investigation Supervisor has been obtained.

S1.12.13 Accreditation required

The Contractor shall propose the details and methodology for geo-environmental testing for the acceptance of the Investigation Supervisor.

Chemical laboratory testing shall be carried out to BS EN ISO / IEC 17025.

Laboratories for contamination testing shall be MCERTS and UKAS accredited and CONTEST/AQUACHECK registration for water analysis. Prior to commencement of works the Contractor must confirm the name of the proposed environmental laboratory, the proposed analytical methods and accreditation details and method reporting limits.

S1.12.14 Headspace testing (Clause 7.9.8)

Photo ionisation detector (PID) testing is required in accordance with Clause 7.9.8 at all locations where soil samples for geo-environmental testing are obtained or where suspected contamination is identified, as outlined in S1.12.11. The PID shall have a lamp characteristic value of 10.6eV and shall include a moisture filter. Calibration of the PID must be to 100ppm isobutylene equivalent and calibration records shall be provided to the Investigation Supervisor.

For soil sampling, 1 litre capacity plastic bags will be at least half-filled and sealed. Granular materials will be placed directly into the bag. Cohesive or clayey material will be cut or torn into fragments no larger than 25 mm immediately prior to being placed within the bag. The sampling process shall be carried out rapidly and the bags sealed as soon as possible to minimise the loss of VOCs. The precise time of sampling shall be added onto the bag in addition to the standard labelling requirements.

Headspace bags shall not be cooled but shall be kept out of direct sunlight or any location subject to other heat sources.

The bags shall be left at ambient temperature for a standing time of between 60-90 minutes between sampling and PID analysis.

Immediately prior to analysis, a hole slightly larger than the instrument probe shall be drilled or punched into the bag. The hole must be kept sealed until the probe is ready to be inserted.

The probe should be inserted into the bag no more than 20 mm to avoid clogging the inlet with soil or drawing water. The reading should be taken when the instrument reading has stabilised.

S1.15 In situ testing (Specification Section 10) Particular restrictions/relaxations

S1.15.1 Tests in accordance with British Standards (Clause 10.3)

California Bearing Ratio (750mm)

In situ CBR tests (750mm) are required at locations as specified in Schedule 2; the depths of the tests shall be as per Schedule 2 and as confirmed by the Investigation Supervisor. Testing shall be carried out and reported in accordance with the Standards set out in Appendix D of this Specification.

S1.15.6 Soil infiltration test (Clause 10.6)

Infiltration tests (commonly referred to as ‘soakaway tests’ shall be undertaken in accordance with the Standards set out in Appendix D of this Specification and carried in the three trial pits as specified in Schedule 2.

The location and depth of the testing is provided in Schedule 2 of this Specifications and shall be confirmed prior to commencement of the test by the Investigation Supervisor.

S1.15.10 Metal detection (Clause 10.10)

None in excess of that as stated in S1.8.20 for UXO and S1.11.1 for buried services.

S1.18 Daily records (Specification Section 13) Particular restrictions/relaxations

S1.18.1 Information for daily records (Clause 13.1)

The GI Contractor shall submit a proforma or example record for approval to the Investigation Supervisor at least 7 days prior to commencement of fieldwork.

The information to be transmitted in Daily Records shall be as given in Clauses 13.1 and 13.2. Daily progress reports are required including provision of the driller’s logs.

S1.18.2 Special in situ tests and instrumentation records (Clause 13.4)

In addition to the information to be provided in Clause 13.2 and these Schedules, the GI Contractor shall provide the results of the test or monitoring and complete a brief but detailed description of the work carried out, problems encountered, and the solutions adopted, any deviations from the instructed or agreed methodology and any instructions received from the Investigation Supervisor.

S1.19 Geotechnical laboratory testing (Specification Section 14) Particular restrictions/relaxations

S1.19.1 Investigation Supervisor or Contractor to schedule testing (Clause 14.1.1)

The Investigation Supervisor shall prepare a schedule of tests based on daily records and provisional logs from a schedule of available samples prepared by the GI Contractor.

S1.19.2 Tests required (Clause 14.1.2)

The following geotechnical soil testing will be undertaken; and shall be done in accordance with the Standards specified in Appendix D of this Specification:

- Classification tests:
  - Particle size distribution (wet and by pipette)
  - Moisture content
  - Atterberg limits (liquid limit, plastic limit and plasticity index)
  - Density by linear measurement
- Strength tests:
  - Undrained unconsolidated triaxial
  - Drained consolidated triaxial
  - Small / large shear box
- Oedometer tests
- Compaction tests

Additional testing may be required and will be requested by the Investigation Supervisor if necessary.

Laboratory test results shall be provided in draft form to the Investigation Supervisor within 3 days of completion of each test.

S1.19.4 UKAS accreditation to be adopted (Clause 14.3)

All laboratory testing shall be carried out under UKAS Accreditation.

The GI Contractor shall nominate the laboratory to be used in their tender for approval by the Investigation Supervisor. Once approved the laboratory shall not be changed without the permission of the Investigation Supervisor.

S1.19.7 Laboratory testing on site (Clause 14.7)

Site-based laboratory testing

Standard laboratory testing shall be undertaken on site during the period of works. The laboratory shall be UKAS accredited and managed by suitably qualified personnel.

S1.20 Geo-environmental laboratory testing (Specification Section 15) Particular restrictions/relaxations

S1.20.1 Investigation Supervisor or Contractor to schedule testing (Clause 15.1)

The Investigation Supervisor will schedule the chemical laboratory testing of soil samples taken by the GI Contractor.

Within 48hours of geo-environmental samples being collected from each exploratory hole location, the GI Contractor shall provide to the Investigation Supervisor a schedule of the samples taken, and a draft log of sufficient detail to allow scheduling of tests (including a brief description of the ground conditions, PID readings, any visual or olfactory evidence of contamination, the type and frequency of anthropogenic materials in Made Ground and the potential presence of asbestos).

S1.20.2 Accreditation required (Clause 15.2)

Chemical laboratory testing shall be carried out in accordance with the Standards set out in Appendix D. Laboratory test data on soil samples shall conform to the MCERTs standard. The chosen UKAS-accredited analytical laboratory and their accreditations to undertake testing and proposed testing methodology (where varied from the Specification given in Section 1.20.3) shall be agreed with the Investigation Supervisor prior to appointment.

S1.20.3 Chemical testing for contamination (Clause 15.3) (Test Suites E – G overleaf)

The following Test Suites are required:

- Suite E – Soil Samples
- Suite Ei – Additional Soil Samples
- Suite F – Soil Leachate Samples
- Suite G – Surface Water Samples

The laboratory method detection limits for the above contaminants are to be agreed with the Investigation Supervisor prior to undertaking the chemical analysis.

It should be noted that this is not exhaustive and will be determined by on site conditions.

Soil leachate testing is to be undertaken in accordance with preparation requirements in BSEN12457-1:2002 single stage 2:1.

Schedule 1.20.3 **Sheet 1 of 3**

CHEMICAL LABORATORY TESTING FOR CONTAMINATION

Nominated test laboratory:

Required testing turnaround times:

NB. **A. This proforma Schedule MUST be reviewed in the light of site-specific desk study results and amended accordingly to include any additional determinands likely to be required.**

B. Limits of detection should reflect the guideline/threshold values against which the test results will be compared.

SUITE E – Soil samples

Determinand (Procurer to list required determinands)	Limit of detection required/offered (mg/kg)	Test method required/offered	Accreditation required/offered
Arsenic	< 1	TBC	UKAS/MCERTS
Boron	< 0.2	TBC	UKAS/MCERTS
Cadmium	< 0.2	TBC	UKAS/MCERTS
Chromium (total)	< 1	TBC	UKAS/MCERTS
Chromium (hexavalent)	< 1	TBC	UKAS/MCERTS
Copper	< 1	TBC	UKAS/MCERTS
Lead	< 1	TBC	UKAS/MCERTS
Mercury	< 0.2	TBC	UKAS/MCERTS
Nickel	< 1	TBC	UKAS/MCERTS
Selenium	< 1	TBC	UKAS/MCERTS
Zinc	< 1	TBC	UKAS/MCERTS
Vanadium	< 1	TBC	UKAS/MCERTS
Aluminium	< 1	TBC	UKAS/MCERTS
Antimony	< 1	TBC	UKAS/MCERTS
Barium	< 1	TBC	UKAS/MCERTS
Beryllium	< 1	TBC	UKAS/MCERTS
Iron	< 40	TBC	UKAS/MCERTS
Manganese	< 1	TBC	UKAS/MCERTS
Magnesium	< 20	TBC	UKAS/MCERTS
Molybdenum	< 1	TBC	UKAS/MCERTS
Potassium	< 20	TBC	UKAS/MCERTS
Asbestos (and subsequent quantification if identified)	presence initially (Quantification: <0.001%)	TBC	UKAS/MCERTS
pH	-	TBC	UKAS/MCERTS
Water soluble sulphate (as SO4)	< 2.5	TBC	UKAS/MCERTS
Soil organic matter	-	TBC	UKAS/MCERTS
Sulphate	< 100	TBC	UKAS/MCERTS
Sulphide	< 1	TBC	UKAS/MCERTS

Phosphorus	< 20	TBC	UKAS/MCERTS
Ammoniacal Nitrogen as N	< 5	TBC	UKAS/MCERTS
Nitrate	< 5	TBC	UKAS/MCERTS
Nitrite	< 5	TBC	UKAS/MCERTS
Chloride	< 5	TBC	UKAS/MCERTS
Nitrogen	< 5	TBC	UKAS/MCERTS
Calcium	< 20	TBC	UKAS/MCERTS
Cyanide (total)	< 1	TBC	UKAS/MCERTS
Cyanide (free)	< 1	TBC	UKAS/MCERTS
Cyanide (complex)	< 1	TBC	UKAS/MCERTS
Speciated polycyclic aromatic hydrocarbons (17 PAHs)	< 0.05	TBC	UKAS/MCERTS
Phenol	< 2	TBC	UKAS/MCERTS
TPH CWG (UK)	< 0.05	TBC	UKAS/MCERTS
BTEX (incl MTBE)	< 0.001	TBC	UKAS/MCERTS
SUITE Ei – Soil samples - additional			
VOCs	< 0.001	TBC	UKAS/MCERTS
sVOCs	< 0.1	TBC	UKAS/MCERTS
PCBs	-	TBC	UKAS/MCERTS

Schedule 1.20.3 **Sheet 2 of 3**

CHEMICAL LABORATORY TESTING FOR CONTAMINATION

Nominated test laboratory:

Required testing turnaround times:

NB. **A. This proforma Schedule MUST be reviewed in the light of site-specific desk study results and amended accordingly to include any additional determinands likely to be required.**

B. Limits of detection should reflect the guideline/threshold values against which the test results will be compared.

SUITE F – Soil Leachate samples

Determinand (Procurer to list required determinands)	Limit of detection required/offered (µg/l)	Test method required/offered	Accreditation required/offered
Arsenic	< 1	TBC	UKAS / ISO:17025
Boron	< 1	TBC	UKAS / ISO:17025
Cadmium	< 0.1	TBC	UKAS / ISO:17025
Chromium (total)	< 1	TBC	UKAS / ISO:17025
Chromium (hexavalent)	< 1	TBC	UKAS / ISO:17025
Copper	< 1	TBC	UKAS / ISO:17025
Lead	< 1	TBC	UKAS / ISO:17025
Mercury	< 0.05	TBC	UKAS / ISO:17025
Nickel	< 1	TBC	UKAS / ISO:17025
Selenium	< 1	TBC	UKAS / ISO:17025
Zinc	< 1	TBC	UKAS / ISO:17025
Vanadium	< 1	TBC	UKAS / ISO:17025
Aluminium	< 1	TBC	UKAS / ISO:17025
Antimony	< 1	TBC	UKAS / ISO:17025
Barium	< 1	TBC	UKAS / ISO:17025
Beryllium	< 1	TBC	UKAS / ISO:17025
Iron	< 1	TBC	UKAS / ISO:17025
Manganese	< 1	TBC	UKAS / ISO:17025
Magnesium	< 1	TBC	UKAS / ISO:17025
Molybdenum	< 1	TBC	UKAS / ISO:17025
Potassium	< 1	TBC	UKAS / ISO:17025
pH	-	TBC	UKAS / ISO:17025
Water soluble sulphate (as SO4)	< 50	TBC	UKAS / ISO:17025
Sulphide	< 5	TBC	UKAS / ISO:17025
Phosphorus	< 5	TBC	UKAS / ISO:17025
Ammoniacal Nitrogen as N	< 10	TBC	UKAS / ISO:17025
Nitrate	< 10	TBC	UKAS / ISO:17025

Nitrite	< 10	TBC	UKAS / ISO:17025
Chloride	< 10	TBC	UKAS / ISO:17025
Nitrogen	< 10	TBC	UKAS / ISO:17025
Calcium	< 10	TBC	UKAS / ISO:17025
Cyanide (total)	< 1	TBC	UKAS / ISO:17025
Cyanide (free)	< 1	TBC	UKAS / ISO:17025
Cyanide (complex)	< 1	TBC	UKAS / ISO:17025
Speciated polycyclic aromatic hydrocarbons (17 PAHs)	< 0.001	TBC	UKAS / ISO:17025
Phenol	< 1	TBC	UKAS / ISO:17025
BTEX and MTBE	< 1	TBC	UKAS / ISO:17025
TPH CWG (UK)	< 1	TBC	UKAS / ISO:17025

Schedule 1.20.3 **Sheet 3 of 3**

CHEMICAL LABORATORY TESTING FOR CONTAMINATION

Nominated test laboratory:

Required testing turnaround times:

NB. **A. This proforma Schedule MUST be reviewed in the light of site-specific desk study results and amended accordingly to include any additional determinands likely to be required.**

B. Limits of detection should reflect the guideline/threshold values against which the test results will be compared.

SUITE G – Water samples

Determinand (Procurer to list required determinands)	Limit of detection required/offered (µg/l)	Test method required/offered	Accreditation required/offered
Arsenic	< 1	TBC	UKAS / ISO:17025
Boron	< 1	TBC	UKAS / ISO:17025
Cadmium	< 0.1	TBC	UKAS / ISO:17025
Chromium (total)	< 1	TBC	UKAS / ISO:17025
Chromium (hexavalent)	< 1	TBC	UKAS / ISO:17025
Copper	< 1	TBC	UKAS / ISO:17025
Lead	< 1	TBC	UKAS / ISO:17025
Mercury	< 0.05	TBC	UKAS / ISO:17025
Nickel	< 1	TBC	UKAS / ISO:17025
Selenium	< 1	TBC	UKAS / ISO:17025
Zinc	< 1	TBC	UKAS / ISO:17025
Vanadium	< 1	TBC	UKAS / ISO:17025
Aluminium	< 1	TBC	UKAS / ISO:17025
Antimony	< 1	TBC	UKAS / ISO:17025
Barium	< 1	TBC	UKAS / ISO:17025
Beryllium	< 1	TBC	UKAS / ISO:17025
Iron	< 1	TBC	UKAS / ISO:17025
Manganese	< 1	TBC	UKAS / ISO:17025
Magnesium	< 1	TBC	UKAS / ISO:17025
Molybdenum	< 1	TBC	UKAS / ISO:17025
Potassium	< 1	TBC	UKAS / ISO:17025
Chemical Oxygen Demand	-	TBC	UKAS / ISO:17025
Biological Oxygen Demand	-	TBC	UKAS / ISO:17025
pH	-	TBC	UKAS / ISO:17025
Electrical Conductivity	-	TBC	UKAS / ISO:17025
Water soluble sulphate (as SO4)	< 50	TBC	UKAS / ISO:17025
Sulphide	< 5	TBC	UKAS / ISO:17025

Phosphorus	< 5	TBC	UKAS / ISO:17025
Ammoniacal Nitrogen as N	< 10	TBC	UKAS / ISO:17025
Nitrate	< 10	TBC	UKAS / ISO:17025
Nitrite	< 10	TBC	UKAS / ISO:17025
Chloride	< 10	TBC	UKAS / ISO:17025
Nitrogen	< 10	TBC	UKAS / ISO:17025
Calcium	< 10	TBC	UKAS / ISO:17025
Cyanide (total)	< 1	TBC	UKAS / ISO:17025
Cyanide (free)	< 1	TBC	UKAS / ISO:17025
Cyanide (complex)	< 1	TBC	UKAS / ISO:17025
Speciated polycyclic aromatic hydrocarbons (17 PAHs)	< 0.001	TBC	UKAS / ISO:17025
Phenol	< 1	TBC	UKAS / ISO:17025
BTEX and MTBE	< 1	TBC	UKAS / ISO:17025
TPH CWG (UK)	< 1	TBC	UKAS / ISO:17025
SUITE Gi – Groundwater - Additional			
VOCs	< 0.1	TBC	UKAS / ISO:17025
sVOCs	< 0.001	TBC	UKAS / ISO:17025
PCBs	-	TBC	UKAS / ISO:17025
Hardness (CaCO3)	< 1	TBC	UKAS / ISO:17025
Dissolved Organic Carbon	< 1	TBC	UKAS / ISO:17025

S1.20.4 Waste characterisation (Clause 15.4)

To be undertaken by the GI Contractor prior to disposal of arisings.

S1.20.5 Waste Acceptance Criteria testing (Clause 15.5)

Where instructed by the Investigation Supervisor, soil samples shall be subject to waste acceptance criteria (WAC) testing.

The following WAC suite (Suite H) should be used:

SUITE H – Soil samples for Waste Acceptance Criteria Testing (10:1)*

Determinand	Limit of detection required	Test method required	Accreditation required
Soil Analyses			
Total Organic Carbon	<0.1%	Titremetry	ISO17025
Loss on Ignition	<0.01%	Gravimetric	ISO17025
BTEX	1 mg/kg	HS-GC/MS	ISO17025
PCBs (7 congeners)	0.001 mg/kg	GC/MS	ISO17025
Mineral oil C10-C40	0.1 - 10 mg/kg (fraction dependent)	HS-GC/MS & GC/MS	ISO17025
PAHs	0.01 - 0.001 mg/kg (compound dependent)	GC/MS	ISO17025
pH	+/- 0.1 pH units	Potentiometric	ISO17025
Acid neutralising capacity	0.01 µmol/l	Titremetry	ISO17025
Leachate Analyses			
Arsenic (dissolved)	<10 µg/l	ICP-OES	ISO17025
Barium (dissolved)	<0.5 µg/l	ICP-OES	ISO17025
Cadmium (dissolved)	<1µg/l	ICP-OES	ISO17025
Chromium (dissolved)	< 4 µg/l	ICP-OES	ISO17025
Copper (dissolved)	<3 µg/l	ICP-OES	ISO17025
Mercury (dissolved)	<5 µg/l	ICP-OES	ISO17025
Molybdenum (dissolved)	<4 µg/l	ICP-OES	ISO17025
Nickel (dissolved)	<3 µg/l	ICP-OES	ISO17025
Lead (dissolved)	<10 µg/l	ICP-OES	ISO17025
Antimony(dissolved)	<17 µg/l	ICP-OES	ISO17025
Selenium (dissolved)	<40 µg/l	ICP-OES	ISO17025
Zinc (dissolved)	<4 µg/l	ICP-OES	ISO17025
Chloride	<40 µg/l	Discrete Analyser	ISO17025
Fluoride	<0.5 µg/l	ISE	ISO17025
Sulphate (as SO4)	<0.3 mg/l SO4	ICP-OES	ISO17025
Total Dissolved Solids	<40	Gravimetric	ISO17025
Phenols Total (monohydric)	<0.15	Skalar CFA	ISO17025

Dissolved organic carbon at own pH or pH7.5-8.0	<0.01 mg/l	Titremetry	ISO17025

*All WAC leachate testing should be undertaken in accordance with British Standard BS EN 12457-2:2002. Characterisation of waste. Leaching. Compliance test for leaching of granular waste materials and sludges. One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction). All limits of detection shall be low enough to satisfy either Environment Agency Environmental Quality Standards or Drinking Water Standards, whichever is lower.

S1.21 Reporting (Specification Section 16) Particular restrictions/relaxations

S1.21.1 Form of exploratory hole logs (Clauses 16.1 and 16.2.1)

Exploratory hole logs shall be prepared in accordance with the Standards specified in Appendix D of this Specification. The GI Contractor shall submit specimen borehole and trial pit logs with their tender for approval of the Investigation Supervisor. Preliminary logs shall be submitted to the Investigation Supervisor within 3 working days of completion of boring/drilling of the explorations to which they refer.

Test results for the contamination ground investigation shall be accompanied by an unambiguous description of sample preparation, extraction and analysis method used. Draft results of the chemical analysis shall be reported to the Investigation Supervisor as they become available.

The GI Contractor shall provide the additional details in the Report (this shall be regarded as the data quality assessment report):

- The full analytical procedure for each parameter determined, including the detection limit and susceptibility to interference of the method and an appropriate reference to the method.
- Details of the chain of custody between sampling and analysis, including the time between sampling and analysis, storage procedures, procedures for quantifying analytical errors including data quality assessments and quality management procedures.

S1.21.2 Information on exploratory hole logs (Clause 16.2.2)

As per Clauses 5.4.6 and 16.2.2.

S1.21.3 Variations to final digital data supply requirements (Clause 16.5.1)

All data which is collected during the investigation in accordance with the codes and standards used for the contract are to be transferred in electronic format.

The format of the digital data files shall comply with the Association of Geotechnical and Geo-environmental Specialists (AGS) publication 'Electronic transfer of geotechnical and geo-environmental data' Edition 4.0, known as AGS4.

The GI Contractor is to provide all field and laboratory data in digital form, as well as in paper form. This shall include all data from sub-contractors.

The AGS data and associated files shall be complete and identical to the data provided in the paper copy of the factual report. To ensure that the AGS4 data provided is identical to the paper copy version, both the paper and digital versions of the data must be generated from the same source. The preferred approach is to use database software specifically intended for this purpose.

The units of measurement and abbreviations within the data file should accord with those presented in the AGS publication unless otherwise stated below.

No additional groups, fields or codes shall be accepted without the prior agreement of the Project Manager, and then only in exceptional circumstances.

The GI Contractor shall be responsible for assigning GEOL_GEOL and GEOL_GEO2 codes, in collaboration with the Investigation Supervisor.

Where particular or project-specific requirements are required they are listed below:

Group	Field	Note / example
PROJ	PROJ_ID	5220316
	PROJ_NAME	Alveston Hill FBC
	PROJ_CLNT	South Gloucestershire Council
	PROJ_ENG	Atkins
TRAN	TRAN_STAT	Preliminary, Draft or Final
LOCA	LOCA_ID	See list in Schedule
	LOCA_TYPE	Compound abbreviations to be used where appropriate, e.g. CP+RC

Group	Field	Note / example
	LOCA_NATE LOCA_NATN LOCA_GL	Used to report hole collar position in UK National Grid coordinates and datum
	LOCA_LOCX LOCA_LOCY LOCA_LOCZ	Used to report hole collar position in site coordinates and datum
	LOCA_CLST	Set to 'Phase 1'
	LOCA_LOCA	Not used
ISPT		Incremental blows and penetrations must be provided. Use of other fields that duplicate this data (ISPT_MAIN etc.) is optional. The GI Contractor may determine the format for ISPT_REP.
WETH		Group required.

Reported Units of Measurement

The units of measurement for the data presented within the data file shall be those required by the specifications and standards specified in the Contract. Where these are different to the Suggested Units defined in the AGS4 publication they are listed below:

Group	Field	Unit
IRES	IRES_IRES	ohm cm

Note that all units used in the data file are to be fully defined in the UNIT Group. A standard list of units is provided on the AGS website (www.ags.org.uk).

Abbreviations

A standard list of abbreviations is provided on the AGS website (www.ags.org.uk). These shall be used except as listed below.

Other abbreviations shall only be used where no alternative exists in AGS4 or this specification and where the Investigation Supervisor has given prior approval to their use.

Note that all abbreviations used in the data file are to be fully defined in the ABBR Group.

The following groups and fields require specific abbreviations to be used:

Field	Abbreviation	Description
LOCA_TYPE		As AGS website (www.ags.org.uk)
SAMP_TYPE		As AGS website (www.ags.org.uk)
GEOL_GEOL		As table below
GEOL_GEO2		As table below

Geology Codes (GEOL_GEOL)

Drift / superficial deposits	
Code	**Name**
MG	Made Ground
Solid Geology	
CDM	Clifton Down Mudstone Formation
GUO	Gully Oolite Formation
BRL	Blackrock Limestone Subgroup
MMMF	Mercia Mudstone Group (Marginal Facies)
AVO	Avon Group
TSG	Tintern Sandstone Formation

Note: These would normally be BGS Lexicon codes. Further sub-division, if desired, can be achieved using GEOL_GEO2, GEOL_GEO3, etc.

Second Geology Codes (GEOL_GEO2)	
General Soil type codes	
Code	Description
CL	Clay
SL	Silt
SD	Sand
GR	Gravel
CO	Cobbles
Conc	Concrete
Trmc	Tarmac / blacktop
Wst	Waste (e.g. landfill)

Associated files

The following associated files are to be included in the AGS data submission. The formats for specific associated files are given below:

Files Format (Clause)	Group	File format
Photographs of cores and trial pits (Cl. 5.8 & 6.12)	FILE	JPG
Drawing(s) (Cl.16.4)	FILE	AutoCAD v13 DXF
As required (geophysics/ televiewer/advanced lab/SBP)		

Other formats for these data deliverables shall only be used with the prior approval of the Investigation Supervisor.

Geo-environmental data requirements

MONG (Monitoring Installations and Instruments) and MOND (Monitoring Readings) groups are to be used for groundwater/surface water monitoring. SAMP (Sample Information) and ERES (Environmental Contaminant Testing) are to be used to record data for environmental sampling and testing.

Rows in light blue are **KEY FIELDS**, which must be consistent through each table of the dataset. In MONG group, key fields identify a single installation. In MOND group, key fields identify a single monitoring reading. In SAMP and ERES groups, these identify one single sample. Should any variation occur within these fields, the database will incorrectly identify it as a separate installation, monitoring reading or a separate sample, respectively.

Rows with *italics* are currently being proposed to the AGS committee and as of are not implemented, yet.

Groundwater and Ground Gas Monitoring

Not required.

Environmental Sampling and Testing

Table 4 - SAMP and ERES specification

Field	Abbreviation	Description
LOCA Group		

Field	Abbreviation	Description
LOCA_ID		**Location Identifier** i.e. ATK001 Requirements provided by Atkins. Guidance on naming specific samples/locations – they must contain the following: "SW" – for surface water locations "DUP" – for duplicate sample (see SAMP_LINK for identifying the duplicate) "BLANK" – any trip blank or field blank sample Please keep capitalisation.
SAMP Group		
SAMP_TOP		**Depth to Top of Sample (m)**
SAMP_REF		**Sample Reference** Number of sample taken during ground investigation, allocated in sequence regardless of SAMP_TYPE i.e. 1, 2, 3, 4 for ES1, COMP2, B3, D4, etc. Requirements provided by Atkins.
SAMP_TYPE		**Sample Type**
	ES	Discrete geo-environmental soil samples (including leachate)
	COMP	Composite samples for waste classification analysis
	EW	Environmental water samples
	ACM	*Suspected asbestos containing material (TBC)*
	EWG	*Groundwater samples (TBC)*
	EWS	*Surface water samples (TBC)*
SAMP_ID		**Sample Unique Global Identifier** Requirements provided by Atkins. Unique sample identification number can be allocated by contractor often related to barcodes if used on samples.
SAMP_BASE		**Depth to Base of Sample (m)**
SAMP_DTIM		**Date and Time Sample Taken (yyyy-mm-ddThh:mm)** Report Greenwich Mean Time (GMT), not British Summer Time (BST).
SAMP_LINK		**Sample Record Link** Provide link between fields to identify monitoring rounds and duplicates The following formats should be used: <u>Monitoring</u>: "MOND"|MONG_ID|MOND_REF - Where no MONG_ID (e.g. surface water monitoring), use "NA" <u>Duplicates:</u> "SAMP"|LOCA_ID|SAMP_TOP|SAMP_REF|SAMP_TYPE|SAMP_ID - do **not** share with laboratories if scheduling electronically
ERES Group		
ERES_CODE		**Chemical Code** As AGS website *See below for details on asbestos reporting
ERES_METH		**Test Method**

Field	Abbreviation	Description
ERES_MATX		**Laboratory Test Matrix**
		As AGS website
	SOLID	Soil testing
	LEACHATE	Leachate testing
	LIQUID	Water testing
ERES_NAME		**Chemical Name**
		Should be indicated whether the chemical has been determined as total, free or dissolved (i.e. Chromium (Total), Cyanide (Free), etc.).
		Must be consistent for each project/lab. Any misspellings cause issues with automated data processing.
ERES_RVAL		**Result Value**
		All results that can be reported as a number (integer/float) should be reported in this column. If results are below LOD, the LOD should be reported with no qualifiers ('<', etc.).
		Values must be the same as ERES_RTXT and reported to sufficient number of decimal places.
ERES_RUNI		**Result Unit**
		"NO UNIT" when no unit is applicable
ERES_RTXT		**Reported Result**
		All results should be reported as text (string) in this column. The column includes "< " symbol for results below LOD and no symbol for results above LOD.
		Values must be the same as ERES_RVAL and reported to sufficient number of decimal places.
		Asbestos detects should be reported as "Present" and no detects should be reported as "Not Detected".
		*See below for details on asbestos reporting
ERES_RDLM		**Reporting Detection Limit**
		Reported limit of detection, do not use ERES_MDLM or ERES_QLM
ERES_DUNI		**Detection Limit Unit**
		Doesn't have to be reported if same as ERES_RUNI
ERES_RDAT		**Sample Receipt Date at Laboratory (yyyy-mm-dd)**
ERES_DTIM		**Analysis Date and Time (yyyy-mm-ddThh:mm)**
ERES_TEST		**Test Name as Defined in LBST_TEST**
	Suite __	Enter project-specific defined suites in a list here
	Suite WAC	WAC: Ensure that waste classification/WAC tests include the word 'WAC' in the suite name.
	Etc.	
ERES_DIL		**Dilution Factor**
		To be used for leachate testing only (2:1, 8:1, etc.)
ERES_LMTH		**Leachate Preparation Method**
		Differentiate between leachate preparations (i.e. BS EN 12457-3 10:1 two stage)
ERES_LAB		**Name of Testing Laboratory**
ERES_CRED		**Accrediting Body**
		Accreditation status – where a test has more than one accreditation they should be concatenated with a '+'

Field	Abbreviation	Description
ERES_RDEV		**Sample Deviations** User-defined field to enter data about sample deviations. For user-defined field see AGS website. User defined groups and headings are reported in DICT Group. Abbreviations would be provided in ABBR Group.
SPEC_DESC		**Specimen Description** For geo-environmental samples ONLY to include physical description of asbestos if positively identified
SPEC_REF		**Laboratory Specimen Reference** Can be used by the lab to match sample reference to their PDF/Excel reports
FILE Group		
FILE_FSET		**Associated File Reference** Laboratory report number if applicable See AGS website for details of the FILE Group and Rule 20 in AGS Guidance Notes.
MOND Group		
MOND_REF		**Reading Reference** Denote different rounds of monitoring (examples):
	R1	Round 1
	R2	Round 2, etc.
		Requirements provided by Atkins.
LBST Group		
LBST_TEST		**Test Name** Only used when electronic scheduling is utilised for the project. Should match ERES_TEST to define testing suites.

Asbestos reporting

Stage 1

Asbestos ID: Asbestos should be identified with the following entries:

- ERES_NAME as “Asbestos”
- ERES_CODE as the chemical code (CAS no.: 1332-21-4)
- ERES_RTXT should be reported as “Present”/”Not Detected”
- ERES_RVAL column should be left blank

Stage 2

Asbestos quantification: If asbestos is detected, quantification should be undertaken. Additional rows should be added to report the quantification results with the following entries:

- ERES_NAME containing the asbestos type (chrysotile, amosite, crocidolite)
- ERES_CODE provided as CAS number (2001-29-5, 12172-73-5, 12001-28-4, respectively)
- ERES_RVAL/ERES_RTXT headings containing the reported value
- SPEC_DESC to include remarks about physical description of asbestos

An example is provided below:

LOCA _ID	SAMP_ TOP	SAMP_ TYPE	ERES_ NAME	ERES_ RTXT	ERES_ RVAL	ERES_ CODE	SPEC_ DESC
ATK01	0.2	ES	Asbestos	Not Detected		1332-21-4	
ATK01	1.5	ES	Asbestos	Present		1332-21-4	

ATK01	1.5	ES	Amosite	0.003	0.003	12172-73-5	Loose fibres

Example for ERES_RVAL and ERES_RTXT:

ERES_NAME	ERES_RVAL	ERES_RTXT
Chloride	12.000000	12.000000
Thiocyanate	0.500000	< 0.500000
Cyanide	0.006000	0.006000
Chromium	0.0000001	< 0.0000001

S1.21.4 Preliminary digital data (Clause 16.5.3)

Preliminary digital data from the fieldwork shall be gathered and transmitted daily on the same day that the work to which it refers is carried out, directly to an email address advised by the Investigation Supervisor (this may be achieved using electronic data recording system equipment such as KeyLogBook facilitating the daily transmittal of data from site to laboratory and/or design office, by email).

Draft digital data shall also accompany, and be identical to, all paper records issued to the Investigation Supervisor.

S1.21.5 Type(s) of report required (Clause 16.6)

The factual part of the Geotechnical Investigation Report is required. Draft and Final versions of the report shall be provided in digital form in PDF format, with embedded AGS digital data. Hard copies of the Final report may be requested.

S1.21.6 Electronic report requirements (Clause 16.6.3)

Electronic reports shall be delivered via file transfer or email, and photographs shall be in JPG format. AGS data is to be in AGS Edition 4 format. Photographs shall be cross-referenced within the AGS data as associated files. The AGS data file shall be provided both as a stand-alone file or files, and shall be embedded within the PDF format report.

S1.21.8 Contents of Ground Investigation Report (or specified part thereof) (Clause 16.9)

The factual part of the Geotechnical Investigation Report is required as specified in Clause 16.8 with contents as given in Clause 16.8.1.

S1.21.10 Time for supply of electronic information (Clause 16.10.1)

The electronic data is to be submitted in accordance with the following schedule:

Data Type	Timing
Field data	Within one day of completion of hole
Preliminary data	Within one week of completion of test
Final prelim	Within two weeks of completion of all testing
Final	Within one week of Engineers approval of final prelim report

Preliminary digital data for the fieldwork is to be issued to the Investigation Supervisor by email attachment on completion of each exploratory hole. Other draft data, and updates to fieldwork data, is to be issued with each issue of hard copy information in accordance with the above schedule.

A complete set of digital data is to be supplied with draft and approved final copies of the report.

S1.21.11 Electronic information transmission media (Clause 16.10.2)

AGS Format data shall be issued as a single file. However, subject to the agreement of the Investigation Supervisor, separate files may be permitted in the following cases:

- Separate field and laboratory data for preliminary issue (if this serves to expedite the issue of data);
- In situ data as, separate files for each test where the data files are large (for preliminary issue); and/or
- Post-fieldwork monitoring results.

The associated files that are required to complete the factual data submission shall be provided and referenced in the associated file (FILE_FSET) fields. When these are submitted the GI Contractor shall provide AGS Format data and associated files within single identifiable submissions.

The digital data provided by the GI Contractor with the Factual Report is required to be complete and a total replacement of any previous preliminary data.

The GI Contractor shall provide a Report with a digital copy of those field and laboratory data and associated files specified in the Contract to be in digital form. This report shall consist of a disk(s), or other agreed transmission medium, containing the digital data and associated files and paper copies of any data or drawings not included in digital form.

Draft data is that which is represented by the draft factual report. Submission of data shall be by email to the address(es) given in Schedule S1.2. Where data files are too large for practical transmission by email, alternative methods of transmittal may be agreed with the Investigation Supervisor which may include FTP transfer or distribution via extranet.

Files shall not be compressed (zipped) without the agreement of the Investigation Supervisor.

All issues of data, including preliminary, shall be accompanied by an issue record that shall include the following information: This information is also included in the TRAN group.

- The heading 'AGS Format Data'
- The title 'Media Index Record' (or similar)
- The project identification (PROJ_ID)
- The unique issue sequence number (TRAN_ISNO)
- The date of issue to the Engineer (TRAN_DATE)
- The name of the GI Contractor issuing the transmission media (TRAN_PROD)
- The name of the Engineer to whom the transmission media was issued (TRAN_RECV)
- A general description of the data transferred and/or a file listing for associated files
- The status of the data (preliminary, draft or final)

For each AGS Format data set, including all associated files, the index will detail:

- The file name including the file extension
- The date and time the file was created
- The file size in bytes/kilobytes/megabytes as appropriate
- A general description of the data contained in each file and/or a file listing for associated files.

All data shall be checked for AGS format errors / integrity prior to issue using AGS checking software. All files shall be checked for viruses etc. prior to issue.

All information may be transmitted by file transfer or email.

S1.21.12 Report approval (Clause 16.11)

The GI Contractor shall submit a draft preliminary copy of the factual report within 6 weeks of the completion of the field works. This report is to contain draft borehole logs and the results of the completed laboratory testing at this stage.

One electronic copy of the draft report is to be submitted to the Investigation Supervisor within 2 weeks of the completion of laboratory testing. The Investigation Supervisor's comments on the draft report and associated digital data will be issued within 2 weeks from receipt of the draft.

One electronic copy of the final report is to be submitted to the Investigation Supervisor within a further 1 week.

Further particular Contract restrictions/relaxations shall be entered below, using sequential numbers to those above

S1.21.13 Laboratory testing duration

All laboratory testing shall be completed and reported within six weeks of the completion of the fieldwork period.

S1.21.14 Data Share

Please note that we ordinarily donate digital ground investigation data to The National Geoscience Data Centre (NGDC) at the British Geological Survey (BGS) to become part of the UK repository of subsurface data for re-access and longevity. If you do not want the data donated, or want the data to remain confidential (and only used for BGS science purposes) for an agreed period of time, please state this in your tender return.

Schedule 2: Exploratory holes

S2.1 Hole number

Hole numbers are given in the table. Holes shall not be renumbered without reference to, and the agreement of, the Investigation Supervisor.

S2.2 Type

The type codes used are AGS format type codes.

S2.3 Scheduled depth

The scheduled depth given is the anticipated depth, which may be varied on site depending on the ground conditions encountered.

S2.4 National grid reference

The grid reference shall be Ordnance Survey National Grid.

The national grid reference given is provisional, for setting out purposes. The final positions must be determined by survey.

S2.5 Approximate ground level

The datum shall be Ordnance Datum (m OD).

The ground level given is provisional. The actual ground level must be determined by survey.

S2.6 Remarks

As a change to the ICE Specification for ground Investigation, the remarks column shall be used to highlight any specific hole or location requirements not discussed in the columns as stated in S2.7 and S2.8 below.

S2.7 Provisional In Situ Testing Requirements

The provisional in situ testing requirements column gives indication of any proposed in situ testing type and depths. These are provisional and shall be confirmed by the Investigation Supervisor on site.

S2.8 Provisional Installation Requirements

The provisional installation requirements column gives indication of any proposed installation type and depths. These are provisional and shall be confirmed by the Investigation Supervisor on site.

S2.9 Rationale for Hole

A rationale for the requirements of each exploratory hole is provided to inform any changes required to be made by the Investigation Supervisor or GI Contractor. Any changes made by the GI Contractor must be approved by the Investigation Supervisor. Changes may include, but are not limited to, location, depth, method, installation details or in situ/laboratory testing.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
TP101	TP	2	363579	188101	100	In situ CBR test taken at 0.6 m depth.	N/A	To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Clifton Down Mudstone Formation for pavement subgrade.
TP102	TP	2	363550	188137	99			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Clifton Down Mudstone Formation for pavement subgrade.
TP103	TP	2	363516	188175	99			To investigate geotechnical, geo--environmental and groundwater conditions to inform design of cycleway.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Clifton Down Mudstone Formation for pavement subgrade design.
TP104	TP	2	363483	188213	99			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Gully Oolite Formation for pavement subgrade design.
TP105	TP	2	363457	188264	99			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
								Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Gully Oolite Formation for pavement subgrade design.
TP106	TP	2	363467	188318	99			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Gully Oolite Formation for pavement subgrade design.
TP107	TP	2	363485	188363	99			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Gully Oolite Formation for pavement subgrade design.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
TP108	TP	2	363499	188414	99			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Black Rock Limestone for pavement subgrade design.
TP109	TP	2	363502	188459	99			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Black Rock Limestone for pavement subgrade design.
TP110	TP	2	363500	188501	97	Infiltration testing to be taken at 2 m depth.		To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
								Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. Infiltration testing to be taken on Black Rock Limestone to inform drainage design.
TP111	TP	2	363482	188551	95	In situ CBR test taken at 0.6 m depth.	N/A	To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Black Rock Limestone for pavement subgrade design.
TP112	TP	2	363458	188596	92			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
								CBR testing to be taken on Black Rock Limestone for pavement subgrade design.
TP113	TP	2	363429	188652	87			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing grass verge. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Black Rock Limestone for pavement subgrade design.
TP114	TP	2	363415	188692	84			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Black Rock Limestone for pavement subgrade design.
TP115	TP	2	363390	188738	78			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Mercia Mudstone Group for pavement subgrade design.
TP116	TP	2	363395	188786	73	Infiltration testing taken at 2 m depth.		To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. Infiltration testing to be taken on Mercia Mudstone Group to inform drainage design.
TP117	TP	2	363415	188834	69	In situ CBR test taken at 0.6 m depth.	N/A	To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
								CBR testing to be taken on Mercia Mudstone Group for pavement subgrade design.
TP118	TP	2	363436	188882	65			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Mercia Mudstone Group for pavement subgrade design.
TP119	TP	2	363459	188927	63			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Mercia Mudstone Group for pavement subgrade design.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
TP120	TP	2	363519	188974	61	Infiltration testing taken at 2 m depth.		To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. Infiltration testing to be taken on Mercia Mudstone Group to inform drainage design.
TP121	TP	2	363536	189027	58	In situ CBR test taken at 0.6 m depth.	N/A	To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design.
TP122	TP	2	363546	189072	57			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
								Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
TP123	TP	2	363531	189121	55			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
TP124	TP	2	363519	189168	54			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
TP125	TP	2	363507	189225	52			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				Exploratory hole located within grass field. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
TP126	TP	2	363563	189285	53			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Mercia Mudstone Group for pavement subgrade design.
TP127	TP	2	363611	189308	52			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
								Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Mercia Mudstone Group for pavement subgrade design.
TP128	TP	2	363705	189315	57			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Mercia Mudstone Group for pavement subgrade design.
TP129	TP	2	363724	189393	55			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
TP130	TP	2	363760	189484	53			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
TP131	TP	2	363799	189596	53			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
TP132	TP	2	363839	189673	53			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement.

Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
TP133	TP	2	363825	189731	56			To investigate geotechnical, geo-environmental and groundwater conditions to inform design of cycleway. Exploratory hole located along existing pavement. Bulk samples at rate of one per stratum or 1m interval. Small samples at a rate of one per stratum or 0.5m interval. CBR testing to be taken on Tintern Sandstone for pavement subgrade design
SW01	SW	-			Surface water samples from surface water receptor		Geo-environmental testing of the surface water receptor upstream of the site.	
SW02	SW	-			Surface water samples from surface		Geo-environmental testing of the surface water receptor	

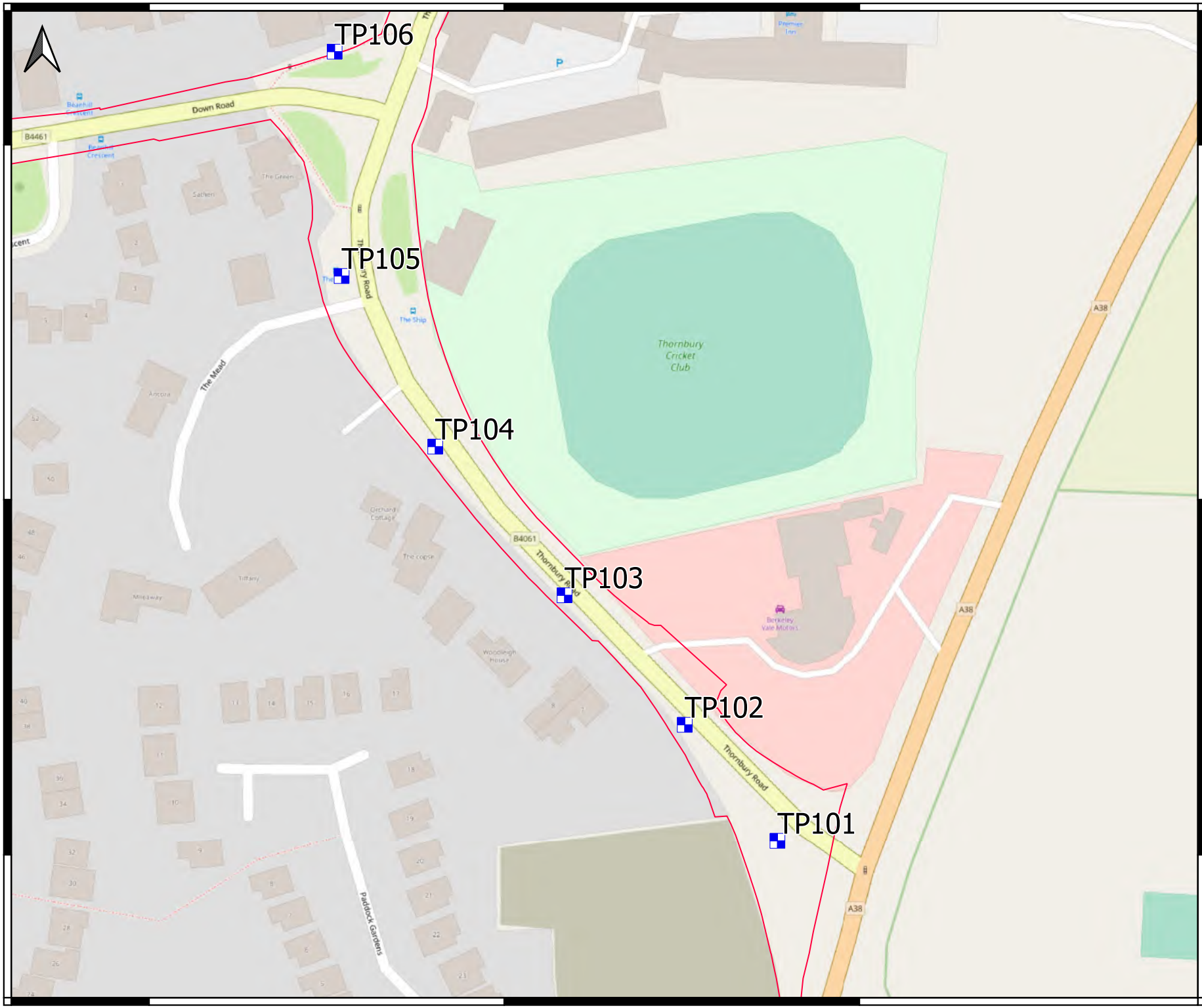
Hole Number	Type	Scheduled Depth (m bgl)	National Grid Reference*		Approximate Ground Level (m AOD)	Provisional In Situ Testing Requirements*	Provisional Installation Requirements*	Rationale for Hole
			Easting	Northing				
				water receptor		downstream of the site.		

Note: * Provisional only. To be confirmed by the Investigation Supervisor during the fieldwork.

CP = cable percussion borehole; **DS** = dynamic sample borehole; **RC** = rotary cored borehole; **WS** = windowless sample borehole; **+RC** = with rotary follow-on; **IP** = hand-dug inspection pit; **TP** = trial pit; **DP** = dynamic probe; **CPT** = cone penetrometer test; **SW** = surface water.

Appendices

Appendix A. Exploratory Hole Plan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Paddock Gardens
Legend
Cycleway Alignment
GI Locations
Hand Dug Inspection Pit
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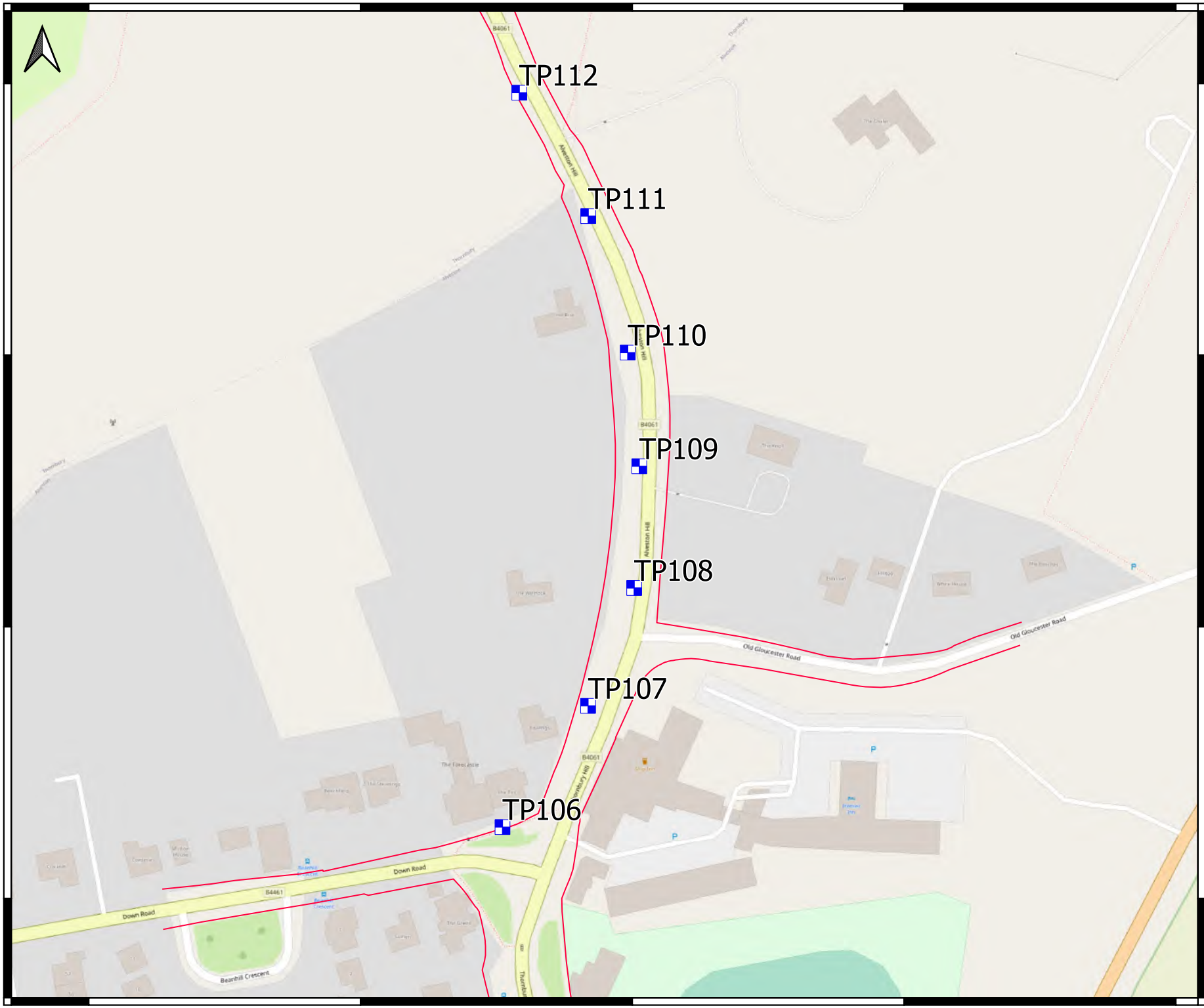
25
50 m
ATKINS
Member of the SNC-Lavalin Group
CLIENT
South Gloucestershire Council
PROJECT
Alveston Hill FBC
TITLE
Proposed GI Location Plan
OpenStreetMap standard mapping - https://www.openstreetmap.org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Cycleway Alignment
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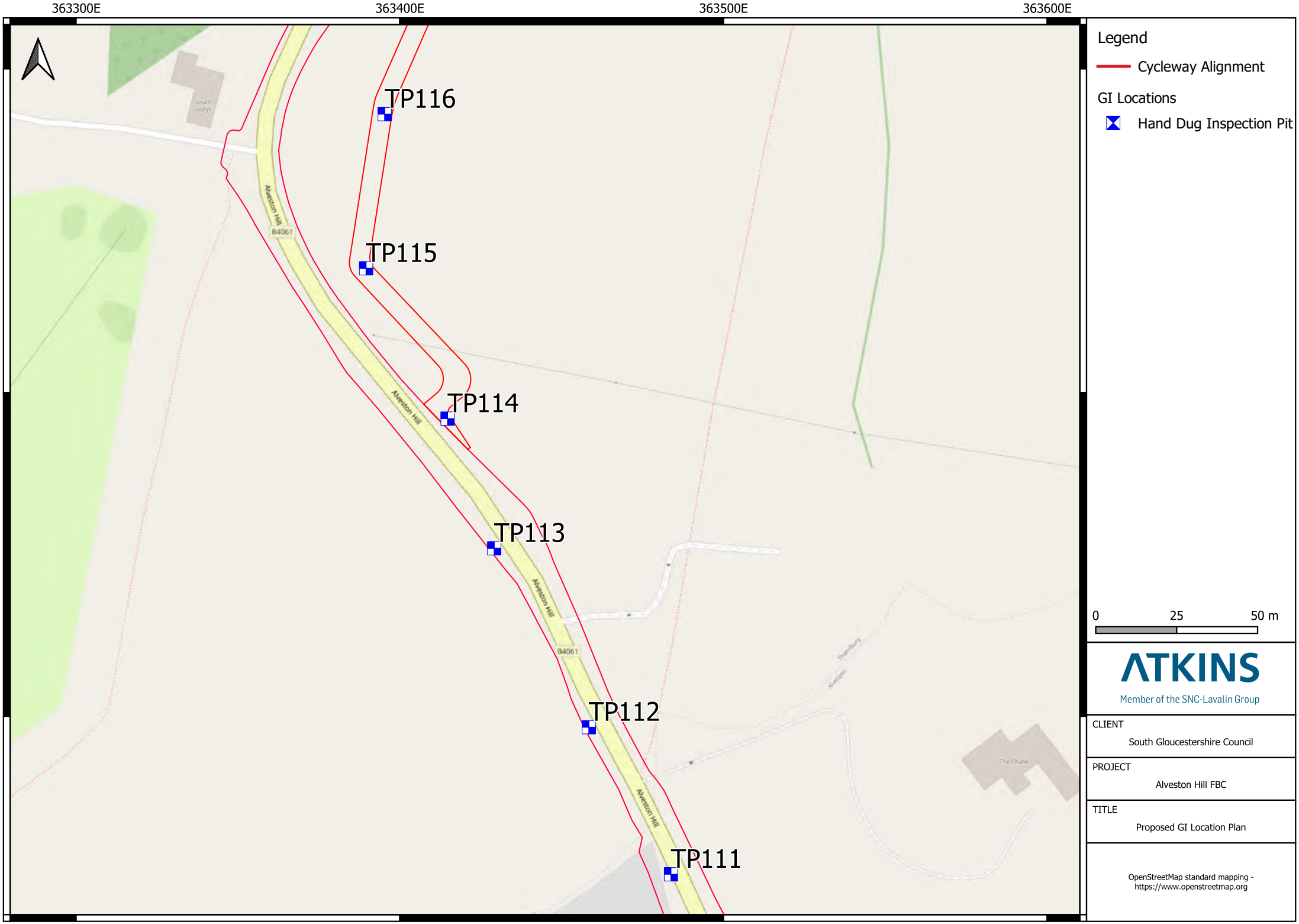
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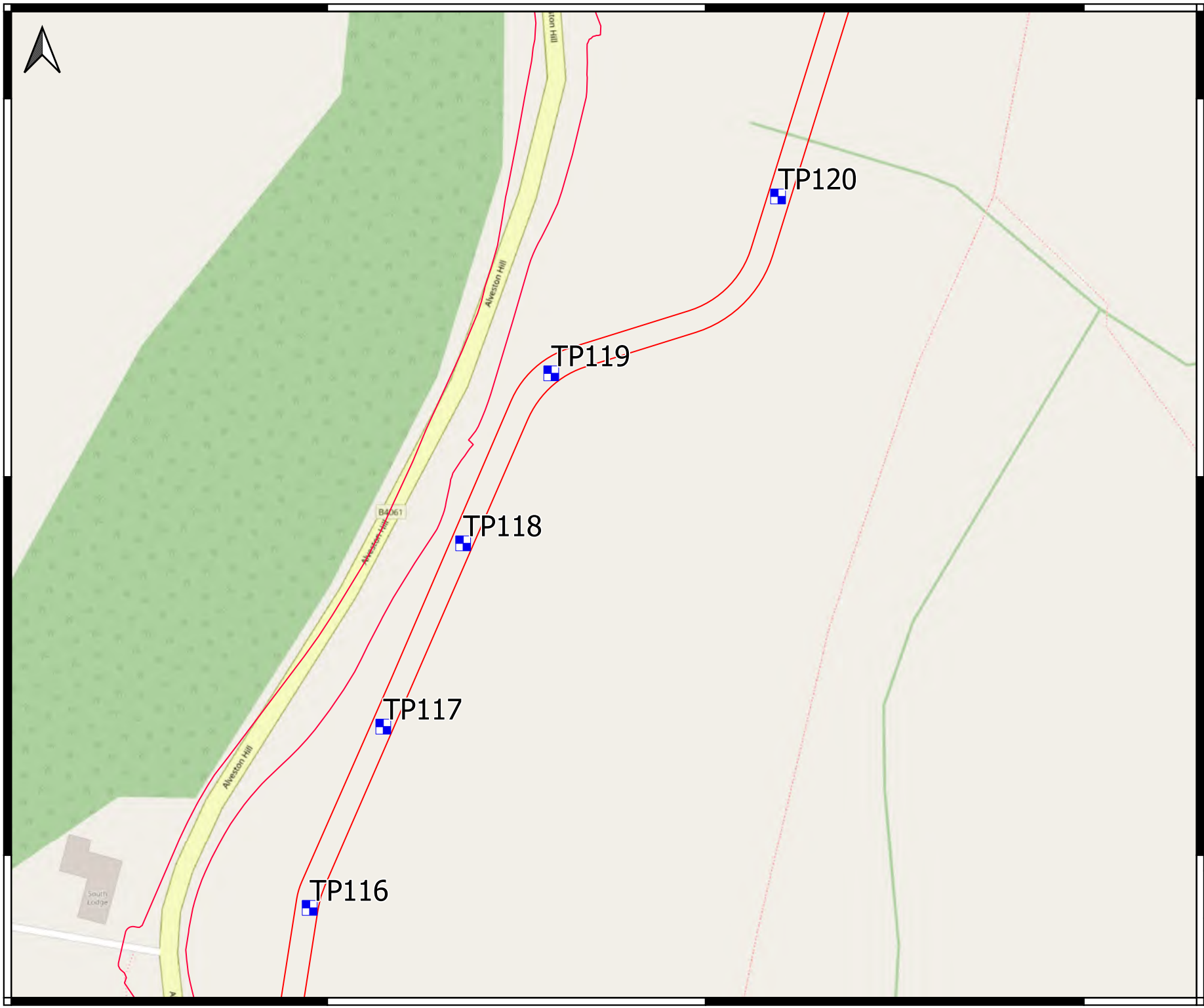
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Cycleway Alignment
GI Locations
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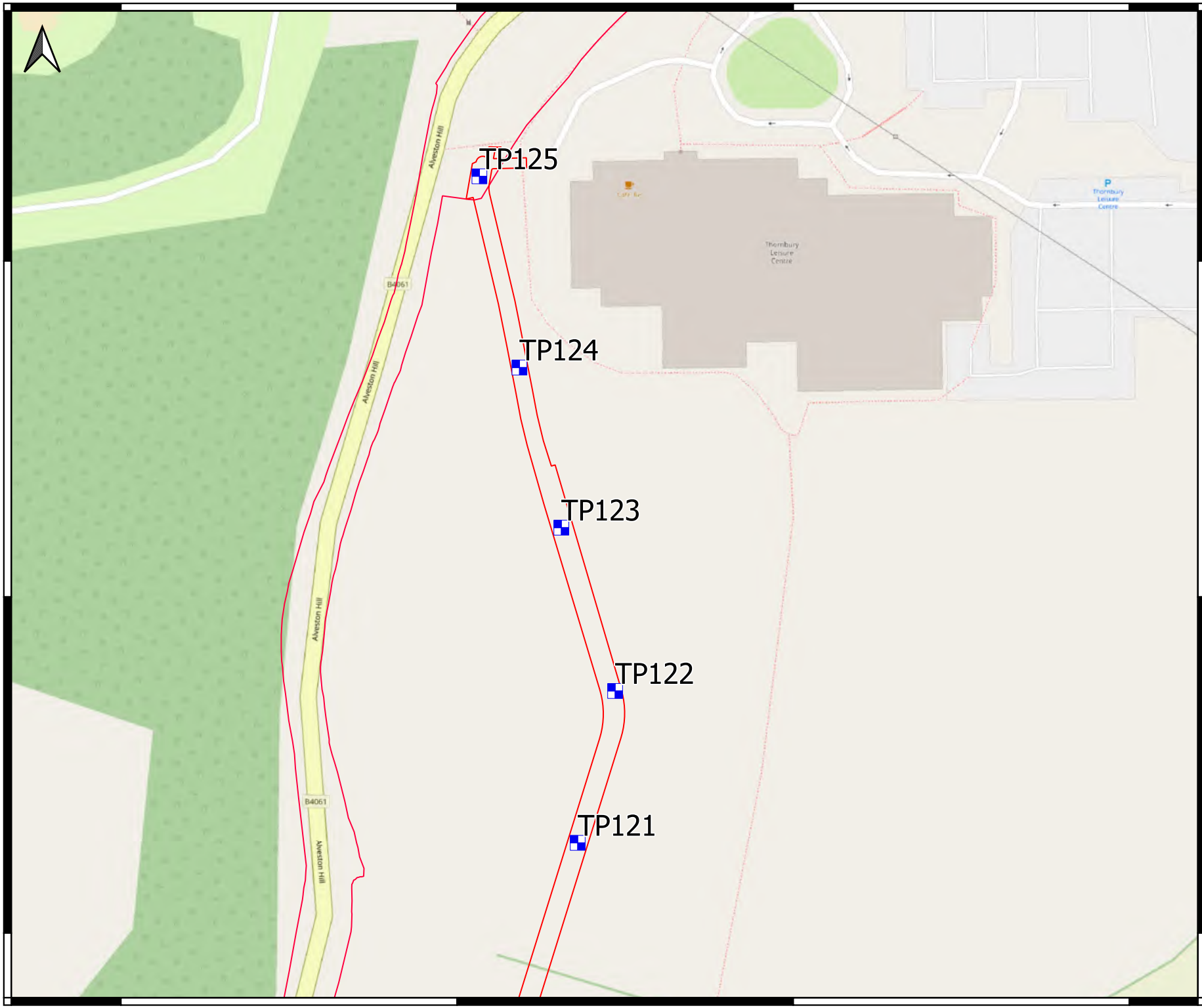
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Legend
Cycleway Alignment
GI Locations
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ATKINS
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South Gloucestershire Council
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Alveston Hill FBC
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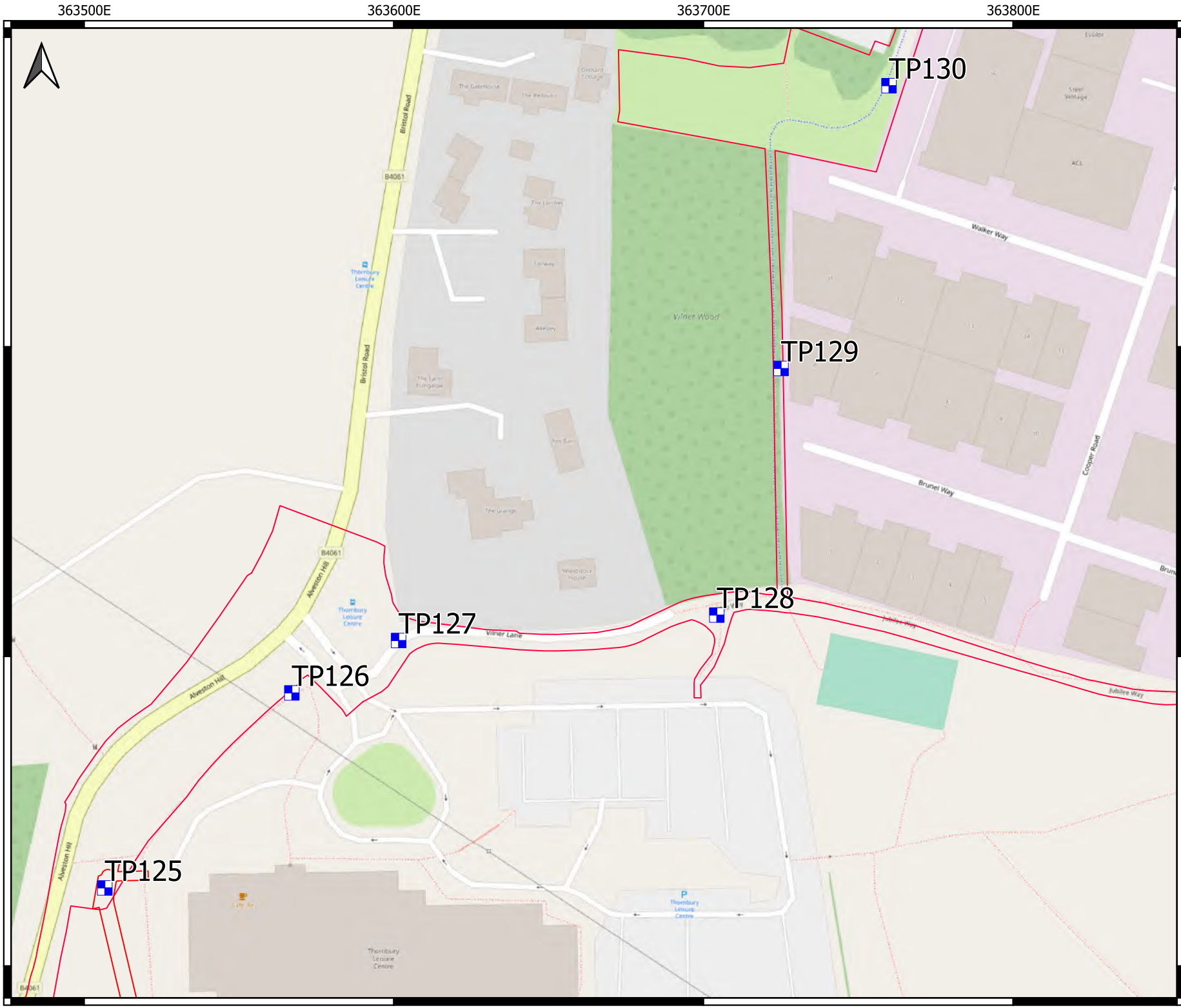
OpenStreetMap standard mapping - https://www.openstreetmap.org



Legend

Cycleway Alignment

GI Locations

Hand Dug Inspection Pit

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South Gloucestershire Council

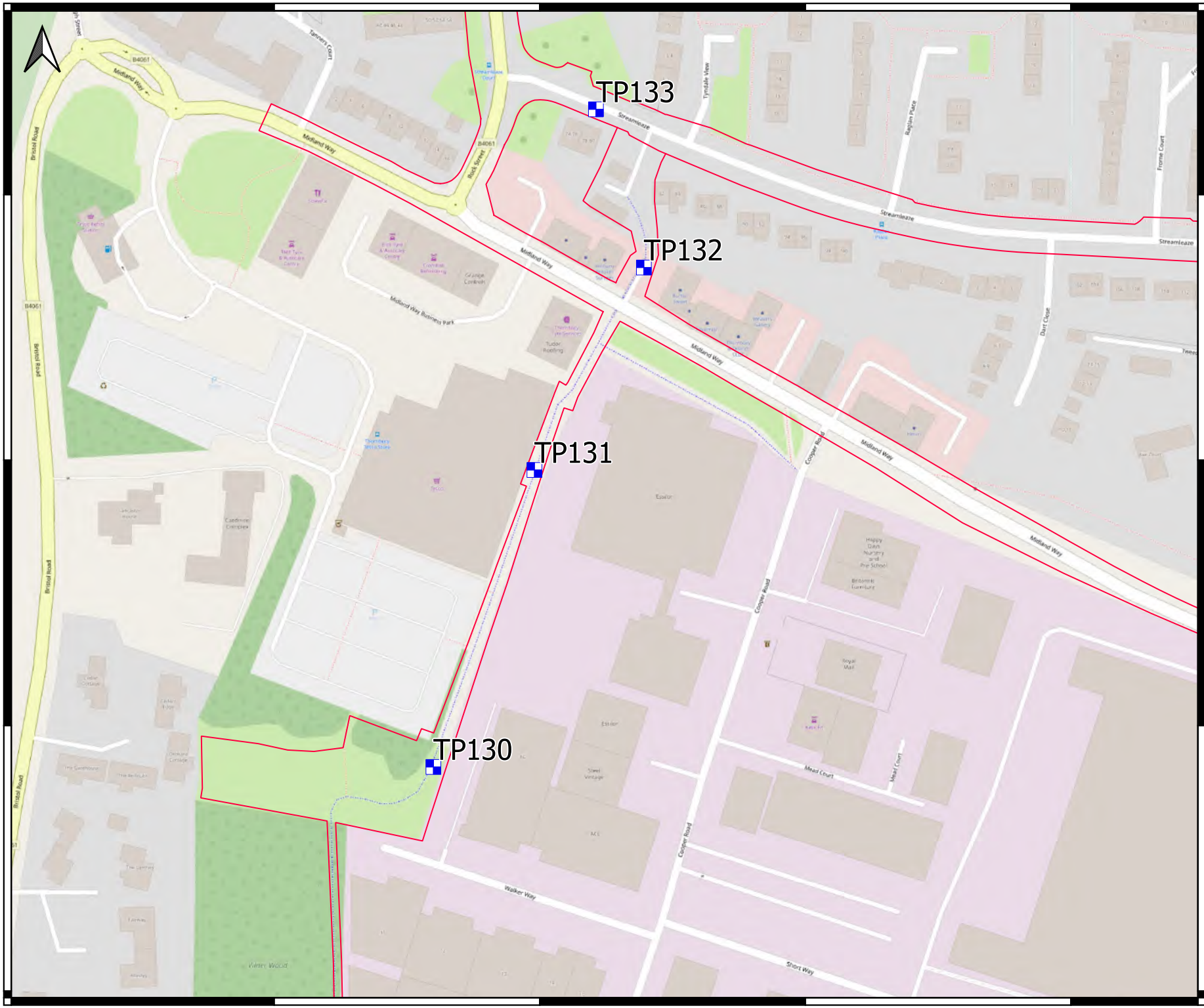
PROJECT

Alveston Hill FBC

TITLE

Proposed GI Location Plan

OpenStreetMap standard mapping - https://www.openstreetmap.org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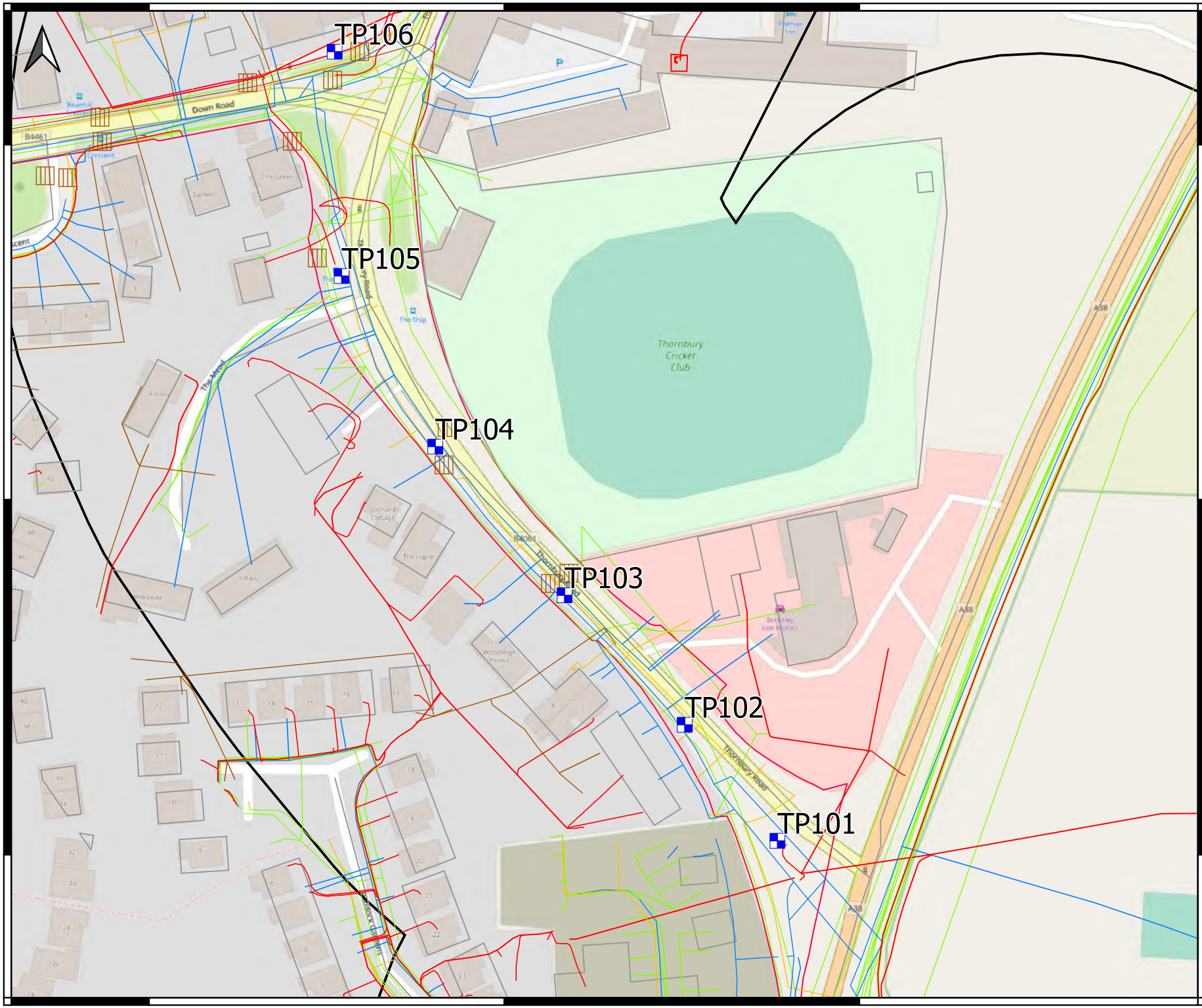
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Cycleway Alignment
GI Locations
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Sewerage - Wessex Water Foul Sewer
Gas - Wales and West Utilities
Telecom - Openreach
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ATKINS
Member of the SNC-Lavalin Group
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Proposed GI Location Plan with STATS
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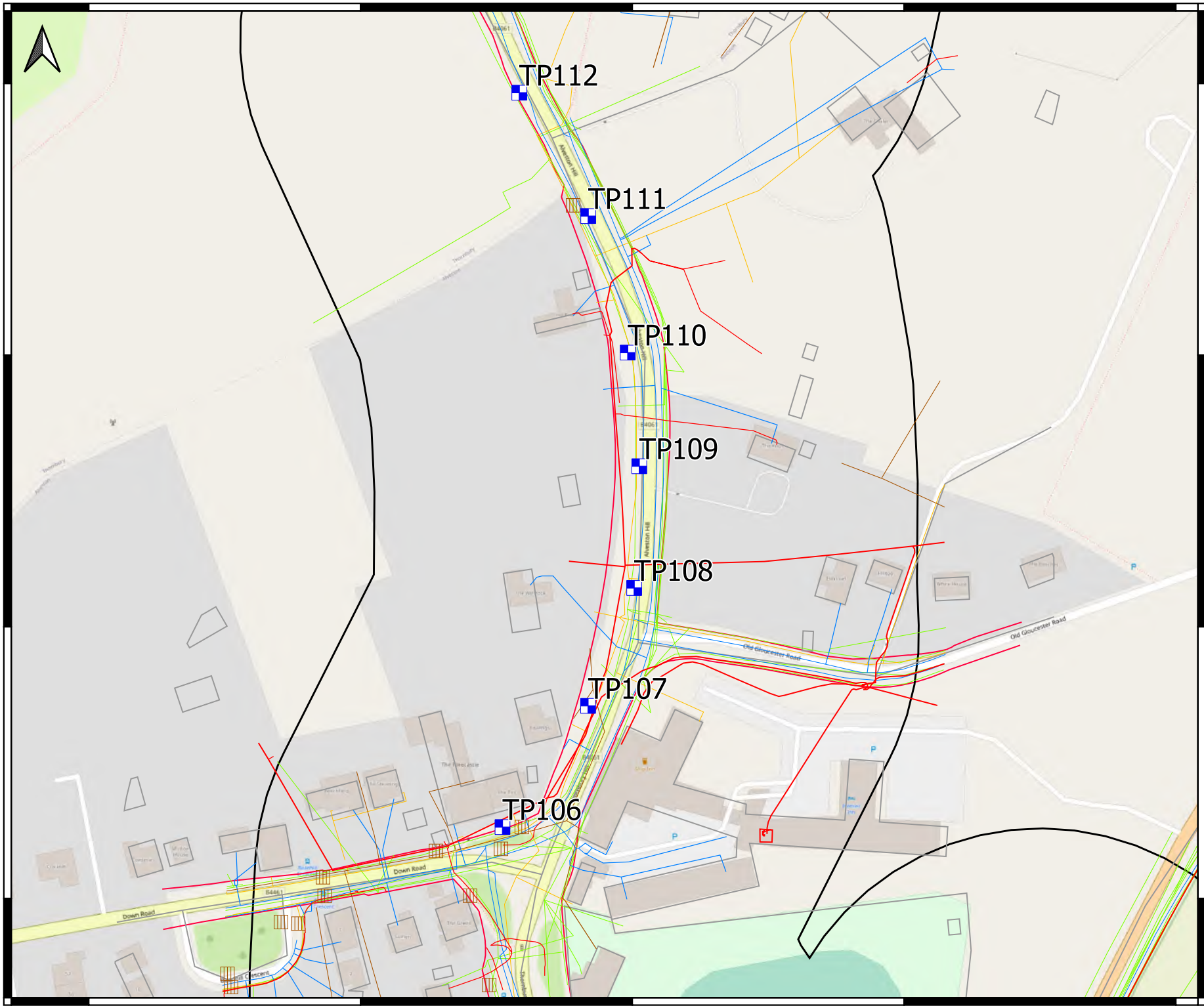
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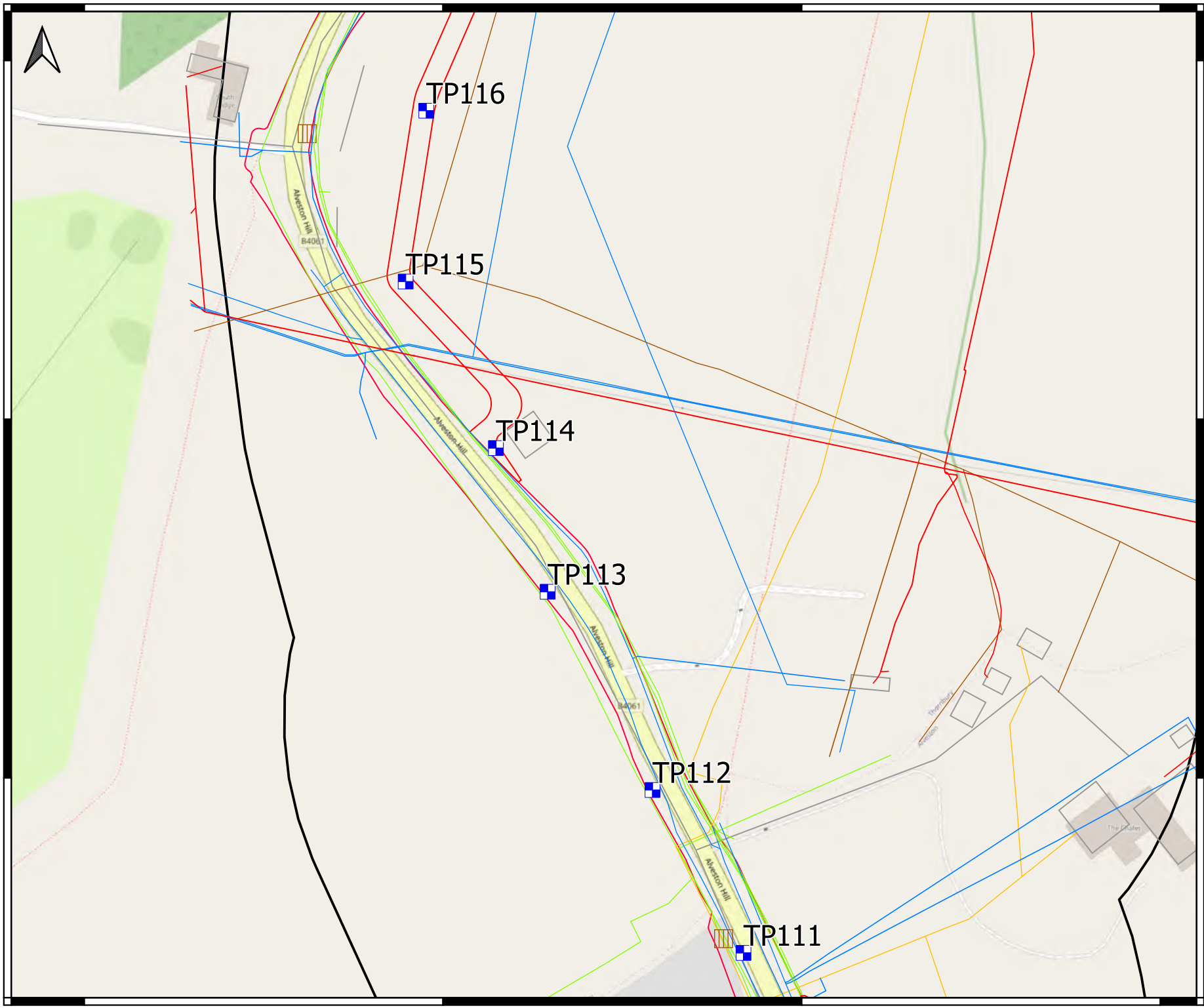
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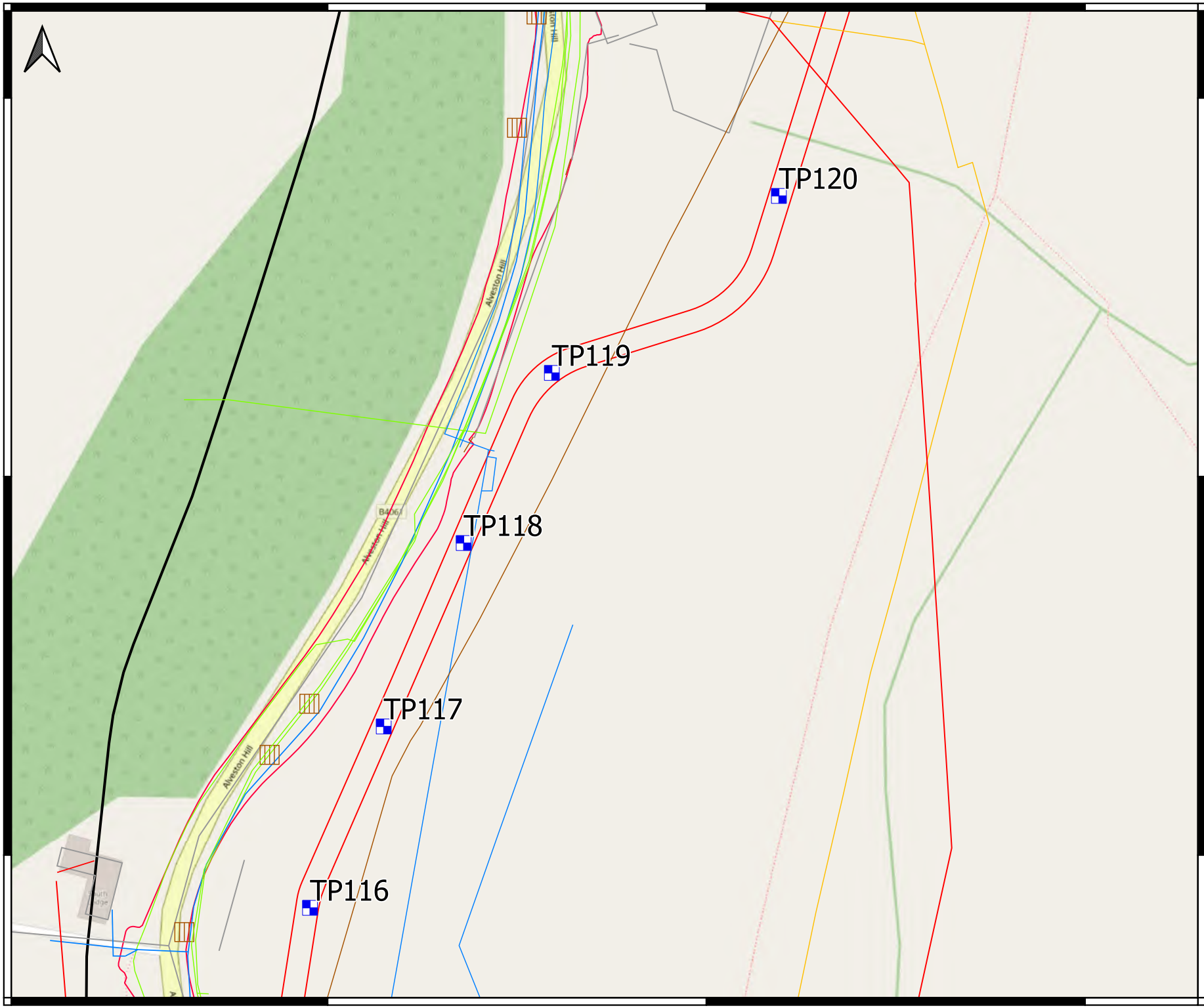
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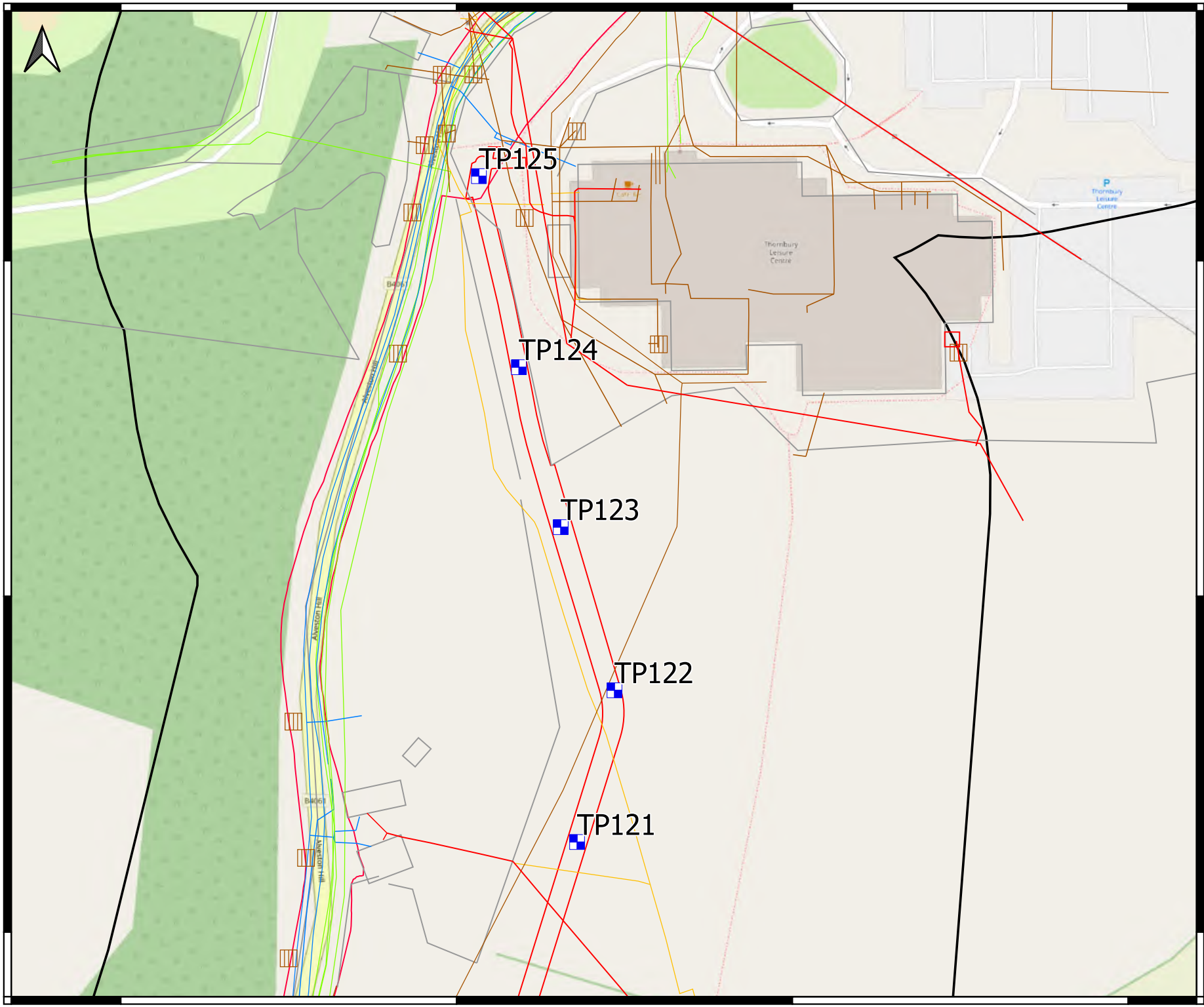
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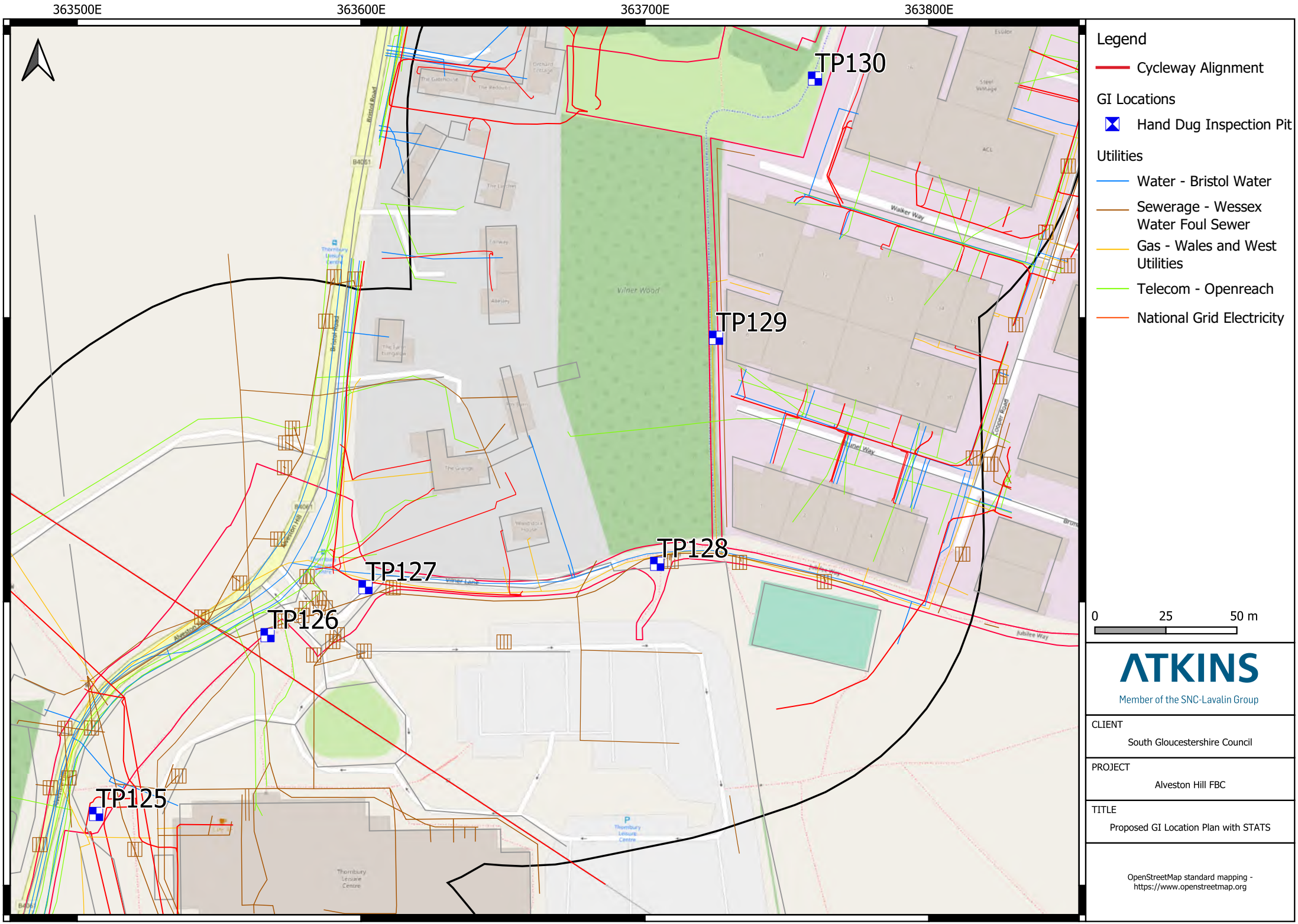
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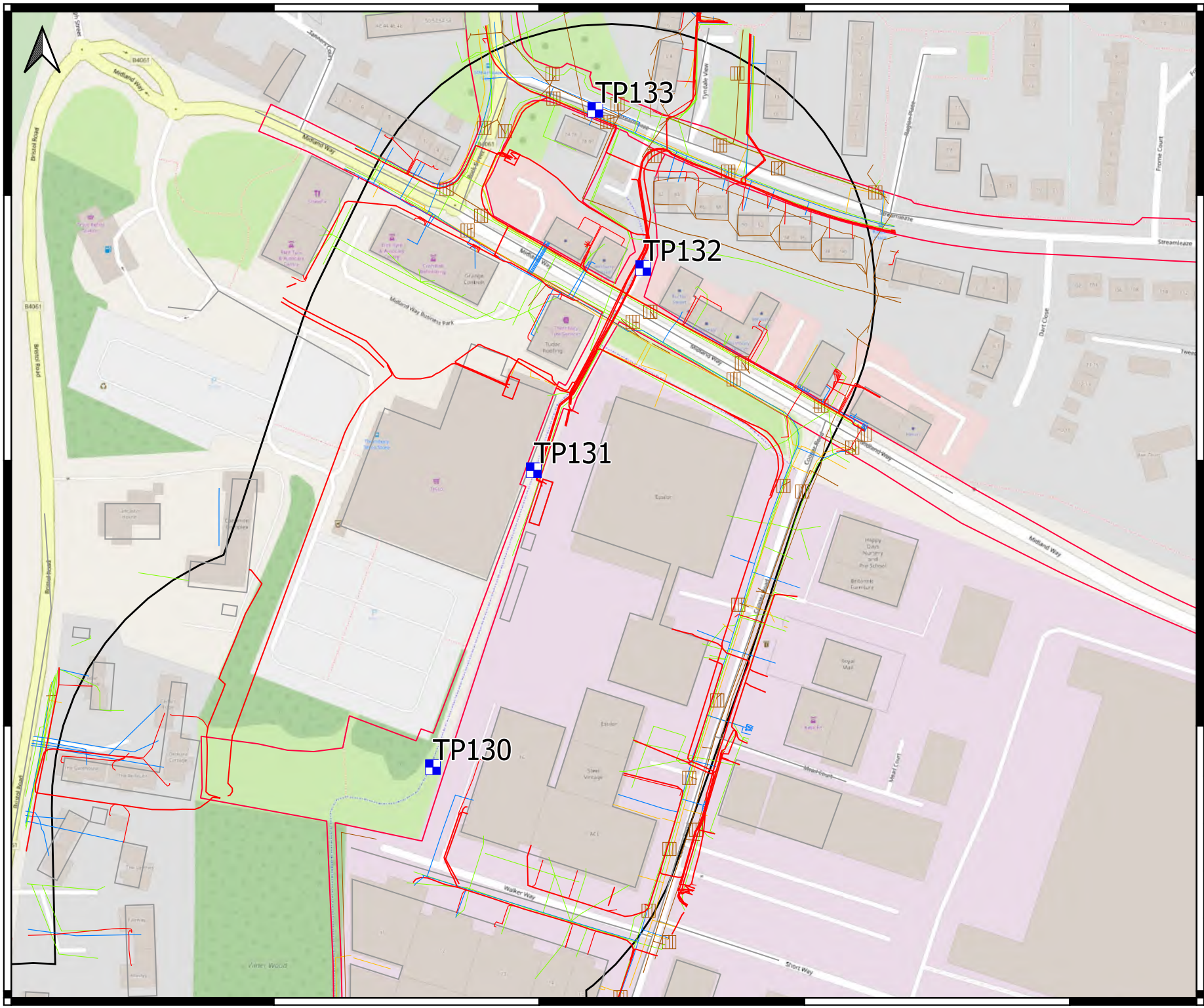
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Member of the SNC-Lavalin Group
CLIENT
South Gloucestershire Council
PROJECT
Alveston Hill FBC
TITLE
Proposed GI Location Plan with STATS
OpenStreetMap standard mapping - https://www.openstreetmap.org

Appendix B. Risk Register

This section provides an initial geotechnical and geo-environmental risk register for the ground investigation. The risk register should be considered as a 'live' document in which to capture the project risks and shall be updated regularly as additional information becomes available.

Definition of Risk

The risks included in this report shall not be considered exhaustive of every aspect of the project; rather they are illustrative of the key geotechnical and geo-environmental risks, and corresponding planning, commercial and construction risks.

In line with industry norms, Risk (R) is defined as:

R = P x I

Where:

P = Probability (%) of an event (hazard) occurring

I = Impact of the event (hazard), should it occur

It should be noted for the purposes of this report, impact (I) is defined in terms of construction and operation/maintenance. Other definitions of impact (e.g. based on environmental considerations) can also be applied once additional information becomes available.

Definitions of the scale of Probability (P) and Impact (I) values used in this report are presented in Table B-1 and Table B-2 below. The rating has been assigned based on experience and engineering judgment.

Table B-3 below presents the definitions of the risk levels derived from probability and impact using the risk classification matrix. The overall risk classification shall be considered as qualitative rather than quantitative as the rating is largely based on experience and engineering judgement, therefore the overall risk rating shall not be used for quantitative statistical analyses.

The preliminary risk register shows the calculated risk result for some of the key geotechnical and project hazards along with the calculated risk results, both prior to, and post risk control measures (RCM).

Not all the constraints and hazards identified in this report have been assessed in terms of risk at this stage. However, the risk register represents an initial means of demonstrating how the risks can be reduced once control measures are in place.

Table B-1 Qualitative scale of probability (P)

Probability of event (P)

Scale	Likelihood	Probability (%)
5	Very Likely	>70
4	Likely	40 – 70
3	Possible	10 – 40
2	Unlikely	1 – 10
1	Very Unlikely	<1

Table B-2 Qualitative scale of Impact (I)

Impact of event (I)

Scale	Class Descriptor	Construction Impact	Operation / Maintenance Impact
5	Very Serious	Construction unsustainable	Scheme operation unsustainable/deaths & serious injury
4	Serious	Significantly increased construction costs & operational difficulty	Increased scheme costs Injury/Illness
3	Moderate	Impact to costs/programme	Effect on scheme costs
2	Slight	Impact to programme	Small effect on scheme costs
1	Negligible	Negligible	Negligible

Table B-3 Risk classification matrix

Risk Classification (R)

Risk Matrix (R = P x I)							Risk Classification		
Probability (P)	5	5	10	15	20	25	17 - 25	High Risk	Unacceptable. Consider unfeasible and review concepts
	4	4	8	12	16	20			
	3	3	6	9	12	15	9 - 16	Medium Risk	Identify and implement all practical risk control measures
	2	2	4	6	8	10			
	1	1	2	3	4	5	5 - 8	Low Risk	Identify and implement cost effective risk control measures
		1	2	3	4	5	1 - 4	Very Low Risk	Acceptable. Monitor at key stages
		Impact (I)							

Risk Register

Table B-4 Risk Register

Ref No	Hazard/Risk Raised	Description of Hazard/Risk	Initial Risk Rating			Proposed Mitigation/Controls	Responsibility	Final Risk Rating		
			P	I	R			P	I	R
1	Concurrent site activities	Potential hazards from different teams working in the same area	2	3	6	Contractors to ensure that different working teams are inducted and are aware of each other's activities.	Principal Contractor	2	1	2
2	Existing underground and overhead services	Hitting buried services. Hitting overhead services with plant and machinery. Risk of electrocution, fire, explosion etc.	4	5	20	Provision of STATS information. Appropriate PPE to be worn and appropriate working methods to be undertaken by The GI Contractor. CAT and genny scanning at each exploratory hole location. GPR and service trenching to be undertaken prior to determining final exploratory hole locations.	Client; Designer; Principal Contractor	1	5	5
3	Interface with the public, land use, existing structures, adjacent properties	Impact from plant in use, exploratory holes taking place in cycle path, noise associated with drilling	4	3	12	Backfill exploratory holes immediately upon completion. No equipment to be left unattended. Notify adjacent landowners of work.	Client; Designer; Principal Contractor	1	3	3
4	Manual handling	Potential for injury due to incorrect lifting of loads.	4	4	16	Construction workers are aware of correct manual handling technique. Use lifting equipment if necessary.	Principal Contractor	1	4	4
5	Ground contamination	Contamination may be present in the ground due to the current use of the land. This may be hazardous to human health or other environmental receptors.	3	3	9	Designer to communicate the findings of desk-based studies and identify areas to take precautions. Contractor shall remain vigilant at all times during ground investigation activities. Gloves to be worn whilst sampling soils. Wash hands before eating and drinking.	Designer; Principal Contractor	3	1	3
7	Environmental impacts associated with drilling activities.	Fuel spillages or drilling flush could be discharged into the watercourses /environmental receptors	4	3	12	Fuel spillage kits. GI contractor to collect all flush and dispose of it at an appropriate disposal facility.	Principal Contractor	1	3	3

Appendix C. Pre-Construction Information Pack

UNEXPLODED BOMB RISK MAP

SITE LOCATION

Map Centre: 363675,189312

LEGEND

- **High:** Areas indicated as having a bombing density of 50 bombs per 1000acre or higher.
- **Moderate:** Areas indicated as having a bombing density of 15 to 49 bombs per 1000acre.
- **Low:** Areas indicated as having 15 bombs per 1000acre or less.

miltary | **industry** | **UXO find**
transport | **dock** | **Luftwaffe targets**
utilities | **Bombing decoy** | **other**

How to use your Unexploded Bomb (UXB) risk map?

The map indicates the potential for Unexploded Bombs (UXB) to be present as a result of World War Two (WWII) bombing.

You can incorporate the map into your preliminary risk assessment* for potential Unexploded Ordnance (UXO) for a site. Using this map, you can make an informed decision as to whether more in-depth detailed risk assessment* is necessary.

What do I do if my site is in a moderate or high risk area?

Generally, we recommend that a detailed UXO desk study and risk assessment is undertaken for sites in a moderate or high UXB risk area.

Similarly, if your site is near to a designated Luftwaffe target or bombing decoy then additional detailed research is recommended.

More often than not, this further detailed research will conclude that the potential for a significant UXO hazard to be present on your site is actually low.

Never plan site work or undertake a risk assessment using these maps alone. More detail is required, particularly where there may be a source of UXO from other military operations which are not reflected on these maps.

If my site is in a low risk area, do I need to do anything?

If both the map and other research confirms that there is a low potential for UXO to be present on your site then, subject to your own comfort and risk tolerance, works can proceed with no special precautions.

A low risk really means that there is no greater probability of encountering UXO than anywhere else in the UK.

If you are unsure whether other sources of UXO may be present, you can ask for one of our **pre-desk study assessments (PDSA)**

If I have any questions, who do I contact?

tel: **+44 (0) 1993 886682**

email: **uxo@zetica.com**

web: **www.zeticauxo.com**

The information in this UXB risk map is derived from a number of sources and should be used in conjunction with the accompanying notes on our website: **(https://zeticauxo.com/downloads-and-resources/risk-maps/)**

It is important to note that this map is not a UXO risk assessment and should not be reported as such when reproduced.

*Preliminary and detailed UXO risk assessments are advocated as good practice by industry guidance such as CIRIA C681 'Unexploded Ordnance (UXO), a guide for the construction industry'.

Appendix D. Professional Standards

All works shall be undertaken in accordance with best practice and relevant technical guidance, including (but not limited to):

- British Standards Institution EN 1997 (2010) “BS EN 1997 Eurocode 7 Geotechnical Design”.
- British Standards Institution (2020) “BS 5930: Code of Practice for Ground Investigations”.
- British Standards Institution (2011) “BS 10175: Investigation of Potentially Contaminated Sites”.
- British Standards Institution (2011) “BS 22475 Geotechnical Investigation and Testing”.
- British Standards Institution (2013) “BS 8576 Guidance on Investigations for Ground Gas”.
- British Standards Institution (2016) “BS 1377 Methods of Test for Soils for Civil Engineering Purposes”.
- British Standards Institute “BS EN ISO 17892 Geotechnical Investigation and Testing”.

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6. Flood Risk assessment report

ATKINS

Member of the SNC-Lavalin Group

Alveston Hill cycle scheme

Flood Risk Assessment

South Gloucestershire Council

23 May 2023

5220316

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This document has 24 pages including the cover.

Document history

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Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
0.1	Draft for comment	RR	MJV	ATR		

Client signoff

Client	South Gloucestershire Council
Project	Alveston Hill cycle scheme
Job number	5220316
Client signature/date	

Contents

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1. Site Details

1.1. Site location

The Alveston Hill cycle scheme is located near the B4061 highway between the village of Alveston and town of Thornbury, north of Bristol.

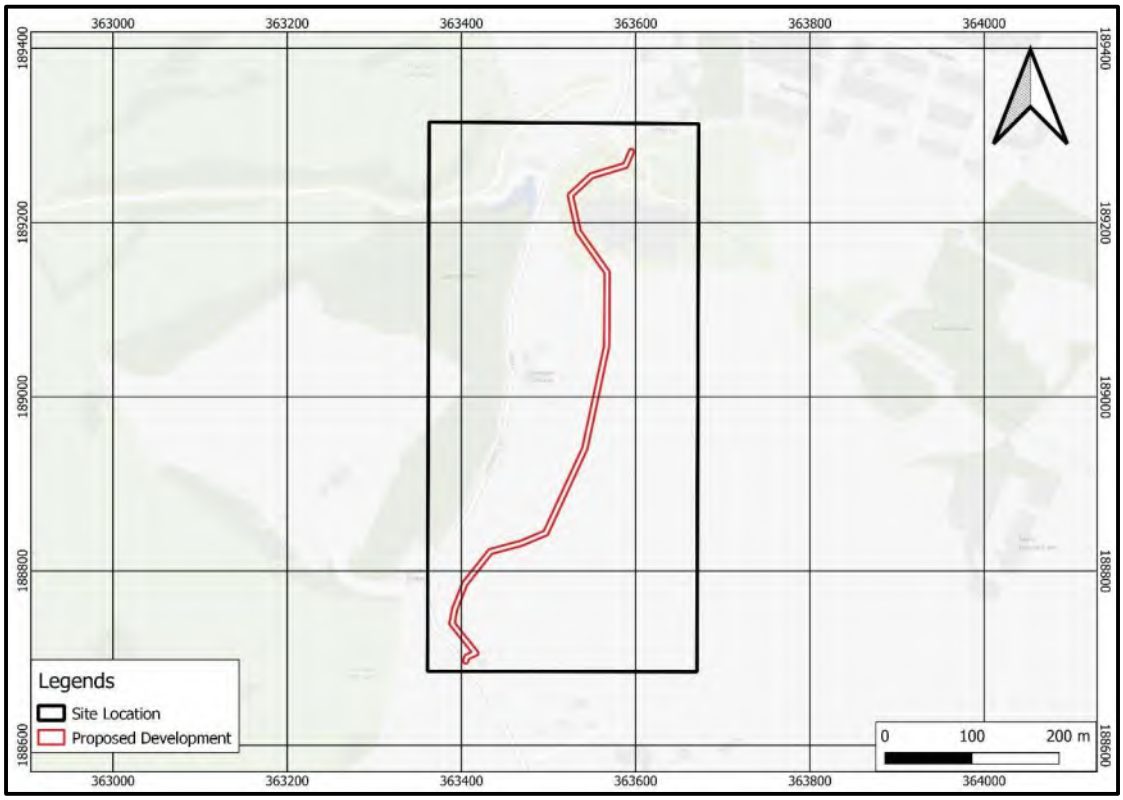


Figure 1-1 - Location plan

Table 1-1 - Site location

Lead local flood authority	South Gloucestershire
Borough council	n/a
River Basin	Severn
River management catchment	Avon Bristol and Somerset North Streams Management Catchment Severn Lower Vale Operational Catchment Oldbury Naite Rhine Water Body

Table 1-2 - Site details

Site centroid grid reference	363509, 188986
Maximum / minimum elevation	83.3 mAOD / 51.16 mAOD
Site area	4371.0 m
General direction slope across site	North

1.2. Development proposals

1.2.1. The cycle route starts near the access the Marlwood Grange and the Thornbury Golf Centre, and proceeds northwards to the Thornbury Leisure

1.3. Flood risk assessment

1.3.1. A flood risk assessment is required for most developments within one of the flood zones. This includes developments:

- in flood zone 2 or 3 including minor development and change of use
- more than 1 hectare (ha) in flood zone 1
- less than 1 ha in flood zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs)
- in an area within flood zone 1 which has critical drainage problems as notified by the Environment Agency

1.3.2. The objectives of a site-specific flood risk assessment are to establish:

- whether a proposed development is likely to be affected by current or future flooding from any source, and to demonstrate that any residual risks to the development and its users would be acceptable;
- whether it will increase flood risk elsewhere (to demonstrate that the development would not increase flood risk elsewhere);
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test, and, where applicable, whether the development will be safe and pass the Exception Test; and
- to satisfy the requirements of the National Planning Policy Framework (NPPF), and for this scheme the National Policy Statement for National Networks section on Flood Risk.

1.3.3. Flood risk should be considered alongside other spatial planning issues such as transport, housing, economic growth, natural resources, regeneration, biodiversity, the historic environment and the management of other hazards.

1.3.4. CIRIA C624[1] , from 2004, provides guidance on the implementation and good practice in assessing flood risks through the development process. The aim of C624 is to promote developments that are sustainable with regard to flood risk. The document recommends that an FRA should be undertaken in phases so that the type of development corresponds with the detail required.

1.3.5. There are three levels of assessment:

- **Level 1 FRA (Screening Study):** To identify if there are any flooding issues related to a development site which may warrant further consideration. The screening study will ascertain whether a Level 2 or Level 3 FRA is required.
- **Level 2 FRA (Scoping Study):** Undertaken if a Level 1 study indicates that the site may lie within an area which is prone to flooding or that the site may increase flood risk due to increased runoff; and to confirm the possible sources of flooding which may affect the site. The Scoping Study will identify any residual risks that cannot easily be controlled and, if necessary, will recommend that a Level 3 FRA is undertaken. It is typically a qualitative assessment using available data.
- **Level 3 FRA (Detailed Study):** Undertaken if the Level 2 study concludes that quantitative analysis is required to assess flood risk issues related to the development site. This may include detailed hydraulic modelling of rivers or drainage systems.

[1] Lancaster, J.W., Preene, M. & Marshall, C.T. (2004) Development & Flood Risk – Guidance for the Construction Industry. CIRIA publication C624.

1.3.6. This report forms a Level 1 FRA. Hence this report provides a screening assessment of the risks arising to the Scheme as a result of its location and design.

1.3.7. Specifically, this report seeks to consider the 'key questions':

- Is the site likely to be at risk of flooding from: a watercourse, the sea, an estuary, groundwater, overland flow, an artificial drainage system, infrastructure failure?
- Is the Scheme likely to obstruct the maintenance access requirements or affect the integrity of an existing flood defence?
- Is the Scheme likely to increase flood risk elsewhere due to increased runoff rates and volumes from the site?
- Given the above and the nature of the development, is continued promotion of a possible development at the site appropriate?

1.3.8. The report has been completed in line with the NPPF and makes use of readily available information from the following sources:

- Environment Agency online flood map for planning.
- Environment Agency online long term flood risk map.
- LiDAR data for the site obtained from the .Gov website.

2. Flood risk data

2.1. FRA information

Table 2-1 – Flood risk information

HISTORICAL FLOODING	
Site within EA historic flood extent	No
Distance and direction to nearest historic flooding[2]	2.725 km, North
FLUVIAL FLOODING	
Flood zone	Fluvial Flood Zone 3. The unnamed tributary of the Oldbury Pill is indicated by the Environment Agency to present Flood Zone 3, despite not being a Main River.
Flood Zone 2	Within scheme boundary -Yes Distance from scheme boundary: 0 m,
Flood Zone 3	Within scheme boundary-Yes Distance from scheme boundary: 0 m,
Nearest watercourses	The cycle scheme crosses the Pool Brook and another unnamed tributary of the Oldbury Pill near the Bristol Road. These are Ordinary Watercourses. There are no Main Rivers present.
Distance to watercourses	314 m, 585 m, 603 m
Distance to nearest watercourses	314 m, North
Nearest flood defence	2.4 km, South East
Nearest flood defence description	Fluvial. High ground
Within an area benefitting from defences	Yes. Flood defences along the eastern bank of the tidal River Severn maybe proving benefit to the Alveston Area.
HYDROMETRIC DATA	
Number of flow gauges within search radius	2
Closest flow gauge	Frampton Cotterell, gauge number 530240
Distance to closest flow gauge	7.179 km, South
Number of rain gauges within search radius	4
Closest rain gauge	Cromhall, gauge number 1811
Distance to closest rain gauge	4.411 km, East
TIDAL FLOODING	
Flood zone	No tidal flood risk indicated with ground levels above 50m AOD.
Flood Zone 2	Within scheme boundary - No Distance from scheme boundary: 7.4 km, West

[2] Distance to nearest historic flood extent within the given dataset. Absence of historic flood extent does not confirm it has not previously flooded.

Flood Zone 3	Within scheme boundary - No Distance from scheme boundary: 2.2 km, North West
Distance to nearest mean tidal high water	4.7 km, North West
SURFACE WATER FLOODING	
High risk zone (1 in 30)	Within scheme boundary - Yes Distance from scheme boundary: 0 m, NA
Medium risk zone (1 in 100)	Within scheme boundary - Yes Distance from scheme boundary: 0 m, NA
Low risk zone (1 in 1000)	Within scheme boundary - Yes Distance from scheme boundary: 0 m, NA
Overall risk of SW flooding	30 year
GROUNDWATER FLOODING	
Geology	The National river Flow Archive described the area as a responsive to rainfall with steep headwaters which drain complex sequence of limestones, sandstones and clays of Lower and Middle Jurassic; The flat Vale of Berkeley is underlain by Cambrian inlier, Keuper Marl and Lias clays. Generally low or mixed permeability bedrock not overly supportive of groundwater flooding. The UK Water Resources portal indicates the presence of a low to moderately productive aquifer.
RESERVOIRS	
Within reservoir wet day inundation flood extent?	N/A
Reservoir name	-
Reservoir operator	-
Risk designation	No Risk
OTHER	
Canals – nearest canal	No Canals within 10km
Water transmission infrastructure – distance to…	Unknown

2.2. Figures

Figure 2-1 - Fluvial flooding

Figure 2-2 - Surface water flooding

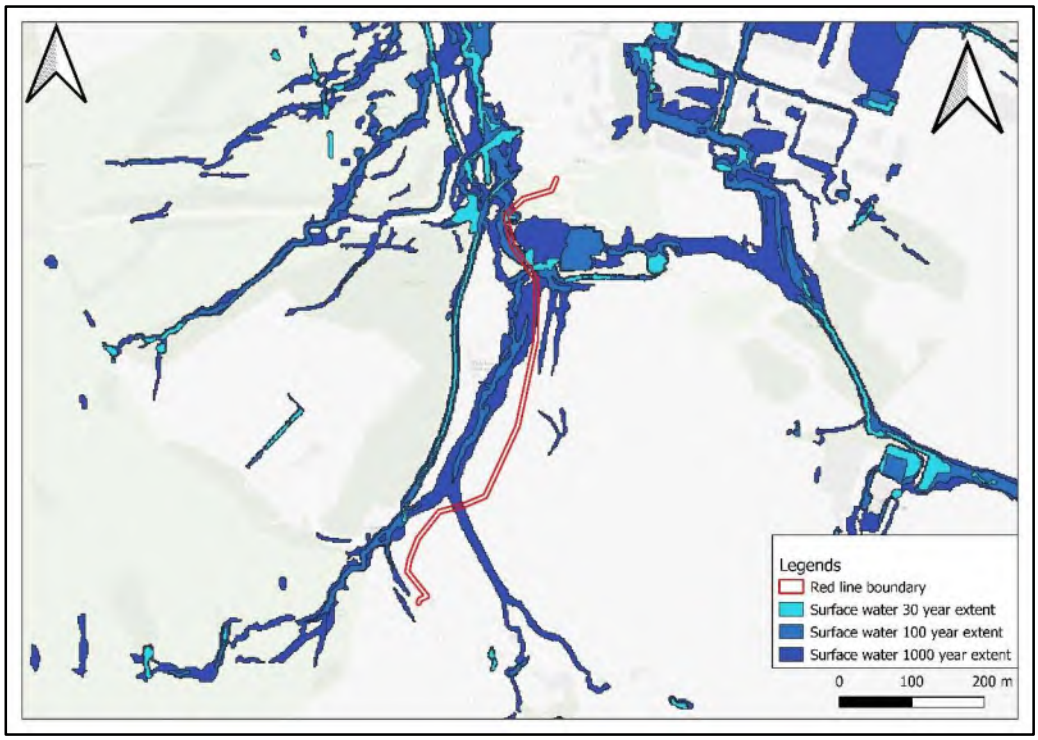


Figure 2-3 - Tidal flooding

Figure 2-4 - Historic flooding

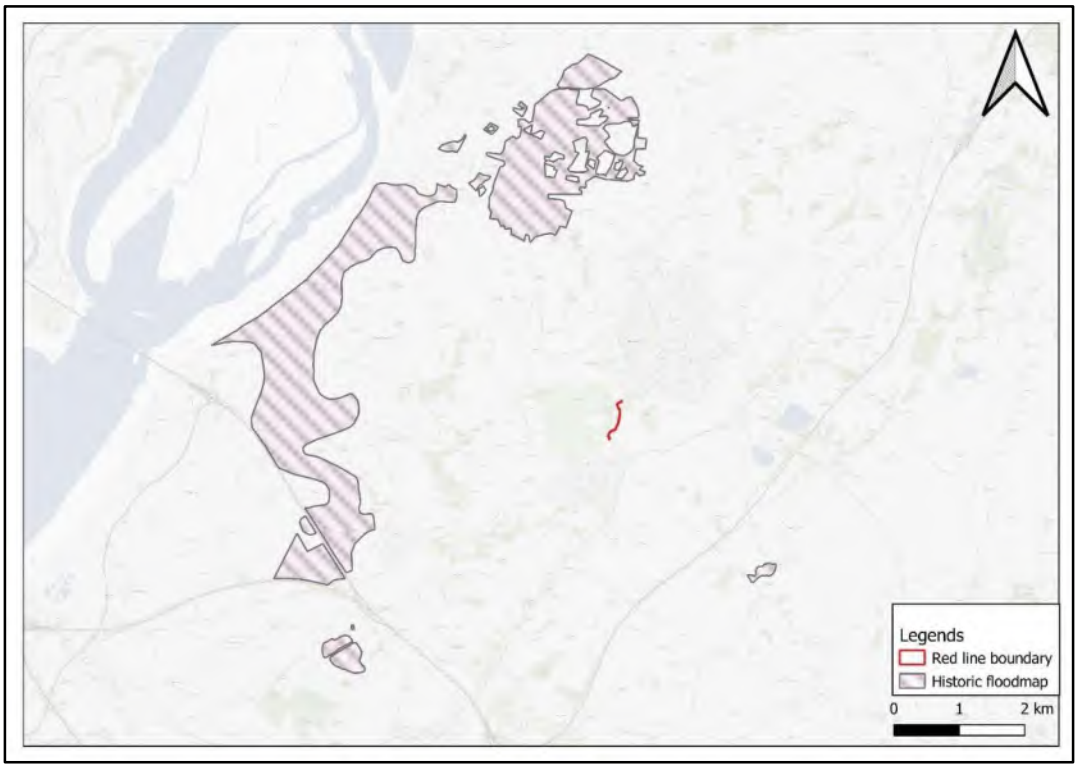


Figure 2-5 – Flood defences

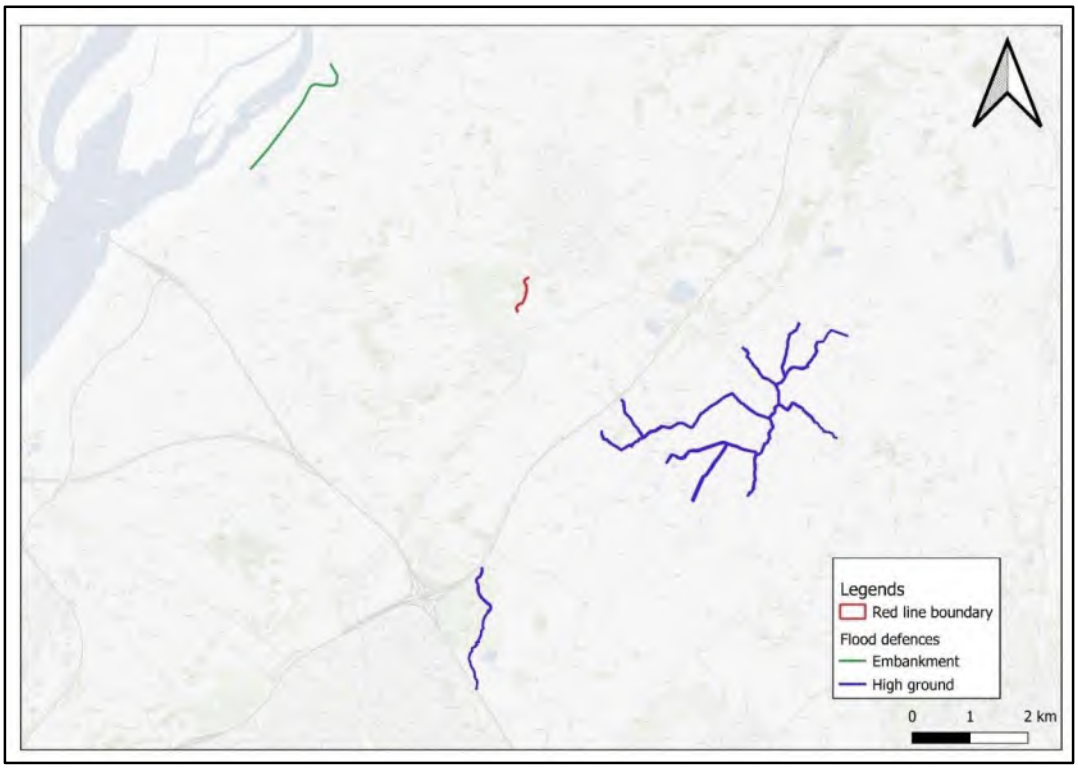


Figure 2-6 - Gauge locations

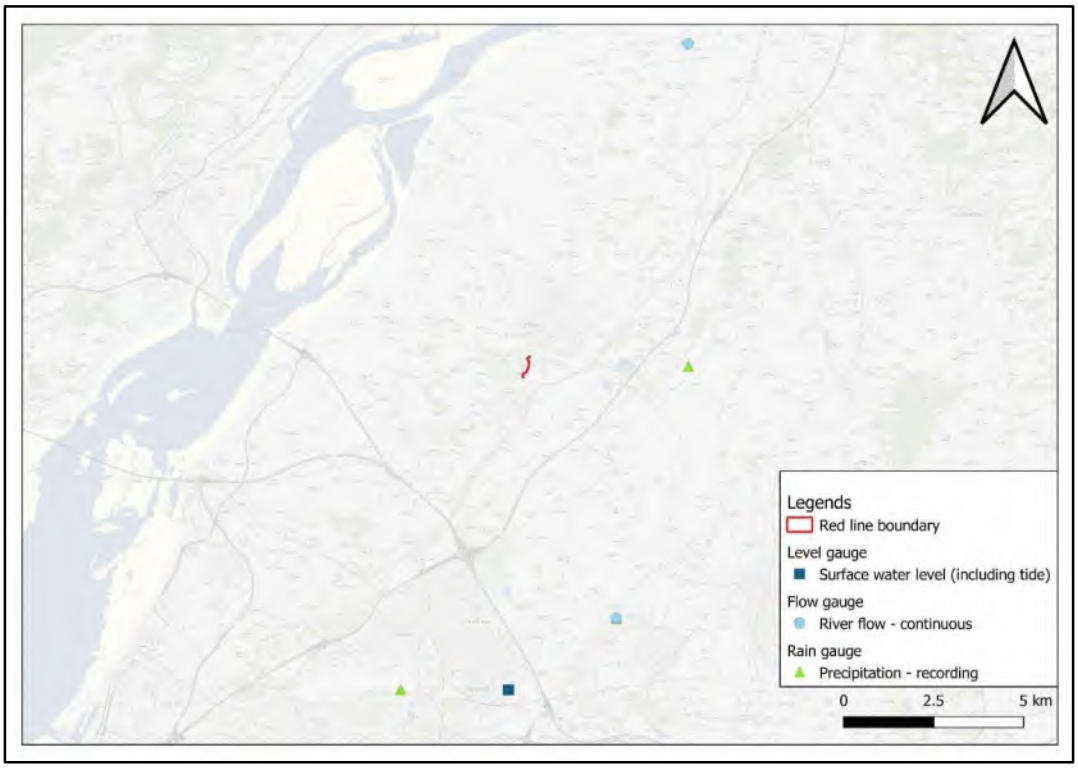


Figure 2-7 – Lidar

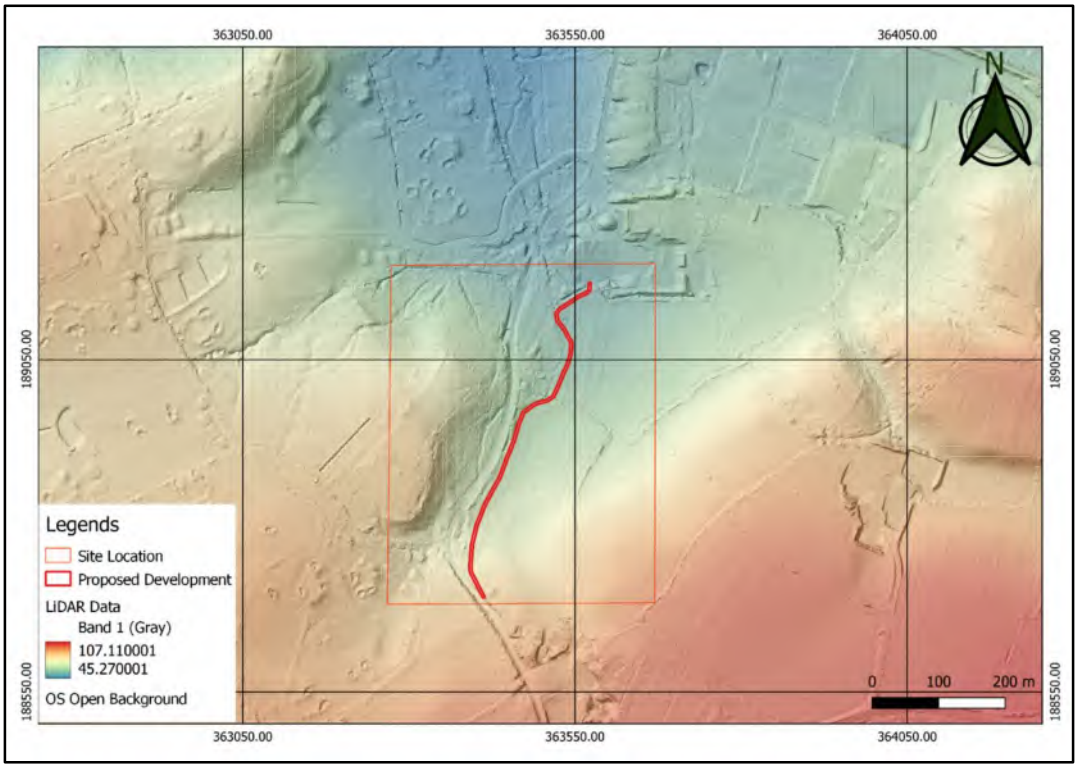


Figure 2-8 – Superficial geology

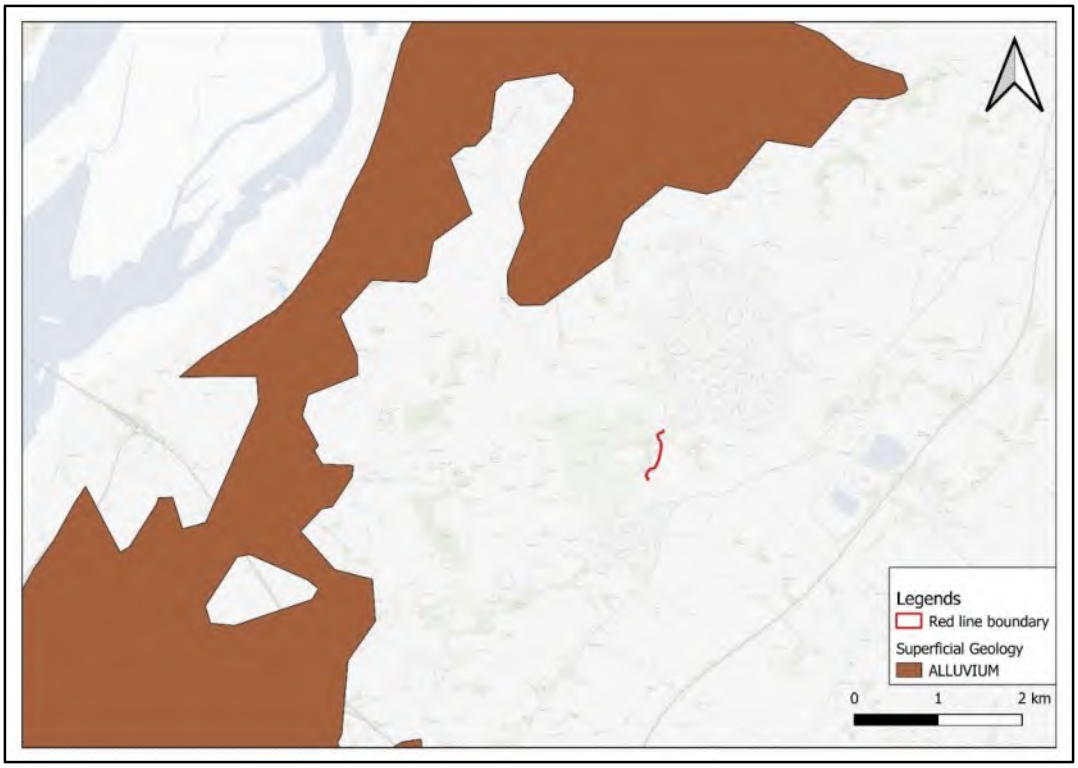


Figure 2-9 – Bedrock geology

2.3. Summary of flood risk sources

2.3.1. Table below summarises the likely sources of flood risk to this Scheme.

Table 2-2 – Sources of flood risk summary

Flood risk	Baseline risk	Commentary
Fluvial	High	Flood risk from the Oldbury Pill and its tributaries.
Tidal	None	Not applicable - no tidal influences.
Surface Water	High	Surface water flood risk arising from runoff from the south, draining into the Oldbury Pill and its tributaries.
Groundwater	Low	Based on geology the risk of groundwater flooding is low.
Sewers	Low	Low risk in rural area.
Other sources	Low	Risk of flooding from the Dowdeswell Reservoir should failure occur. Reservoirs Act requirements reduce this risk to an acceptable level.

2.3.2. The predominant risk of flooding to the site arises from fluvial and surface water flooding.

3. Assessment of flood risk

3.1. Initial assessment

3.1.1. The primary source of flood risk for consideration with the Scheme is fluvial and surface water. The risk of surface water flooding is connected with the fluvial flood risk.

3.1.2. Table 3-1Table sets out the NPPF flood risk vulnerability and Flood Zone compatibility assessment, as taken from Table 2 of the NPPF Planning Practice Guidance (paragraph 079). The definitions for vulnerability type and Flood Zone compatibility are available on the Gov.uk website. The table indicates which development types are appropriate within each Flood Zone.

Table 3-1 – 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 *	✗	✗	✗	✓ *

✓ Development is appropriate ✗ Development should not be permitted

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood.
- result in no net loss of floodplain storage.
- not impede water flows and not increase flood risk elsewhere.

3.1.3. The Scheme will be part of a transport infrastructure that can be described as a non-key transport link. Under the NPPF guidance (Annex 3), the development can be classified as Less Vulnerable, although this will need to be confirmed by the planning authority.

The Scheme is considered by this FRA to be classified as Less Vulnerable.

3.1.4. Based on its Less Vulnerable classification, and crossing Environment Agency Flood Zone 3, Table 3-1indicates that the Scheme is compatible with the flood risk.

The Scheme is compatible with the flood risk

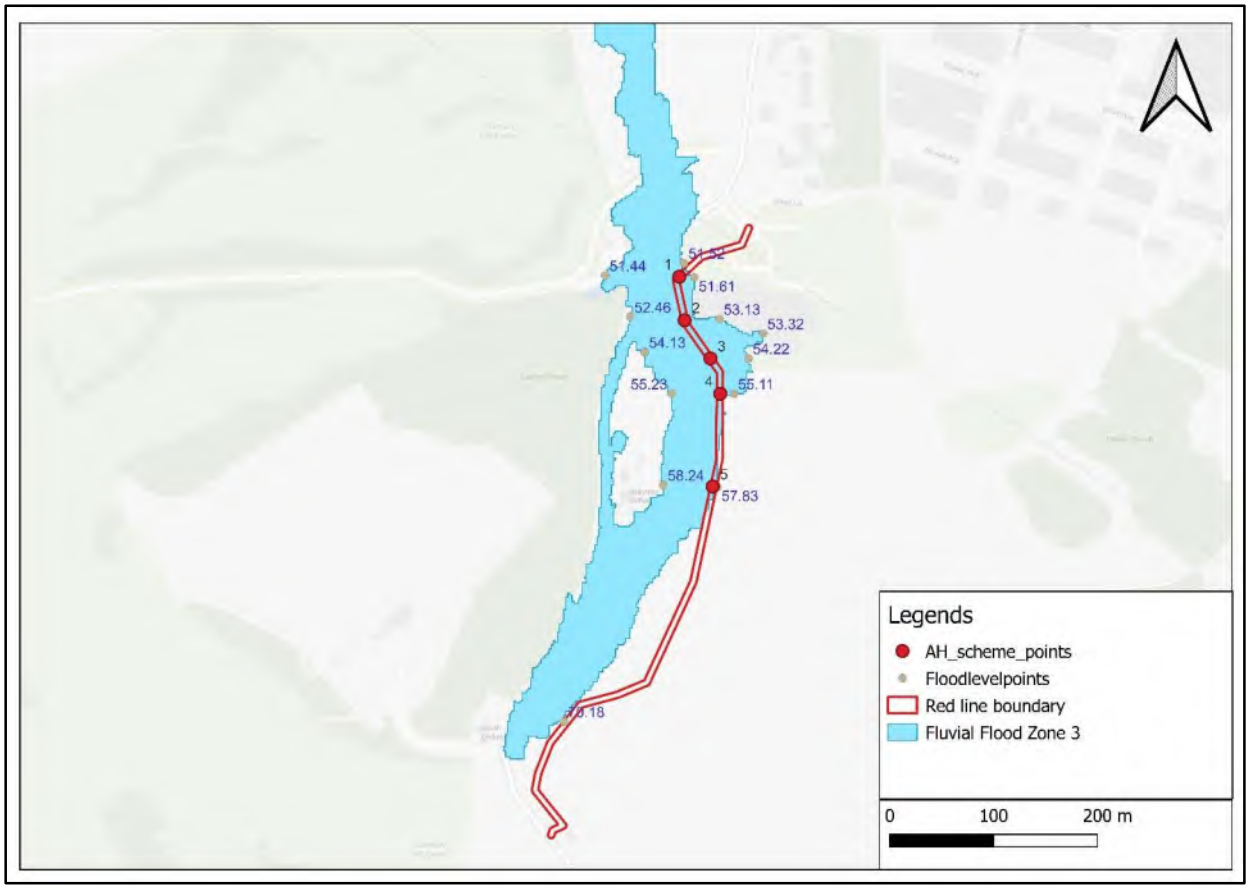
Flood depths

3.1.5. The published Environment agency map gives the extent of flooding excluding the effect of future climate change.

3.1.6. The flood level was estimated for the 1% annual exceedance probability event (1 in 100-year return period) using the published Environment Agency flood map. The ground levels were evaluated where the flood extent intersected with the ground (flood level being the ground level).

3.1.7. Locations were selected along the cycleway route at which to determine the ground level, as shown in Figure 3-1.

Figure 3-1 – Flood depth evaluation
Flood levels shown in m AOD



3.1.8. The flood depth at the cycleway was then calculated as the difference between the nearest flood extent flood level and existing ground level at the cycleway, as shown in Figure 3-1. This shows flood depths over 700 mm can be expected along the cycleway route in the present day conditions.

Table 3-2 – Approximate flood depth at the Alveston Hill cycleway

Flood levels and depths for 1% annual exceedance probability event (1 in 100-year return period) event

AH Scheme Points	Ground Level in m	Flood Level in m (approx.)	Flood Depth in mm
	(1)	(2)	(3) = (2) – (1)
1	51.32	51.61	290
2	52.92	53.13	210
3	53.45	54.22	770
4	55.08	55.11	30
5	57.70	57.83	130

3.2. Sequential Test

3.2.1. The South Gloucestershire Council scheme is a development to improve transport infrastructure at a regional level. It is not specifically described in the 2018-2036 Local Plan, although that promotes sustainable transport.

3.2.2. Alternative options were considered for the Scheme. These are described in the [3]. The route assessment indicates that the Scheme satisfies the application of the Sequential Test to justify the location of the development.

3.2.3. Table 3-3, below, addresses the steps in the Sequential Test.

Table 3-3 – NPPF Sequential Test application on the Scheme

Sequential Test step	Test step question	Test outcome
1	Can development be allocated in Flood Zone 1?	No, the cycleway has to cross the floodplain as it connects with existing highways at either end and seeks an appropriate route up Alveston Hill.
2	Can development be allocated in Flood Zone 2?	No, the cycleway has to cross the floodplain.
3	Can development be allocated within lowest risk sites available in Flood Zone 3?	No ,the cycleway has to cross the floodplain
4	Is development appropriate in remaining areas?	Yes. Development considered to be “Less Vulnerable”, It crosses Flood Zone 3 “Floodplain (defined in NPPF, Table 1, Paragraph 078. Development can be allocated to the area

3.2.4. It should be noted that paragraph 5.102 of the National Policy Statement on National Networks accepts that there will be cases where, “…infrastructure is being provided connecting two points that are not in flood risk areas, but where the most viable route between the two passes through such an area.”

3.3. Exception Test

3.3.1. The Scheme does not require application of the Exception Test. However, as the Scheme crosses Flood Zone 3a it should be designed and constructed to remain operational and safe in times of flood. It is not understood to cross Flood Zone 3b (functional floodplain).

3.4. Impact of future climate change

3.4.1. The published Environment Agency mapping does not include for the effects of future climate change.

3.4.2. The climate change uplift for the flows was determined using the Environment Agency’s May 2022 climate change guidance for river flow in Flood Risk Assessments. The Avon Bristol and Somerset North Streams management catchment was used (Severn river basin district), indicating a 2080s Central estimate of 26% increase in flow over the next 100 years

Table 3-4 – Climate change allowances for peak river flow

River Basin	Severn
River management catchment	Avon Bristol and Somerset North Streams
Central allowance	26%
Higher Central allowance	39%

[3] Ref to any option study

Upper End allowance	71%

3.4.3. As a Less Vulnerable the Central allowance (+39%) should be applied to the assessment design.

3.4.4. Increased rainfall affects river levels and land and urban drainage systems. The anticipated changes in peak rainfall intensity in small catchments (less than 5 km^2), or urbanised drainage catchments are shown below. For flood risk assessments the Environment Agency advice is to assess both the central and upper end allowances to understand the range of impact.

Table 3-5 –Climate change predictions on rainfall intensity for the Scheme site

Allowance category	Total potential change anticipated for the		
	2020s' (2015 to 2039)	2050s' (2040 to 2069)	2080s' (2070 to 2115)
Rainfall intensity in small catchments (less than 5km2), or urbanised drainage catchments			
Upper End	10%	20%	40%
Central	5%	10%	20%

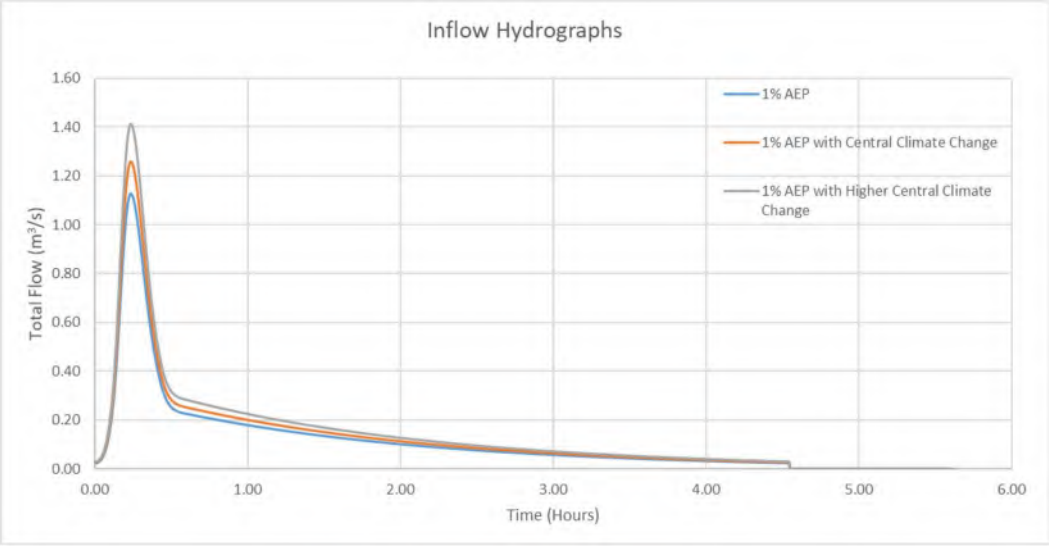
3.4.5. The Design Manual for Roads and Bridges (DMRB) technical note on the Design of Highway Drainage Systems states that drainage designs shall be developed on the basis that all new road drainage has a minimum design lifetime of 60 years, unless otherwise instructed. And with a 20% uplift in peak rainfall intensity as the basic climate change factor. It also recommends a sensitivity test with 40% uplift in peak rainfall intensity to establish a robust drainage design that accounts for the inherent uncertainty in the estimation of flow and climate change impacts on rainfall.

Flood Modelling

3.4.6. To better understand the depth of flooding at the site a high-level, 2D only, hydraulic model was setup using HEC-RAS version 6.3.1. The available Defra LiDAR data was used to prepare a 2D grid. No grid enhancements were made, and no structures included.

3.4.7. The inflow hydrographs for the HEC-RAS model estimated using the ReFH2 approach, taking catchment descriptors for the online FEH Web service. The inflows were calculated for 1% annual exceedance probability event (1 in 100-year return period) applying the central (26%) and higher central (39%) climate change impact. The resulting flow hydrographs are shown in **Figure 3-2**. The 1% annual exceedance probability event (1 in 100-year return period) flow peaks at 1.1 m^3/s, rising to 1.25 m^3/s and 1.4 m^3/s with future climate change (26% and 39% respectively).

Figure 3-2 – Inflow Hydrograph from ReFH2 Software



3.4.8. The maximum flood depth map for 1% AEP with central climate change is shown in Figure 3-3, and the 1% AEP with higher central climate change is shown in Figure 3-4.

Figure 3-3 – Maximum Flood Depth Map (1% AEP with Central Climate Change)

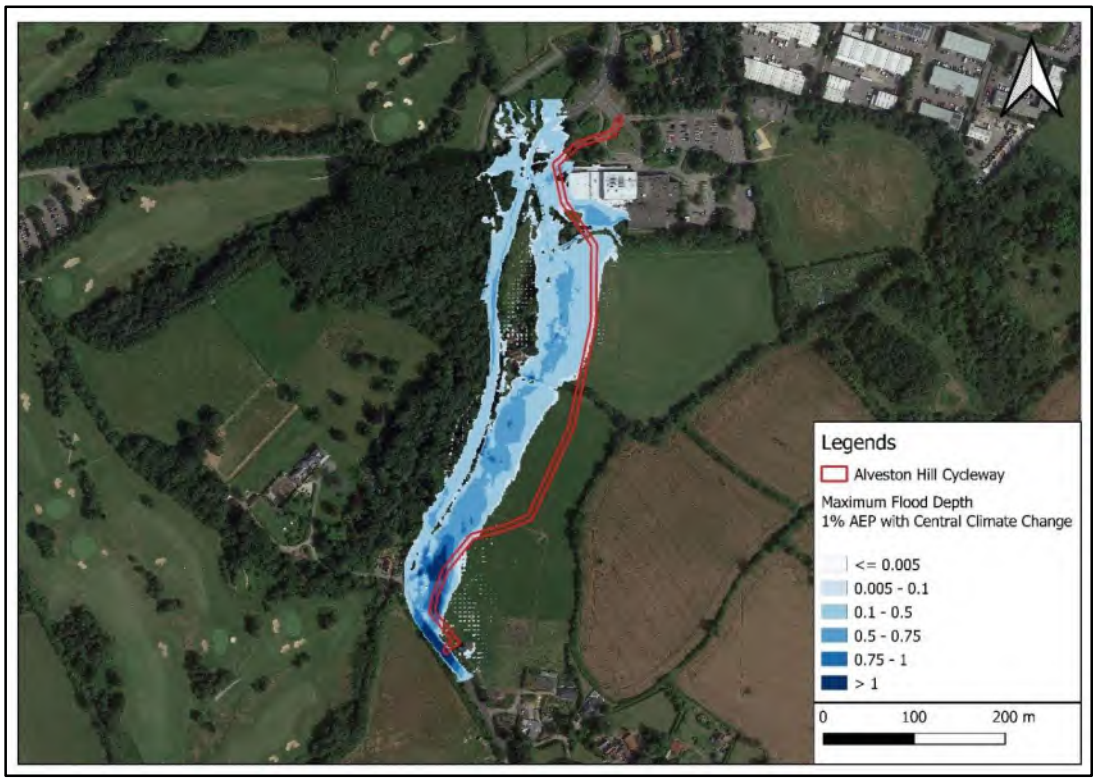
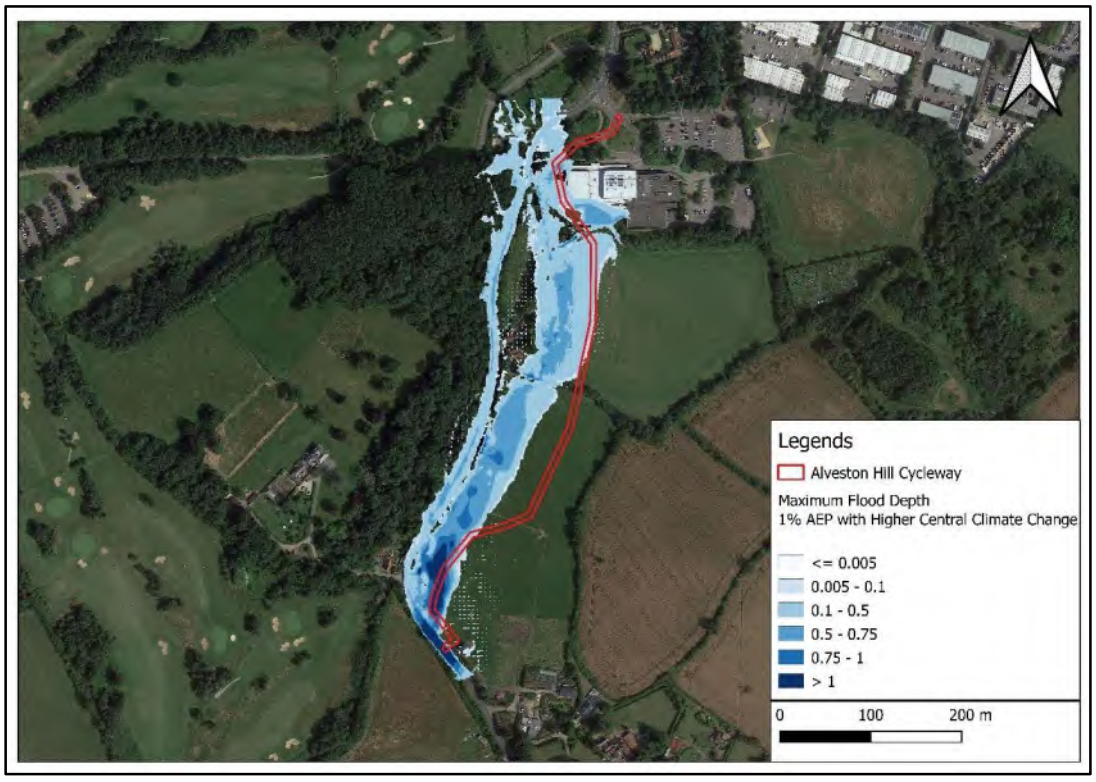


Figure 3-4 – Maximum Flood Depth Map (1% AEP with Higher Central Climate Change)



3.4.9. The maximum flood level and depth along the cycleway (north to south) for 1% AEP with central and higher central climate change is shown in the profile plots Figure 3-5 and Figure 3-6 respectively. The range of flood depth along the Alveston Hill cycle way was found to be up to 1.25 m for 1% AEP with the central climate change allowance, and up to 1.28 m for 1% AEP with the higher central climate change.

Figure 3-5 – Maximum Flood Level and Depth Plot (1% AEP with Central Climate Change)

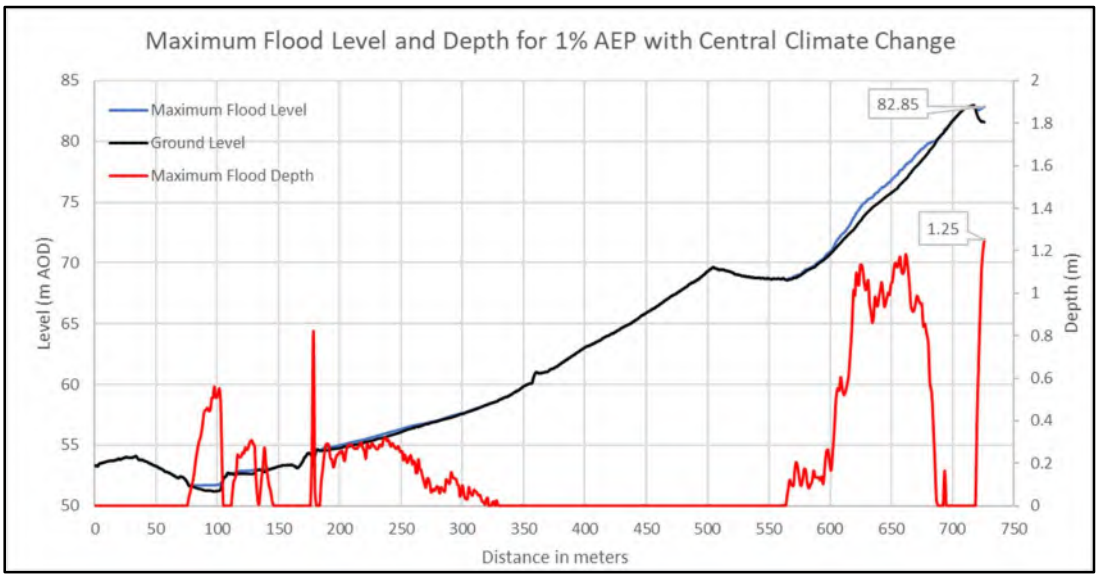
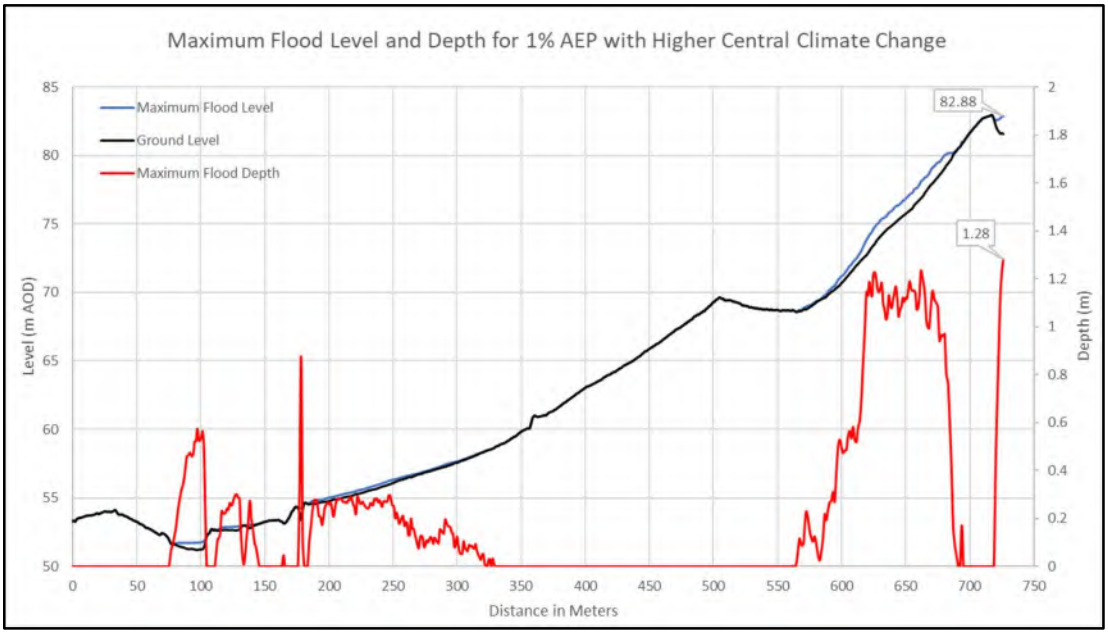


Figure 3-6 – Maximum Flood Level and Depth Plot (1% AEP with Higher Central Climate Change)



3.4.10. The greatest risk of deep water flooding is at chainage 600m to 700m on these plots. This is at the southern end of the cycleway, near the driveway to Marlwood Grange. Flood depths in this area exceed 1m over several 10s of metres.

4. Conclusion

4.1.1. This FRA has presented an assessment of flood risk to the Alveston Hill cycleway. The Scheme is at risk from flood sources as summarised below, with the risk based only on the published Environment Agency data, and reinforced by the high-level flood modelling.

Table 4-1 - Summary of flood risk

Flood risk Source	Relevant Source of flooding	Risk	Requires further assessment?
Fluvial	Yes	High	Yes – the impact of the Scheme on flood risk elsewhere needs to be considered.
Surface water	Yes	High	
Groundwater	Yes	Low	No
Sewers	No	Low	No
Other sources	No	Low	No
Coastal/tidal	No	None	No

4.1.2. At this stage, with limited design, no assessment has been made of the potential flood impacts on external receptors arising from the construction or operation of the cycleway. However, the assessment describes that the cycleway will be at flood risk, with some deep water inundation expected, particularly at the southern end where depths of over 1 m are predicted over the next 100 years.

4.1.3. This FRA concludes that:

- The Scheme crosses Environment Agency Flood Zone 2 and 3, albeit not over a Main River.
- The vulnerability classification of the Scheme is Less Vulnerable.
- The Scheme vulnerability is compatible with the envisaged flood risk.
- The Scheme satisfies the Sequential Test.

4.1.4. The Sequential Test is passed for the Scheme, through demonstration of the site selection process that took flood risk into account alongside other constraints.

4.1.5. Increases in rainfall and river flow arising from future climate change will increase flood risk from all sources.

4.2. Answers to the key questions

4.2.1. The FRA can now consider the questions:

Is the site likely to be at risk of flooding from: a watercourse, the sea, an estuary, groundwater, overland flow, an artificial drainage system, infrastructure failure?

Yes, there is a risk of flooding from the unnamed Ordinary Watercourse , a tributary of the Oldbury Pill, and also from overland flow arising from surface water accumulation.

Is the Scheme likely to obstruct the maintenance access requirements or affect the integrity of an existing flood defence?

No, there are no existing flood defences, or maintenance routes to any watercourse that will be affected by the Scheme.

Is the Scheme likely to increase flood risk elsewhere due to increased runoff rates and volumes from the site?

It is unknown at this stage, without design information, whether the Scheme would increase flood risk elsewhere. Controls on peak discharge rates and volumes will be included in the design. Further assessment will be required.

Given the above, and the nature of the development, is continued promotion of a possible development at the site appropriate?

Yes – the Scheme satisfies the basic requirements of the NPPF with regards flood risk.

4.3. Concluding remarks

4.3.1. In conclusion, the site at Alveston is at risk of flooding from fluvial and pluvial sources. There is a risk that the cycleway infrastructure will be inundated by the 1% annual exceedance probability event (1 in 100-year return period) over a combined distance of some 200m. However, much of the site will also remain flood free.

4.3.2. Flood levels across the site are predicted to increase with future climate change, with an uplift of 26% applied to surface flows, and/or 20% on peak rainfall intensity.

4.3.3. Site topographic survey and hydrological and hydraulic modelling would need to be carried out to complete a more detailed assessment of flood risk to the proposed cycleway.

4.4. Recommendations

4.4.1. It is recommended that the Scheme is tested through hydraulic modelling before detailed design, to define the risk over the lifetime of the development and ensure risks to the path and its users are minimised.

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