

***RIVER AVON TIDAL FLOOD RISK
MANAGEMENT STRATEGY***

***Activity 9A: Environmental Baseline
Review***

March 2016

Prepared for Bristol City Council

| Issue | Date | Details | Prepared by | Checked by | Approved by |
|-------|---------|-----------------------------|------------------------------|-------------|-------------|
| 1 | 11/1/16 | Draft report | Hayley Siers Gerwyn Macey | Sarah Milne | Neil Titley |
| 2 | 14/1/16 | Updated following JD review | Hayley Siers Gerwyn Macey | Sarah Milne | Neil Titley |
| 3 | 17/2/16 | Updated after client review | Hayley Siers | Sarah Milne | Neil Titley |
| 4 | 07/3/16 | Updated after client review | Hayley Siers | Sarah Milne | Neil Titley |

Limitations

AECOM Infrastructure & Environment UK Limited (“AECOM”) has prepared this Report for the sole use of **Bristol City Council** in accordance with the Agreement under which our services were performed [**River Avon Tidal Flood Risk Management Strategy RESP1007626 (23/10/15) and Response to Tender Submission Clarifications (03/11/15)**]. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by AECOM. The report takes into account the particular instructions and requirements of Bristol City Council. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by AECOM has not been independently verified by AECOM, unless otherwise stated in the Report.

The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between **14 December 2015** and **15 February 2016** and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances.

Where assessments of works or costs identified in this Report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM’s attention after the date of the Report.

Certain statements made in the Report that are not historical facts may constitute estimates, projections or other forward-looking statements and even though they are based on reasonable assumptions as of the date of the Report, such forward-looking statements by their nature involve risks and uncertainties that could cause actual results to differ materially from the results predicted. AECOM specifically does not guarantee or warrant any estimate or projections contained in this Report, but does take into account the particular instructions and requirements of Bristol City Council.

Copyright

© This Report is the copyright of AECOM Infrastructure & Environment UK Limited. Any unauthorised reproduction or usage by any person other than the addressee is strictly prohibited.

TABLE OF CONTENTS

| | | |
|-----|--|----|
| 1. | INTRODUCTION | 5 |
| 1.1 | River Avon Tidal Flood Risk Management Strategy | 5 |
| 1.2 | Purpose of this Report | 5 |
| 2. | APPROACH..... | 5 |
| 2.1 | Study Area | 5 |
| 2.2 | Sources of Mapping Data | 6 |
| 2.3 | Previous studies examined as part of TFRMS | 10 |
| 2.4 | Analysis and Mapping..... | 10 |
| 2.5 | Limitations..... | 11 |
| 2.6 | Consultation..... | 11 |
| 3. | FINDINGS FROM PREVIOUS STUDIES | 12 |
| 3.1 | Avon Strategic Defences First Phase Feasibility Study | 12 |
| 3.2 | Vulnerability of Historic Buildings to Tidal Flooding in Bristol due to Climate Change | 13 |
| 3.3 | Bristol Docks Estate, Wildlife Survey and Assessment..... | 14 |
| 3.4 | Bristol Deep Sea Container Terminal Environmental Statement, 2008..... | 14 |
| 4. | FINDINGS FROM DESKTOP MAPPING..... | 14 |
| 4.1 | Reach 1 | 16 |
| 4.2 | Reach 2 | 18 |
| 4.3 | Reach 3 | 21 |
| 5. | PROGRAMME, CONSENTING AND CONSULTATION..... | 24 |
| 5.1 | Programme | 24 |
| 5.2 | Consenting..... | 26 |
| 5.3 | Consultation..... | 26 |
| 6. | RECOMMENDATIONS AND NEXT STEPS..... | 28 |
| 6.1 | Look Ahead to Options Appraisal (Task 9B) | 28 |
| 6.2 | Next Steps to Inform Options Appraisal (Task 9B) | 28 |
| 6.3 | Look Ahead to Pre-Scoping Report (Task 9C)..... | 29 |

TABLES

| | |
|-----------|---|
| Table 2-1 | Sources of Environmental Constraints Data |
| Table 2-2 | Summary of Consultation |
| Table 4-1 | Mapping Index |
| Table 4-2 | Reach 1: Summary of Environmental Constraints and Opportunities |
| Table 4-3 | Reach 2: Summary of Environmental Constraints and Opportunities |
| Table 4-4 | Reach 3: Summary of Environmental Constraints and Opportunities |

APPENDICES

APPENDIX A: FINDINGS FROM PREVIOUS STUDIES

| | |
|------------|---|
| Figure 3-1 | Arup Avon Strategic Defences First Phase Feasibility Study: Study Area and Districts |
| Figure 3-2 | Arup Avon Strategic Defences First Phase Feasibility Study: Bristol Avon Flood Risk Environmental Constraints Map |
| Figure 3-3 | Arup Avon Strategic Defences First Phase Feasibility Study: Environmental Review |
| Figure 3-4 | Vulnerability of Historic Buildings to Tidal Flooding in Bristol due to Climate Change: Study Area |
| Figure 3-5 | Bristol Docks Estate Wildlife Survey and Assessment Study Area |

APPENDIX B: MAPPING

| | |
|--------------|---|
| Figure 4-1 | Study Area |
| Figure 4-2.1 | Ecology - Protected sites, Schedule 8 Sites and Species and Priority Habitats Inventory |
| Figure 4-2.2 | Ecology - Schedule 9 Invasive Species |
| Figure 4-2-3 | Ecology – European Protected Species |
| Figure 4-2.4 | Ecology - Birds |
| Figure 4-3 | Archaeology and Built Heritage |
| Figure 4-4.1 | Landscape and Land Use |
| Figure 4-4.2 | RIGS, ALC and Abstractions |
| Figure 4-5 | Air Quality Management Areas |
| Figure 4-6 | Key Environmental Constraints within Reach 1 |
| Figure 4-7 | Key Environmental Constraints within Reach 2 |
| Figure 4-8 | Key Environmental Constraints within Reach 3 |

APPENDIX C: RECOMMENDATIONS

| | |
|------------|---------------------------|
| Figure 5-1 | Ecological Survey Timings |
|------------|---------------------------|

APPENDIX D: CONFIDENTIAL DATA

| | |
|-----------|---|
| Figure C1 | Confidential - Badger Data |
| Figure C2 | Confidential – Regionally Important Geological Data |
| Figure C3 | Confidential – Bat Roost data |

1. INTRODUCTION

1.1 River Avon Tidal Flood Risk Management Strategy

Bristol City Council (BCC) has commissioned AECOM to prepare the River Avon Tidal Flood Risk Management Strategy (TFRMS). A tidal risk management strategy for Bristol is vitally important for the city, not just because of the threat to lives and property but also because of the risk of long-term reputational damage on the city's attractiveness and economic performance. Climate change predictions have the potential to constrain the scale and form of development in central Bristol today.

This project will deliver a TFRMS. This will recommend an adaptive programme; identify when flood risk management interventions are needed and how they will be funded. The Strategy, once adopted by BCC's Cabinet following a Key Decision, will provide evidence to support the partial refresh of Bristol's Local Plan. The TFRMS may conclude that no strategic intervention is justified for some time if, for instance, another possible form of intervention(s) can achieve the objectives.

Environmental assessment forms one of several work streams informing the development of this TFRMS. Inputs are programmed to ensure that environmental constraints and opportunities are integrated throughout the project, with reporting due at three key points:

- Baseline mapping (Task 9A);
- Options appraisal, including long-listing and short-listing considerations (Task 9B); and
- Pre-scoping report, containing a framework for future environmental assessment of the preferred option (Task 9C).

AECOM's overall approach to the TFRMS is set out within the wider baseline review, which has been prepared as part of Task 3A.

1.2 Purpose of this Report

The purpose of this report is to provide the findings of a desk based review of secondary data for the River Avon and immediate surrounds between the Severn Estuary and Netham Weir.

- Within the wider TFRMS, the project focus is the area of Bristol at risk of flooding from the River Avon – including the city centre (between Cumberland Basin and Netham), Shirehampton and Avonmouth. Consideration of downstream and upstream impacts are to be given including Pill and Portbury;
- Flood risk is dominated by tidal events (approx. downstream of Avon Bridge) however consideration for residual pluvial and fluvial flood risk is to be given.

The purpose of this report for activity 9A is to identify potential key constraints or opportunities relevant to a future flood risk management intervention. This has involved:

- An examination of relevant work undertaken to date, such as the Arup Pre-Feasibility Report;
- Baseline constraints mapping using open-source and other publicly available data, mapping into Geographical Information Systems (GIS);
- Initial consultation with data providers such as BCC's in-house GIS team and Ecological Officer, Natural England, the Environment Agency, Historic England and the Archaeological Officer;
- Illustration of constraints data overlaid on base mapping to inform the future tasks within the TFRMS programme; and
- Presenting recommendations for the next steps and how environmental considerations could be integrated within the wider TFRMS' evolution.

This report therefore contains a short overview of the methodology, followed by a description of the maps and findings. Site walkovers are scheduled for later in the programme, once specific options have been developed.

2. APPROACH

2.1 Study Area

The TFRMS extends from the mouth of the River Avon in the west, at the point where it joins the Severn Estuary, through Bristol city centre, to Netham Weir in the east. The Study Area has been divided into three reaches to assist in reporting and data interpretation, as illustrated in Figure 4-1:

- Reach 1: Avonmouth (from the seaward end of the longest breakwaters at the mouth of the estuary) to the eastern boundary of the Severn Estuary Special Area of Conservation (SAC) boundary on the River Avon;

- Reach 2: The Severn Estuary SAC boundary to the western end of Cumberland Basin; and
- Reach 3: The western end of Cumberland Basin to Netham Weir.

The Study Area boundary has been established based on the area of Bristol that is potentially at risk from tidal flooding by the end of the TFRMS appraisal period (2115). The area at risk was determined using a modelling approach, whereby the land elevation within Bristol that falls beneath the 2115 1:200 year (0.5% AEP) tidal water level i.e. Environment Agency Flood Zone 3 in the future, was defined and considered to be at risk. The extreme water level for 2115 was based upon the 'Upper end' climate change emissions scenario to derive the maximum potential flood extent.

2.2 Sources of Mapping Data

Ordnance Survey (OS) base mapping was obtained from BCC.

Environmental constraints data were obtained from the sources documented in Table 2-1.

Table 2-1: Sources of Environmental Constraints Data

| Data source | Datasets provided | Licence notes |
|---|--|--|
| Administration Boundaries - Downloaded from OS Open Data (December 2015) | Admin_Boundary_v1_pg | Contains OS data © Crown copyright [and database right] (2015) |
| Agricultural Land Classification - Downloaded from Environment Agency geoportal (December 2015) | Agricultural_Land_Class_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| AMIE - Downloaded from Historic England (2016) | AMIE_Events_v1_pt, AMIE_Monuments_v1_pg, AMIE_Monuments_v1_pl, AMIE_Monuments_v1_pt | - |
| Ancient Woodland Inventory - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - Ancient_Woodland_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| AQMA - Data downloaded from DEFRA (2015) | UK_AQMA_v1_pg | - |
| Bristol Regional Environmental Records Centre (BRERC) - Downloaded from Bristol City Council (2016) | Data provided for extent of Bristol City Council, clipped to BRERC Study area based on the advice of Ecologist, 500m from Severn Estuary, 100m from Study Area elsewhere, the data was further refined by performing definition queries to establish the relevant species and sites of significance - BRERC_AllRemaining_Schedule8_v1_pg, BRERC_Badgers_v1_pg, BRERC_Birds_v1_pg, BRERC_Complete_v1_pg, BRERC_Defined_v1_pg, BRERC_EuropeanProtectedSites_v1_pg, | - |

| Data source | Datasets provided | Licence notes |
|---|---|---|
| | BRERC_InvasiveSpecies_v1_pg, BRERC_LessThan1km_v1_pg | |
| Bus Stops - Downloaded from Bristol City Council (2015) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, BusStops_1kmClip_v1_pt | - |
| Conservation Areas - Downloaded from Bristol City Council (2015) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, Conservation_Areas_1kmClip_v1_pg | - |
| Country Parks - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - Country_Parks_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Cycle Network - Downloaded from Bristol City Council (2015) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, Cycle_Network_1kmClip_v1_pl | - |
| European Protected Species - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - EPS_1kmClip_v1_pt | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Historic Environment Records (HER) data. | Data provided for the extent of Bristol City Council, then clipped to a 1km buffer of the study area, Monuments_1kmClip_v1_pt | - |
| Important Bird Areas (IBA) - Downloaded from RSPB dataset website (2015) | Data Downloaded and clipped to 1km buffer of study area - IBA_1kmClip_v1_pg | - |
| Landfills - Downloaded from Bristol City Council (2015) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, HousholdWasteCentres_v1_pt | - |
| Listed Buildings - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - Listed_Buildings_1kmClip_v1_pt | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © |

| Data source | Datasets provided | Licence notes |
|--|---|--|
| | | Royal Mail copyright and database right 2015. |
| Local Nature Reserve (LNR) - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - LNR_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| National Character Areas - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - National_Character_Areas_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| National Nature Reserve (NNR) - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - NNR_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Public Rights of Way - Downloaded from Bristol City Council (2015) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, PRow_1kmClip_v1_pl | - |
| Noise - Downloaded from Bristol City Council (2015) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, ROAD_RAIL_NOISE_2005_10M1_1kmClip_v1 | - |
| Parks and Gardens - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - Parks_And_Gardens_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Priority Habitat Inventory - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - PriorityHabitatsInventory_1kmClip_v1_pg | - |

| Data source | Datasets provided | Licence notes |
|---|--|--|
| Regionally Important Geological Sites (RIGS) - Downloaded from Bristol City Council (2016) | Data provided for extent of Bristol City Council, clipped to 1km of Study Area - RIGS_Bristol_v1_pg | |
| Scheduled Monuments - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - Schedule_Monument_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Site of Special Scientific Interest (SSSI) - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - SSSI_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| SNCI – Bristol City Council (January 2016) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, SNCI_v1_pg | - |
| Special Areas of Conservation (SAC) - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - SAC_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Special Protection Areas (SPA) - Downloaded from Environment Agency geoportal (December 2015) | Data Downloaded and clipped to 1km buffer of study area - SPA_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Watercourses- Downloaded from OS Open Data (December 2015) | Data Downloaded and clipped to 1km buffer of study area - Surface_Water_1kmClip_v1_pg, Surface_Water_1kmClip_v1_pl | Contains OS data © Crown copyright [and database right] (2015) |
| Wetlands of International Importance | Data Downloaded and clipped to 1km buffer of study area - RAMSAR_1kmClip_v1_pg | © Environment Agency copyright and database rights 2015. © Ordnance |

| Data source | Datasets provided | Licence notes |
|---|--|--|
| (RAMSAR) - Downloaded from Environment Agency geoportal (December 2015) | | Survey Crown copyright. All rights reserved. Environment Agency, 100026380. Contains Royal Mail data © Royal Mail copyright and database right 2015. |
| Wildlife Corridors – Bristol City Council (January 2016) | Data provided for extent of Bristol City Council, clipped to 1km buffer of study area, Wildlife_Corridor_v1_pg | - |
| Woodlands- Downloaded from OS Open Data (December 2015) | Data Downloaded and clipped to 1km buffer of study area - Woodland_1kmClip_v1_pg | Contains OS data © Crown copyright [and database right] (2015) |

2.3 Previous studies examined as part of TFRMS

As part of the TFRMS the following studies have been reviewed:

- Arup (2014) Avon Strategic Defences First Phase Feasibility Study;
- Bristol City Council, Central Area Flood Risk Assessment;
- Wong, C; Foo, C; (2015) Vulnerability of Historic Buildings to Tidal Flooding in Bristol due to Climate Change;
- MPEcology (2009) Bristol Docks Estate, Wildlife Survey and Assessment; and
- Royal Haskoning (2008) Bristol Deep Sea Container Terminal Environmental Statement.

A summary of each study is provided in Section 3, the findings of which will be considered later in the strategic options appraisal.

2.4 Analysis and Mapping

ArcGIS 10.2 was used to collate the constraints data from numerous different data sources. All the data was imported into one uniform projection to ensure boundary matching. Once imported, geometry checking was performed to eliminate any potential data errors such as superfluous and redundant nodes. Attribute data was added to ensure that the source of the data was captured in the metadata, and then run through a clip analysis to the chosen Study Area boundary. A QA/QC procedure was undertaken to review and check this analysis, following which the Study Area was divided again into three separate zones allowing the flood zone to be studied in smaller portions. A buffer analysis was also run on several linear features; this allows the project team to view the critical constraints within the measured zones. A ‘falls within’ analysis was run to select all the constraints that are within these critical zones. Lastly, the constraints layers were symbolised appropriately ready for mapping output.

The BRERC data have been analysed using the following criteria, noting that the provided dataset contained over one million records:

- Records over 20 years old have been removed, along with those that lie out with the Study Area (defined for this dataset as the river channel edge plus 100 metres (m), increasing to plus 500 m beside the SPA)
- Species have been included if they feature on one or more of the following:
 - Wildlife and Countryside Act 1981: Schedules 1, 5, 8 and 9;
 - Conservation of Habitats and Species Regulations 2010: Schedule 2;
 - Natural Environment and Rural Communities Act 2006: Section 41;
 - The Protection of Badgers Act 1996;
 - Red List of Birds: Red and Amber List;
 - Any bird cited as a feature of interest for the Severn Estuary SPA; and
 - Any species cited as Annex II for the Severn Estuary SAC.

Three datasets are confidential: the badger records, the Regionally Important Geological Site and bat roost data therefore the maps will be issued separately.

2.5 Limitations

The Study Area is deliberately broad during this initial phase of environmental appraisal, and a corresponding level of detail of each dataset has been examined. In practice, this means that site walkovers have not been undertaken at this stage, and the assessment of potential significance of effects is not possible until design information is available for potential options. Similarly, no modelling to determine traffic, air or noise sensitivities (for example), nor detailed assessment (e.g. of traffic flows), has been undertaken to inform this report.

The potential sensitivity of locations to flood risk is covered in other AECOM reports. This 9A report does not cover technical constraints such as navigation, drainage, design of flood protection measures, or hydraulic modelling.

This report relies upon third party data as listed in Table 2-1, gathered in January 2016 (with the exception of BRERC data).

Data providers have also advised of the following limitations:

- BCC has provided BRERC data, but advises that the dataset was last refreshed in early 2015. It is recommended that a further download directly from BRERC is commissioned to inform stages 9B and 9C of the TFRMS
- North Somerset Council has not provided any Conservation Area data

Additionally, other data has been requested but is still awaited from third party providers including wildlife corridors, landscape character areas (other than National Character Areas) and any areas of green belt.

2.6 Consultation

Table 2-2 below summarises the relevant consultation undertaken during the preparation of the baseline mapping review.

Table 2-2: Summary of Consultation

| Consultee | Summary of feedback provided in relation to the baseline review |
|--|--|
| BCC County Ecologist (consulted via telephone) | BCC is a partner with BRERC and is sent a download of the central dataset on an annual basis. The dataset provided to inform the TFRMS dates to early 2015. Particular care should be taken when interpreting species records, e.g. some are logged to the nearest 1km grid square. Species such as otter may well be recorded outside the TFRMS study area but could still be using the watercourses as part of a wider territory, so advice from ecologists is recommended when interpreting the records. It is recommended that the Sites of Nature Conservation Interest are recorded, together with Wildlife Corridors which have the aspiration of connecting such sites. Generally in agreement with the approach to task 9A. |
| BRERC Manager (consulted via telephone) | Provided an overview of the datasets available and the commercial arrangements for obtaining the data via BCC or BRERC directly. |
| BCC Historic Environment (consulted via telephone conference with project manager, AECOM and Environment Agency) | General commentary on datasets such as the Historic Environment Record, noting that historic landscape character areas have not been defined for Bristol. Generally in agreement with the approach to Task 9A. |
| Natural England Land Use Planning (consulted via telephone) | Recommended that landscape character areas are mapped within the baseline review. Identified other datasets that could be worth considering later in the programme such as Nature Improvement Areas. Overall the approach to environmental assessment is in line with expectations. |
| North Somerset Council Biodiversity Officer (consulted via telephone) | Confirmation received that biological records are sent to Bristol Regional Environmental Records Centre. |

3. FINDINGS FROM PREVIOUS STUDIES

A summary of the documents reviewed as part of the TFRMS is provided below. Drawings and tables that are particularly pertinent have been extracted and are presented in the Appendix A.

3.1 Avon Strategic Defences First Phase Feasibility Study

A First Phase Feasibility Study¹ was produced by Arup for Bristol City Council in June 2014 to appraise strategic options to manage flood risk in central Bristol from the present day to 2110. The study area includes the River Avon, the Floating Harbour, and adjacent areas in central Bristol see Appendix A Figure 3-1.

Flood risk predictions were based on the findings of the Central Area Flood Risk Assessment (CAFRA), which is a collection of technical studies commissioned by BCC between 2010 and 2013 to investigate flood risk from tidally influenced watercourses within Bristol.

The First Phase Feasibility study concluded that large parts of Bristol's centre are vulnerable to flooding, predominantly from the River Avon's tides and storm surges. It found that 300 homes and commercial properties have a greater than a 1 in 20 predicted annual chance of flooding from the River Avon today.

If the current trend of rising sea levels continues and accelerates, as expected due to climate change, the study found that the chance of flooding significantly increases with a prediction of almost 1,500 city centre properties with a relatively low chance of flooding today having a 1 in 2 chance of flooding in any year by the end of the 21st Century.

A preliminary environmental baseline desk study was completed for the Arup Study Area. This covers a similar area to that used in this report (refer to section 2.1). However, is slightly different as it begins further upstream at Hanham Weir and ends where the M5 crosses the River Avon in Avonmouth, therefore does not include the area where the River Avon meets the Severn estuary. A map showing the key environmental constraints for each intervention is appended to this report in Appendix A Figure 3-2. An environmental review is included in Appendix A Figure 3-3.

A high level environmental baseline desk study was completed as part of the study. A summary is provided below:

Flora and Fauna

There are five statutory designated sites within the Arup study area, comprising:

- The Avon Gorge Site of Special Scientific Interest (SSSI) and the Avon Gorge Woodlands Special Area of Conservation (SAC) adjacent to the river mudflats.
- The Severn Estuary, situated close to Pill, is designated as a SSSI, SAC, Ramsar and Special Protection Area (SPA). The SAC incorporates the River Avon whilst the SPA incorporates the River Avon mudflats.
- Horseshoe Bend SSSI is located on the northern bank of the River Avon along the section closest to Shirehampton Park.
- Ashton Court SSSI is located outside the city centre of Bristol as the river flows downstream to the Avon Gorge.
- Leigh Woods National Nature Reserve is situated beside the River Avon adjacent to Ashton Court.

There are also numerous Sites of Nature Conservation Interest (SNCI) within the area, including the River Avon SNCI (extending approximately from the M5 Bridge at Avonmouth to the east side of Bristol) and Lamplighters Marsh SNCI at Shirehampton. Lamplighters Marsh is a public open space comprising a narrow strip of land between the railway line, which connects Bristol to Avonmouth and the River Avon.

The River Avon (from the Severn confluence to the Cumberland Basin Lock) is designated as a heavily modified waterbody. The current ecological quality and predicted ecological quality for 2015 are "good potential", however it has an at risk status; works within channel or with potential to impact on water quality could therefore impact on the current good status. Upstream of this, within Bristol City Centre, the River Avon and its tributaries are designated as "moderate potential" and at risk.

Protected Species

The ecological surveys carried out for BCC in 2009 identified some statutory protected species including mute swans and evidence of otter. No reptiles or amphibians were recorded.

¹ Arup (2014) Avon Strategic Defences First Phase Feasibility Study

Archaeology and Cultural Heritage

Scheduled Monuments within the study area include the Underfall Yard, Fairbairn Crane and the nearby Clifton Down camp in Leigh Woods. The Underfall Yard is also designated as Grade II* listed.

Clifton Down Suspension Bridge is Grade I listed and several bridges crossing the New Cut are designated Grade II listed. There are many Grade II listed buildings within the centre of Bristol, including along York Road and in Bedminster.

Landscape and Visual Amenity

The Study Area covers a wide area of the city and the surrounding landscape. The majority of the Study Area falls within the Bristol, Avon Valleys and Ridges National Character Area (NCA). The City Docks Conservation Area 17 is within the Study Area. The river valley of two rivers has produced a fairly low lying level valley bottom with pronounced hillsides. The Conservation Area comprises rich views with traditional features, contributing significantly to the townscape character. A small portion of the Study Area along the Lower Avon (see Figure 17) is within the Severn and Avon Vales NCA.

Geomorphology

Within Bristol, the River Avon has been heavily modified. The majority of the section of the watercourse known as the New Cut was created to divert a section of the River Avon after its original course was used to form the Floating Harbour. As the watercourse flows out of the city towards the Severn Estuary it is re-joined by the Floating Harbour and then becomes a much wider channel passing through the Avon Gorge with the A4 (known as the Portway) forming the northern bank until just west of the Clifton Suspension Bridge. The watercourse becomes a more natural state as it flows through open landscape towards the Severn Estuary.

Transport

The River Avon is navigable from Bristol City Centre to the Severn Estuary by seagoing vessels and there is frequent commercial and non-commercial traffic on the river and in the harbour area.

The river is navigable either side of high tide but dries to non-navigable steep sided muddy channel at low tide. Local sailing clubs operate on the Avon, including at Shirehampton and at Pill.

The A4 Portway is a key route into the city, an important public transport route with a local rail line and park and ride facility. The opposite bank has an active freight railway to Portishead.

Recommendations

The study recommended an adaptive strategic approach to reduce the predicted flood threat to people and property in central Bristol including:

- Improving the evidence base and confidence in predictions of present and future flood risk;
- Better flood forecasting, warning and planning;
- Raising defences at low-spots along the riverside to reduce the risk of overtopping into the Floating Harbour;
- Local interventions and improving operational resilience to lower the residual flood risk from high river flows and surface water as part of the wider Flood Risk Management Strategy for Bristol; and
- Longer term strategic protection against storm tides within allowance for the effect of climate change; the most likely recommendation is for a citywide solution, involving a tidal surge barrier on the River Avon that would be designed and operated to exclude the very highest tides.

3.2 Central Area Flood Risk Assessment

The Bristol Central Area Flood Risk Assessment (CAFRA) was commissioned by BCC to assess the present day flood risk from the River Avon based on fluvial and tidal modelling. Whilst the Assessment is useful in understanding the hydrological baseline of the area, it did not add any specifics when considering the environmental constraints within the Study Area and therefore was not considered any further within this report. Please refer to the Baseline Review for activity 3A for further information on this CAFRA.

3.3 Vulnerability of Historic Buildings to Tidal Flooding in Bristol due to Climate Change²

This University College London (UCL) undergraduate project aims to assess the vulnerability of historic buildings to tidal flooding in Bristol city through a vulnerability index model, physical models and economic models.

The vulnerability of historic buildings is defined as the exposure, susceptibility and resilience of structures listed as Grade I, II* or II to flooding. Field data was collected from buildings in Bristol (see Appendix A Figure 3-4) for those listed as historic or heritage buildings, and within a predicted flood extent of a 1 in 200 year flood event.

This initial report outlines the preparation that has been involved with the data collection, analysis and model stages of the project. Evidence from the processed data indicates that there is an increased threat of damage to historical buildings due to climate change. The project will be compiled and presented in the form of a dissertation which is due to be submitted in March 2016. This report currently has limited value to the TFRMS; however it does have the potential to add value to the options appraisal when fully developed into a dissertation.

3.4 Bristol Docks Estate, Wildlife Survey and Assessment

This assessment³ was commissioned by BCC and presents the findings of a wildlife survey of the BCC Docks Estate in 2009. A map of the assessment Study Area is appended to this report and is shown in Appendix A Figure 3-5.

The aim of the survey was to assist the Council in its duties under the Natural Environment and Rural Communities Act (NERC) 2006, to conserve biodiversity interest on land and buildings within its ownership. Primarily the survey was intended to identify:

- Areas of high biodiversity value;
- Locations of rare or uncommon species;
- Areas where protected species may reasonably be presumed present;
- Opportunities for habitat enhancement and improved public enjoyment.

The most notable finding from the survey was that otters are active within the city centre and that there is potential for this species to breed here as long as quality otter habitat is retained and, is created for them.

Additionally, a rich diversity and high biomass of fish, both freshwater and estuarine species was found. Over 400 species of vascular plant were recorded, the majority of which were native, but also many alien species. A number of recommendations were made in order to increase the knowledge base, enhance biodiversity interest, and engage the public with the Docks Estate. The findings from this assessment will be considered in later stages of the strategic options appraisal, however it is important to note that the survey area only covers a small area of the TFRMS study extent and the protected species surveys have surpassed the industry standard life span and would require repeat surveys to refresh the survey findings.

3.5 Bristol Deep Sea Container Terminal Environmental Statement, 2008

An Environmental Statement⁴ accompanied a planning application for a deep sea container terminal on the site of a former oil terminal at Avonmouth Dock. It was proposed that this terminal would be designed to service existing large container ships. In order to accommodate these vessels, redevelopment and reclamation of an area of land for a new quay and container handling and storage facilities would be required. A wide range of parameters were assessed through the EIA process including ecology, archaeology and heritage and landscape and visual setting amongst others. The baseline information that is included in the Environmental Statement is potentially useful, however the survey area only covers a small area and the protected species surveys would no longer comply with industry standard guidance due to the amount of time that has passed since they were completed.

4. FINDINGS FROM DESKTOP MAPPING

A series of figures have been produced to illustrate the environmental data. An index of the environmental constraints drawings is provided in Table 4-1.

Table 4-1: Mapping Index

² Wong, C; Foo, C; (2015) Vulnerability of Historic Buildings to Tidal Flooding in Bristol due to Climate Change

³ MPEcology (2009) Bristol Docks Estate, Wildlife Survey and Assessment

⁴ Royal Haskoning (2008) Bristol Deep Sea Container Terminal Environmental Statement

| Figure | Title | Content |
|--------|---|---|
| 4-1 | Study area | Study area Reaches 1-3 |
| 4-2.1 | Ecology | Study area Reaches 1-3 Protected sites (international, national and local) BRERC data – Schedule 8 (Wildlife and Countryside Act 1981) Sites and Species Priority Habitats Inventory SNCI data Wildlife Corridors |
| 4-2.2 | Ecology | Study area Reaches 1-3 BRERC Data – Schedule 9 (Wildlife and Countryside Act 1981) Invasive Species |
| 4-2.3 | Ecology | Study area Reaches 1-3 BRERC Data – European Protected Sites and Species (Note that designated sites such as SSSI, SPA and SAC are included in Figure 4-2-1) |
| 4-2.4 | Ecology | Study area Reaches 1-3 BRERC Data – Birds |
| 4-3 | Archaeology and built heritage | Study area Reaches 1-3 Scheduled monuments Listed Buildings Conservation Areas Registered parks and gardens AMIE Monuments (Archives Monument Information England) |
| 4-4.1 | Landscape and Land Use | Study area Reaches 1-3 Recycling Centres Household Waste Centres National Cycle Networks Public Rights of Way National Character Areas |
| 4-4.2 | Regionally Important Geological Sites (RIGS), Agricultural Land Classification and Abstractions | Regionally Important Geological Sites (RIGS) Agricultural Land classification Abstractions |
| 4-5 | Air quality | Air Quality Management Areas |

| Figure | Title | Content |
|--------|---|--|
| 4-6 | Key Environmental Constraints within Reach 1 | <p>Internationally designated sites (SAC, SPA, Ramsar)</p> <p>Important Bird Areas</p> <p>Conservation Areas, Listed Buildings, and Scheduled Monument within 10m of the river (although there is potential for significant effects beyond this distance, dependent upon design parameters)</p> <p>National Nature Reserves and SSSIs, and Ancient Woodland and Priority Habitats within 10m of the river bank</p> |
| 4-7 | Key Environmental Constraints within Reach 2 | <p>Internationally designated sites (SAC, SPA, Ramsar)</p> <p>Important Bird Areas</p> <p>Conservation Areas, Listed Buildings, and Scheduled Monument within 10m of the river (although there is potential for significant effects beyond this distance, dependent upon design parameters)</p> <p>National Nature Reserves and SSSIs, and Ancient Woodland and Priority Habitats within 10m of the river bank</p> |
| 4-8 | Key Environmental Constraints within Reach 3 | <p>Internationally designated sites (SAC, SPA, Ramsar)</p> <p>Important Bird Areas</p> <p>Conservation Areas, Listed Buildings, and Scheduled Monument within 10m of the river (although there is potential for significant effects beyond this distance, dependent upon design parameters)</p> <p>National Nature Reserves and SSSIs, and Ancient Woodland and Priority Habitats within 10m of the river bank</p> |
| C1 | Confidential – badger data | BRERC – Badger Sites |
| C2 | Confidential – Regionally Important Geological Sites (RIGS) | BRERC - RIGS |
| C3 | Confidential – bat roosts data | BRERC |

4.1

Reach 1

This Reach extends from Avonmouth (from the seaward end of the longest breakwaters at the mouth of the estuary) through Avonmouth and Shirehampton to the SAC boundary on the River Avon.

Table 4-2: Reach 1, Summary of Environmental Constraints and Opportunities

| Topic area | Commentary |
|------------|---|
| Land Use | Reach 1 is located within the jurisdiction of Bristol City Council, on the border with North Somerset and covers the area from Avonmouth to Shirehampton. Due to the low lying topography of this Reach the River can be easily accessed from the river bank. |

| Topic area | Commentary |
|------------|---|
| | <p>The M5 crosses the River Avon near the Avonmouth Docks. There is a railway track which runs along the northern bank of the River Avon with railway stations at Avonmouth and Shirehampton. There is a Public Right of Way (PRoW) and cycle path which runs along the bank of the River Avon in the south east of Reach 1.</p> <p>Avonmouth Docks is located on the eastern bank of Reach 1, and therefore Reach 1 is mainly industrial in terms of land use. The western bank comprises of grade 3 (good to moderate quality) and grade 4 (poor quality) agricultural land.</p> |
| Ecology | <p><u>Designations</u></p> <p>The whole of Reach 1 is designated as the Severn Estuary Site of Special Scientific Interest (SSSI), the condition of which is described as 'unfavourable declining'. Reach 1 is also designated as a Special Area of Conservation (SAC) and Special Protection Areas (SPA). The SAC incorporates the River Avon whilst the SPA incorporates the River Avon mudflats. Additionally, the whole of Reach 1 is also a Ramsar site and an Important Bird Area (IBA) according to RSPB data. Lamplighters Marsh Site of Nature Conservation Interest (SNCI) is located within Reach 1 on the eastern bank of the River Avon within Shirehampton.</p> <p>There is a Wildlife Corridor within this Reach which is the Railway adjacent to Gloucester Road sidings. A smaller Wildlife Corridor is located at Portway Allotments.</p> <p><u>Protected Species</u></p> <p><i>European Protected Species</i></p> <p>No records of European protected species were returned from the data search within the Reach 1 Study Area or the immediate surrounding area.</p> <p><i>Birds</i></p> <p>The following bird species which are all Schedule 1, Red or Amber listed were recorded in the data search within the Reach 1 Study Area: starling (<i>Sturnus vulgaris</i>), whinchat (<i>Saxicola rubetra</i>), lesser back-backed gull (<i>Larus fuscus</i>), black-headed gull (<i>Chroicocephalus ridibundus</i>), common sandpiper (<i>Actitis hypoleucos</i>), dunlin (<i>Calidris alpina</i>), green woodpecker (<i>Picus viridis</i>), house martin (<i>Delichon urbicum</i>), house sparrow (<i>Passer domesticus</i>), kingfisher (<i>Alcedo atthis</i>), little grebe (<i>Tachybaptus ruficollis</i>), kestrel (<i>Falco tinnunculus</i>), mallard (<i>Anas platyrhynchos</i>), meadow pipit (<i>Anthus pratensis</i>), peregrine falcon (<i>Falco peregrinus</i>), redshank (<i>Tringa totanus</i>), redwing (<i>Turdus iliacus</i>), swallow (<i>Hirundo rustica</i>), water rail (<i>Rallus aquaticus</i>), willow warbler (<i>Phylloscopus trochilus</i>), shelduck (<i>Tadorna tadorna</i>), lapwing (<i>Vanellus vanellus</i>), reed bunting (<i>Emberiza schoeniclus</i>), bullfinch (<i>Pyrrhula pyrrhula</i>), herring gull (<i>Larus argentatus</i>), curlew (<i>Numenius arquata</i>), dunnock (<i>Prunella modularis</i>), bullfinch (<i>Pyrrhula pyrrhula</i>), linnets (<i>Carduelis cannabina</i>), song thrush (<i>Turdus philomelos</i>), oystercatcher (<i>Haematopus ostralegus</i>), teal (<i>Anas crecca</i>), cormorant (<i>Phalacrocorax carbo</i>), swift (<i>Apus apus</i>), common gull (<i>Larus canus</i>), skylark (<i>Alauda arvensis</i>) and grey wagtail (<i>Motacilla cinerea</i>)</p> <p>The data search also returned addition records of the following birds outside of the Reach 1 Study Area but within close proximity: green woodpecker (<i>Picus viridis</i>); mute swan (<i>Cygnus olor</i>); grasshopper warbler (<i>Locustella naevia</i>); yellowhammer (<i>Emberiza citrinella</i>); black redstart (<i>Phoenicurus ochruros</i>); stonechat (<i>Saxicola torquata</i>); snipe (<i>Gallinago gallinago</i>); ringed plover (<i>Charadrius hiaticula</i>); bar-tailed godwit (<i>Limosa lapponica</i>); Leach's petrel (<i>Oceanodroma leucorhoa</i>); great skua (<i>Stercorarius skua</i>); little gull (<i>Larus minutus</i>); barn owl (<i>Tyto alba</i>); turnstone (<i>Arenaria interpres</i>); Mediterranean gull (<i>Larus melanocephalus</i>); knot (<i>Calidris canutus</i>); Cetti's warbler (<i>Cettia cetti</i>); stock dove (<i>Columba oenas</i>); gadwall (<i>Anas strepera</i>); wigeon (<i>Anas penelope</i>); whimbrel (<i>Numenius phaeopus</i>).</p> <p><i>Badgers (confidential)</i></p> <p>One badger (<i>Meles meles</i>) record was returned from the data search within the Study Area adjacent to Reach 1.</p> <p><i>Invasive species</i></p> <p>A record of Japanese knotweed (<i>Fallopia japonica</i>) was recorded within the Reach 1 Study Area. The record is located north of the River Avon, south of the A4 and east of the M5.</p> <p>Canada goose (<i>Branta Canadensis</i>), New Zealand pigmyweed (<i>Crassula helmsii</i>), Virginia creeper (<i>Parthenocissus quinquefolia</i>) and Himalayan cotoneaster</p> |

| Topic area | Commentary |
|---------------------------------------|---|
| | <i>(Cotoneaster simonsii)</i> were recorded outside the Reach 1 Study Area but in close proximity. |
| Landscape Character and Visual Impact | <p><u>Landscape</u></p> <p>The National Character Area of this Reach is 106 - Severn and Avon Vales.</p> <p>Particularly relevant policies include:</p> <p>SEO 1: Protect and manage the landscape, heritage and biodiversity associated with the Severn Estuary, the river valleys and other hydrological features, planning for a landscape scale expansion of wetlands, intertidal habitats and unimproved grasslands along river floodplains through, restoration, expansion and re-linkage of existing remnant areas of semi-natural habitat.</p> <p>SEO 3: Reinforce the existing landscape structure as part of any identified growth of urban areas, hard infrastructure and other settlements ensuring quality green infrastructure is incorporated enhancing health, access, recreation, landscape, biodiversity and geodiversity.</p> <p><u>Visual Amenity</u></p> <p>The settlements of Pill and Ham Green are located on the western bank of the River Avon in close proximity to Reach 1, which include many residential properties that overlook the river. Shirehampton is located on the eastern bank of the River Avon; properties in this location are generally set back approximately 200 m from the bank of the River Avon in this Reach.</p> |
| Hydrology | <p>Reach 1 is located within an area of tidal water. There are no Surface Water Abstraction points within Reach 1.</p> <p>Please refer to section 2.3.1 of the Bristol Tidal Flood Risk Management⁵ Strategy for further information.</p> |
| Archaeology and Built Heritage | <p>There are 8 Grade II listed buildings located within the vicinity of Reach 1, the majority of which are located behind Royal Edward Docks on the east bank of the River Avon. The setting of which should be a consideration as the options appraisal progresses.</p> <p>There are several HER monuments within Avonmouth Docks. The HER's which are in close proximity to the River Avon include: a First World War Coastal Battery located at the South Pier of Avonmouth Docks, Royal Edward Pier Station, a Gibbet on the north side of the River Avon at Avonmouth and a Limekiln at Avonmouth Dock.</p> <p>There are no Registered Park and Gardens, Scheduled Monuments or Grade I or Grade II* Listed buildings surrounding Reach 1. There are 5 records of Archives and Monuments Information England (AMIE) within Reach 1.</p> |
| Air Quality | This Reach is not within a UK Air Quality Management Area (AQMA). |
| Morphology | The morphology of this Reach is of a natural state as it flows through an open landscape towards the Severn Estuary. |

4.2

Reach 2

Reach 2 extends from the SAC boundary through Pill and the Clifton Suspension Bridge to the western end of Cumberland Basin.

Table 4-3: Reach 2, Summary of Environmental Constraints and Opportunities

| Topic area | Commentary |
|------------|---|
| Land Use | <p>Reach 2 is located within the jurisdiction of the City of Bristol and covers the area from Pill to the Hotwells area of the city.</p> <p>The land use of the western bank of Reach 2 is generally recreational due to the large expanse of woodland which is present along the Avon Gorge, with the exception of the area from Pill to Leigh Court which is grade 2 (very good quality) and 3 (good to</p> |

⁵ AECOM (2016) Bristol Tidal Flood Risk Management Strategy – CAFRA Model Review

| Topic area | Commentary |
|------------|--|
| | <p>moderate quality) agricultural land.</p> <p>On the eastern bank the land use is predominantly residential, particularly in the area surrounding Shirehampton, Sea Mills and Sneyd Park. There are also areas which are more recreational in nature such as Shirehampton Golf Course, Bristol Manor Farm FC in Sea Mills, Leigh Woods National Nature Reserve and Durdham Downs. .</p> <p>A PRoW runs along both sides of Reach 2 which is also part of the cycle network. Accessibility to the River corridor is more difficult in this Reach as the river flows through Avon Gorge which is steeper in topography.</p> <p>A Regionally Important Geological Site (RIGS) adjoins the northern shore of Reach 2, at Horseshoe Bend, Shirehampton; and another near to the Suspension Bridge at Avon Gorge Bridge Road Cutting.</p> |
| Ecology | <p><u>Designations</u></p> <p>There are four SSSI's which are located in close proximity to Reach 2 All of the designated sites are on the banks of the River Avon and not within the river itself. These include:</p> <ul style="list-style-type: none"> • Ham Green SSSI, which is located inland on the southern bank of the River Avon near Pill. A railway track runs through the SSSI, which is designated for its geological importance. The condition of this SSSI is described as 'Unfavourable, No Change'. • Horseshoe Bend SSSI, which is located on the northern bend of the River Avon in front of Shirehampton Golf Course. This SSSI is designated for supporting a number of nationally rare trees as well as nationally scarce plant species. The condition of this SSSI is described as 'Favourable'. • Avon Gorge SSSI, which covers a large area on the eastern and western bank of Reach 2 from Leigh Court up to the Hotwells area of the city. The SSSI is designated for its geological interest and because it supports a number of nationally rare plant and tree species. The condition of this SSSI is generally described as 'Unfavourable Recovering', however there are large areas which are in 'Favourable' condition. The area covering the SSSI is also designated as Avon Gorge Woodlands SAC. • Ashton Court SSSI, located on the western bank of the River Avon in the area between Avon Gorge and Long Ashton Golf Course. This includes the Leigh Woods area. This SSSI is predominantly designated for its rich invertebrate fauna including many species which are nationally scarce. The condition of the SSSI is generally described as 'Favourable', however there is an area in the south western corner of the SSSI which is in 'Unfavourable Recovering' condition. <p>There are several areas of ancient woodland which line the Avon Gorge, mainly on the western bank including: Leigh Wood/Markham Bottom, Leigh Woods which is also a National Nature Reserve and Rownham Wood. On the eastern bank of the river is Clifton Down Wood which is also an area of ancient woodland.</p> <p>The Avon Gorge Woodlands Special Area of Conservation (SAC) is of European importance.</p> <p>There are two SNCI's within Reach 2. Three Acre Covert and Portway Gardens SNCI is located between Shirehampton and Sea Mills close to the A4. Trym Valley SNCI is located within a tributary of the River Avon between Sea Mills and Stoke Bishop.</p> <p>There are several wildlife corridors located within this Reach including: Lamplighters Open Space, City and Port of Bristol Sports Ground, Nibley Road Open Space, Manor Farm Sports Ground and Playing Fields, Signal Station Allotments and Harbour Wall, Land between Sneyd Park and the Portway, <u>Protected Species</u></p> <p><i>European Protected Species</i></p> <p>Otter (<i>Lutra lutra</i>) has been recorded south of Shirehampton golf course within the Reach 2 Study Area.</p> <p>Other European protected species records returned from the data search within the Reach 2 Study Area include: two records of lesser horseshoe bat (<i>Rhinolophus hipposideros</i>); four records of noctule bat (<i>Nyctalus noctula</i>); one record of Daubenton's bat (<i>Myotis daubentonii</i>) and one record of common pipistrelle</p> |

| Topic area | Commentary |
|--|--|
| | <p>(<i>Pipistrellus pipistrellus</i>).</p> <p>Additional European protected species records returned from the data search but outside the Reach 2 Study Area include records of: brown long-eared bat (<i>Plecotus auritus</i>); soprano pipistrelle (<i>Pipistrellus pygmaeus</i>); serotine (<i>Eptesicus serotinus</i>); Natterer's bat (<i>Myotis nattereri</i>); <i>Myotis</i> bat sp.; and greater horseshoe bat (<i>Rhinolophus ferrumequinum</i>).</p> <p><i>Birds</i></p> <p>Records of birds which are Schedule 1, Red or Amber listed within the Reach 2 Study Area are listed below: shelduck; cormorant; mallard; kestrel; redshank; black-headed gull; house martin; meadow pipit; starling; house sparrow; bullfinch; song thrush; dunnock; herring gull; common gull; swift; willow warbler; reed bunting; skylark; grey wagtail; curlew; lapwing; common sandpiper; dunlin; green woodpecker; redwing; water rail; sand martin (<i>Riparia riparia</i>); swallow; oystercatcher; stonechat; teal; stock dove; tufted duck; linnet; lesser black-backed gull; black-headed gull; snipe; mute swan; great black-backed gull; whimbrel; marsh tit (<i>Poecile palustris</i>); yellowhammer; goldcrest (<i>Regulus regulus</i>); goldeneye (<i>Bucephala clangula</i>); greenshank (<i>Tringa nebularia</i>); Mediterranean gull; ruff (<i>Philomachus pugnax</i>); spotted redshank; wigeon; barn owl; kingfisher; crossbill (<i>Loxia curvirostra</i>); ringed plover; peregrine falcon; mistle thrush (<i>Turdus viscivorus</i>); hawfinch (<i>Coccothraustes coccothraustes</i>); and goshawk (<i>Accipiter gentilis</i>).</p> <p><i>Badgers</i></p> <p>The data search returned 11 records of badger within the Reach 2 Study Area and 19 records just outside of the Reach 2 Study Area.</p> <p><i>Invasive Species</i></p> <p>The following invasive non-native species have been recorded within the Reach 2 Study Area: Japanese knotweed; Himalayan balsam (<i>Impatiens glandulifera</i>); grey squirrel (<i>Sciurus carolinensis</i>); and mandarin duck (<i>Aix galericulata</i>).</p> <p>Additional invasive non-native species were returned from the data search but are not within the Study Area: variegated yellow archangel (<i>Lamiastrum galeobdolon subsp. Argentatum</i>); wall cotoneaster (<i>Cotoneaster horizontalis</i>); Virginia creeper; and budgerigar (<i>Melopsittacus undulates</i>).</p> |
| <p>Landscape Character and Visual Impact</p> | <p><u>Landscape</u></p> <p>The National Character Area of this Reach is 118 - Bristol, Avon Valleys and Reaches.</p> <p>Particularly relevant policies include:</p> <ul style="list-style-type: none"> • SEO 2: Protect and manage the strong sense of history and many historical assets ranging from prehistoric barrows to the mining legacy, as well as the Avon Gorge and the many varied geological exposures within this geologically significant landscape, to enable recreation and access, education, tourism and continued enjoyment of the heritage of the area. • SEO 4: Protect and manage the landscape, heritage and biodiversity associated with the Avon River corridor, other river valleys and lakes, planning for a landscape-scale enhancement of wetlands, wet woodland and semi-natural grasslands along river flood plains for the benefits to biodiversity, climate regulation, water quality and flooding mitigation <p><u>Visual Amenity</u></p> <p>The settlements of Ham Green and Pill are in close proximity to Reach 2, there are many residential properties which overlook the River in these areas. Shirehampton is located on the eastern bank of the River Avon; the properties in this location are generally set back approximately 50 m from the river bank. There are additional residential properties located in Sea Mills, Sneyd Park and Clifton which are also set back from the River Bank by approximately 200 m. Sea Mills, Sneyd Park and Clifton are all designated Conservation Areas.</p> |
| <p>Hydrology</p> | <p>Reach 2 is located within an area of tidal water. There are no Surface Water Abstractions within this Reach.</p> <p>Please refer to section 2.3.1 of the Bristol Tidal Flood Risk Management⁵ Strategy for</p> |

| Topic area | Commentary |
|--------------------------------|--|
| | further information. |
| Archaeology and Built Heritage | <p>There are three Scheduled Monuments within the Study Area surrounding Reach 2 including: Part of the Roman Settlement of Abonae, Clifton Down camp and Stokeleigh Camp which is a promontory fort in Leigh Woods. The Part of the Roman Settlement of Abonae Scheduled Monument is particularly sensitive due to its close proximity with the River Avon.</p> <p>Listed buildings include the Grade I Clifton Suspension Bridge and numerous Grade II listed and Grade II* listed buildings located inland within the Clifton area of the city.</p> <p>Notably, there are Grade II listed Harbour Walls of Sea Mills Docks which are particularly sensitive as they border the River. There are also several Grade II and Grade II* listed buildings on Hotwell Road which are located on the eastern bank on the River Avon and therefore are particularly sensitive to flooding.</p> <p>There are several Registered Park and Gardens, including the Grade II Listed Kings Weston House, the Grade II* Blaise Castle and Hamlet, the Grade II Leigh Court, the Grade II Bristol University Botanic Gardens and Rayne Thatch, and the Grade II* Ashton Court. Leigh Court is particularly sensitive as it directly abuts the river on the western bank. However, the remaining Registered Park and Gardens are all in close proximity to the River and therefore the settings of all Registered Park and Gardens should be considered as the options appraisal progresses.</p> <p>There are two HER located on the eastern bank of the River Avon, south west of Shirehampton Railway Station; these are for Lamplighters Hall and Coal Wharf. There is an additional HER on the east bank of the River Avon in Pill at the confluence of Crockerne Pill and the River Avon for a Custom House. A HER for Coal Wharf Hung Row Cottages located on the bank of the River Avon near Shirehampton. There is a record for a Gunpowder magazine south of Shirehampton Park, as well as for the associated landing stage. In Sea Mills there is a HER for Sea Mills Dock, Sea Mills Station and for an Old Signal Station. West of the railway in Sea Mills is a HER for Limekilns. Within Avon Gorge there is a HER for a Medieval Deer Park located on the west bank of the River. On the east bank of the River south of Old Sneyd Park is a HER for a Brick Yard. There are two HER's near to Clifton Down, these are for Clifton Extension Railway and Hotwells Station. There are a further two HER's in this location for a Quarry which is located below Circular Road. There are many HER's within Clifton: those that are in close proximity to the River are for Hotwells Halt, a possible Roman earthwork within Clifton Down Camp, a Lime Kiln below Vincent Rocks, the BBC Emergency Radio Studio, the Hotwell and for the Old Rownham Ferry. There are 2 records of AMIE within Reach 2 which are located within the River. Conservation Areas which abut Reach 2 on the eastern bank of the River Avon include:</p> <ul style="list-style-type: none"> • Kingsweston and Trym Valley • Sea Mills; • Sneyd Park; • The Downs; and • Clifton. |
| Air Quality | This Reach is not within a UK AQMA. |
| Morphology | This Reach is typically wide as it flows through Avon Gorge towards the Severn Estuary. |

4.3

Reach 3

Reach 3 extends from the Western end of Cumberland Basin at the point where the River Avon splits into 2 channels through Hotwells and onto Redcliffe, ending at Netham Weir.

Table 4-4: Reach 3, Summary of Environmental Constraints and Opportunities

| Topic area | Commentary |
|------------|------------|
|------------|------------|

| Topic area | Commentary |
|---------------------------------------|--|
| Land Use | <p>This Reach is located within Bristol City Centre and extends from the Hotwells area through Redcliffe and Temple Meads to Netham Weir.</p> <p>The land uses within Reach 3 includes the residential areas of Clifton and Bedminster, the city centre which mainly contains commercial and recreational uses, as well as some industrial uses around St Philips Marsh.</p> <p>Within the floating harbour the river can be easily accessed within several boats using the floating harbour for recreation.</p> |
| Ecology | <p>Bristol Docks Estate Wildlife Survey covers the whole of Reach 3 and will provide useful information as the options appraisal progresses. The Wildlife Survey is split into 5 areas: Cumberland Basin, Harbour Arena, New Cut, Upper Reaches and the Water Activity Harbour.</p> <p>There are two SNCI's within Reach 3. Bower Ashton Mineral Railway (disused) is on the southern bank of the River Avon in close proximity to the River. Ashton Vale Fields SNCI is also located on the southern side of the River, however is further inland. There are no additional ecological designations within this Reach.</p> <p>The main Wildlife Corridor within Reach 3 is the whole River channel within the Floating Harbour. <u>Protected European Species</u></p> <p><i>European Protected Species</i></p> <p>Multiple numbers of otter records located within the Reach 3 Study Area were returned from the data search.</p> <p>Other European protected species include: common pipistrelle, soprano pipistrelle, Leisler's bat, brown-long eared bat, noctule, serotine and Myotis bat sp.</p> <p><i>Birds</i></p> <p>Records of Schedule 1, Red or Amber listed birds are listed: barn owl; black redstart; black-headed gull; bullfinch; common gull; common sandpiper; cormorant; dunnoek; fieldfare (<i>Turdus pilaris</i>); goldcrest; grasshopper warbler; great northern diver (<i>Gavia immer</i>); green woodpecker; grey wagtail; greylag goose (<i>Anser anser</i>); herring gull; house martin; house sparrow; jack snipe (<i>Lymnocyptes minimus</i>); kestrel; kingfisher; lapwing; lesser black-backed gull; lesser redpoll (<i>Carduelis cabaret</i>); linnet; little egret (<i>Egretta garzetta</i>); little grebe; mallard; marsh tit; meadow pipit; Mediterranean gull; mistle thrush; mute swan; oystercatcher; peregrine; red kite (<i>Milvus milvus</i>); redshank; redwing; reed bunting; sand martin; skylark; snipe; song thrush; starling; stock dove; swallow; swift; teal; whinchat; wigeon; willow warbler; yellow wagtail (<i>Motacilla flava</i>); and yellowhammer.</p> <p><i>Badgers (confidential)</i></p> <p>The data search returned six records of badger within the Reach 3 Study Area and 19 records of badger just outside of the Reach 3 Study Area.</p> <p><u>Invasive non-native species</u></p> <p>The following invasive non-native species have been recorded within the Reach 3 Study Area: wall cotoneaster; Himalayan balsam; Canada goose; grey squirrel; Japanese knotweed; giant hogweed (<i>Heracleum mantegazzianum</i>); and rhododendron (<i>Rhododendron ponticum</i>). A record of muntjac (<i>Muntiacus reevesi</i>) was returned from the data search just outside of the Reach 3 Study Area.</p> |
| Landscape Character and Visual Impact | <p><u>Landscape</u></p> <p>The National Character Area of this Reach is 118 - Bristol, Avon Valleys and Reaches.</p> <p>Particularly relevant policies include:</p> <ul style="list-style-type: none"> • SEO 2: Protect and manage the strong sense of history and many historical assets ranging from prehistoric barrows to the mining legacy, as well as the Avon Gorge and the many varied geological exposures within this geologically significant landscape, to enable recreation and access, education, tourism and continued enjoyment of the heritage of the area. • SEO 4: Protect and manage the landscape, heritage and biodiversity associated with the Avon River corridor, other river valleys and lakes, |

| Topic area | Commentary |
|--------------------------------|--|
| | <p>planning for a landscape-scale enhancement of wetlands, wet woodland and semi-natural grasslands along river flood plains for the benefits to biodiversity, climate regulation, water quality and flooding mitigation.</p> <p><u>Visual Amenity</u></p> <p>There are many residential properties within the Cumberland Basin which are in close proximity to the river bank and overlook the river.</p> |
| Hydrology | <p>Reach 3 is located within an area of tidal water. There are five Surface Water Abstractions within the river. These will need to be considered should this location be taken forward.</p> <p>Please refer to section 2.3.1 of the Bristol Tidal Flood Risk Management⁵ Strategy for further information.</p> |
| Archaeology and Built Heritage | <p>Scheduled Monuments in Reach 3 include Underfall Yard which is located just east of Cumberland Basin within Bristol Docks. Due to its close proximity to the river it is particularly sensitive to flooding. Other Scheduled Monuments less at risk of flooding include Temple Church which is in the area of Redcliffe and Dominican Friars (Quaker's Friars) which is located in the area of Broadmead.</p> <p>There are several Grade I, Grade II listed and Grade II* listed buildings listed buildings within the city. The most sensitive of which, due to their proximity with the river, are those located within the Floating Harbour which are all Grade II listed with the exception of the swing bridge over Brunels North, West and South entrance, and SS Great Britain which are all Grade II*. The settings of which should be a consideration as the options appraisal progresses.</p> <p>There are numerous HER within Reach 3. The HER's which are located within the river or in close proximity are mentioned here. Within the Cumberland Basin there are HER's for Harbour Master's House, New Rownham Ferry, Cumberland Buildings, Transit Shed, Nova Scotia Yard and Hydraulic Engine House. Within the Floating Harbour there are HER's for: Great Western Dry Dock, Fairbairn Steam Crane, M Shed, Crane in the Amphitheatre of Canons Marsh, Manfields Boat Yard, Crane at the end of Narrow Quay, Gibb Slip, The Great Crane, Mud Dock and Severn Shed. Within the New Cut there are HER's for: Ashton Swing Bridge, Vauxhall Footbridge, Gaol Ferry, Totterdown Bridge, a Private vehicle Bridge over the River Avon, Netham Dam and New Brislington Bridge.</p> <p>There are 7 records of AMIE within Reach 3 which are located within the River. There are no registered Parks or Gardens within this Reach, however there are several conservation areas including:</p> <ul style="list-style-type: none"> • Clifton; • City Docks; • Bower Ashton; • Bedminster; • Redcliffe; • City and Queen Square; • St James' Parade; • Portland and Brunswick Square; and • Old Market. |
| Air Quality | <p>Reach 3 is located within 'AQMA 10', which is designated due to elevated concentrations of fine particulate matter (PM₁₀) and nitrogen dioxide (NO₂). This is unlikely to be a constraint to flood defences, although may require more robust emissions management of construction vehicles and plant.</p> |
| Morphology | <p>The majority of the section of this Reach is heavily modified and is known as the New Cut. It was created to divert a section of the River Avon after its original course was used to form the Floating Harbour.</p> |

4.4 Interpretation

The purpose of this baseline report has been to characterise the nature of the environmental constraints within the study area, and to provide a basis upon which to inform future workstreams (e.g. options long listing, short listing, and selection of a preferred concept). It has remained neutral in terms of significance of effect, as noted in section 2.5, given that at the time of writing the options are not yet available. The vulnerability or sensitivity of various baseline assets cannot be fully characterised without further information as to the nature of proposed development.

The interpretation of the datasets will therefore be expanded upon in phases 9B and 9C, informed by input from specialist advisors and the consultation process.

It is, however, possible to draw out some initial observations. Features that are of international importance (such as Special Areas of Conservation, European Protected Species, Ramsar or Special Protected Areas) are recognised in law as particularly valuable, and therefore sensitive to development. There are a number of such designations, several of which overlap, particularly concentrated in the western end of the study area in Reach 1 as the Severn Estuary is joined by the River Avon. There is also the Avon Gorge Woodlands SAC which runs through Reach 2, which should also be considered. Such international designations are clearly particularly sensitive to development, and accordingly have a more onerous consenting route. Consultation with regulators will be important should any development be planned in these areas.

Features that are designated of national importance remain material considerations in the planning process, for example Scheduled Monuments, and SSSIs, and further advice should be sought if likely significant effects are predicted during the options appraisal. The TFRMS should also be mindful of protection afforded to various assets within policies such as the National Planning Policy Framework (NPPF) and the local plan, as this may introduce wider considerations as programme and mitigation considerations. For example, local planning policy DM19 states that 'Development which would have a harmful impact on the nature conservation value of a Site of Nature Conservation Interest will not be permitted' indicating that whilst of lower value than an internationally designated site, local features play an important role in the city's environmental setting.

As requested by BCC, three drawings have been produced illustrating the key environmental sensitivities that should be considered during the future workstreams (one for each reach). These drawings provide a summary and therefore do not contain all the important features and constraints identified in this report, which should be considered during the design process. Reference should be made to the GIS shapefiles for full information.

Figures 4.6, 4.7 and 4.8 present key constraints by study area reach which are considered most sensitive to the proposed project (and therefore best avoided if possible to minimise risk of objections or challenge). Species data have been excluded for simplification of mapping but it is essential that the datasets are referred back to during the decision making process. The following have been mapped:

- Internationally designated sites (SAC, SPA, Ramsar);
- Important Bird Areas;
- Conservation Areas, Listed Buildings, and Scheduled Monument within 10 m of the river (although there is potential for significant effects beyond this distance, dependent upon design parameters);
- National Nature Reserves and SSSIs, and Ancient Woodland and Priority Habitats within 10 m of the river bank.

Given the lack of design information at the time of writing, it is also not possible to consider likely significant indirect impacts that could elevate a receptor to 'high' status. For example, there are a number of heritage assets beyond 10 m from the river bank where significant indirect impacts may occur on the setting, which will need to be considered following determination of a location, size and nature of development. These three maps are therefore only intended as an initial guide, and the reader is signposted back to the wider dataset.

5. PROGRAMME, CONSENTING AND CONSULTATION

5.1 Programme

Depending on the nature of the development, certain environmental studies may be required to support a planning application. Appendix C Table 5-1 summarises timings of ecology surveys, and provides further advice on timings for implementation of mitigation measures. For example, a development such as a tidal barrier positioned close to the Severn Estuary SPA may well require two seasons of bird survey data, potentially needing 24 months of survey data before a valid application can be submitted to the regulator. More specific advice in this regard will be provided during the options appraisal phase.

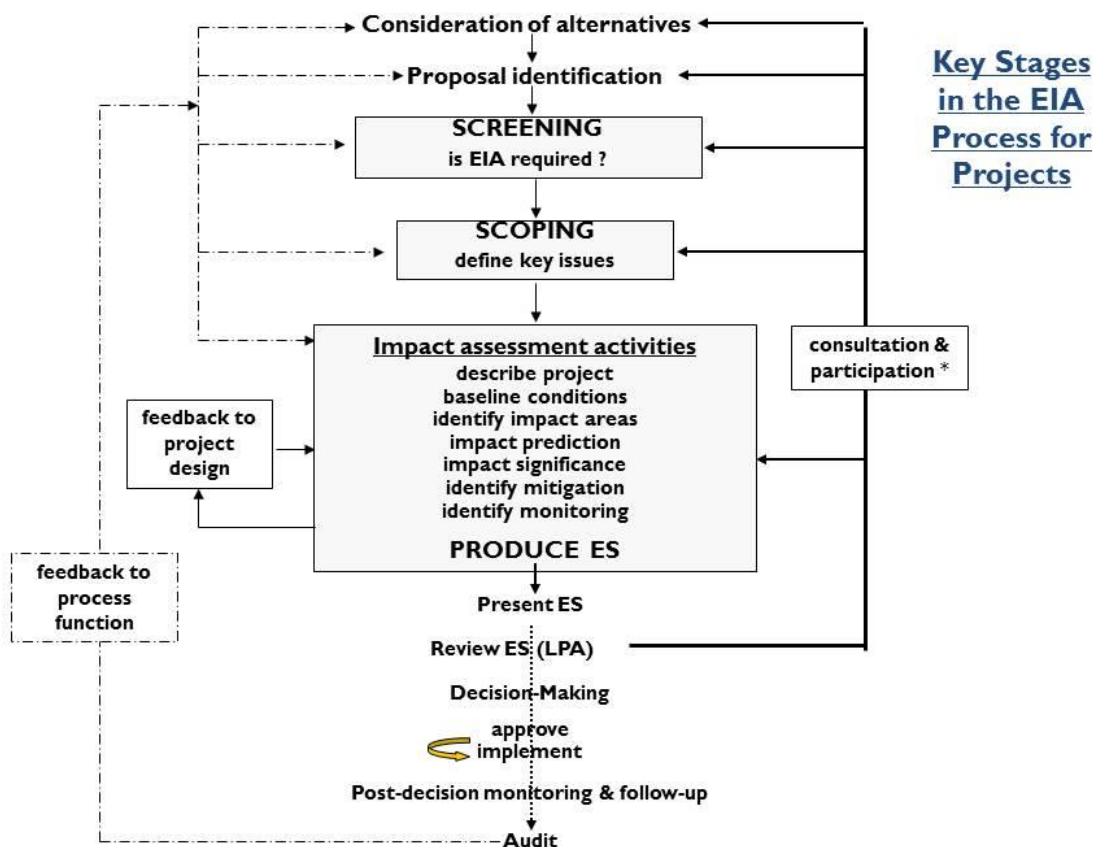
European Protected Species data (i.e. great crested newts (GCN), bats, dormice, crayfish) should ideally be less than two years old at the start of the construction phase but slightly older data may be acceptable

if the impact of the development on these species is considered to be low. Should any licenses be required (i.e. GCN, badger, bat), these will need to be prepared one year in advance of the commencement of construction.

Whilst the approach to the TFRMS is one of non-statutory environmental appraisal, there is possibility that the preferred option could trigger statutory Environmental Impact Assessment (EIA). With that in mind, there is an option to seek a screening opinion as part of Task 9C. It was agreed with the TFRMS Project Manager and the Environment Agency National Environmental Assessment Service (NEAS) via a teleconference on 17 December 2015, that a decision whether to seek such an opinion would be made later in 2016. A screening opinion should be returned by the Local Planning Authority (in this case, likely to be BCC) within three weeks.

An overview of the statutory EIA process is illustrated in Figure 5-1.

Figure 5-1 – Approach to EIA



5.2 Consenting

The approach to consenting will require further consideration, particularly for a scheme located towards the mouth of the River Avon, given the potential for numerous stakeholders. The regulators will be consulted as the preferred option evolves, to ensure that the development management team understand the potential implications of different consenting requirements. This will require validation as the design continues to evolve beyond the TFRMS however. Given the potential for significant effects to occur in relation to ecology, archaeology and the water environment, it is possible that EIA will be required.

At the time of writing, if a barrier option is chosen, the Transport and Works Act is the most likely consenting route given the potential interface with navigation. However, BCC is currently taking advice on this and further detail regarding the possible consenting mechanisms is likely in the near future.

5.3 Consultation

Given BCC's underpinning objective of securing a scheme that has a realistic prospect of delivery, it is important that potential views of statutory consultees are taken into consideration as the options selection process continues. A Stakeholder Engagement Workshop was held on 8 December 2015, which was attended by Environment Agency representatives, Sayers and Partners, West of England Local Enterprise Partnership, Wessex Water, and The Bristol Port Company. Apologies were received from North Somerset Council. A subsequent teleconference was held on 21st December this was attended by representatives from the Environment Agency. A second stakeholder workshop is scheduled for March 2016.

The separate Stakeholder Engagement Plan (SEP) for the TFRMS provides a framework for how various environmental consultees are to be engaged with, and feedback will be captured as the programme progresses and used to inform options appraisal. At this point in time, Natural England (Amanda Grundy) has provided preliminary advice on the potential consenting implications of development proposals near

to the internationally protected sites of the Severn Estuary, and also the Avon Gorge SSSI to assist the options appraisal process. This advice was given in 2013 and has been captured here for ease of reference. Key points raised include:

- *Natural England's key concern would primarily relate to potential impacts on the Severn Estuary and Avon Gorge national and European protected sites, which may result from the construction and/or operation of the proposed tidal barrier.*
- *The Avon Gorge Site of Special Scientific Interest (SSSI) is one of the principle nature conservation sites in southwest Britain consisting of the sides of a large limestone gorge and extensive plateau areas adjacent to the tops of the gorge. Much of the ground is wooded but the unwooded rocky gorge sides provide habitat for a long list of rare and scarce vascular plants and is considered one of the best sites in the world for rare whitebeam trees. The SSSI is also designated for its geological interest and although not part of the current designation, is of major importance for invertebrates and both greater and lesser horseshoe bats occur. The Avon Gorge Woodlands Special Area of Conservation (SAC) is of European importance because of its representation of Tilio-Acerion forests on the limestone cliffs and screes and the semi-natural dry grasslands and scrubland facies. Further details will be needed to demonstrate that all potential effects on the Avon Gorge designated site and qualifying features have been adequately considered, and how these would be addressed should this prove necessary.*
- *European designated sites are afforded a very high level legal protection. As the proposal is not necessary for European site management, your authority would need to determine whether the proposal is likely to have a significant effect on any European site. If your authority were not able to rule out the likelihood of significant effects, it should undertake an Appropriate Assessment, in accordance with Regulation 61 of the Habitats Regulations, including consultation with Natural England. In-combination effects with other plans or projects should also be considered.*
- *If a project is to proceed despite a negative assessment it must firstly be demonstrated that there are no alternative solutions that would have a lesser effect on the integrity of the site. Alternative solutions are different ways of achieving the objectives of the project, which would have a lesser effect on the integrity of the site. Alternative solutions may be more expensive, more difficult or less convenient to implement, but must at least still be realistic. Unrealistic alternatives that cannot be achieved are not alternative solutions.*
- *NE should be consulted on whether identifiable alternative solutions would have a lesser effect on the European site's integrity. This may involve assessment of effects of the alternative solutions on different interest features, or different European sites.*
- *If there are no alternative solutions, the competent authority may consider whether the project is necessary, urgent and in the public interest, and whether the importance of the project outweighs the harm it may cause to the European site. It should be noted that, in accordance with the Habitats Directive, social and economic reasons do not apply if the project would affect priority habitats or species.*
- *If minded to proceed with a project for imperative reasons of overriding public interest, a competent authority must notify the Government and wait 21 days. The decision as to whether to allow a project to proceed under the provisions of Article 6(4) is, in effect therefore, a Government decision. In accordance with the tests set out within the Habitats Directive, the Government will scrutinise the availability of alternative solutions before addressing the case for imperative reasons of overriding public interest.*
- *The National Planning Policy Framework Paragraph 14 makes it clear that the presumption in favour of sustainable development does not apply where development requiring appropriate assessment under the Birds or Habitats Directives is being considered, planned or determined. Paragraph 118 advises that proposed development on land within or outside a Site of Special Scientific Interest likely to have an adverse effect on a SSSI (either individually or in combination with other developments) should not normally be permitted. Where an adverse effect on the site's notified special interest features is likely, an exception should only be made where the benefits of the development, at this site, clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs.*
- *9. For example, those policies relating to sites protected under the Birds and Habitats Directives (see paragraph 119) and/or designated as Sites of Special Scientific Interest; land designated as Green Belt, Local Green Space, an Area of Outstanding Natural Beauty, Heritage Coast or within a National Park (or the Broads Authority); designated heritage assets; and locations at risk of flooding or coastal erosion. 10 Unless material considerations indicate otherwise.)*

With this advice in mind, it will be important that the options appraisal process is robust and transparent, clearly demonstrating how decisions have been made, to ensure that a full consideration of alternatives is made. The integration of environmental appraisal into the wider programme will assist in this regard.

6. RECOMMENDATIONS AND NEXT STEPS

6.1 Look Ahead to Options Appraisal (Task 9B)

The baseline presented within this report and supporting mapping is intended to provide a foundation upon which the options can be developed. During the options selection phase, non-statutory environmental appraisal would comprise a table for each option that sets out its objectives and technical considerations (to be sourced from the project manager) and provide commentary upon:

- Environmental constraints and opportunities associated with the concept/location, drawing upon the spatial database;
- ‘Show-stoppers’ for example where the team considers the environmental effects would be significant and planning permission is unlikely to be granted for such a scheme;
- Programme implications (e.g. in terms of potential survey requirements, consenting regime); and
- Potential mitigation measures. This will be based on an initial appraisal of baseline conditions only but will ensure environmental considerations run parallel with the engineering design. This is critical to ensure a deliverable scheme.

6.2 Next Steps to Inform Options Appraisal (Task 9B)

Given that the ecological records from BCC date from early 2015, an up-to-date download from BRERC is advised to ensure that any additional records (e.g. of protected species) from the rest of 2015 are obtained. This will provide a more comprehensive platform to inform Task 9C, in particular. This may incur an additional data charge from BRERC and processing time by AECOM.

It is not clear from previous work whether the Marine Management Organisation (MMO) has already been engaged. AECOM plans to approach the MMO to obtain potential views upon the long-listing process, with two objectives. Firstly, to seek views on the consenting strategy to inform programme; and secondly to seek early views on the potential constraints and opportunities associated with the TFRMS.

A desktop baseline will be prepared to enable potential implications to be considered in terms of the Habitat Regulations Assessment (potential for likely significant effects, for example, and ramifications in terms of consenting) and compliance with the Water Framework Directive.

Web-based mapping could add value to the River Avon TFRMS, subject to the agreement of additional resource. Given the multi-disciplinary approach to the TFRMS development, and indeed the importance of consultation with and achieving support from numerous agencies, it is recommended that the team considers this tool further. In particular:

- The portal could encompass all project specific data including all environmental baseline data, links to CAD design plans and flood modelling outputs. It can incorporate other online data sources such as BCC Mapping server.
- This system allows all project stakeholders to be kept up to date on the latest project specific information including latest boundaries and constraints. Thus eliminating the danger of working on out of date designs. It allows the ease of pulling all information from all different stakeholders together and overlaying them in one uniform coordinate system. This eliminates the need to try and overlay information from numerous different websites and paper maps.
- The portal has interactive layers that can be clicked off and on, printing/pdf-ing tools, feature identification, zoom, buffer, redlining tools, coordinate, extraction, address search and measurement (areas and distances) tools allow all stakeholders to create their own maps at the click of a few buttons, eliminating the need to go back to the CAD or GIS analyst and request a map. This offers time saving in meetings and presentations or day to day evaluation of the project area.
- Photos and other documents can be linked to features within the mapping portal. The user selects a feature i.e. a point, line or polygon in the map, and the attribute table will appear. This table can contain links to photos or other documents associated with that feature. The user simply selects the link and the photo or document or website will open.
- Additional query or analysis tools can be added such as route analysis, least cost pathways, statistical analysis, etc.
- The web mapping portal will be accessed via a secure webpage with assigned secure user names and passwords for external users and using our single sign on for those on the internal AECOM network.
- There will be an initial additional effort to set up the externally-accessible portal, and we would then recommend an additional ongoing maintenance role to ensure that the content remains aligned with the strategy’s development.

Dependent upon the options progressed, it may be advisable to undertake an additional extended Phase 1 habitat survey for the Reach that is taken forward further in the strategic options appraisal process due to the large number of Protected Species that the data search returned, and potentially also to inform the design of detailed proposals once selected.

There are numerous residential properties which overlook the River in Reach 1, 2 and 3. These properties should be a consideration as the options appraisal progresses, and may need consulting with as part of more focused public consultation exercise beyond the proposed public engagement activity.

It is also recommended that the TFRMS considers the final report from the Vulnerability of Historic Buildings to Tidal Flooding in Bristol, which is due for submission to University College London in late March 2016.

6.3 Look Ahead to Pre-Scoping Report (Task 9C)

The objective here will be the development of a Pre-Scoping report, providing a framework for a future EIA, based upon a preferred option's concept design. The general approach is one of non-statutory environmental appraisal.

Proposed contents:

- Description of the preferred option and outline construction/operation approach;
- Overview of consenting route;
- Proposed structure of an Environmental Report/Statement;
- Non-key issues that are expected to be scoped out of the Environmental Statement;
- For each key environmental topic, the following information will be presented:
 - Concise baseline summary, which will identify data gaps to be filled
 - Overview of assessment methodology (e.g. guidance to be followed)
 - Overview of potential impacts (qualitative – no modelling proposed)
 - Outline mitigation measures.

Consultation on the Pre-Scoping Report will be undertaken, enabling statutory consultees and project stakeholders to provide feedback on the future direction of the TFRMS and its approach to environmental appraisal. The report is not intended to be formal scoping, however, but would provide valuable information ahead of kick starting any future planning application.

Given the numerous environmental designations along the Study Area, consideration will also be given to the Water Framework Directive. The potential need for Habitats Regulation Assessment also needs to be borne in mind. If an Appropriate Assessment is likely to be required to inform a future planning application, the necessary underpinning data will need to be obtained, potentially affecting the critical path for the development. .

The approach to environmental appraisal, and the contents of the Pre-Scoping, should be reviewed as the design progresses to ensure that the contents remain valid.

APPENDIX A

Figure 3-1 Arup Avon Strategic Defences First Phase Feasibility Study: Study Area

Figure 3-2 Arup Avon Strategic Defences First Phase Feasibility Study: Flood Risk Environmental Constraints Map

Figure 3-3 Arup Avon Strategic Defences First Phase Feasibility Study: Environmental Review

Figure 3-4 Vulnerability of Historic Buildings to Tidal Flooding in Bristol due to Climate Change Field Survey Map

Figure 3-5 Bristol Docks Estate Wildlife Survey & Assessment

AECOM TRFMS Figure 3-1

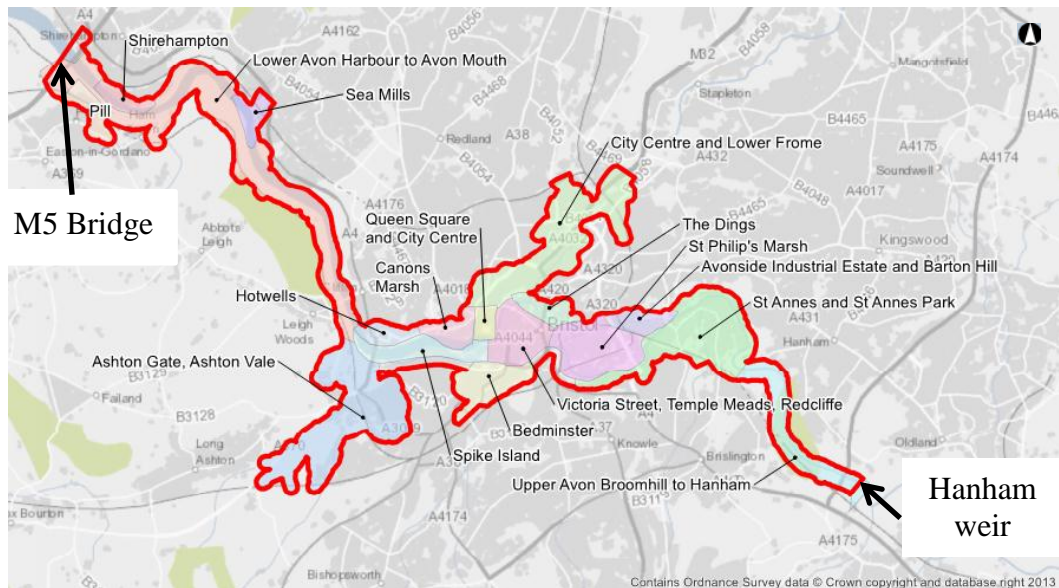


Figure 1 – Study area and districts

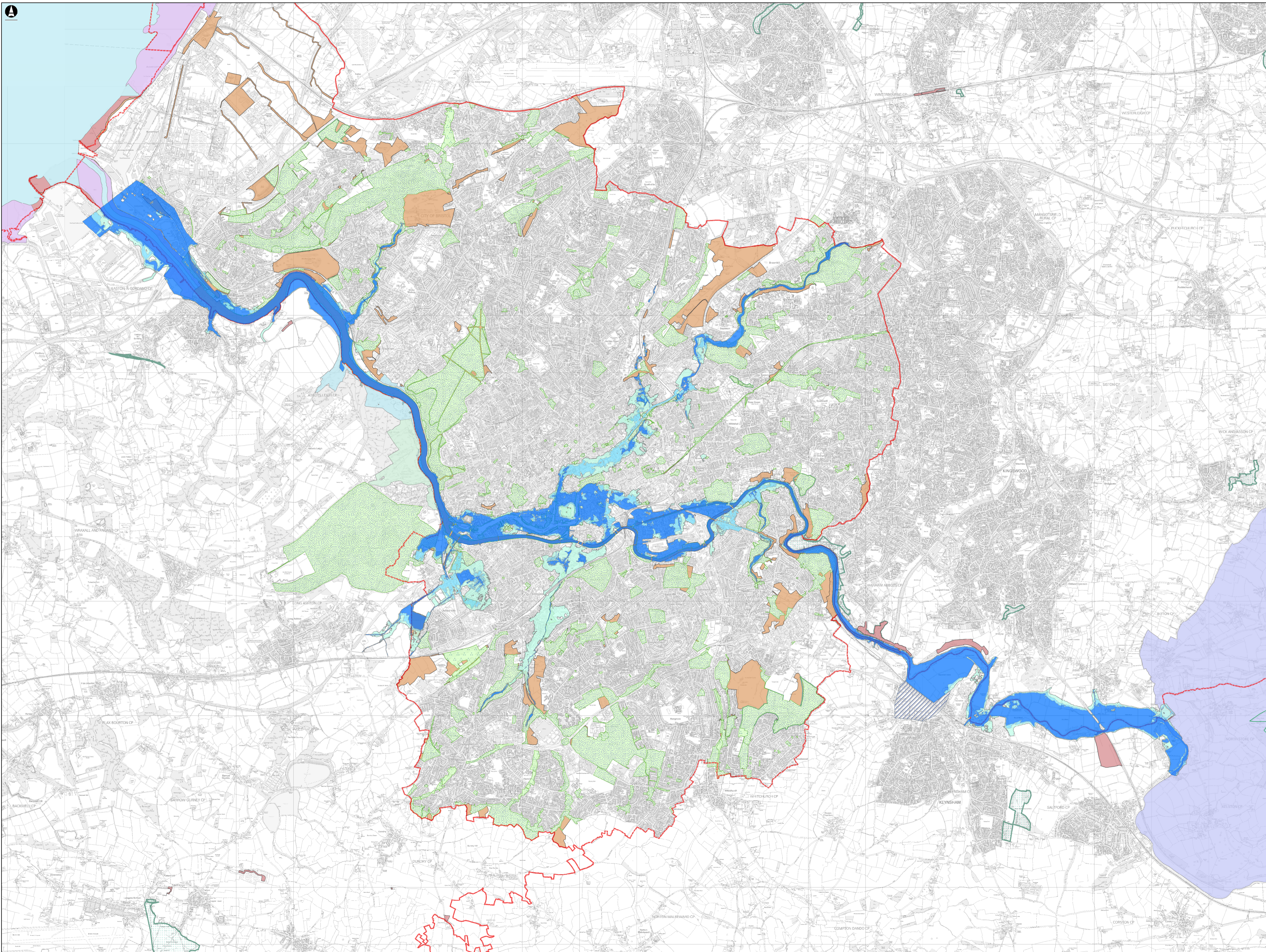
Whilst rare, extreme floods do happen. The estimated likelihood of a flood event is expressed as the chance that certain scale of event occurring in any one year in the location.

In recent times, flood events including those in Yorkshire in 2007, Northumberland in 2008, Cumbria in 2009, Newcastle in 2011 and the East Coast 2013 all had return periods of more than 1 in 150 chance of occurring in any one year. Flood events like these will occur somewhere in England much more frequently than once every 150 years. Indeed the Government reported that if certain assumptions are made, there is an estimated 65% chance of at least one place in England flooding on the same scale each year (EA,2008).

1.2 Report Layout

This report is structured as follows:

- Section 2 - Background. This section outlines the study context.
- Section 3 - The flood risk challenge. This section outlines the flood risk predictions on the City of Bristol using existing information.
- Section 4 - Interventions to reducing flood risk. This section describes the process of long and shortlisting interventions to manage predicted flood risk.
- Section 5 - Justification for interventions. This section outlines the impact of flood risk predictions on the City of Bristol. This section also details the high-level economic appraisal of intervention scenarios.
- Section 6 - Implementation of the recommended strategic approach to reduce flood risk. This section describes the outline programme of further work and potential funding opportunities.
- Section 7 – Recommendations and conclusions.



- Legend**
- Flooding not in Model
 - 2110 Combined 20yr without bridges
 - 2110 Combined 100yr without bridges
 - 2110 Combined 1000yr without bridges
- Parks**
- TYPE**
- Grass Highway & Housing
 - Hard Surface
 - Parks and Green Space Site
 - Designated Bristol Parks Site
 - National Trails
 - RAMSAR
 - National Nature Reserve (NNR)
 - Special Area of Conservation (SAC)
 - Special Protection Area (SPA)
 - Site of Special Scientific Interest (SSSI)
 - Local Nature Reserves
 - Country Parks
 - Area of Outstanding Natural Beauty (AONB)
 - Sites of Nature Conservation Importance (SNCI)
 - Biosphere Reserve

This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationery Office.
 © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to criminal proceedings. Bristol City Council, 10002048, 2013.
 © Crown Copyright. All rights reserved 2012.
 © Crown Copyright 2015. All rights reserved.
 © Bristol City Council. All rights reserved 2013.

| | | | |
|-------|------------|-----|------|
| F1 | 2013-08-29 | 952 | DB |
| Issue | Date | By | Chkd |
| | | | |

ARUP

4th Floor
 Central Station, Canal Street
 Bristol, Bristol, BS1 6QJ
 www.arup.com

Client
Bristol City Council

Job Title
Avon Defence Feasibility Study

Bristol Avon Flood Risk Environmental Constraints

Scale at A1
1:30,000

Job No
213584-25

Drawing Status
For Issue

Drawing No
1004

Sheet
F1

AECOM TRFMS Figure 3-3

C4 Environmental Review

A summary of the key environmental constraints associated with the interventions is presented below.

| Constraint | Feature | Potential issues and requirements |
|-----------------------------------|---|---|
| Planning | Works in Bristol harbour | Likely to trigger EIA and Marine EIA regulations. Works below MHWS would require a marine licence. Bristol City Council as planning authority. |
| | Works on tidal barrier | Definitely require EIA/Marine EIA. May be classed as an NSIP. Definitely requires a marine licence. Complex planning due to three authorities – NSC, BCC and the MMO. Could potential require hybrid bill. Further legal advice needed. |
| | Other schemes | Works within Bristol should consider the proposed route of the BRT scheme in the western half of City; the Temple Quarter Enterprise zone – new bridge anticipated; proposed areas of new car parking at Portway. |
| Flora and fauna | European/Nationally designated sites | Habitats Regulation Assessment will be required in relation to the potential effect of the tidal barrier on the Severn Estuary EMS. Further evaluation of the impact on Lamplighters Marsh and River Avon SNCI will be required. |
| | European designated habitat (saltmarsh) | Requirement to provide compensatory habitat if lost. Priority should be avoidance. |
| | Protected species | Reptile, bat, otter – unable to comment until detailed proposals provided and footprint of works known but would require further survey and potential licensed works. |
| | Other | There are lots of areas of neglected land within the town that provide habitat benefit e.g. for plants and any proposals should consider how these could be retained/ avoided or enhanced. |
| Population | Potential disturbance during construction. | Assessment required and management through appropriate Construction Environmental Management Plan. |
| | Reduced flood risk | Beneficial social and economic effect in terms of reduced flood risk. |
| Air quality | Construction works and traffic | Assessment required and management through appropriate Construction Environmental Management Plan. |
| Water | Potential pollution risks | All works require appropriate assessment of risks due to construction (including disturbance of potentially contaminated harbour sediments). |
| | Reduced flood risk | Beneficial social and economic effect in terms of reduced flood risk. |
| Contamination and hydrogeology | Construction works within Bristol and River Avon | Potential to disturb contaminated land and sediments. Appropriate contamination risk assessment and testing required in advance of works to inform a management strategy. Potential risk of unexploded ordnance requires further evaluation for all works. |
| Archaeology and cultural heritage | Underfall Yard Scheduled Monument | Scheduled Monument consent required for works affecting the site. |
| | Listed buildings | Listed building consent required for works affecting the buildings. |
| | Avon Valley Conservation area | All trees in conservation areas are afforded automatic protection – any works in this location require permission from the LPA. |
| | Tidal barrier and works within Bristol City. | Potential to disturb previously unknown archaeological remains requires further assessment. |
| Landscape and visual amenity | Visual impact of construction works and operational impact of flood structures. | Further landscape and visual assessment required. The scheme presents significant opportunities to beneficially enhance the public realm and green infrastructure and integrate with other infrastructure delivery proposals in Bristol. |
| Transport | Construction traffic | Assessment required and management through appropriate Construction Environmental Management Plan. |
| | Navigational impacts of barrier solution | Potential to impact on recreational sailing club activities and commercial navigation activity requires further detailed investigation. |
| Noise | Construction works | Assessment required and management through appropriate Construction Environmental Management Plan. |

Table - Key environmental constraints

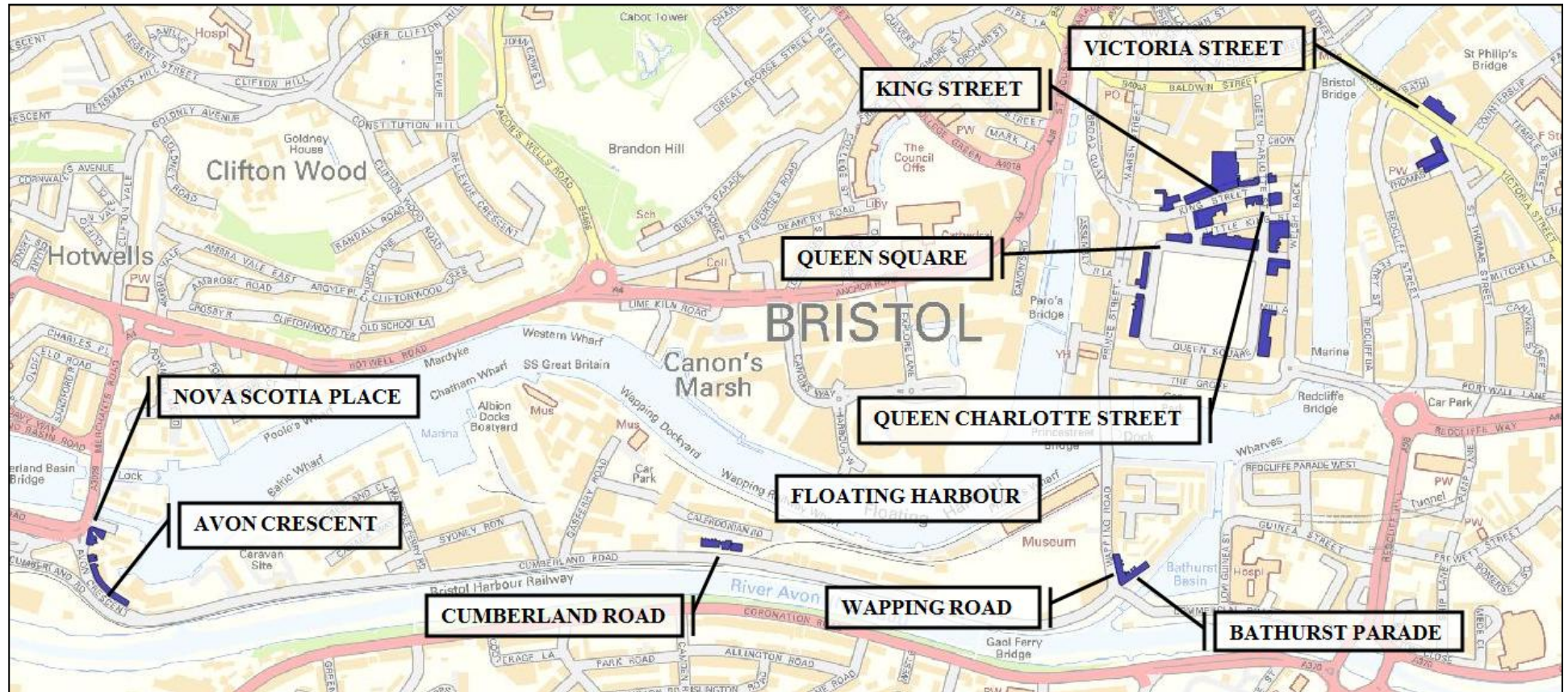


Figure 12 | Map of Bristol indicating assessed historical buildings (highlighted in purple).



| | | | | |
|---|--|---|---|---------------|
| <p>Client</p>  | <p>Project</p> <p>Bristol Docks Estate Wildlife Survey & Assessment</p> | <p>Title</p> <p>Management Units within the Docks Estate</p> | <p>Phil Quinn (Ecology and Landuse)</p> | <p>Notes:</p> |
| <p>Figure</p> <p>Figure 1</p> | |  <p>MPEcology</p> | | |

APPENDIX B

Figure 4-1 Study Area

Figure 4-2.1 Ecology - Protected sites, Schedule 8 sites and Species, Priority Habitats Inventory, SNCI data and Wildlife Corridors

Figure 4-2.2 Ecology - Schedule 9 Invasive Species

Figure 4-2.3 Ecology – BRERC European Protected Species

Figure 4-2.4 Ecology - Birds

Figure 4-3 Archaeology and Built Heritage

Figure 4-4.1 Landscape and Land Use

Figure 4-4.2 ALC and Abstractions

Figure 4-5 Air Quality Management Areas

Figure 4-6 Key Environmental Constraints within Reach 1

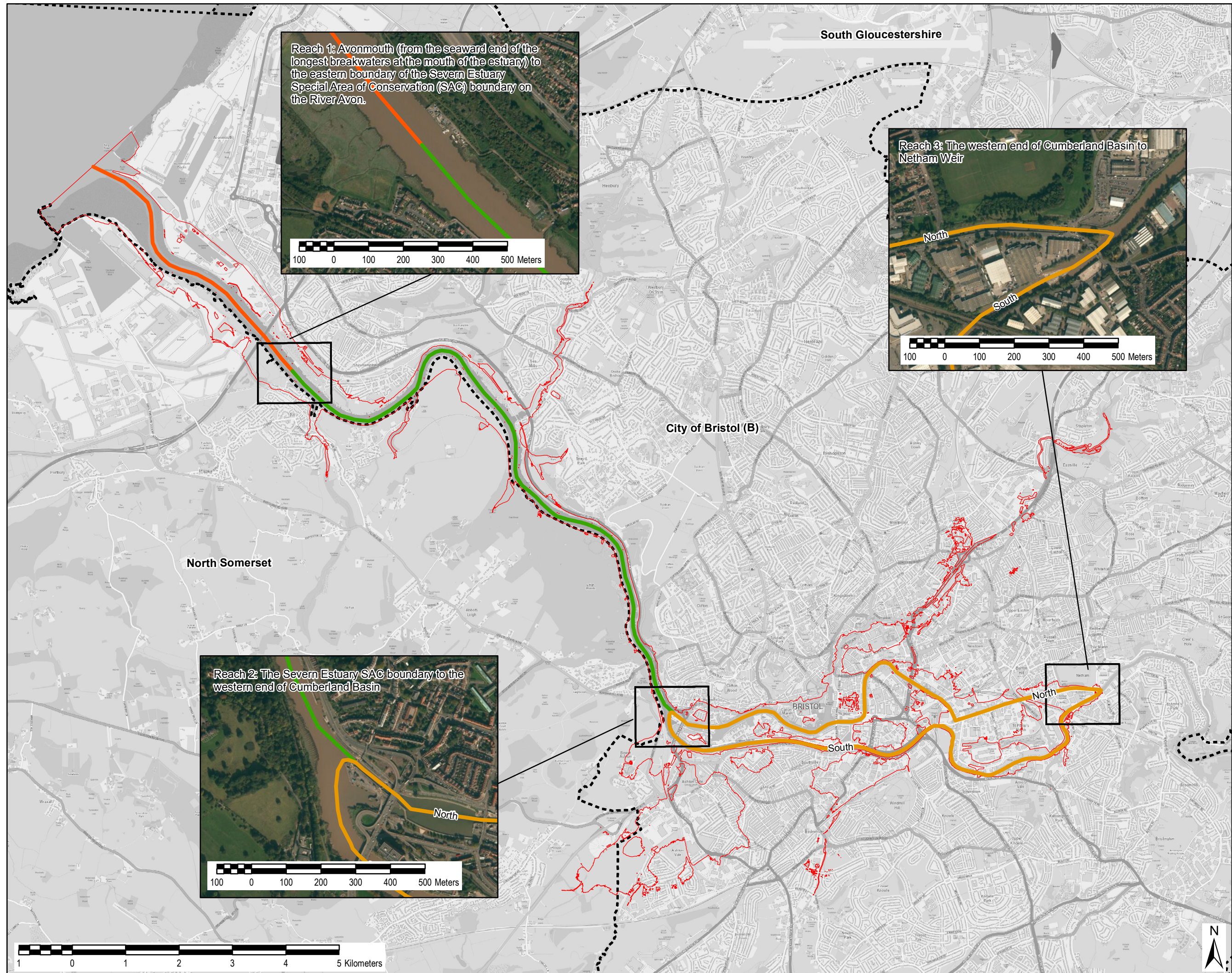
Figure 4-7 Key Environmental Constraints within Reach 2

Figure 4-8 Key Environmental Constraints within Reach 3



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Administration Boundaries



Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.1
STUDY AREA**

Scale at A3: 1:65,064.6

Drawing No: **Rev:**

FIGURE 4.1 V1

Drawn: **Chk'd:** **App'd:** **Date:**

GM SM NT 11/01/16



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- SNCI Sites
- Wildlife Corridors
- Surface Water - Linear
- Ancient Woodland
- Site of Special Scientific Interest - Environment Agency
- Special Protection Areas - Environment Agency
- Special Areas of Conservation - Environment Agency
- RAMSAR - Environment Agency
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland calcareous grassland
- Lowland dry acid grassland
- X No main habitat but additional habitats
- Traditional orchard
- National Nature Reserves - Environment Agency
- Local Nature Reserves - Environment Agency
- Important Bird Areas - RSPB
- Woodland - OS Open Data
- Foreshore - OS Open Data
- Tidal Water - OS Open Data
- Surface Water - OS Open Data
- BRERC Schedule 8 of Wildlife and Countryside Act 1981 - Sites and Species**
- Common
- Local
- Not common / status not well known
- Proposed BRERC Notable 2004 as nationally notable
- Proposed BRERC Notable 2008 as UK BAP listed
- Proposed BRERC Notable 2009 as protected
- Rare
- Scarce
- Uncommon / Declining
- Widespread / Locally Abundant when breeding
- Widespread / Locally Common

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:

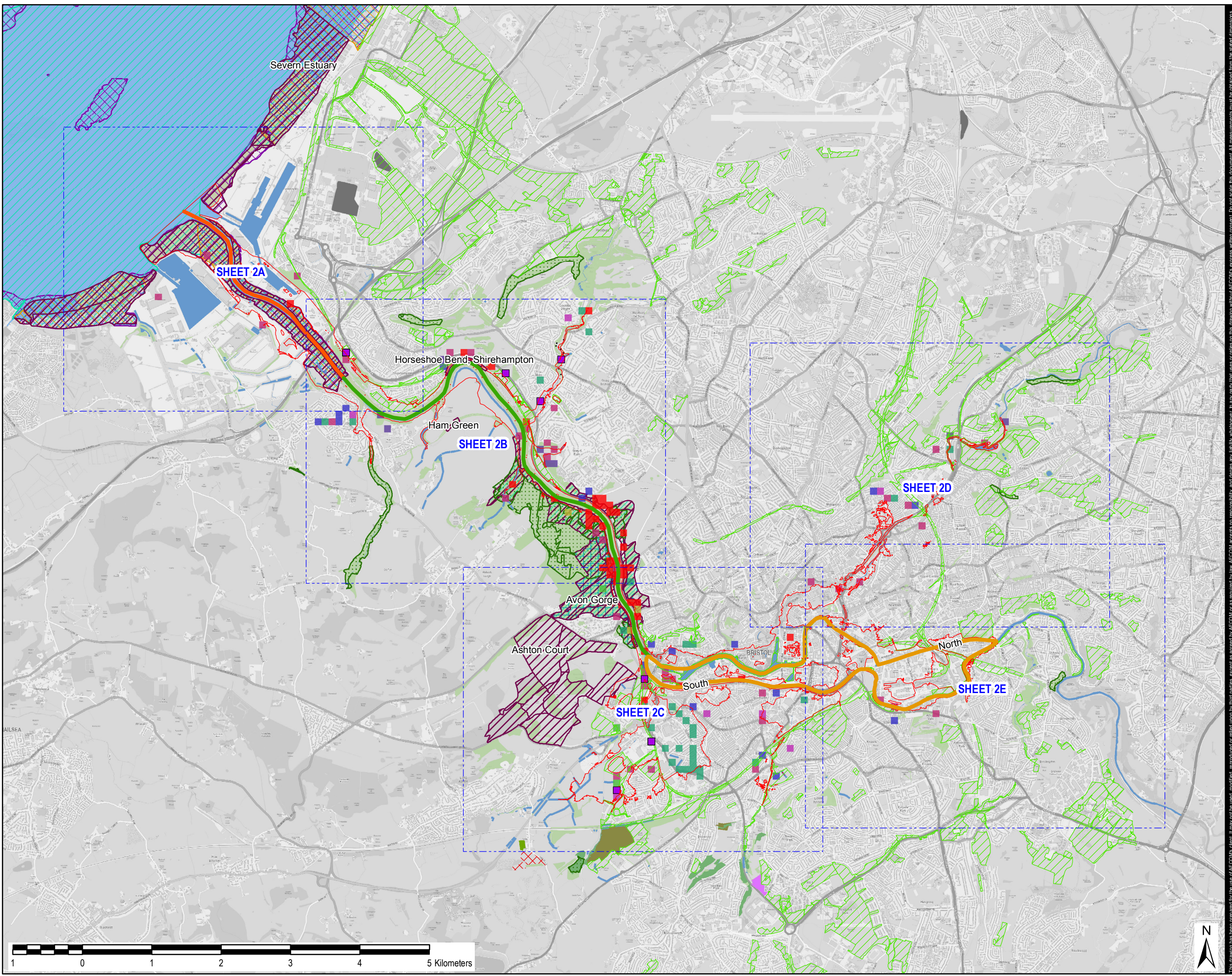
**FIGURE 4.2.1
ECOLOGY**

Scale at A3: 1:50,000

Drawing No: FIGURE 4.2.1 **Rev:** V2

Drawn: Chk'd: App'd: **Date:** 26/01/16

GM SM NT



This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- SNCI Sites
- Wildlife Corridors
- Surface Water - Linear
- Ancient Woodland
- Site of Special Scientific Interest - Environment Agency
- Special Protection Areas - Environment Agency
- Special Areas of Conservation - Environment Agency
- RAMSAR - Environment Agency
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland calcareous grassland
- Lowland dry acid grassland
- No main habitat but additional habitats
- Traditional orchard
- National Nature Reserves - Environment Agency
- Local Nature Reserves - Environment Agency
- Important Bird Areas - RSPB
- Woodland - OS Open Data
- Foreshore - OS Open Data
- Tidal Water - OS Open Data
- Surface Water - OS Open Data
- BRERC Schedule 8 of Wildlife and Countryside Act 1981 - Sites and Species**
- Common
- Local
- Not common / status not well known
- Proposed BRERC Notable 2004 as nationally notable
- Proposed BRERC Notable 2008 as UK BAP listed
- Proposed BRERC Notable 2009 as protected
- Rare
- Scarce
- Uncommon / Declining
- Widespread / Locally Abundant when breeding
- Widespread / Locally Common

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.2.1A
 ECOLOGY**

Scale at A3: 1:15,000

Drawing No: FIGURE 4.2.1A **Rev:** V2

Drawn: Chk'd: App'd: **Date:**

GM SM NT 26/01/16



This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- SNCI Sites
- Wildlife Corridors
- Surface Water - Linear
- Ancient Woodland
- Site of Special Scientific Interest - Environment Agency
- Special Protection Areas - Environment Agency
- Special Areas of Conservation - Environment Agency
- RAMSAR - Environment Agency
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland calcareous grassland
- Lowland dry acid grassland
- ✕ No main habitat but additional habitats
- Traditional orchard
- National Nature Reserves - Environment Agency
- Local Nature Reserves - Environment Agency
- Important Bird Areas - RSPB
- Woodland - OS Open Data
- Foreshore - OS Open Data
- Tidal Water - OS Open Data
- Surface Water - OS Open Data
- BRERC Schedule 8 of Wildlife and Countryside Act 1981 - Sites and Species**
- Common
- Local
- Not common / status not well known
- Proposed BRERC Notable 2004 as nationally notable
- Proposed BRERC Notable 2008 as UK BAP listed
- Proposed BRERC Notable 2009 as protected
- Rare
- Scarce
- Uncommon / Declining
- Widespread / Locally Abundant when breeding
- Widespread / Locally Common

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
 60478613

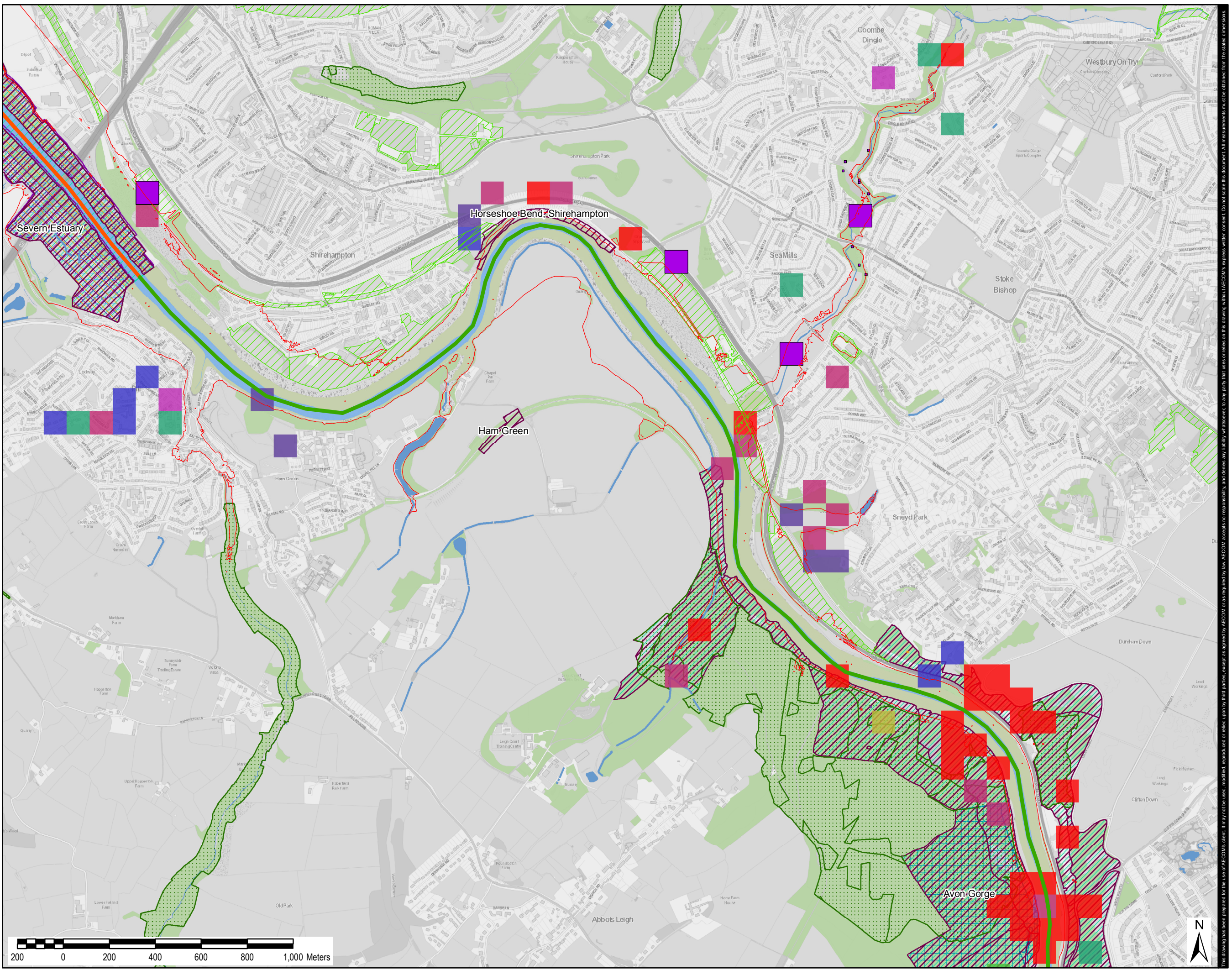
Drawing Title:

**FIGURE 4.2.1B
 ECOLOGY**

Scale at A3: 1:15,000

Drawing No: FIGURE 4.2.1B **Rev:** V2

Drawn: Chk'd: App'd: Date:
 GM SM NT 26/01/16



This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- SNCI Sites
- Wildlife Corridors
- Surface Water - Linear
- Ancient Woodland
- Site of Special Scientific Interest - Environment Agency
- Special Protection Areas - Environment Agency
- Special Areas of Conservation - Environment Agency
- RAMSAR - Environment Agency
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland calcareous grassland
- Lowland dry acid grassland
- No main habitat but additional habitats
- Traditional orchard
- National Nature Reserves - Environment Agency
- Local Nature Reserves - Environment Agency
- Important Bird Areas - RSPB
- Woodland - OS Open Data
- Foreshore - OS Open Data
- Tidal Water - OS Open Data
- Surface Water - OS Open Data
- BRECR Schedule 8 of Wildlife and Countryside Act 1981 - Sites and Species**
- Common
- Local
- Not common / status not well known
- Proposed BRECR Notable 2004 as nationally notable
- Proposed BRECR Notable 2008 as UK BAP listed
- Proposed BRECR Notable 2009 as protected
- Rare
- Scarce
- Uncommon / Declining
- Widespread / Locally Abundant when breeding
- Widespread / Locally Common

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.2.1C
ECOLOGY**

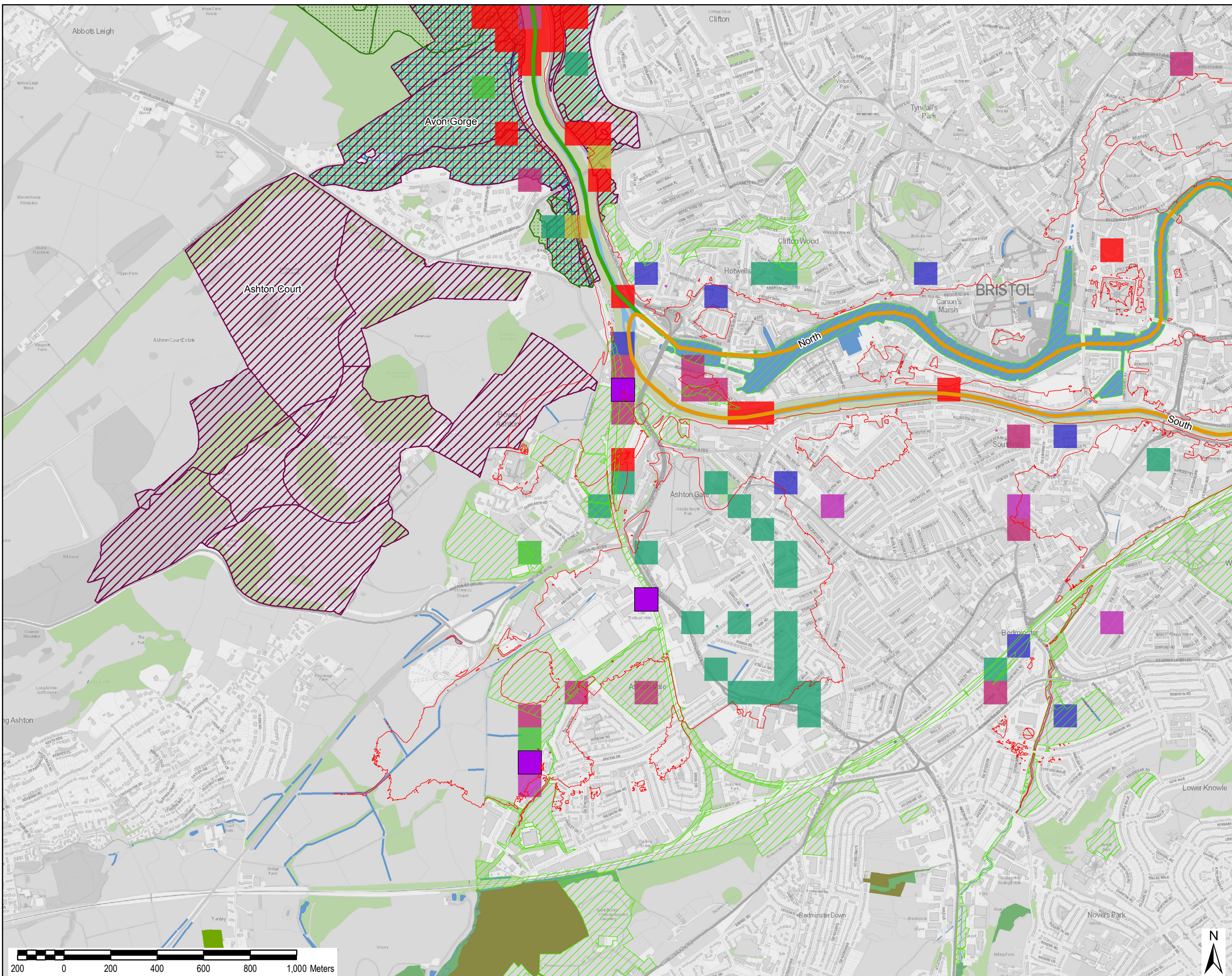
Scale at A3: 1:15,000

Drawing No: **Rev:**

FIGURE 4.2.1C V2

Drawn: Chk'd: App'd: **Date:**

GM SM NT 26/01/16



This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- SNCI Sites
- Wildlife Corridors
- Surface Water - Linear
- Ancient Woodland
- Site of Special Scientific Interest - Environment Agency
- Special Protection Areas - Environment Agency
- Special Areas of Conservation - Environment Agency
- RAMSAR - Environment Agency
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland calcareous grassland
- Lowland dry acid grassland
- No main habitat but additional habitats
- Traditional orchard
- National Nature Reserves - Environment Agency
- Local Nature Reserves - Environment Agency
- Important Bird Areas - RSPB
- Woodland - OS Open Data
- Foreshore - OS Open Data
- Tidal Water - OS Open Data
- Surface Water - OS Open Data
- BRERC Schedule 8 of Wildlife and Countryside Act 1981 - Sites and Species**
- Common
- Local
- Not common / status not well known
- Proposed BRERC Notable 2004 as nationally notable
- Proposed BRERC Notable 2008 as UK BAP listed
- Proposed BRERC Notable 2009 as protected
- Rare
- Scarce
- Uncommon / Declining
- Widespread / Locally Abundant when breeding
- Widespread / Locally Common

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

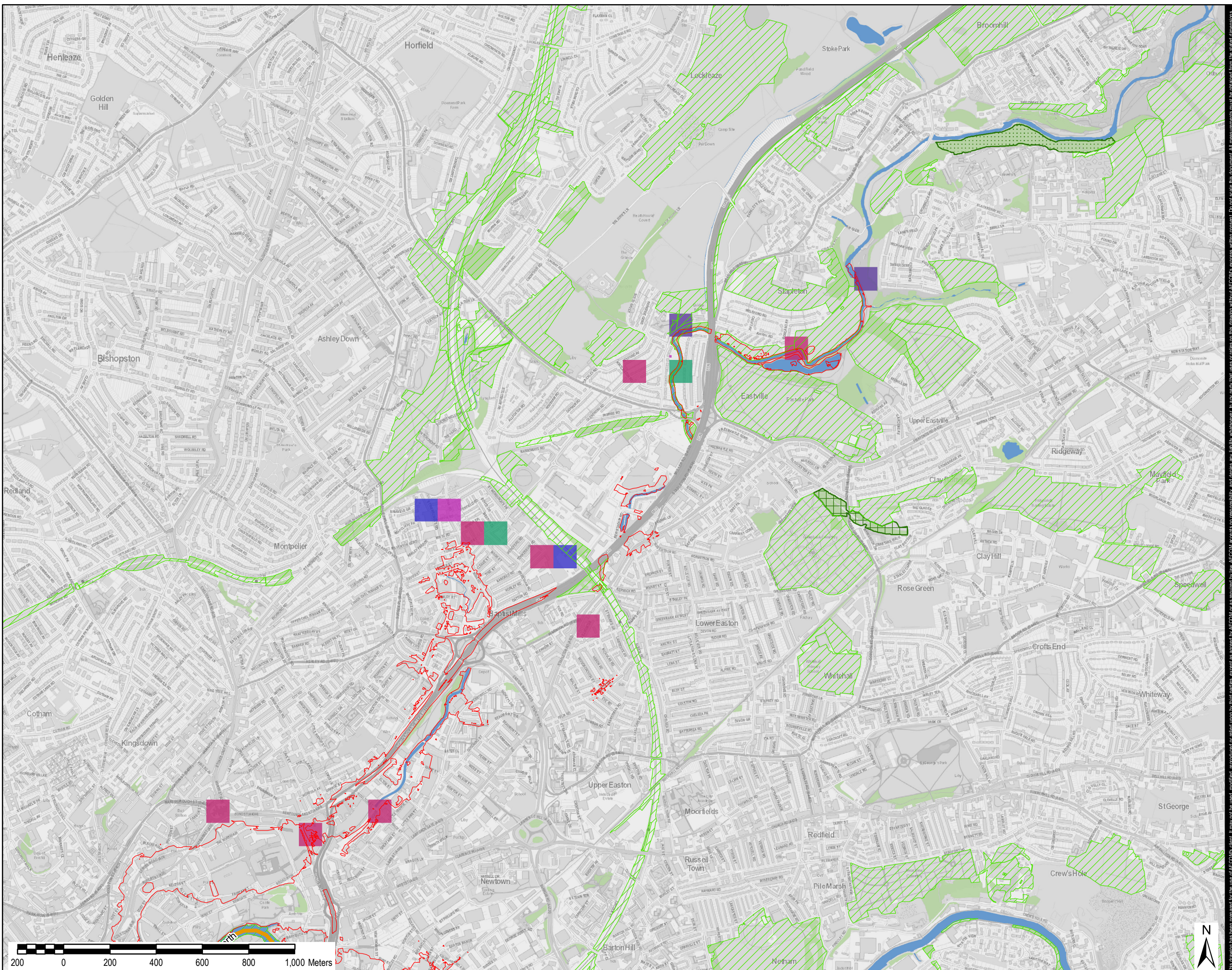
**FIGURE 4.2.1D
 ECOLOGY**

Scale at A3: 1:15,000

Drawing No: FIGURE 4.2.1D **Rev:** V2

Drawn: Chk'd: App'd: **Date:**

GM SM NT 26/01/16



This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, for any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- SNCI Sites
- Wildlife Corridors
- Surface Water - Linear
- Ancient Woodland
- Site of Special Scientific Interest - Environment Agency
- Special Protection Areas - Environment Agency
- Special Areas of Conservation - Environment Agency
- RAMSAR - Environment Agency
- Coastal and floodplain grazing marsh
- Deciduous woodland
- Good quality semi-improved grassland
- Lowland calcareous grassland
- Lowland dry acid grassland
- ✕ No main habitat but additional habitats
- Traditional orchard
- National Nature Reserves - Environment Agency
- Local Nature Reserves - Environment Agency
- Important Bird Areas - RSPB
- Woodland - OS Open Data
- Foreshore - OS Open Data
- Tidal Water - OS Open Data
- Surface Water - OS Open Data
- BRERC Schedule 8 of Wildlife and Countryside Act 1981 - Sites and Species**
- Common
- Local
- Not common / status not well known
- Proposed BRERC Notable 2004 as nationally notable
- Proposed BRERC Notable 2008 as UK BAP listed
- Proposed BRERC Notable 2009 as protected
- Rare
- Scarce
- Uncommon / Declining
- Widespread / Locally Abundant when breeding
- Widespread / Locally Common

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.2.1E
 ECOLOGY**

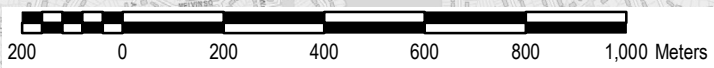
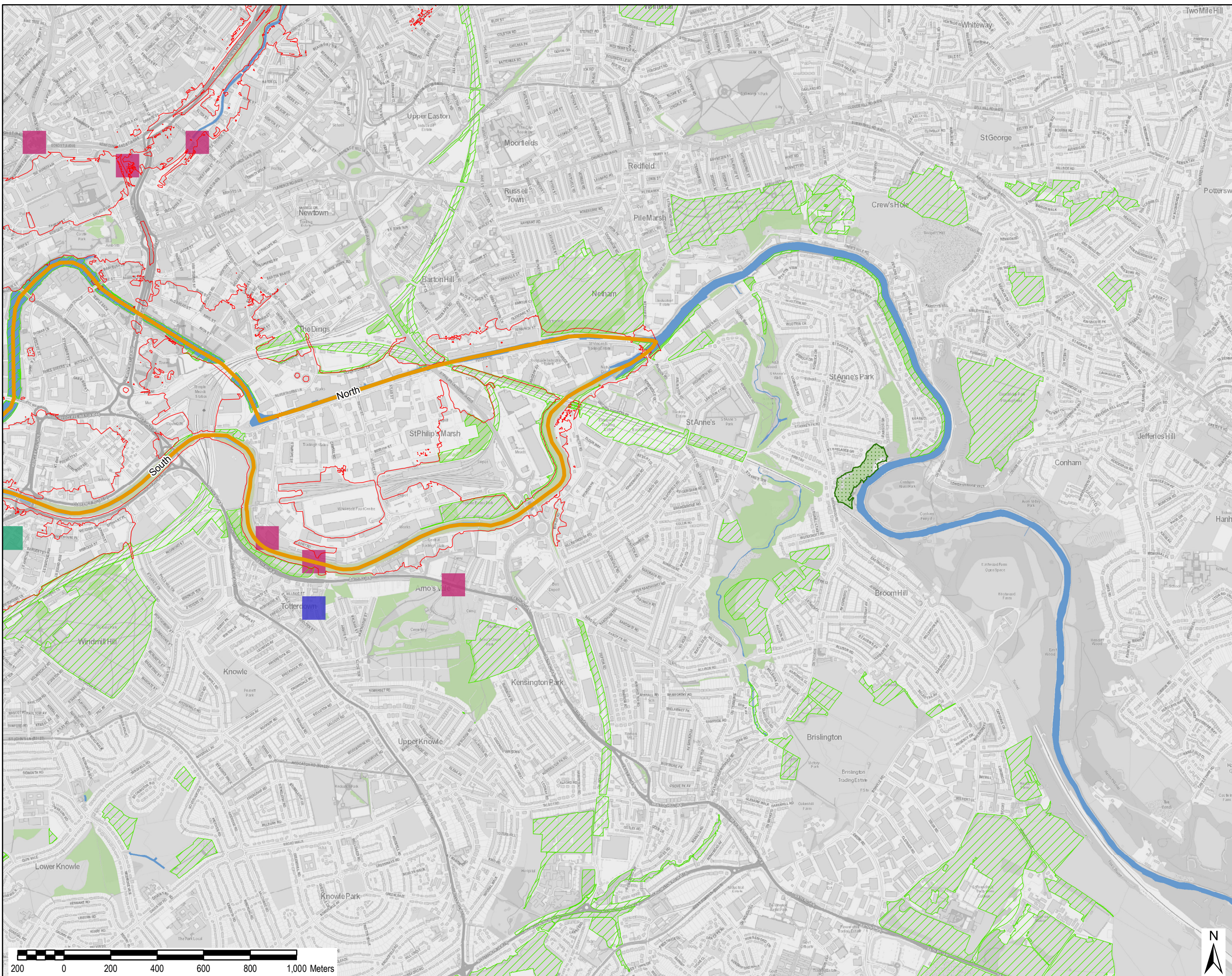
Scale at A3: 1:15,000

Drawing No: **Rev:**

FIGURE 4.2.1E V2

Drawn: Chk'd: App'd: Date:

GM SM NT 26/01/16

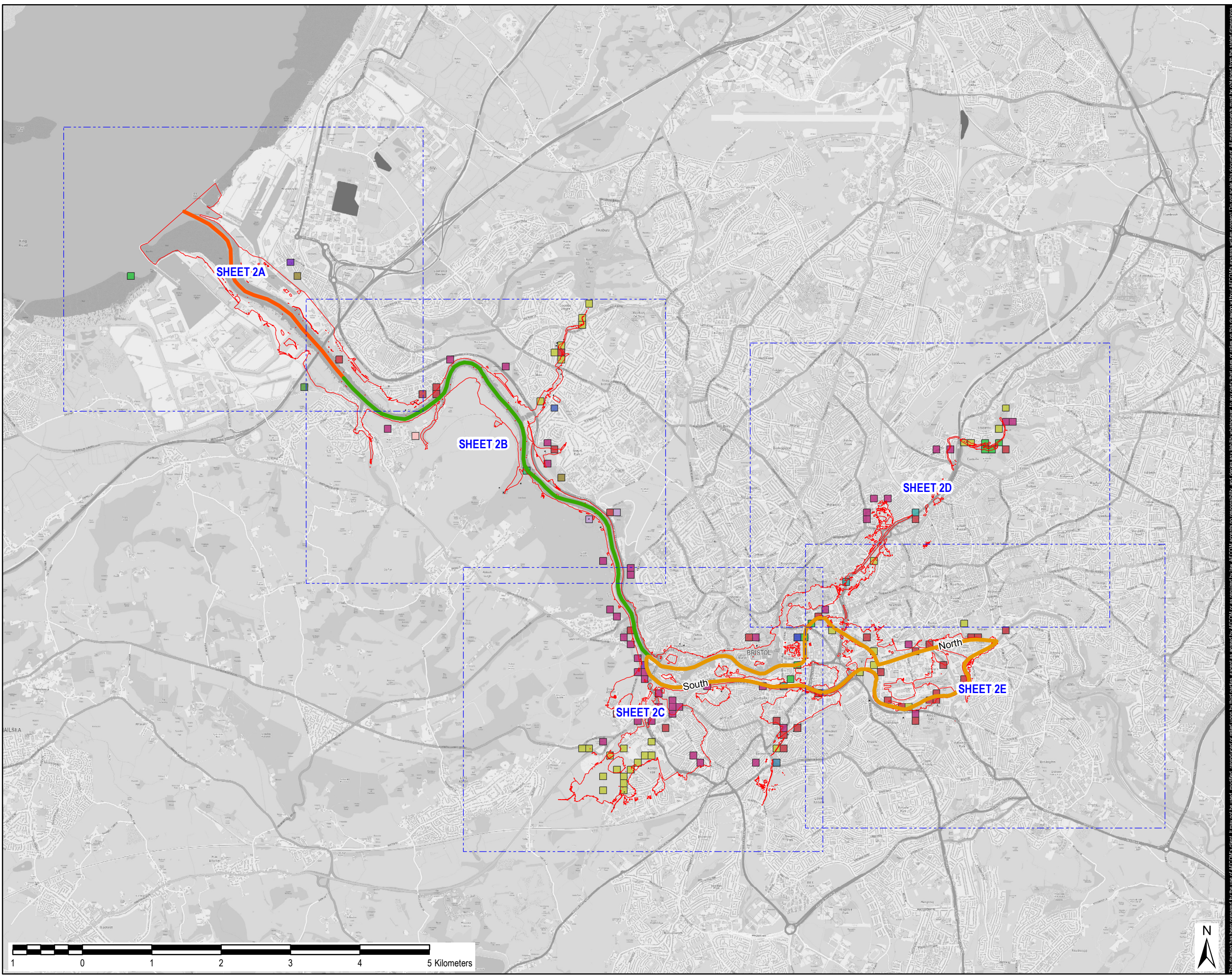


This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
 - Reach 2
 - Reach 3
 - Study Area
- BRERC Schedule 9 of Wildlife and Countryside Act 1981 - Invasive Species**
- Budgerigar
 - Canada Goose
 - Carolina Wood Duck
 - Giant Hogweed
 - Grey Squirrel
 - Himalayan Balsam
 - Himalayan Cotoneaster
 - Japanese Knotweed
 - Mandarin
 - Muntjac
 - New Zealand Pigmyweed
 - Rhododendron
 - Variegated Yellow Archangel
 - Virginia-creeper
 - Wall Cotoneaster



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
FIGURE 4.2.2
ECOLOGY
SCHEDULE 9 INVASIVE
SPECIES

Scale at A3: 1:50,000

Drawing No: FIGURE 4.2.2 **Rev:** V2

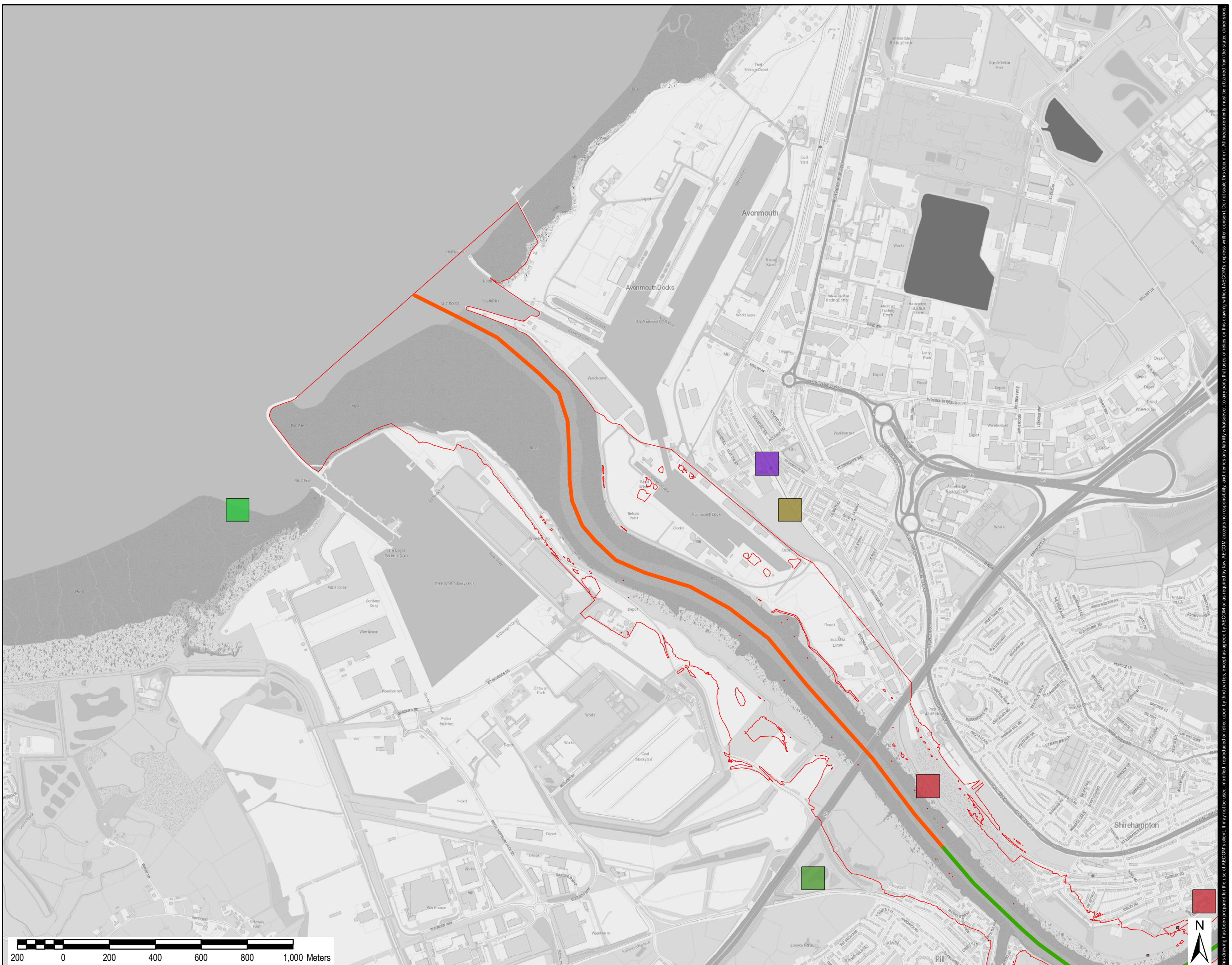
Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and AECOM disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Budgerigar
- Canada Goose
- Carolina Wood Duck
- Giant Hogweed
- Grey Squirrel
- Himalayan Balsam
- Himalayan Cotoneaster
- Japanese Knotweed
- Mandarin
- Muntjac
- New Zealand Pigmyweed
- Rhododendron
- Variegated Yellow Archangel
- Virginia-creeper
- Wall Cotoneaster



Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

FIGURE 4.2.2A
ECOLOGY
SCHEDULE 9 INVASIVE
SPECIES

Scale at A3: 1:15,000

Drawing No: FIGURE 4.2.2A **Rev:** V2

Drawn: Chk'd: App'd: **Date:**

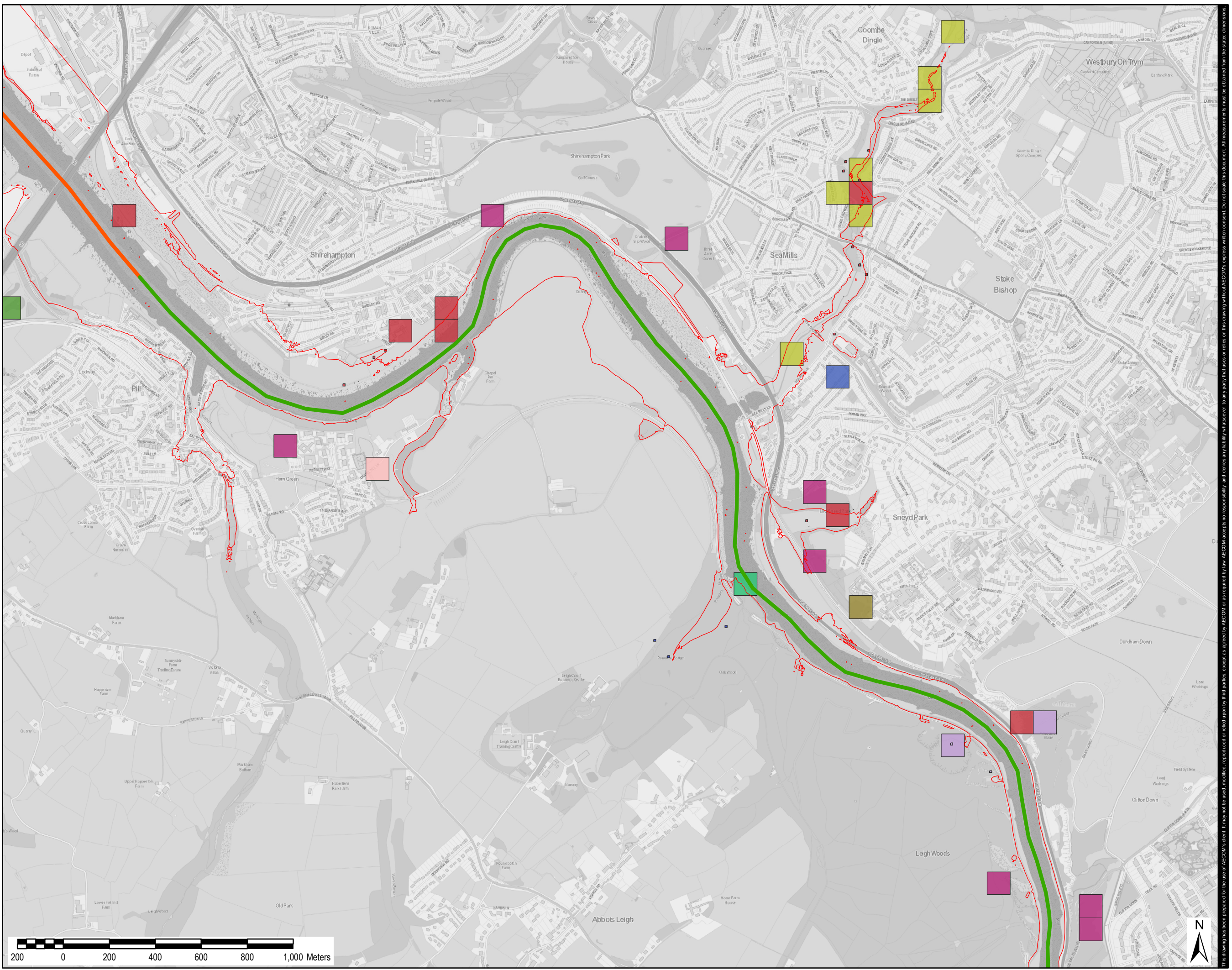
GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Budgerigar
- Canada Goose
- Carolina Wood Duck
- Giant Hogweed
- Grey Squirrel
- Himalayan Balsam
- Himalayan Cotoneaster
- Japanese Knotweed
- Mandarin
- Muntjac
- New Zealand Pigmyweed
- Rhododendron
- Variegated Yellow Archangel
- Virginia-creeper
- Wall Cotoneaster



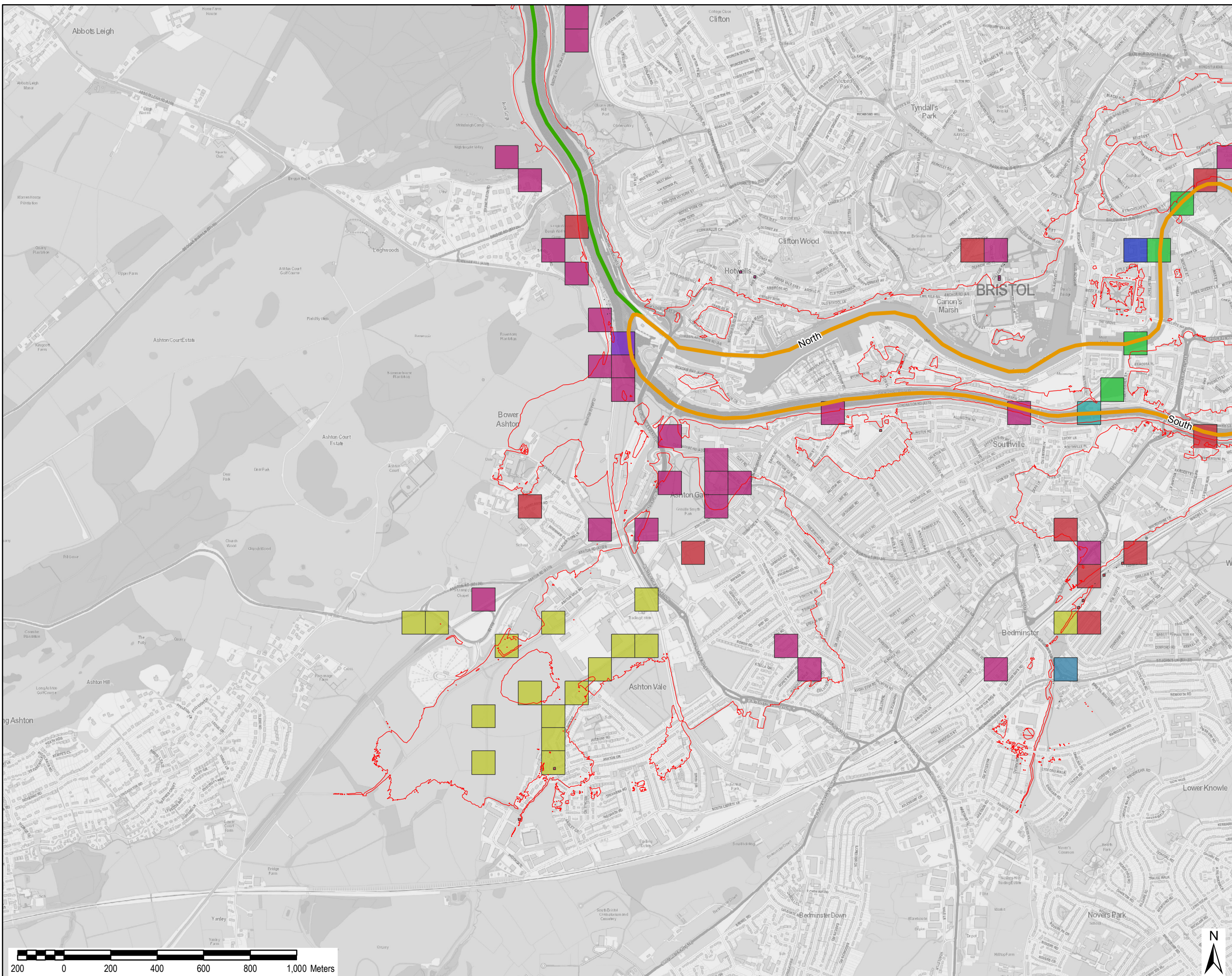
Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
FIGURE 4.2.2B
ECOLOGY
SCHEDULE 9 INVASIVE
SPECIES

Scale at A3: 1:15,000
Drawing No: FIGURE 4.2.2B
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Budgerigar
- Canada Goose
- Carolina Wood Duck
- Giant Hogweed
- Grey Squirrel
- Himalayan Balsam
- Himalayan Cotoneaster
- Japanese Knotweed
- Mandarin
- Muntjac
- New Zealand Pigmyweed
- Rhododendron
- Variegated Yellow Archangel
- Virginia-creeper
- Wall Cotoneaster

Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

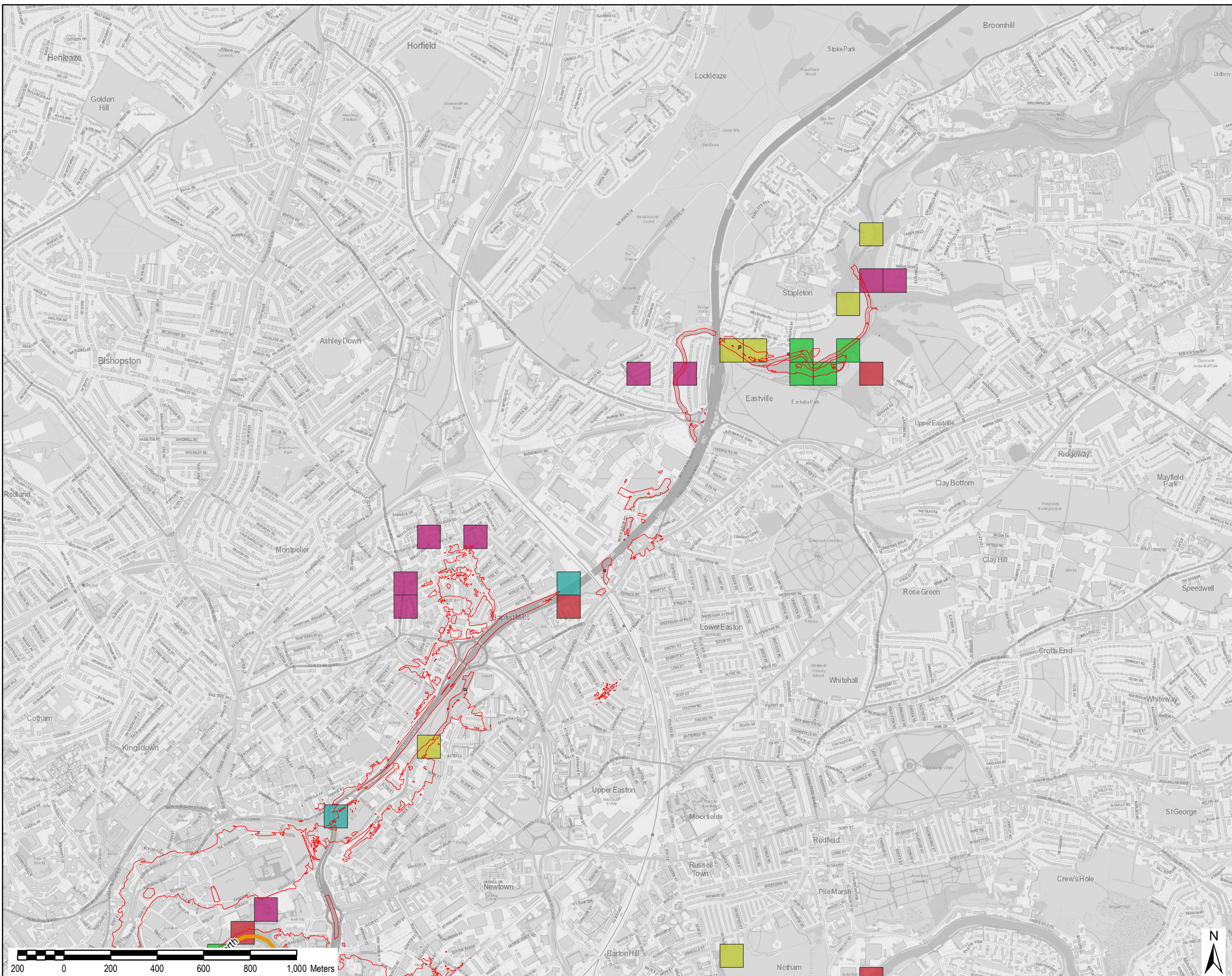
Drawing Title:
 FIGURE 4.2.2C
 ECOLOGY
 SCHEDULE 9 INVASIVE
 SPECIES

Scale at A3: 1:15,000

Drawing No: FIGURE 4.2.2C
Rev: V2

Drawn: Chk'd: App'd: Date:
 GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Budgerigar
- Canada Goose
- Carolina Wood Duck
- Giant Hogweed
- Grey Squirrel
- Himalayan Balsam
- Himalayan Cotoneaster
- Japanese Knotweed
- Mandarin
- Muntjac
- New Zealand Pigmyweed
- Rhododendron
- Variegated Yellow Archangel
- Virginia-creeper
- Wall Cotoneaster

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

FIGURE 4.2.2D
 ECOLOGY
 SCHEDULE 9 INVASIVE
 SPECIES

Scale at A3: 1:15,000

Drawing No: FIGURE 4.2.2D **Rev:** V2

Drawn: Chk'd: App'd: **Date:**

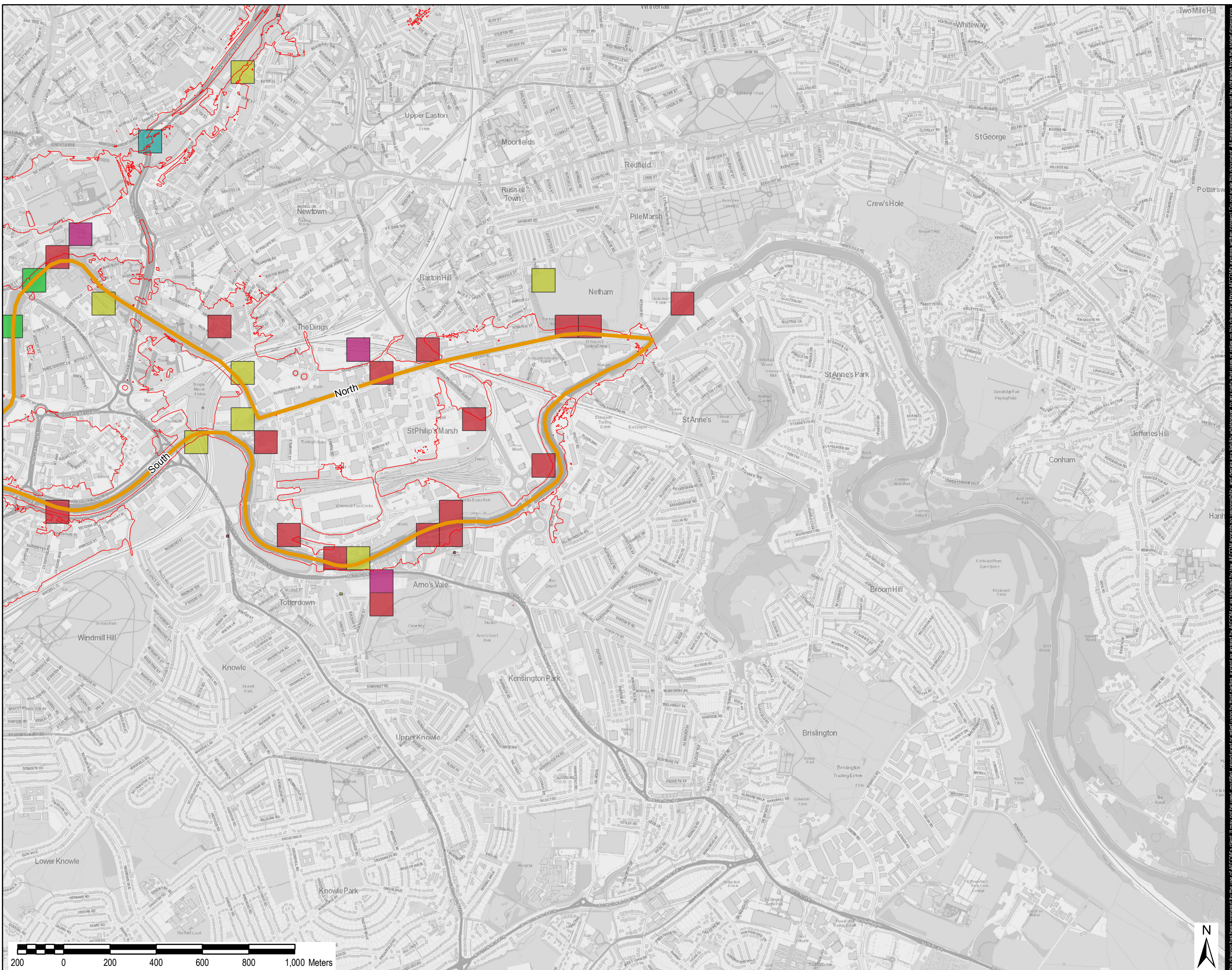
GM SM NT 11/01/16

This drawing has been prepared by the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Budgerigar
- Canada Goose
- Carolina Wood Duck
- Giant Hogweed
- Grey Squirrel
- Himalayan Balsam
- Himalayan Cotoneaster
- Japanese Knotweed
- Mandarin
- Muntjac
- New Zealand Pigmyweed
- Rhododendron
- Variegated Yellow Archangel
- Virginia-creeper
- Wall Cotoneaster



Copyright:

OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.2.2E
 ECOLOGY
 SCHEDULE 9 INVASIVE
 SPECIES**

Scale at A3: 1:15,000

Drawing No: **Rev:**

FIGURE 4.2.2E V2

Drawn: **Chk'd:** **App'd:** **Date:**

GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, copied or related upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Brown Long-eared Bat
- Bullhead
- Common Pipistrelle (45kHz)
- Common Porpoise
- Daubenton's Bat
- Great Crested Newt
- Greater Horseshoe Bat
- Leisler's Bat
- Lesser Horseshoe Bat
- Natterer's Bat
- Noctule
- Otter - likely to be present along the entire
- Pipistrelle (45 or 55kHz)
- Serotine
- Soprano Pipistrelle (55kHz)
- a Myotis bat (unidentified)
- a Vespertilionidae Bat (unidentified)

Additional designated sites such as SSSI, SAC and SPA are shown in Figure 4.2.1

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

FIGURE 4.2.3A
ECOLOGY
EUROPEAN PROTECTED
SITES AND SPECIES

Scale at A3: 1:15,000

Drawing No: **Rev:**

FIGURE 4.2.3A V2

Drawn: **Chk'd:** **App'd:** **Date:**

GM SM NT 11/01/16



This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Brown Long-eared Bat
- Bullhead
- Common Pipistrelle (45kHz)
- Common Porpoise
- Daubenton's Bat
- Great Crested Newt
- Greater Horseshoe Bat
- Leisler's Bat
- Lesser Horseshoe Bat
- Natterer's Bat
- Noctule
- Otter - likely to be present along the entire
- Pipistrelle (45 or 55kHz)
- Serotine
- Soprano Pipistrelle (55kHz)
- a Myotis bat (unidentified)
- a Vespertilionidae Bat (unidentified)

Additional designated sites such as SSSI, SAC and SPA are shown in Figure 4.2.1

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.2.3B
ECOLOGY
EUROPEAN PROTECTED
SITES AND SPECIES**

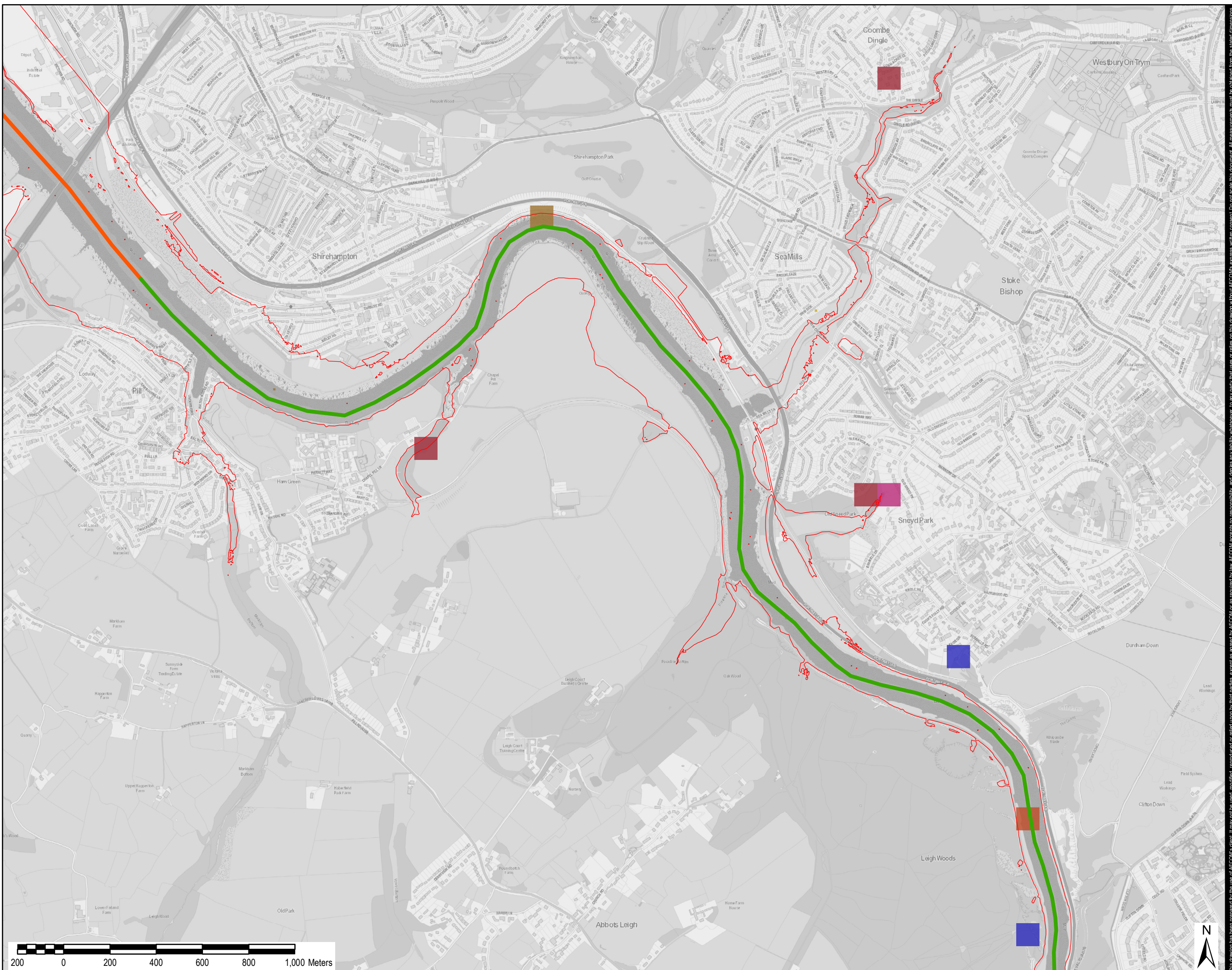
Scale at A3: 1:15,000

Drawing No: **Rev:**

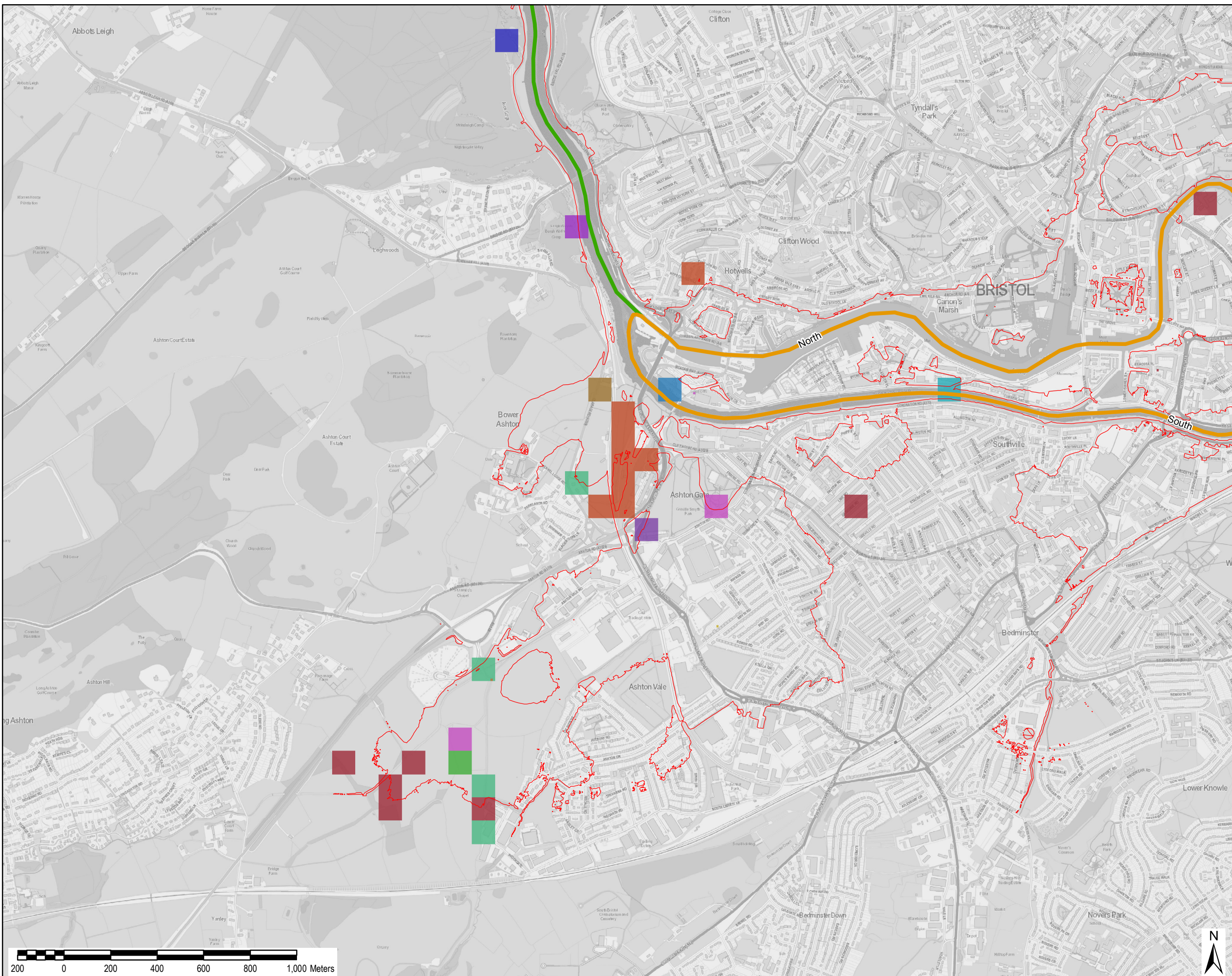
FIGURE 4.2.3B V2

Drawn: **Chk'd:** **App'd:** **Date:**

GM SM NT 11/01/16



This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Brown Long-eared Bat
- Bullhead
- Common Pipistrelle (45kHz)
- Common Porpoise
- Daubenton's Bat
- Great Crested Newt
- Greater Horseshoe Bat
- Leisler's Bat
- Lesser Horseshoe Bat
- Natterer's Bat
- Noctule
- Otter - likely to be present along the entire
- Pipistrelle (45 or 55kHz)
- Serotine
- Soprano Pipistrelle (55kHz)
- a Myotis bat (unidentified)
- a Vespertilionidae Bat (unidentified)

Additional designated sites such as SSSI, SAC and SPA are shown in Figure 4.2.1

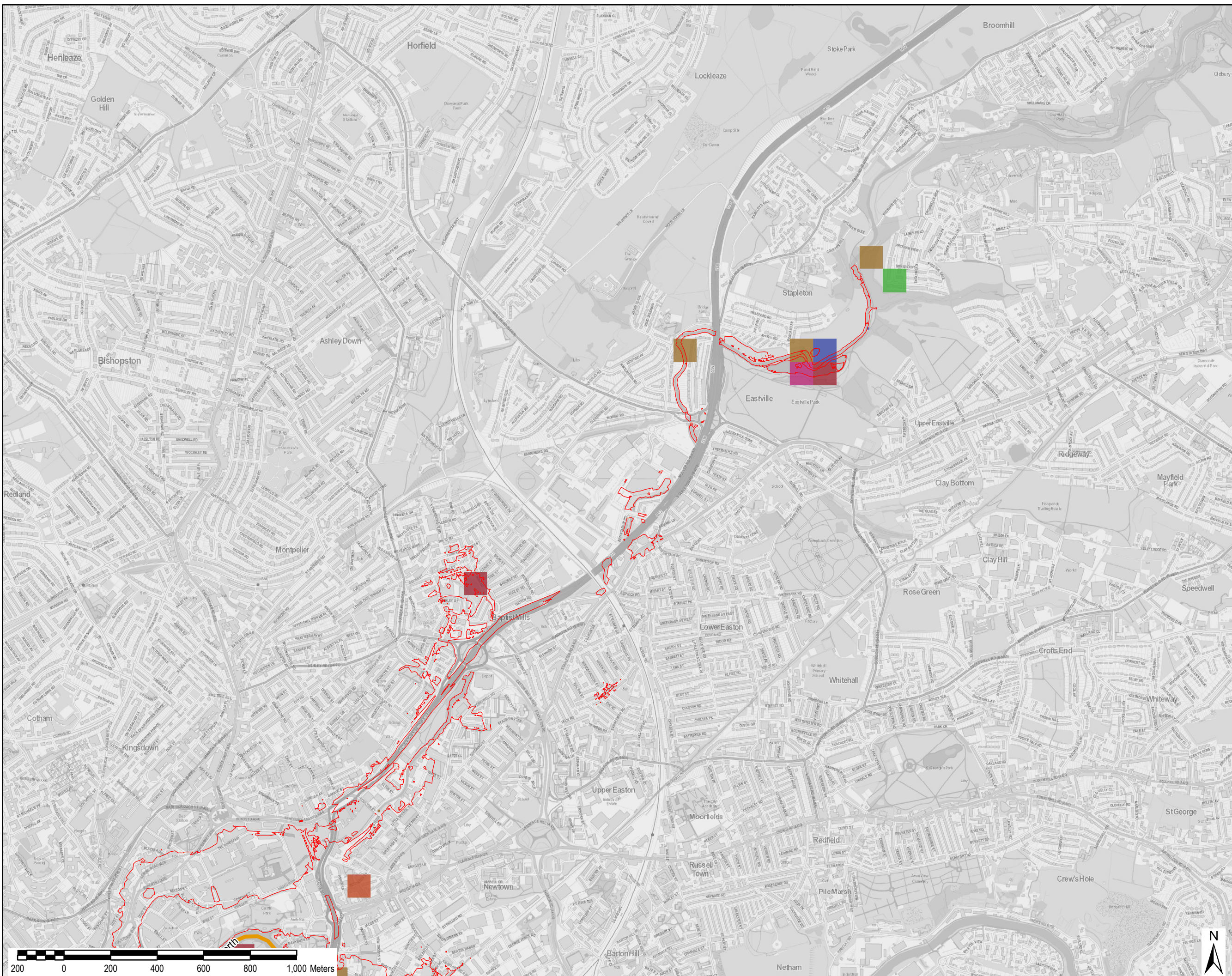
Copyright:
 OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
 FIGURE 4.2.3C
 ECOLOGY
 EUROPEAN PROTECTED
 SITES AND SPECIES

Scale at A3: 1:15,000
Drawing No: FIGURE 4.2.3C
Rev: V2
Drawn: Chk'd: App'd: Date:
 GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Brown Long-eared Bat
- Bullhead
- Common Pipistrelle (45kHz)
- Common Porpoise
- Daubenton's Bat
- Great Crested Newt
- Greater Horseshoe Bat
- Leisler's Bat
- Lesser Horseshoe Bat
- Natterer's Bat
- Noctule
- Otter - likely to be present along the entire
- Pipistrelle (45 or 55kHz)
- Serotine
- Soprano Pipistrelle (55kHz)
- a Myotis bat (unidentified)
- a Vespertilionidae Bat (unidentified)

Additional designated sites such as SSSI, SAC and SPA are shown in Figure 4.2.1

Copyright:
 OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
 FIGURE 4.2.3D
 ECOLOGY
 EUROPEAN PROTECTED
 SITES AND SPECIES

Scale at A3: 1:15,000
Drawing No: FIGURE 4.2.3D
Rev: V2
Drawn: Chk'd: App'd: Date:
 GM SM NT 11/01/16

This drawing has been prepared by the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Brown Long-eared Bat
- Bullhead
- Common Pipistrelle (45kHz)
- Common Porpoise
- Daubenton's Bat
- Great Crested Newt
- Greater Horseshoe Bat
- Leisler's Bat
- Lesser Horseshoe Bat
- Natterer's Bat
- Noctule
- Otter - likely to be present along the entire
- Pipistrelle (45 or 55kHz)
- Serotine
- Soprano Pipistrelle (55kHz)
- a Myotis bat (unidentified)
- a Vespertilionidae Bat (unidentified)

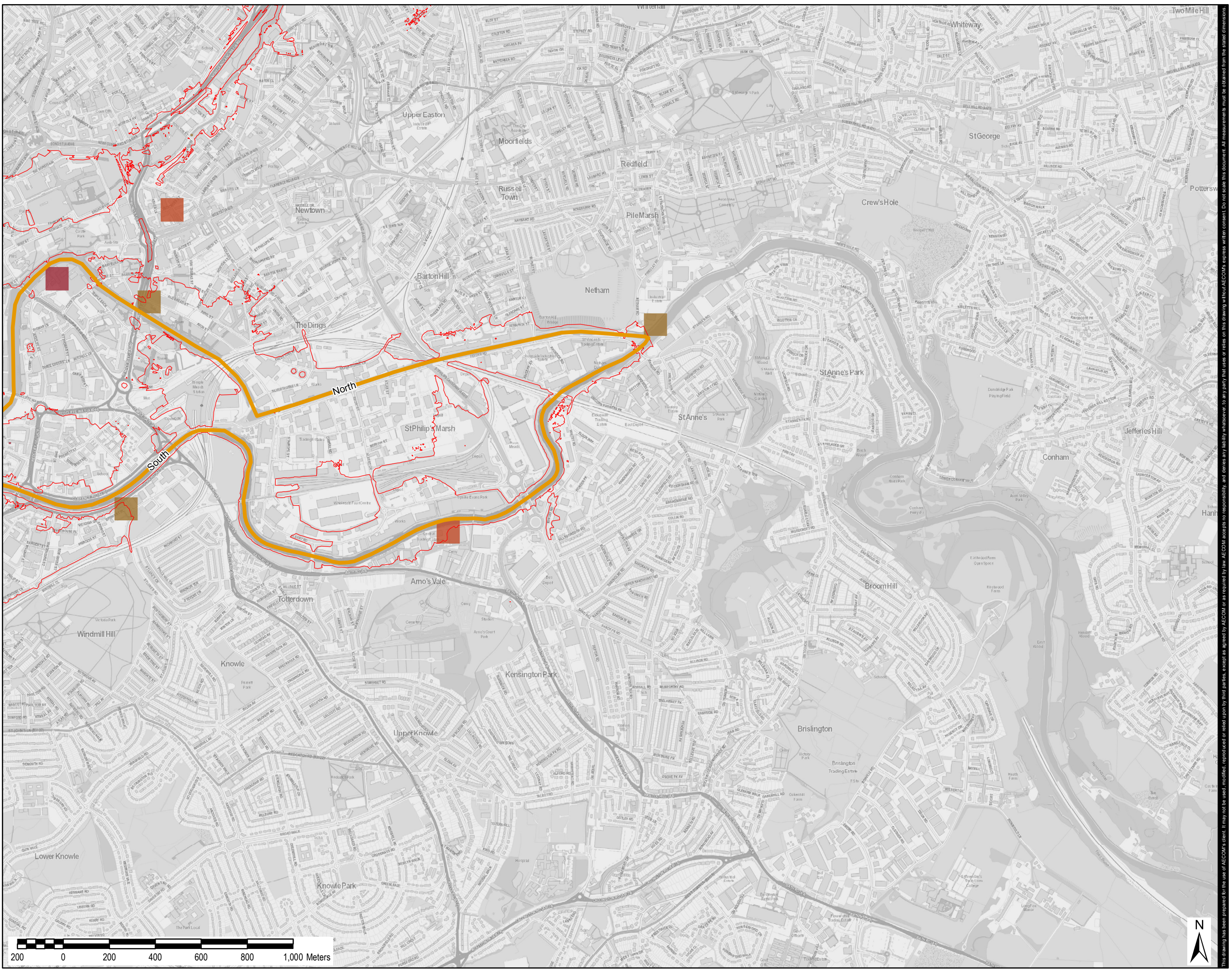
Additional designated sites such as SSSI, SAC and SPA are shown in Figure 4.2.1

Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
**FIGURE 4.2.3E
ECOLOGY
EUROPEAN PROTECTED
SITES AND SPECIES**

Scale at A3: 1:15,000
Drawing No: FIGURE 4.2.3E
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16

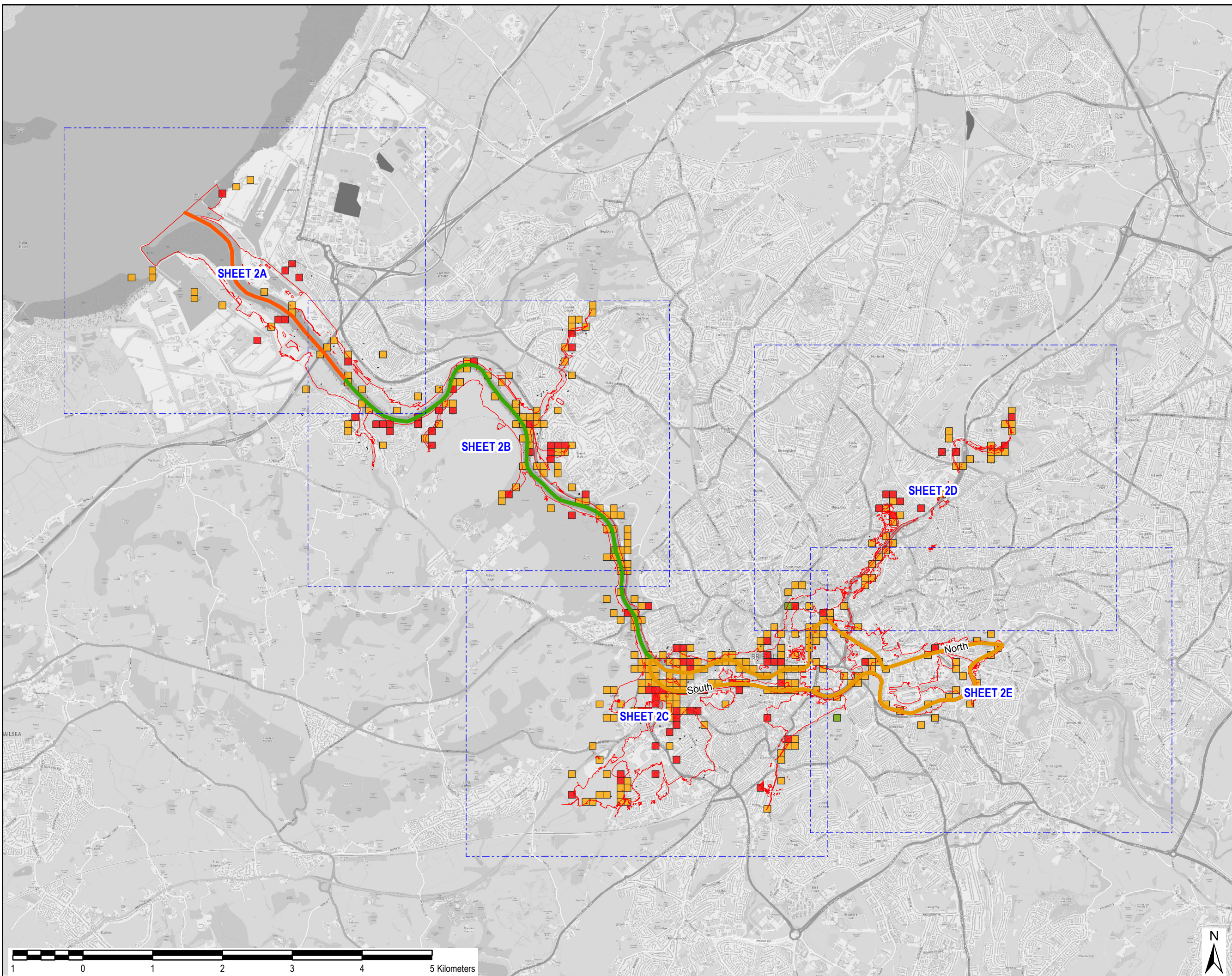


This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or related upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
 - Reach 2
 - Reach 3
 - Study Area
- BRERC Birds -
RSPB Birds of
Conservation
Concern 4
(BoCC 4)**
- Green List
 - Amber List
 - Red list



Copyright:
OS data © Crown copyright &
database rights 2015 Ordnance
Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
FIGURE 4.2.4
ECOLOGY
BIRDS

Scale at A3: 1:50,000

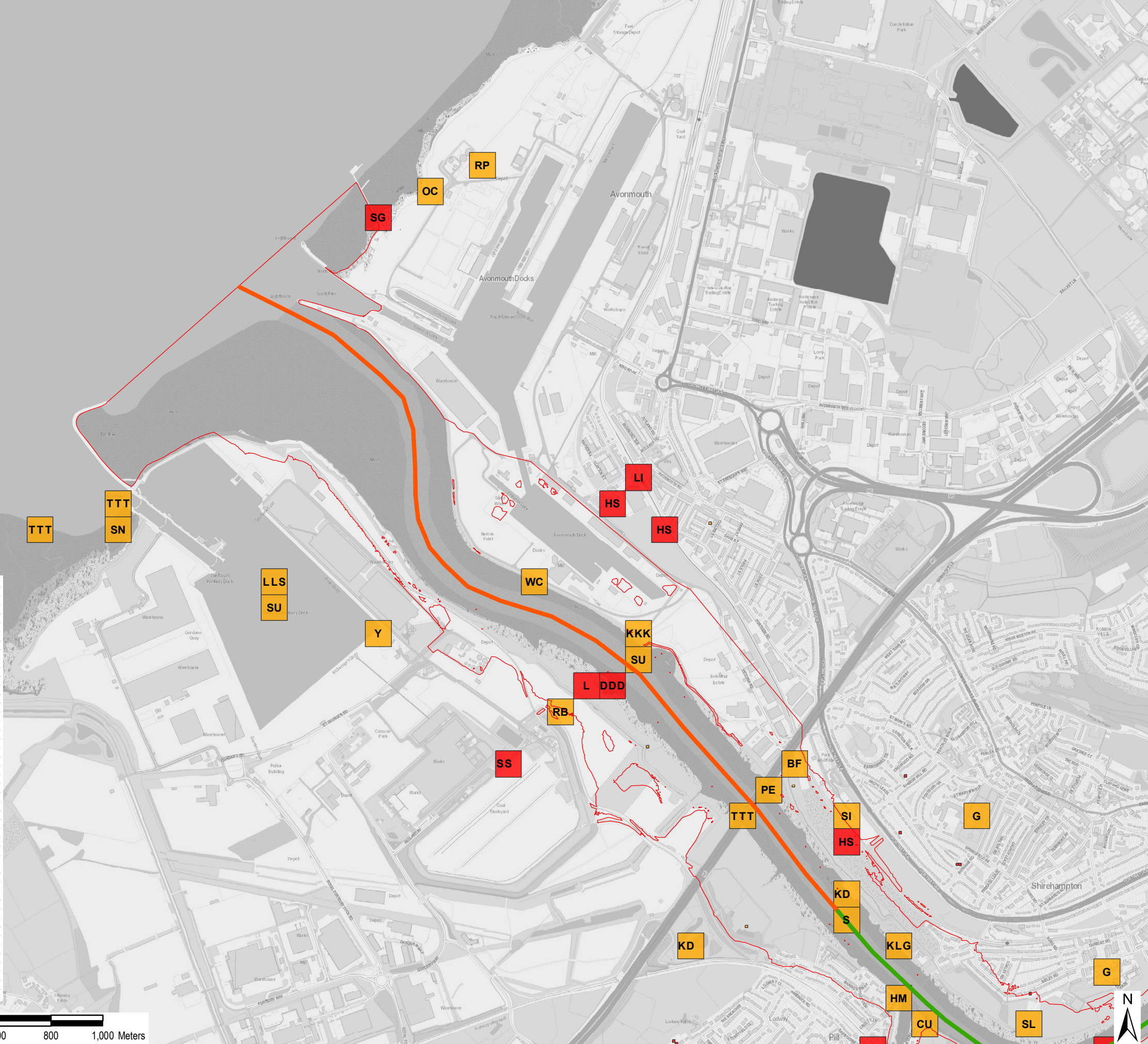
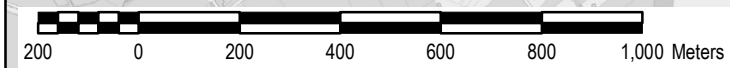
| Drawing No: | Rev: | | |
|--------------|--------|--------|----------|
| FIGURE 4.2.4 | V2 | | |
| Drawn: | Chk'd: | App'd: | Date: |
| GM | SM | SM | 11/01/16 |

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and AECOM disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

| Bird Species | BTO Code | Bird Species | BTO Code |
|--------------------------|----------|----------------------|----------|
| Bar-tailed Godwit | BA | Little Egret | ET |
| Barn Owl | BO | Little Grebe | LG |
| Black Redstart | BX | Little Gull | LU |
| Black-headed Gull | BH | Mallard | MA |
| Black-tailed Godwit | BW | Marsh Tit | MT |
| Brambling | BL | Meadow Pipit | MP |
| Bullfinch | BF | Mediterranean Gull | MU |
| Cetti's Warbler | CW | Mistle Thrush | M |
| Common Gull | CM | Mute Swan | MS |
| Common Sandpiper | CS | Oystercatcher | OC |
| Cormorant | CA | Peregrine | PE |
| Crossbill | CR | Pied Flycatcher | PF |
| Cuckoo | CK | Pochard | PO |
| Curlew | CU | Red Kite | KT |
| Dunlin | DN | Redshank (bird) | RK |
| Dunnock | D | Redstart | RT |
| Fieldfare | FF | Redwing | RE |
| Firecrest | FC | Reed Bunting | RB |
| Gadwall | GA | Ring-necked Parakeet | RI |
| Goldcrest | GC | Ringed Plover | RP |
| Goldeneye | GN | Ruddy Duck | RY |
| Goshawk | GI | Ruddy Shelduck | UD |
| Grasshopper Warbler | GH | Ruff | RU |
| Great Black-backed Gull | GB | Sand Martin | SM |
| Great Northern Diver | ND | Shelduck | SU |
| Great Skua | NX | Shoveler | SV |
| Green Sandpiper | GE | Skylark | S |
| Green Woodpecker | G | Snipe | SN |
| Greenshank | GK | Song Thrush | ST |
| Grey Wagtail | GL | Spotted Flycatcher | SF |
| Greylag Goose | GJ | Spotted Redshank | DR |
| Guillemot | GU | Starling | SG |
| Hawfinch | HF | Stock Dove | SD |
| Herring Gull | HG | Stonechat | SC |
| Hobby | HY | Swallow | SL |
| House Martin | HM | Swift | SI |
| House Sparrow | HS | Teal | T |
| Jack Snipe | JS | Tufted Duck | TU |
| Kestrel | K | Turnstone | TT |
| Kingfisher | KF | Water Rail | WA |
| Knot | KN | Whimbrel | WM |
| Lapwing | L | Whinchat | WC |
| Leach's Petrel | TL | Widgeon | WN |
| Lesser Black-backed Gull | LB | Willow Warbler | WW |
| Lesser Redpoll | LR | Yellow Wagtail | YW |
| Linnet | LI | Yellowhammer | Y |



Copyright:

OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

FIGURE 4.2.4A
 ECOLOGY
 BIRDS

Scale at A3: 1:15,000

Drawing No: FIGURE 4.2.4A **Rev:** V2

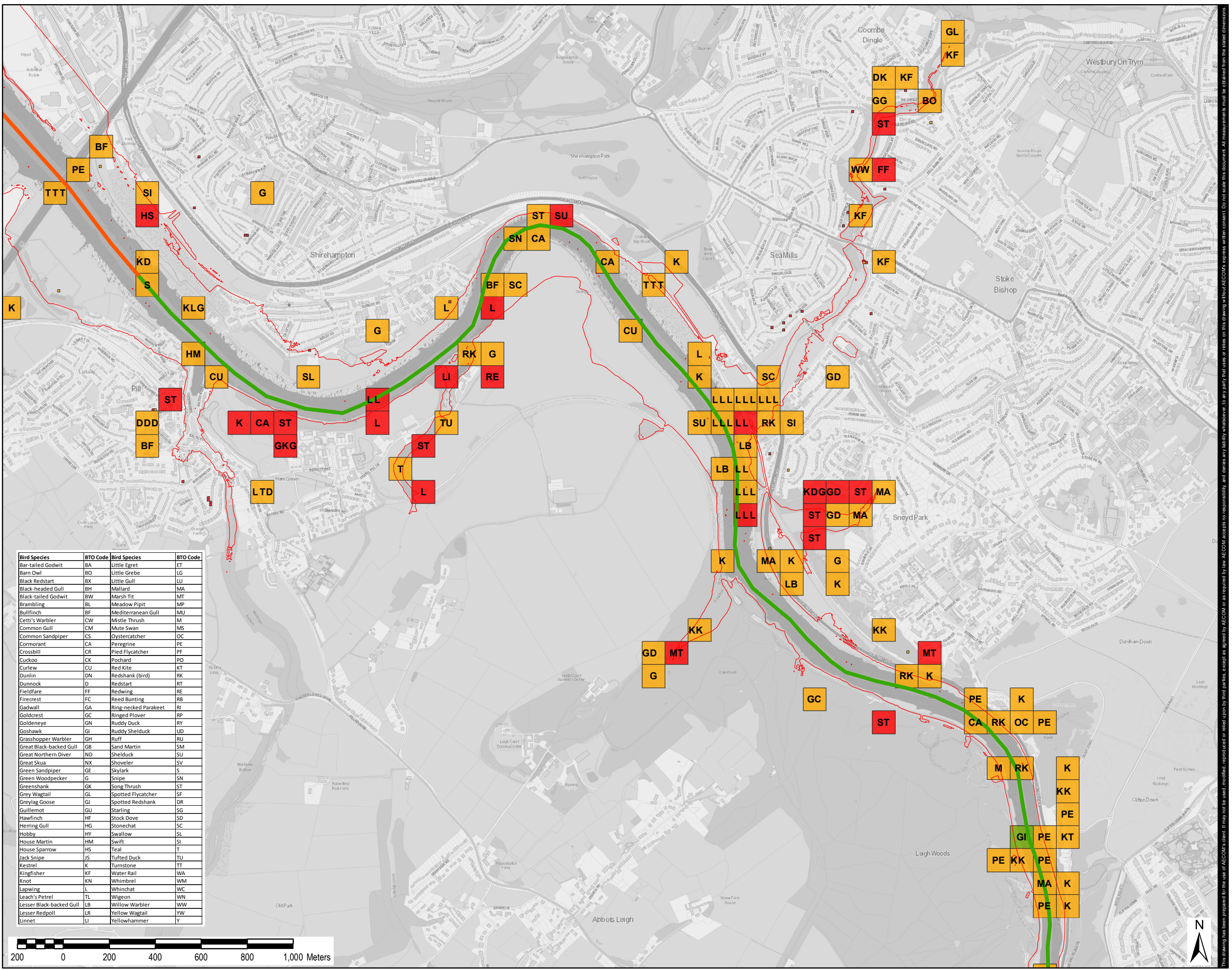
Drawn: Chk'd: App'd: **Date:**

GM SM NT 11/01/16

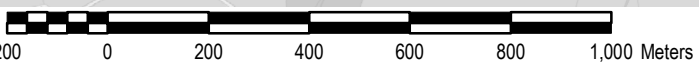
This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND



| Bird Species | BTO Code | Bird Species | BTO Code |
|--------------------------|----------|----------------------|----------|
| Bar-tailed Godwit | BA | Little Egret | ET |
| Barn Owl | BO | Little Grebe | LG |
| Black Redstart | BX | Little Gull | LU |
| Black-headed Gull | BH | Mallard | MA |
| Black-tailed Godwit | BW | Marsh Tit | MT |
| Brambling | Bl | Meadow Pipit | MP |
| Bullfinch | BF | Mediterranean Gull | MU |
| Cetti's Warbler | CW | Mistle Thrush | M |
| Common Gull | CM | Mute Swan | MS |
| Common Sandpiper | CS | Oystercatcher | OC |
| Cormorant | CA | Peregrine | PE |
| Crossbill | CR | Pied Flycatcher | PF |
| Cuckoo | CK | Pochard | PO |
| Curlew | CU | Red Kite | KT |
| Dunlin | DN | Redshank (bird) | RK |
| Dunnock | D | Redstart | RT |
| Fieldfare | FF | Redwing | RE |
| Firecrest | FC | Reed Bunting | RB |
| Gadwall | GA | Ring-necked Parakeet | RI |
| Goldcrest | GC | Ringed Plover | RP |
| Goldeneye | GN | Ruddy Duck | RY |
| Goshawk | GI | Ruddy Shelduck | UD |
| Grasshopper Warbler | GH | Ruff | RU |
| Great Black-backed Gull | GB | Sand Martin | SM |
| Great Northern Diver | ND | Shelduck | SU |
| Great Skua | NX | Shoveler | SV |
| Green Sandpiper | GE | Skiplark | S |
| Green Woodpecker | G | Snipe | SN |
| Greenshank | GK | Song Thrush | ST |
| Grey Wagtail | GL | Spotted Flycatcher | SF |
| Greylag Goose | GJ | Spotted Redshank | DR |
| Guillemot | GU | Starling | SG |
| Hawfinch | HF | Stock Dove | SD |
| Herring Gull | HG | Stonechat | SC |
| Hobby | HY | Swallow | SL |
| House Martin | HM | Swift | SI |
| House Sparrow | HS | Teal | T |
| Jack Snipe | JS | Tufted Duck | TU |
| Kestrel | K | Turnstone | TT |
| Kingfisher | KF | Water Rail | WA |
| Knot | KN | Whimbrel | WM |
| Lapwing | L | Whinchat | WC |
| Leach's Petrel | TL | Widgeon | WN |
| Lesser Black-backed Gull | LB | Willow Warbler | WW |
| Lesser Redpoll | LR | Yellow Wagtail | YW |
| Linnet | LI | Yellowhammer | Y |



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

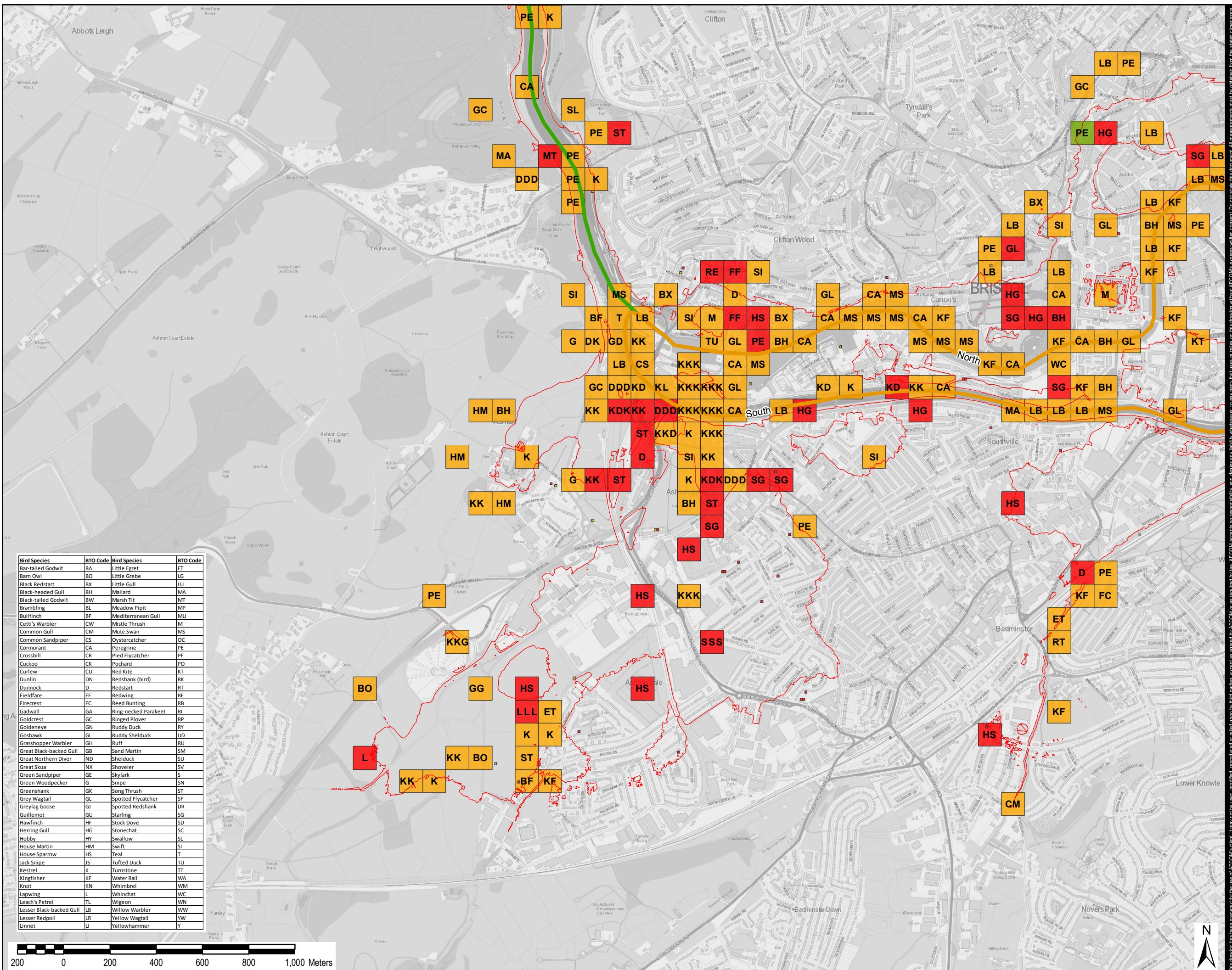
Drawing Title:
FIGURE 4.2.4B
ECOLOGY
BIRDS

Scale at A3: 1:15,000
Drawing No: FIGURE 4.2.4B
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16

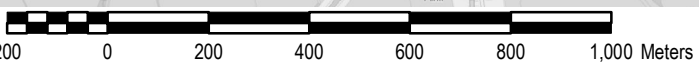
This drawing has been prepared by the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND



| Bird Species | BTO Code | Bird Species | BTO Code |
|--------------------------|----------|----------------------|----------|
| Bar-tailed Godwit | BA | Little Egret | ET |
| Barn Owl | BO | Little Grebe | LG |
| Black Redstart | BX | Little Gull | LU |
| Black-headed Gull | BH | Mallard | MA |
| Black-tailed Godwit | BW | Marsh Tit | MT |
| Brambling | BL | Meadow Pipit | MP |
| Bullfinch | BF | Mediterranean Gull | MU |
| Cetti's Warbler | CW | Mistle Thrush | M |
| Common Gull | CM | Mute Swan | MS |
| Common Sandpiper | CS | Oystercatcher | OC |
| Cormorant | CA | Peregrine | PE |
| Crossbill | CR | Pied Flycatcher | PF |
| Cuckoo | CK | Pochard | PO |
| Curlew | CU | Red Kite | KT |
| Dunlin | DN | Redshank (bird) | RK |
| Dunnock | D | Redstart | RT |
| Fieldfare | FF | Redwing | RE |
| Firecrest | FC | Reed Bunting | RB |
| Godwin | GA | Ring-necked Parakeet | RI |
| Goldcrest | GC | Ringed Plover | RP |
| Goldeneye | GN | Ruddy Duck | RY |
| Goshawk | GI | Ruddy Shelduck | UD |
| Grasshopper Warbler | GH | Ruff | RU |
| Great Black-backed Gull | GB | Sand Martin | SM |
| Great Northern Diver | ND | Shelduck | SU |
| Great Skua | NX | Shoveler | SV |
| Green Sandpiper | GE | Skylark | S |
| Green Woodpecker | G | Snipe | SN |
| Greenshank | GK | Song Thrush | ST |
| Grey Wagtail | GL | Spotted Flycatcher | SF |
| Greylag Goose | GJ | Spotted Redshank | DR |
| Guillemot | GU | Starling | SG |
| Hawfinch | HF | Stock Dove | SD |
| Herring Gull | HG | Stonechat | SC |
| Hobby | HY | Swallow | SL |
| House Martin | HM | Swift | SI |
| House Sparrow | HS | Teal | T |
| Jack Snipe | JS | Tufted Duck | TU |
| Kestrel | K | Turnstone | TT |
| Kingfisher | KF | Water Rail | WA |
| Knot | KN | Whimbrel | WM |
| Lapwing | L | Whinchat | WC |
| Leach's Petrel | TL | Widgeon | WN |
| Lesser Black-backed Gull | LB | Willow Warbler | WW |
| Lesser Redpoll | LR | Yellow Wagtail | YW |
| Linnet | LI | Yellowhammer | Y |



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

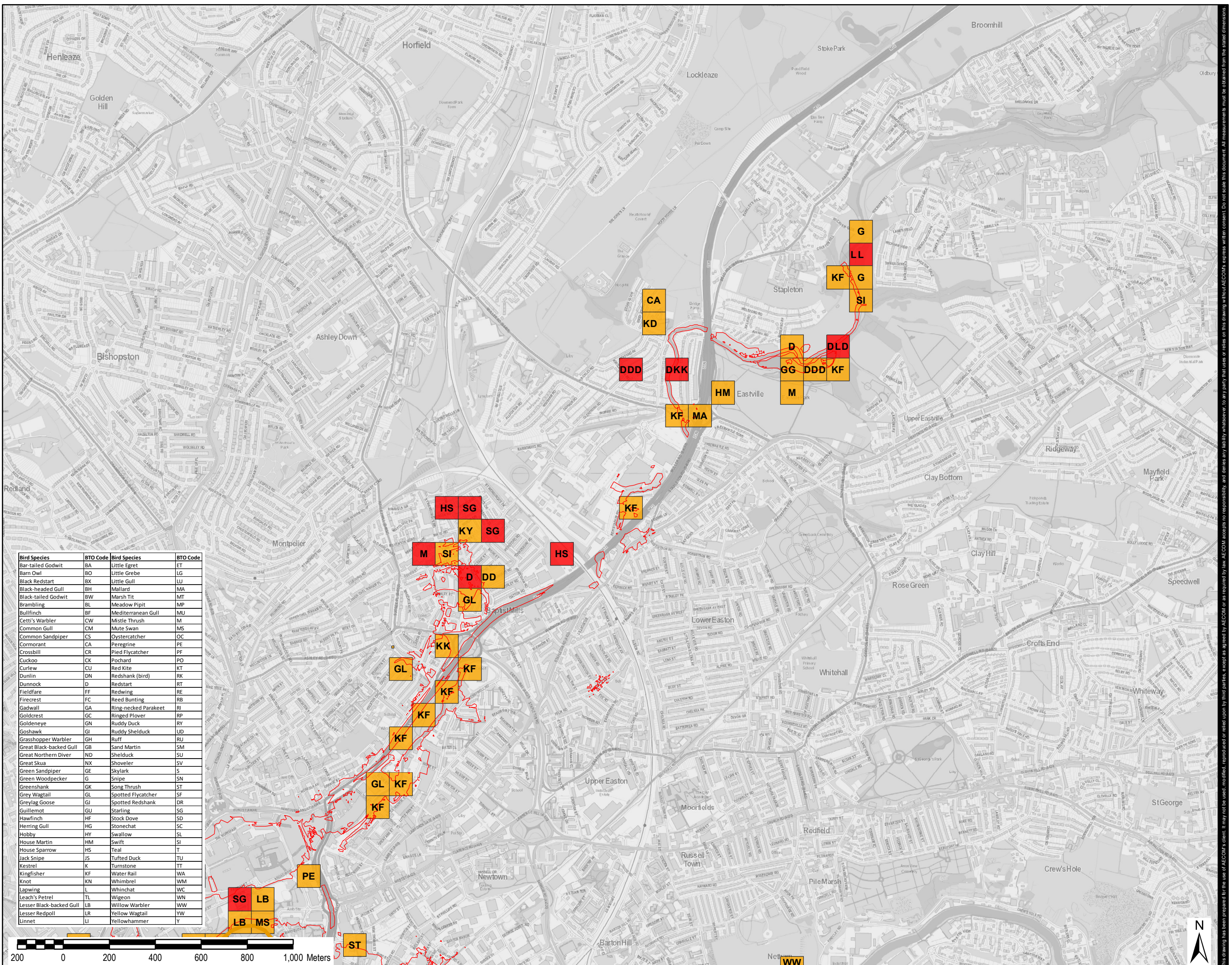
Drawing Title:
FIGURE 4.2.4C
ECOLOGY
BIRDS

Scale at A3: 1:15,000
Drawing No: FIGURE 4.2.4C
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND



| Bird Species | BTO Code | Bird Species | BTO Code |
|--------------------------|----------|----------------------|----------|
| Bar-tailed Godwit | BA | Little Egret | ET |
| Barn Owl | BO | Little Grebe | LG |
| Black Redstart | BX | Little Gull | LU |
| Black-headed Gull | BH | Mallard | MA |
| Black-tailed Godwit | BW | Marsh Tit | MT |
| Brambling | Bl | Meadow Pipit | MP |
| Bullfinch | BF | Mediterranean Gull | MU |
| Cetti's Warbler | CW | Mistle Thrush | M |
| Common Gull | CM | Mute Swan | MS |
| Common Sandpiper | CS | Oystercatcher | OC |
| Cormorant | CA | Peregrine | PE |
| Crossbill | CR | Pied Flycatcher | PF |
| Cuckoo | CK | Pochard | PO |
| Curlew | CU | Red Kite | KT |
| Dunlin | DN | Redshank (bird) | RK |
| Duncock | D | Redstart | RT |
| Fieldfare | FF | Redwing | RE |
| Firecrest | FC | Reed Bunting | RB |
| Gadwall | GA | Ring-necked Parakeet | RI |
| Goldcrest | GC | Ringed Plover | RP |
| Goldeneye | GN | Ruddy Duck | RY |
| Goshawk | GI | Ruddy Shelduck | UD |
| Grasshopper Warbler | GH | Ruff | RU |
| Great Black-backed Gull | GB | Sand Martin | SM |
| Great Northern Diver | ND | Shelduck | SU |
| Great Skua | NX | Shoveler | SV |
| Green Sandpiper | GE | Skylark | S |
| Green Woodpecker | G | Snipe | SN |
| Greenshank | GK | Song Thrush | ST |
| Grey Wagtail | GL | Spotted Flycatcher | SF |
| Greylag Goose | GJ | Spotted Redshank | DR |
| Gullinot | GU | Starling | SG |
| Hawfinch | HF | Stock Dove | SD |
| Herring Gull | HG | Stonechat | SC |
| Hobby | HY | Swallow | SL |
| House Martin | HM | Swift | SI |
| House Sparrow | HS | Teal | T |
| Jack Snipe | JS | Tufted Duck | TU |
| Kestrel | K | Turnstone | TT |
| Kingfisher | KF | Water Rail | WA |
| Knot | KN | Whimbrel | WM |
| Lapwing | L | Whinchat | WC |
| Leach's Petrel | TL | Widgeon | WN |
| Lesser Black-backed Gull | LB | Willow Warbler | WW |
| Lesser Redpoll | LR | Yellow Wagtail | YW |
| Linnet | LU | Yellowhammer | Y |

Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
FIGURE 4.2.4D
ECOLOGY
BIRDS

Scale at A3: 1:15,000

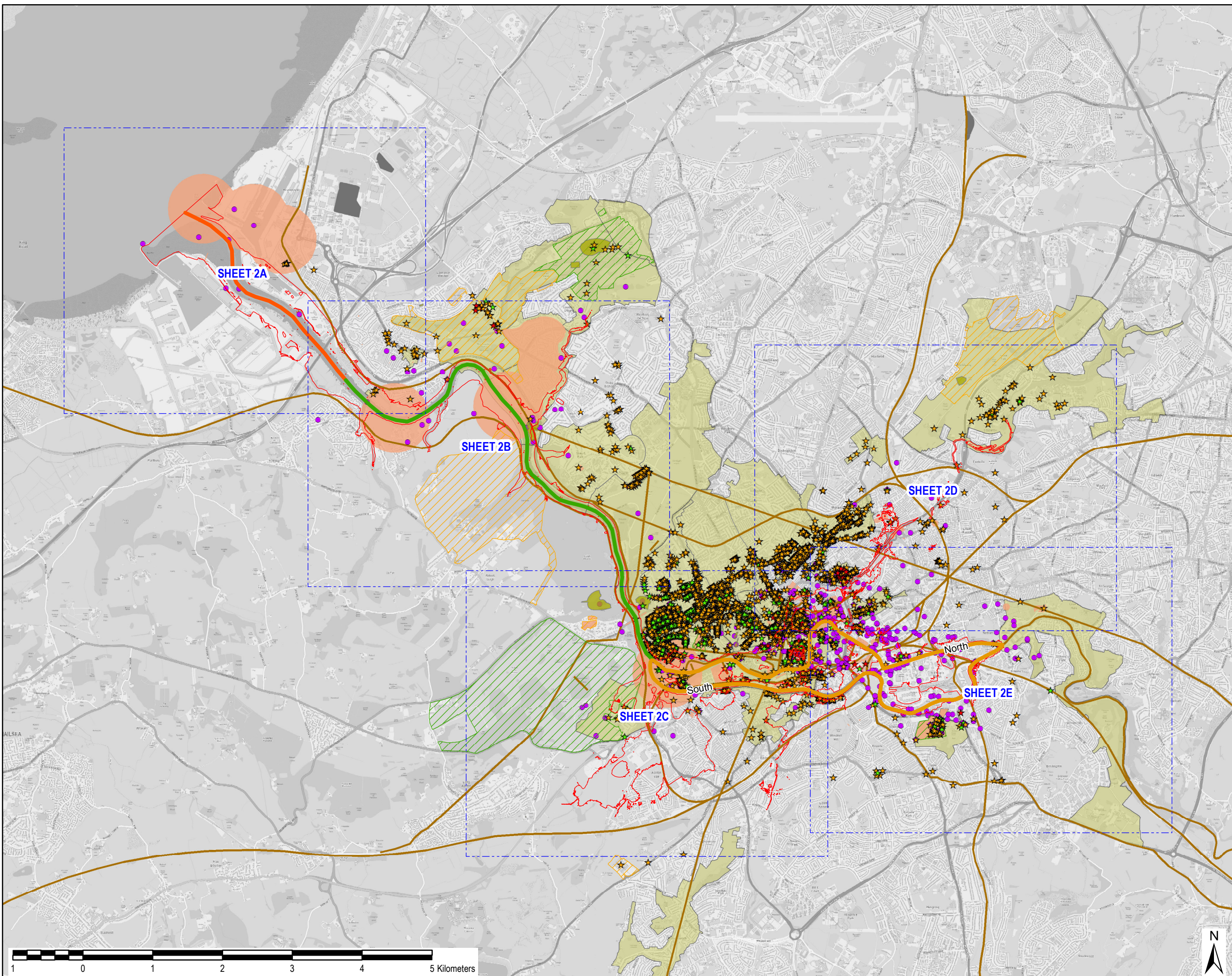
Drawing No: FIGURE 4.2.4D
Rev: V2

Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16



LEGEND

- Reach 1
 - Reach 2
 - Reach 3
 - Study Area
 - AMIE Monuments
 - ★ Grade I Listing
 - ★ Grade II Listing
 - ★ Grade II* Listing
 - AMIE Linear Monuments
 - Scheduled Monument
 - AMIE Approximate Locations of Monuments
 - Conservation Areas
- Registered Park and Garden**
- Grade II
 - Grade II*



Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

FIGURE 4.3
ARCHAEOLOGY AND
BUILT HERITAGE

Scale at A3: 1:50,000

Drawing No: **Rev:**

FIGURE 4.3 V2

Drawn: **Chk'd:** **App'd:** **Date:**

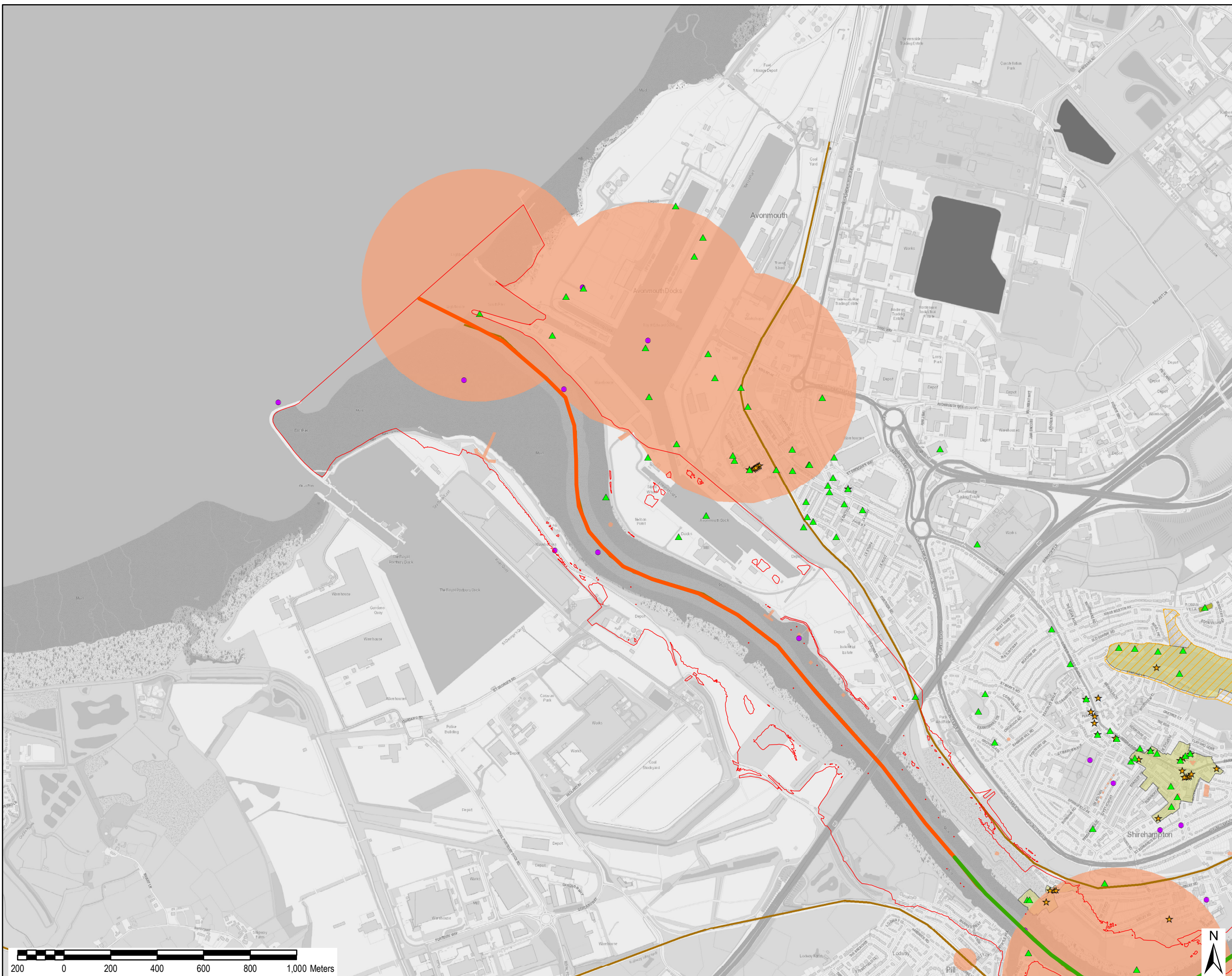
GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and AECOM disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ▲ Historic Environment Record
- AMIE Monuments
- AMIE Linear Monuments
- AMIE Approximate Locations of Monuments
- Scheduled Monument
- Conservation Areas
- Listed Buildings**
- ★ Grade I Listing
- ★ Grade II Listing
- ★ Grade II* Listing
- Registered Park and Garden**
- Grade II
- Grade II*



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
 FIGURE 4.3A
 ARCHAEOLOGY AND
 BUILT HERITAGE

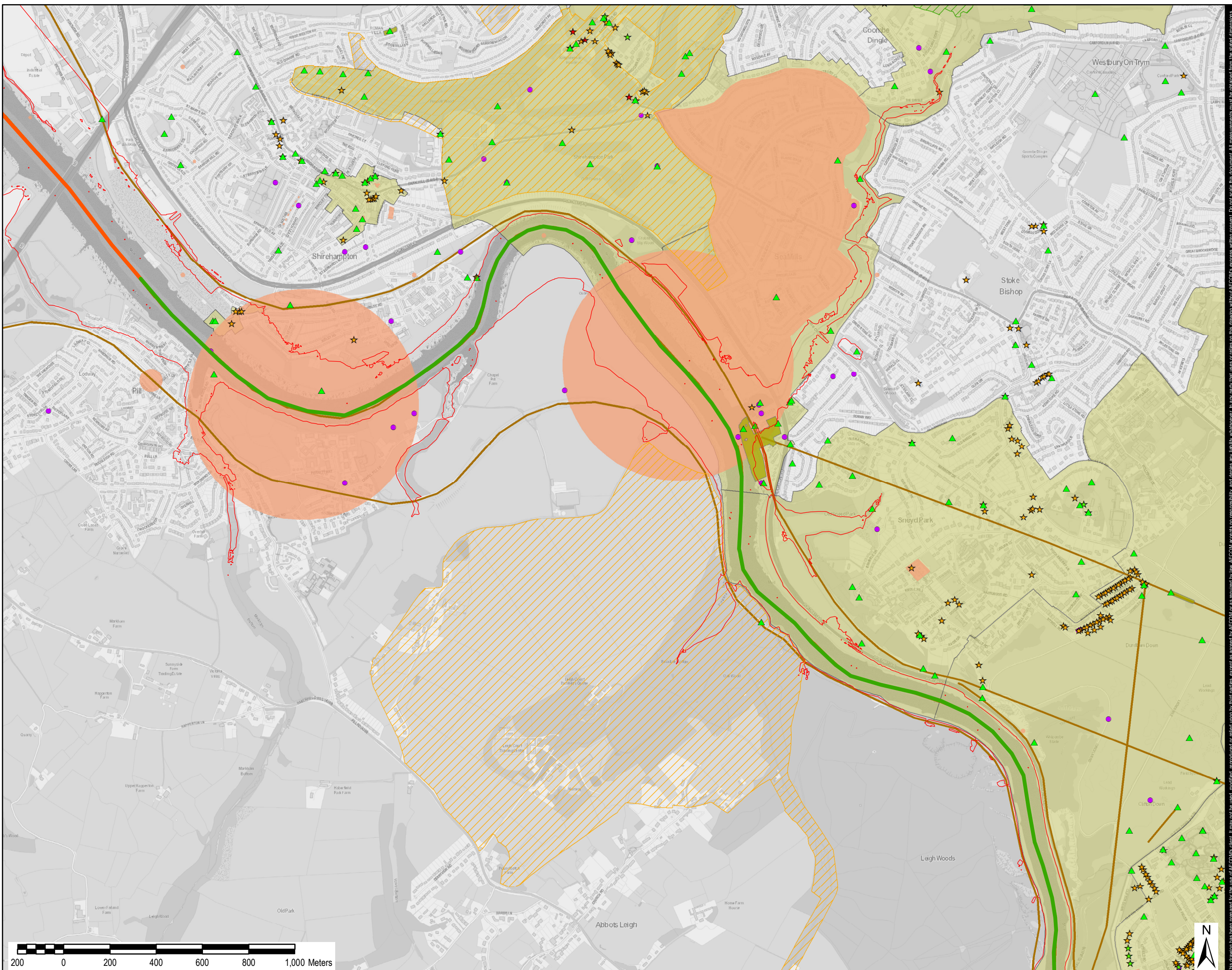
Scale at A3: 1:15,000
Drawing No: FIGURE 4.3A
Rev: V2
Drawn: Chk'd: App'd: Date:
 GM SM NT 27/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ▲ Historic Environment Record
- AMIE Monuments
- AMIE Linear Monuments
- AMIE Approximate Locations of Monuments
- Scheduled Monument
- Conservation Areas
- Listed Buildings**
- ★ Grade I Listing
- ★ Grade II Listing
- ★ Grade II* Listing
- Registered Park and Garden**
- Grade II
- Grade II*



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

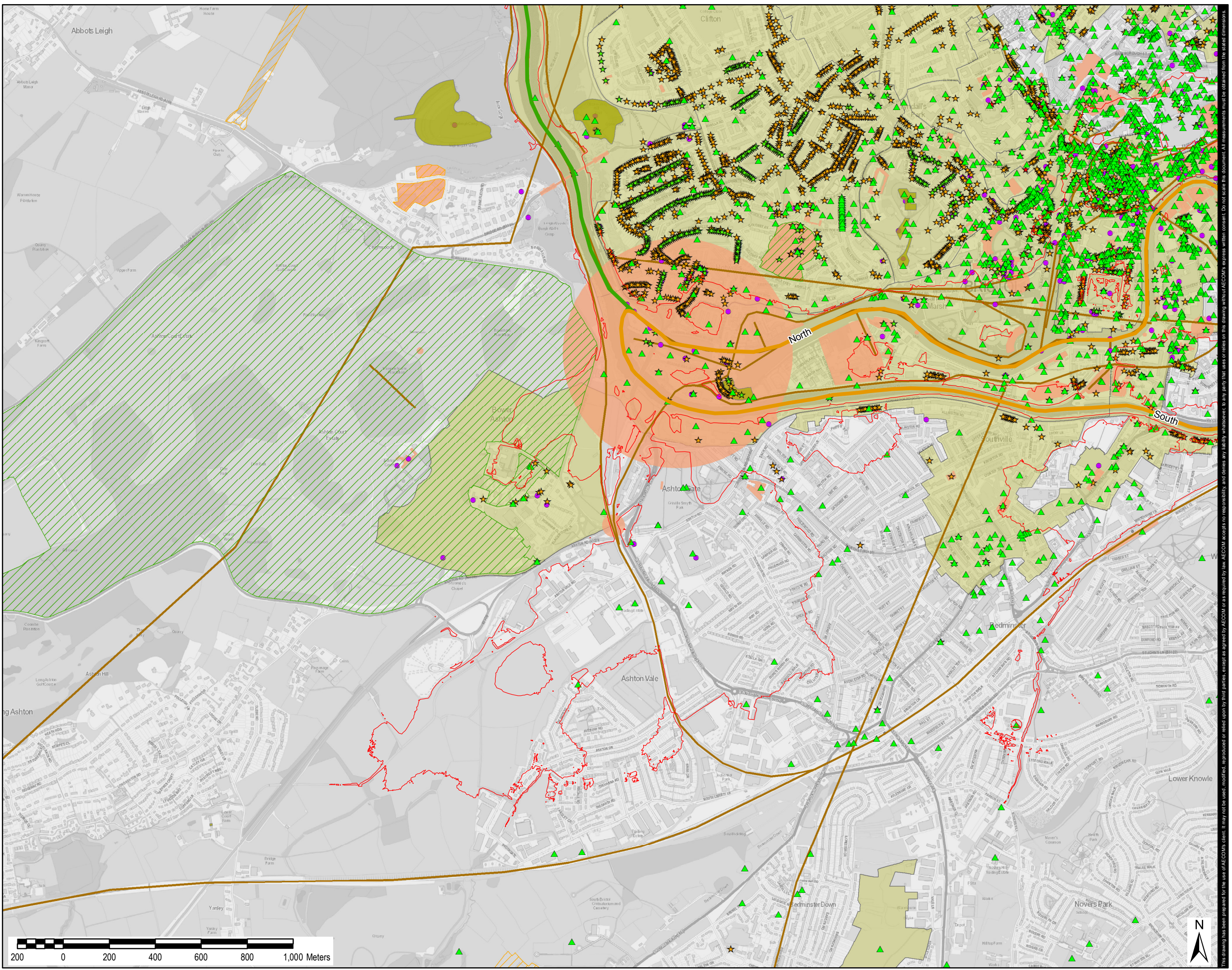
Drawing Title:
FIGURE 4.3B
ARCHAEOLOGY AND
BUILT HERITAGE

Scale at A3: 1:15,000
Drawing No: FIGURE 4.3B
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 27/01/16



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ▲ Historic Environment Record
- AMIE Monuments
- AMIE Linear Monuments
- AMIE Approximate Locations of Monuments
- Scheduled Monument
- Conservation Areas
- Listed Buildings**
- ★ Grade I Listing
- ★ Grade II Listing
- ★ Grade II* Listing
- Registered Park and Garden**
- Grade II
- Grade II*



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

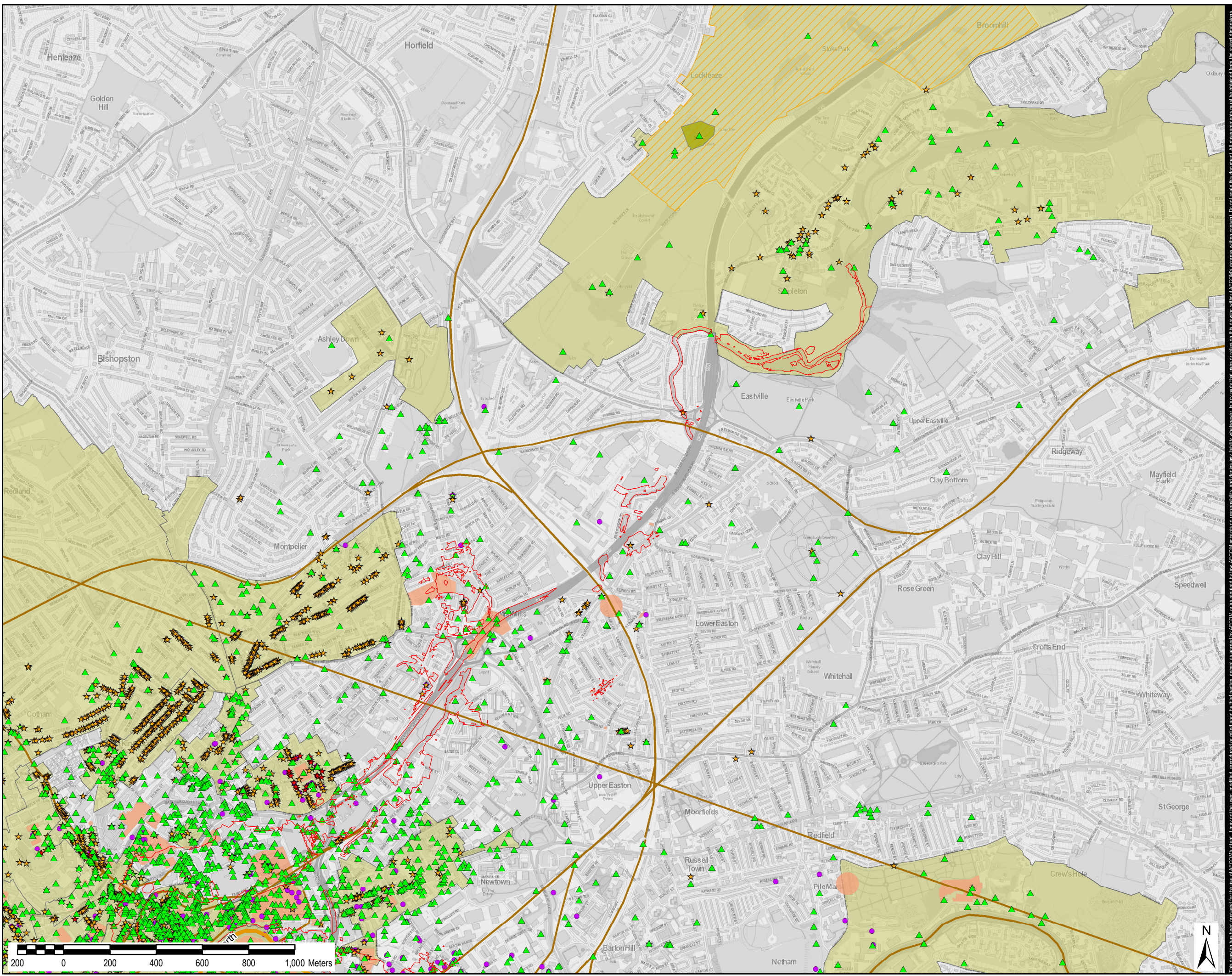
Drawing Title:
FIGURE 4.3C
ARCHAEOLOGY AND
BUILT HERITAGE

Scale at A3: 1:15,000
Drawing No: FIGURE 4.3C
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 27/01/16



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ▲ Historic Environment Record
- AMIE Monuments
- AMIE Linear Monuments
- AMIE Approximate Locations of Monuments
- Scheduled Monument
- Conservation Areas
- Listed Buildings**
- ★ Grade I Listing
- ★ Grade II Listing
- ★ Grade II* Listing
- Registered Park and Garden**
- Grade II
- Grade II*



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
FIGURE 4.3D
ARCHAEOLOGY AND
BUILT HERITAGE

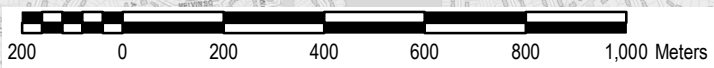
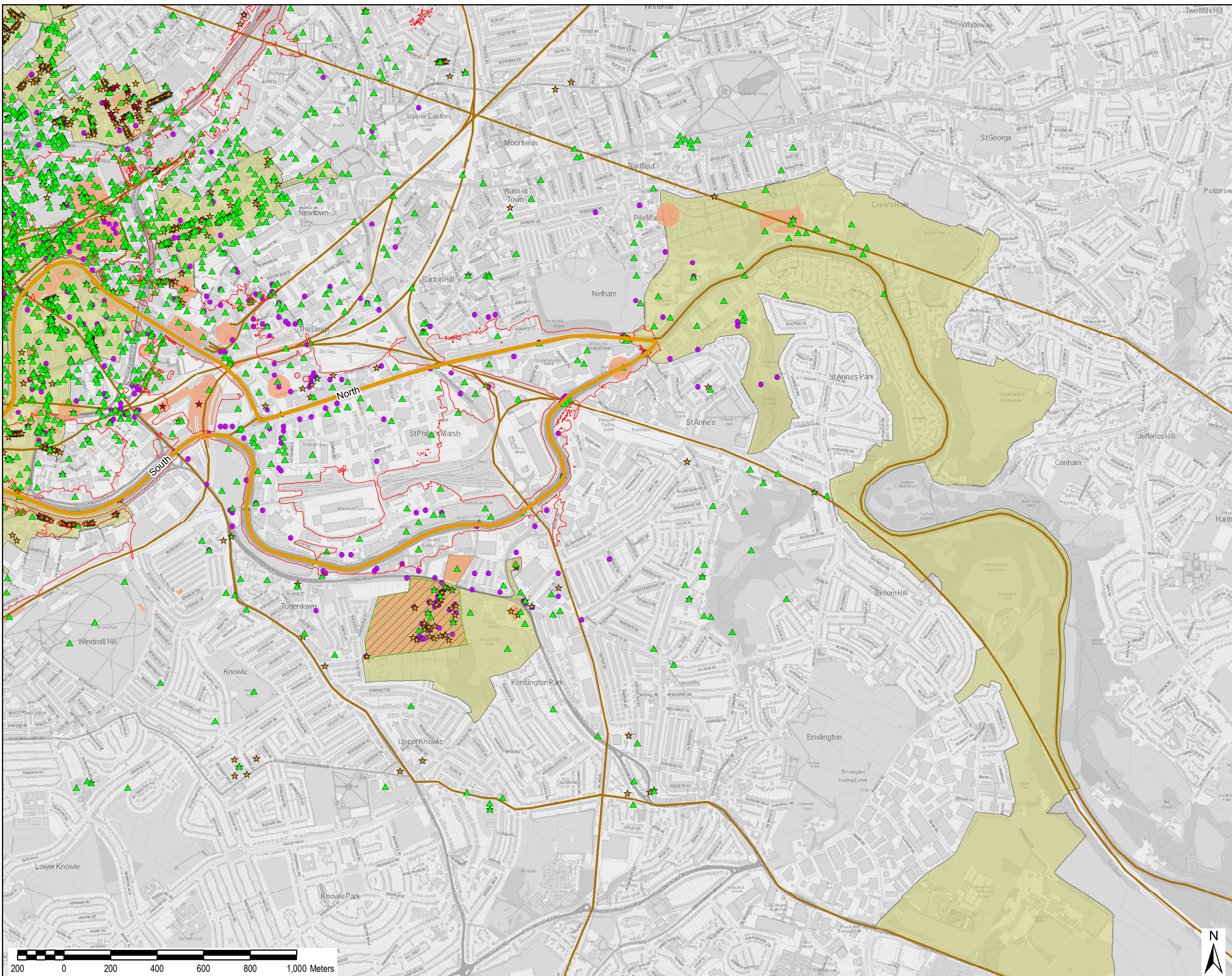
Scale at A3: 1:15,000
Drawing No: FIGURE 4.3D
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 27/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ▲ Historic Environment Record
- AMIE Monuments
- AMIE Linear Monuments
- AMIE Approximate Locations of Monuments
- Scheduled Monument
- Conservation Areas
- Listed Buildings**
- ★ Grade I Listing
- ★ Grade II Listing
- ★ Grade II* Listing
- Registered Park and Garden**
- Grade II
- Grade II*



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
FIGURE 4.3E
ARCHAEOLOGY AND
BUILT HERITAGE

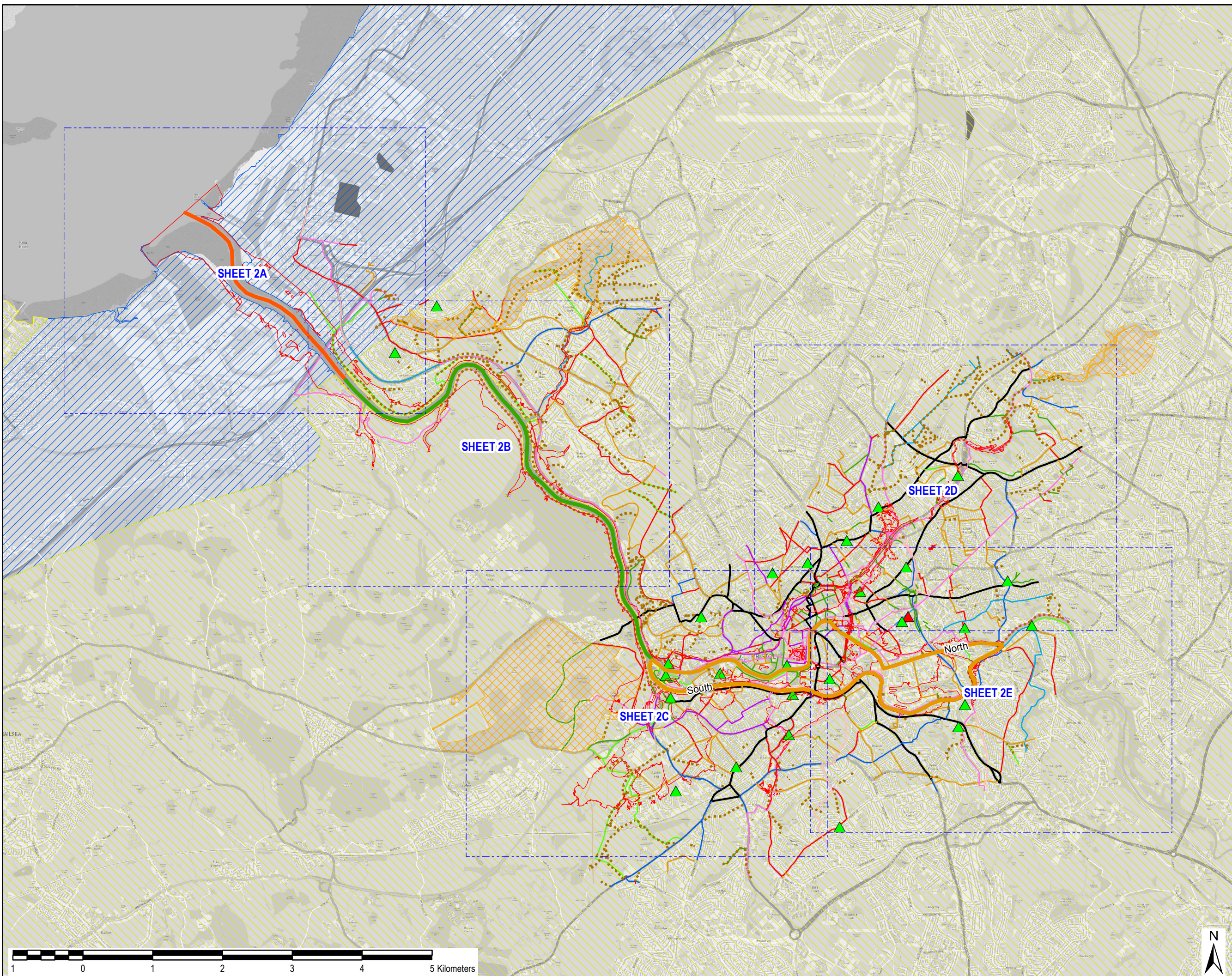
Scale at A3: 1:15,000
Drawing No: FIGURE 4.3E
Rev: V2
Drawn: Chk'd: App'd: Date:
GM SM NT 27/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Country Parks
- ▲ Recycling Centres
- ▲ Household Waste Centres
- Public Rights of Way**
- Bridleway
- ⋯ Footpath
- Registered byway
- Cycle Network**
- Aspirational Route on Busier Roads
- Aspirational Route on Traffic Free & Quiet Roads
- Distributor Links
- Local Road Links
- Other cycle infrastructure
- Other cycle infrastructure - aspirational
- Planned Route on Busier Roads
- Planned Route on Traffic Free & Quiet Roads
- Popular Busier Roads
- Popular Busier Roads - not numbered
- Traffic Free & Quiet Roads
- National Character Areas**
- Bristol, Avon Valleys and Ridges
- Severn and Avon Vales



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
 FIGURE 4.4.1
 LANDSCAPE AND
 LANDUSE

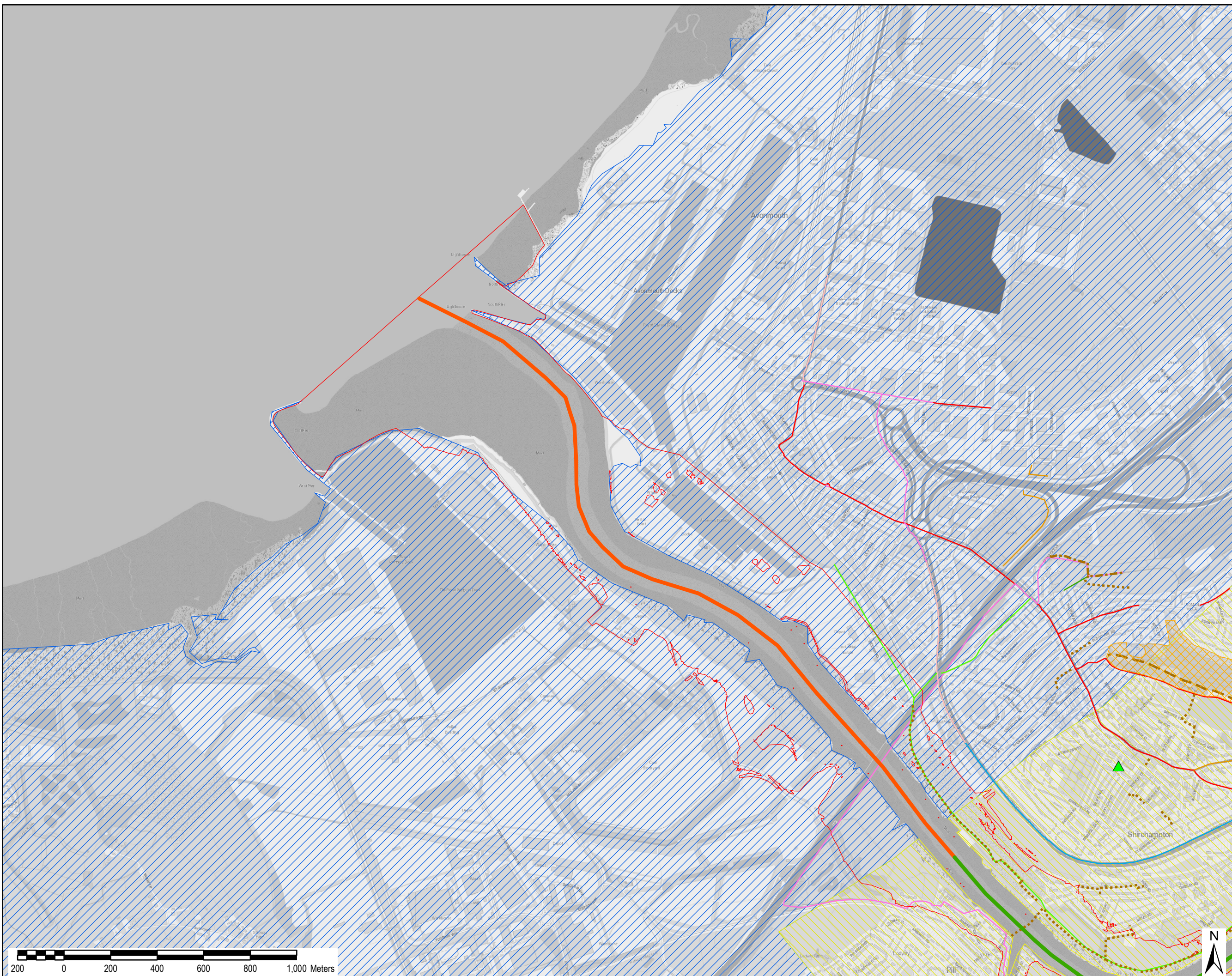
Scale at A3: 1:50,000
Drawing No: FIGURE 4.4.1
Rev: V2
Drawn: Chk'd: App'd: Date:
 GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Country Parks
- ▲ Recycling Centres
- ▲ Household Waste Centres
- Bridleway
- - - Footpath
- · - · - Registered byway
- Aspirational Route on Busier Roads
- Aspirational Route on Traffic Free & Quiet Roads
- Distributor Links
- Local Road Links
- Other cycle infrastructure
- Other cycle infrastructure - aspirational
- Planned Route on Busier Roads
- Planned Route on Traffic Free & Quiet Roads
- Popular Busier Roads
- Popular Busier Roads - not numbered
- Traffic Free & Quiet Roads
- Bristol, Avon Valleys and Ridges
- Severn and Avon Vales



Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

FIGURE 4.4.1A
 LANDSCAPE AND
 LANDUSE

Scale at A3: 1:15,000

Drawing No: FIGURE 4.4.1A **Rev:** V1

Drawn: Chk'd: App'd: **Date:**

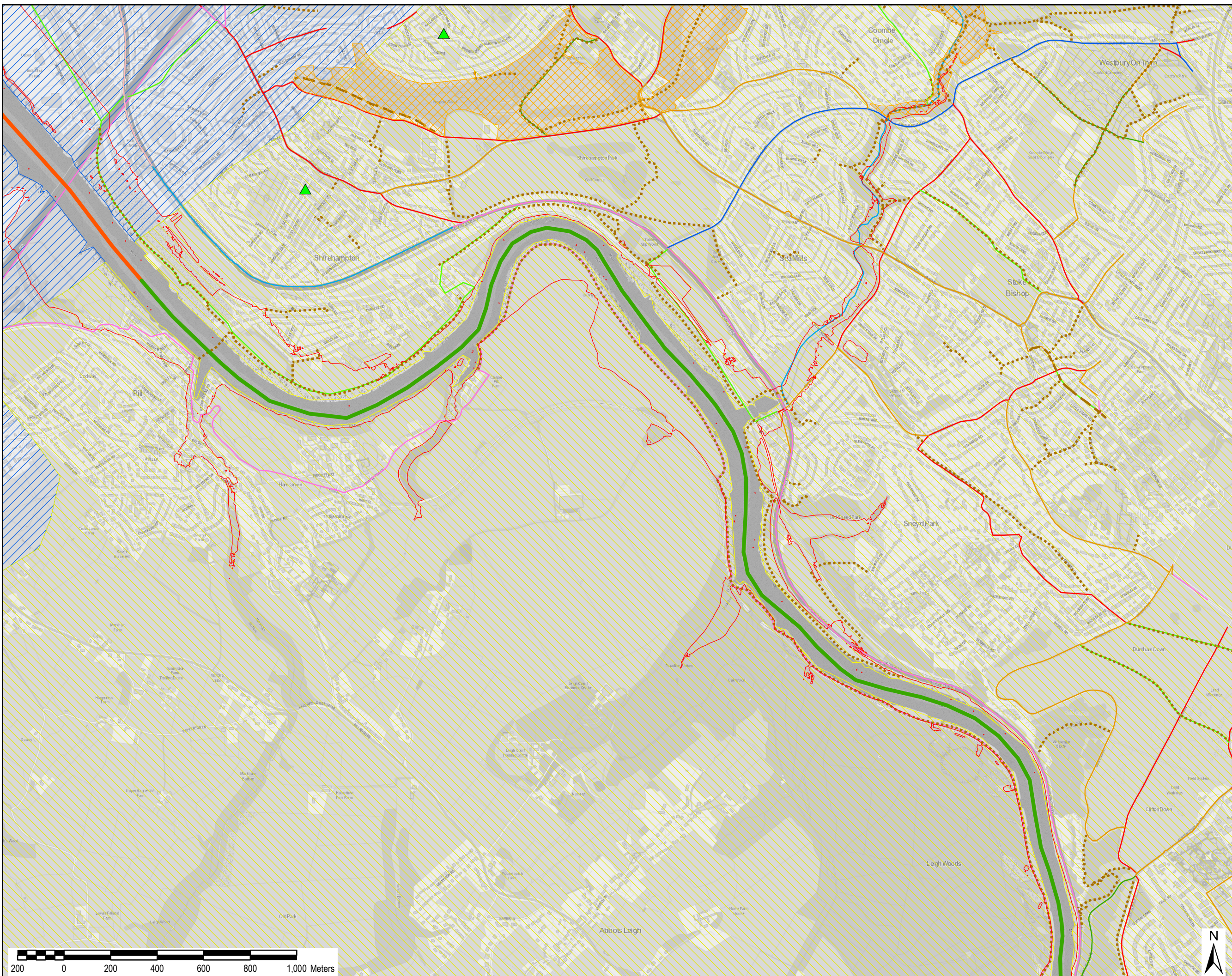
| | | | |
|----|----|----|----------|
| GM | SM | NT | 11/01/16 |
|----|----|----|----------|

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or related upon by third parties, except as agreed by AECOM or as required by AECOM, accepts no responsibility, and disclaims any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Country Parks
- ▲ Recycling Centres
- ▲ Household Waste Centres
- Bridleway
- Footpath
- Registered byway
- Aspirational Route on Busier Roads
- Aspirational Route on Traffic Free & Quiet Roads
- Distributor Links
- Local Road Links
- Other cycle infrastructure
- Other cycle infrastructure - aspirational
- Planned Route on Busier Roads
- Planned Route on Traffic Free & Quiet Roads
- Popular Busier Roads
- Popular Busier Roads - not numbered
- Traffic Free & Quiet Roads
- Bristol, Avon Valleys and Ridges
- Severn and Avon Vales



Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

FIGURE 4.4.1B
LANDSCAPE AND
LANDUSE

Scale at A3: 1:15,000

Drawing No: FIGURE 4.4.1B **Rev:** V1

Drawn: Chk'd: App'd: **Date:**

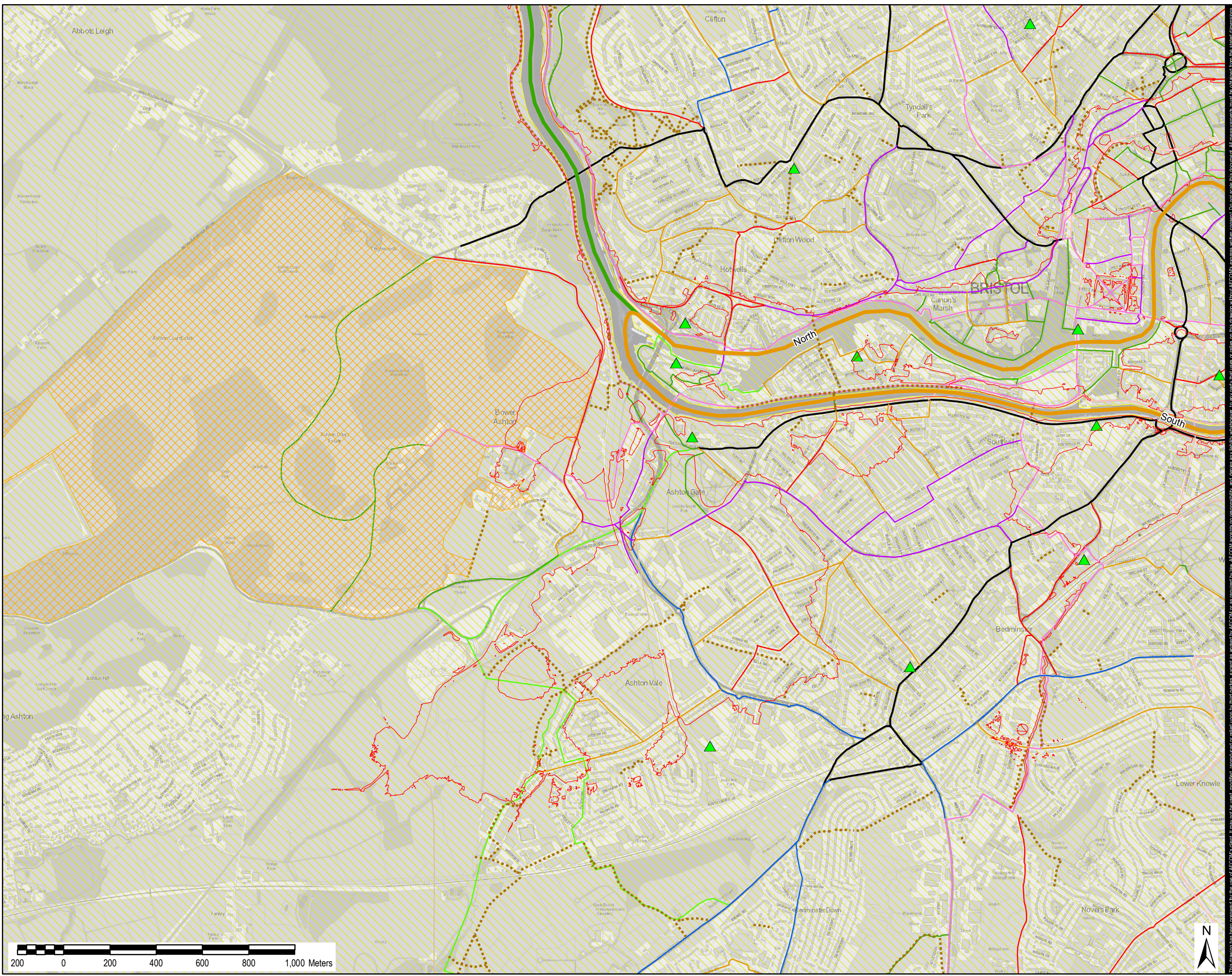
| | | | |
|----|----|----|----------|
| GM | SM | NT | 11/01/16 |
|----|----|----|----------|

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Country Parks
- ▲ Recycling Centres
- ▲ Household Waste Centres
- Bridleway
- - - Footpath
- - - Registered byway
- Aspirational Route on Busier Roads
- Aspirational Route on Traffic Free & Quiet Roads
- Distributor Links
- Local Road Links
- Other cycle infrastructure
- - - Other cycle infrastructure - aspirational
- Planned Route on Busier Roads
- Planned Route on Traffic Free & Quiet Roads
- Popular Busier Roads
- Popular Busier Roads - not numbered
- Traffic Free & Quiet Roads
- Bristol, Avon Valleys and Ridges
- Severn and Avon Vales



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

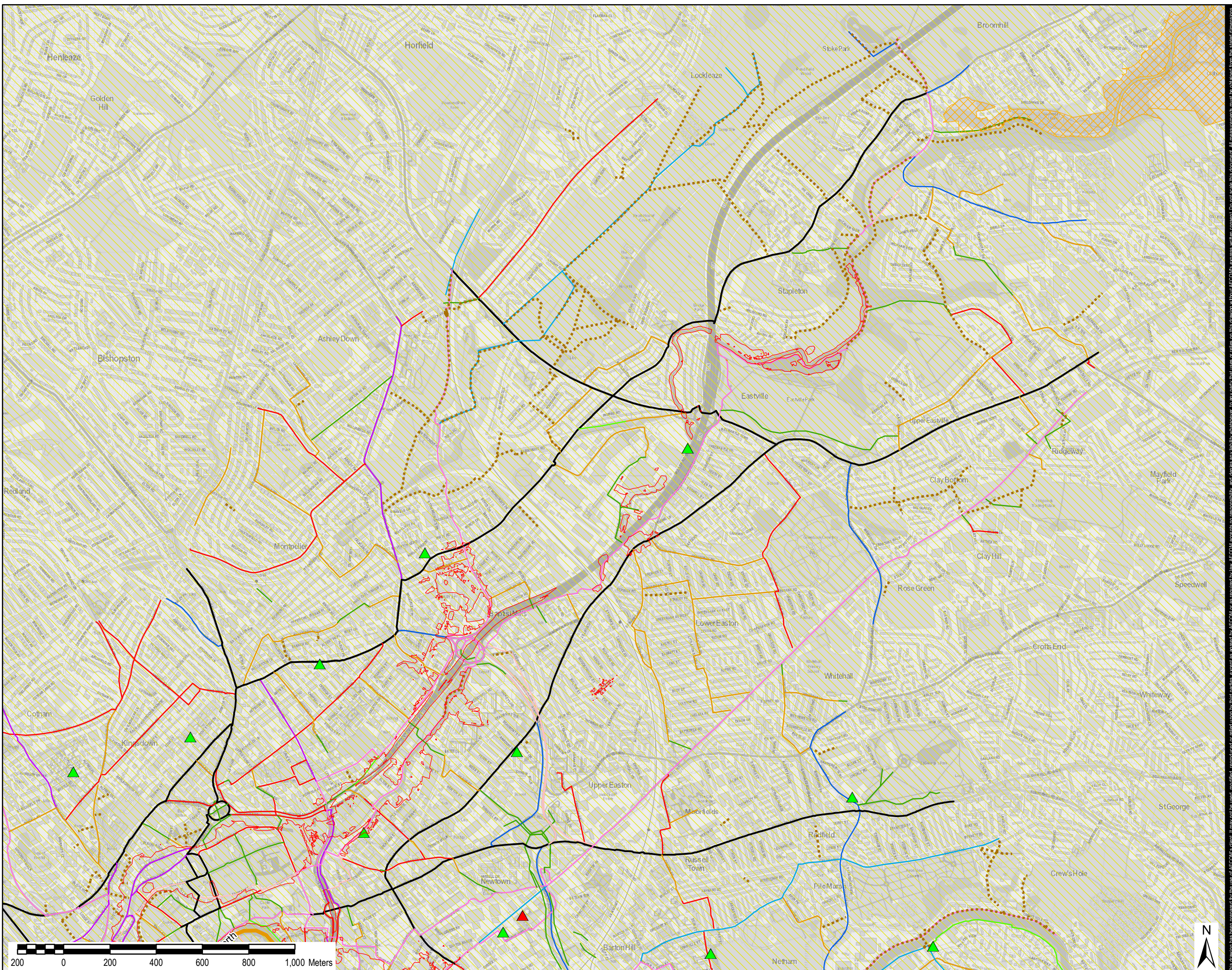
Drawing Title:
FIGURE 4.4.1C
LANDSCAPE AND
LANDUSE

Scale at A3: 1:15,000
Drawing No: FIGURE 4.4.1C
Rev: V1
Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Country Parks
- ▲ Recycling Centres
- ▲ Household Waste Centres
- Bridleway
- - - Footpath
- · - · - Registered byway
- Aspirational Route on Busier Roads
- Aspirational Route on Traffic Free & Quiet Roads
- Distributor Links
- Local Road Links
- Other cycle infrastructure
- Other cycle infrastructure - aspirational
- Planned Route on Busier Roads
- Planned Route on Traffic Free & Quiet Roads
- Popular Busier Roads
- Popular Busier Roads - not numbered
- Traffic Free & Quiet Roads
- Bristol, Avon Valleys and Ridges
- Severn and Avon Vales



Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:
60478613

Drawing Title:
FIGURE 4.4.1D
LANDSCAPE AND
LANDUSE

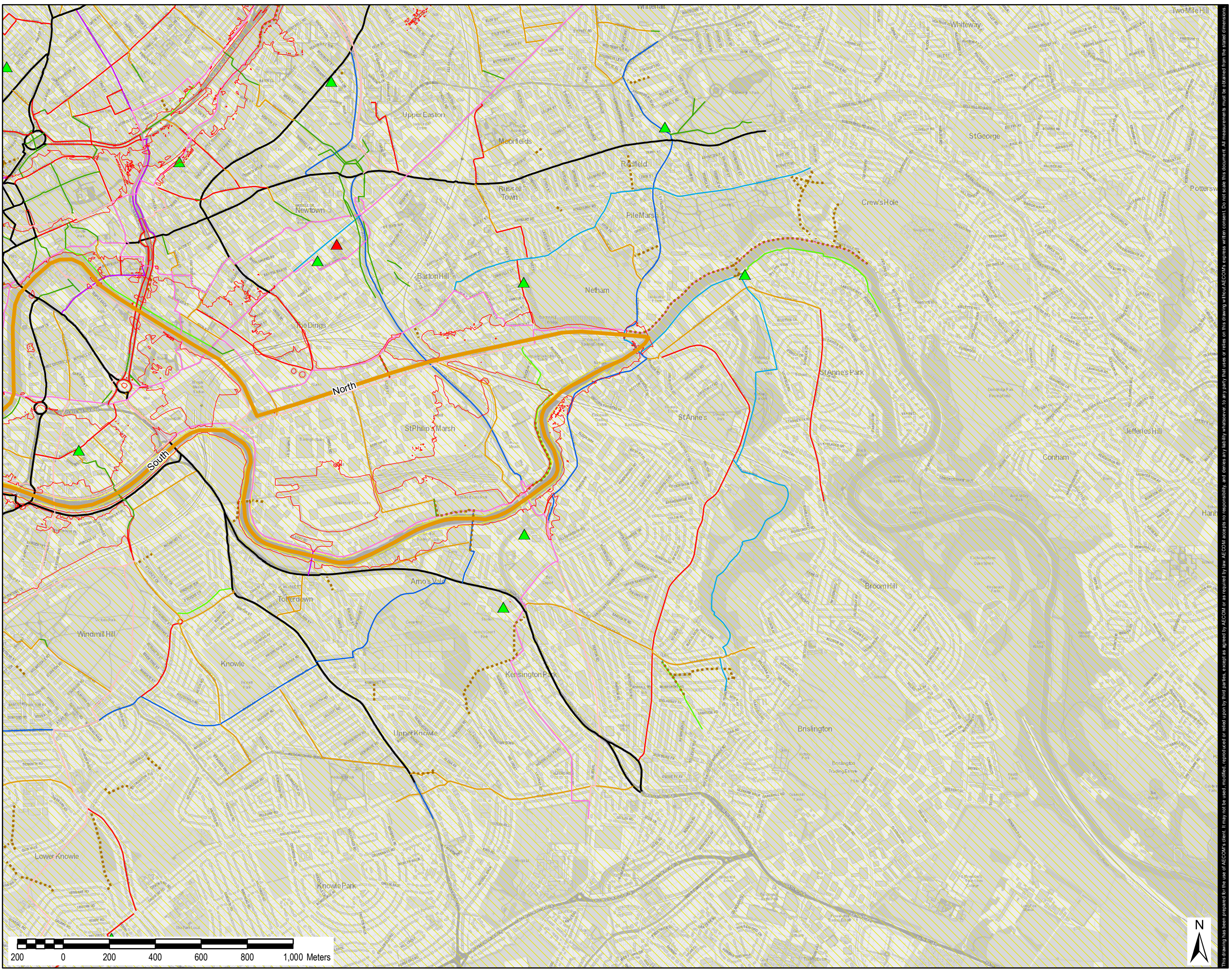
Scale at A3: 1:15,000
Drawing No: FIGURE 4.4.1D
Rev: V1
Drawn: Chk'd: App'd: Date:
GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- Country Parks
- ▲ Recycling Centres
- ▲ Household Waste Centres
- Bridleway
- - - Footpath
- - - Registered byway
- Aspirational Route on Busier Roads
- Aspirational Route on Traffic Free & Quiet Roads
- Distributor Links
- Local Road Links
- Other cycle infrastructure
- - - Other cycle infrastructure - aspirational
- Planned Route on Busier Roads
- Planned Route on Traffic Free & Quiet Roads
- Popular Busier Roads
- Popular Busier Roads - not numbered
- Traffic Free & Quiet Roads
- Bristol, Avon Valleys and Ridges
- Severn and Avon Vales



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
**FIGURE 4.4.1E
 LANDSCAPE AND
 LANDUSE**

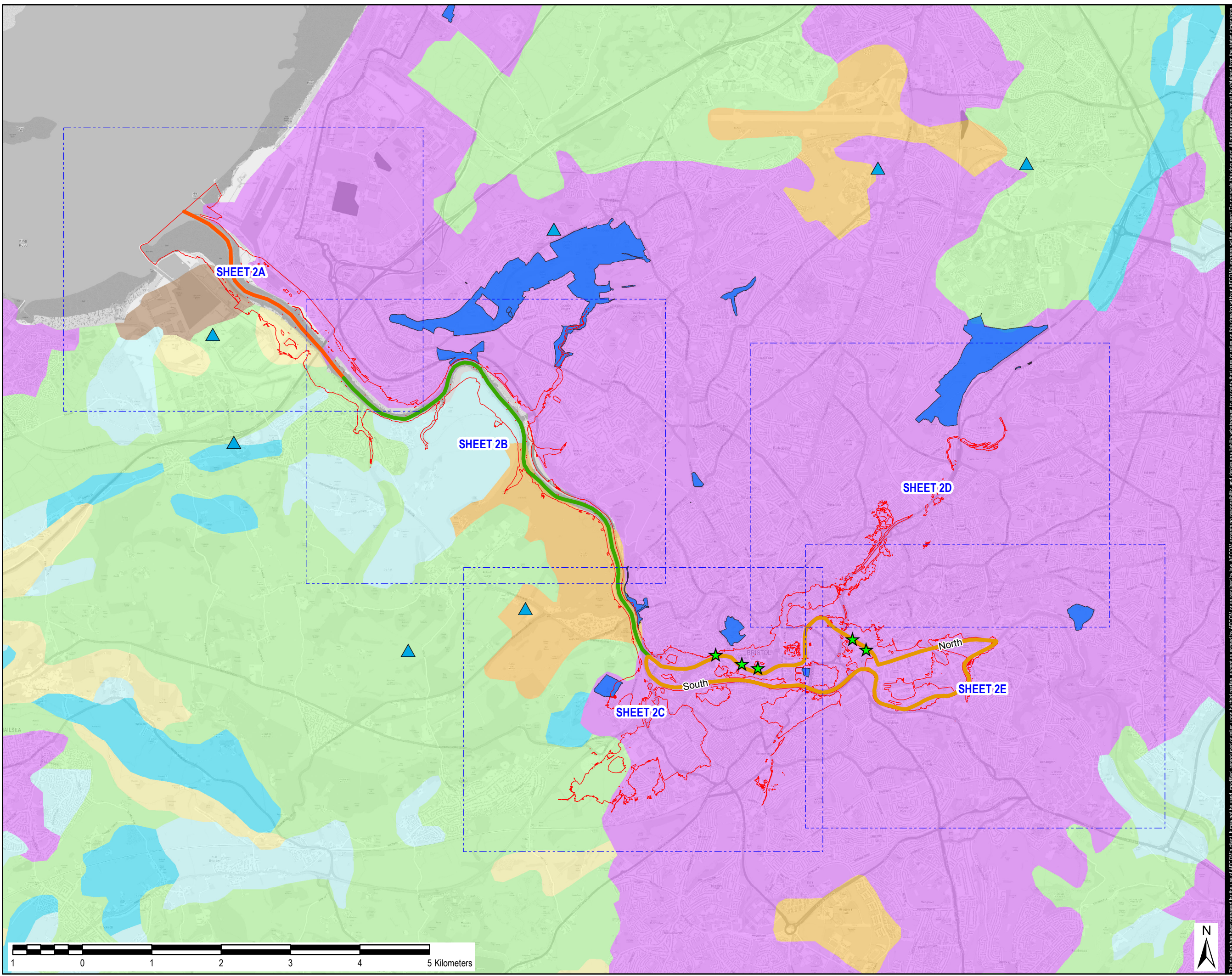
Scale at A3: 1:15,000
Drawing No: FIGURE 4.4.1E **Rev:** V1
Drawn: Chk'd: App'd: Date:
 GM SM NT 11/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ★ Surface Water Abstraction
- ▲ Groundwater Abstraction (Borehole)
- Regionally Important Geological Sites (RIGS)**
- Regionally Important Geological Sites (RIGS)
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Non Agricultural
- Urban



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
 FIGURE 4.4.2
 LANDSCAPE AND
 LANDUSE

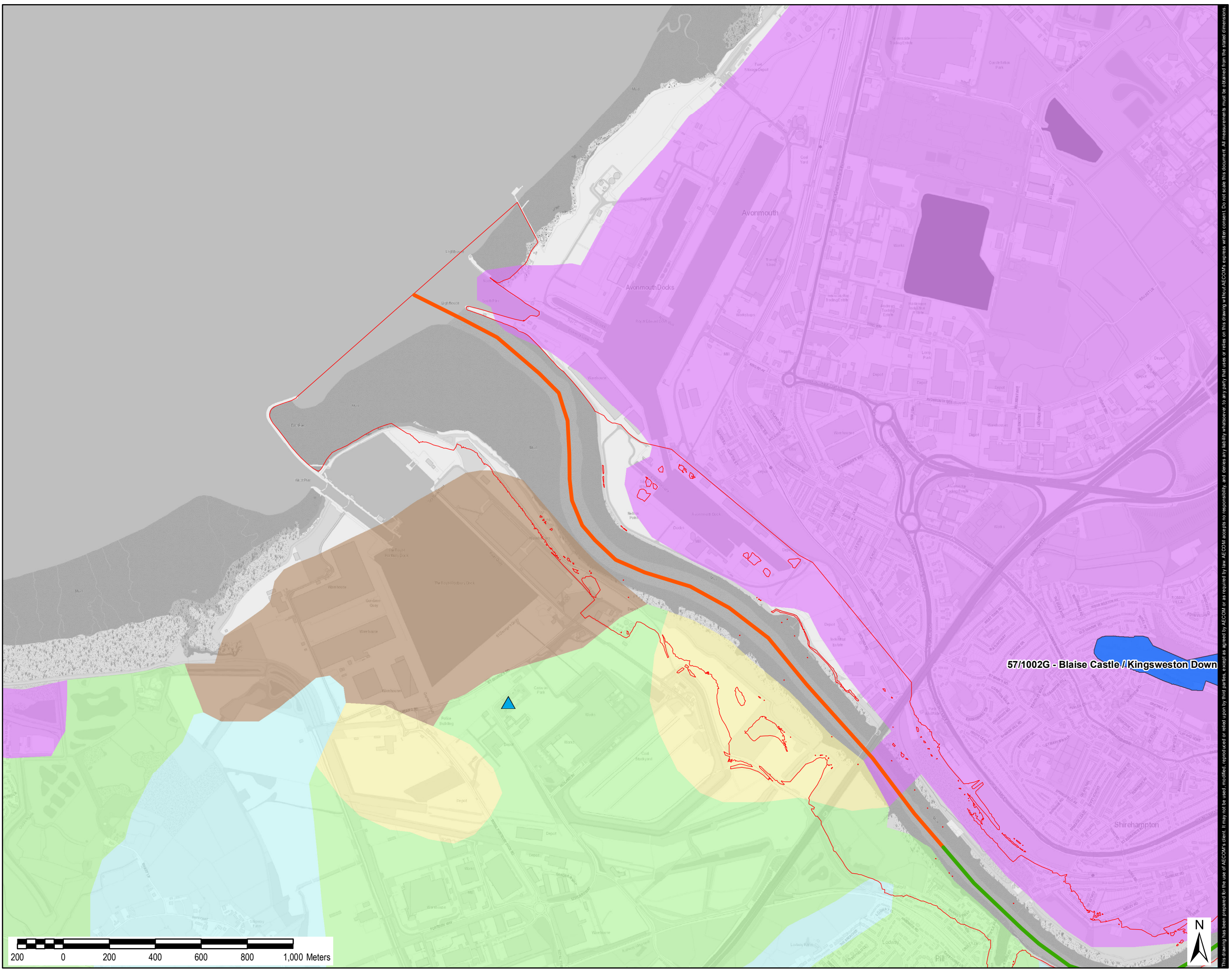
Scale at A3: 1:50,000
Drawing No: FIGURE 4.4.2
Rev: V2
Drawn: Chk'd: App'd: Date:
 GM SM NT 13/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and AECOM disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ★ Surface Water Abstraction
- ▲ Groundwater Abstraction (Borehole)
- Regionally Important Geological Sites (RIGS)
- Provisional Agricultural Land Classification © ADAS & Defra**
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Non Agricultural
- Urban



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
**FIGURE 4.4.2A
 LANDSCAPE AND
 LANDUSE**

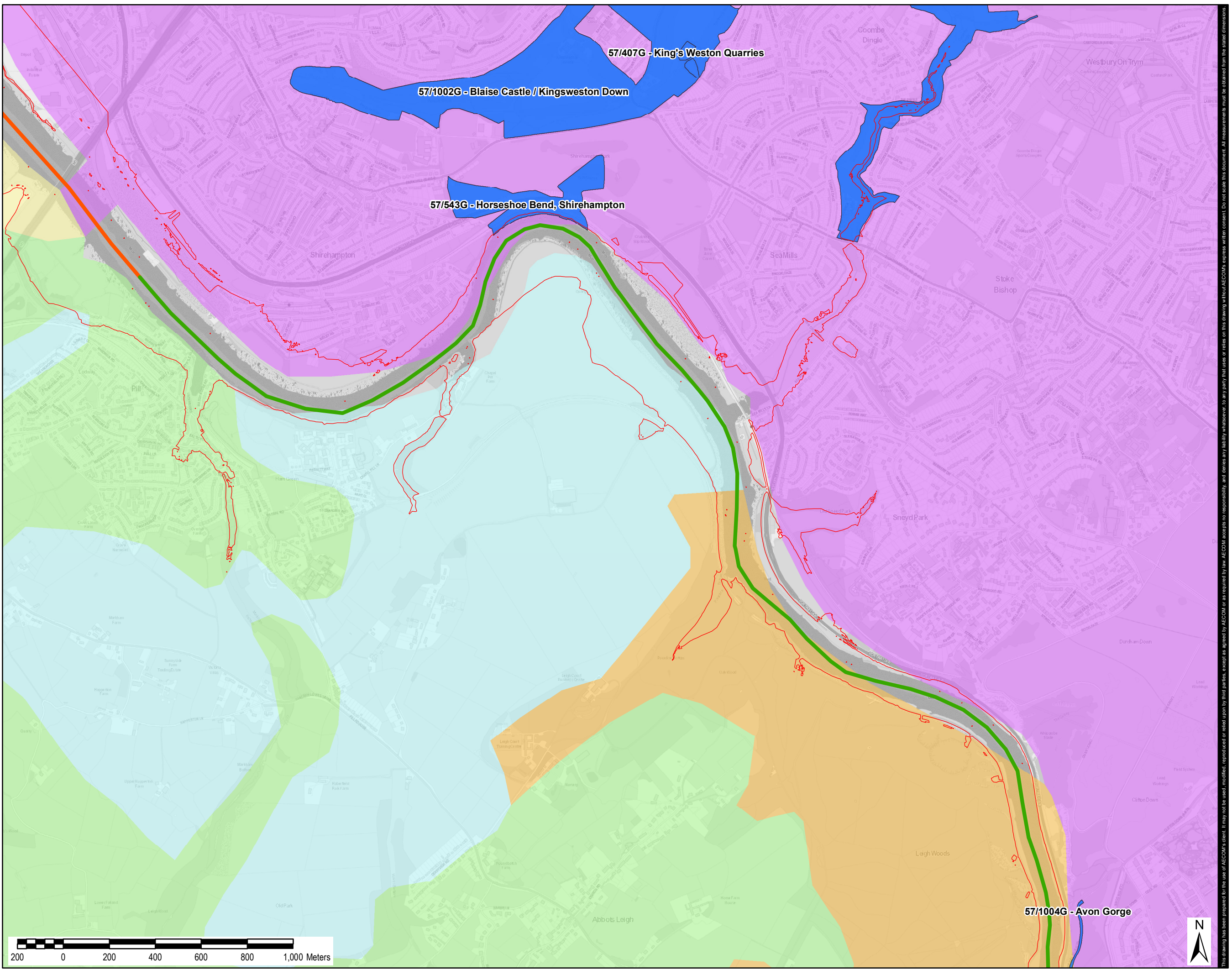
Scale at A3: 1:15,000
Drawing No: FIGURE 4.4.2A **Rev:** V1
Drawn: Chk'd: App'd: Date:
 GM SM NT 13/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ★ Surface Water Abstraction
- ▲ Groundwater Abstraction (Borehole)
- Regionally Important Geological Sites (RIGS)
- Provisional Agricultural Land Classification © ADAS & Defra**
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Non Agricultural
- Urban



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
 FIGURE 4.4.2B
 LANDSCAPE AND
 LANDUSE

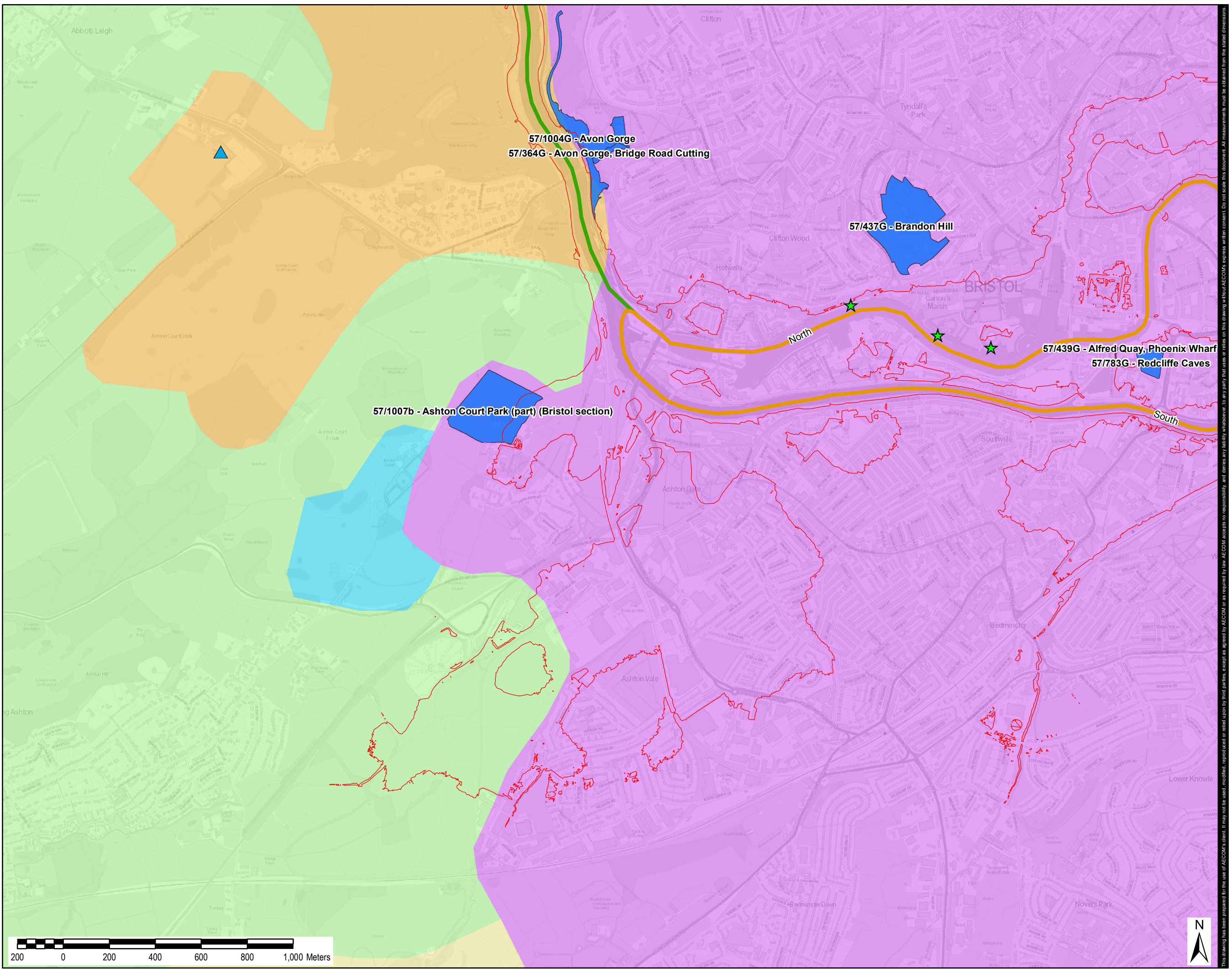
Scale at A3: 1:15,000
Drawing No: FIGURE 4.4.2B
Rev: V1
Drawn: Chk'd: App'd: Date:
 GM SM NT 13/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ★ Surface Water Abstraction
- ▲ Groundwater Abstraction (Borehole)
- Regionally Important Geological Sites (RIGS)
- Provisional Agricultural Land Classification © ADAS & Defra**
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Non Agricultural
- Urban



Copyright:
OS data © Crown copyright &
database rights 2015 Ordnance
Survey 100023406

AECOM Internal Project No:
60478613

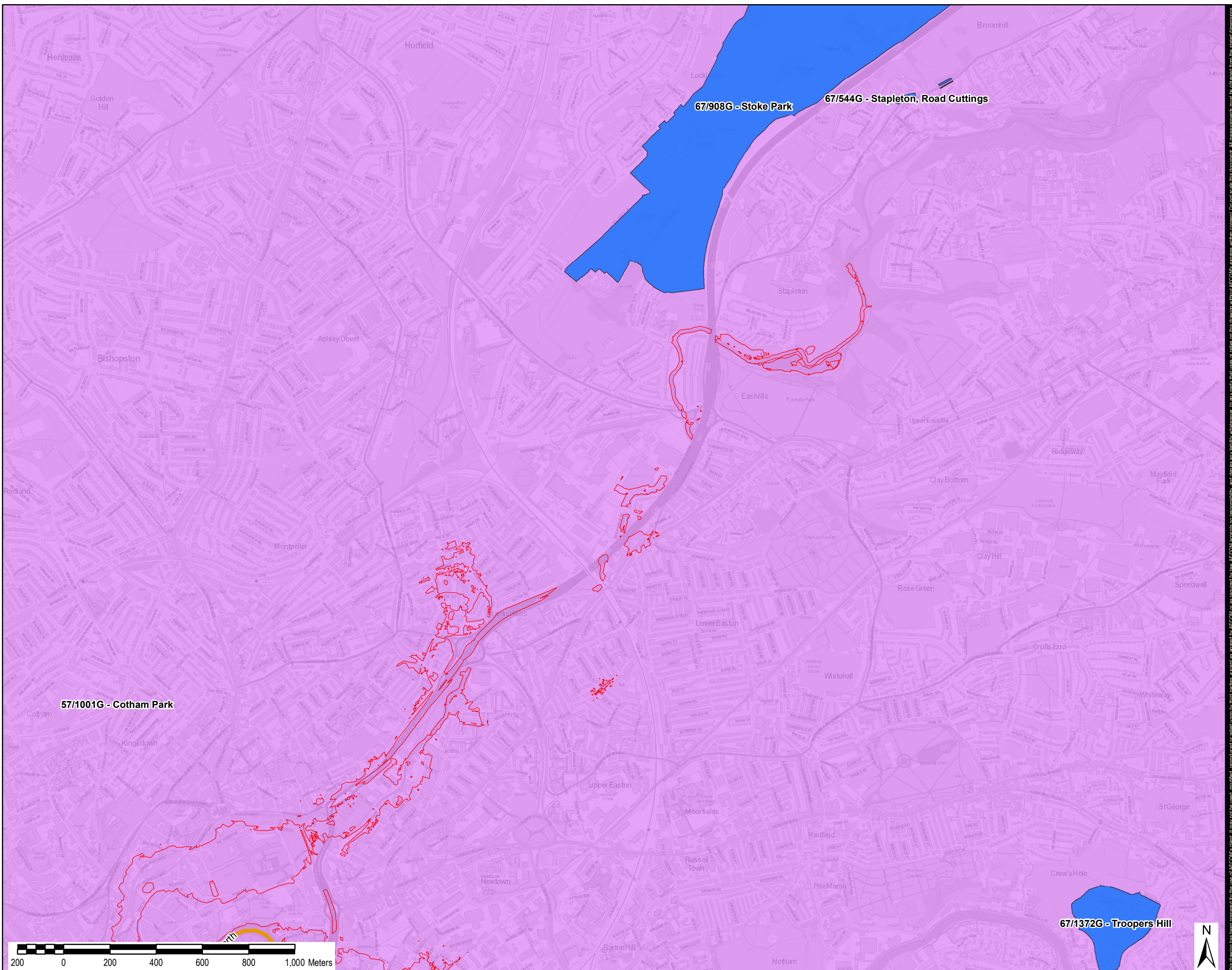
Drawing Title:
FIGURE 4.4.2C
LANDSCAPE AND
LANDUSE

Scale at A3: 1:15,000
Drawing No: FIGURE 4.4.2C
Rev: V1
Drawn: Chk'd: App'd: Date:
GM SM NT 13/01/16



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ★ Surface Water Abstraction
- ▲ Groundwater Abstraction (Borehole)
- Regionally Important Geological Sites (RIGS)
- Provisional Agricultural Land Classification © ADAS & Defra**
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Non Agricultural
- Urban



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613

Drawing Title:
 FIGURE 4.4.2D
 LANDSCAPE AND
 LANDUSE

Scale at A3: 1:15,000

Drawing No: FIGURE 4.4.2D **Rev:** V1

Drawn: Chk'd: App'd: **Date:**

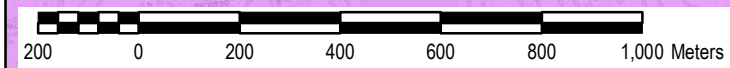
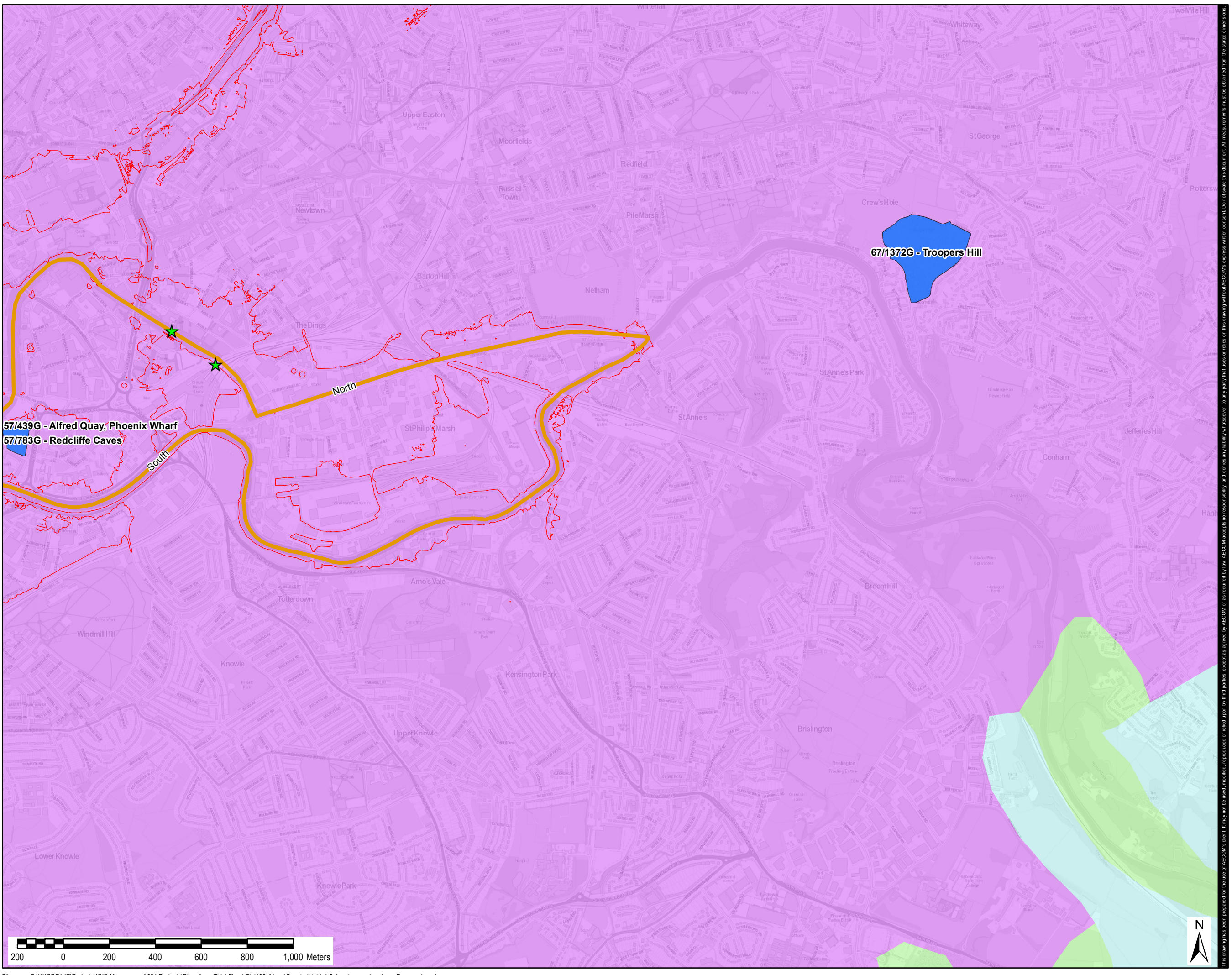
| | | | |
|----|----|----|----------|
| GM | SM | NT | 13/01/16 |
|----|----|----|----------|

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Reach 2
- Reach 3
- Study Area
- ★ Surface Water Abstraction
- ▲ Groundwater Abstraction (Borehole)
- Regionally Important Geological Sites (RIGS)
- Provisional Agricultural Land Classification © ADAS & Defra**
- Grade 1
- Grade 2
- Grade 3
- Grade 4
- Grade 5
- Non Agricultural
- Urban



Copyright:
 OS data © Crown copyright &
 database rights 2015 Ordnance
 Survey 100023406

AECOM Internal Project No:
 60478613


Drawing Title:
**FIGURE 4.4.2E
 LANDSCAPE AND
 LANDUSE**

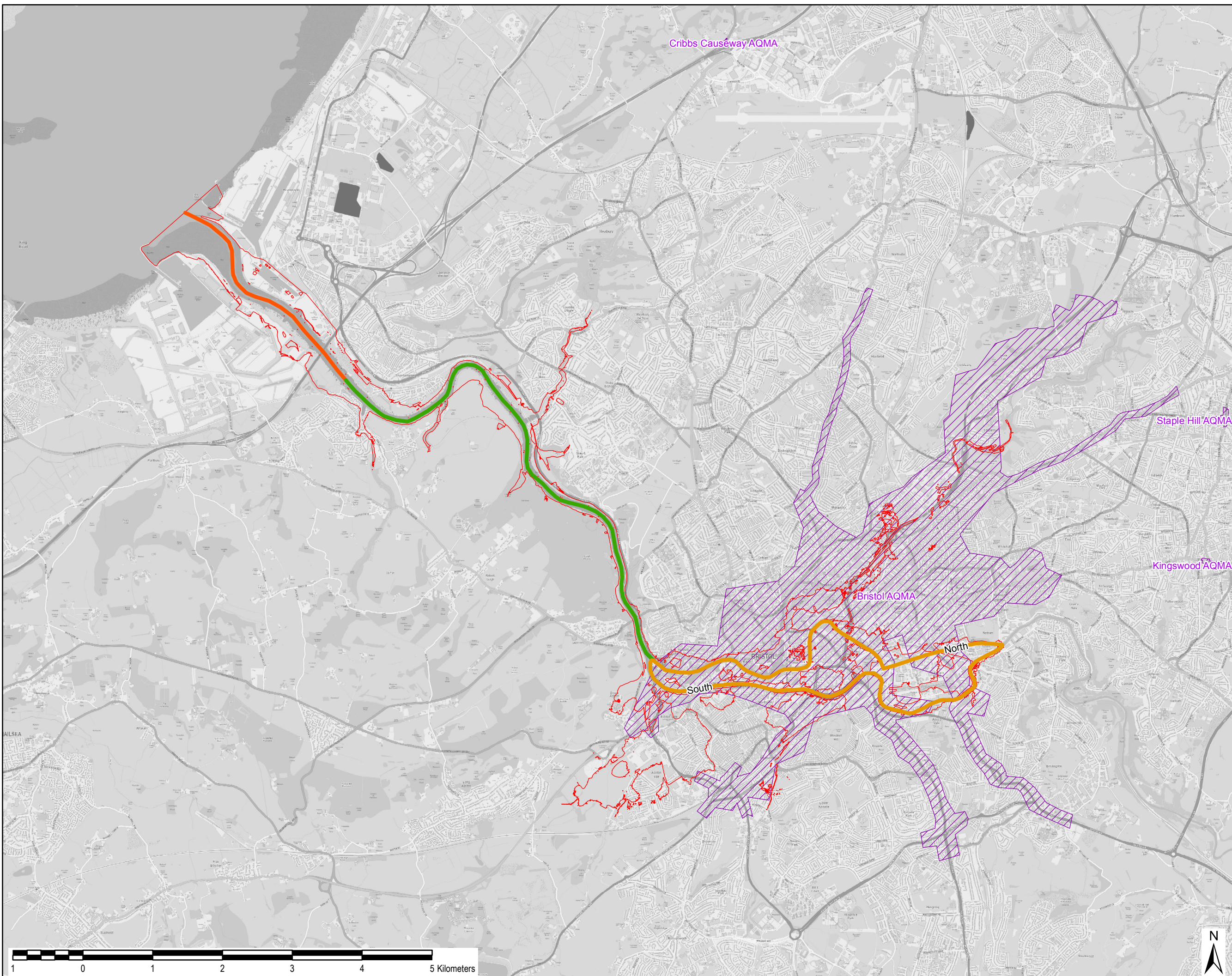
Scale at A3: 1:15,000
Drawing No: FIGURE 4.4.2E **Rev:** V1
Drawn: Chk'd: App'd: **Date:**
 GM SM NT 13/01/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM or its client, as required by law, AECOM accepts no responsibility, and denies any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

-  Reach 1
-  Reach 2
-  Reach 3
-  Study Area
-  Air Quality Management Areas



Copyright:

OS data © Crown copyright &
database rights 2015 Ordnance
Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.5
AIR QUALITY**

Scale at A3: 1:50,000

Drawing No: **Rev:**

FIGURE 4.5 V2

Drawn: Chk'd: App'd: Date:

GM SM NT 11/01/16

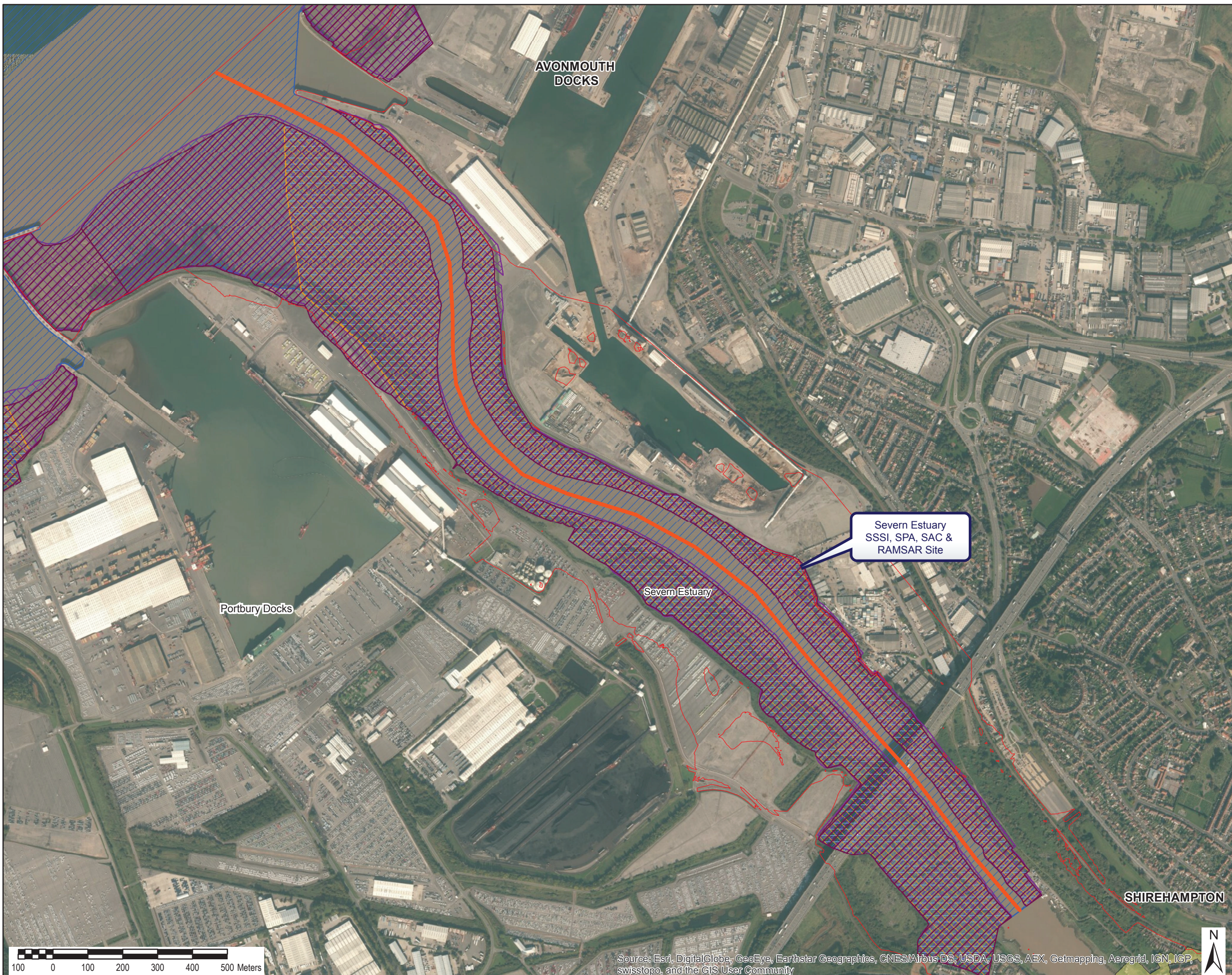
This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and AECOM disclaims any liability, whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 1
- Study Area
- Site of Special Scientific Interest
- Special Protection Areas
- RAMSAR - Wetlands of International Importance
- Special Areas of Conservation
- Important Bird Areas
- Conservation Areas

This figure is intended as a high level guide to selected environmental constraints within 10 m of the river, and should be interpreted in conjunction with section 4 of the Environmental Baseline Review (9a)



Severn Estuary
SSSI, SPA, SAC &
RAMSAR Site



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Copyright:
OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406
AECOM Internal Project No:
60478613
Drawing Title:

FIGURE 4.6
REACH 1 DETAIL
Scale at A3: 1:10,000
Drawing No: FIGURE 4.6 **Rev:** V2
Drawn: Chk'd: App'd: Date:
GM SM NT 01/02/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



LEGEND

- Reach 2
- Study Area
- Site of Special Scientific Interest
- Ancient Woodland
- Special Protection Areas
- RAMSAR - Wetlands of International Importance
- Special Areas of Conservation
- Important Bird Areas
- Confidential Regionally Important Geological Sites (RIGS)
- ★ Grade I Listing
- ★ Grade II Listing
- ★ Grade II* Listing
- Scheduled Monument
- Conservation Areas

This figure is intended as a high level guide to selected environmental constraints within 10 m of the river, and should be interpreted in conjunction with section 4 of the Environmental Baseline Review (9a)

Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

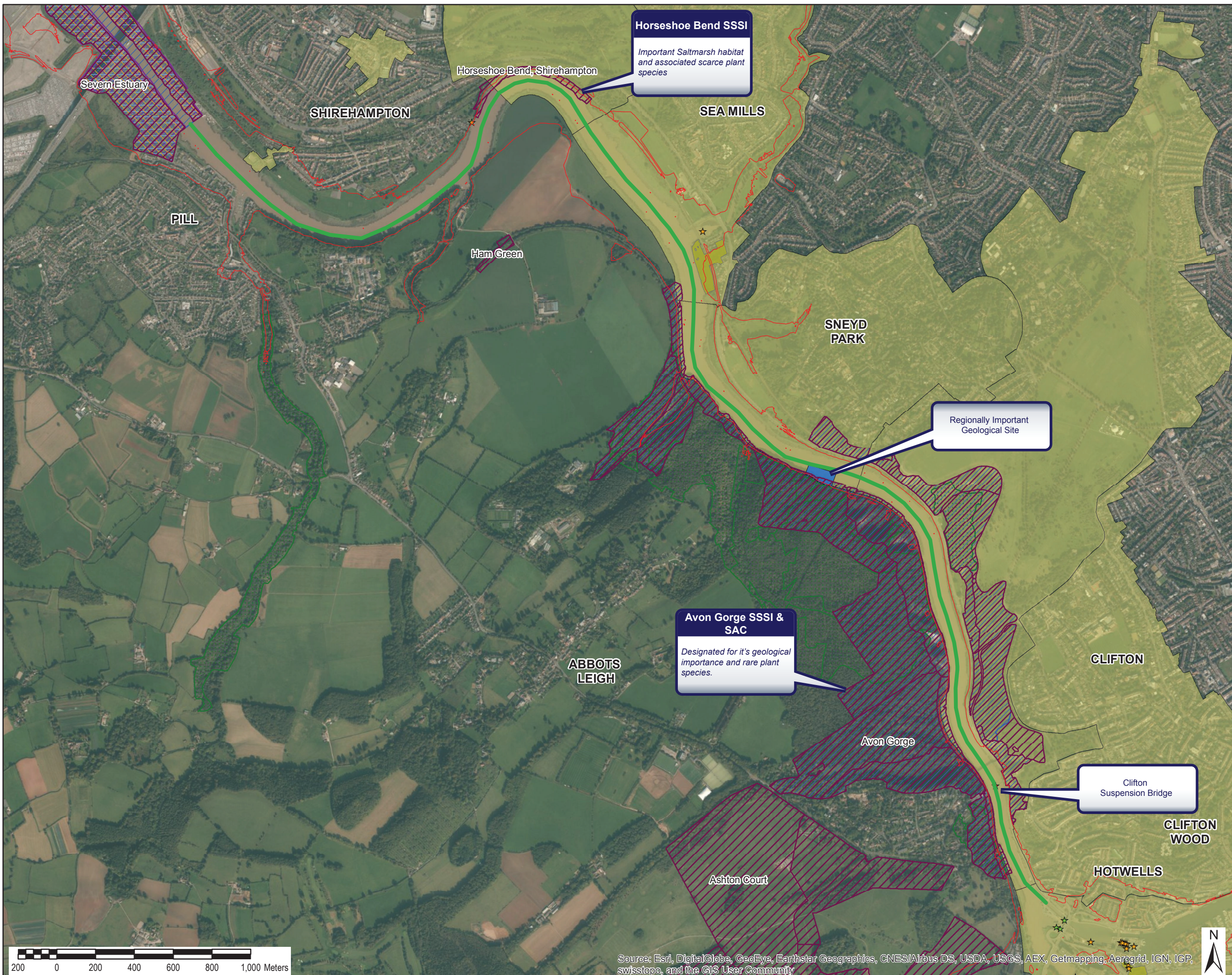
**FIGURE 4.7
REACH 2 DETAIL**

Scale at A3: 1:18,000

Drawing No: FIGURE 4.7 **Rev:** V2

Drawn: Chk'd: App'd: **Date:**

| | | | |
|----|----|----|----------|
| GM | SM | NT | 01/02/16 |
|----|----|----|----------|



Horseshoe Bend SSSI
Important Saltmarsh habitat and associated scarce plant species

Regionally Important Geological Site

Avon Gorge SSSI & SAC
Designated for its geological importance and rare plant species.

Clifton Suspension Bridge



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

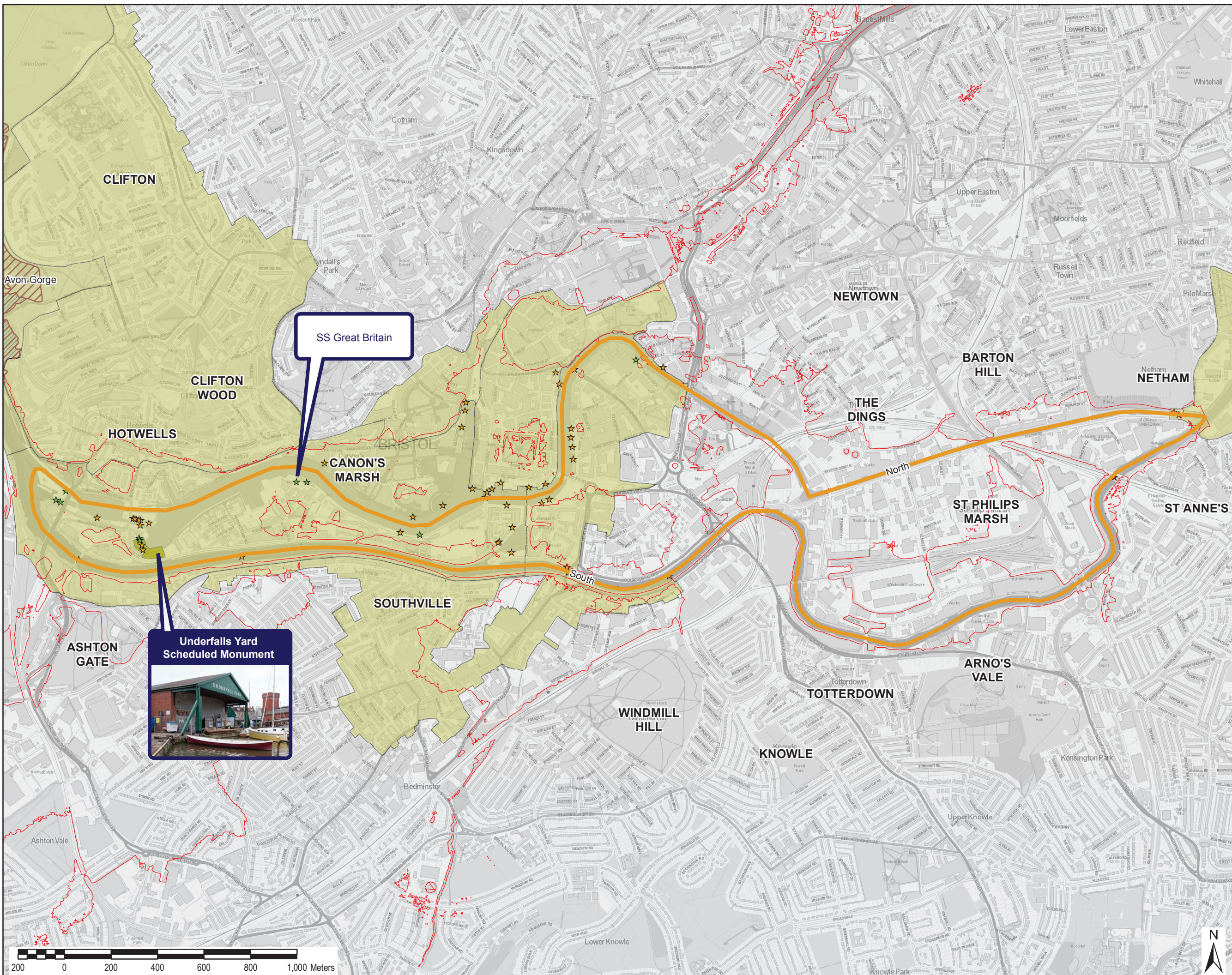




LEGEND

- Reach 3
- Study Area
- Listed Buildings**
- ★ Grade I Listing
- ★ Grade II Listing
- ★ Grade II* Listing
- Scheduled Monument
- Conservation Areas
- Site of Special Scientific Interest
- Special Areas of Conservation

This figure is intended as a high level guide to selected environmental constraints within 10 m of the river, and should be interpreted in conjunction with section 4 of the Environmental Baseline Review (9a)



Copyright:

OS data © Crown copyright & database rights 2015 Ordnance Survey 100023406

AECOM Internal Project No:

60478613

Drawing Title:

**FIGURE 4.8
REACH 3 DETAIL**

Scale at A3: 1:15,000

Drawing No: FIGURE 4.8 **Rev:** V2

Drawn: Chk'd: App'd: **Date:**

GM SM NT 17/02/16

This drawing has been prepared for the use of AECOM's client. It may not be used, modified, reproduced or relied upon by third parties, except as agreed by AECOM or as required by law. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that uses or relies on this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.




APPENDIX C

Figure 5-1 Ecological Survey Timings

Survey Timing

| Survey | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|-------------------------------------|--|-----|-----|---|-----|---|------|-----|------|------------|-----|-----|
| Phase 1 Habitat survey | [Optimal] | | | | | | | | | | | |
| Detailed botanical survey (e.g NVC) | [Sub optimal] | | | | | | | | | | | |
| Badger | [Optimal] | | | | | | | | | | | |
| Bats - emergence/re-entry | [Optimal] | | | | | | | | | | | |
| Bats - activity ¹ | [Sub optimal] | | | | | | | | | | | |
| Bat roost potential - structures | Hibernation roosts | | | Survey licence needed to disturb roosts | | | | | | | | |
| Breeding birds | [Sub optimal] | | | | | | | | | | | |
| Winter and passage birds | [Optimal] | | | | | | | | | | | |
| Reptiles | [Sub optimal] | | | | | | | | | | | |
| Amphibians (newts) | Pond surveys Other less effective detection methods may be possible | | | | | | | | | | | |
| Hazel dormouse | Hazelnut search | | | Nest tube surveys | | Nest tube surveys - May to September; Nut search - August to November | | | | Nut search | | |
| Water vole | [Sub optimal] | | | | | | | | | | | |
| Otter | [Optimal] | | | | | | | | | | | |
| Pine marten | [Sub optimal] | | | | | | | | | | | |
| Red squirrel ² | [Sub optimal] | | | | | | | | | | | |




¹ Depending on location and survey objectives ² Survey periods may vary depending on survey objectives

| | |
|---|---|
|  Optimal | <p>Timings are indicative. They may be affected by site conditions, habitat type and average weather conditions, which will vary from year to year and across regions. Seasonal constraints to surveys should also be considered for other species groups, such as: white-clawed crayfish and other aquatic invertebrates, specific bird species and terrestrial invertebrates.</p> <p>Please contact AECOM ecologists for more information on ecological timings or other species surveys.</p> |
|  Sub optimal | |
|  Outside typical survey season | |

Mitigation Timing

| Species | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|--|-----|-----|-----------------------------|-----|---|-----|-----------------------------|-----|----------------------|-----|
| Badger (sett closure) | Licensed exclusion under extenuating circumstances | | | | | | Badger exclusion licensing season | | | | | |
| Bats (works to hibernation roosts) ³ | Under licence | | | | | | | | | | | |
| Bats (works to maternity roosts) ³ | To commence only once breeding has finished and under licence | | | | | | To commence only once breeding has finished and under licence | | | | | |
| Reptiles | Habitat manipulation - March to September; translocation - April to September | | | | | | | | | | | |
| Hazel dormouse | Habitat manipulation | | | | | | | | | | | |
| | Translocation under licence | | | | | | | | | | | |
| Amphibians (newts) | Translocation under licence | | | | | | | | | | | |
| Nesting birds | Vegetation clearance | Clearance works only possible if an ecologist confirms the absence of active nests | | | | | | | | | Vegetation clearance | |
| Water vole | Displacement | | | | | | | | | | | |
| | Translocation under licence | | | | Translocation under licence | | | | Translocation under licence | | | |

³ The timing of mitigation works affecting bat roosts can vary depending on the species present, their status and the nature of the works to be carried out.

| | |
|---|---|
|  Optimal | <p>Timings are indicative. They may be affected by site conditions, habitat type and average weather conditions, which will vary from year to year and across regions. Seasonal constraints to mitigation should also be considered for: white-clawed crayfish translocation, otter habitat/dwelling compensation, habitat creation and enhancement.</p> <p>Please contact AECOM ecologists for more information on mitigation timings.</p> |
|  Sub optimal - mitigation work may be less effective or not possible | |
|  Mitigation often not effective or possible | |