MIDDLEMARCH

Natural Heritage Audit – Watercourses and water dependent habitats

Transforming the Trent Headwaters

Part of Transforming the Trent Valley

Staffordshire Wildlife Trust

Made possible with Heritage Fund

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Quality Assurance

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Non-Technical Summary

Project Background

In December 2024, Staffordshire Wildlife Trust commissioned Middlemarch to undertake a Natural Heritage Audit for the Trent Headwaters with a focus on watercourses and associated habitats. The report forms a baseline assessment to identify the current condition of natural heritage assets within the landscape and to identify opportunities that will lead to future restoration and enhancement projects.

Scope of Survey

To fulfil the above brief, the report aims to;

- Collate, analyse and present existing natural heritage data and assets within the project area.
- Review maps and reports created through the first stage of the project.

- Create a Natural Heritage Audit focussed on watercourses in the project area as well as the natural habitats associated with these watercourses. The predominant watercourse is the River Trent, however there are a number of tributaries that form the headwaters.
- Undertake an audit to identify opportunities for the restoration of watercourses and associated water dependent habitats.

In order to inform the development of natural heritage projects to be carried out as part of the Transforming the Trent Headwaters National Lottery Heritage Fund Project, Middlemarch Environmental Ltd was commissioned to conduct an audit covering the project area to produce baseline records of watercourse conditions and to assist in the development of ecological network mapping and restoration project optioneering.

Data from a wide range of sources was collated and reviewed to inform decision making in relation to feasibility and scale of potential restoration works within the project catchment and to provide a baseline for comparison in future years following delivery of habitat restoration works.

Restoration opportunities were developed with partner organisations to deliver improvements in line with the reasons for failure identified within the audit.

Summary of Key Findings

The project area for the Transforming the Trent Headwaters project covers almost 17,000 hectares with over 260km of watercourses feeding into the River Trent. These tributaries flow through a complex matrix of rural, urban and industrial areas and are subjected to numerous, diverse pressures ranging from diffuse and point source pollution, physical modifications to the river bed and banks, barriers to fish movement and alterations to their natural flow regime.

These changes have resulted in deterioration of the aquatic habitats and functions of the rivers in that wildlife has suffered and been displaced and the river catchments as a whole no longer provides all the benefits they once did in the form of flood and drought resilience and enabling the wellbeing of local communities to benefit from clean, healthy and aesthetically pleasing rivers, brooks, wet woodlands, pond and wetlands for their recreational enjoyment.

Analysis of environmental data and ecological records indicates that the watercourses within the Trent Headwaters have been and are still under considerable pressure and are currently not in their best possible condition. In order for these tributary watercourses and ultimately the River Trent as a whole, to achieved ‘good ecological status’, these pressures require action to address, remove and mitigate for historical degradation and to return the valuable aquatic habitats of the Trent Headwaters to ones that support diverse and healthy wildlife and provide resources for the people that live within the river catchments.

Amongst other pressures, this study has identified 133 river obstacles which impede fish, water and essential river gravel movement within the Trent Headwater river networks, over 3700 hectares of areas suitable for wetland or pond creation or restoration, 61 historical river channels that could be suitable for restoration into valuable offline river habitats or wetlands, 87km of river habitat that would benefit from additional overhanging tree canopy and 850 hectares of areas suitable for planting trees to help reduce flooding. Information from routine water quality monitoring has also identified pressures from sewage and mine discharges and run-off from agricultural land which should be addressed and solutions identified and actioned in partnership with stakeholders within the catchment.

In response to these pressures, this study, in collaboration with a range of partner organisations has identified a wide range of potential restoration measures that would use tried and tested methods to restore river habitats and help return the catchments to areas supporting diverse and healthy wildlife. These measures include;

- Planting trees along river banks providing shade to keep rivers cool during hot weather thus protecting fish populations.
- Creating buffer strips along rivers to help capture polluting silt and nutrients which cause damage to sensitive river wildlife.
- Removal of redundant riverbank protection to restore natural processes and habitats.
- Removal of man-made physical barriers which prevent fish and other wildlife from moving upstream to breed.
- Reconnection of rivers to their floodplains to help prevent flooding of homes and urban areas.
- Restoration of wetlands which are important water dependent habitats, providing essential habitats for insects, birds, bats, reptiles and mammals and help with reducing flooding and droughts by 'slowing the flow' of water and keeping upper catchments wetter for longer in dry weather.
- Restoration of ponds and open water habitats to benefit wildlife and recreational angling.

Recommendations

The impacts facing watercourses in the Trent Headwaters have been shown to be complex and require a strategic and coordinated approach to their resolution. This report, the wealth of published data that has been reviewed and local and national expert knowledge are invaluable for developing a plan for the restoration of the River Trent and its tributaries.

Tried and tested techniques and methods are available for achieving the necessary improvements and funding/man-power are all that is necessary to see results.

This report helps provide a focus for the issues facing the Trent Headwaters and it is recommended that the impacts and pressures identified are included and developed into an ongoing restoration strategy and Master Plan which should be adopted by relevant stakeholders including agencies, third sector organisations and local action groups for a joined up approach to 'getting results'.

It is recommended that the development phase of the Transforming the Trent Headwaters National Lottery Heritage Fund Project should focus on taking forwards the restoration measures that have been proposed withing this report and further develop additional projects identified from the findings of this audit. For the reasons described within this report, these should ideally include prioritising further scoping and development of projects to;

- Remove river obstacles.
- Create and restore wetlands and ponds (both for biodiversity and NFM).
- Establish riparian and floodplain woodlands and manage riparian woodland to maximise aquatic habitat conditions.
- Remove river channel constraints to allow natural processes to reestablish.
- Develop a programme for reintroducing macrophytes.
- Increase in-channel structural diversity to maximise habitat value.

Key priorities to progress these projects will require the following;

- Landowner engagement to gain permissions and buy-in.
- Baseline habitat surveys to acquire habitat and species data. Any work to existing ponds should consider Great Crested Newt presence with mitigation strategies employed.
- Preliminary surveys e.g. soil analyses, infiltration tests to determine suitability for wetland habitat establishment.

- Activities within 8m of a watercourse will require an Environment Agency Flood Risk Activity Permits (FRAP). Due to delays in 2025, this process is now taking up to 6 months and early application is recommended. Planning permission and Flood Risk Assessments may also be required depending on the nature, location and scale of the works.
- In-river works will generally be required to take place between June and September inclusive in line with the Salmon and Freshwater Fisheries Act 1975.
- Activities that may result in disturbance to fish will likely require fish rescues and associated licenses e.g. FR2 obtainable from the Environment Agency.
- Any work on a SSSI will require a 'Notice of proposal to carry out an operation on an SSSI' obtained from Natural England.
- Where land is in an existing Environmental Stewardship scheme a derogation request may be needed from Natural England where a variation is proposed to the management of the land, including habitat creation work.

Engaging with local communities and creating local pride for their watercourses and water habitats is a crucial part of establishing support and momentum for this type of work. The community events that were held as part of this audit proved to be very valuable exercises and provided information that only locals would know. It is recommended that events like this continue throughout the development and delivery phases to capture local knowledge and memories before it is lost.

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Methodologies

Desktop Study

Data provided by Staffordshire Wildlife Trust, Environment Agency, Wild Trout Trust and a range of other sources were reviewed and have been summarised within this report (Table 2 & Table 3).

The reports provided were reviewed and findings cross referenced with available mapped data to develop a series of maps and data set identifying impacts and conditions across the Transforming the Trent Headwaters project study area (Figure 1).

As part of the desk study, GIS data was loaded onto QGIS (3.34.12-Prizren) and analyses performed as described in each of the following sections.

Walk over and Ground-truthing study

In addition to desk based data reviews and analyses, walk over surveys and ground-truthing exercises were undertaken to confirm the findings from the data review and to provide information on sites where information was lacking.

Site visits took place on the 27th February, 28th February, 19th March, 26th March, 15th April, 24th April, 29th April, 14th May and 15th May 2025 with members of project partner organisations, Staffordshire Wildlife Trust, Groundwork, Wild Trout Trust and Trent Rivers Trust.

Details including anthropogenic impacts, restoration opportunities and photographs were collected and included in the site specific restoration proformas (Please refer to Section - Opportunities for restoration)

Restoration measures opportunities

Project descriptions, restoration measures, estimated costs and delivery timescales were developed and populated into the project proforma datasheets as provided by Staffordshire Wildlife Trust. These projects were focussed on an existing list of 'Priority Sites' (Figure 1 and Table 1), however, additional opportunities were included when encountered. These forms are included within the report in section - Opportunities for restoration).

Table 1. Natural Heritage Audit Priority Sites - ID, Name and Areas (Ha).

ID	Site Name	Area (Ha)
1	Central Forest Park	46.89
2	Clayton Lane	27.32
3	Smith's Pool LNR	9.39
4	Fenton Road	1.62
5	M6 (south of)	7.38
6	Grange Park	1.29
7	Twigg Street	0.27
8	Fowlea Brook Etruria Valley	12
9	Leek New Road (north of railway)	46.79
10	Crowborough Wood	5.78
11	Whitfield Valley LNR	41.64
12	Victoria Ground	27.26
13a	Cockster Brook	15.43
13b	Cockster Brook 2	0.37
13c	Cockster Brook 3	19.29
14	Hem Heath & Newstead Woods	53.34
15	Tongue Lane (north of)	31.74
16	The Dingle	1.77
17	Chillington Way	9.16
18	Bradwell Wood	75.85

ID	Site Name	Area (Ha)
19	Greenway Bank	13.4
20	Apedale Country Park	136.34
21	Guernsey Drive	8.94
22	Waterside Drive	0.89
23	Leek New Road (north of)	6.97
24	Fenton Road Causeley Brook	13.21
25	Pool Dam Marsh LNR	19.36
26	Cotswold Avenue	1.67
27	Staffordshire University	14.59
28	Thistleberry Parkway	5.38
29	Wetley Moor SSSI	68.89
30	Cromer Road	17.04
31	Westport Lake	30.1
32	Newport Lane green space	0.11
33	Longton Brook Greenway	2.4
34	Clayton M6	8.66
35	Coyney Wood	31.02
36	Milton United FC (south of)	1.13
37	Townsend Place	0.74
38	Hilton Road	0.84
39	Michelin Fields	5.76
40	Chatterley Whitfield Heritage Country Park	60.23
41	Birches Head Academy	11.13
42	Knypersley Reservoir	58.4
43	Tag Marsh	5.97
44	Bagnall Road Wood	6.48
45	Bradeley Fields	12.77
46	Florence meadows	11.82
47	Holden Lane Pools	9.26
48	Hartshill Park	13.68
49	Milton	30.06
50	Park Hall NNR	40.78
51	St Paul's Road	3.16
52	Lyme Valley Parkway	32.05
53	Springpool Wood	42.74
54	Lymedale Business Park (south of)	54.23
55	Baldies Fields	7.41
56	Golden Hill ex-golf course	48.59
57	Berryhill Fields	76.84
58	Bucknall Park	8.45

ID	Site Name	Area (Ha)
59	Scotia Valley	11.47
60	Trent Mill	9.11
61	Bucknall Park Cricket Ground	1.67
62	Acreswood	0.68
63	Ball Green	11.04
64	Tank Field	0.46
65	Trentham Golf Course	3.76
66	Causeley Road	14.12
67	Silverdale Country Park	63.74
68	Longton Brook - Trentham Garden Centre	0.16

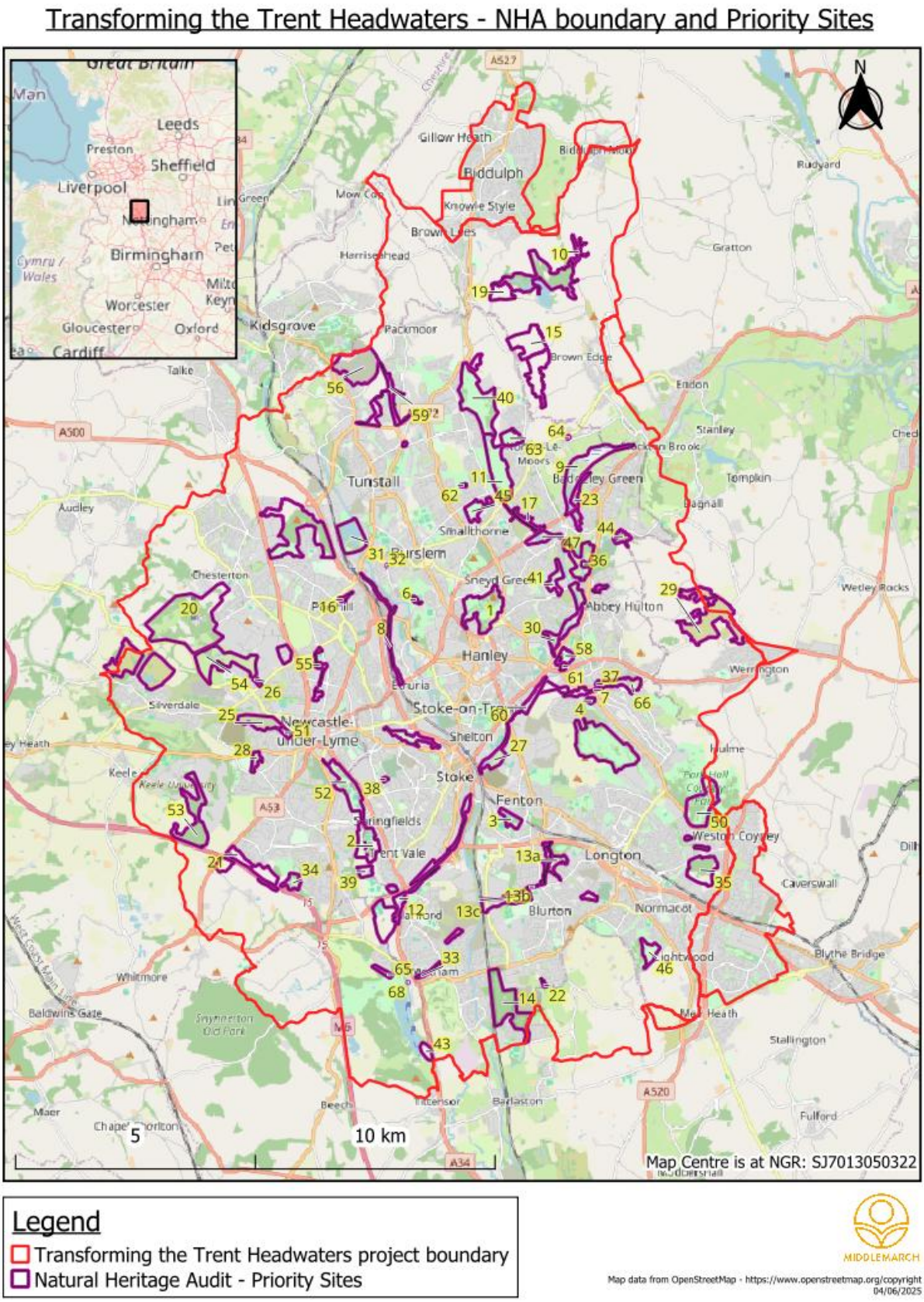

Figure 1. Map - Transforming the Trent Headwaters Natural Heritage Audit project area.

Data resources

Table 2. List of reports reviewed as part of the audit.

Document	Author
Lyme Brook catchment report.pdf	Environment Agency
GB104028053271 R Trent from Fowlea Bk to Tittensor Level 2 catchment report v5.pdf	Environment Agency
GB104028053271 R Trent from Fowlea Bk to Tittensor Tech Priority matrix, mit plan.pdf	Environment Agency
GB104028053280 Park brook invertebrate and macrophyte deterioration.pdf	Environment Agency
GB104028053300 River Trent Causeley Bk to Fowlea Bk A&R Report v1.pdf	Environment Agency
GB104028053300 Trent Causeley to Fowlea WFD Cause of Failure Report v2.pdf	Environment Agency
GB104028053300 Trent, Causeley to Fowlea Level 1 Assessment.pdf	Environment Agency
GB104028053300 Trent, Causeley to Fowlea Technical Priority matrix and mitigation plan.pdf	Environment Agency
GB104028053300 Trent, Fowley to Causeley Level 2 report.pdf	Environment Agency
GB104028053310 Causeley Brook from source to River Trent A&R Report V1.pdf	Environment Agency
GB104028053320 River Trent Ford Green Bk to Causley Bk A&R Report v1.pdf	Environment Agency
GB104028053340 Lyme Brook Catch Technical Priority matrix and mitigation plan.pdf	Environment Agency
GB104028053340 Lyme Brook Level 1 Assessment.pdf	Environment Agency
GB104028053360 Fowlea Brook from Source to River Trent Catchment Map.pdf	Environment Agency
GB104028053360 Fowlea Brook from Source to River Trent A Journey along the Fowlea Brook.pdf	Environment Agency
GB104028053360 Fowlea Brook from Source to River Trent A&R Report v1.pdf	Environment Agency
GB104028053380 Ford Green Bk source to River Trent A&R Report v1.pdf	Environment Agency

Document	Author
GB104028053400 River Trent from source to Ford Green Brook Level 1 Assessment.pdf	Environment Agency
GB104028053400 R Trent, Source to Ford Green Bk Tech Priority matrix & mit. plan.pdf	Environment Agency
GB104028053400 River Trent from Source to Ford Green Brook Level 2 report.pdf	Environment Agency
Heritage at Risk.pdf	Environment Agency
Wild Trout Trust advisory visit report - TrenthamGAV2016.pdf	Wild Trout Trust
Wild Trout Trust advisory visit report - TrentStokeAV2014.pdf	Wild Trout Trust
Wild Trout Trust advisory visit report – Causley BrookPP 2015.pdf	Wild Trout Trust
Wild Trout Trust advisory visit report - FordGreenandLymeBrookAVFinal2016.pdf	Wild Trout Trust
Wild Trout Trust advisory visit report - Lyme Brook PP 2015.pdf	Wild Trout Trust
Wild Trout Trust advisory visit report - LymeandCausleyWeirs2016.pdf	Wild Trout Trust
Wild Trout Trust advisory visit report - LymeBrook2023AV.pdf	Wild Trout Trust
Wild Trout Trust advisory visit report - LymeProjectProposal.pdf	Wild Trout Trust
SUNRISE report	Staffordshire Wildlife Trust
Project proforma datasheet – to be populated with restoration measures, estimated costs and delivery timeframes.	Staffordshire Wildlife Trust

Table 3. List of data sources reviewed as part of the audit.

Data resource	Date type	Author
Transforming the Trent Headwaters project boundary	GIS shapefile	Staffordshire Wildlife Trust
Natural Heritage Audit Priority sites	GIS shapefile	Staffordshire Wildlife Trust
Nature Recovery Network mapping & Local Wildlife Sites	GIS shapefile	Staffordshire Wildlife Trust

Data resource	Date type	Author
Habitat Composite	GIS shapefile	Staffordshire Wildlife Trust
Digital River Network & Culverts Network	GIS shapefile	Staffordshire Wildlife Trust
Environment Agency water quality data – Catchment Data Explorer	Web data repository	Environment Agency
RENEW Project sites outline	GIS shapefile	Staffordshire Wildlife Trust
Environment Agency National LiDAR Programme - Digital Elevation Model	GeoTIFF	Environment Agency
Forestry Commission – EWCO Keeping Rivers Cool Riparian Buffers	GIS shapefile	Forestry Commission
Forestry Commission – EWCO Flood risk management planting opportunities	GIS shapefile	Forestry Commission
Local Authority Districts (December 2023) Boundaries UK BFE	GIS shapefile	Office for National Statistics
Palaeochannels of the Trent Catchment	GIS shapefile	York Archaeological Trust (2017) Palaeochannels of the Trent Catchment . York: Archaeology Data Service https://doi.org/10.5284/1043773
River obstacles data	GIS shapefile	Environment Agency
Environment Agency Water Quality Sampling Sites	GIS shapefile	Environment Agency
Trent Headwater Wetland Constraints Mapping & Trent Headwater Wetland Opportunity Area Mapping	GIS shapefile	Staffordshire Wildlife Trust
OS Mastermap water network	GML	Ordnance Survey license – through Newcastle-under-Lyme Borough Council
Flood zone mapping - Zone 2 & 3	GIS shapefile	Environment Agency
Wetlands for flood resilience, water quality, carbon capture and urban wellbeing potential	GIS shapefile	Wildfowl & Wetlands Trust
AIMS channel line data - Asset Information Management System	GIS shapefile	Environment Agency
Riparian Shade (England) - data from the Environment Agency showing relative levels of shade on rivers and lakes by vegetation and topography	Raster layer WMS	Environment Agency

Community event	Date	Venue
Transforming the Trent Headwaters Community Conversations https://events.humanitix.com/transforming-the-trent-headwaters-community-conversations	6th March 2025	New Vic Theatre, Etruria Road, Newcastle-under-Lyme, ST5 0JG
Transforming the Trent Headwaters – Green Network Event https://www.ticketsource.co.uk/vast/transforming-the-trent-headwaters-world-cafe/e-ddrvog	24th March 2025	Dudson Centre, Hope Street, Hanley, Stoke-on-Trent, ST1 5DD

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Natural Heritage Audit

Water Framework Directive Catchment Data

The Water Framework Directive Regulations

The WFD came into force in December 2000. It requires the protection and improvement of the water environment, through river basin management plans. These plans set environmental objectives for water bodies and set out programmes of measures to achieve those objectives. There are a number of water quality objectives in WFD, and key aspects are:

- aquatic ecology and water chemistry.
- the impact of physical modification of water bodies.
- specific unique and valuable habitats (protected sites) drinking water resources.
- bathing waters and coastal waters use for shellfish aquaculture.

The EU Water Framework Directive (WFD) created a mechanism for assessing and managing the water environment, through a 6-yearly cycle of river basin management planning and implementing measures to protect and improve the water environment. The Water Environment (Water Framework Directive) (England and Wales) 2017 Regulations transposed WFD into law in England and Wales. Similar regulations transposed WFD in Scotland and Northern Ireland, respectively. All these regulations were retained in UK law after EU Exit via the EU Withdrawal Act 2018. The Environment Agency continues to classify and report water body status under the 2017 regulations. For ease of reference this legislation is referred to as the WFD Regulations throughout this document.

The WFD Regulations specifies the quality elements that can be used to assess the surface water status of a water body. Quality elements can be biological (for example, fish, invertebrates and plants), chemical (for example, heavy metals, pesticides and nutrients) or indicators of the condition of the habitats and water flows and levels (for example, presence of barriers to fish migration and modelled lake level data). Under WFD Regulations the ‘one-out-all-out’ approach means that if just one quality element fails good status, the overall water body classification will be less than good. Classifications indicate where the quality of the environment is good, where it may need improvement and what may need to be improved. They can also be used, over the years, to plan improvements, show trends and monitor progress. Surface water status in WFD Regulations looks at both the chemical status and the ecological (including biological and habitat condition) status of a water body. Chemical status comprises around 50 priority substances. Other chemicals are included as elements in ecological status. Chemical and ecological status are reported separately but can be combined as an overall status.

For a broader view of the condition of the water environment, see Indicator B3 in the Outcome Indicator Framework for the 25 Year Environment Plan: 2023 update. Information on the objectives to improve and protect each water body, as well as measures defined to ensure the objectives are met, can be found on the Environment Agency website (see web links for further information).

Methodology for data collection

In England, WFD Regulations status classification is based on information obtained from monitoring of water quality and biological elements in both long-term surveillance networks and more risk-based operational networks.

The programme of monitoring that takes place in a given period is informed by the results of the previous cycle of monitoring and risk assessments. Where it is known with high certainty that a water body is in good status or in less-than-good status, monitoring effort can be refocused to areas at higher risk. This helps to target resources where they are needed most in the environment.

Surveillance water bodies are monitored more intensively. One objective of surveillance monitoring is to look for signs of impact from pressures in order to validate risk assessments and provide a consistent, long-term monitoring network of sites. At water bodies chosen for the surveillance network, data collectors aim to monitor all quality elements over a river basin management plan cycle.

If there are no sampling data for a particular classification period, results from previous classifications may be rolled-over into the classification assessment. For example, river phosphorus results are calculated from data from the previous 3 years. If there are no data in that sampling period, the last classification assessment is rolled forward.

The key developments per cycle are listed below:

Cycle 1 (2009 - 2015)

During 2013 and 2014, England introduced the Ecological Status Indicator (ESI) monitoring programme in order to establish a new fixed network of sampling points and provide a complete baseline of ecological status, covering every river water body in England. This new monitoring programme significantly increased the number of samples that would normally be collected in any single year. This improved confidence in the classification of ecological status and reported statistics of environmental change in river water bodies from 2014.

Cycle 2 (2015 - 2025)

The introduction of new WFD Regulations monitoring data and classification standards (including a new baseline adopting all of the new standards, tools, designations and water body boundaries) in 2014 led to a step change in the number of water bodies assessed as being in each status classification in following years. It also led to a reduction in the total number of water bodies being assessed because under the new WFD Regulations guidance, water bodies below the 10 kilometres squared catchment area no longer need to be included. The formal reporting of new standards used the second cycle plans published in 2015. The Environment Agency reported using cycle 2 for the first time in 2015, alongside reporting for the end of cycle 1 in both 2015 and 2016.

Cycle 3 and beyond (2025 onwards)

New water body classifications were produced in 2019 for reporting of the third cycle plans which were published in 2022. This is combined with a review of monitoring and data provision for reporting on the state of the water environment in future.

The Trent Headwaters project area – WFD statuses.

Data from the Environment Agency Catchment Data Explorer[1] is displayed below (Table 4 and Figure 2) for the tributaries of the River Trent that rise and flow in the project watershed. Detailed information for each catchment including a full breakdown of Classification Items for each waterbody catchment can be found in the separate document: 'Appendix 1 – WFD catchment data'.

Routine sampling usually takes place once per month and is uploaded within 2 days to the Environment Agency Water Quality Data Archive[2]. This data is used to quantify Ecological Status.

There are 73 water quality sampling sites within the Transforming the Trent Headwaters project area (Figure 3).

None of the waterbodies within the Transforming the Trent Headwater project boundary meet 'Good Ecological Status' in Cycle 3 of the WFD assessments (Table 4 and Figure 2). Seven Waterbodies including Ford Green Brook, Fowlea Brook, Park Brook, the Trent from Ford Green Brook to Fowlea Brook, the Trent from Fowlea Brook to Tittensor, and both Buddulph Brook and the River Blith achieved 'Moderate Ecological Status'.

Causley Brook, Longton Brook and Lyme Brook achieved 'Poor Ecological Status' and the Trent from Source to Ford Green Brook achieved 'Bad Ecological Status'.

Table 4. Summary of WFD Ecological Status for watercourses within the TTH project area.

Waterbody name	WFD Ecological Status	Classification Item	2022
Causeley Brook from Source to River Trent	**Poor**	Ecological	**Poor**
		Physico-chemical quality elements	**Good**
		Hydro-morphological Supporting Elements	**Not high**
Ford Green Brook from Source to R Trent	**Moderate**	Ecological	**Moderate**
		Physico-chemical quality elements	**Moderate**
		Hydro-morphological Supporting Elements	**Not high**
Fowlea Brook from Source to River Trent	**Moderate**	Ecological	**Moderate**
		Physico-chemical quality elements	**Good**
		Hydro-morphological Supporting Elements	**Not high**
Longton Brook - source to R Trent	**Poor**	Ecological	**Poor**
		Physico-chemical quality elements	**Moderate**
		Hydro-morphological Supporting Elements	**Not high**
Lyme Brook Catchment (trib of Trent)	**Poor**	Ecological	**Poor**
		Physico-chemical quality elements	**Good**
		Hydro-morphological Supporting Elements	**Not high**
Park Brook Catchment (trib of Trent)	**Moderate**	Ecological	**Moderate**
		Physico-chemical quality elements	**Moderate**
		Hydro-morphological Supporting Elements	**Not high**
	Moderate	Ecological	**Moderate**

[1] https://environment.data.gov.uk/catchment-planning/
[2] https://environment.data.gov.uk/water-quality/view/landing

Waterbody name	WFD Ecological Status	Classification Item	2022
Trent - Ford Green Bk to Fowlea Bk		Physico-chemical quality elements	Moderate
		Hydro-morphological Supporting Elements	Not high
Trent from Fowlea Brook to Tittensor	Moderate	Ecological	Moderate
		Physico-chemical quality elements	Moderate
		Hydro-morphological Supporting Elements	Not high
Trent from Source to Ford Green Brook	Bad	Ecological	Bad
		Physico-chemical quality elements	Moderate
		Hydro-morphological Supporting Elements	Not high
Biddulph Brook	Moderate	Ecological	Moderate
		Physico-chemical quality elements	Moderate
		Hydro-morphological Supporting Elements	Not high
Blithe from Source to Tad Brook	Moderate	Ecological	Moderate
		Physico-chemical quality elements	Moderate
		Hydro-morphological Supporting Elements	Not high

Causeley Brook from Source to River Trent

Within this catchment, barriers to fish migration have been identified as a reason for not achieving good ecological status (RNAG – See Table 2 and Table 3 in the separate 'Appendix 1 – WFD catchment data'). Weirs within this catchment have been a focus of investigation and a project to remove the weir at NGR: SJ 85779 44170 has been proposed within the TTH project proformas (Section - Opportunities for restoration).

Ford Green Brook from Source to R Trent Water Body

Sewage discharges, poor livestock management and urbanisation have been identified as major causes for not achieving good ecological status for invertebrates (RNAG – See Table 4 and Table 5 in the separate 'Appendix 1 – WFD catchment data'). A focus on improving river habitat conditions including gravel supply, retention and restoration of aquatic macrophyte populations has been investigated and measures included within the proposed project proformas (Section - Opportunities for restoration).

Fowlea Brook from Source to River Trent Water Body

Urbanisation and sewage discharges have been identified as significant reasons for not achieving good ecological status for invertebrates within this catchment (RNAG - See Table 6 and Table 7 in the separate 'Appendix 1 – WFD catchment data'). Measures to denaturalise river beds and create diverse, clean gravels have been investigated for proposed restoration measures (Section - Opportunities for restoration).

Longton Brook - source to River Trent Water Body

Sewage discharge, urbanisation and physical modifications (barriers to migration) have been identified as reasons for not achieving good ecological status for invertebrates within this catchment (RNAG – See Table 8 and Table 9 in the separate 'Appendix 1 – WFD catchment data'). Restoration opportunities at Bradwell Wood have been proposed to address a number of physical modifications within this catchment (Section - Opportunities for restoration).

Lyme Brook Catchment (tributary of Trent) Water Body

Fish and invertebrate populations achieved moderate ecological status in Lyme Brook. During walkover and ground-truthing surveys, modifications and poor gravel substrate supply and retention were identified as potential reasons for not achieving good ecological status (RNAG – See Table 10 and Table 11 in the separate 'Appendix 1 – WFD catchment data'). Habitat restoration on Lyme Brook at Lyme Valley Parkway and weir removal at Clayton Lane have been proposed as restoration opportunities as measures to address these failures (Section - Opportunities for restoration).

Park Brook Catchment (tributary of Trent) Water Body

Park Brook achieved moderate ecological status in 2022 for fish and invertebrates (RNAG – See Table 12 and Table 13 in the separate 'Appendix 1 – WFD catchment data'). Restoration measures in the catchment have focused on in-river channel improvements for fish movement through weir removals/easements and improvements into gravel supply (Section - Opportunities for restoration).

Trent - Ford Green Bk to Fowlea Bk Water Body

This catchment achieved moderate ecological status for fish and poor status for invertebrates with urbanisation, sewage and physical barriers identified as reasons for not achieving good ecological status for invertebrates within this catchment (RNAG – See Table 14 and Table 15 in the separate 'Appendix 1 – WFD catchment data'). Weir removal at Milton and channel improvements at Cromer Road have been identified as restoration measures suitable for action against these RNAG's.

Trent from Fowlea Brook to Tittensor Water Body

Poor livestock management, diffuse pollution from agricultural land and sewage discharges have been identified as significant reasons for not achieving good ecological status for invertebrates within this catchment (RNAG – See Table 16 and Table 17 in the separate 'Appendix 1 – WFD catchment data'). Working with riparian landowners in this catchment should be a priority to address these issues.

Trent from Source to Ford Green Brook Water Body

Poor livestock management and impoundments from Knypersley Reservoir have been identified as reasons for not achieving good ecological status for invertebrates and fish within this catchment (RNAG – See Table 18 and Table 19 in the separate 'Appendix 1 – WFD catchment data').

Gravel supply issues due to regulated flows and dissolved oxygen concentrations within this catchment were identified as part of this study and restoration measures at Tongue Lane and Leek New Road have been identified as potential restoration measures to address gravel supply issues and maintaining adequate base flows within this catchment (Section - Opportunities for restoration).

Biddulph Brook Water Body

Moderate ecological status for macrophytes and phytobenthos within this catchment have been attributed to urbanisation, sewage discharges and poor livestock management (RNAG – See Table 20 and Table 21 in the separate 'Appendix 1 – WFD catchment data'). Projects aimed at working with riparian landowners to create riparian buffer strips and to improve livestock management to

minimise nutrient and sediment inputs into the watercourse should be prioritised within this catchment.

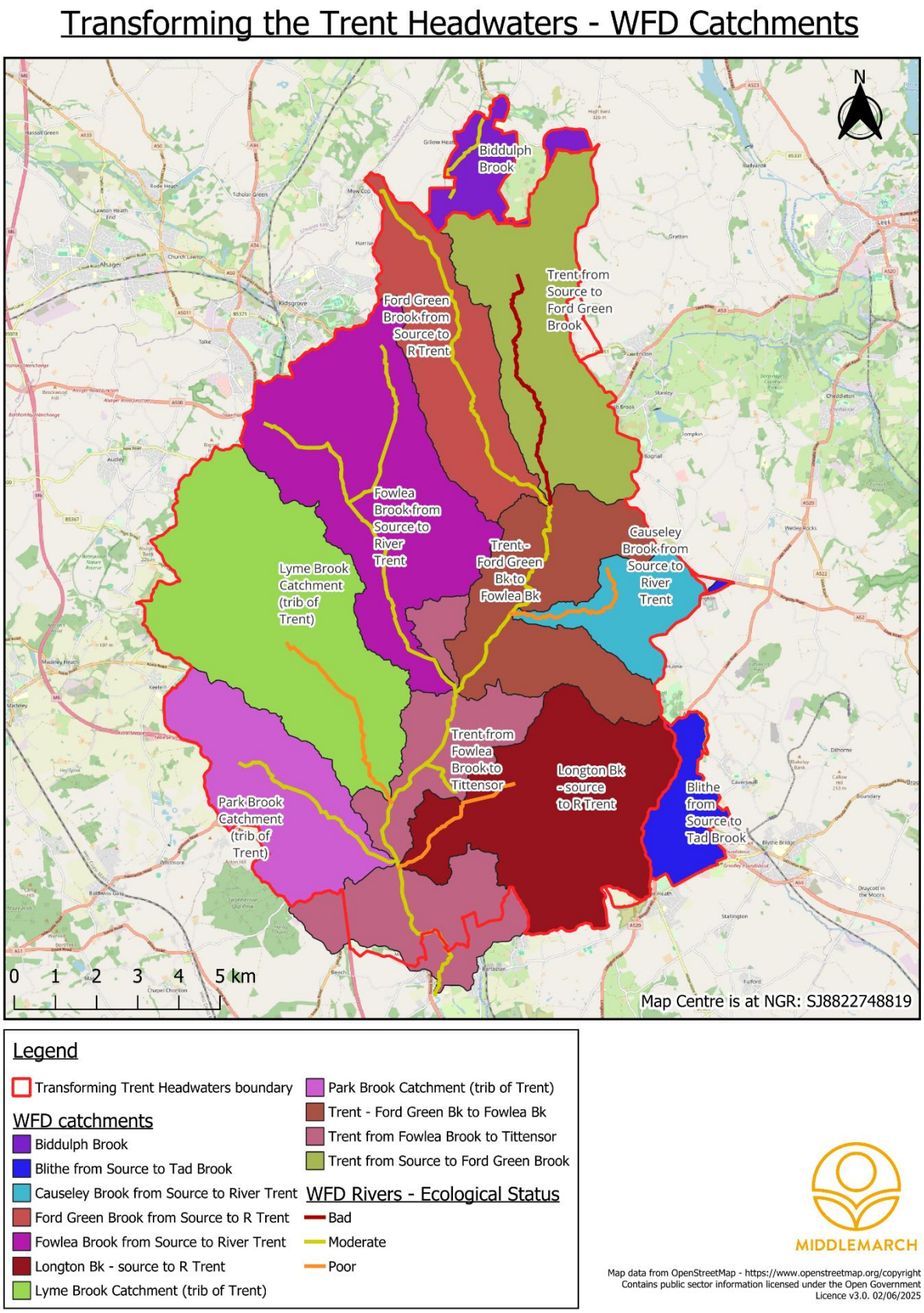

Figure 2. Map showing tributary catchments and watercourses with WFD Ecological status within the TTH project area.

Transforming the Trent Headwaters - Water quality sampling sites

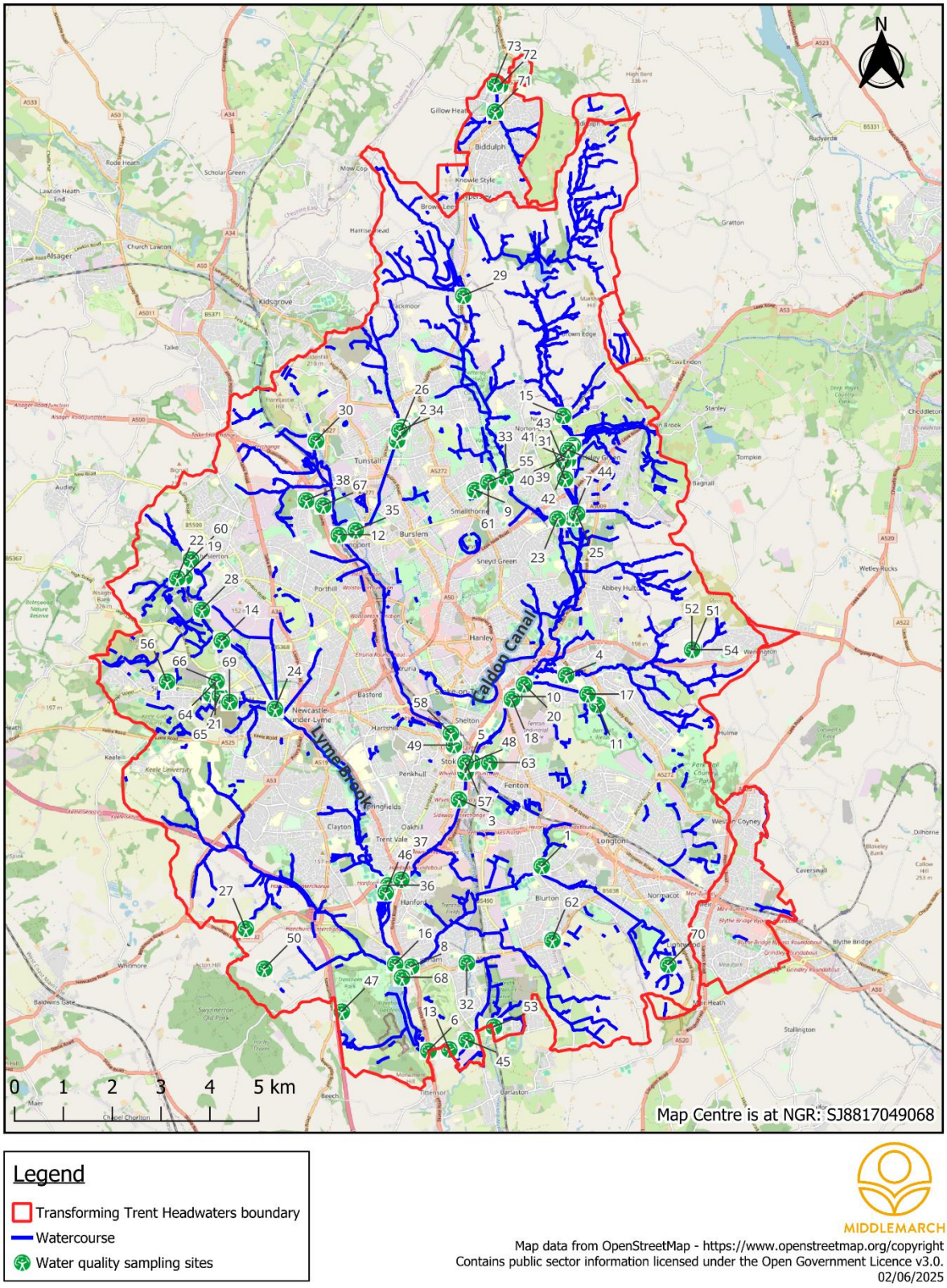

Figure 3. Map showing water quality sampling sites within the TTH project area.

Surface flow pathways

Analysis of surface flow pathways are an important process in determining a number of hydrological impacts and influences and is a useful tool for understanding the following;

- Routes of overland flows during periods of heavy rainfall.
- Potential run-off routes through areas of pollutants e.g. farmyards, slurry pits, tracks etc.
- Sources of water for wetland habitats.
- Locations for optimal construction of run-off attenuation features to store water as natural flood management.
- Routes of palaeochannels – assisted through analysis of digital terrain models and LiDAR data.

For this study, LiDAR data was analysed to determine surface flow pathways across the priority sites identified under the Transforming the Trent Headwaters project.
Surface flow pathway models were produced using digital terrain model (DTM) data and primary and secondary flow pathways were drawn for each of the priority sites using QGIS 3.34.12-Prizren - r.stream and SAGA Strahler order functions.
These maps, along with wetland opportunity mapping outputs were used to identify areas where wetland creation that would be beneficial for habitat creation, natural flood management and drought resilience.

Maps from this data analysis are presented in the separate ‘Appendix 2 – Surface flow pathways’.

Wetland opportunities

Wetland opportunity GIS modelling outputs were analysed to identify areas within the project boundary that would be suitable for wetland creation and/or regeneration. The models identify approximately 3766.5Ha of potential wetland creation areas (Figure 4). These areas range from agricultural land, parkland, golf courses, allotments, college grounds and residential property gardens. Areas that occur within prioritised project areas have been identified and included in proposed restoration measures within the project proformas and descriptions (Section - Opportunities for restoration).

Maps showing the extent of wetland creation opportunities are presented in the separate ‘Appendix 3 – Wetland creation opportunities’.

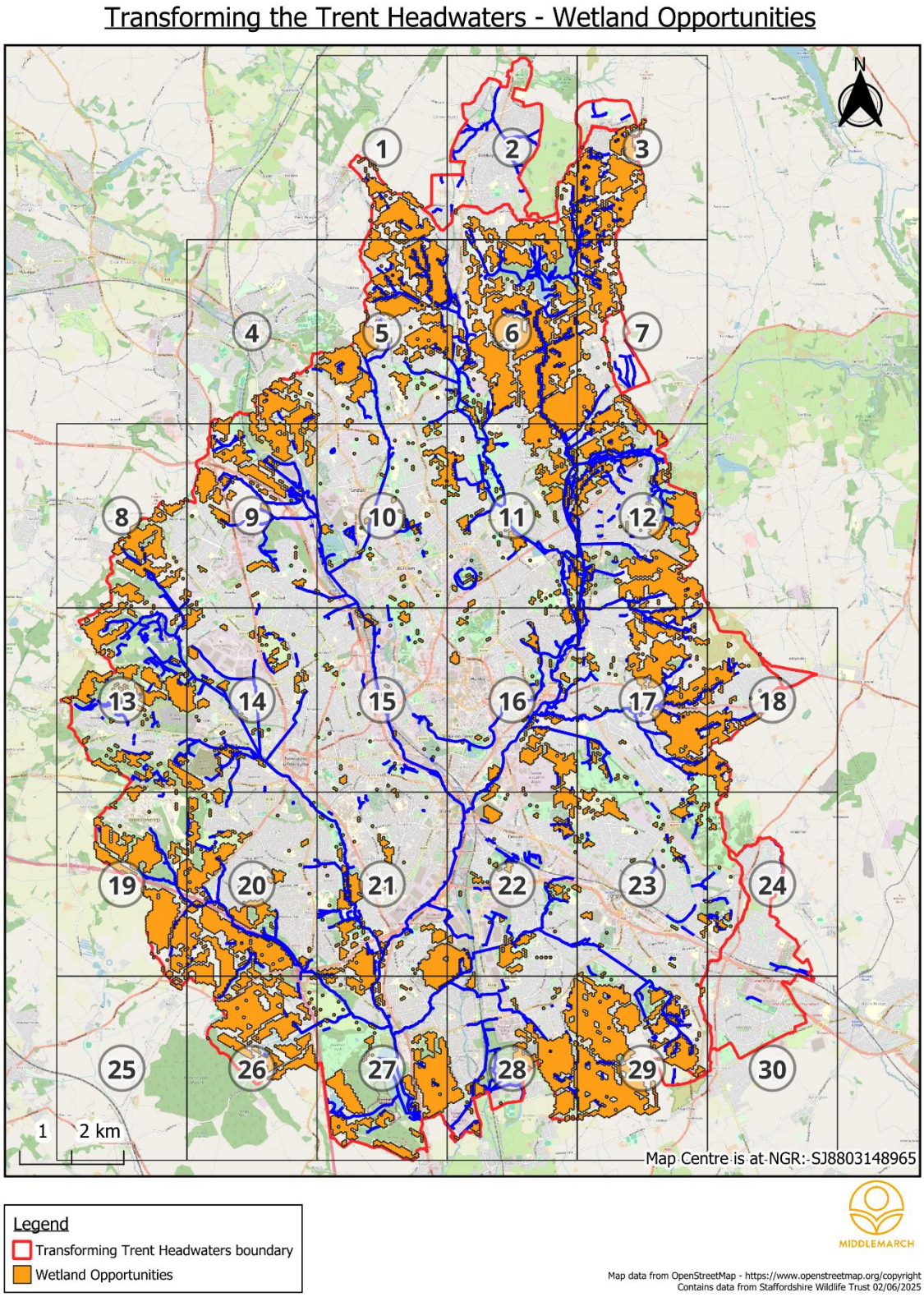

Figure 4. Map showing wetland creation opportunity areas within the TTH boundary.

Palaeochannels

Palaeochannels are important historical channels within floodplains and can be used to identify historic routes taken by actively (or now constrained) watercourses and often contain areas of important sediment deposits and remnant lotic and wetland habitats. As part of this study, available data from York Archaeology[3] was examined to identify palaeochannels within the project area and to focus on instances where restoration may be feasible.

There are 61 palaeochannels identified within the Transforming the Trent Headwaters project boundary. These are identified on maps in Figure 5 in this report and Figures 1 to 30 in the separate 'Appendix 4 – Palaeochannel data and maps'.

Paleochannel restoration has been included as a potential restoration measure at the following sites: Milton, Tag Marsh, Causeley Brook, Leek New Road (North of railway) and Clayton Lane.

It is recommended that instances of palaeochannels outside of the priority sites should be further investigated to determine their hydrological and ecological value/condition and potentially incorporated into future restoration measure opportunities and the Transforming the Trent Headwaters Master Plan.

[3] https://archaeologydataservice.ac.uk/archives/view/trentcatch_he_2017/

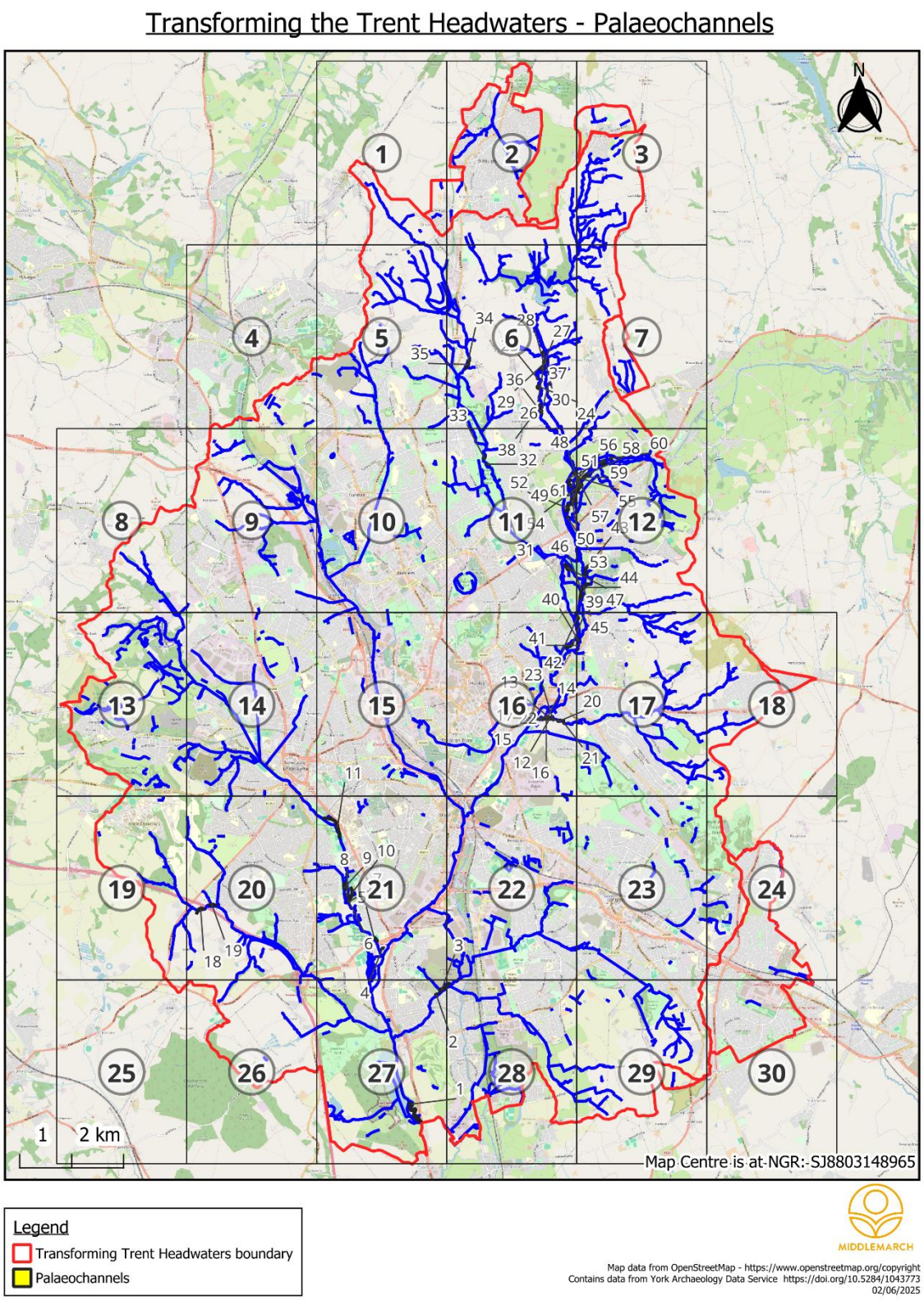

Figure 5. Map - Palaeochannels within the TTH project boundary

Riparian and floodplain tree planting

Keeping rivers cool

Historically in the UK, riparian zones and floodplains were more extensively wooded than they are today. Much of this tree cover has been lost due to agriculture and other floodplain developments. Woody debris would also have been a common feature in river channels. Shading from riparian trees and shrubs can help reduce local stream temperatures, with summer mean and maximum water temperatures on average 2 to 3˚C lower in shaded areas than in open, uncanopied rivers.

Current projections predict that average UK summer air temperatures will rise between 2°C and 4°C by the 2050s compared to the long-term 1961 to 1990 average temperature[4]. River temperatures are also expected to rise by a similar amount[5]. Even these small changes can have a negative impact on the health of aquatic wildlife. Brown trout and Atlantic salmon are particularly vulnerable, with an increase in water temperature to above 22°C for more than seven consecutive days being potentially lethal for brown trout[6]. Some rivers in England and Wales have already reached these lethal temperatures during recent hot, dry summers, putting trout and salmon populations under considerable stress and causing severe declines is recruitment success rates.

Tree roots, fallen trees and woody debris also forms an integral part of in-channel structural complexity and contributes to diverse hydro-geomorphological processes such as bank and bed substrate erosion and deposition together with providing complex habitats and food for many species of plants, invertebrates and fish.

Analysis of available data from the Woodland Trust and Environment Agency has identified 87.8km of watercourse withing the Transforming the Trent Headwaters project boundary that has less than 20% canopy cover (Figure 6 in this report and Figures 1 to 30 in the separate 'Appendix 5 – Riparian planting opportunities'). Aquatic wildlife within these unshaded reaches of watercourse are at risk of future predicted high summer temperatures which presents an opportunity for intervention to establish riparian buffer strips with overhanging vegetation to provide shade.

This study has identified restoration measure opportunities at several sites where riparian tree planting would be beneficial. These site are: Tongue Lane, Lyme Valley Parkway, Holden Lane Pools, Bradeley Fields, Chatterley Whitfield Heritage Country Park, Whitfield Valley LNR, Milton, Victoria Ground, Springpool Wood, Fenton Road (Causeley Brook), Clayton Lane and the Canal network (areas to be confirmed). Additionally, it is recommended that the modelled data for uncanopied reaches of watercourses should be further examined and sites on the ground assessed for suitability and feasibility of establishing riparian buffer strips and riparian shade.

Flood risk management tree planting

In addition to keeping rivers cool by shading aquatic habitats, establishing woodland in strategic flood mitigation locations can help reduce the impacts of storm and flood water and alleviate the impact of drought, improve water quality and reduce soil erosion.

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[4] Jenkins, G.J., Perry, M.C., and Prior, M.J. (2008). The climate of the United Kingdom and recent trends. Met Office Hadley Centre, Exeter, UK. (UKCP09 scientific report).

[5] Webb, B.W. & Nobilis, F. (1997). Long-term perspective on the nature of the air-water temperature relationship: a case study. Hydrological processes. Vol.11, 137-147.

[6] Elliot, J.M. and Elliot J.A. (2010). Temperature requirements of Atlantic salmon *Salmo salar*, brown trout *Salmo trutta* and Arctic charr *Salvelinus alpinus*: predicting the effects of climate change, Journal of Fish Biology (2010) 77, 1793–1817.

A well-planned and well positioned woodland can help to slow the flow of water and reduce flood peaks by up to 65%[7]. Rough vegetation helps to slow the flow of water during flood events and the volume of run-off can be reduced as trees improve rainwater infiltration (that's water on the ground surface that enters the soil). Infiltration is 60 times higher under woodland compared to grass – this is because woodland soils are more open and less compact, enabling the soil to soak up and store rainwater like a sponge. Under-planting of shrubs can also increase infiltration rates across existing woodland and in a mature woodland provides continued roughness to slow the flow of water. Having woodland in a catchment increases the interception and evaporation of rainfall – further contributing towards effective natural flood management.

Analysis of data within the Transforming the Trent Headwaters project area indicates that there is an area of approximately 851Ha that has potential for the establishment of woodland to specifically reduce flood risk and offer natural flood management 'ecosystem services'. Locations and extent of these areas is shown in Figure 7 in this report and Figures 1 to 30 in the separate 'Appendix 6 – Flood risk management planting opportunities'.

It is recommended that in addition to riparian tree planting for 'keeping rivers cool', natural flood management tree planting schemes be investigated and scoped as part of the development phase of the Transforming the Trent Headwaters project and future collaborative work with the Woodland Trust, Forestry Commission and other stakeholders be developed and included in the Master Plan. These planting schemes should focus on both urban and rural/agricultural/riparian schemes to provide benefit and improvements to localised flood issues.

[7] Hornigold, K. (Ed.) (2022). Wood Wise: Trees for water. The Woodland Trust, Grantham, UK.

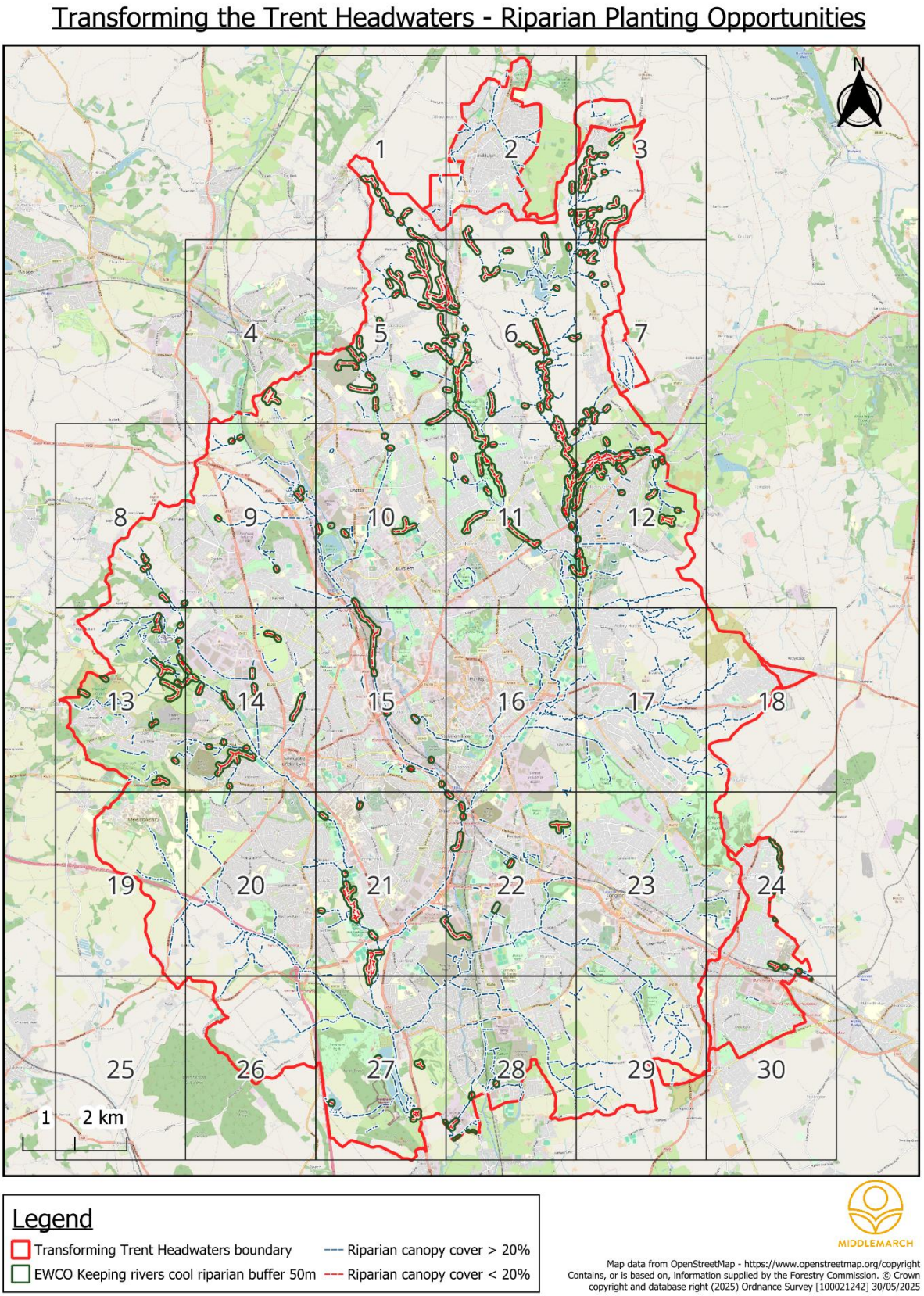


Figure 6. Map - EWCO 'Keeping rivers cool' riparian tree planting opportunities.

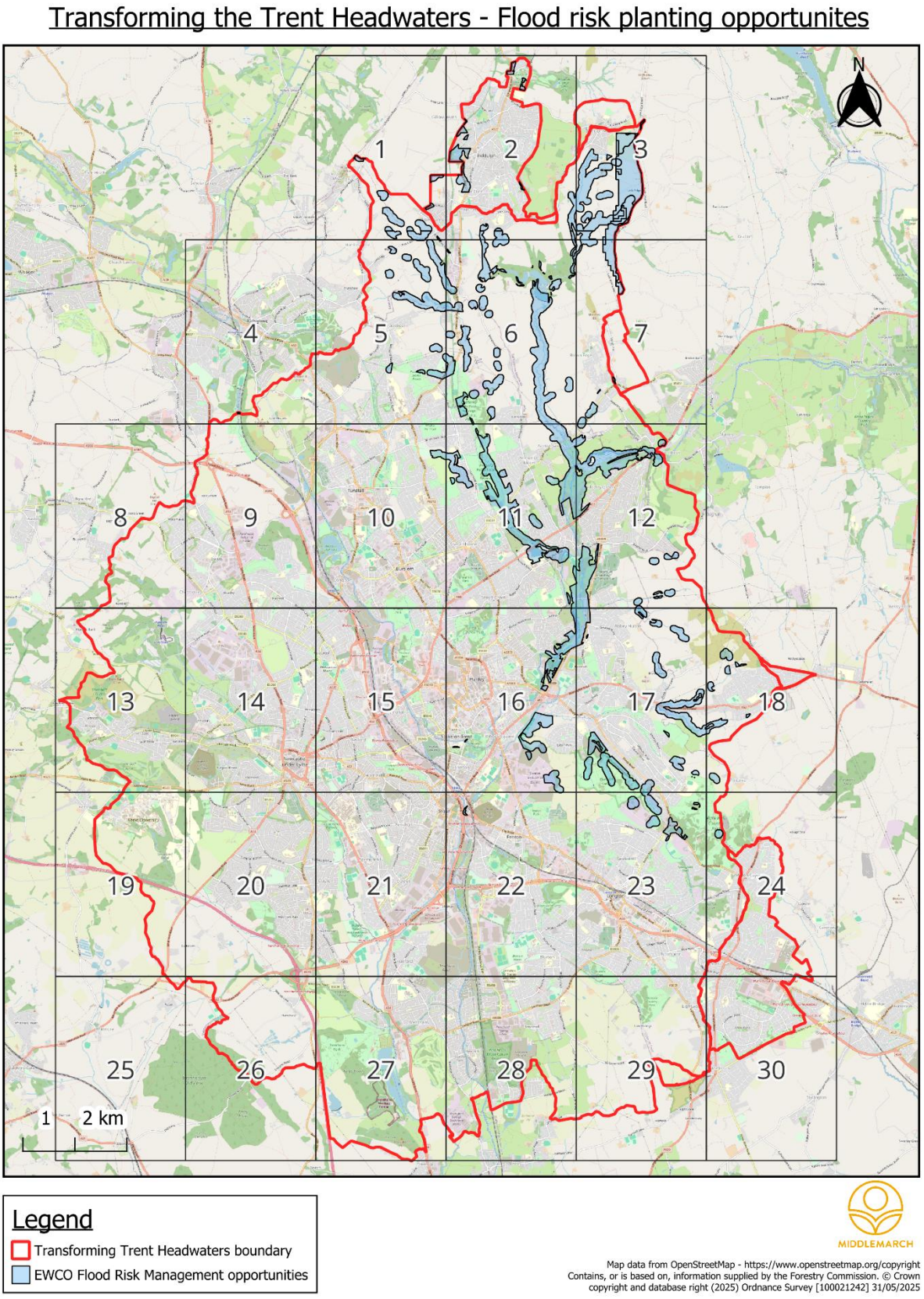


Figure 7. Map - EWCO Flood Risk Management tree planting opportunities.

River obstacles

River obstacles such as weirs and culverts negatively impact large stretches of the UK's watercourses. Structures that impede flow of water and bed load within a river can have significant impacts both upstream and downstream through the creation of depleted reaches downstream of structures and impounded reaches upstream where flow rates, sediment deposition and physical access up and down the river by aquatic wildlife is impeded.

Depleted reaches are often subject to elevated levels of erosion where gravels are stripped away due to increased stream power within the watercourse flows. This can eliminate bed substrates that are essential for aquatic invertebrates and fish and can cause instability of river banks, resulting in bank collapses and silt pollution downstream (Figure 8)

Impounded reaches experience uniform, slower flow rates which allow finer silts to be deposited on the bed which are often rich in plant nutrients and can stimulate excessive nuisance algal growths (Figure 8). This silt can reduce the value of the upstream habitat and render the bed gravels unusable by the majority of invertebrates and fish.

Weirs and culverts also pose a direct barrier to both upstream and downstream fish movements which can cumulatively result in catastrophic declines in the success of upstream and downstream migrations due to increases in predation of fish around weirs by pisciverous birds and the cumulative effects of additional energy expenditure on the success of spawning by anadromous fish species e.g. Salmon and Sea Trout.

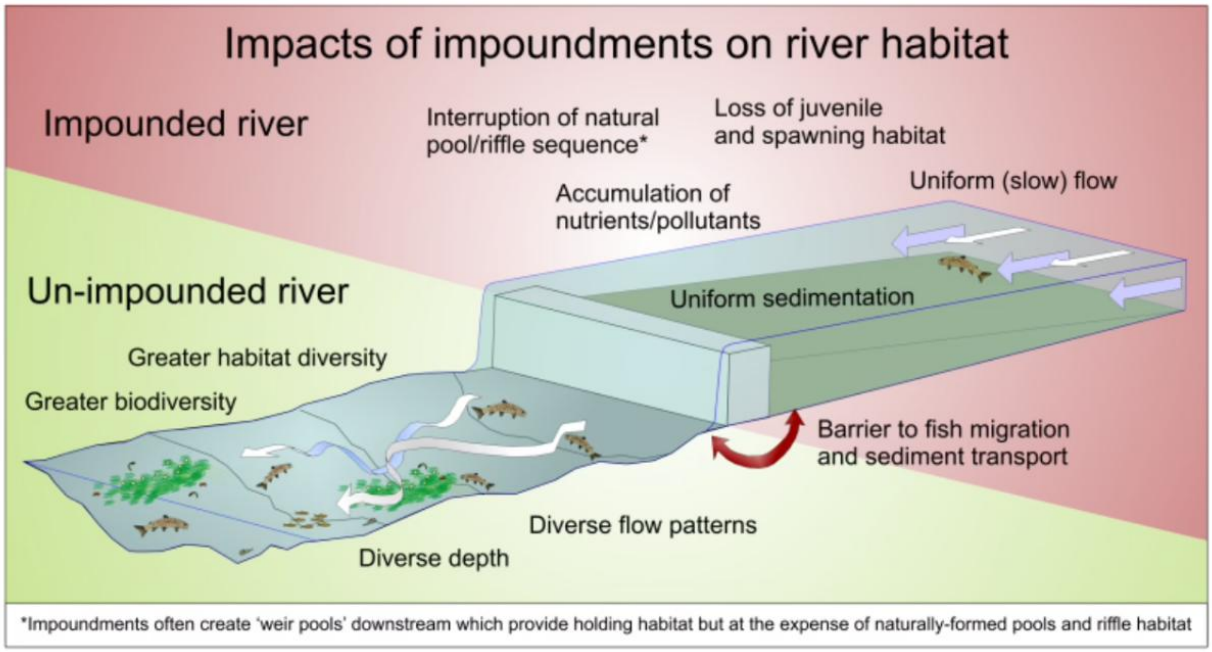
Barriers result in fragmented and degraded habitat, leading to isolated populations of fish. These isolated populations are vulnerable to problems such as pollution or climate change. A fully connected river habitat is much more resilient as it allows natural recovery and recruitment by migration from trout populations upstream, from side streams or from the sea.

These man-made structures are often redundant relics from water powered industry however, some are still important for managing river bed movement, erosion and also flood risk.

Installation of fish passes or easement over weirs and through culverts are a common intervention and whilst they may improve access over these structures for larger fish species, they have limited benefit to smaller fish species, invertebrates and to solving the negative impacts caused by the weir or culvert in the depleted and impounded reaches. Therefore, where possible, weir and culvert removals are the preferred approach as these types of interventions produce a natural, unimpeded flow of water, substrate and wildlife. Additionally, a removal project eliminates the structure entirely, removing any future maintenance or liability legacy.

Obstacles within the Trent Headwaters

Analysis of the data indicates that there are 133 river obstacles within the Transforming the Trent Headwaters project boundary. Of these, 88 are culverts, 30 are weirs and 15 are locks on the canal network. These structures are identified in maps in Figure 9 of this report together with Figures 1 to 30 and Table 1 and 2 within the separate 'Appendix 7 – River obstacles data and maps'.



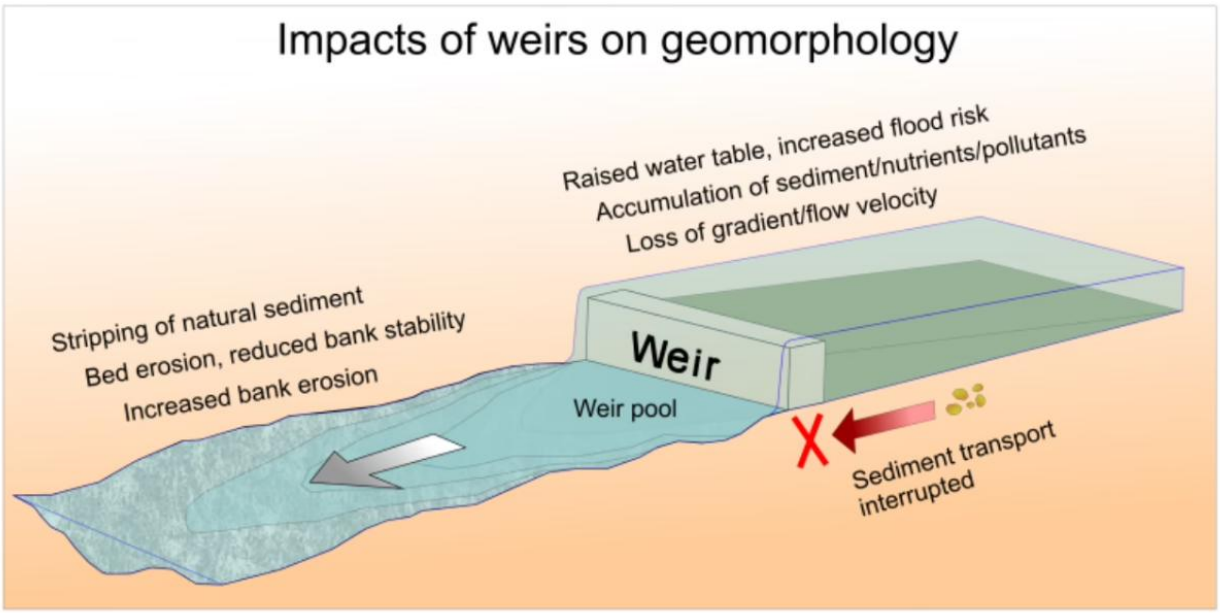


Figure 8. Diagram representing the impacts of impoundments on river habitats and geomorphology. Diagram © Wild Trout Trust[8]

Weir and culvert improvement opportunities have been identified at Knypersley Reservoir, Milton, Cockster Brook, Springpool Wood, Fenton Road Causeley Brook and Clayton Lane (please refer to section - Opportunities for restoration). Many other weir removal opportunities exist within the project area and it is recommended that these are investigated further for potential removal and/or easement as part of the Development phase of this ongoing project and incorporated within the Trent Headwaters Master Plan.

[8] Wild Trout Trust – Weirs, Barriers and Hydropower. Website: https://www.wildtrout.org/content/weirs-culverts-and-barriers

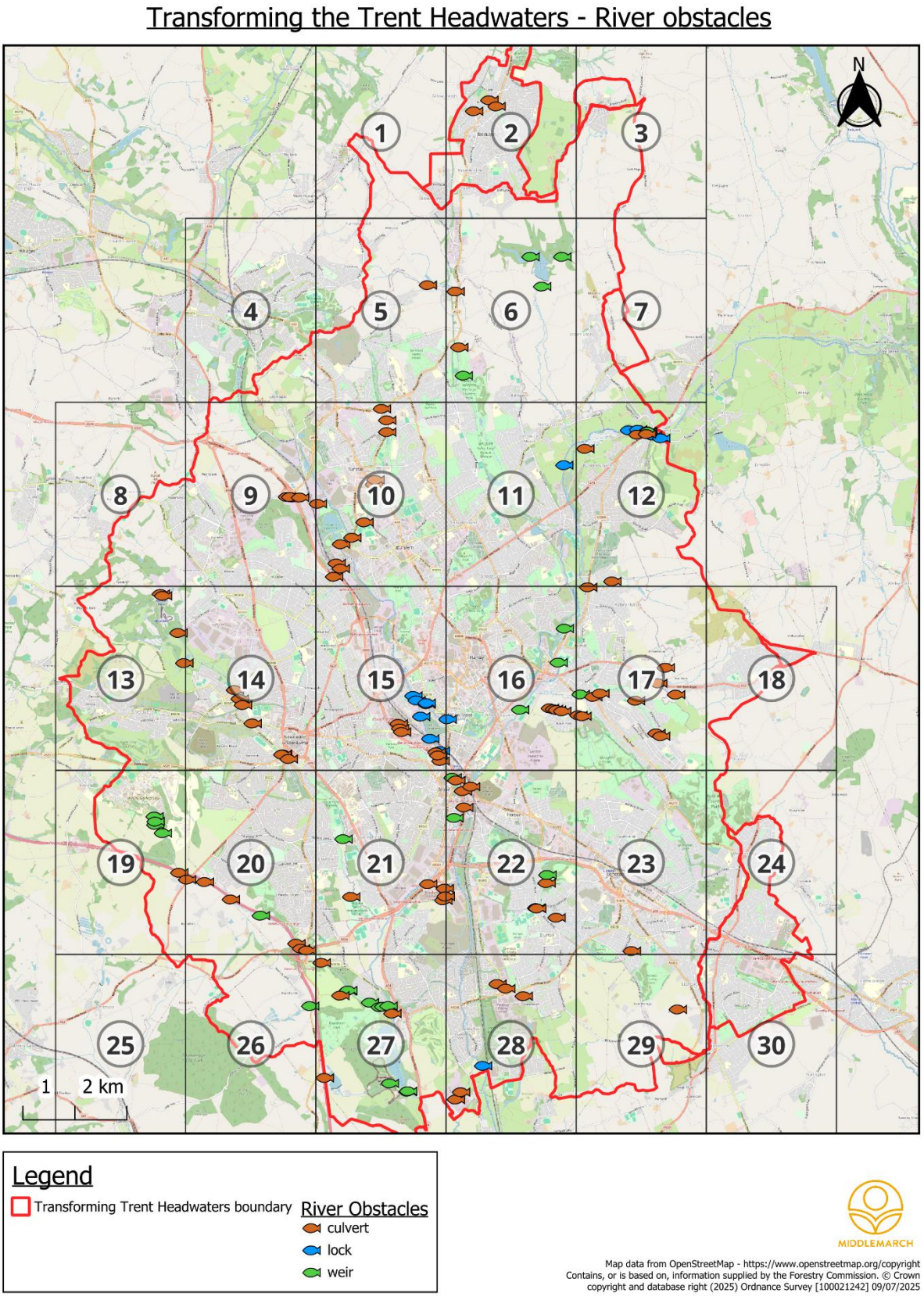


Figure 9. Map - River obstacles within the TTH project boundary.

Waste regulations – historic landfill and pollution sources

During the audit, numerous references were encountered that relate to the extensive industrial heritage of the Trent Headwaters watershed. These include historic landfill sites and other registered and potential sources of pollution emanating from historic mines, spoil heaps and other similar industrial legacy sites.

The cataloguing of these potential constraints to restoration of watercourses and wetland areas are outside the scope of this audit yet remain an important aspect of any future development, scoping or design of restorative intervention.

With this in mind, it is critical that additional consultations take place with relevant authorities e.g. Environment Agency Waste Regulations Team throughout the next stages of the Transforming the Trent Headwaters National Lottery Heritage Fund Project to determine the most appropriate and environmentally sympathetic approach to delivering improvements to the catchment.

Opportunities for restoration

Opportunities for restoration within the Trent Headwaters catchment are detailed in the following project proformas. These project proformas were designed by the delivery Team at Staffordshire Wildlife Trust and include information relevant to the continued development of restoration projects.

Estimated costs summary

The estimated costs that have been drawn up for these project proposal proformas has been based on restoration techniques that align with an 'assisted natural recovery' approach where anthropogenic impacts/constraints are removed or bypassed, allowing the watercourse to re-establish more naturalised hydro-geomorphological processes. This approach to river restoration allows for the re-naturalisation of modified watercourses without the high expense of large scale channel works such as excavating paleochannels. Working this way allows for restoration to take place across wider areas, leaving the re-meandering of watercourses to take place of their own accord. This not only keeps costs down but allows for a gradual release of much needed gravel within the catchment which distributes itself downstream during spate events.

Site Name	Estimated cost	Designs	Capital works
Knypersley Reservoir	£200,000	£10,000	£190,000
Tongue Lane	£20,000	£500	£19,500
Lyme Valley Parkway	£40,000	£3,000	£37,000
Holden Lane Pools	£30,000	£1,000	£29,000
Cromer Road	£20,000	£1,000	£19,000
Bradeley Fields	£20,000	£1,000	£19,000
Chatterley Whitfield	£20,000	£1,000	£19,000
Whitfield Valley LNR	£20,000	£2,000	£18,000
Golden Hill	£30,000	£3,000	£27,000
Milton	£25,000	£1,000	£24,000
Victoria Ground	£50,000	£3,000	£47,000
Longton Brook Trentham Garden Centre	£30,000	£2,000	£28,000
Cockster Brook & Longton Brook	£415,000	£65,000	£350,000
Tag Marsh	£30,000	£2,000	£28,000
Springpool Wood	£50,000	£2,000	£48,000
Hem Heath	£20,000	£2,000	£18,000
Causeley Brook	£40,000	£4,000	£36,000
Leek New Road (north of railway)	£30,000	£2,000	£28,000
Apedale	£25,000	£2,000	£23,000
Clayton Lane	£50,000	£4,000	£46,000
TOTAL ESTIMATED COSTS	£1,165,000		

Site Name – (whole TTH project area)	Estimated cost
Canal network	Up to £1,000,000
Riparian planting – Keeping rivers cool	Up to £1,400,000
Buffer strip fencing – Keeping rivers cool	Up to £886,000
Tree Planting – Flood Risk Management Opportunities	Up to £5,900,000

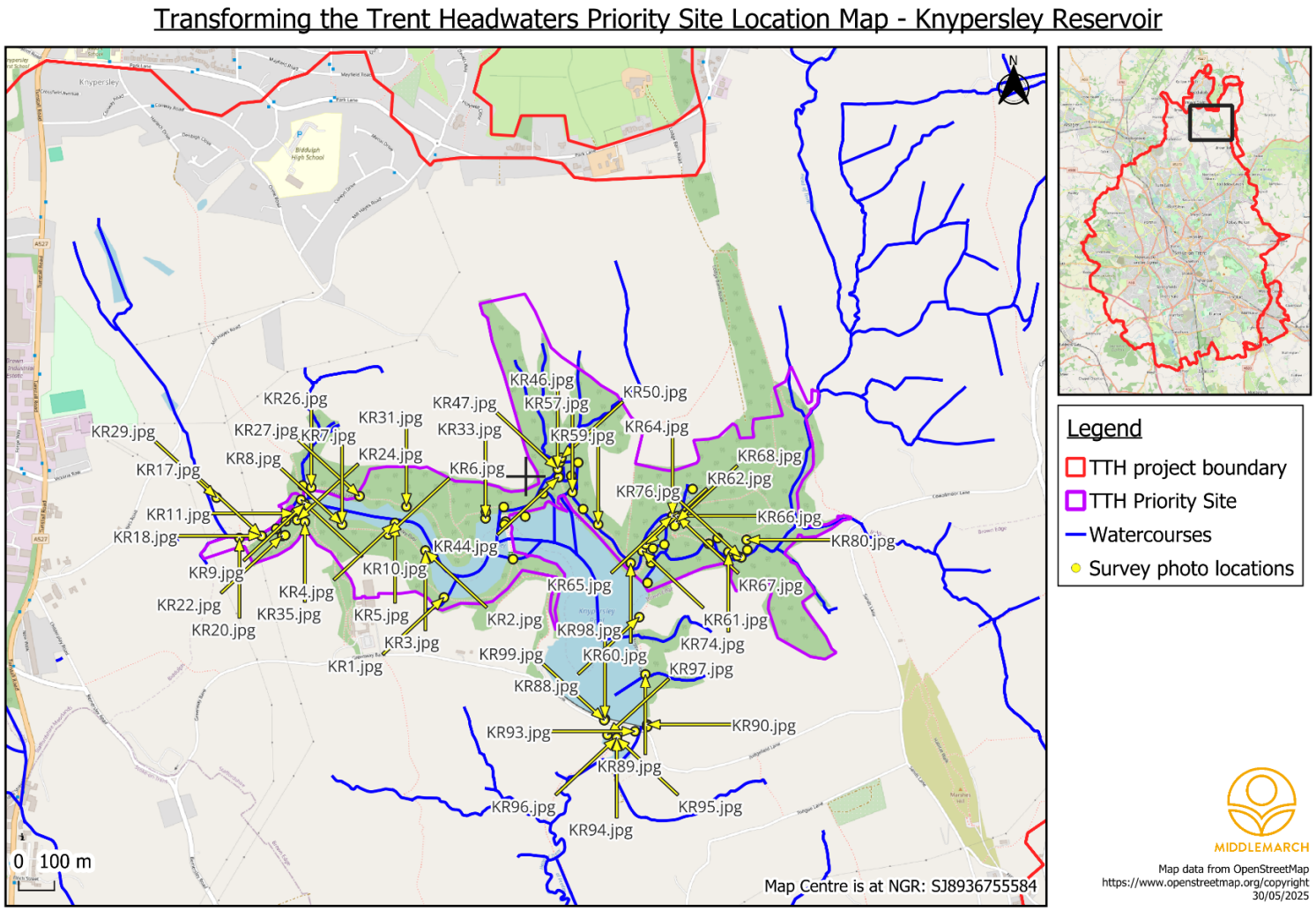


Figure 10. Map showing location and survey photos at Knypersley Reservoir.

Transforming the Trent Headwaters - Priority Site opportunities - Knypersley Reservoir

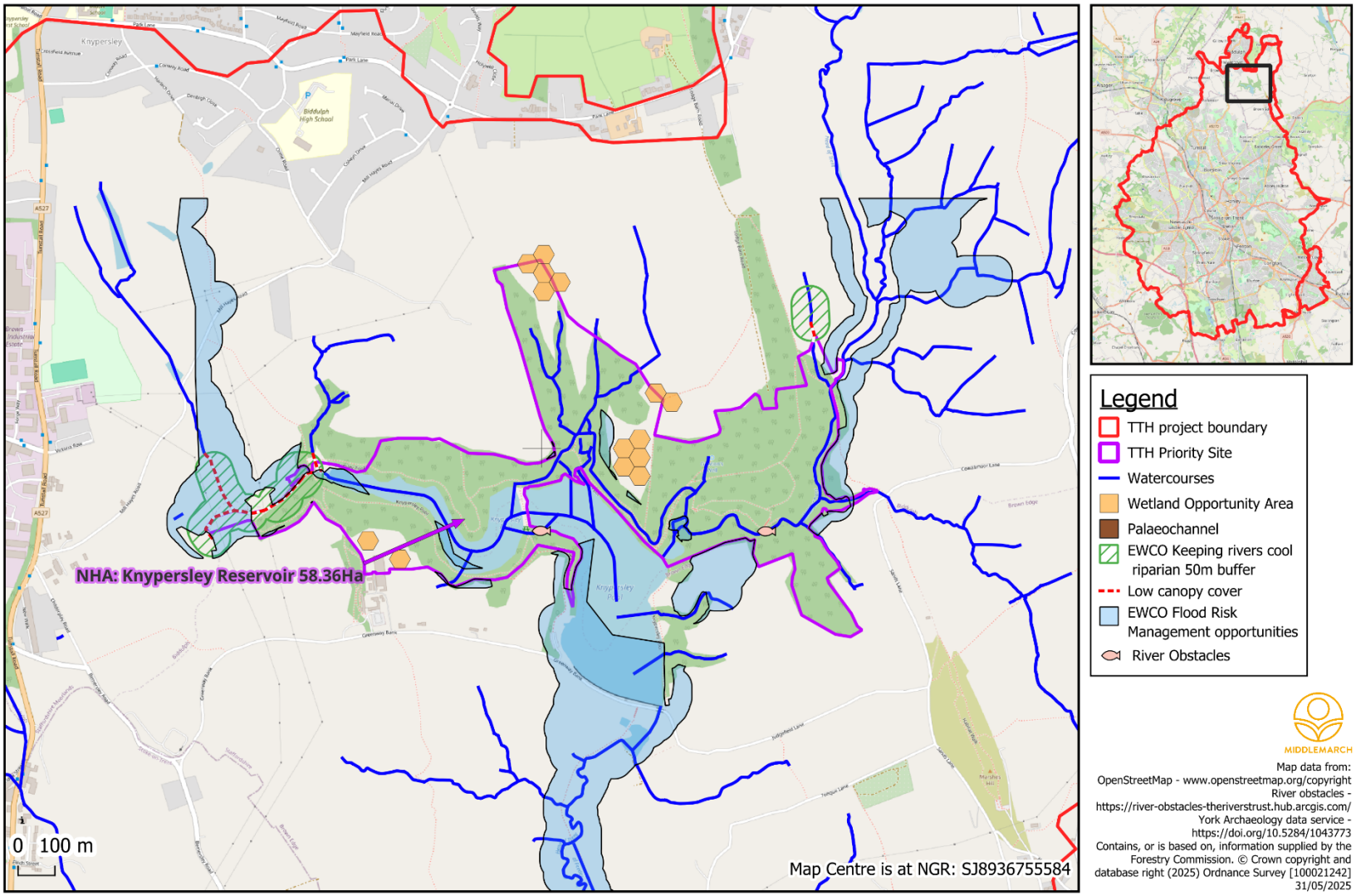


Figure 11. Map showing restoration opportunities at Knypersley Reservoir.

Watercourse / water body catchment	Head of Trent & The Serpentine
District	Staffordshire Moorlands
Grid Reference	SJ 89640 55408
Size	58.36Ha
Public Access	Yes
Site description	Knypersley Reservoir – including tributaries Knypersley Reservoir consists of two basins separated by a partition dam. The tributary watercourse of 'The Serpentine' and the 'Head of the Trent' are the main tributaries serving the reservoirs. The wider land holding consists of deciduous woodland and wet woodland habitats.
Restoration measures	**<u>This site offers significant restoration potential and lends itself to being classed as a 'flagship ' project.</u>** **Littoral habitat improvements:** the majority of the littoral habitat of Knypersley Reservoir shelves steeply to deep water, such that littoral vegetation struggles to establish along the shoreline. Heavy shade from dense woodland right to the water's edge also impacts on the success of emergent vegetation in this valuable habitat area of the waterbody. Occasional patches of Iris *spp* have established where shallow water conditions occur and sufficient light is maintained – these areas are typically around angling platforms where canopy cover has been removed to facilitate casting of rods and line. This waterbody presents a valuable opportunity for the establishment of diverse shallow water, littoral habitats with rich assemblages of submerged and emergent vegetation which would provide habitat for a wide range of fish, invertebrate and birds/bats. Improvements could be made in strategic areas where gravel material (potentially from areas of deposition around inflowing watercourses or from other nearby sources – there is an excellent track network around most of the reservoir which would allow for transportation of materials with relative ease **Wet woodland restoration:** Along almost the entire shoreline of Knypersley Reservoir, ditches have been created which accelerate movement of water through the surrounding woodlands. It is unclear as to the purpose of these ditches, however it may have been implemented to drain the perimeter of the waterbody for the construction of the track/footpath network. These ditches reduce the latency of water within the woodlands and presents a significant opportunity for the re-wetting of woodlands and wetland areas through the blocking of drains and ditches. By recreating wet woodland habitats, water will be held in the catchment for longer, providing resilience during drought conditions and providing a buffer during heavy rainfall events in the form of natural flood management. Wetland habitats also sequester carbon which acts as an additional ecosystem service. **Wetland restoration:** During a site visit on the 15th May 2025, evidence of channel dredging and clearance was observed in the tributary watercourse named 'The Serpentine'. This channel maintenance appears to be designed to continue to drain the wetlands situated in the valley bottom. This valuable wetland habitat could be restored through the blocking of the drain/ditches which would

	'slow the flow' of water which would allow for resilience of the wetland during dry periods/droughts and would contribute to natural flood management in the catchment as higher flows are dissipated, increasing the residency time within the catchment. Re-wetting of the wetland would aid in expanding the wetland habitat to historic extents and providing a carbon sink through the sequestration of organic matter and carbon within the wetlands. Resilient wetlands also provide a buffer for storing water within the catchment which can help in maintaining adequate base-flows in the Trent catchment during prolonged dry periods. **Floating reedbeds/marginal habitat refuges: This** site offers an excellent opportunity to create additional floating habitats such as reedbeds and bird nesting islands. This technique has been used within the Canal and River Trust canal network and could be utilised to bolster this type of habitat at Knypersley Reservoir. **Restoration of Gawton's well:** This historical feature is in a dilapidated state with evidence of antisocial behaviour taking place nearby. There is an opportunity to restore this structure and improve its visitor appeal. This would have minimal benefit to biodiversity but would add to the cultural heritage of the site and compliment the other 'water' projects at the site. **Improvements to the weir on the 'Head of Trent':** This weir, commonly known as Knypersley waterfall (NGR: SJ 89970 55359) presents a barrier to migration and disrupts gravel movement and flows down the depleted reach of the watercourse. Whilst this section of the Head of Trent is disconnected from the lower catchment to migratory fish by the main dam on Knypersley Reservoir, improvements to this smaller weir could have positive impacts for resident fish and invertebrate species.
Constraints	This site has frequent visitors who use the network of footpaths and tracks. Any large scale works would likely interrupt this access. A feeder channel which diverts water to the upper Reservoir basin intercepts numerous ditches and smaller feeder streams. Details of discharge rates of this feeder should be examined to determine the impact this has on the water volume and refill rate of the upper Reservoir basin. Changes to the flows along this channel could impact the levels in the upper basin as flow would be partially diverted into the lower basin. Rewetting of woodland and slowing the flow in wetlands might cause overspill across footpaths making access more difficult during wet periods.
Date of Site Visit	15th May 2025
Priority Overview	High Priority
Estimated budget	Total cost = £200,000 Designs = £10,000 Capital works = £190,000

Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar

Year 1				Year 2				Year 3				Year 4				Year 5			
Q 1	Q 2	Q 3	Q 1	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4

Photographic record

Figure 12: Photograph taken at Knypersley Reservoir

Additional photos are available in the separate ‘Appendix 8 – Survey photos catalogue’.

Other information

Tongue Lane (North of)

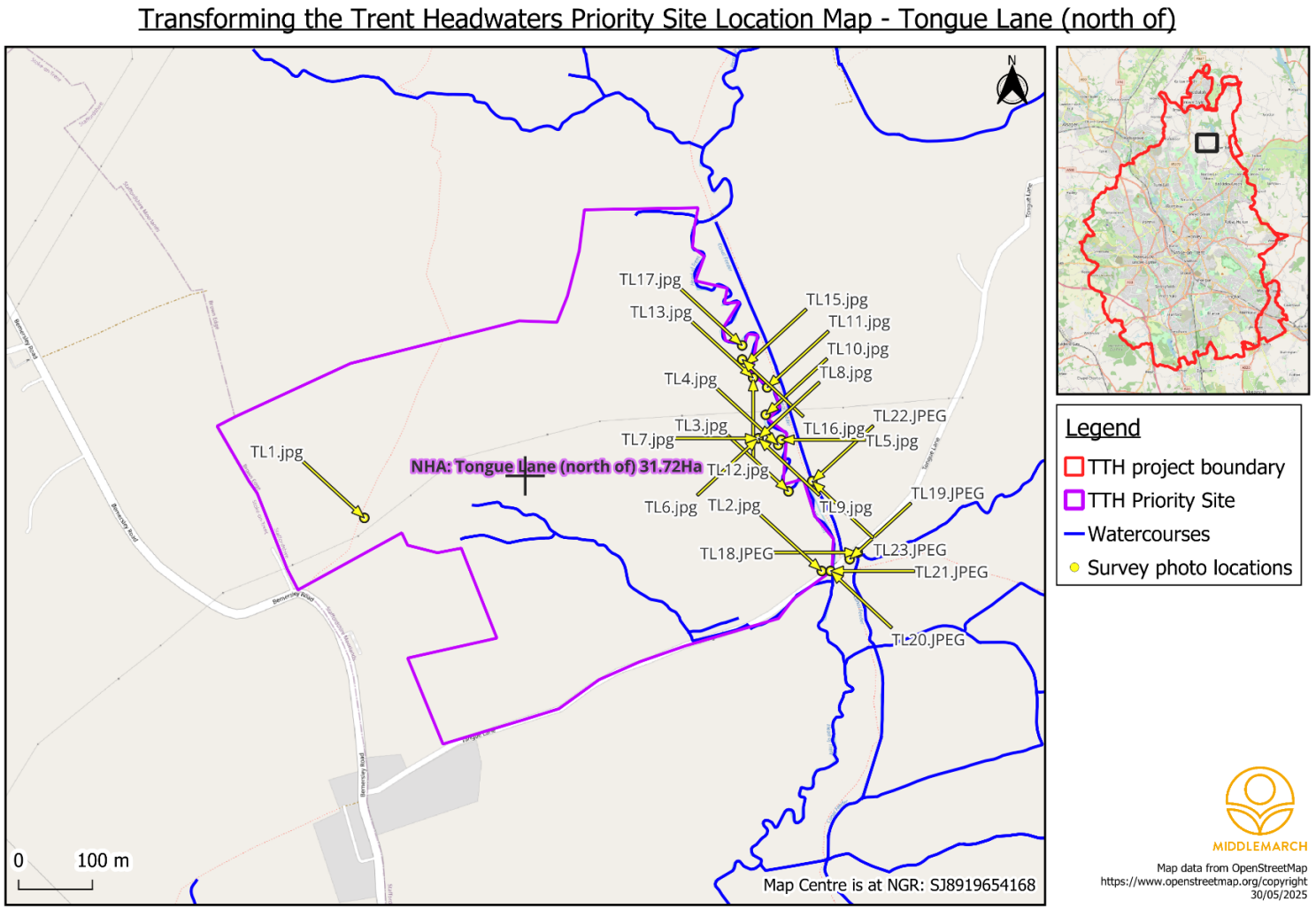


Figure 13. Map showing location and survey photos at Tongue Lane.

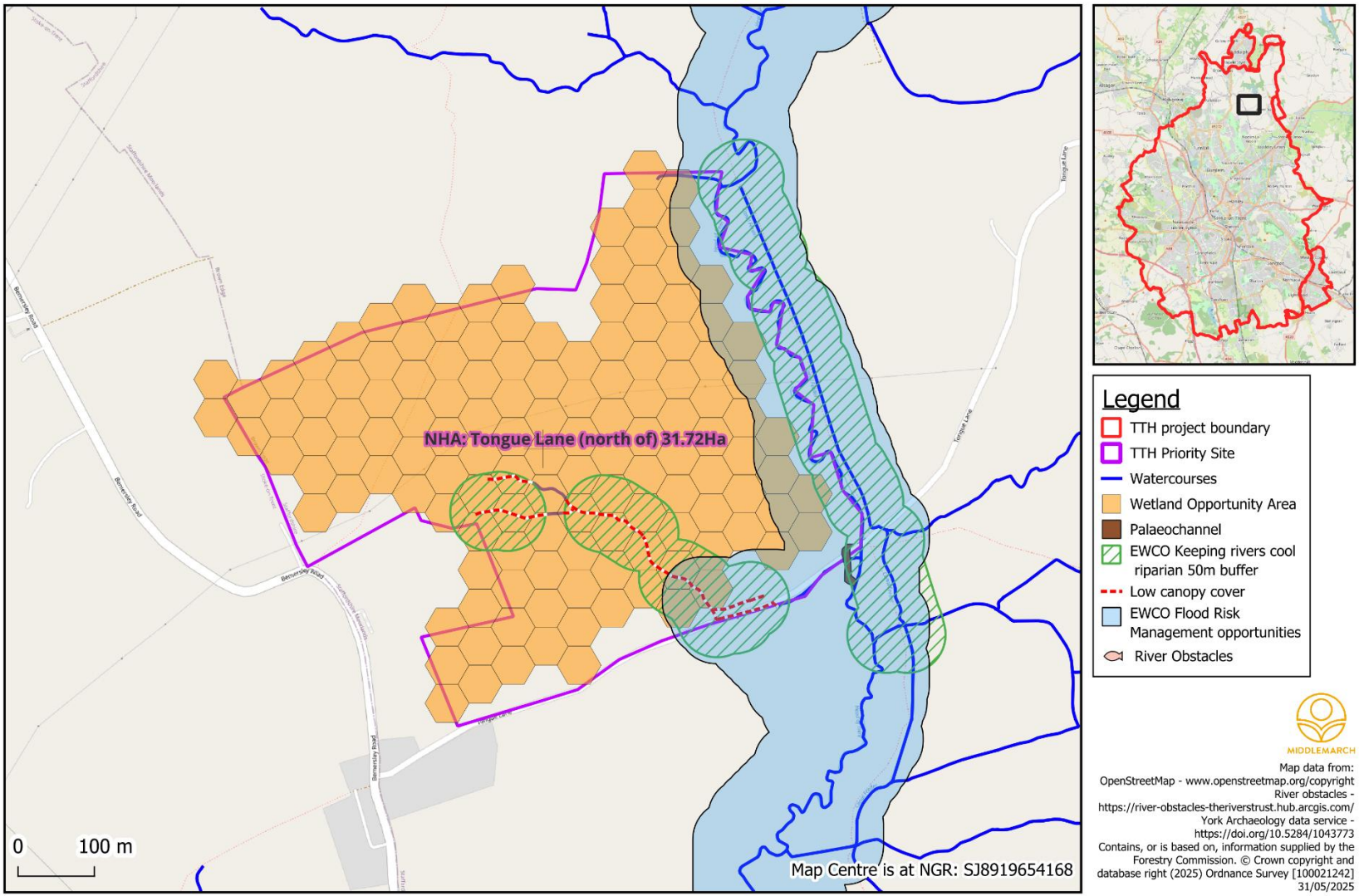


Figure 14. Map showing restoration opportunities at Tongue Lane.

Watercourse / water body catchment	Head of Trent
District	Staffordshire Moorlands
Grid Reference	SJ 89238 54167
Size	31.72Ha
Public Access	Yes – public footpath only
Site description	Tongue Lane (north of) This site is largely natural without many significant anthropogenic modifications. The watercourse is deep and incised in places due to inadequate gravel supply (due to the presence of the Knypersley Reservoir dams with acts as a substrate migration barrier). Low substrate supply has also negatively impacted on bed substrate formations with few gravel bars and a predominant armoured and large course substrate morphology. The channel has moderate to high canopy cover with few areas receiving substantial sunlight. Coarse woody debris is frequent along the reach within the Tongue Lane site and this adds a degree of beneficial habitat heterogeneity and in-channel structural complexity. The surrounding riparian strip consists of predominantly deciduous woodland and scrub vegetation. Large areas of the floodplain and riparian zone are densely colonised by Himalayan balsam.
Restoration measures	**Gravel seeding:** an opportunity exists at this site to supplement gravel and bed substrate by seeding the site with gravel obtained from a donor site. This restoration measure, whilst not being a permanent solution, would create beneficial gravel bars and improve spawning beds quickly, **Canopy reduction:** This reach of the Head of the Trent would benefit from increased light variation with a range of shaded, dappled and open sections to allow for different aquatic habitats to establish. The overly shaded reaches prevent any significant establishment of aquatic macrophytes and the creation of open reaches would allow for a potential re-establishment of this type of habitat. Strategic felling (or toppling) of larger trees would allow for the creation of open canopied areas whilst also creating important areas of habitat within the uprooted zones. Uprooted, full trees offer an excellent large woody debris material which is resilient to movement during high flow episodes. Root boles could be positioned to be submerged within the watercourse to offer habitat complexity and to provide submerged refuges for fish and invertebrates together with above water perches for birds and emergent invertebrate adults. **Tree planting:** The reach of Head of Trent within the Tongue Lane site is adequately (if not too highly) canopied; however, the Canal feeder is not canopied for the majority of its length and would benefit from shading to reduce water temperatures in low flow

<table>
<tr><td></td><td>and high temperature periods. This man-made channel has poor morphology but still supports aquatic wildlife and reducing summer water temperatures would also benefit aquatic habitats and species in the Canal network, which this water supplies.
Tree planting for flood mitigation: Areas with the Tongue Lane site have been identified as potential flood risk management opportunities. Planting in these areas will not only provide woodland habitat but will contribute towards ‘slowing the flow’ through the provision of natural flood management, reducing flood risk downstream and reducing scour on watercourses during heavy rainfall events.
Macrophyte reintroduction/reestablishment: Similar to other sites across the Trent Headwaters catchment, in-channel aquatic macrophytes are scarce. This is presumably due to limited availability of suitable areas of bed substrate (see above). The absence of significant gravel movement and deposition is likely to be limited the colonisation and spread of macrophytes that are dependent on coarse and finer grave accumulations e.g Ranunculus spp. In conjunction with gravel seeding, a reintroduction programme would create a diverse habitat within this stretch of the river in a short space of time. Donor sites within the wider catchment could be used together with volunteers for donor material collection and propagation.
Small scale wetland restoration: At this site, there a number of small drainage ditches which appear to be preventing the establishment of wetland habitats. Simple ditch blocking exercises could allow for these pathways to be intercepted and water held on the site for longer in the form of wet flush areas/wetland habitats.
Invasive Non Native Species control: INNS are a catchment wide issue and require a coordinated approach to controlling their spread. This site’s position in the upper catchment places it as a priority for INNS control. A strategic eradication at this site could be achieved through ongoing volunteer efforts or through novel techniques such as intensive grazing of the riparian strip by goats.</td></tr>
<tr><td>Constraints</td><td>None</td></tr>
<tr><td>Date of Site Visit</td><td>15th May 2025</td></tr>
<tr><td>Priority Overview</td><td>High Priority – This site has landowner buy-in and restoration works are theoretically able to start very quickly.</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £20,000
Designs = £500
Capital works = £19,500</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 15: Photograph taken at Tongue Lane (North of)* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'. **Error! Reference source not found.**
Other information	

Lyme Brook at Lyme Valley Parkway

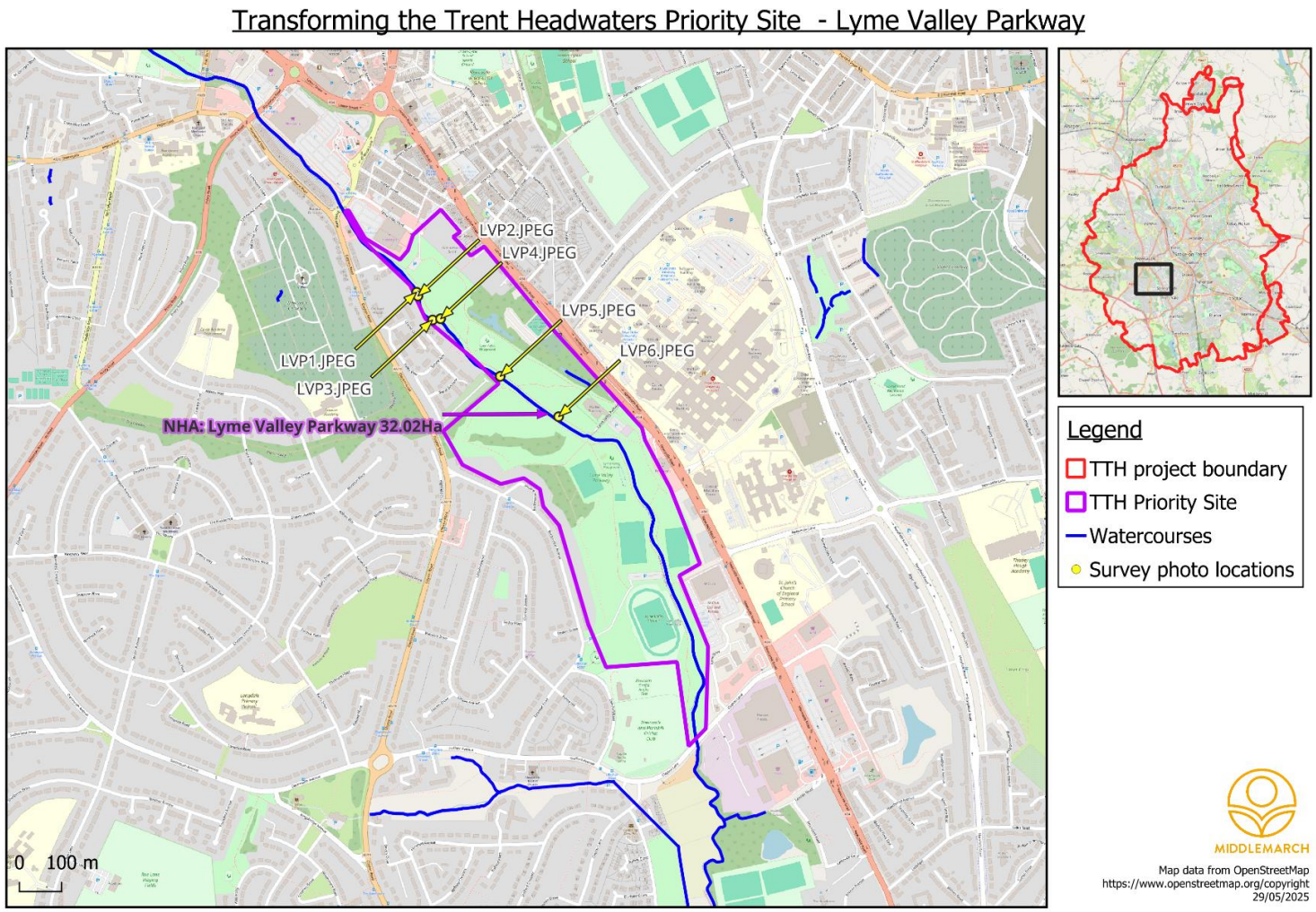

Figure 16. Map showing location and survey photos at Lyme Valley Parkway.

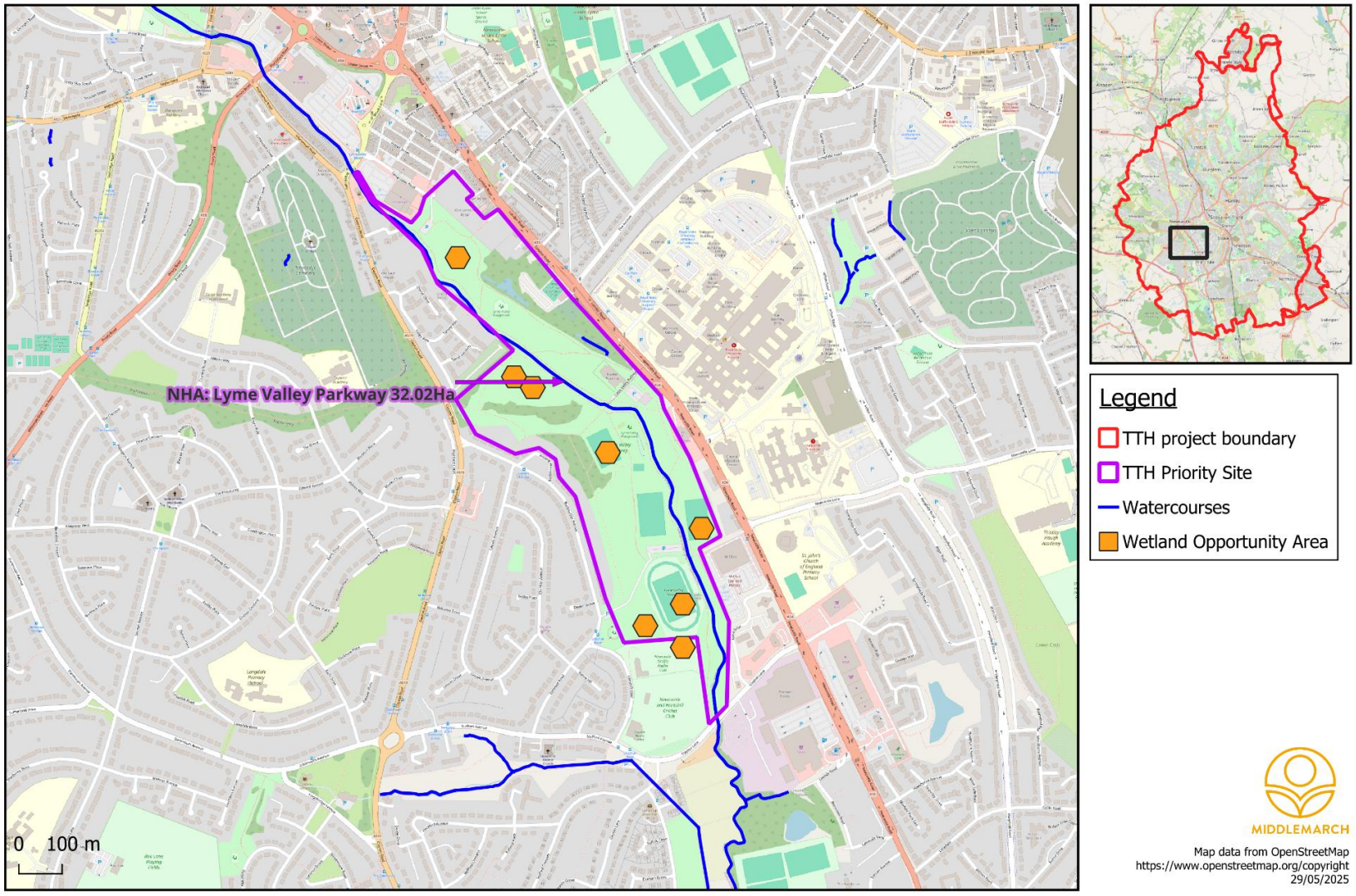

Figure 17. Map showing restoration opportunities at Lyme Valley Parkway.

Watercourse / water body catchment	Lyme Brook at Lyme Valley Parkway
District	Newcastle under Lyme
Grid Reference	SJ 8534 4505
Size	32.02Ha
Public Access	Yes
Site description	Site owner: Newcastle under Lyme Borough Council Lyme Valley Parkway is an area of amenity grassland, deciduous woodland and watercourses. The site is publicly accessible and houses carparking areas, playgrounds, sportsgrounds, parkland, wildlife areas and allotments. Lyme Brook flows through the site for a distance of approx. 1450m where is occupies a straightened and deepened channel comprising reinforced banks with toe protection A footpath follows the course of Lyme Brook and in one location is situated at the top of a steep bank and is subsequently being undermined by bank erosion. During the site visit, the watercourse was briefly inspected to assess its condition and it was determined that despite historic intervention where flow defectors had been installed to create flow complexity and to encourage variation in gravel and river bed substrate deposition, the reach of Lyme Brook at this site still exhibits poor geomorphology. The straightened channel still remains, which during high flow episodes strips the reach of bed substrate due to faster flow rates associated with straightened watercourses like this. Toe protection still remains along the majority of the reach and is a very effective modification for eliminating hydrological processes e.g. erosion, meandering which is contributing towards the lack of finer river bed substrate. Bed composition is lacking gravel and finer substrates due to poor supply from upstream and minimal hydro-geomorphological processes taking place within the reach itself. The bed exhibits natural armouring in places where larger stone substrate has aligned and compacted to form a resilient bed which is poor quality habitat for aquatic invertebrates and fish. There was little submerged, floating or emergent aquatic vegetation visible within the channel and this also negatively impacts on the habitat value of the river. Within the site is an old section of canal which is now a densely canopied and overgrown area of wetland and still water. This area presents an opportunity for habitat improvements and potential access for educational purposes.
Restoration measures	**River channel re-naturalisation** - Opportunities exist at this site for the removal of river bank and toe protection which have been historically installed to limit bank erosion and hydro-geomorphological processes. These measures are relatively simple in nature but would require extensive work along the majority of the length of the watercourse at

	this site. Boulders that form the tow protection are of a suitable size for removal by hand and could be achieved using volunteers. These works will help to restore natural hydro-geomorphological processes and will encourage erosion of the banks, creating a localised supply of gravel to aid in restoring natural river bed morphology, thus benefitting aquatic invertebrates and fish that utilise this habitat. Installation of flow deflectors on the true left bank (facing downstream) would also aid in creating additional erosion of the right bank, providing additional gravel subsidies during higher flows. Flow deflectors in the form of tree root boles provide an excellent, long lasting structure to deflect flows and also provide habitat complexity of aquatic species and also perches for feeding pisciverous birds. Materials would need to be sourced from off site and coniferous windblown root boles are a common occurrence from clear felled forests – the roots are a byproduct and serve no purpose in forestry timber extraction/processing. Root boles will require the use of machinery to embed them into the true left bank and access along this bank is generally good. Once removed, bank protection stone could be dispersed within the river channel to provide additional habitat complexity and to aid in accumulation of gravels through deposition within boulder clusters and in back-water areas. Additional larger boulders could be imported into the site to bolster the in-river habitat and flow complexity. This section is of low gradient and materials such as root boles and large boulders should not pose any significant risk of mobilisation and movement in higher flows. **Aquatic macrophyte vegetation –** This area lends itself very well for reintroduction of aquatic macrophytes e.g. *Ranunculus fluitans* and other trailing species which provide refuge for aquatic fauna and create eddy currents and back-water areas allowing the deposition of gravel and bed sediment. This technique could involve utilising local donor sites and volunteers for re-planting. **Riparian canopy -** Very densely canopied areas could be managed to allow dappled shade to the river channel which will increase light levels and increase plant productivity, providing additional in-river habitat complexity in the form of trailing and emergent plants which will provide refuge and foraging habitat for fish and invertebrates. **Gravel seeding –** It was noted during the site visit and through conversations with local experts from the Wild Trout Trust that gravel supply along Lyme Brook has been severely limited due to large scale channel modifications upstream of the site. Culverting and bank revetment has eliminated natural deposition of gravel into the watercourse which has negatively affected the habitat value for aquatic species that reply on gravel e.g spawning fish, invertebrates and aquatic macrophytes that anchor within finer and course gravels. Whilst it not being a permanent solution, gravel seeding at the upstream regions of the reach would rapidly improve river gravel habitats allowing for natural ‘top-up’ following the removal of toe/bank protection and the installation of

	root bole flow deflectors. Gravel supply from the proposed restoration measures will be a gradual process and could take several years (and several higher flow episodes) to generate a measurable increases in gravels. This seeding technique would give the process and jump start and provide a much quicker improvement through assisted natural recovery.

Figure 18. Photograph showing installation of Larch root bole flow deflectors.

Figure 19. Photograph showing installation of Larch root bole flow deflectors.

Figure 20. Photograph showing installation of Larch root bole flow deflectors.

<table>
<tr><td>Constraints</td><td>A footpath runs close to Lyme Brook along its true left bank (facing downstream). This path has experienced subsidence in recent months and is closed in sections for repair or relocation.
The presence of this footpath is a constraint for river works such that erosion should be minimised on the true left bank and maximised on the true right bank. By installing flow deflectors on the left bank, protection is offered to preserve the footpath whilst the right bank provides a low risk opportunity to encourage natural erosion and material input into the watercourse.
The footpath offers an excellent, wheelchair friendly, access route along the length of Lyme Brook and interpretation installations can be produced to showcase the works and its aims whilst providing a route for visitors to easily see the restoration works.
Whilst the footpath is currently experiencing undermining from natural river processes, it would be proposed that the river and its riparian strip are accommodated in future management, with a buffer strip provided to allow the river to function more naturally, rather than being further constrained by large scale bank protection, purely aimed at protecting a footpath that would benefit from being set-back from the river. This approach would eliminate the cost to protect the river bank, eliminate the environmental impact of in-river works constructing bank protection and would also minimise the long-term impact on the river by no longer requiring in-river structures that prevent natural processes.</td></tr>
<tr><td>Date of Site Visit</td><td>15th April 2025</td></tr>
<tr><td>Priority Overview</td><td>High Priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £40,000
Designs = £3,000
Capital works = £37,000</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 21: Photograph taken at Lyme Brook – Lyme Valley Parkway.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Holden Lane Pools

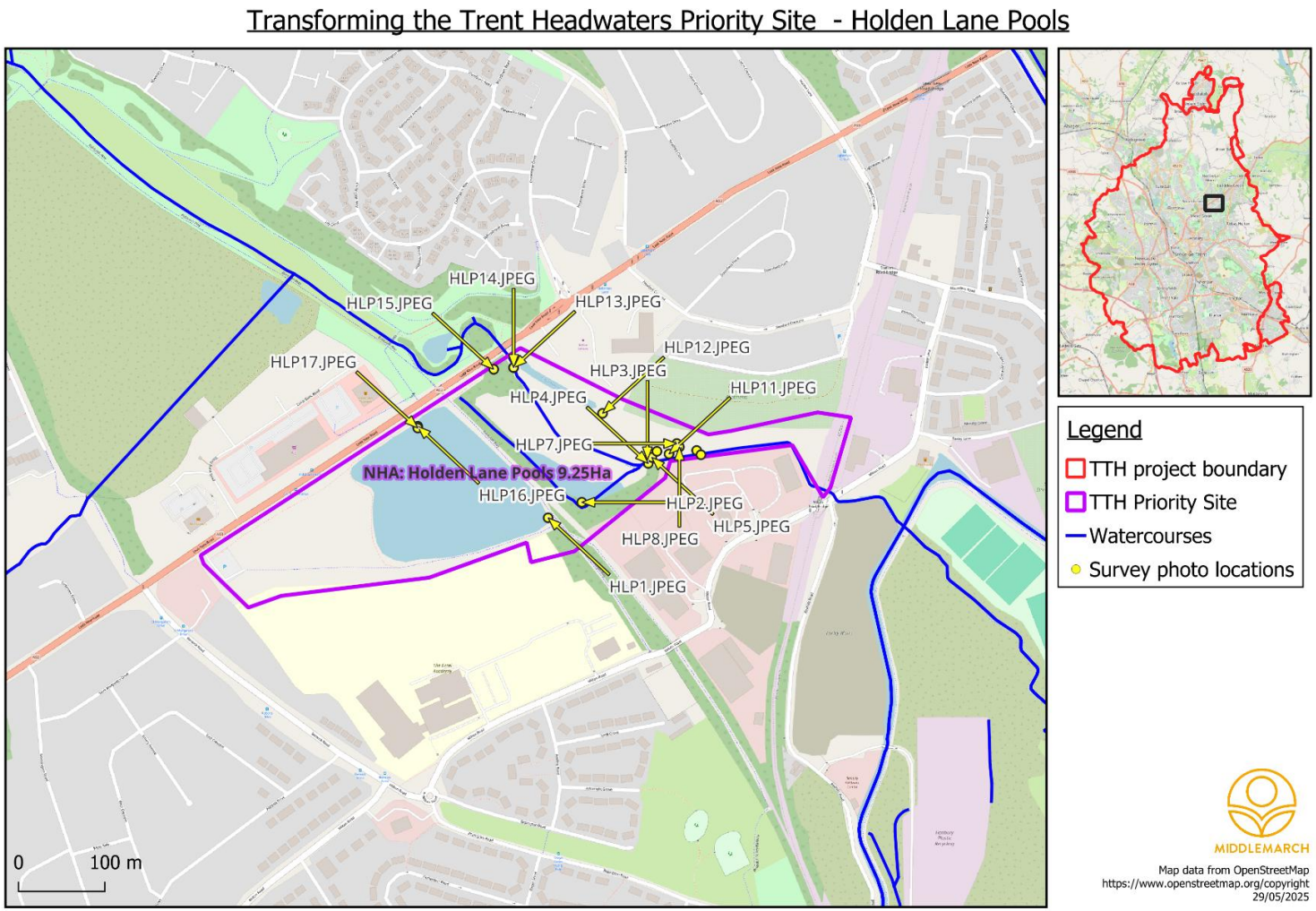

Figure 22. Map showing location and survey photos at Holden Lane Pools.

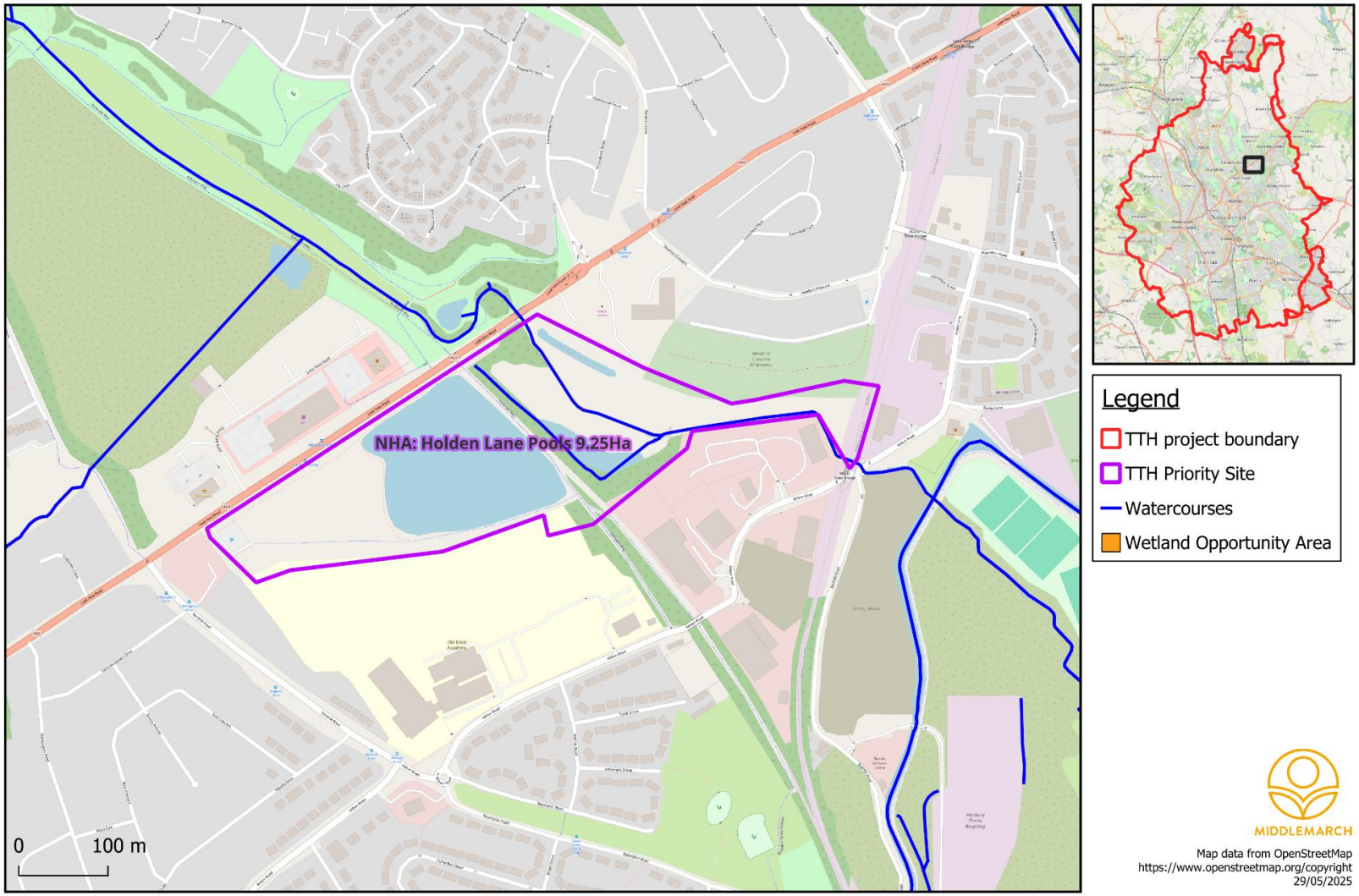

Figure 23. Map showing restoration opportunities at Holden Lane Pools.

Watercourse / water body catchment	Ford Green Brook
District	Stoke on Trent
Grid Reference	SJ 89483 50119
Size	9.25Ha
Public Access	Publicly accessible – the site has a network of formal footpaths and desire lines. The 'pool' waterbody is accessible to anglers with angling platforms provided. There is a car park and access to southern region of the site along a gravel track.
Site description	Holden Lane Pools Nature Reserve – this area of woodland and man-made ponds lies next to Ford Green Brook. The site is used as amenity land and accessed by walkers, dog walkers, anglers and cyclists. The lower (eastern) part of the site supports some wet woodland and wetland habitats, however, drainage has resulted in the drying out of these areas.
Restoration measures	**Wet woodland restoration:** Modification of the drainage network at this site would allow for the re-naturalisation of wet woodland and wetland habitats. Through the blocking of ditches, water would be allowed to spill onto existing woodland habitats, creating valuable wetland habitat. This relatively simple intervention would provide a valuable benefit to the sites biodiversity. **Establishment of marginal habitat along shoreline of pool:** The shoreline of the main pool support very little aquatic emergent or submerged vegetation. Restoration works at this site could deliver significant improvements to this waterbody and provide beneficial habitat for fish, invertebrates and birds/bats. Strategic works to modify the shoreline of the pool (away from angling platforms) to establish shallower areas would allow for vegetation to colonise. **Tree planting and in-river improvements on Ford Green Brook:** at the downstream region of this site, Ford Green Brook flows through a straightened channel which is maintained with low levels of riparian vegetation. This short section of watercourse could be improved through the installation of boulders, LWD and additional gravel seeding. Tree planting along the banks would offer shading during hot weather and would assist in keeping the river cool. **Floating habitat islands:** The sheltered location of Holden Lane Pools offers an opportunity to install floating reedbed habitats which will be beneficial for nesting birds and will offer habitat/refuge for fish.
Constraints	Rewetting of the eastern region of the site may impact on the footpaths in this area. Remedial work may be necessary as part of any rewetting to raise or adapt the footpaths to allow for continued public access.
Date of Site Visit	28th Feb 2025

<table>
<tr><td>Priority Overview</td><td>Medium Priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £30,000
Designs = £1000
Capital works = £29,000</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
<table>
<tr><td colspan="4">Year 1</td><td colspan="4">Year 2</td><td colspan="4">Year 3</td><td colspan="4">Year 4</td><td colspan="4">Year 5</td></tr>
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<tr><td>Photographic Record</td><td></td></tr>
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	 *Figure 24. Photograph taken at Holden Lane Pools.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Cromer Road

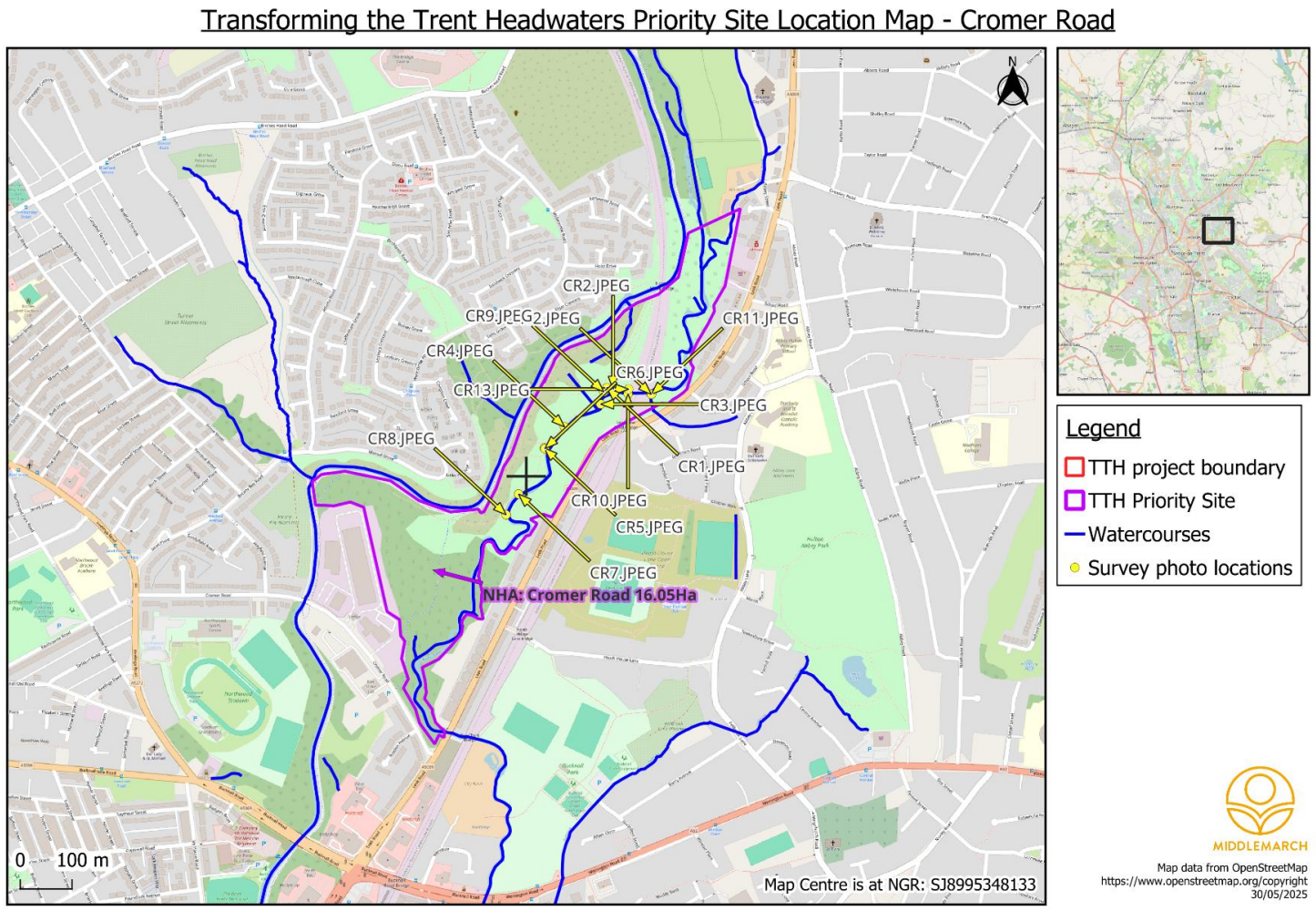

Figure 25. Map showing location and survey photos at Cromer Road.

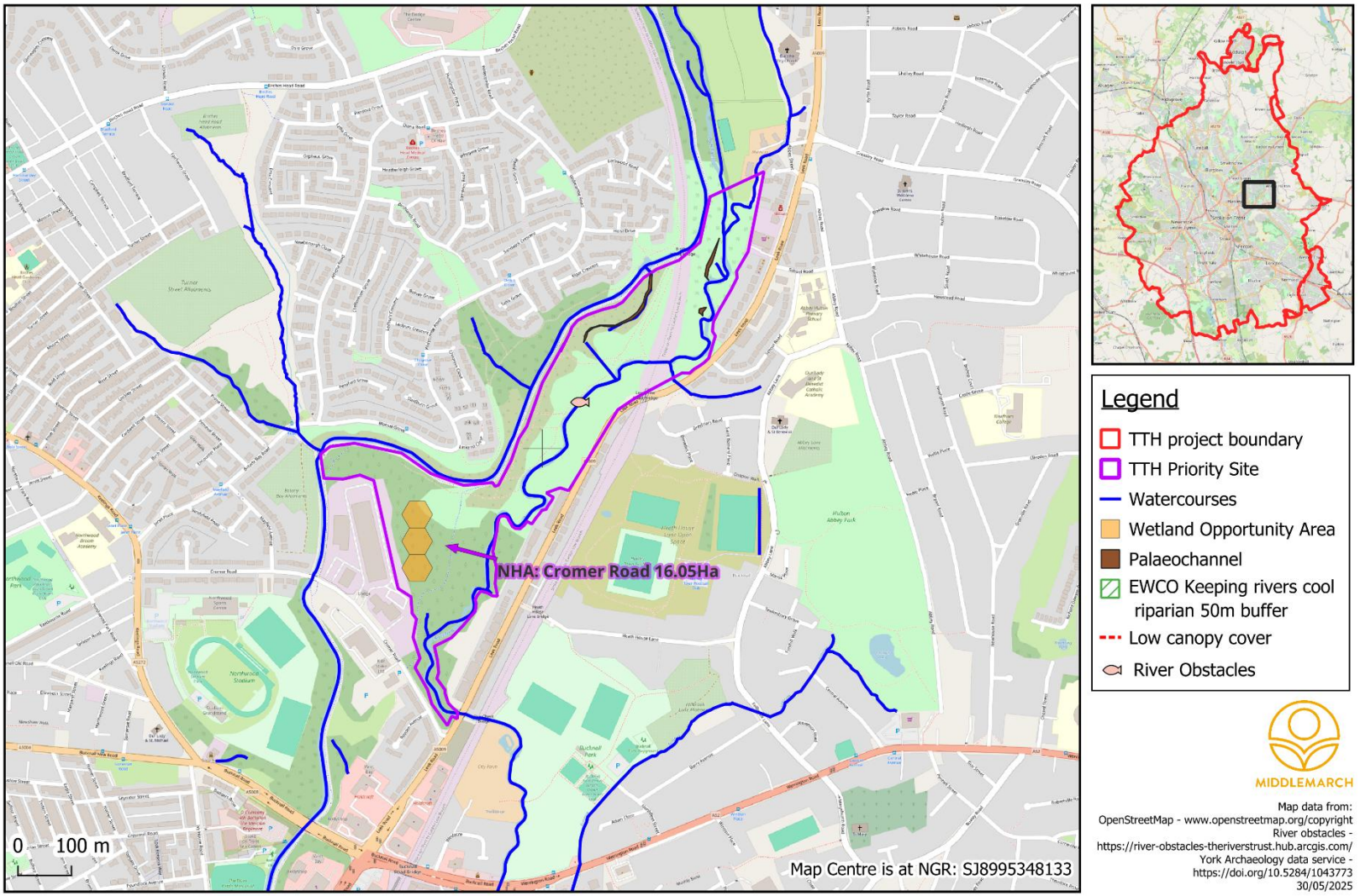

Figure 26. Map showing restoration opportunities at Cromer Road.

Watercourse / water body catchment	River Trent
District	Stoke on Trent
Grid Reference	SJ 90012 48231
Size	16.05Ha
Public Access	Yes – a network of footpaths and desire lines follow the river on the true right bank.
Site description	The Trent at the Cromer Road site has received restorative works in the past where a straightened section of the river has been re-meandered and a redundant concrete weir has been removed. The River Trent at this site is bordered by deciduous woodland to the east and floodplain meadows/swamp areas to the west. This reach does not support substantial gravel deposits and is lacking in gravel beds and gravel riffle habitats. Large portions of the bed are accreted with silt and dominated with larger bed substrate fractions resulting in poor spawning habitat and invertebrate habitat. The channel has begun to migrate and meander following the removal of historic revetment and weir structures, however these processes could be accelerated and additional improvements made through the incorporation of supplementary in-channel features such as large woody debris, boulders and gravel additions. The right bank floodplain is heavily dominated by Himalayan balsam which causes excessive erosion in a number of places and leaves the bank-top devoid of vegetation during the winter months. This floodplain area has a network of shallow drains which have been created to reclaim the area for grazing. An outfall of unknown origin was observed during the site visit which was discharging effluent rich in organic matter and strands/clumps of sewage fungus.
Restoration measures	**In-river improvements:** Straightened sections within the channel still remain and would benefit from increased in-channel structural complexity in the form of large boulders and large woody debris structures. By incorporating larger substrate materials like this, hydro-geomorphological processes including erosion, deposition and bed aggradation will occur, creating a more diverse bed morphology with a more diverse range of habitats. Altered flow rates and routes will assist in cleaning gravels and mobilising silt from this reach, creating a habitat more suitable for spawning fish. **Control of INNS:** Himalayan balsam is present along considerable lengths of the banks at Cromer Lane and a control/eradication programme should be established to compliment the other restoration interventions. A catchment wide INNS control programme would be very beneficial, however, localised control and eradication is also beneficial and can help to protect habitats from excessive silt inputs when INNS die back in the winter months.

<table>
<tr><td></td><td>Floodplain wetland/wet woodland creation: The right bank at Cromer Lane extends from between 50m and 100m until it reaches the footings of the embankment of the Caldon Canal. This floodplain area is well suited for the establishment of wet woodland, wetland and swamp habitats and through the simple action of blocking drains, water could be held within this habitat which will not only improve the water dependent habitats for biodiversity but will add to carbon sequestration.</td></tr>
<tr><td>Constraints</td><td>A pipe, which is believed to be a Severn Trent Water owned sewer pipe spans the watercourse at NGR SJ 89919 48055 – installation of LWD should take into account this structure.</td></tr>
<tr><td>Date of Site Visit</td><td></td></tr>
<tr><td>Priority Overview</td><td>Medium</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £20,000
Designs = £1,000
Capital works = £19,000</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
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Photographic Record	 *Figure 27: Photograph taken at Cromer Road.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Bradeley Fields

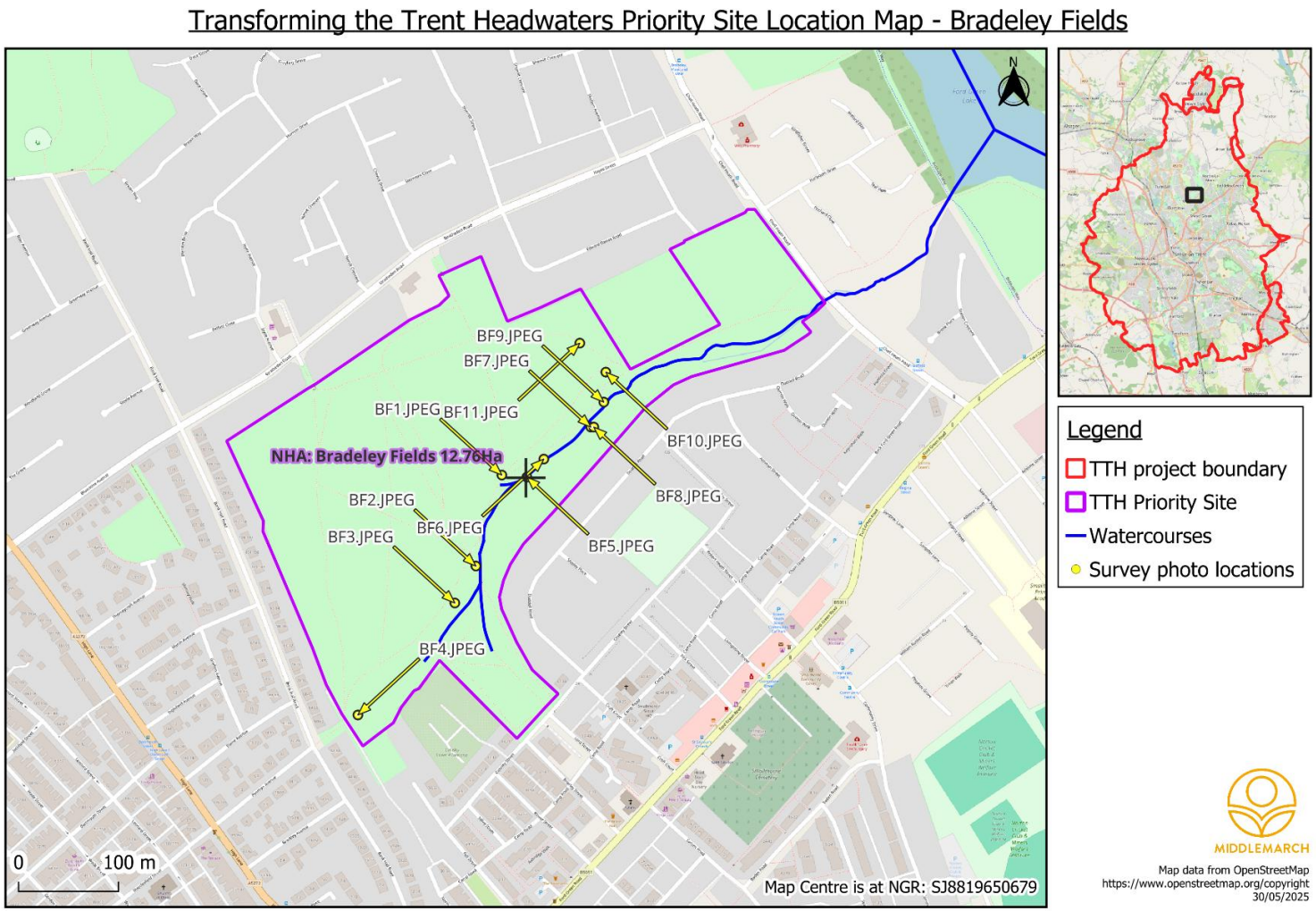

Figure 28. Map showing location and survey photos at Bradeley Fields.

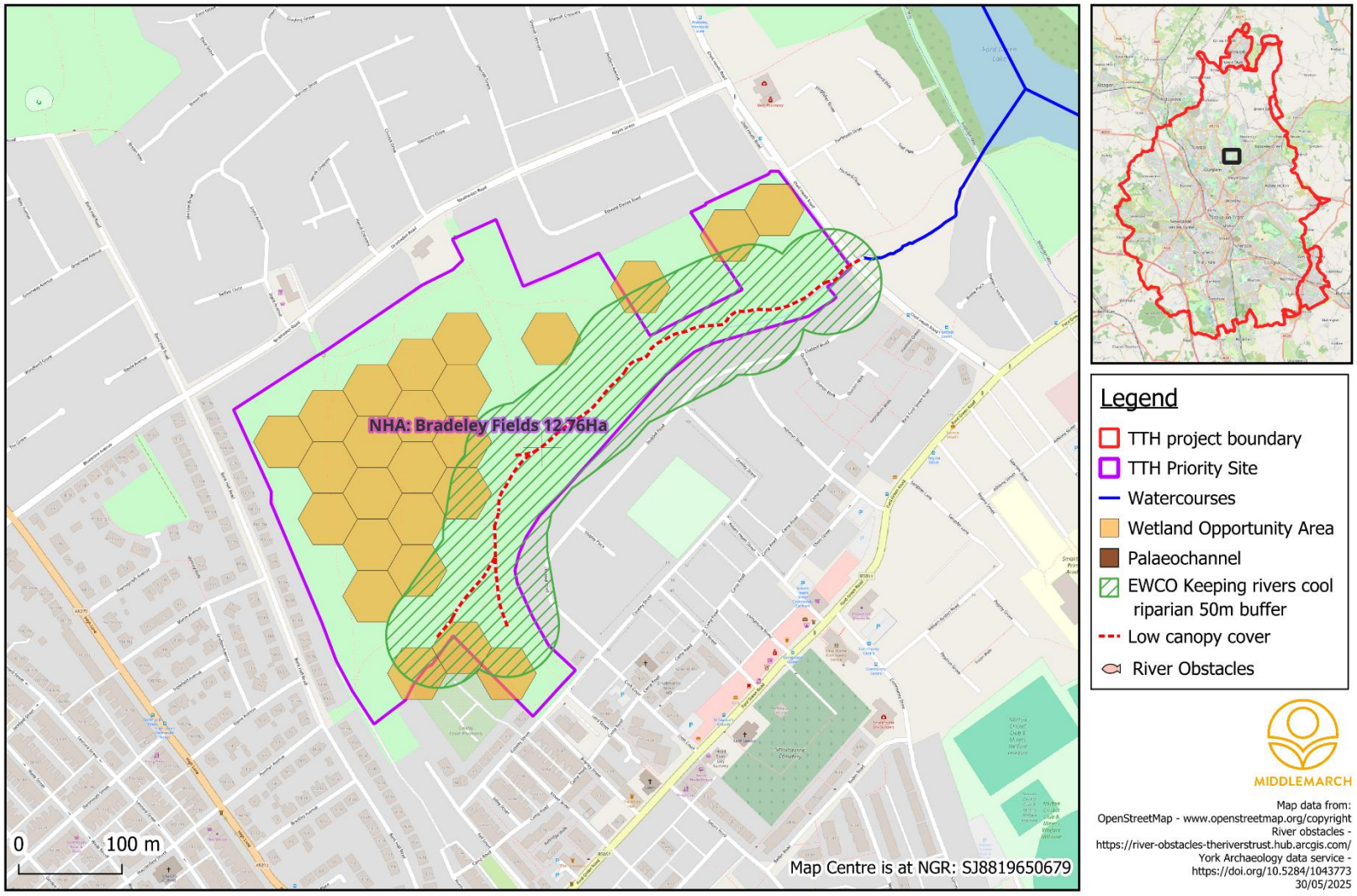

Figure 29. Map showing restoration opportunities at Bradeley Fields.

Watercourse / water body catchment	Tributary of the Trent – Old Colliery Brook
District	Stoke on Trent
Grid Reference	SJ 88144 50675
Size	12.76Ha
Public Access	Yes – Public footpath, playing fields, open access grassland with desire lines.
Site description	Bradeley Fields is an area of open access amenity grassland with playing fields and a network of footpaths and desire lines. The site is used by walkers, dog walkers and for sports. There is a culverted watercourse running for approximately 350m where it opens to a settlement reedbed pool. This watercourse is monitored by the Environment Agency (https://environment.data.gov.uk/catchment-planning/MonitoringSite/271224) and the Mining Remediation Authority.
Restoration measures	The site at Bradeley Fields has been identified as suitable for wetland creation: there are wet flush areas within the grassland site which could be altered to hold more water or modified into scrapes or ponds. The culverted watercourse could be 'daylighted' to create an open channel and associated wetland habitats with riparian strips and wet woodland areas.
Constraints	**OLD COLLIERY BK - D/S OF CULVERT Monitoring Site** Get monitoring site data Download data (CSV) **Site level classification and monitoring data** Time period: Cycle 3 Classification Item / 2019 Cadmium and Its Compounds: Good Copper: High Iron: Moderate Lead and Its Compounds: Good Manganese: Moderate Nickel and Its Compounds: Good Zinc: High The watercourse comprises outflows from a disused colliery and may have elevated concentrations of pollutants. Preliminary observations of EA monitoring data indicates that all measured determinands reach above moderate, however further research is advised to ascertain whether the water quality is suitable for habitat creation.
Date of Site Visit	26th March 2025

<table>
<tr><td>Priority Overview</td><td>Medium</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £20,000
Designs = £1,000
Capital works = £19,000</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 30: Photograph taken at Bradeley Fields* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Chatterley Whitfield Heritage Country Park

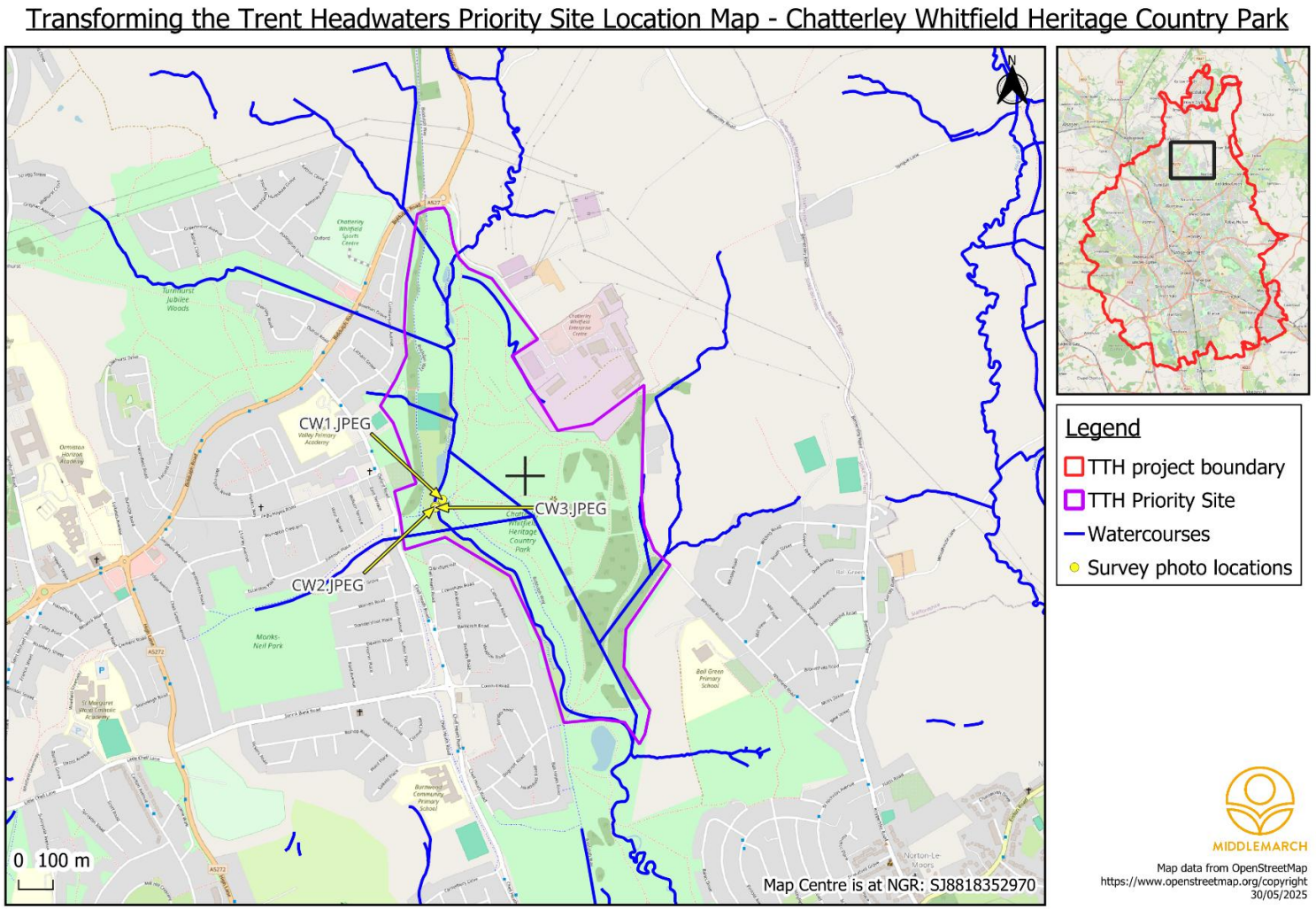

Figure 31. Map showing location and survey photos at Chatterley Whitfield Heritage Country Park.

Transforming the Trent Headwaters - Priority Site opportunties - Chatterley Whitfield Heritage Country Park

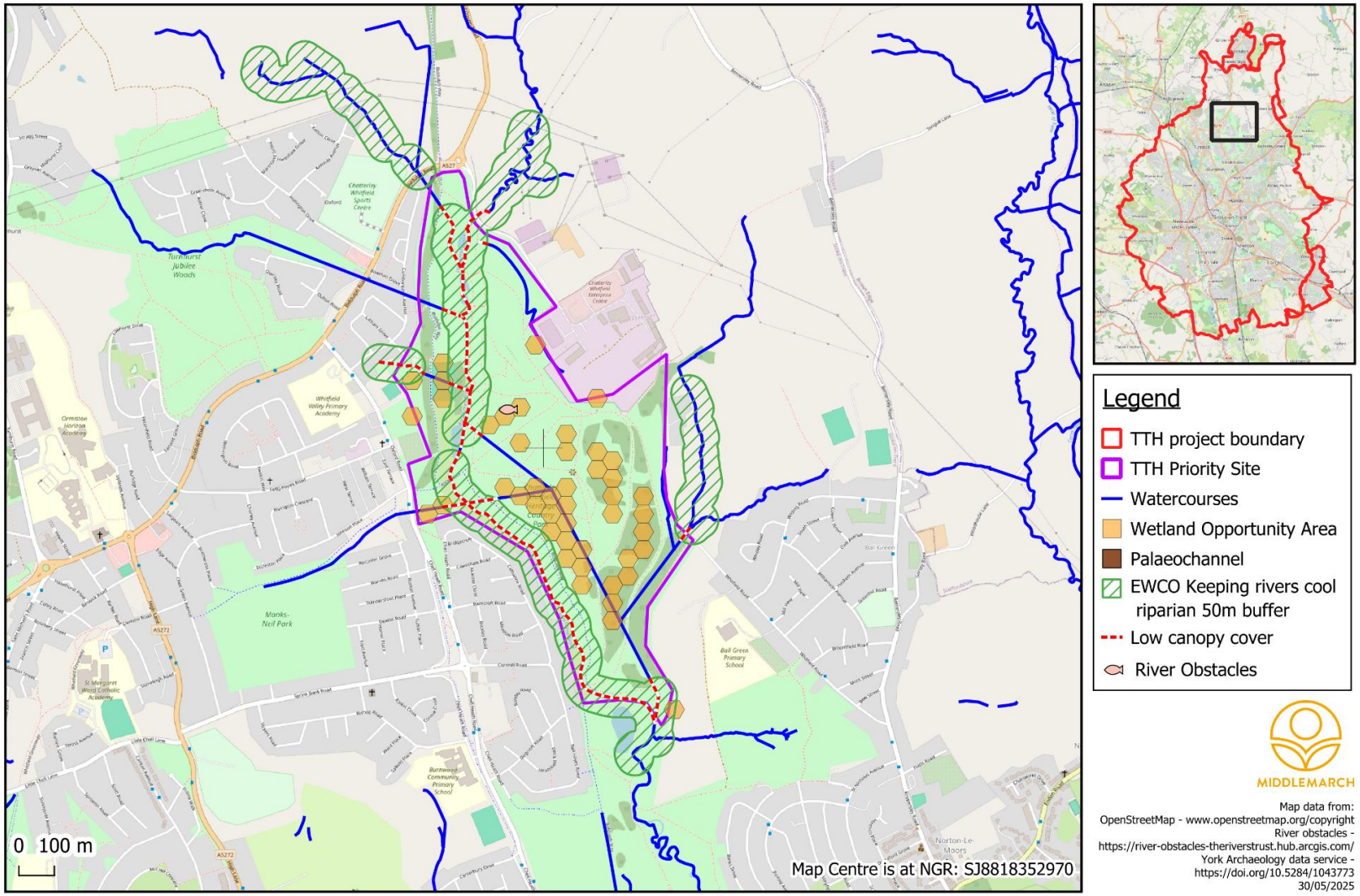

Figure 32. Map showing restoration opportunities at Chatterley Whitfield Heritage Country Park.

Watercourse / water body catchment	Ford Green Brook
District	Stoke on Trent
Grid Reference	SJ 88243 52874
Size	60.19Ha
Public Access	Yes – this site has an extensive network of footpaths, tracks and desire lines. The site hosts the Chatterley Whitfield Colliery Heritage Centre with carparks.
Site description	A heritage country park created on the derelict Chatterley Whitfield colliery site. The 60 hectare site has been restored from mine spoils to an open access Country Park , including restoring Ford Green Brook into an open stream and other landscaping works to create wildlife habitats including woodland, grassland, heath and wetland areas.
Restoration measures	**The following proposed restoration measures are aimed at complimenting the existing and ongoing restoration measures of the Trent ReNEW project.** **Tree planting:** almost the entire length of Ford Green Brook at this site has been identified as a priority for riparian tree planting for 'keeping river cool'. Tree planting and riparian buffer strip creation would benefit this watercourse by providing shade during hit, dry weather and would provide additional supplies of organic matter in the form of leaf litter and coarse/small woody debris that contributes to habitat complexity within the channel. **In-river habitat complexity:** as this watercourse is still adapting following previous restoration, large woody debris and large in-river features are uncommon. Provision of large woody structures (imported from nearby donor sites) would aid in establishing more complex morphological features within the channel and would create variation in bed substrate deposition and erosion, creating habitats such as riffles, glides and pools. Gravel accumulation around large structures and in eddy currents would also add to the habitat value of the watercourse. **Wetland creation:** large portions of this site have been identified in wetland opportunity mapping exercises to be suitable for wetland creation. Dependent on ground conditions within the remediation areas of this site, wetland habitat could be created through the construction of impounding bunds or scrapes. Wetland habitat would contribute to a more diverse mosaic of habitat within this site and would benefit aquatic flora and fauna species, together with birds and bats that forage within these areas.

<table>
<tr><td></td><td>Wetland creation would also provide natural flood management benefits and would help in providing resilience to the catchment by holding water within upper reaches to maintain healthy base flows during periods of drought.</td></tr>
<tr><td>Constraints</td><td></td></tr>
<tr><td>Date of Site Visit</td><td>27th Feb 2025</td></tr>
<tr><td>Priority Overview</td><td>Medium priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £20,000
Designs = £1,000
Capital works = £19,000</td></tr>
<tr><td>Delivery Timeline
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Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 33: Photograph taken at Chatterley Whitfield Heritage Country Park.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Whitfield Valley LNR (Ford Green)

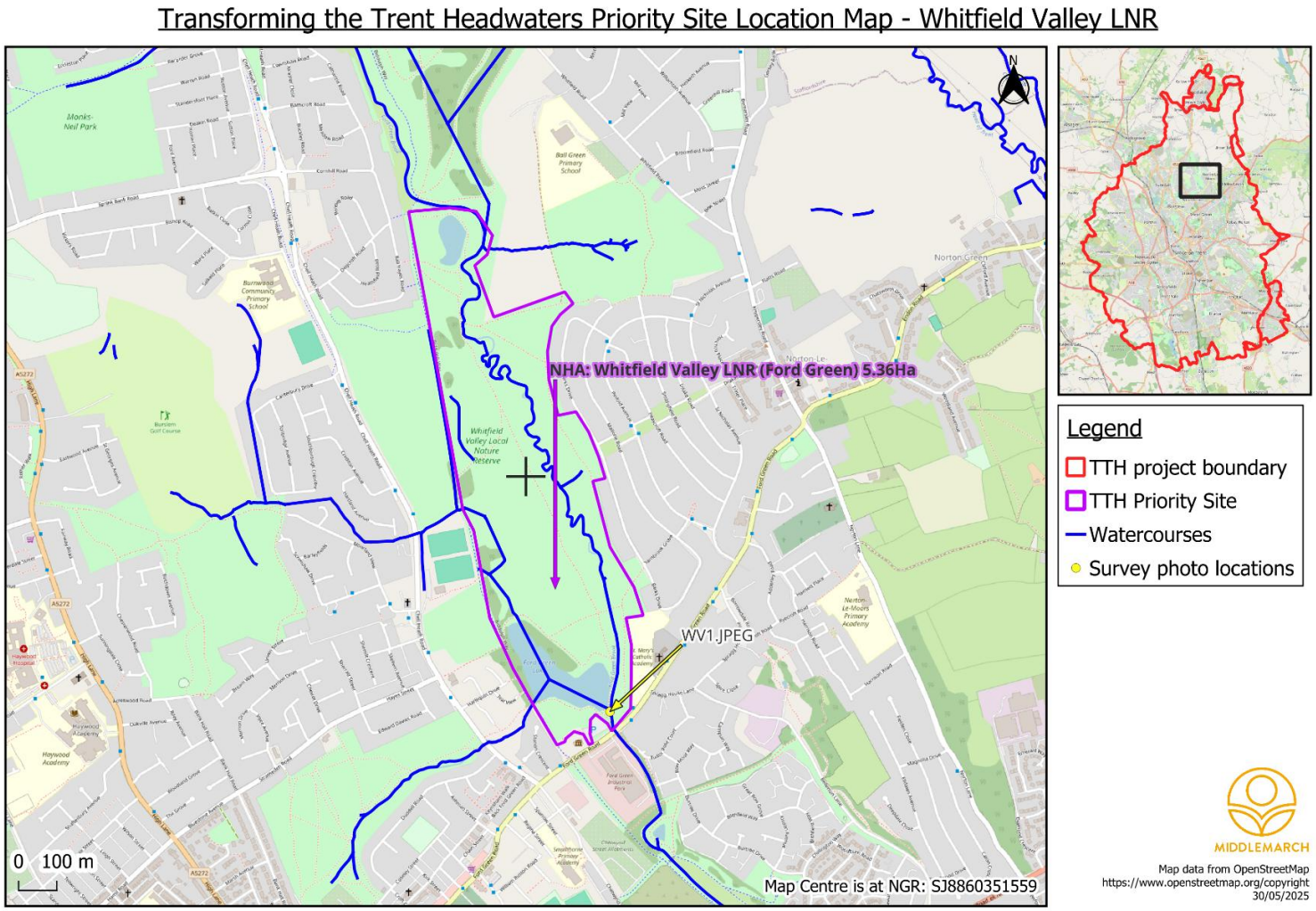

Figure 34. Map showing location and survey photos at Whitfield Valley LNR.

Transforming the Trent Headwaters - Priority Site opportunties - Whitfield Valley LNR

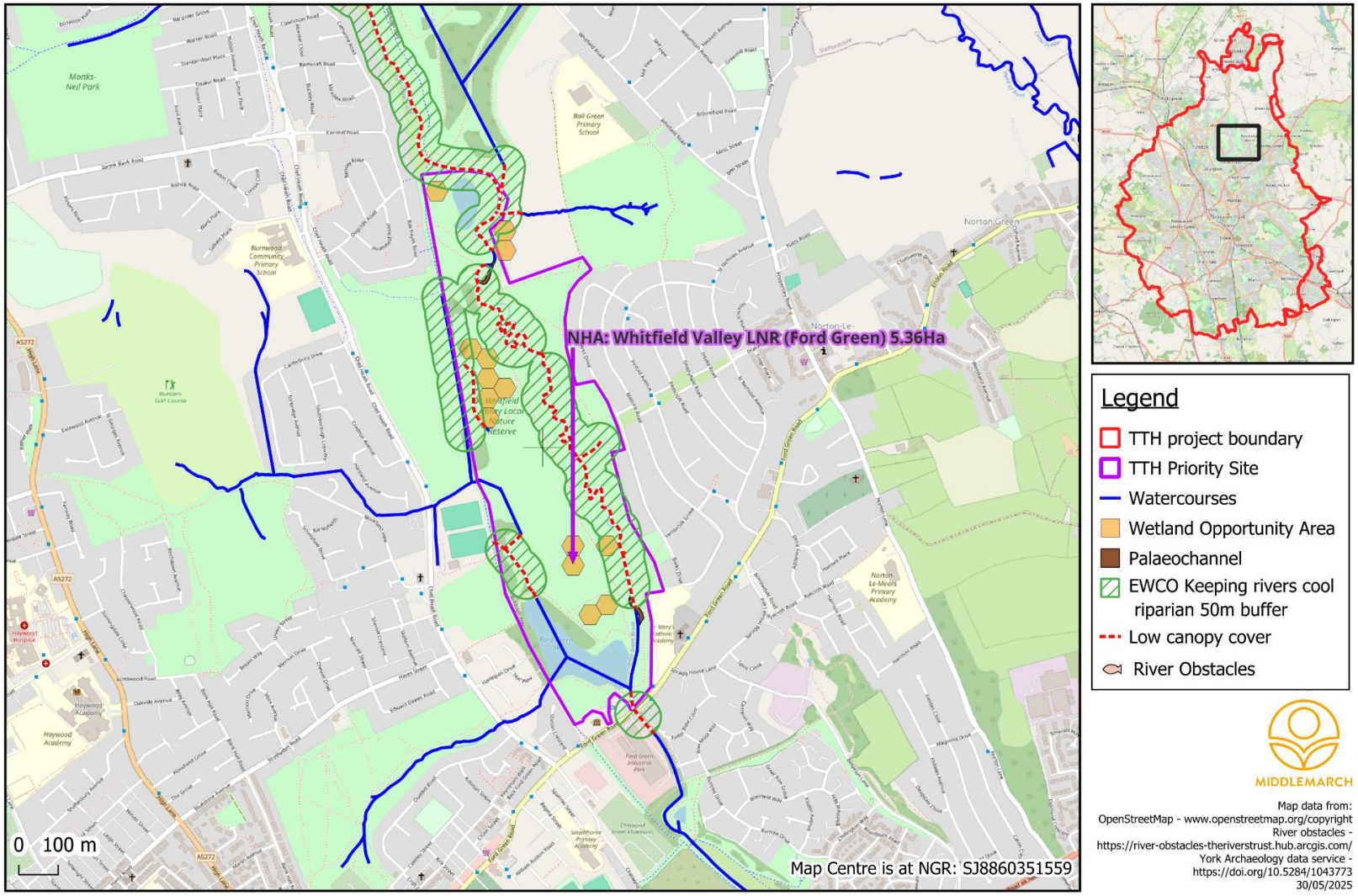

Figure 35. Map showing restoration opportunities at Whitfield Velley LNR.

Watercourse / water body catchment	Ford Green Brook
District	Stoke on Trent
Grid Reference	SJ 88568 51638
Size	5.36Ha
Public Access	Yes
Site description	Whitfield Valley Local Nature Reserve also known as Ford Green Nature Reserve is one of the largest reserves in the city of Stoke On Trent and boasts a wide range of habitats. The Ford Green Brook flows through the site and there are patches of grassland, hay meadow, heathland, hedgerow, ponds and scattered trees. Ford Green Reedbed, a Site of Special Scientific Interest, is located at the southern end of the nature reserve and many ducks and other water birds breed and overwinter here.
Restoration measures	**Reedbed restoration:** The SSSI reedbed has been declining for several years and the raised water levels in the lake/pond are likely contributing towards this as the reeds may at their maximum depth tolerance for the majority of the year. By gradually lowering the water level in the pond, the shallow, gradual littoral habitat will be restored and water levels will be returned to those in previous times where reedbeds were more extensive. If this reduction in water level in conducted gradually over many months, natural vegetation will expand and colonise the newly accessible shallows and no unsightly, muddy expanses will be created. The sluice at NGR SJ 88822 50952 where the pond enters Ford Green Brook could be easily modified and made adjustable to allow for these gradual changes. By lowering the water levels in this pond, additional storage will be created for periods of heavy rainfall and this waterbody will serve to buffer high flows, providing natural flood management for Ford Green Brook, helping to reduce high flows and export of valuable bed gravels. Buffering flows from this site will also help reduce flood risk for communities at risk in downstream reaches. **Wetland creation:** Wetland opportunity mapping has identified several areas within the site boundary that are potentially suitable for wetland creation. **Riparian tree planting and buffer strips:** the majority of Ford Green Brook at this site has been identified as beneficial for establishing riparian buffer strips and canopied reaches to aid in ‘keeping rivers cool’. Trees could be planted to create a diverse light regime along the watercourse that would not only provide shade and keep water temperatures low during droughts and hot weather but would provide shelter and refuge for a wide range of both aquatic and terrestrial wildlife.

<table>
<tr><td></td><td>Reductions in shading on pond shoreline: Reedbeds occupy both the terrestrial (reedbed) and aquatic transitional zones (reed swamp). Rhizomes occupying the dryer, shoreline habitats are typically more resilient as this habitat is more stable and receives less wave wash than submerged habitat. A reedbed requires a healthy semi-terrestrial component which provides a source of growth into the submerged littoral habitat. Overshading of the shoreline can have negative effects on reedbeds and can ultimately result in declines and eradication of reedbeds and reed swamps, The shoreline at this site is densely shaded in places and represents successional willow carr and emergent woodland habitat. This natural succession will likely cause the reedbeds to decline further through increasing shading. Coppicing of shoreline canopies will benefit the reedbeds at this site and will increase light levels, allowing a healthier and more resilient terrestrial reedbed component to exist.

Swan mussel reintroduction: This site could be suitable for the re-introduction of freshwater mussel species e.g. swan mussels.</td></tr>
<tr><td>Constraints</td><td>Public perception of changes to the water levels in the pond may not be positive. Education and interpretation will be important.</td></tr>
<tr><td>Date of Site Visit</td><td>19th March 2025</td></tr>
<tr><td>Priority Overview</td><td>High</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £20,000
Designs = £2,000
Capital works = £18,000</td></tr>
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Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 36: Photograph taken at Whitfield Valley LNR.*
Other information	

Golden Hill ex-golf course

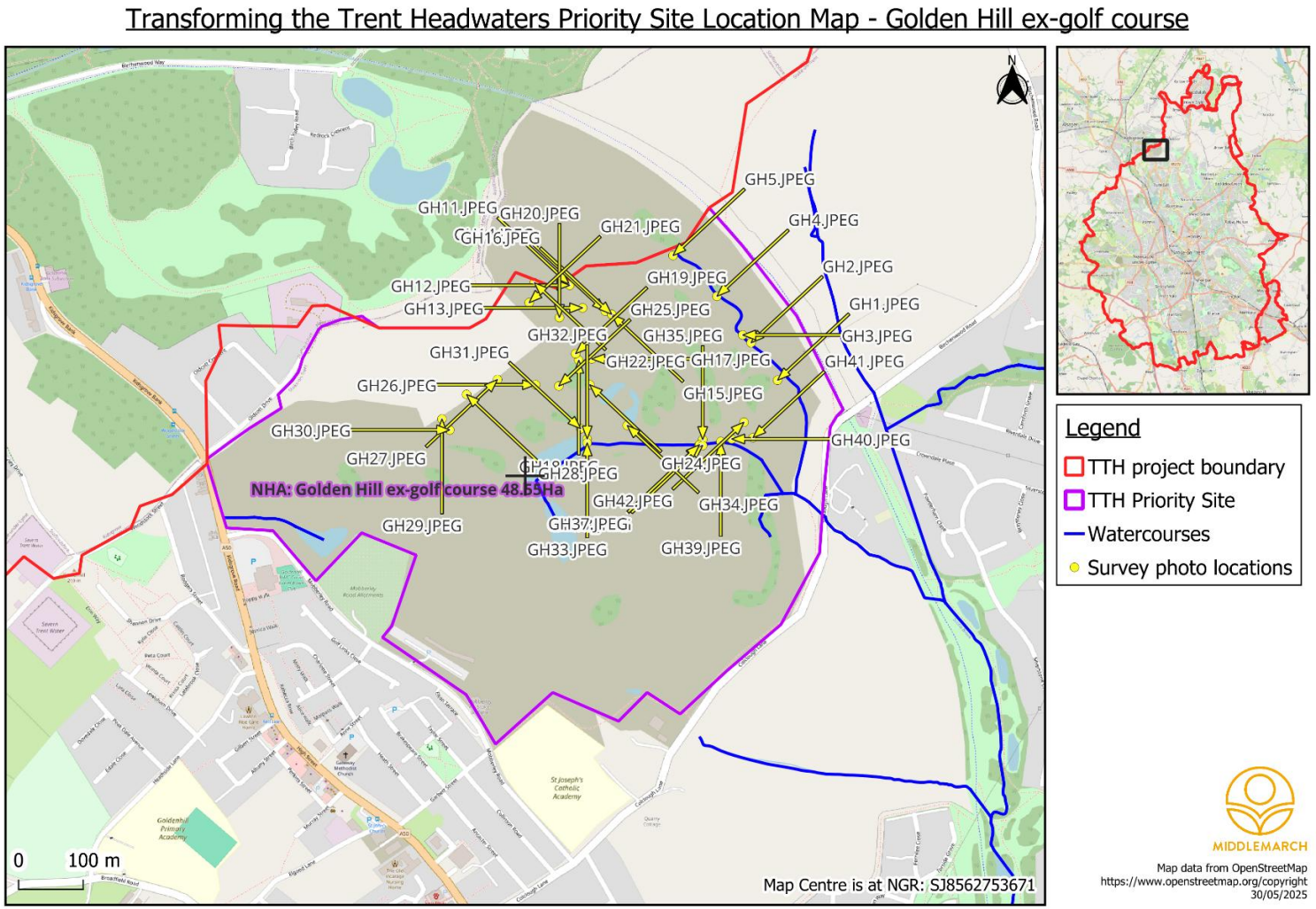

Figure 37. Map showing location and survey photos at Golden Hill

Transforming the Trent Headwaters - Priority Site opportunties - Golden Hill ex-golf course

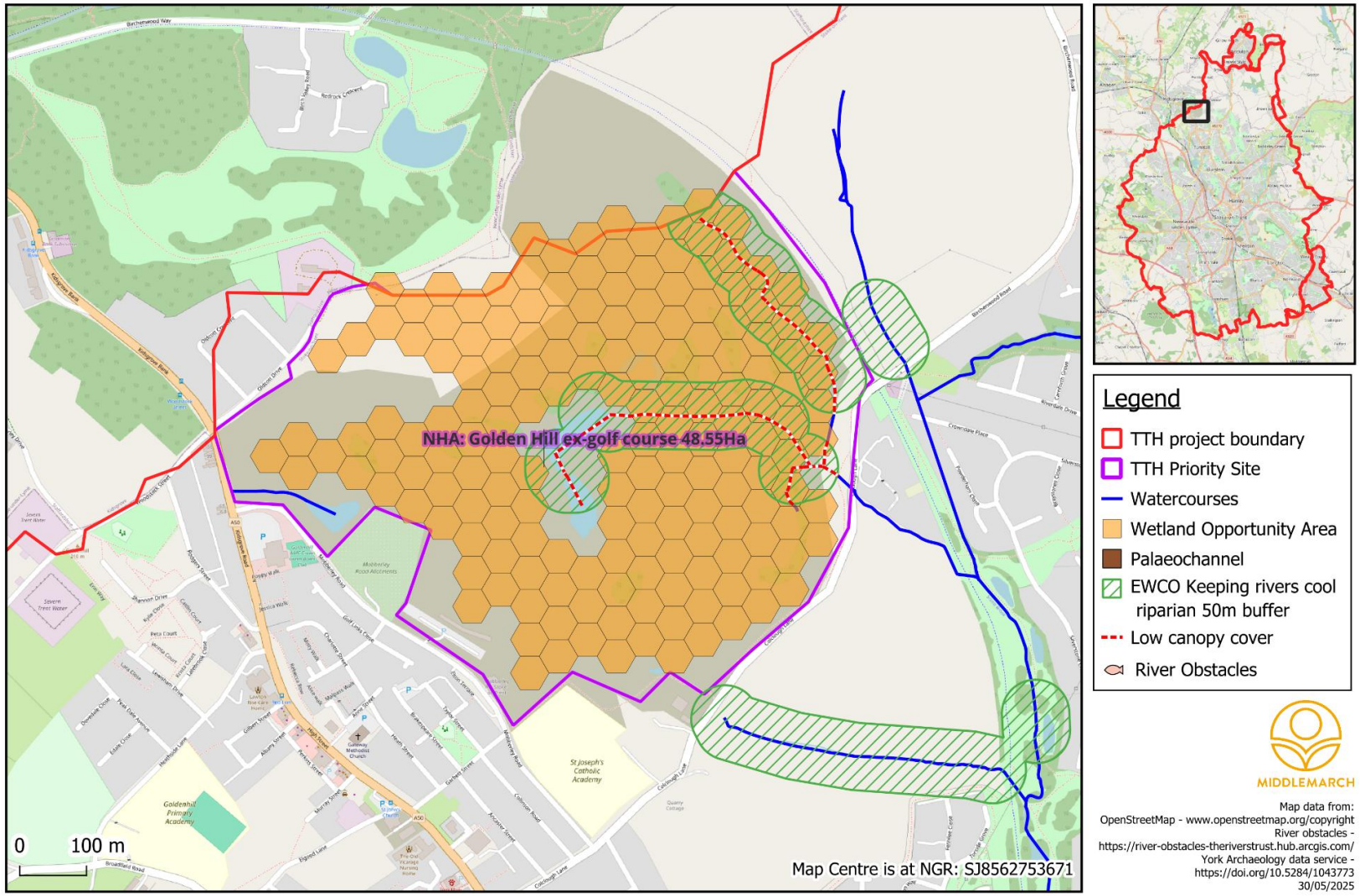

Figure 38. Map showing restoration opportunities at Golden Hill.

Watercourse / water body catchment	Scotia Brook
District	Stoke on Trent
Grid Reference	SJ 85667 53687
Size	48.55Ha
Public Access	Yes – Open access with a complex network of footpaths and desire lines. Land is informally used for motocross offroad motorcycling
Site description	This site occupies the grounds of a former golf club that closed around 2011. The gold clubhouse was demolished in 2022 leaving the site's future management and use in question. The site is a mosaic of woodland and scrub strips with open grassland and wetland areas. The site has 3 ponds at its centre which support wildfowl and marginal reedbed and wetland habitats. An extensive network of drainage ditches are present across the site which have successfully dried the site allowing for golf to take place. The most significant ditch flows from the largest pond where a constant supply of water passes to Scotia Brook. The ditches are becoming overgrown and draining more slowly and as such, wetter areas are developing. The site appears to be frequented by offroad motorcyclists and is experiencing considerable damage in a few locations where rutting of tracks and severe erosion is taking place.
Restoration measures	**Wetland and pond creation:** the majority of the Golden Hill site has been identified as possessing wetland creation opportunities. During the site visit, large extents of wetter areas were identified and these areas could be easily re-wetted further through the blocking of the drainage network and through either excavation of scrapes (excavated material used to infill the drainage ditches) or through the construction of bunds/swales to attenuate water. Pond emergent macrophytes are present on the site in existing pond habitats and could provide a donor for plant material to accelerate colonisation rates. This site could be used as a local demonstration site to showcase small scale natural flood management techniques e.g. run-off attenuation features. Access across the site will still be required for the public and for site management/maintenance and strategically placed and constructed bunds can provide raised access routes whilst holding water uphill. Tree planting: The existing network of drainage ditches are predominantly uncanopied, however, it is proposed that these drained be blocked to restore wetland habitats. Tree planting could be delivered along uncanopied stretches of watercourses
Constraints	Other stakeholders with interest in maintaining the site in a drier state.
Date of Site Visit	27th Feb 2025
Priority Overview	High priority

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Designs = £3,000
Capital works = £27,000</td></tr>
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Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 39: Photograph taken at Golden Hill ex-golf course.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Milton

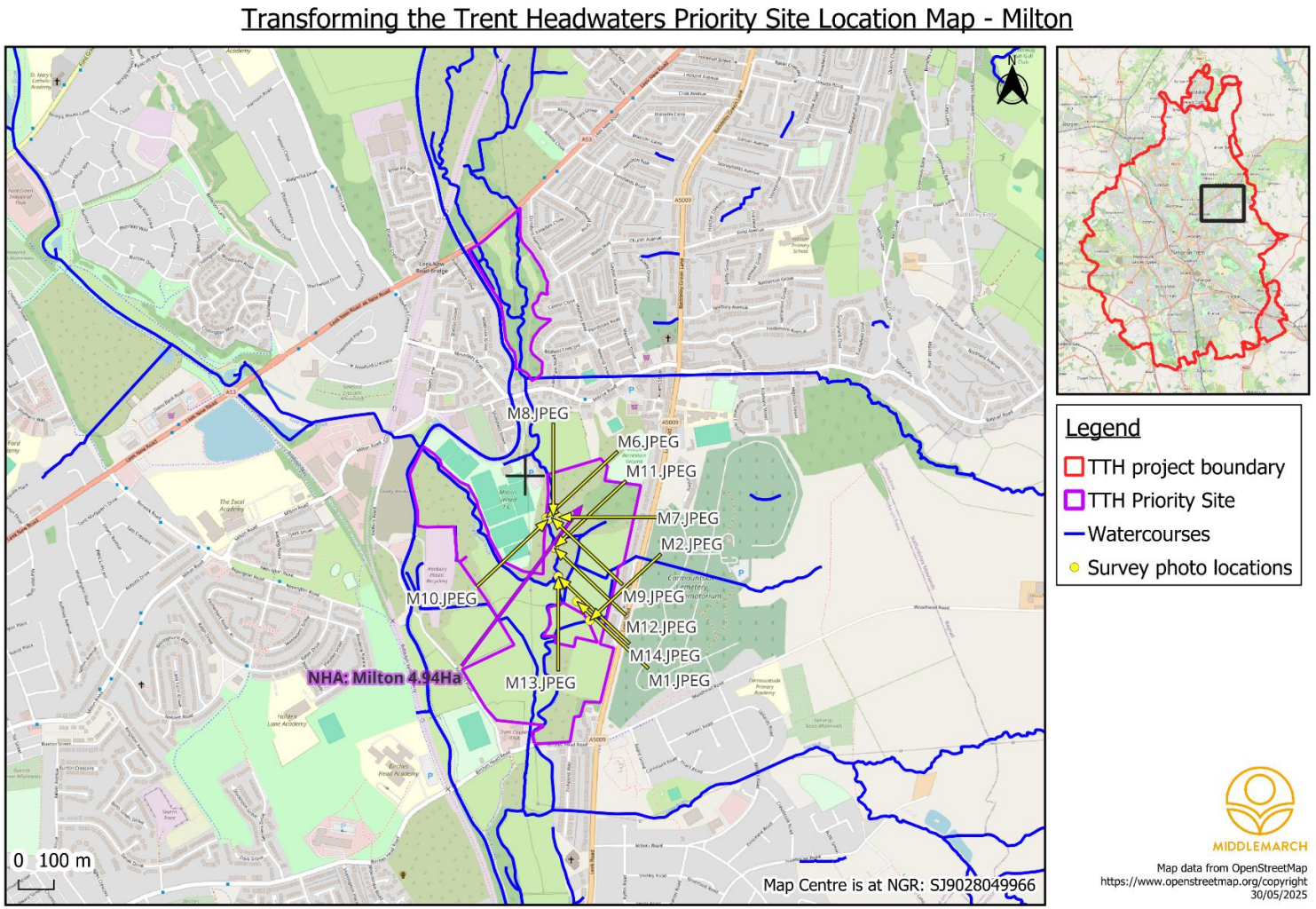

Figure 40. Map showing location and survey photos at Milton.

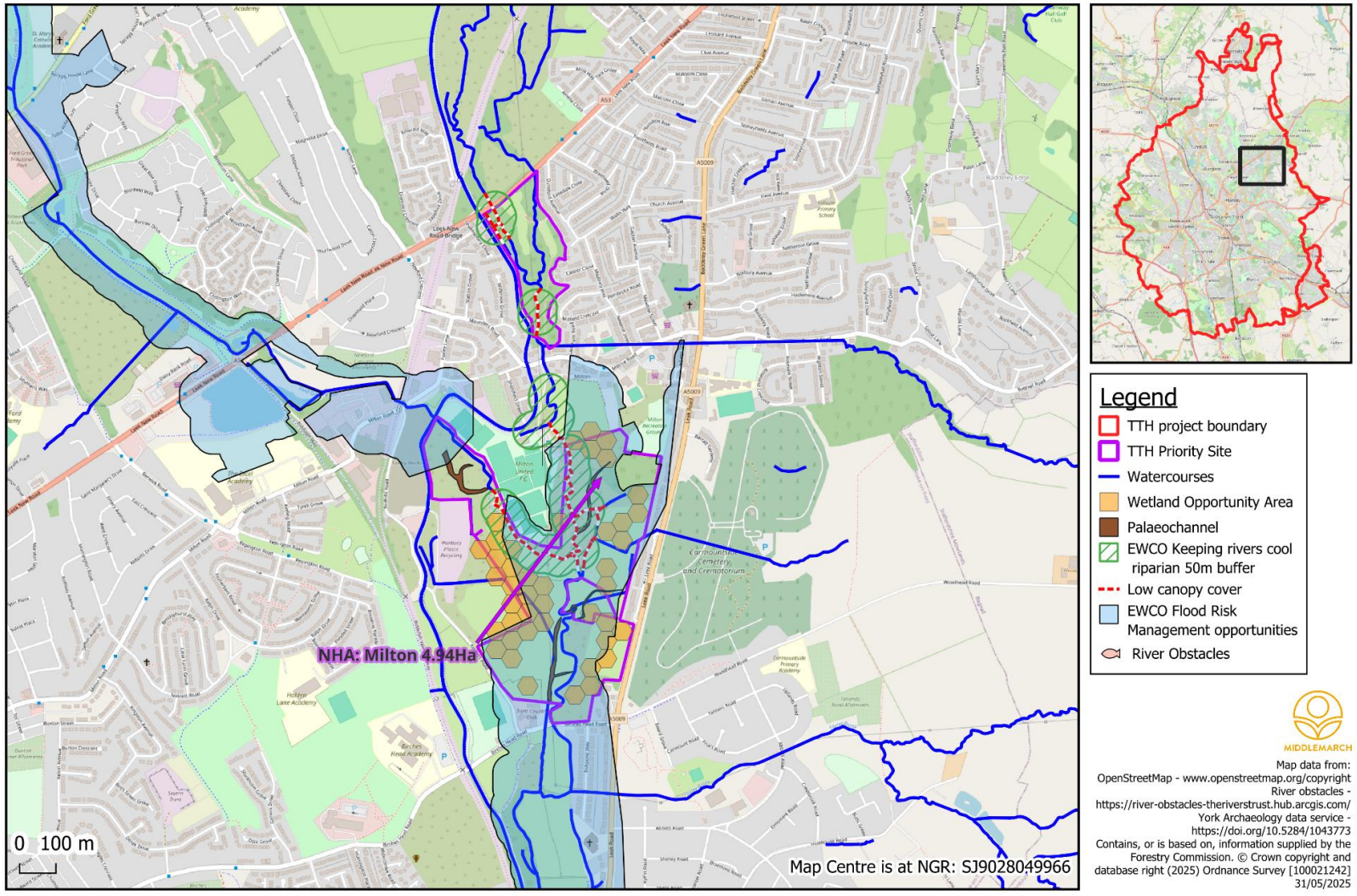

Figure 41. Map showing restoration opportunities at Milton.

Watercourse / water body catchment	Head of Trent Ford Green Brook
District	Stoke on Trent
Grid Reference	SJ 90351 49654
Size	4.94Ha
Public Access	Yes – access is limited to one public footpath running from Leek Road past Milton United F.C.
Site description	Milton is an area of floodplain that is predominantly used for horse and pony grazing. The area is wet with numerous areas of permanent and ephemeral wetland and shallow ponds. The site is very heavily grazed due to the permanent presence of approx. 10 horses and as a result, the ground is heavily poached and compacted across much of the site. The footpath crosses the middle of the site and at the time of the site survey, was impassable due to standing water to approx. 30cm depth. Both river channels of Ford Green Brook and the Head of Trent are heavily colonised by Himalayan balsam and extensive erosion and bare, unvegetated banks were observed. Buffer strips along these watercourses are minimal and often, stock fences are positioned at bank top.
Restoration measures	Wetland creation: Large portions of this site are suitable for wetland creation. The water table is close to and frequently at ground surface level which provides an excellent opportunity for creating floodplain wetland habitat. **Riparian buffer zone:** The watercourses would benefit from the creation of riparian buffer strips which would act as sediment sinks, intercepting silt laden run-off from the neighbouring horse paddocks. Riparian canopy from trees within the buffer strips would provide shade to the watercourse, maintaining low water temperatures during periods of hot, dry weather. Overhanging vegetation will also provide refuge for fish and will provide woody material and leaves which can benefit aquatic invertebrate populations.

	Installation of alternative drinking solutions, e.g. solar powered pumps either from the river or from shallow boreholes would eliminate the need for livestock to access the river banks, reducing poaching and bank slumping. **INNS control:** Himalayan balsam is extensive along the banks of these watercourses, especially on the right bank of the Head of Trent. Control of this species should be targeted to reduce its impact on water quality. **In-channel structural complexity:** Much of the watercourse channels at this site are devoid of any significant in-channel structural complexity. The addition of resilient materials e.g. boulders and large woody material will benefit the aquatic habitat through the creation of a greater degree of flow diversity, gravel and substrate mobilisation and sorting and increasing hydro-geomorphological processes which are likely to improve gravel supply to the watercourse and create a more diverse planform with meanders, riffles and pool formation. **Weir removal:** Reports of an unconsented weir at this site. Removal is necessary and would restore fish assess and natural hydro-geomorphological processes within this reach of the river. Exact location unconfirmed as access has not been granted to survey all areas. **Palaeochannel reinstatement:** Data indicates the presence of five palaeochannels within this site and neighbouring Milton United FC (south of). Reinstatement or reconnection of these channels through modifications to the channel structure and potentially installing flow deflectors to allow connection during high flows would increase the biodiversity value of the floodplain, reduce pressure on the existing channel through reductions in spate high flows. This would allow for a greater retention of bed load within the main river, providing a more resilient bad habitat for fish and invertebrates.
Constraints	Recent information that the Landowner/Tenant are not in favour of the works Any works would need to maintain access along the footpath.
Date of Site Visit	28th February 2025
Priority Overview	Medium Priority
Estimated budget	Total cost = £25,000 Designs = £1000 Capital works = £24,000

Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar

Year 1				Year 2				Year 3				Year 4				Year 5			
Q1	Q2	Q3	Q1	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Photographic Record

Figure 42: Photograph taken at Milton.

Additional photos are available in the separate ‘Appendix 8 – Survey photos catalogue’.

Other information

Victoria Ground – Downstream of Boothen Old Road

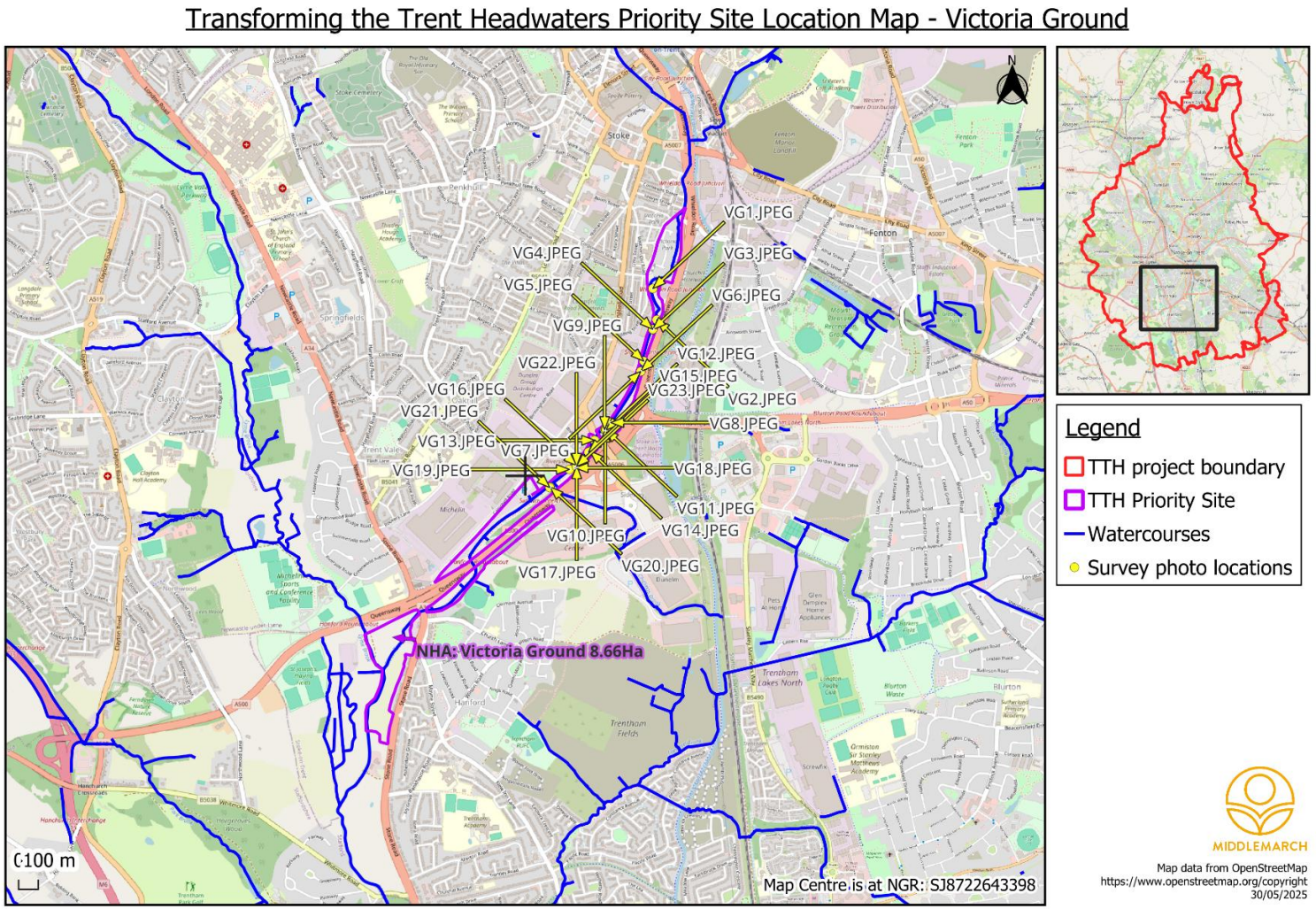

Figure 43. Map showing location and survey photos at Victoria Ground.

Transforming the Trent Headwaters - Priority Site opportunties - Victoria Ground

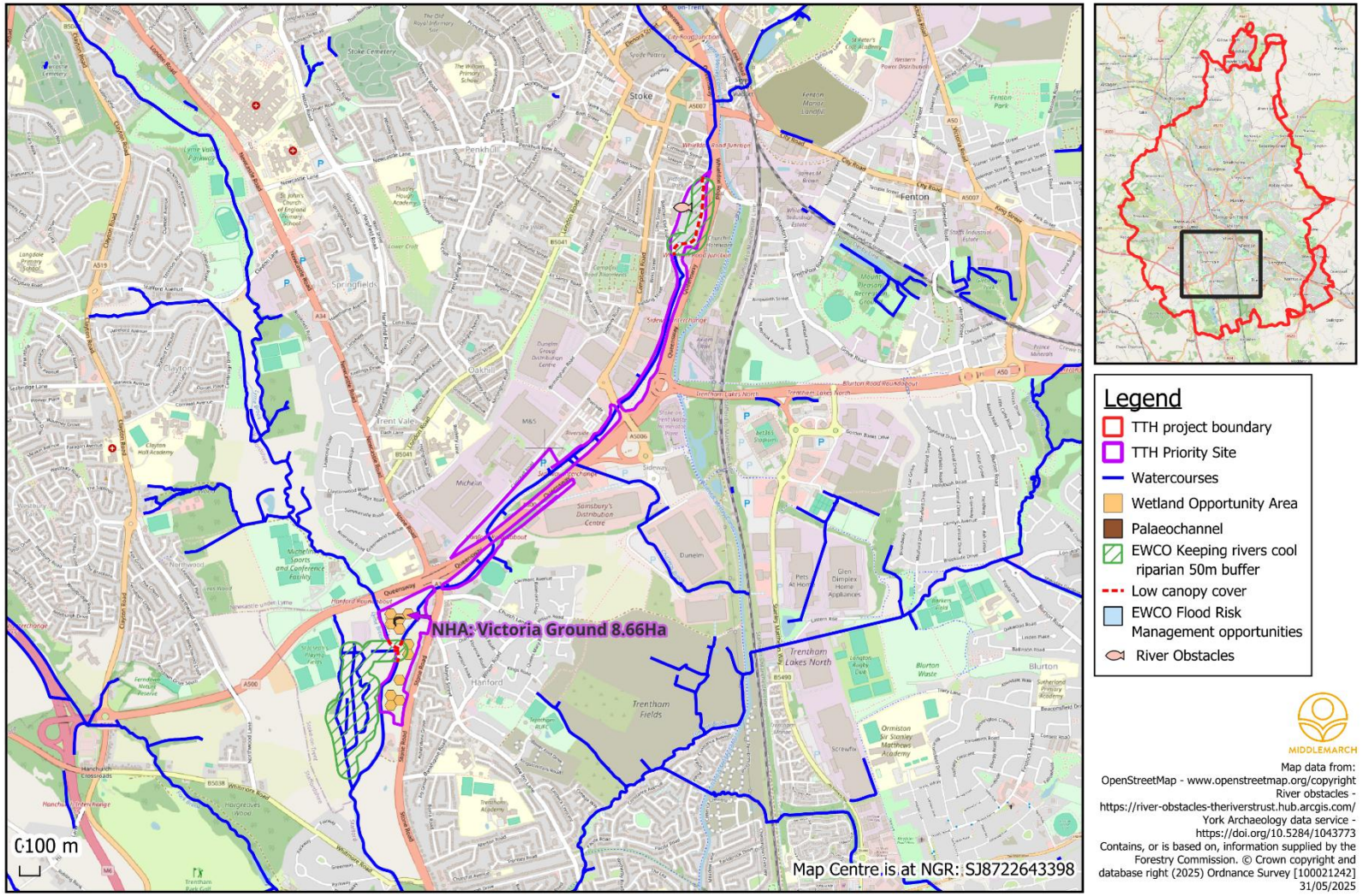

Figure 44. Map showing restoration opportunities at Vicotria Ground.

Watercourse / water body catchment	River Trent
District	Stoke on Trent
Grid Reference	SJ 87809 43928
Size	8.66Ha
Public Access	Yes – Public access along the Trent River Path.
Restoration measures	Removal of bank and toe protection: By removing bank protection and toe protection, the river will be able to migrate laterally and in-channel features such as gravel bars, riffles and pools will form. Revetment materials (cobbles and small boulders) can be distributed within the channel to create habitat and morphological structural variation. Gravel and boulder supplements: The reach has poor gravel supply and retention. Additions of gravel and strategic in-stream structural complexity e.g. large woody debris, large boulders etc, will facilitate natural sorting of substrate materials and will create flow diversity within the reach. Gravels will be flushed and cleaned, creating beneficial habitat for aquatic wildlife. Installation of flow deflectors: Additional placement of large, secured flow deflectors such as large root boles will create further flow diversity within this straightened reach. Riparian tree planting: This stretch of river has limited riparian canopy or bankside vegetation on the left bank. Planting of stands of trees will create areas of well lit and areas of dappled shade, increasing the habitat variability of the site. Provision of overhanging vegetation will provide refuge and cover for fish and will also assist in keeping water temperatures low during prolonged hot and dry weather periods.
Constraints	River runs alongside A50 Queensway – This is a low gradient reach of the Trent and erosion of river banks in close proximity to major infrastructure must be assessed. Strategic River Trent Path follows the river on the left bank – migration of the channel may result in undercutting of the footpath. With these constraints in mind, removal of bank protection and re-establishment of natural hydrological process could be focussed on the right bank, away from the footpath and road.

<table>
<tr><td></td><td>Sections of this reach of the River Trent are perched which could impact on the benefits realised by restoration works at this location – however, the reach of the Trent at this site is very heavily constrained so any improvement would be beneficial. Additionally, this location is high profile as the Trent Footpath follows the river and attracts walkers and visitors.</td></tr>
<tr><td>Date of Site Visit</td><td>19th March 2025</td></tr>
<tr><td>Priority Overview</td><td>Medium Priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £50,000
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Q2: Jul-Sep
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Photographic Record	 *Figure 45: Photograph taken at Victoria Ground downstream of Boothen Old Road.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Longton Brook (Trentham Garden Centre)

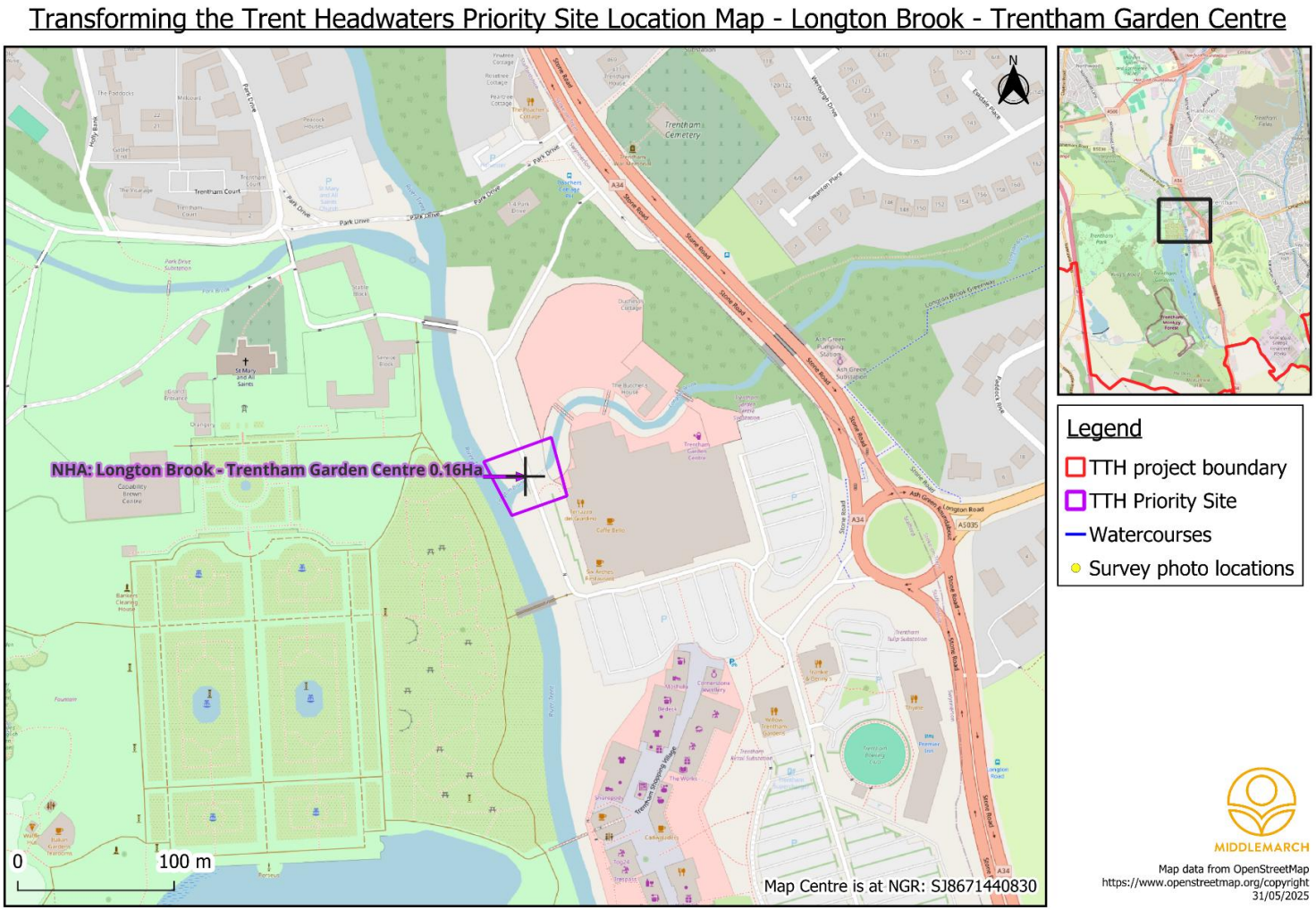

Figure 46. Map showing location and survey photos at Longton Brook, Trentham Garden Centre.

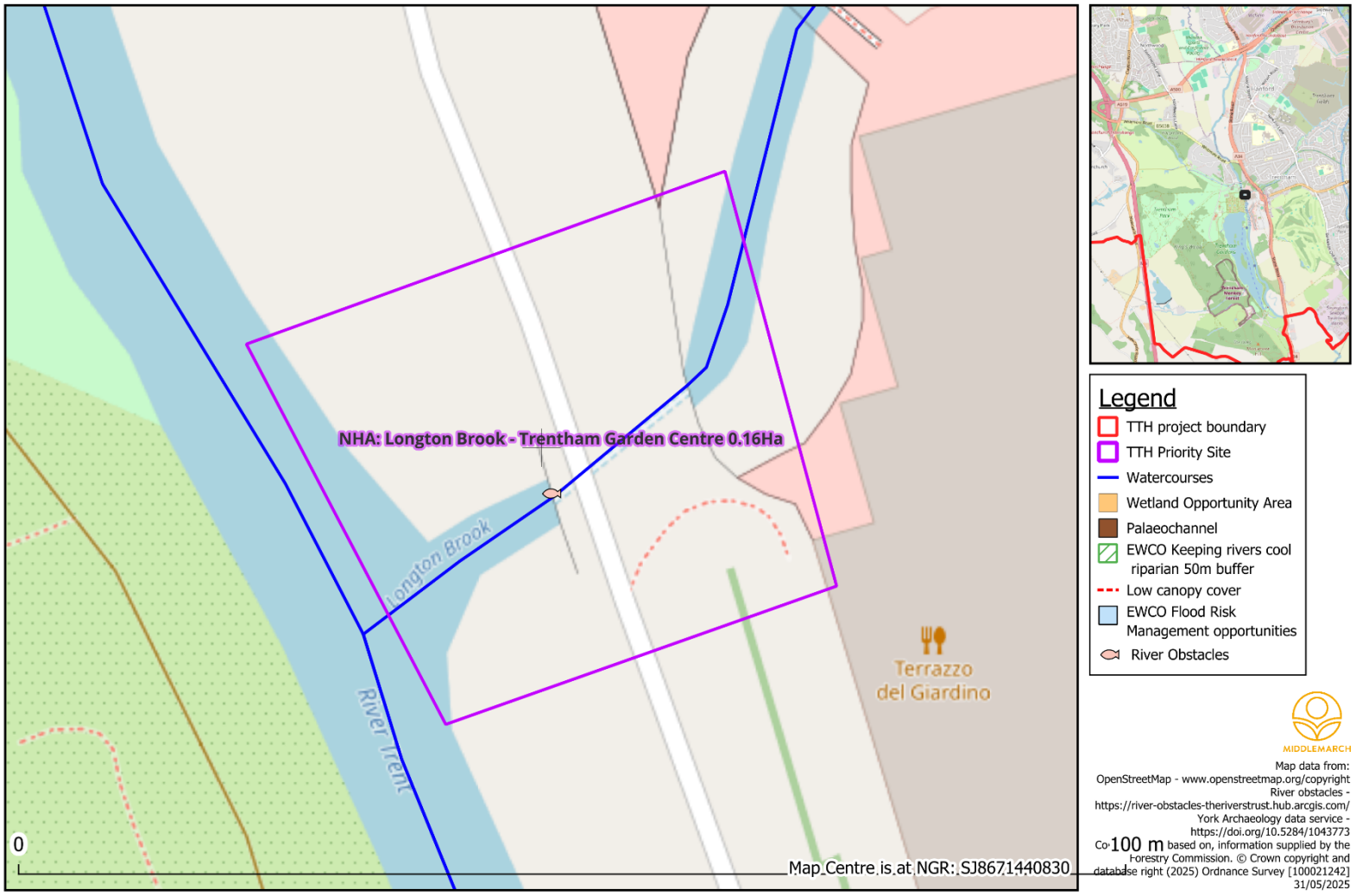

Figure 47. Map showing restoration opportunities at Longton Brook, Trentham Garden Centre.

Watercourse / water body catchment	Longton Brook
District	Stafford
Grid Reference	SJ 86714 40830
Size	0.16Ha
Public Access	Yes – Public and vehicle access along highway
Site description	At this site is a culvert beneath an access road past Trentham garden centre and towards Trentham Hall. The culvert is impassible to fish due to its construction, a relatively narrow circular, raised pipe.
Restoration measures	Replacement of pipe culvert to oversized, fish friendly culvert or clear span bridge.
Constraints	Alternative Vehicle access will be required to allow any works to take place.
Date of Site Visit	19th March 2025
Priority Overview	High Priority
Estimated budget	Total cost = £30,000 Designs = £2,000 Capital works = £28,000
Delivery Timeline **Q1: Apr-Jun** **Q2: Jul-Sep** **Q3: Oct-Dec** **Q4: Jan-Mar**	

Year 1				Year 2				Year 3				Year 4				Year 5			
Q1	Q2	Q3	Q1	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Photographic Record	Photographs held by SWT and Trent Rivers Trust
Other information	

Cockster Brook/Longton Brook

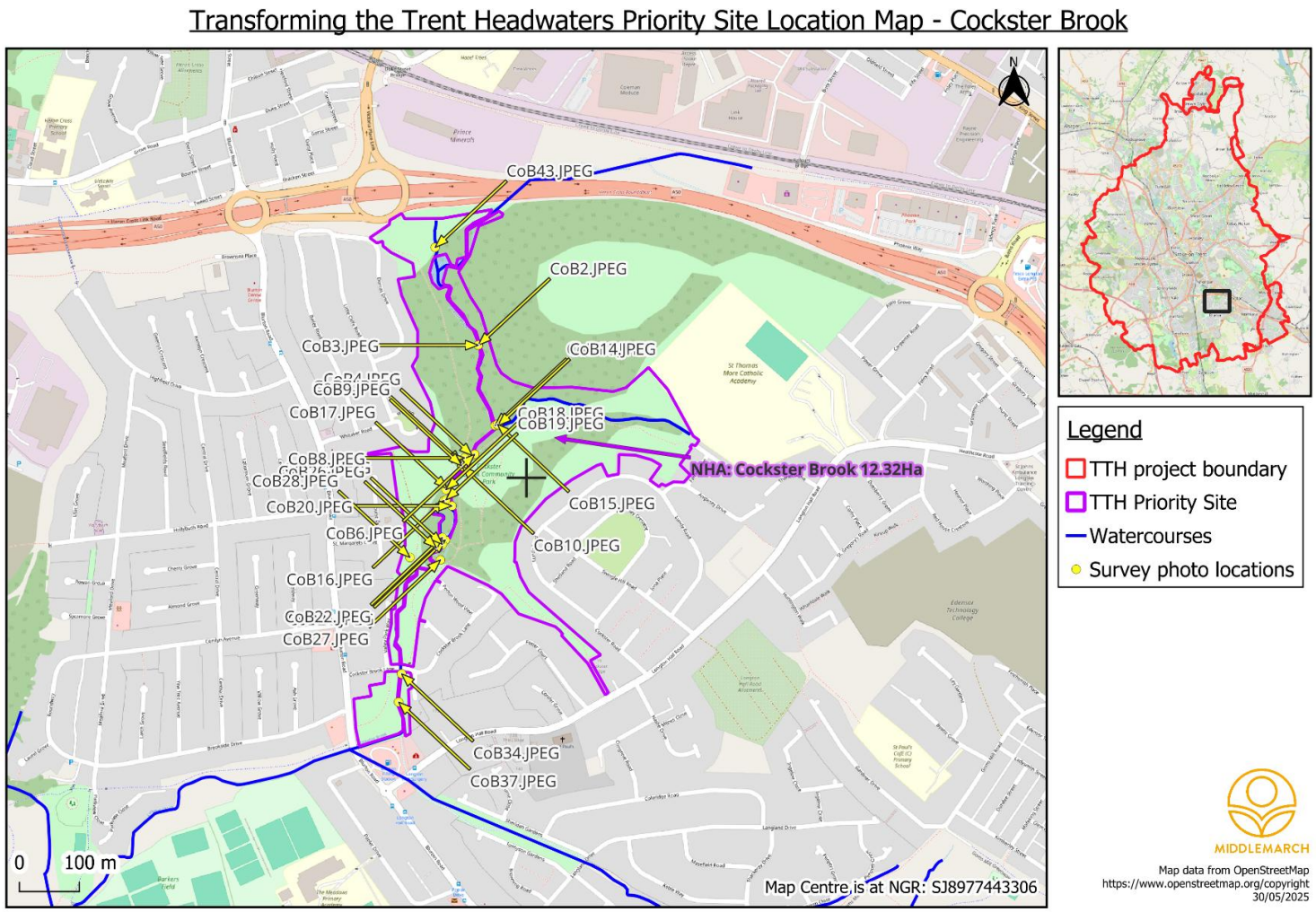

Figure 48. Map showing location and survey photos at Cockster Brook.

Transforming the Trent Headwaters - Priority Site opportunities - Cockster Brook

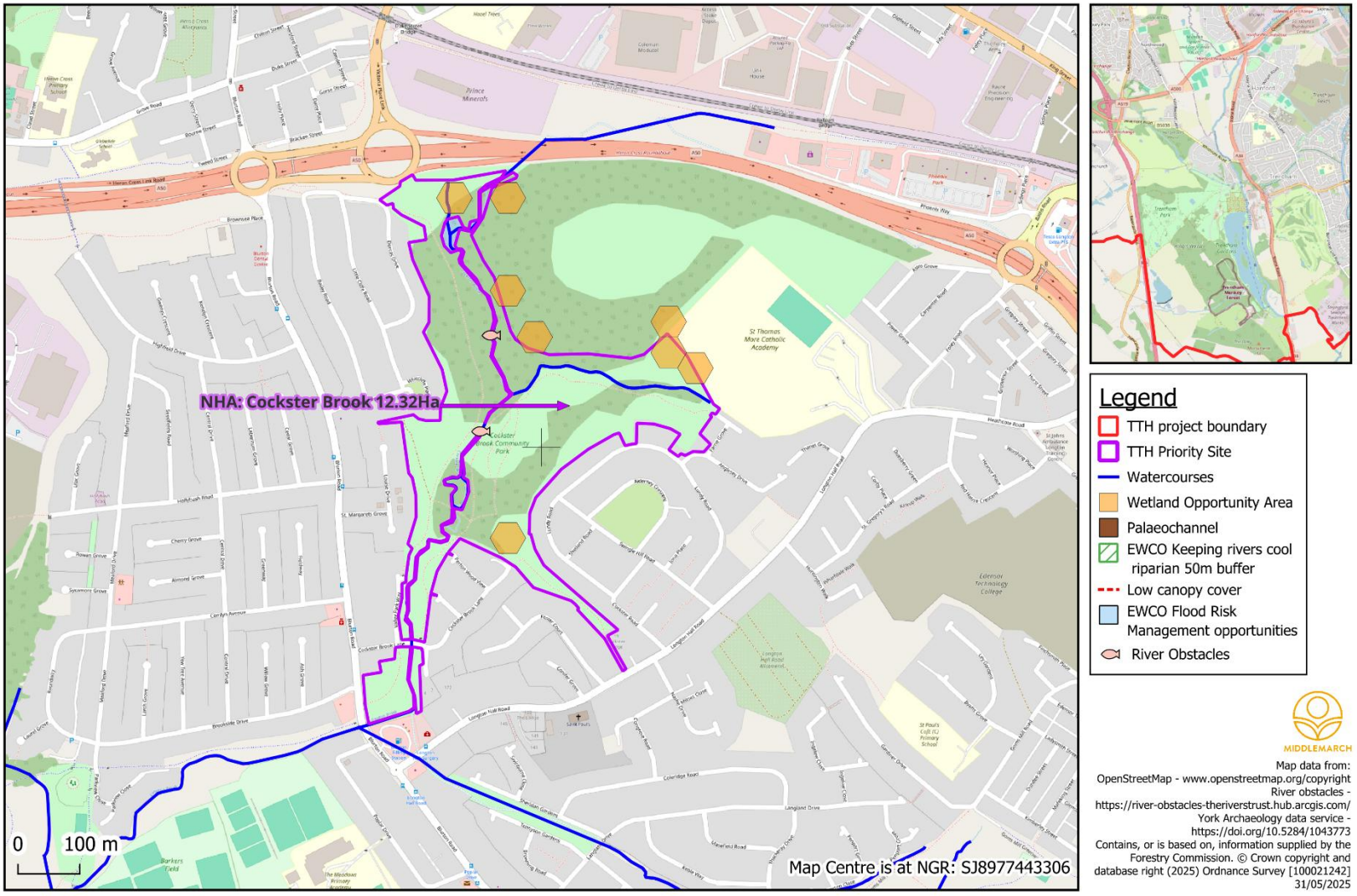

Figure 49. Map showing restoration opportunities at Cockster Brook.

Watercourse / water body catchment	Cockster Brook and Longton Brook
District	Stoke on Trent
Grid Reference	SJ 89739 43387
Size	12.32Ha
Public Access	Public access along existing footpaths. Desire lines also present across wider site.
Site description	The site at Cockster Brook is an area of Community Park with a network of footpaths and seating areas. This is the site of a historic landfill site. EA waste notes are: “Shraff tip and surplus material from A50. Should be inert. dry non-inflammable pottery and builders waste and paper, cardboard, plastic and similar material”. The watercourse flowing through this site is predominantly unmodified except for a small, informal weir and a culvert under a track crossing point. Both of these structures negatively impact on habitat quality and hydro-geomorphological processes. The impounded reaches upstream of both structures are heavily silted due to low flow rate which has resulted in the accretion and smothering of bed gravels. The watercourse is heavily shaded for the majority of its length and as a result, in-channel macrophyte populations are low and habitat value is limited. There is evidence of straightening of the channel around NGR: SJ 89725 43392 and these sections demonstrate poor morphology with low diversity flow regimes and poor gravel/bed substrate composition dominated by larger cobbles.
Restoration measures	**<u>This site offers significant restoration potential and lends itself to being classed as a ‘flagship ‘ project.</u>** **Weir removals:** The upper region of the site (Cockster Brook) has a small, dilapidated weir present at approximately NGR: SJ 89693 43490 which is impounding water for approximately 50m. This has created an overly deep and silted area of the watercourse with slow flowing water and accreted substrates. The removal of this weir is a low risk restoration measure which could be completed at relatively low cost either by hand (as the majority of the construction comprises block stones and concrete pieces. The weir construction comprises a few larger pieces of concrete which could be broken up and removed. This measure would lower the bed to near natural levels and restore a more naturalised flow regime within this reach. Faster flow rates will

	assist in cleaning the bed substrate and minimising deposition of silt. The removal of the weir will eliminate the artificial barrier to fish movement and will allow free movement of fish and other aquatic species throughout this reach of Cockster Brook. **Culvert removal:** A culverted section of Cockster Brook (NGR: SJ 89680 43338) could be restored through the removal of the culvert and the replacement of the overhead track with a clear span bridge. Alternatively, the narrow culvert could be replaced with an oversized culvert to allow free passage of fish and other aquatic species together with the re-naturalisation of the river bed profile and flow conditions within this reach. **Longton Brook - Fish Pass/eel pass and culvert 'daylighting':** The lower reach of Longton Brook at this site comprises a complex network of heavily modified structures including culverts, weirs and trash screens. These structures pose an impassible barrier for fish and eels which presents an opportunity for mitigation and improvement. The structures are in close proximity to houses, roads and other infrastructure which present complex constraints and as such, full removal and re-naturalisation will likely be extremely costly and fraught with risk. Therefore, the options of daylighting culverts, installation of fish and eel passes together with in-channel improvements would represent an alternative option for improving this reach of Longton Brook.
Constraints	Nearby developments: roads and houses Ground testing may be advisable depending on the type, scale and extent of works and further consultation with the EA Waste Team would be required as part of any further project development.
Date of Site Visit	14th May 2025
Priority Overview	High Priority
Estimated budget	<u>Cockster Brook</u> Total cost = £115,000 Designs = £15,000 Capital works = £100,000 <u>Longton Brook</u> Total cost = £300,000 Designs = £50,000 Capital works = £250,000

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Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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<tr><td>Photographic Record</td><td> 
Figure 50: Photograph taken at Cockster Brook.

Additional photos are available in the separate ‘Appendix 8 – Survey photos catalogue’.</td></tr>
<tr><td>Other information</td><td>Close liaison with Environment Agency will be required to determine feasibility of removal or modification of trash screens to reestablish unimpeded movement within the channel.</td></tr>
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Tag Marsh

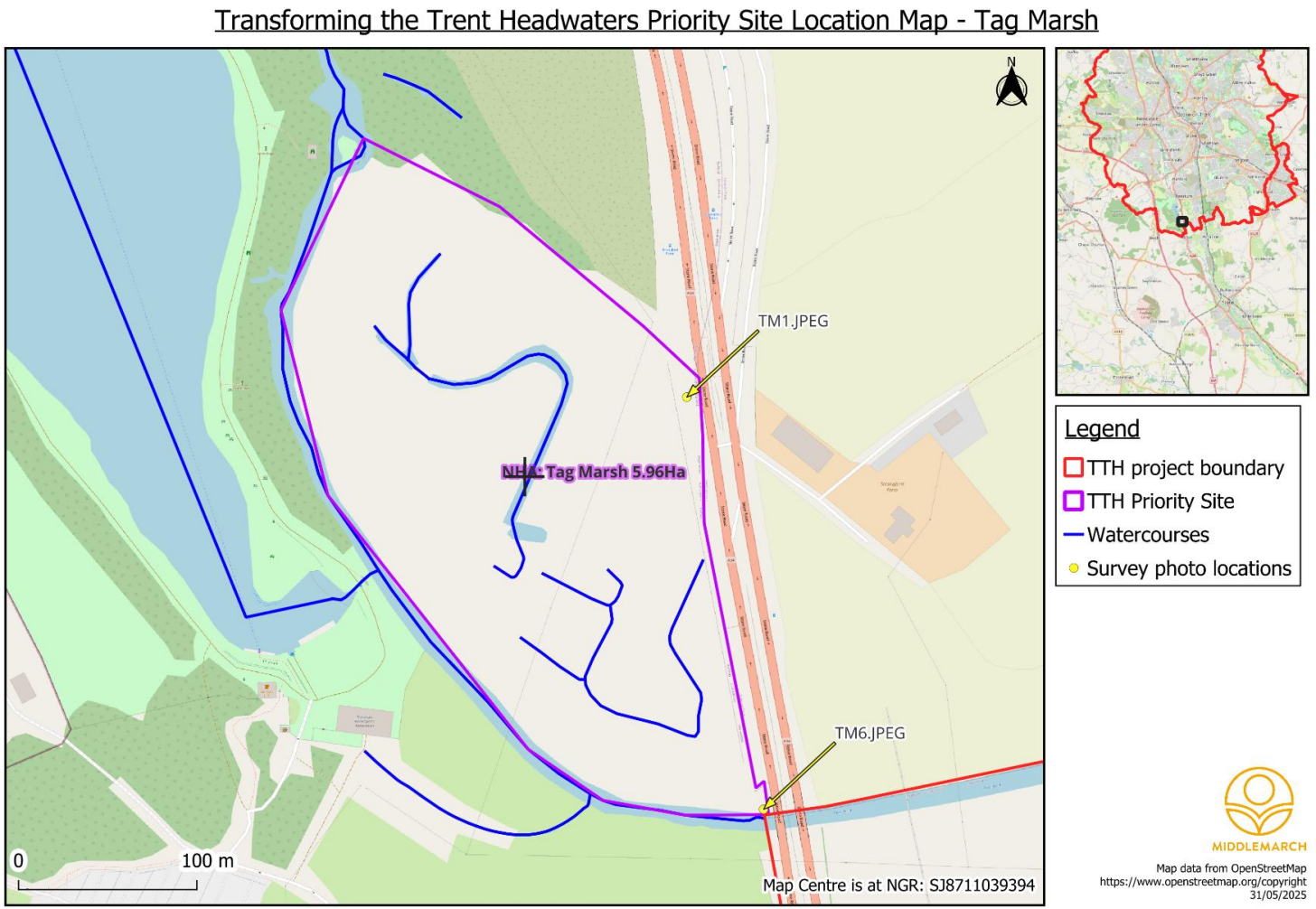

Figure 51. Map showing location and survey photos at Tag Marsh.

Transforming the Trent Headwaters - Priority Site opportunities - Tag Marsh

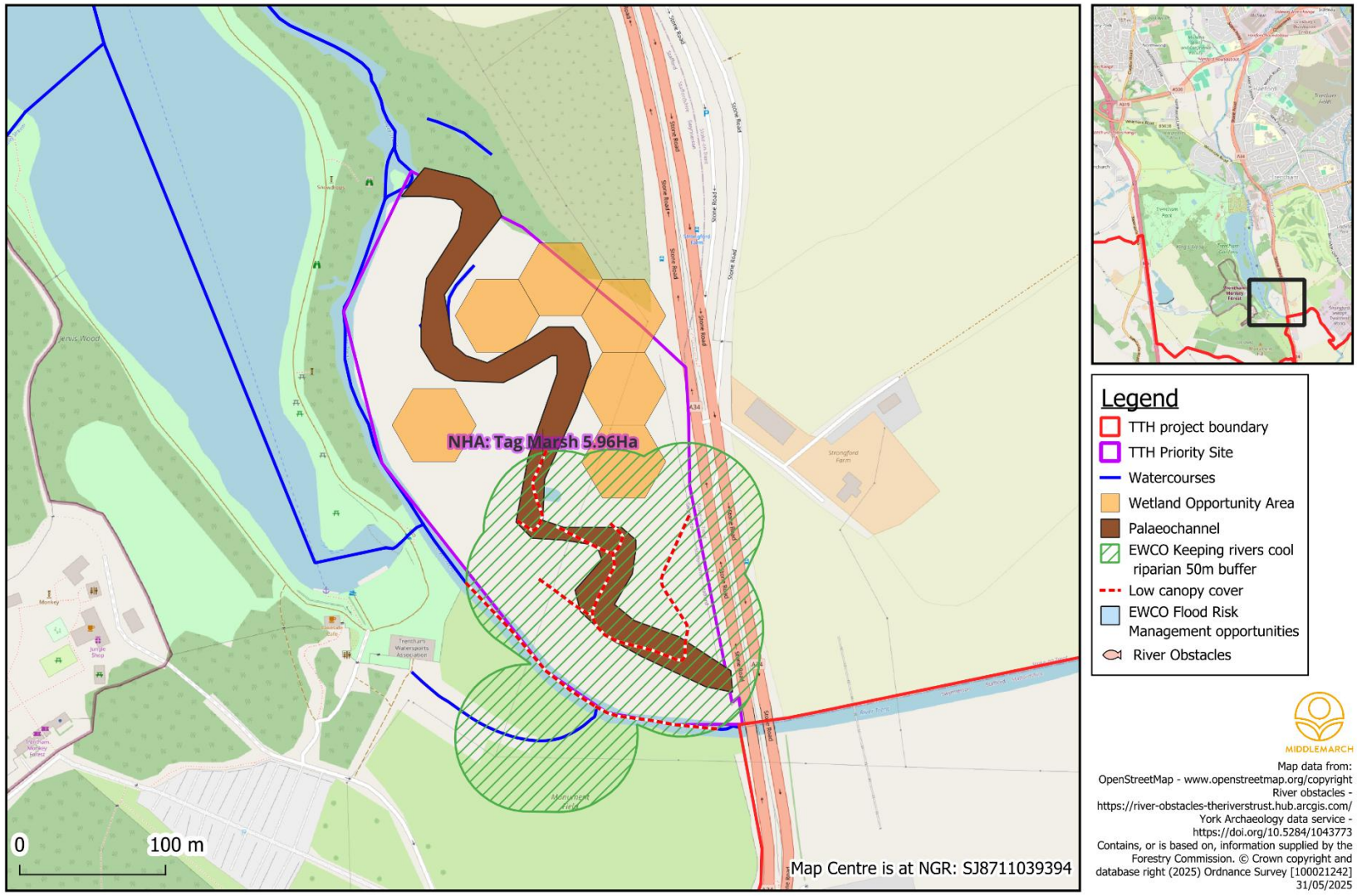

Figure 52. Map showing restoration opportunities at Tag Marsh.

Watercourse / water body catchment	River Trent
District	Stafford
Grid Reference	SJ 86859 39414
Size	5.96Ha
Public Access	No
Site description	Floodplain wetland and grassland/rush pasture Standing water present in palaeochannels
Restoration measures	Reconnection of floodplain and palaeochannel: River restoration opportunities are present at Tag Marsh. Evidence of a palaeochannel on the left bank presents an opportunity to encourage higher flows to reconnect with the floodplain, offering flood mitigation benefits and mechanisms to further re-wet the riparian habitats. Creation of wet woodland: Opportunities for the creation of flood-plain wet woodland are present at Tag Marsh. The creation of this habitat will provide valuable transitional habitat for a wide range of aquatic and terrestrial species. Wet woodland also offers natural flood management benefits through slowing the flow of floodplain flows. Creation of wetland habitat: Areas of the right bank at Tag Marsh have been identified as being suitable for wetland creation. The above restoration measures will compliment any wetland creation, providing habitat and drought resilience benefits.
Constraints	Close proximity to A34 Stone Road bridge.
Date of Site Visit	24th April 2025
Priority Overview	Medium priority

<table>
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Designs = £2000
Capital works = £28,000</td></tr>
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Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 53: Photograph taken at Tag Marsh.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Springpool wood

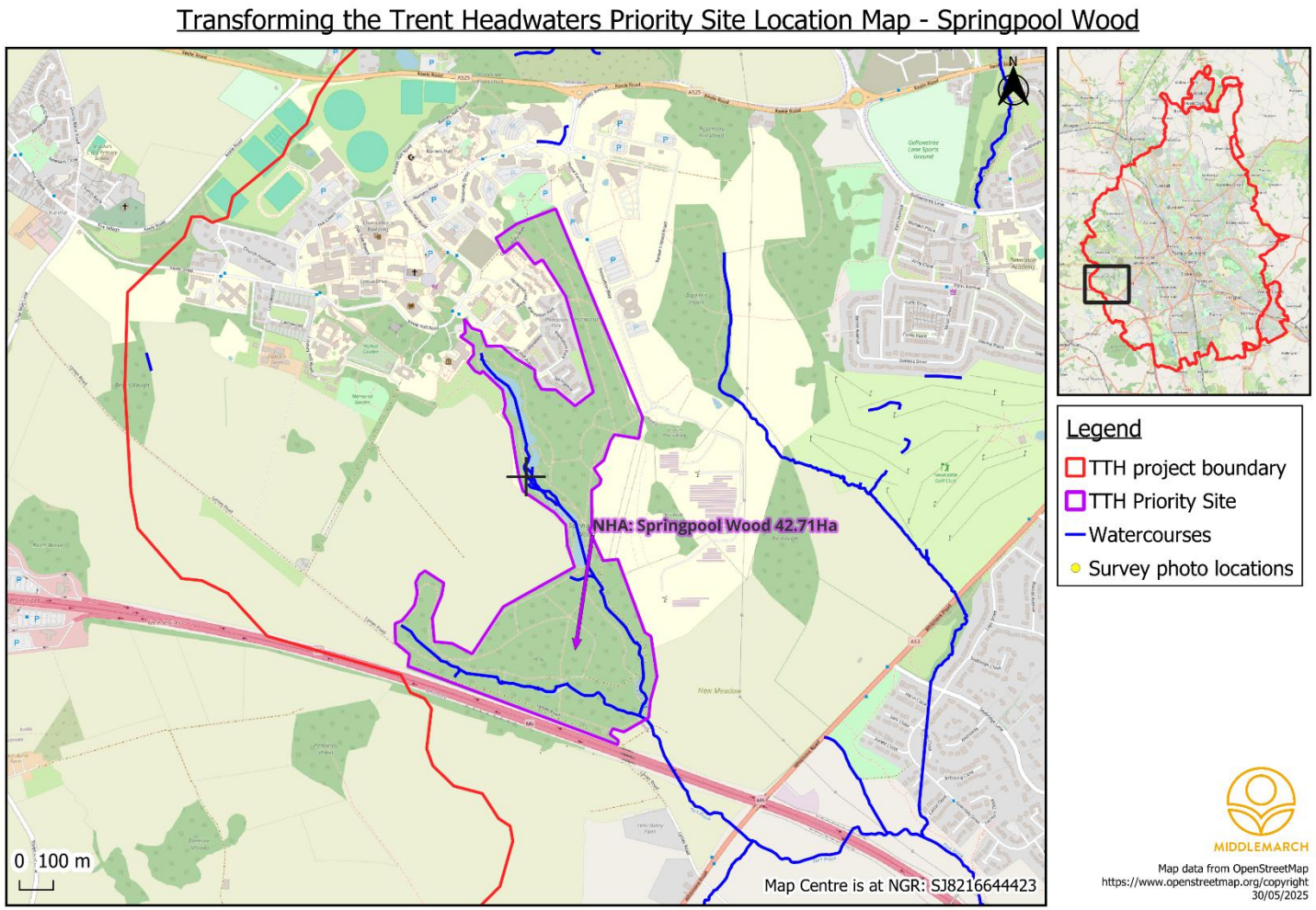

Figure 54 Map - NHA Priority site location map - Springpool Wood

Transforming the Trent Headwaters - Priority Site opportunties - Springpool Wood

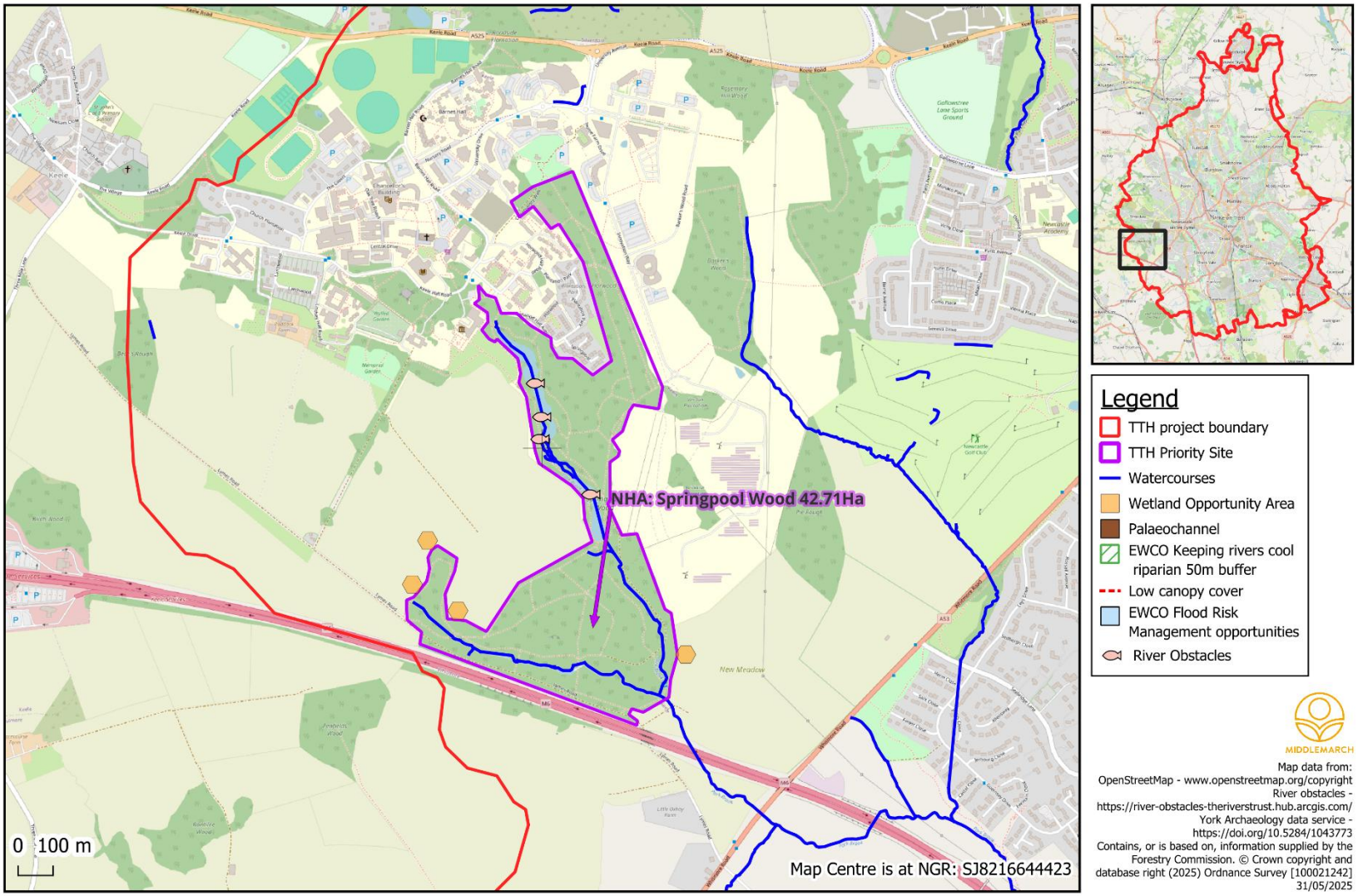

Figure 55 Map - NHA Priority site opportunities - Springpool Wood

Watercourse / water body catchment	Park Brook
District	Newcastle-under-Lyme
Grid Reference	SJ 82272 44481
Size	42.71Ha
Public Access	Yes – extensive network of footpaths
Site description	Mixed woodland with a series of in-line ponds/pools in the channel of Park Brook.
Restoration measures	**Weir removal or modification:** Within the grounds of Park Brook, there are 4 weirs present – these present an opportunity for either removal or installation on fish/eel passes or easements. **Wetland creation:** The site has been identified as a potential wetland creation area. Wet woodland and wetland areas could be created through blocking of drains or creation of scrapes/bunds to hold water. **Riparian canopy management:** the site is a mixed woodland which shades almost the entire reach of Park Brook. Management of the canopy through strategic felling or coppicing/laying would facilitate the growth of macrophytes which add habitat diversity to the river channel and provide refuge and foraging grounds for fish and aquatic invertebrates. **In-channel structural complexity:** This undeveloped site could provide a gravel supply for the lower, modified reaches. Installation of flow deflectors, LWD and boulders would increase hydro-geomorphological process such as channel migration and bank erosion which would produce gravel and bed substrate material to migrate downstream.
Constraints	
Date of Site Visit	No site visit to date
Priority Overview	Medium priority

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Designs = £2,000
Capital works = £48,000</td></tr>
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Q3: Oct-Dec
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<tr><td>Photographic Record</td><td>No photographic record - No site visit to date</td></tr>
<tr><td>Other information</td><td></td></tr>
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Hem Heath & Newstead Woods

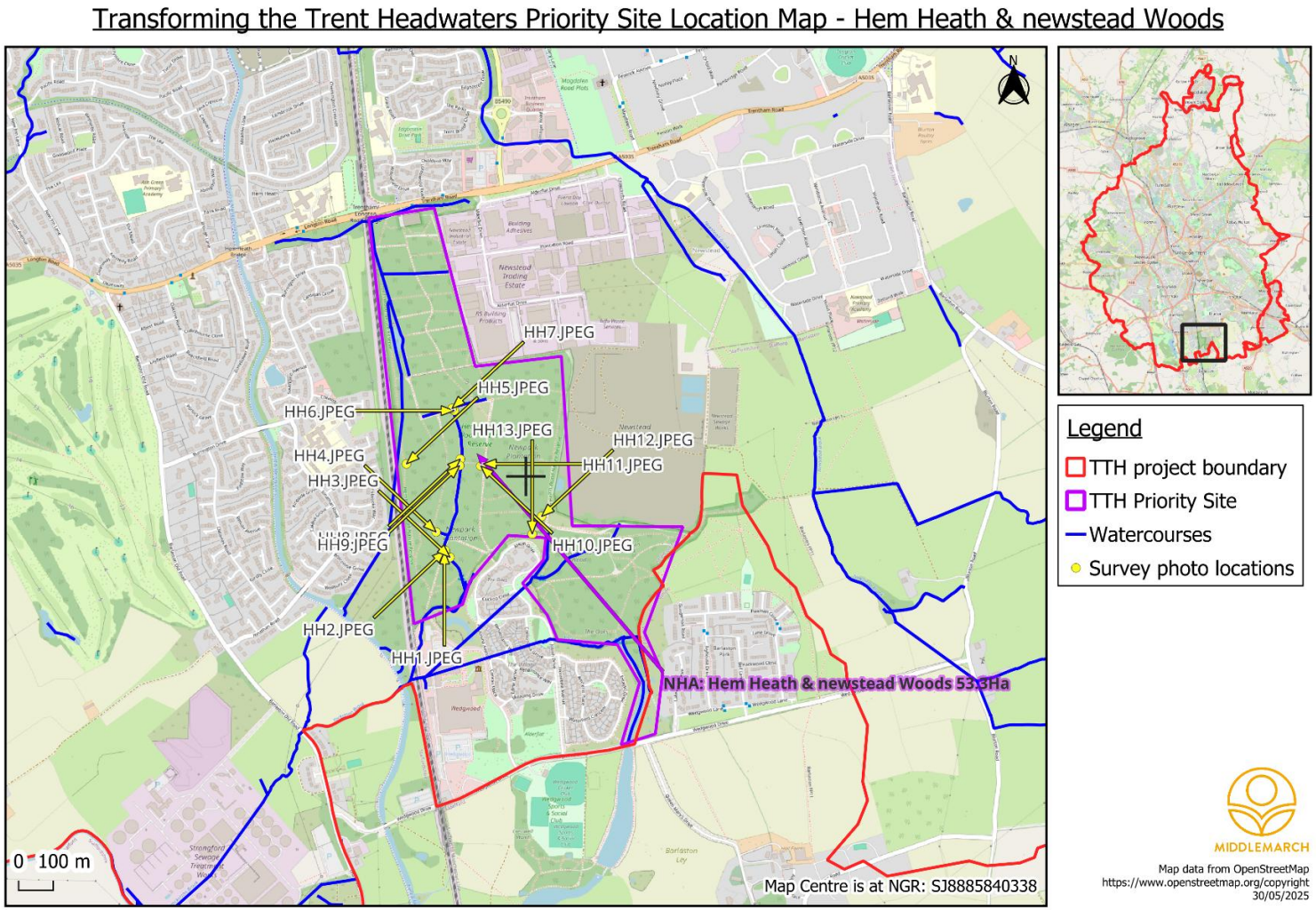

Figure 56. Map showing location and survey photos at Hem Heath & Newstead Woods.

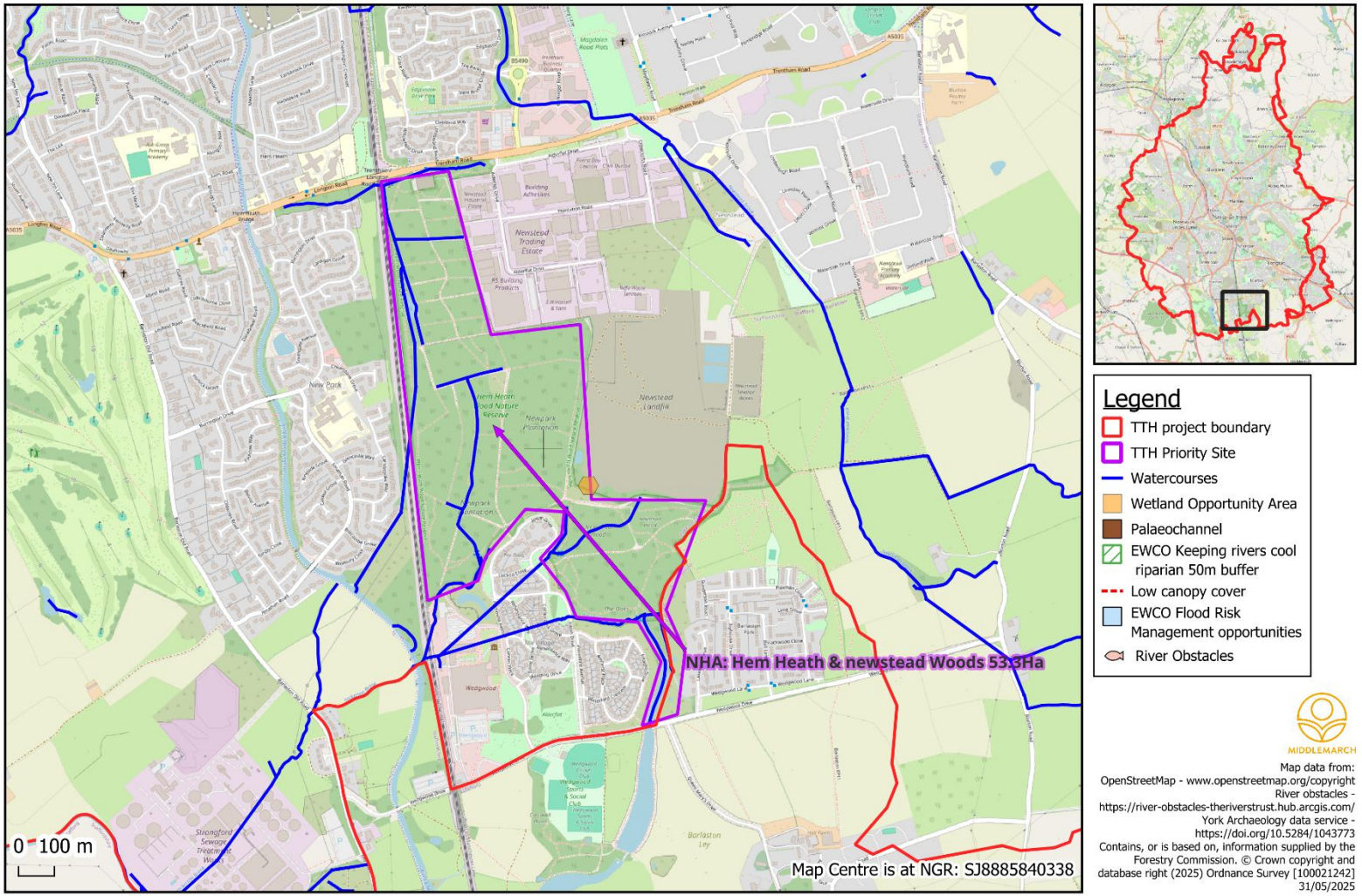

Figure 57. Map showing restoration opportunities at Hem Heath & Newstead Woods

Watercourse / water body catchment	Yockerton Brook
District	Stoke on Trent
Grid Reference	SJ 88785 40330
Size	53.3Ha
Public Access	Yes – This reserve has an extensive network of footpaths and tracks
Site description	The area of the reserve is approximately 53 hectares. There are four woods: the Oaks, at the southern end, is known to have been woodland for over 400 years; Newstead Woods, Newpark Plantation and Hem Heath were planted, on former farmland, in the mid-1800s. Although parts of the site may once have been heathland, there is no heath today. There is a network of walking trails in the woods. The woodland is managed so that it can regenerate naturally, and remain as woodland in the long term. Individual trees or small groups of trees may be felled so that a more open canopy will let seedlings establish themselves. The management of the wood is intended to ensure that a range of trees is maintained. The species include oak, ash, cherry, sycamore and beech. An understorey of woody shrubs is encouraged, including hazel, rowan and hawthorn, which provide homes for wildlife. The central/southern region around the boundary between Newpark Plantation and Newstead Wood supports some wet woodland/willow carr habitat. There is an extensive network of drainage ditches which aids in keeping most of the site dry and facilitates widespread access along the network of tracks.
Restoration measures	Creation of wet woodland: During the site visit, many kilometres of drainage ditches were observed which successfully maintain the majority of the site as a dry woodland habitat. Blocking these ditches and the creation of impounding contour bunds will allow for areas of the woodland to re-wet and hold water. This will create a diverse mosaic of broadleaf woodland, wet woodland and wetland habitats, increasing the biodiversity value of the woodland.
Constraints	Re-wetting of the site may render some tracks or footpaths difficult to pass and designs/levels should consider this.

<table>
<tr><td></td><td>Footpaths can be built on top of impounding bunds to function as both a bund and a raised walkway.</td></tr>
<tr><td>Date of Site Visit</td><td>24th April 2025</td></tr>
<tr><td>Priority Overview</td><td>Medium priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £20,000
Designs = £2,000
Capital works = £18,000</td></tr>
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Q3: Oct-Dec
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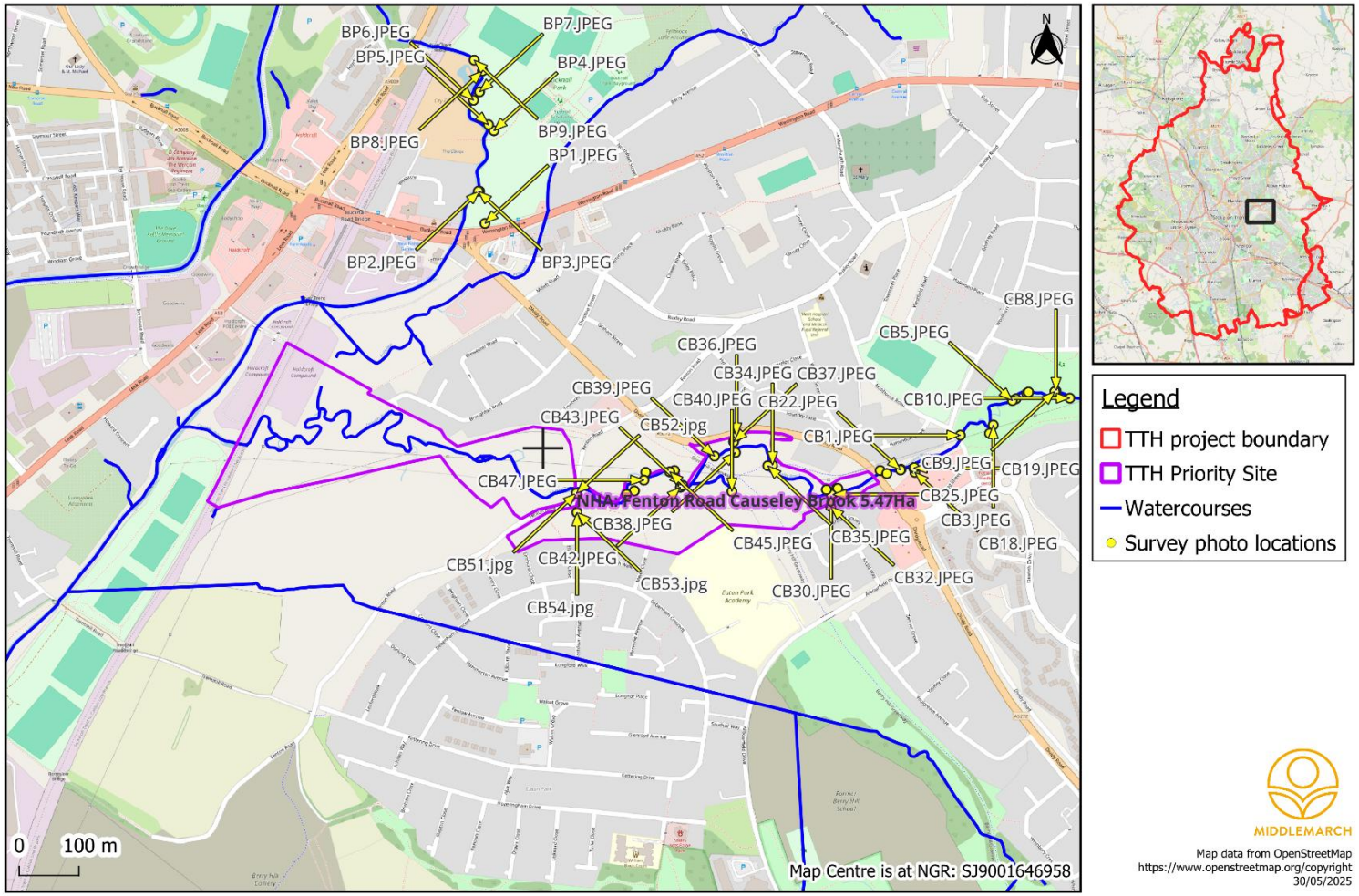
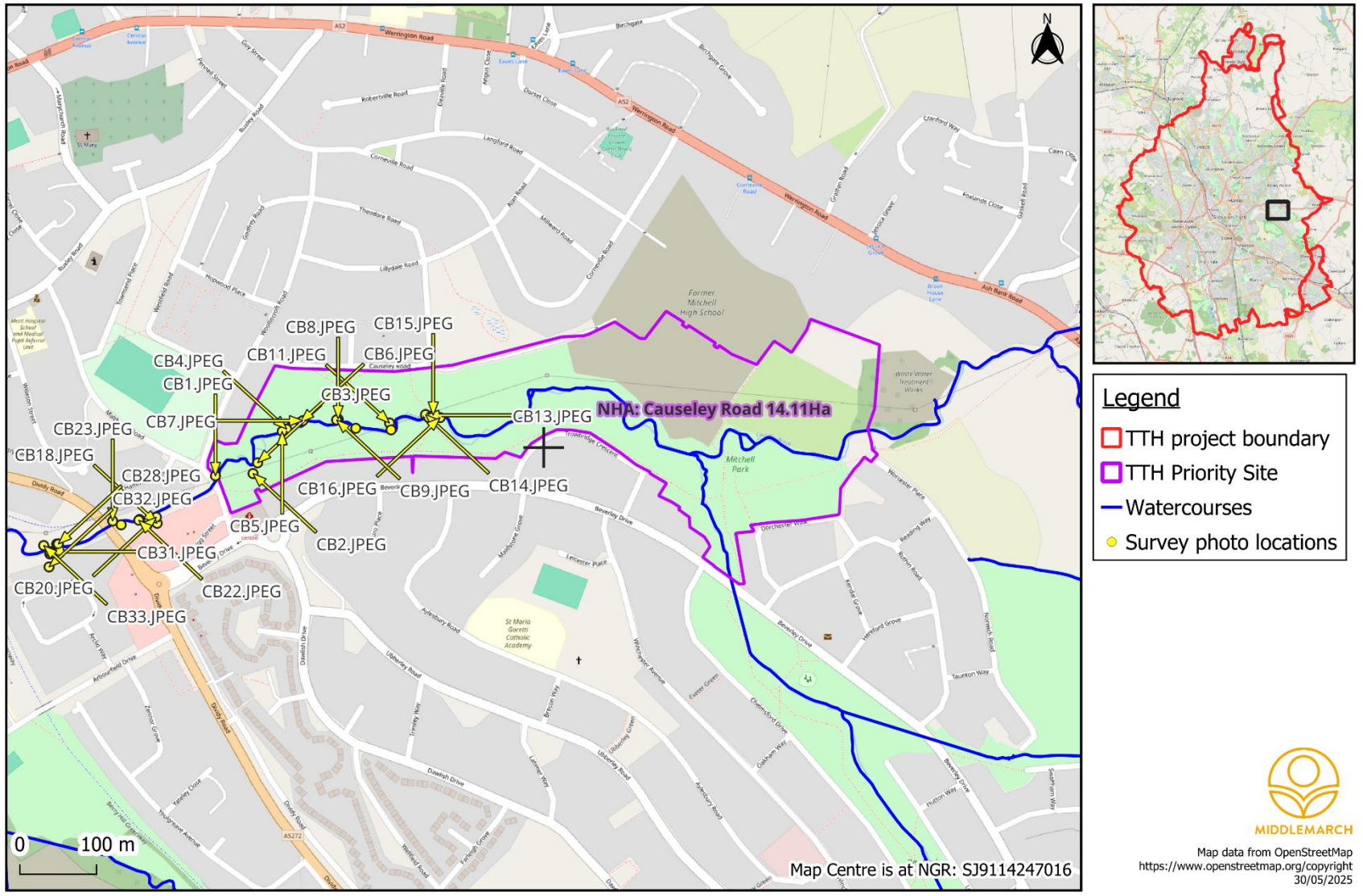
Photographic Record	 *Figure 58: Photograph taken at Hem Heath & Newstead Woods.* Additional photos are available in the separate 'Appendix 8 – Survey photos catalogue'.
Other information	

Fenton Road/Causeley Brook

Transforming the Trent Headwaters Priority Site Location Map - Fenton Road Causeley Brook



Transforming the Trent Headwaters Priority Site Location Map - Causeley Road

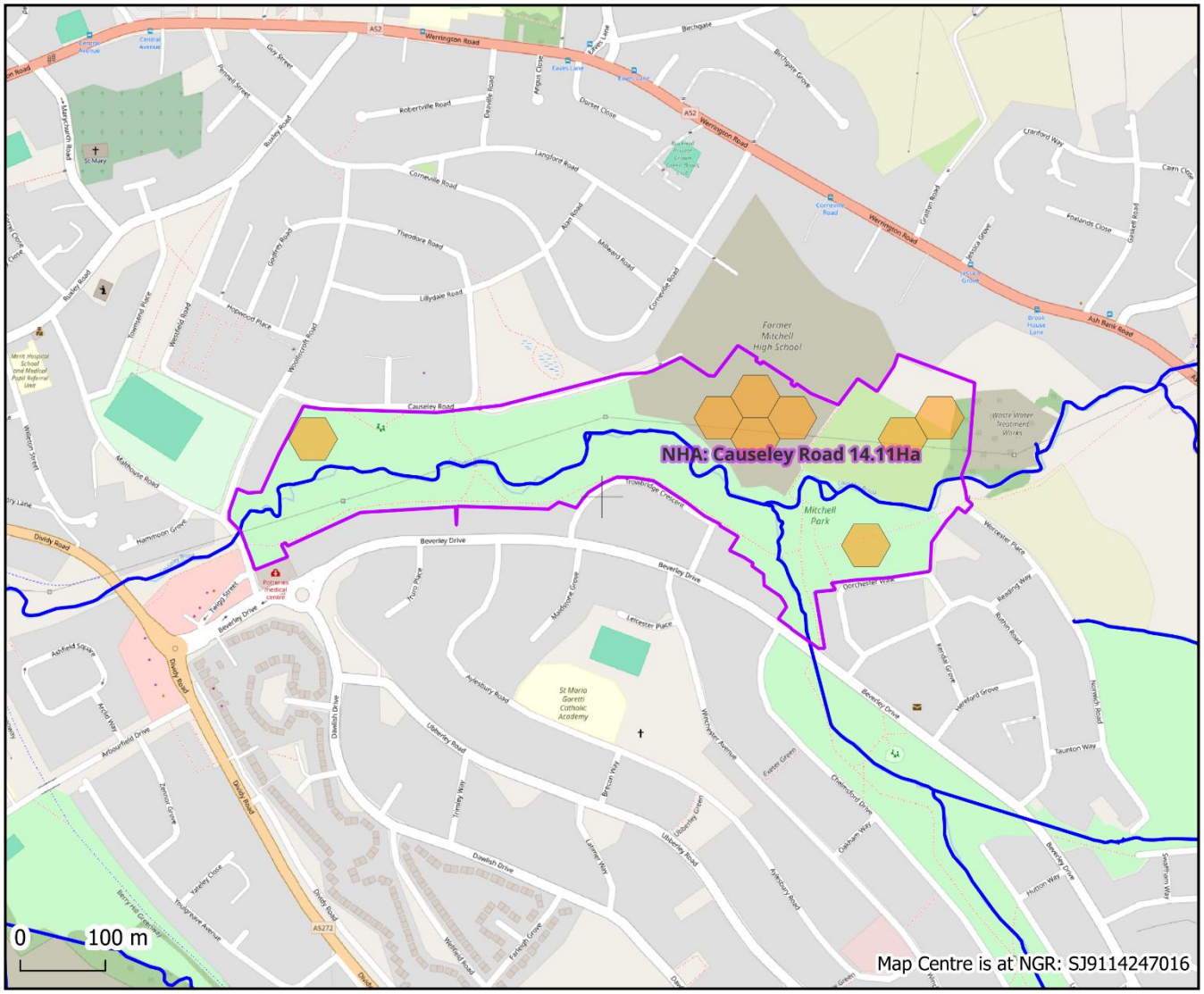


Legend

- TTH project boundary
- TTH Priority Site
- Watercourses
- Survey photo locations

MIDDLEMARCH

Transforming the Trent Headwaters - Priority Site opportunties - Causeley Road



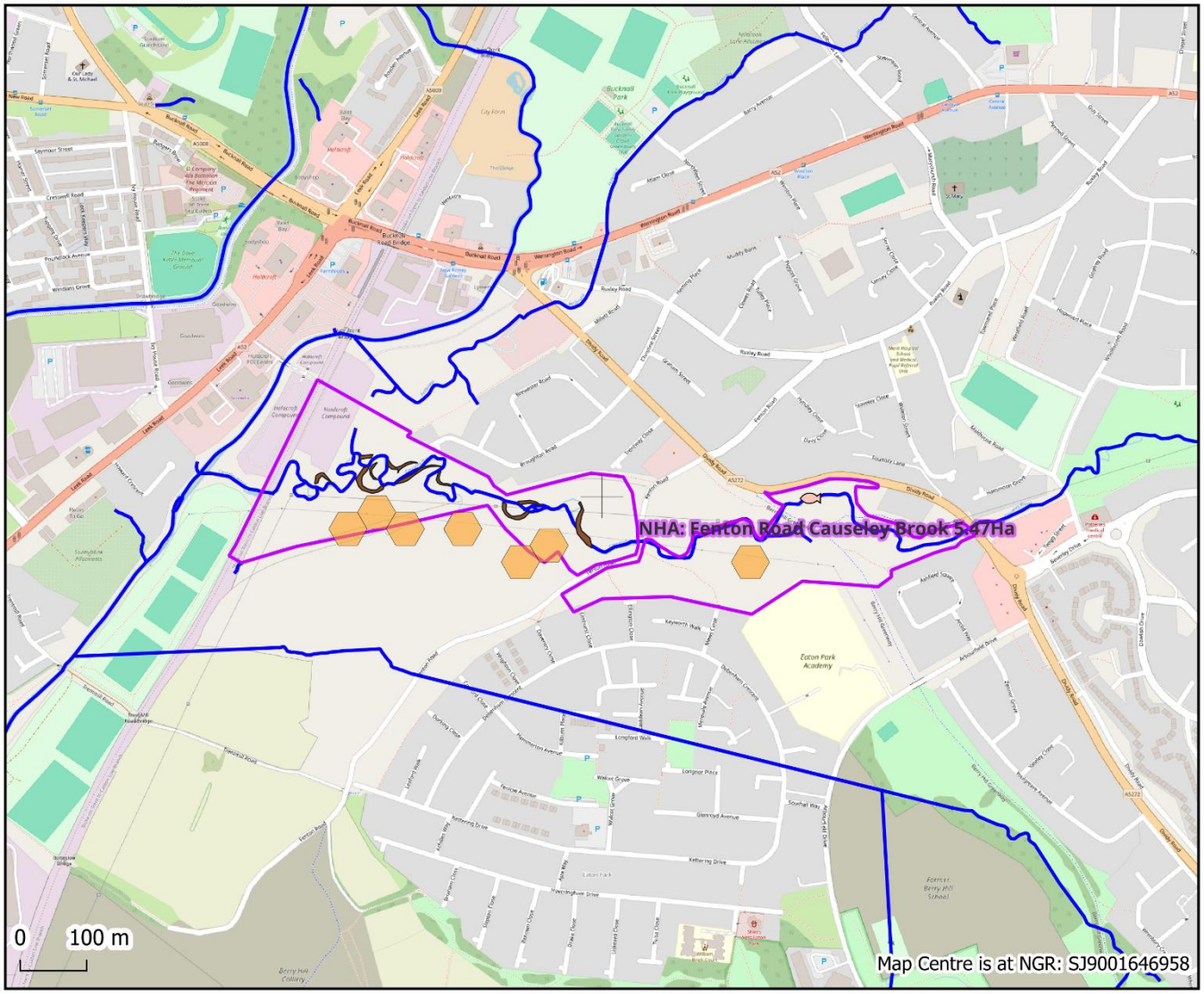
Legend

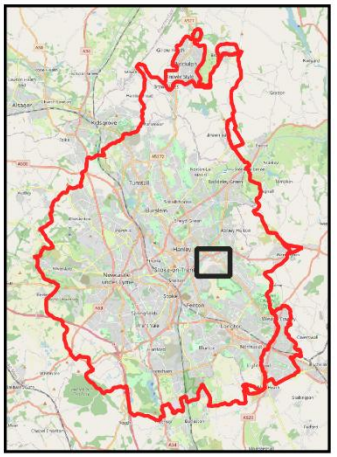
- TTH project boundary
- TTH Priority Site
- Watercourses
- Wetland Opportunity Area
- Palaeochannel
- EWCO Keeping rivers cool riparian 50m buffer
- Low canopy cover
- River Obstacles

MIDDLEMARCH

Map data from:
OpenStreetMap - www.openstreetmap.org/copyright
River obstacles - https://river-obstacles-theriverstrust.hub.arcgis.com/
York Archaeology data service - https://doi.org/10.5284/1043773
30/05/2025

Transforming the Trent Headwaters - Priority Site opportunties - Fenton Road Causeley Brook





Legend

- TTH project boundary
- TTH Priority Site
- Watercourses
- Wetland Opportunity Area
- Palaeochannel
- EWCO Keeping rivers cool riparian 50m buffer
- Low canopy cover
- River Obstacles

MIDDLEMARCH

Map data from:
OpenStreetMap - www.openstreetmap.org/copyright
River obstacles - https://river-obstacles-theriverstrust.hub.arcgis.com/
York Archaeology data service - https://doi.org/10.5284/1043773
30/05/2025

Watercourse / water body catchment	Causeley Brook
District	Stoke on Trent
Grid Reference	SJ 91068 47051
Size	14.11Ha & 5.47Ha
Public Access	Yes. Public footpath follows watercourse. Playing fields within Causeley Road Park, Mitchell Park and site of Former Mitchell High School
Site description	Causeley Road & Fenton Road/Causeley Brook This reach of Causeley Brook exhibits a wide range of semi-natural and modified sections. The upper reach within the 'Causeley Road' site demonstrates some valuable hydro-geomorphological processes and is predominantly unconstrained by modifications. This reach is heavily shaded and as such, there is an absence of in-river aquatic macrophytes which negatively impacts the habitat value. Occasional woody structures in this section provide complexity and facilitates bed morphology variation as gravels are mobilised and sorted into bars and riffle habitats. The lower site at 'Fenton Road/Causeley Brook' is considerably more modified with artificial structures within the channel and along the banks which impound sections of the river and armour the banks, reducing and in some places eliminating natural processes. This section presents more significant opportunities for improvement.
Restoration measures	**Riparian Canopy management:** The riparian zone of Causeley Brook supports a contiguous stand of moderate to densely shading tree canopy. Management of this canopy to create more open, dappled shade would benefit in-river productivity and facilitate growth of aquatic macrophytes. Coppicing and/or laying of suitable trees would allow for the canopy to be opened up. The area immediately upstream of Malthouse Road bridge is uncanopied and would benefit from some tree planting to provide shade and reduce water temperatures in dry summer periods. **Weir removal:** The removal of the dilapidated weir at SJ 85779 44170 would re-naturalise the impounded reach of Causeley Brook and would remove the barrier to fish movement. During the site visit, the purpose of the weir was not determined (also in previous site visits made by the Wild Trout Trust). Removal of this weir appears to be a relatively simple operation as large portions of its structure are wooden. Removal of the small informal weir at SJ 90872 47053 would be beneficial to restore natural flow and gravel movement in this location. **Fish passage improvements:** Opportunities are present for improving fish and eel passage through the culverts under Malthouse Road and Dividy Road. Retrofit eel boards and fish baffles could be installed to improve these structures. **In-channel structural complexity – floodplain and palaeochannel reconnection: The** reach of Causeley Brook currently supports little in-channel habitat and flow diversity. The introduction of structural complexity in the form of boulders and large

	woody debris will enhance the habitat and encourage hydro-geomorphological process to occur which will include bed and bank scour, resulting in the movement and addition of gravel substrate. Woody structures will also help retain material in the reach which will benefit spawning fish and invertebrate populations. Increasing the amount of retained allochthonous organic matter will provide greater resources for detritivorous invertebrates, feeding the higher food web within the river. **INNS control:** Himalayan balsam is present along considerable lengths of the banks of Causeley Brook and a control/eradication programme should be established to compliment the other restoration interventions. A catchment wide INNS control programme would be very beneficial, however, localised control and eradication is also beneficial and can help to protect habitats from excessive silt inputs when INNS die back in the winter months. **Wetland/pond creation:** Wetland opportunity mapping has identified opportunities for wetland or pond creation within this site. Standing water and wetland habitat is rare in this area and creation of this type of habitat would be beneficial for wildlife that rely on this. As the site is frequented by walkers and is used for ball games, the positioning of these wetlands would need to be agreed in consultation with local council and other stakeholders. These ponds/wetlands could be created in the locations of historic palaeochannels of which there are ten within this reach of Causeley Brook.
Constraints	This site is accessed by the public for the majority of its length. Footpaths are close by but not in any risk zone to works of this scale. Causeley Brook passes under two roads in this section therefore any LWD or other materials incorporated into the channel must be securely fixed to prevent movement downstream. Electricity pylons are situated within 20m of the watercourse in three locations and must be considered when accessing the site with tall machinery, however the proposed works pose little risk to these. As with all weir removals, further investigations into the structure and purpose of the weir should be conducted. The function of this weir is unclear and despite its removal appearing to not have adverse impacts on river bank stability, it should be confirmed that its removal will not cause significant bed erosion or knickpoint migration which could impact on structures close to the river.
Date of Site Visit	29th April 2025
Priority Overview	High Priority
Estimated budget	Total cost = £40,000 Designs = £4000 Capital works = £36,000

Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar

Year 1				Year 2				Year 3				Year 4				Year 5			
Q1	Q2	Q3	Q1	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Photographic Record

Figure 59: Photograph taken at Fenton Road (Causeley Brook)

Additional photos are available in the separate ‘Appendix 8 – Survey photos catalogue’.

Other information

Leek New Road (north of railway)

Transforming the Trent Headwaters Priority Site Location Map - Leek New Road (north of railway)

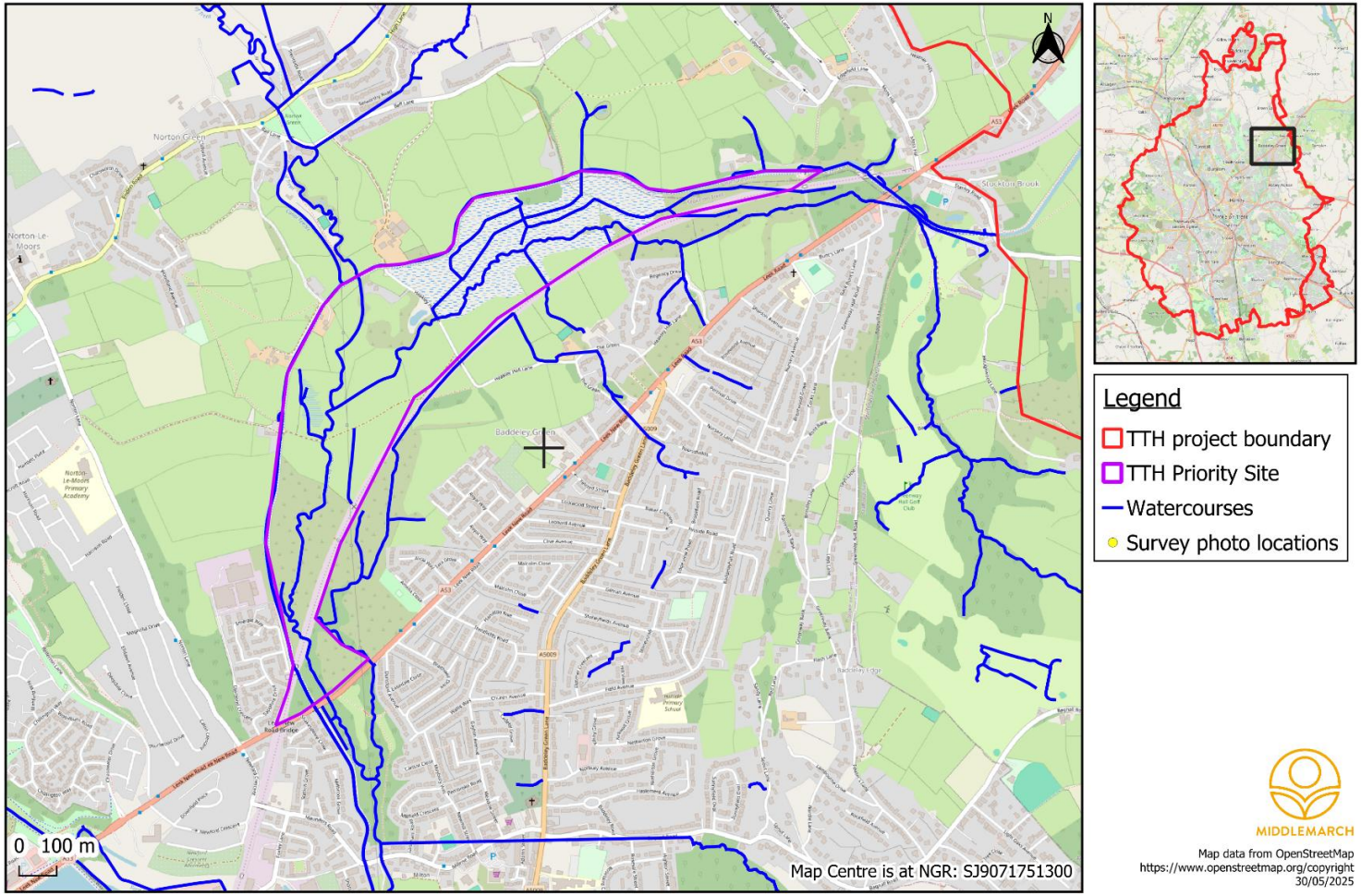


Figure 60 Map - NHA Priority site location map - Leek New Road (north of railway)

Transforming the Trent Headwaters - Priority Site opportunities - Leek New Road (north of railway)

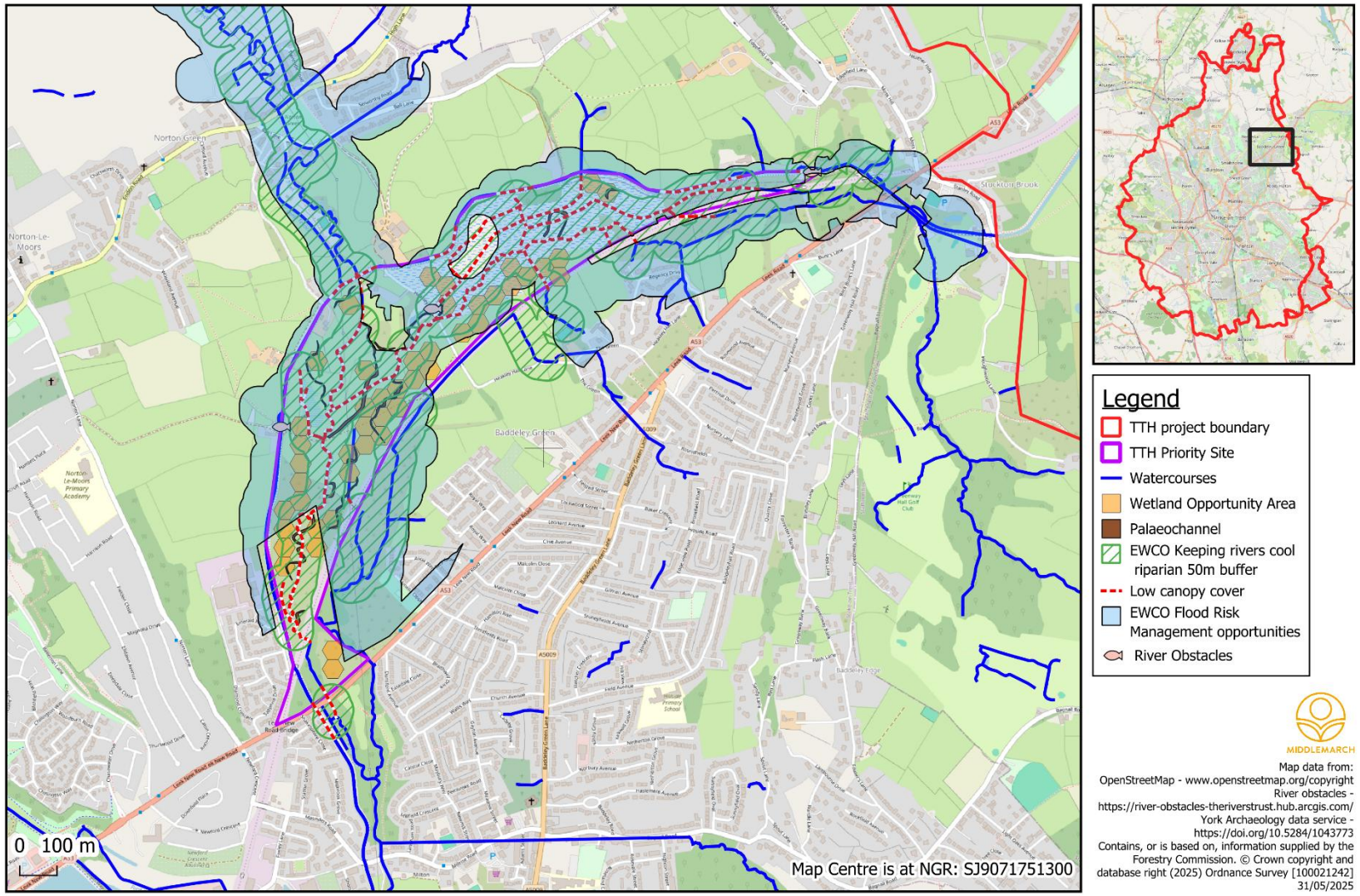


Figure 61 Map - NHA Priority site opportunities - Leek New Road (north of railway)

Watercourse / water body catchment	Head of Trent
District	Staffordshire Moorlands
Grid Reference	SJ 90365 51612
Size	46.75Ha
Public Access	Minimal public access
Site description	A wetland/wet woodland mosaic floodplain habitat along the valley bottom alongside the Head of Trent.
Restoration measures	**Pond creation:** large areas of this site have been identified as potential wetland creation areas. These areas are within the floodplain and existing drained wetland areas and would be simple to re-create. **Palaeochannel reinstatement:** fourteen palaeochannels have been identified within this site. These areas could be reconnected with the main stem of the watercourse through the installation of flow deflectors that divert higher flows through side channels. **Ditch blocking and wetland re-wetting:** analysis of lidar and existing maps of watercourses/ditches indicates an extensive network of straight, artificial drainage ditches throughout this site. Blocking of these ditches will help in rewetting the site, creating wetland areas and wet flushes which will benefit wetland plant and animal species and act as natural flood management by slowing the flow of water across these habitats. Storing more water within wetlands will also provide resilience to the catchment by holding water in the catchment which percolates more slowly and can help to maintain healthy base flows in the watercourse during dry periods. Creation and improvement of wetlands can also offer additional ecosystem services such as carbon sequestration as organic matter is held with wetlands. **NFM and keeping rivers cool planting:** Almost the entire site has been identified as being suitable for additional tree planting which would serve two purposes a) keeping rivers cool during periods of hot, dry weather by providing shade to the watercourse

<table>
<tr><td></td><td>habitats and reducing solar irradiation b) providing natural flood management by contributing to surface roughness within the floodplain. Trees and scrub act to slow down overland flows and in this location, these benefits have been identified.

Culvert fish easement: There is a culverted road crossing within this site where Heakley Hall Lane passes over the watercourse. Improvements to this culvert would offer improved fish passage and potential improvements to the aquatic habitats upstream as improvements to the impounded reach would be made, allowing for natural flow and gravel movements to be reinstated.</td></tr>
<tr><td>Constraints</td><td>Road access across Heakley Hall Lane</td></tr>
<tr><td>Date of Site Visit</td><td>Site not visited to date</td></tr>
<tr><td>Priority Overview</td><td>Medium priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £30,000
Designs = £2,000
Capital works = £28,000</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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<tr><th colspan="4">Year 1</th><th colspan="4">Year 2</th><th colspan="4">Year 3</th><th colspan="4">Year 4</th><th colspan="4">Year 5</th></tr>
<tr><th>Q1</th><th>Q2</th><th>Q3</th><th>Q1</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th></tr>
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<tr><td>Photographic Record</td><td>No photographic record – site not visited to date.</td></tr>
<tr><td>Other information</td><td></td></tr>
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Apedale Country Park

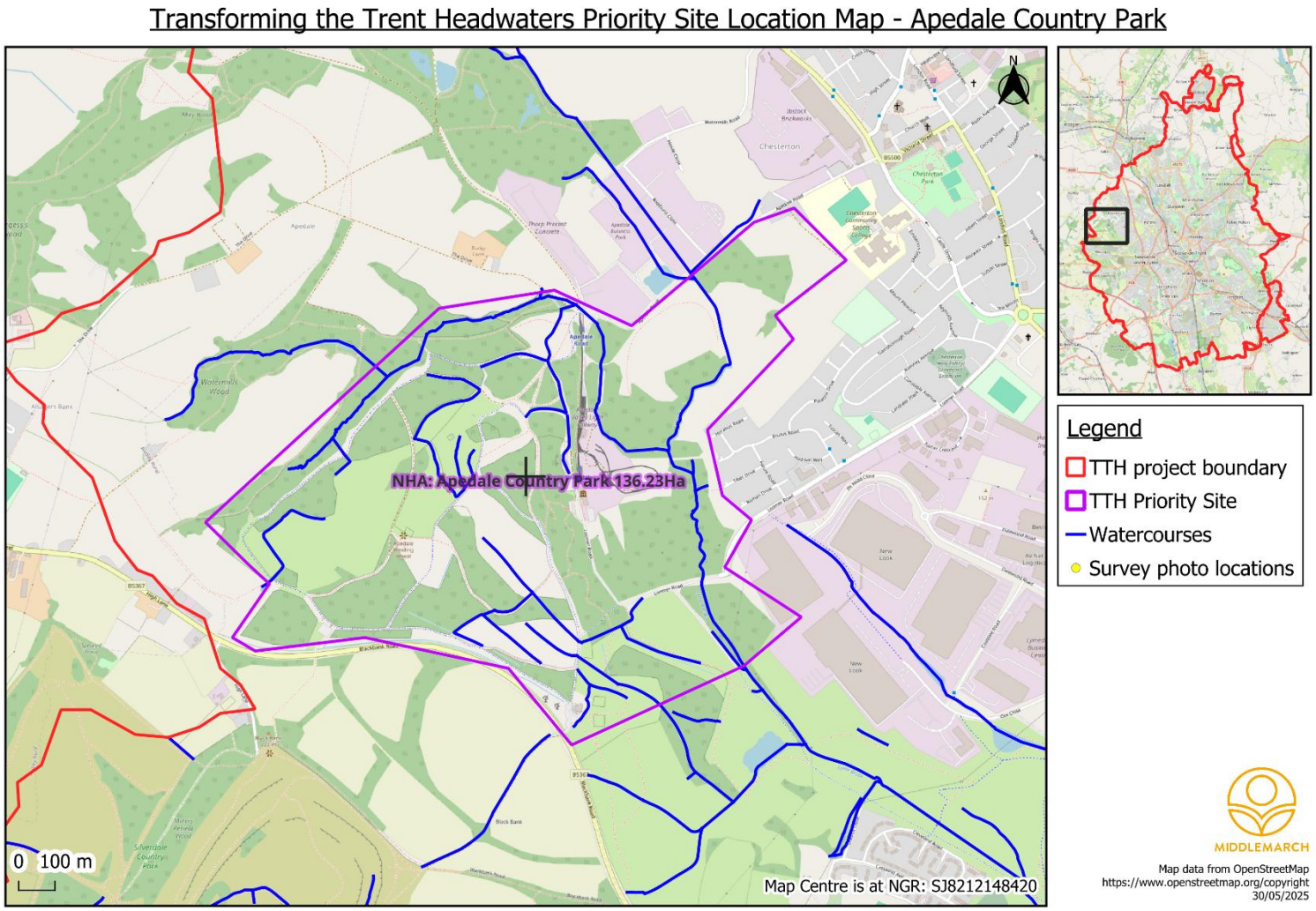

Figure 62 Map - NHA Priority site location map - Apedale Country Park

Transforming the Trent Headwaters - Priority Site opportunties - Apedale Country Park

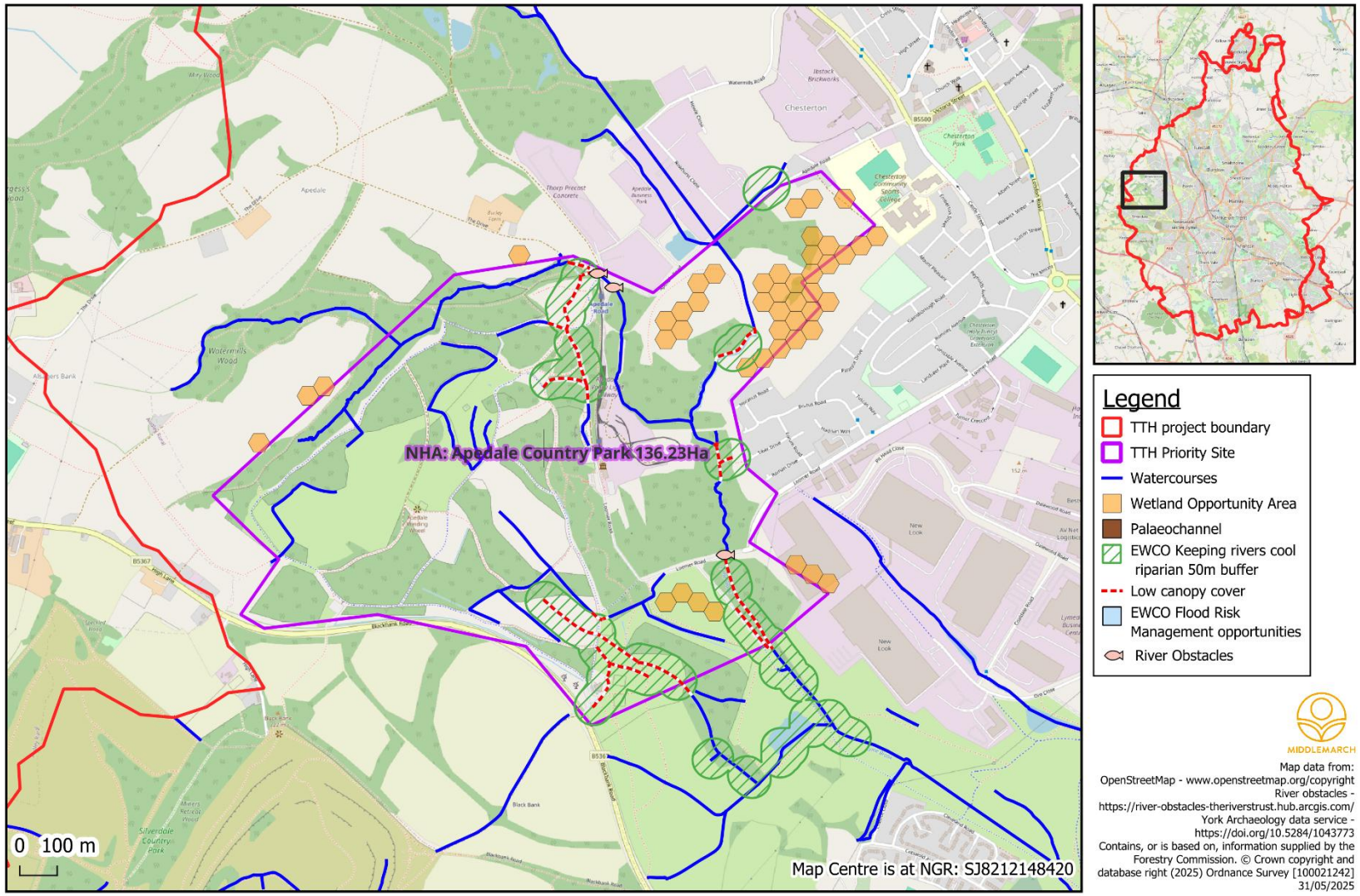

Figure 63 Map - NHA Priority site opportunities - Apedale Country Park

Watercourse / water body catchment	Lyme Brook
District	Newcastle-under-Lyme
Grid Reference	SJ 82121 48420
Size	136.23Ha
Public Access	Yes – open access across the site through extensive network of footpaths and access tracks.
Site description	Apedale Community Country Park is Staffordshire's newest Country Park. The centre offers Family nature trails, pond dipping, guided walks, organised events and festivals, educational activities and special projects.
Restoration measures	**Pond creation:** significant areas of this site have been identified as potential wetland creation areas. These are predominantly open area of grassland/rush pasture and offer opportunity to create scrapes and biodiversity ponds. **Ditch blocking and wetland re-wetting:** analysis of lidar and existing maps of watercourses/ditches indicates an extensive network of straight, artificial drainage ditches and culverts throughout this site. Blocking of these ditches will help in rewetting the site, creating wetland areas and wet flushes which will benefit wetland plant and animal species and act as natural flood management by slowing the flow of water across these habitats. Storing more water within wetlands will also provide resilience to the catchment by holding water in the catchment which percolates more slowly and can help to maintain healthy base flows in the watercourse during dry periods. Creation and improvement of wetlands can also offer additional ecosystem services such as carbon sequestration as organic matter is held with wetlands. NFM and keeping rivers cool planting: Several areas of site has been identified as being suitable for additional tree planting for keeping rivers cool during periods of hot, dry weather by providing shade to the watercourse habitats and reducing solar irradiation.

<table>
<tr><td></td><td>Culvert fish easement: There is a culverted road crossing within this site where Loomer Road passes over the watercourse. Improvements to this culvert would offer improved fish passage and potential improvements to the aquatic habitats upstream as improvements to the impounded reach would be made, allowing for natural flow and gravel movements to be reinstated.</td></tr>
<tr><td>Constraints</td><td>Public access to the site would need to be maintained as well as Loomer Road if works are to be undertaken to the culvert on Lyme Brook at this location.</td></tr>
<tr><td>Date of Site Visit</td><td>Site not visited to date</td></tr>
<tr><td>Priority Overview</td><td>Low priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £25,000
Designs = £2,000
Capital works = £23,000</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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<tr><td>Q1</td><td>Q2</td><td>Q3</td><td>Q1</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td></tr>
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<tr><td>Photographic Record</td><td>No photographic record to date - Site not visited to date</td></tr>
<tr><td>Other information</td><td></td></tr>
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Clayton Lane

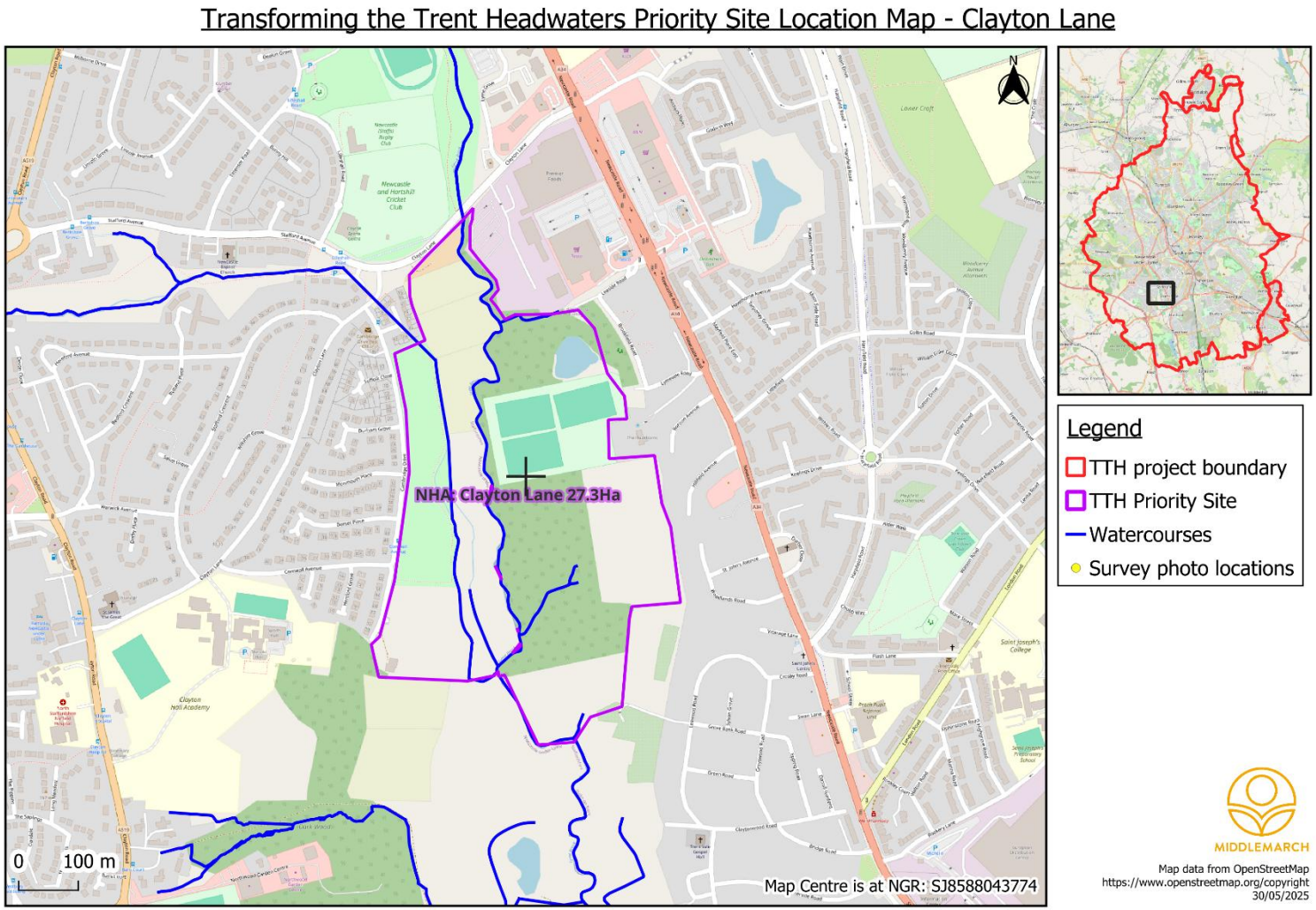

Figure 64 Map - NHA Priority site location map - Clayton Lane

Transforming the Trent Headwaters - Priority Site opportunities - Clayton Lane

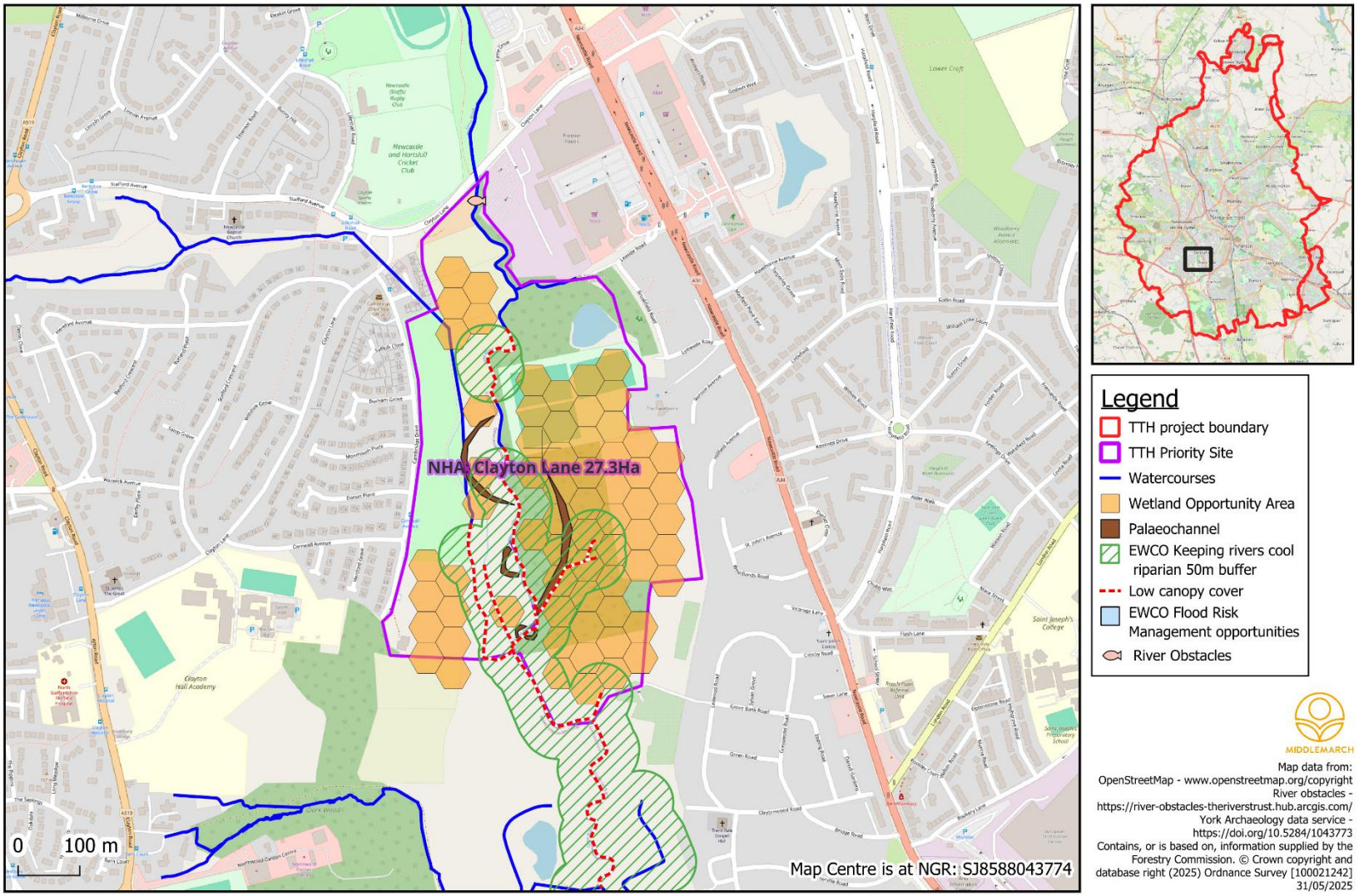

Figure 65 Map - NHA Priority site opportunities - Clayton Lane

Watercourse / water body catchment	Lyme Brook
District	Newcastle-under-Lyme / Stoke on Trent
Grid Reference	SJ 85880 43774
Size	27.3Ha
Public Access	Yes – access via footpaths on right bank and via playing fields on left bank.
Restoration measures	**<u>This site offers significant restoration potential and lends itself to being classed as a 'flagship ' project.</u>** **Weir removal:** A weir at NGR: SJ 85775 44176 was identified in the 2016 report produced by the Wild Trout Trust 'Lyme Brook and Causley Brook: Report and Proposal by the Wild Trout Trust - 17/02/2016'. This weir poses a significant barrier to fish migration and impedes bed substrate movement within the channel of Lyme Brook. The weir impounds approximately 300m of the watercourse up to NGR SJ 85761 44468 and negatively affects bed habitat and hydro-geomorphological processes such that the river bed in this reach is accreted with silt and is of poor quality. Removal or easement of this weir should be considered which could include either the full removal (dependent on nearby infrastructure – see constraints below) or partial removal/easement through the removal of some of the crest of the weir and installation of a rock ramp structure to reinstate fish passage. Only full removal will fully restore the impounded reach and this would be the preferred option. **Restoration of Bridget's Pool:** Improvements to the pond could include installation of exclusion zones to allow establishment of reedbeds and marginal habitat, laying of riparian trees to create littoral habitat complexity to provide habitat refuge for juvenile fish and invertebrates and opening the canopy to increase light levels around the pond shoreline which will stimulate macrophyte growth in the shallow areas. Records show occurrences of algal blooms within this pool Wetland creation / wet woodland / wet meadows: **Keeping rivers cool riparian tree planting:** Approximately 1.3km of watercourse within this site has been identified as providing opportunity for riparian tree planting to 'keep rivers cool'. Creation of buffer strips along these reaches would provide resilience to the watercourse during hot periods by creating dappled shade and reducing solar irradiance. Tree/scrub cover will also provide refuge from predators for fish. Tree roots will also bind the river banks, providing resistance to erosion.

<table>
<tr><td></td><td>Reconnection of palaeochannels and increasing in-channel structural complexity: there are five palaeochannels identified at this site. Reconnection to these channels could be improved through placement of flow constrictors/deflectors which would accelerate floodplain connectivity during spate events. These could be in the form of securely fixed large woody structures or boulders which would force higher flows out of channel.

By utilising the floodplain more readily, habitat improvements would likely occur in the main stem of Lyme Brook as flow rates (and associated bed scour/gravel migration) would be lower and bed substrate would be retained in the channel, providing resilience to spawning habitats.</td></tr>
<tr><td>Constraints</td><td></td></tr>
<tr><td>Date of Site Visit</td><td>Site not visited to date</td></tr>
<tr><td>Priority Overview</td><td>High Priority</td></tr>
<tr><td>Estimated budget</td><td>Total cost = £50,000 (dependent on complexity of weir removal)
Designs = £4000
Capital works = £46,000</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
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Photographic Record	 *Figure 66. Photograph of weir at Clayton Lane (taken from Wild Trout Trust 2016 report).*
Other information	

Canal network

Watercourse / water body catchment	Canal network
District	
Grid Reference	
Size	
Public Access	Yes – towpath and canal users
Restoration measures	Floating reedbeds (or similar): provision of floating habitats at suitable locations along the canal network Management of canal feeder network: Riparian planting to keep the channels cool. Potential construction of in-line ponds within the feeder channels. Further consultations with the Canal and River Trust are required to determine appropriate restoration measures for the canal network. Consultations as part of this audit determined that in the short-term, restoration opportunities are limited due to established management plans for the network. A quick change of management is unlikely to happen and ongoing liaison and engagement with the Canal and River Trust, together with canal users and stakeholders will be required.
Constraints	Wayleaves across other land holdings may prevent additional management of feeder network. Navigation rights and capacity may limit the extent that habitat can be created within the canal network itself.
Date of Site Visit	
Priority Overview	
Estimated budget	Total cost = £ to be confirmed Designs = £ Capital works = £

Delivery Timeline **Q1: Apr-Jun** **Q2: Jul-Sep** **Q3: Oct-Dec** **Q4: Jan-Mar**	
Photographic Record	
Other information	

Year 1				Year 2				Year 3				Year 4				Year 5			
Q1	Q2	Q3	Q1	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

Riparian planting – Keeping rivers cool

Watercourse / water body catchment	Entire TTH project area
District	All
Grid Reference	n/a
Size	Entire TTH project area
Public Access	UNKNOWN – the sites included within this aspect of the project span the entire project area and have yet to be developed with respective landowners.
Site description	Analyses of riparian canopy cover have identified areas where riparian tree planting would be beneficial for providing shade to watercourses to protect aquatic habitats from climate change and to 'keep rivers cool'. Reaches have been identified where canopy cover is less than 20% and additional canopy cover is desirable. Length of watercourse with riparian shade < 20% - 88.6km. Tree planting and buffer strip desirable. Length of watercourses with riparian shade > 20% - 271.6km. No tree planting necessary
Restoration measures	Tree planting within the riparian strip and creation of riparian buffer strips will offer protection from higher summer temperatures and will provide additional habitat for wildlife. Opportunity mapping has identified up to 88.6km of riparian tree planting. These areas would ideally be fenced on both sides of the watercourse with stock proof fencing.
Constraints	Agricultural land may be lost due to the creation of buffer strips and close liaison with landowners/tenants and Natural England will be required to incorporate tree planting into any agri-environment scheme and to ensure compliance with RPA claims.
Date of Site Visit	No site visits undertaken
Priority Overview	High Priority
Estimated budget	Fencing per metre ≈ £8.00 Fencing of both banks along 88.6km = £1.4 million Tree planting per metre ≈ £10.00 Tree planting staggered across both banks along 88.6km = £886,000 The development phase would determine the full feasibility of locations for these interventions.

<table>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
<table>
<tr><td colspan="4">Year 1</td><td colspan="4">Year 2</td><td colspan="4">Year 3</td><td colspan="4">Year 4</td><td colspan="4">Year 5</td></tr>
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</table>
</td></tr>
<tr><td>Photographic Record</td><td>No photographic record to date - the sites included within this aspect of the project span the entire project area and have yet to be developed with respective landowners.</td></tr>
<tr><td>Other information</td><td></td></tr>
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Transforming the Trent Headwaters - Riparian Planting Opportunities

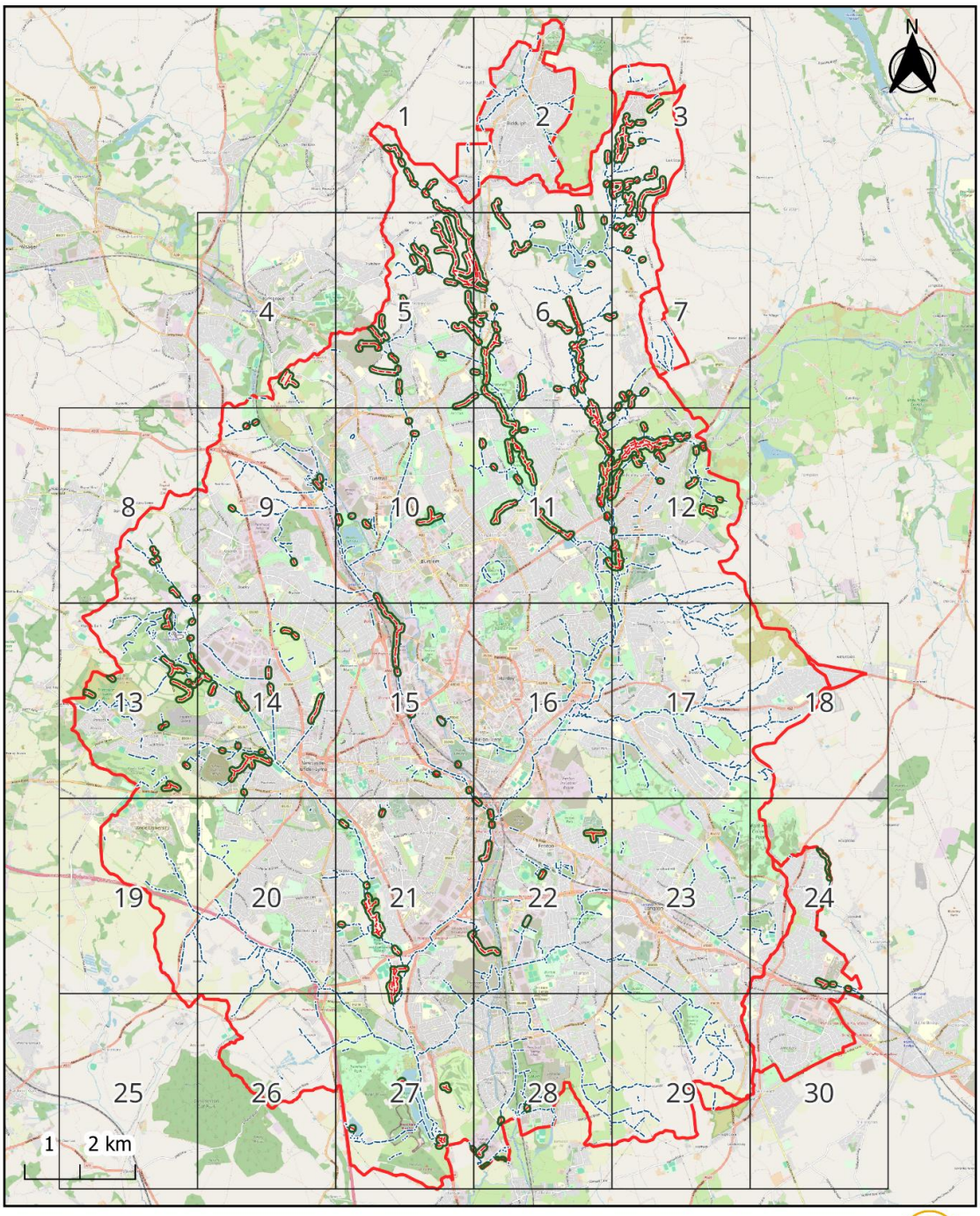

Figure 67 Map - Transforming the Trent Headwaters - Riparian Planting Opportunities

Barriers to migration – whole project area

Watercourse / water body catchment	All watercourses
District	All districts
Grid Reference	See **Error! Reference source not found.** in **Error! Reference source not found.**
Size	133 river obstacles
Public Access	
Site description	Culvert - 88 Lock - 15 Weir – 30
Restoration measures	Investigations into feasibility of removal/easement for the above river obstacles Canal locks are unlikely to be improved, however, culverts and weirs can be investigated and restoration options determined.
Constraints	
Date of Site Visit	
Priority Overview	
Estimated budget	Total cost = £ Further investigation required

<table>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
<table>
<tr><td colspan="4">Year 1</td><td colspan="4">Year 2</td><td colspan="4">Year 3</td><td colspan="4">Year 4</td><td colspan="4">Year 5</td></tr>
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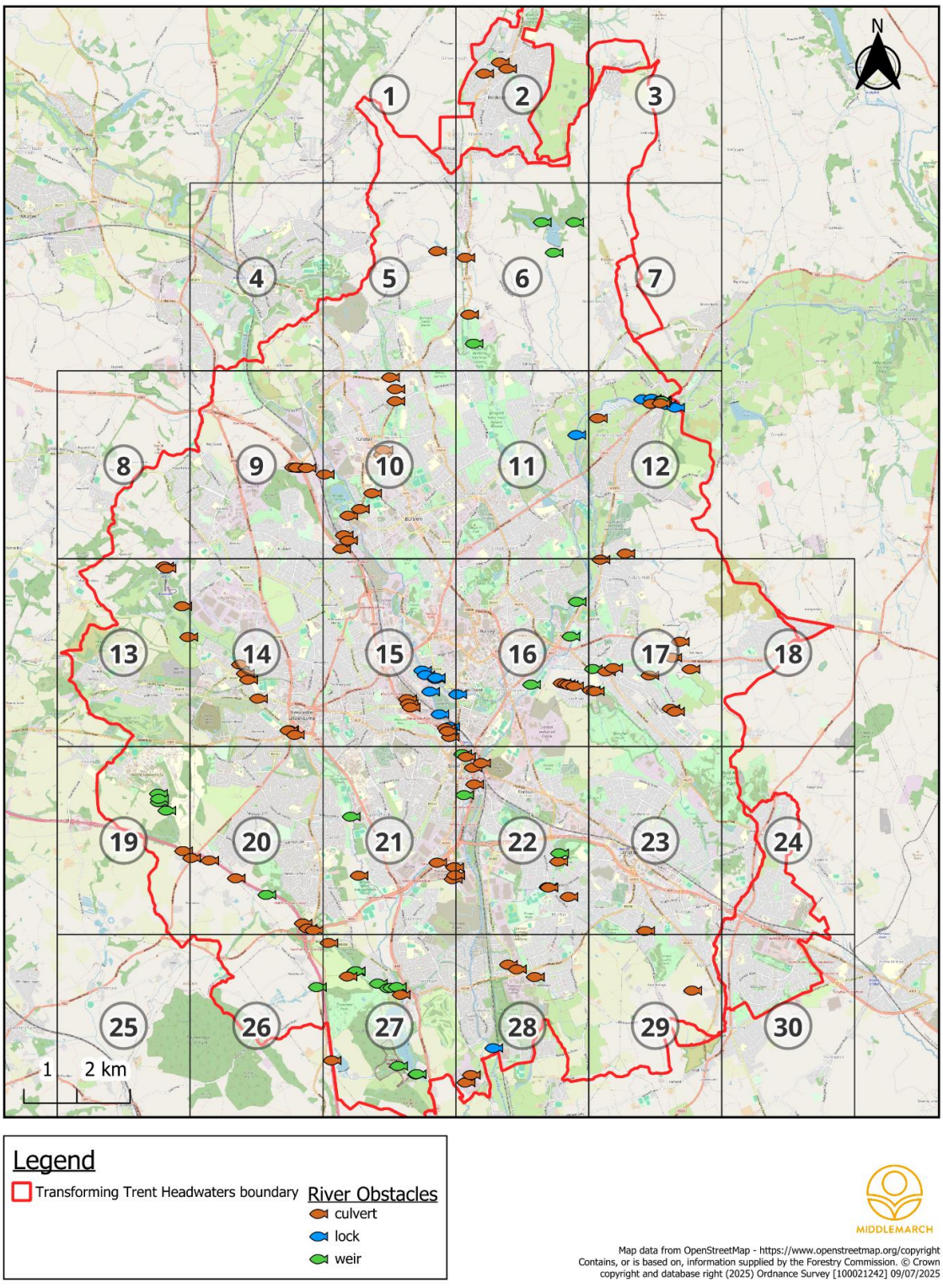

Figure 68. Map showing all river obstacles within the TTH project area.

Tree Planting – Flood Risk Management Opportunities

Watercourse / water body catchment	All watercourses
District	All districts
Grid Reference	Entire THH project area
Size	≈850Ha
Public Access	UNKNOWN
Site description	Areas across the TTH project area - ≈ 850Ha
Restoration measures	Tree planting opportunities have been identified across the TTH project area that would provide flood risk mitigation ecosystem services. The areas identified should be further investigated and consultation undertaken with relevant landowners and stakeholders. Recommendations for tree planting: Tree planting for flood management at a scale of 1600-2250 trees per hectare is recommended, with around 20-30% of the area remaining open. This approach aims to slow down water flow, reduce run-off, and improve soil infiltration, thus mitigating flood risks. **Benefits of Tree Planting for Flood Management:** Slowing Water Runoff: Trees can intercept rainfall and slow down runoff, reducing peak flows in rivers. Improving Soil Infiltration: Trees can increase the infiltration of water into the soil, reducing the amount of runoff that enters rivers. Stabilizing River Banks: Tree roots can help stabilize river banks, preventing erosion. Reducing Flood Damage: By slowing water flow and reducing peak flows, trees can help reduce flood damage. Improving Water Quality: Trees can help filter pollutants and sediment from runoff, improving water quality. Creating Habitat: New woodlands can provide habitat for various species.
Constraints	Landowner buy-in “The right trees in the right place” – consideration should be made for the habitat biodiversity value of the existing site.
Date of Site Visit	No site visits undertaken to date.

<table>
<tr><td>Priority Overview</td><td>Medium Priority</td></tr>
<tr><td>Estimated budget</td><td>Cost of tree planting per tree (including tree ship, spiral guard and labour) can range between £1.50 and £3.50 depending on a variety of factors e.g. tree size, species, location to be planted and labour/contractor costs. Therefore 2000 trees would cost between £2500 and £7000 per hectare. Large scale planting schemes will likely receive significant discounts on this cost.

Landowners, land managers and public bodies can apply to the England Woodland Creation Offer (EWCO) for support to create new woodland, including through natural colonisation, on areas as small as 1 hectare. Applicants could receive up to £10,200 per hectare, plus up to an additional £12,700 in stackable payments when delivering wider benefits to society, nature recovery and the environment, to support your woodland creation scheme.

Total cost = up to £5.9million</td></tr>
<tr><td>Delivery Timeline
Q1: Apr-Jun
Q2: Jul-Sep
Q3: Oct-Dec
Q4: Jan-Mar</td><td>
<table>
<tr><td colspan="4">Year 1</td><td colspan="4">Year 2</td><td colspan="4">Year 3</td><td colspan="4">Year 4</td><td colspan="4">Year 5</td></tr>
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<tr><td>Photographic Record</td><td>No photos – areas not investigated as part of this audit.</td></tr>
<tr><td>Other information</td><td></td></tr>
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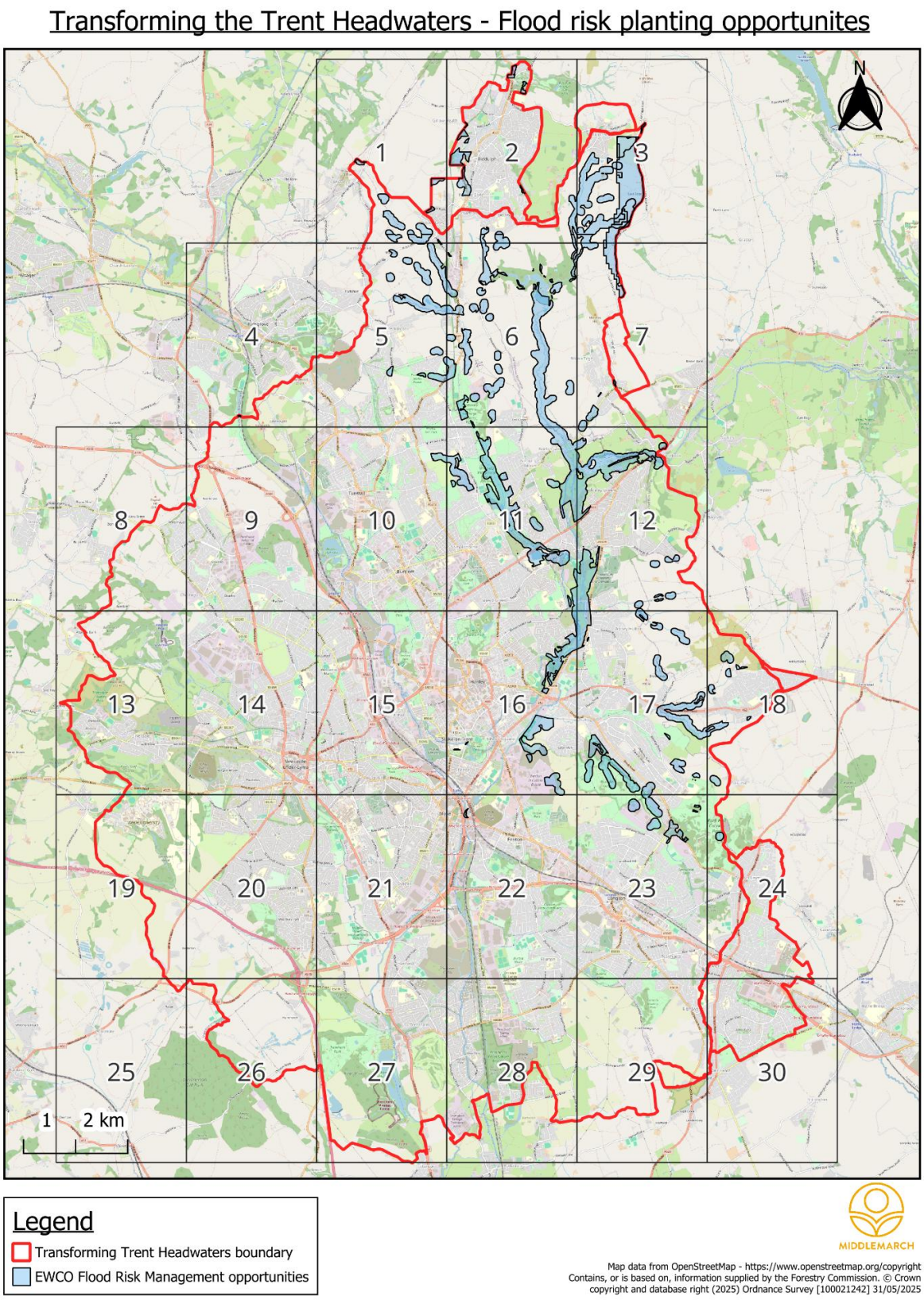

Figure 69. Map showing Flood Risk planting opportunities.

Addendum 1 – Project proposals -concepts developed by Groundwork West Midlands (Lyme Brook, Pool Dam Marsh and Canal Basin)

Please refer to the associated documents produced by Groundwork West Midlands.

1. Project Proposal – Lyme Brook – Park way section.docx
2. Pool Dam March Wetland Restoration Project Proposal.docx
3. Proposal for the Trent Valley Headwaters Project – Canal Basin.docx

Addendum 2 – Project proposals – concepts developed by Trent Rivers Trust (River Trent between the Boothen substation SJ 87864 44347 and Hanford roundabout SJ 86739 42717)

Please refer to the associated documents produced by Trent Rivers Trust

1. River Restoration proposals TRT StokeOT.pdf

Glossary

Allochthonous: Allochthonous material refers to material that has been imported into an ecosystem. In an aquatic ecosystem, this material is commonly arboreal and includes fallen trees and branches in a stream, and a layer of dead leaves on the riverbank.

Anadromous fish: Anadromous fish are those that migrate from saltwater to freshwater to spawn, meaning they spend part of their life cycle in both fresh and saltwater environments. They typically hatch in freshwater, move to the ocean to grow, and then return to the freshwater where they hatched to reproduce.

Biodiversity Net Gain: BNG is an approach to planning development. It makes sure that habitats for wildlife are left in a measurably better state than they were before the development.

Depleted reach: A "depleted reach" refers to a section of a river where the water flow is significantly reduced due to water abstraction, such as for hydropower generation. This reduced flow occurs between the point where water is taken out of the river (the abstraction point) and the point where it is returned (the discharge point).

Detritivorous: "Detritivorous" means feeding on or consuming detritus, which is dead organic matter. Detritivores are organisms that obtain nutrients by eating decomposing plant and animal parts, as well as faeces. They play a crucial role in ecosystems by breaking down dead matter and returning nutrients to the environment.

Diffuse pollution: Diffuse pollution, also known as non-point source pollution, refers to pollution that originates from many small, widespread sources rather than a single, identifiable point. These sources collectively contribute to pollution in a water body, even though each individual source may not have a significant impact on its own.

Ecological status: Ecological status is a measure of the health and quality of an ecosystem, specifically in the context of surface water bodies like rivers and lakes. It's assessed by evaluating various biological, physical, and chemical factors and determining how much the ecosystem deviates from a natural or undisturbed state. The overall goal is to classify water bodies based on their ecological quality, with the aim of achieving good or high status to protect ecosystems.

Ecosystem services: Ecosystem Services are the direct and indirect contributions ecosystems (known as natural capital) provide for human wellbeing and quality of life. This can be in a practical sense, providing food and water and regulating the climate, as well as cultural aspects such as reducing stress and anxiety.

GIS: GIS stands for Geographic Information System. It's a technology that uses computer software to store, manage, analyse, and visualize geographic data.

Hydro-morphology: Hydro-morphology describes the physical characteristics and water content of water bodies, including their shapes, boundaries, and how they interact with the surrounding environment. It considers both natural and human influences on the hydrology and geomorphology of these systems. In essence, hydro-morphology looks at the "hydro" (water flow and levels) and "morphology" (shape and form) of water bodies.

Impoundment: A river impoundment refers to a structure, like a dam or weir, that blocks or restricts the flow of a river, creating a body of water upstream. This structure can raise the water level and

store water for various purposes, such as hydroelectric power generation, flood control, and water supply.

LiDAR: LiDAR, which stands for Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.

Macrophyte: Macrophytes are aquatic plants growing in or near water. They may be either emergent (i.e., with upright portions above the water surface), submerged or floating.

Natural flood management: Natural Flood Management (NFM) is an approach to flood risk reduction that uses natural features and processes to store or slow down water. It aims to mimic or enhance the natural functions of catchments, floodplains, and coastal areas to manage floodwaters. NFM seeks to work with nature rather than against it, often complementing traditional flood defences.

Nature based solutions: Nature-based solutions are actions that utilise, protect, or restore natural or modified ecosystems to address societal challenges like climate change, biodiversity loss, and disaster risk reduction. They aim to simultaneously benefit people and nature by providing solutions that are both effective and sustainable.

Palaeochannel: A palaeochannel refers to an ancient river or stream channel that is no longer actively used by a river or stream. These are essentially old riverbeds, often filled with sediment and potentially containing geological information about past hydrological conditions.

Physico-chemical: refers to the river's physical and chemical characteristics that can impact water quality and the health of the aquatic environment. These parameters include factors like water temperature, dissolved oxygen, pH, and the presence of various dissolved chemicals.

Point source pollution: Point source pollution is pollution that originates from a single, identifiable source, like a pipe. Examples of point source pollution include discharges from factories and sewage treatment works.

River reach: In the context of rivers, a "reach" refers to a distinct section of a stream or river characterized by similar hydrologic conditions like discharge, depth, and slope. It's essentially a stretch of river where the conditions are fairly uniform, allowing for analysis and understanding of its characteristics.

Reason for not achieving good status (RNAG): "Reasons for not achieving good status" (RNAG) refers to the specific factors preventing a water body element from reaching "good" status, as defined by the Water Framework Directive (WFD). It helps identify the sources, activities, and sectors responsible for impacting the water body's quality.

Riparian zone: A riparian zone or riparian area is the interface between land and a river.

River catchment: A river catchment, also known as a drainage basin or watershed, is an area of land where all water flows into a single body of water, such as a river, stream, lake, or ocean. It's essentially a natural drainage system where water collects and flows downhill, eventually reaching a common outlet.

Riverbed substrate: Riverbed substrate refers to the material that makes up the bottom of a river. This material can be inorganic, such as rocks, gravel, sand, silt, or clay, or organic, such as plants, leaves, and decaying matter. The type and composition of the substrate play a crucial role in the river's ecosystem, influencing water quality, habitat for aquatic organisms, and flow patterns.

SWMI (Significant Water Management Issues): this is a concept used by the Environment Agency to identify and address key water-related challenges in England and Wales. SWMI reports help guide the development of River Basin Management Plans, which aim to improve water quality and protect the water environment.

Water Framework Directive: The Water Framework Directive (WFD) is a European Union (EU) environmental law aimed at protecting and improving water quality across all surface and groundwater bodies. Its main goals are to prevent deterioration of aquatic ecosystems, promote sustainable water use, and reduce pollution.