

Urban Opportunities Study

Sleaford,
Lincolnshire

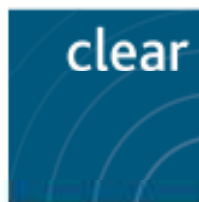
Lincolnshire Rivers Trust



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ENVIRONMENTAL



CLEAN WATER



FLOOD RISK

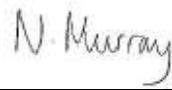
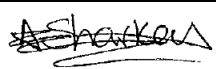


DRAINAGE



ECOLOGY

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1 Introduction and Background

1.1 Purpose of this Report

Clear Environmental Consultants, a trading division of RPS Environmental Management Ltd (Clear) was instructed by Lincolnshire Rivers Trust to carry out an Urban Opportunities Study of Sleaford in Lincolnshire (hereafter referred to as the 'site'). This included the River Slea, Nine Foot River and the Old River Slea between the A15 to the west of Sleaford and the A17 to the east.

1.2 Project Scope

This project comprises an urban opportunities study for Sleaford in Lincolnshire bringing together interested groups and organisations to identify a number of potential projects to benefit the water environment. Existing evidence and data collected from walkovers and stakeholder meetings have been used to inform the plan and map of project ideas which can then be used as a tool for gaining additional funding.

This project focuses on identifying opportunities to enhance the habitat along the River Slea and its tributaries in and around the town for the benefit of wildlife, water quality and people. Projects will look to achieve multiple benefits by improving the riparian habitat for wildlife and amenity use, while managing improving water quality.

1.3 Site Context and Location

The site comprises an approximately 4.1km stretch of the River Slea and surrounding waterbodies and tributaries, grid references TF 05117 45631 - TF 08425 47115. The Slea enters Sleaford via two watercourses, the River Slea and the Nine Foot River, which are additionally fed by springs. It passes through farmland before entering the centre of the town. To the east of Sleaford the river passes alongside an industrial estate before entering predominantly arable countryside. The location in a local context is illustrated on Figures 1 and 2:

Figure 1: Site location plan (blue line denotes waterbodies under consideration)



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Figure 2: Aerial image of the site and local landscape (blue line denotes watercourses under consideration)



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2 Methodology

2.1 Desk Based Assessment

Data regarding statutory and non-statutory designated sites, plus any records of protected or notable species and habitats was requested from the local ecological records centre and online resources, details of which are provided in Table 1 below.

Table 1: Consulted resources

Consultee/Resource	Data Sought	Search Radius from Boundary
Lincolnshire Environmental Records Centre	Site designations, protected/notable species records	2km
www.magic.gov.uk ¹	Statutory Site Designations	5km
www.natureonthemap.gov.uk ²	UK BAP Habitats	5km

2.2 Stakeholder Engagement Meeting

A stakeholder engagement meeting was held on 3rd February 2015 with Lincolnshire Rivers Trust, Environment Agency, North Kesteven District Council, Natural England, Sleaford Navigation Trust, Lincolnshire Wildlife Trust, Internal Drainage Board and land owners/agents to discuss in detail the scope and delivery of the programme. This meeting sought to clarify the desired outcomes of the project, collate stakeholder ideas and local knowledge and identify opportunities for enhancement. All of which have been fed back into our plans to inform recommendations.

2.3 WFD Overview

The Anglian River Basin Management Plan (RBMP) was reviewed to determine the current overall ecological status of the River Slea and identify any pressures that should be addressed in this study.

2.4 Site Walkover

The site walkover was conducted on 11th and 12th February 2015 by Natasha Murray BSc (Hons) MSc MCIEEM and Peter Cowley BSc (Hons) MSc Grad CIEEM. The survey included an assessment of the target watercourses and the surroundings for the potential of habitat enhancement providing environmental, social and economic gains. This included the riparian habitat as well as the watercourses, considering water quality and the impact of identified point and diffuse pollution, biodiversity gains and community engagement.

The survey area included the waterbodies identified in Figures 1 and 2, plus a buffer of 30m of adjoining land, where access was available.

2.5 Limitations

2.5.1 Desk Based Assessment

The desk study data is third party controlled data, purchased for the purposes of this report only. Clear cannot vouch for its accuracy and cannot be held liable for any error(s) in these data.

2.5.2 Survey

The habitat survey was carried out during February 2014 and therefore many faunal species may be less active at this time of year and some floral species may be undetectable. However, it was

¹ Multi Agency Geographic Information for the Countryside Interactive GIS Map.

² Natural England's Nature on the Map online GIS system.



considered that a characterisation of the site and its potential to support protected / notable species was completed robustly.

2.5.3 Accurate Lifespan of Ecological Data

The majority of ecological data remain valid for only short periods due to the inherently transient nature of the subject. The survey results contained in this report are considered accurate for 2 years.



3 Results

3.1 Desk Based Assessment

One statutorily designated site was recorded within the search area; Lollycocks Field Local Nature Reserve is a semi-improved grassland field with standing water and seasonally wet tussocky vegetation. Two non-statutorily designated Local Wildlife Sites were also identified, Sleaford Fen which comprises of wet woodland and running water, and Sleaford Meadow which comprises of semi-improved damp grassland.

European eel *Anguilla anguilla* and brown trout *Salmo trutta* have been recorded between 1985 and 2013 both upstream and downstream of the town centre. Identified opportunities will seek to improve the aquatic habitat to improve foraging and sheltering opportunities as well as improving dispersal by removing barriers. Works should be timed to avoid the brown trout breeding season (November – February).

Water vole *Arvicola amphibius* have been recorded between 1979 and 2011 at numerous locations in the town while otter *Lutra lutra* have been recorded at Sleaford Fen in 2009 and Castle Field in 2011. A full protected species survey would be required prior to any works which are proposed within 8m of the riverbank.

A summary of the designated sites and protected species records considered most relevant to the site are provided in Appendix A. A map of the relevant protected species records is provided in Appendix B.

3.2 WFD Summary

Details from the Anglian RBMP are shown in Table 2 below. The current overall ecological status is recorded as 'Moderate' and the objective to achieve overall 'Good' ecological status is set for 2027. This is a requirement under the Water Framework Directive (WFD 2000/60/EU) which was adopted by the European Union in 2000. The justification for not achieving this objective by 2015 is 'disproportionately expensive and technically infeasible'.

Table 2: Anglian RBMP summary details

Waterbody name	Slea New
Waterbody ID	GB105030056670
Management catchment	Witham
River Basin District	Anglian
Typology	Low, small, Calcareous
Hydromorphological Status	Heavily modified
Current Ecological Quality	Moderate potential
Current Chemical Quality	Does not require an assessment
2015 Predicted Ecological Quality	Moderate potential
2015 Predicted Chemical Quality	Does not require an assessment
Overall Risk	At risk

Table 3 details the information provided for ecological elements in this waterbody. The overall biological quality is 'poor' however this is influenced by the fish supporting element being 'poor' whereas invertebrates are 'good' and macrophytes are 'moderate'. Two protected area



designations are also in place: Freshwater Fish Directive and Nitrates Directive. The hydromorphological designation is 'heavily modified' due to flood protection.

Table 3: Quality element data (adapted from the Humber RBMP and data received from the Environment Agency)

Supporting elements	Current status (2009 data)	Predicted status by 2015
Biological		
Fish	Poor	Moderate
Invertebrates	Good	Good
Macrophytes	Moderate	Moderate
Phytobenthos	Moderate	Moderate
Supporting elements		
Ammonia (Phys-Chem)	High	High
Dissolved oxygen	Moderate	Moderate
pH	High	High
Phosphate	High	High
Temperature	Good	Good
Copper	High	High
Iron	High	High
Zinc	High	High
Ammonia	High	High
Supporting conditions		
Flow	Supports good	Supports good
Chemical status		
Chemical status	Does not require assessment	Does not require assessment

Mitigation measures detailed in the Anglian RBMP for this waterbody are detailed in Table 4 below. A number are currently in place giving a current assessment status of 'moderate' however a number are not, therefore the status objective of 'good' is recorded as 'technically infeasible'.

Table 4: Mitigation measures

Mitigation measure	Status
Appropriate technique to align and attenuate flow to limit detrimental effects of these features (drainage)	In place
Appropriate channel maintenance strategies and techniques – woody debris	In place
Appropriate channel maintenance strategies and techniques – minimise disturbance to channel bed and margins	In place
Sediment management strategies	In place
Appropriate techniques (invasive species)	In place
Appropriate timing (vegetation control)	In place
Appropriate vegetation control technique	In place



Mitigation measure	Status
Selective vegetation control regime	In place
Flood bunds (earth banks in place of flood walls)	In place
Retain marginal aquatic and riparian habitats (channel alteration)	Not in place
Operational and structural changes to locks, sluices, weirs etc	Not in place
Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of impounding works	Not in place
Improve floodplain connectivity	Not in place
Set-back embankments	Not in place
Increase in-channel morphological diversity	Not in place

Any opportunities identified in this study must not cause deterioration in status for the waterbody or compromise the ability of the waterbody to meet the WFD status objectives. The aim of this study, and the projects that will come of this report, is to improve the overall biological quality of the waterbody in order to achieve the status objective of 'good'.

3.3 Stakeholder Engagement Meeting Feedback

Two sessions were held with stakeholders to discuss current projects and issues throughout Sleaford. The main opportunities identified are listed in Appendix C and mapped in Appendix D.

Community involvement was a key theme during both discussions with the aim to encourage public participation to maintain a sense of place and ownership of their town. In addition, it was felt that more should be done to encourage a greater use of the town by improving public transport and cycle links.

Water quality is a recurring issue during the summer months in Sleaford, when water levels are low and silt accumulates. Abstraction and surrounding land use were identified as the main pressures.

Improving habitat and species diversity along the Slea should complement the aims of the Biodiversity Opportunity Mapping Study for Central Lincolnshire³ which includes the creation of wet woodlands and wet meadows, removal of in-channel obstructions, de-silting, increasing channel features and creating a mosaic of wetland habitats.

Navigation is limited to the centre of the town and should not be adversely affected by any proposed plans. The vision to make the Slea entirely navigable is currently unfeasible due to low bridges, pipes and culverts. Proposals to narrow the channel through habitat creation should be focussed where navigation is not currently possible and where it can be maintained.

3.4 Site Walkover Assessment

3.4.1 General

The River Slea appeared to be of good ecological quality; the water was clear with a normal flow, the substrate varied with a mix of cobbles, pebbles and gravel; silt was noted in a number of isolated locations however the substrate remained visible throughout. The water comprised of predominantly slacks, glides and runs with riffles present occasionally.

³ Available at: <http://www.glnp.org.uk/lincolnshire-landscapes/central-lincolnshire-biodiversity-opportunity-mapping.php>



The river course lacked in shade and was influenced by weed cuts. The channel form lacked in features with few meanders, pinch points or gravel riffles. Within the town the channel was heavily modified with brick-lined banks while outside of the town the channel was mainly of a trapezoidal straight form.

3.4.2 Protected/Notable Species

A summary of the faunal species recorded during the site walkover is provided below in Table 5. As kingfisher are legally protected proposed works must ensure they do not damage or destroy a nest, therefore nesting bird surveys will be required to inform the appropriate siting of works.

Table 5: Protected / notable faunal species

Common name	Latin name	Designation	Comments	Grid ref	Figure no. in App E
Brown hare	<i>Lepus europaeus</i>	LBAP, NERC 2006	Recorded south of the Old Sleas River	TF 08334 46835	
Brown trout	<i>Salmo trutta</i>	LBAP, NERC 2006	Sightings of large specimens in numerous locations throughout site, although notably absent outside the town: West Banks Sainsbury's New Street	TF 06472 45734 TF 06638 45656 TF 06638 45656	1
Grey heron	<i>Ardea cinerea</i>	N/A	Indicates a supply of fish Recorded foraging at: Coggleford Mill	TF 07448 46103	3
Grey wagtail	<i>Motacilla cinerea</i>	BOCC Amber	A preference for fast flowing rivers, found in lowland rivers in winter. Recorded at: Electric Station Road Carre Street tilt gate	TF 06339 45740 TF 06896 45753	2
Kingfisher	<i>Alcedo atthis</i>	Schedule 1 ⁴ , BOCC Amber ⁵	Perching on branch in woodland adjacent to river, observed foraging in River Sleas. Sensitive to poor management and pollution, preference to slow flow, indicator of fish supply.	TF 05267 45702	

⁴ Listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended)

⁵ Included on the Birds of Conservation Concern Amber list



4 Identified Opportunities

A total of 35 opportunities identified during the site walkover are listed below in Table 6 which includes the primary themes, constraints and whether the opportunities meet the WFD mitigation measures and the objectives of the Biodiversity Opportunity Mapping Study. Photographs of the locations and issues are provided in Appendix E while example methodology diagrams are provided in Appendix G.

Table 6: Identified opportunities

	Identified opportunity	Grid ref	Scope	Constraints	Primary themes	WFD MM ⁶	BOMS ⁷	Figure no. in App. E
1	Upstream farmland management	TF 05063 45619	A large amount of aquatic vegetation is present in the River Slea upstream of the A15 indicating potential high nutrient input from surrounding farmland. A scheme is required to reduce nutrient runoff: better education and land management e.g. increased buffer strips. Investigate Countryside Stewardship.	Land owner incentives	Water quality, Riparian habitat improvement		✓	4
2	Reed bed filtration of road side ditch	TF 05110 45647	A roadside ditch is present along the A15, during the survey it was damp (no standing water), evidence of road run-off (petrol / oil sheen / rubbish). An overflow pipe led directly into the River Slea. To prevent potential pollution issues, the ditch should be dredged and a reed bed installed to filter the water before it enters the Slea.	Dredged material may be contaminated waste	Water quality, riparian habitat improvement	✓		5, 6
3	Wet meadow creation	TF 05154 45694	Triangle of disused land to be managed as wildflower meadow with scrapes or ponds. Surrounding ditches are dry and unconnected to those to the west of the A15. Possibility to reconnect to create a wetland habitat.	Land ownership and management	Wetland creation		✓	7
4	Riparian habitat improvement – wide buffer strips	TF 05178 45641	A wider buffer strip of uncultivated land in arable field to the south of the Slea would potentially reduce run-off from fields. Compliments existing tree planting which has occurred. Encourage as Countryside Stewardship.	Land owner agreement	Riverbank habitat improvement	✓		8
5	Riparian habitat	TF	Tree planting along Fen Drain to create shade and therefore	Financial	Riverbank	✓		

⁶ WFD Mitigation Measure

⁷ Biodiversity Opportunity Mapping Study for Central Lincolnshire Objective

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	Identified opportunity	Grid ref	Scope	Constraints	Primary themes	WFD MM ⁶	BOMS ⁷	Figure no. in App. E
	improvement – tree planting along Fen Drain	05255 45453	reduce water temperature and increase habitats.	contributor	habitat improvement			
6	Proposed development to provide habitat creation	TF 05367 45833	Proposed development should be encouraged (under the National Planning Policy Framework 2012 ⁸) to incorporate wetland habitats along boundary with the River Slea, with opportunities for public rights of way and nature-focused events.	Development design – early engagement required	Wetland creation		✓	
7	Wet woodland creation	TF 05443 45729	Woodland with large pond and numerous ditches with fast flowing clean spring water. Opportunity to enhance as a wet woodland. contributing the wetland habitat mosaic. Water flows into Nine Foot River, possibility to divert to Slea during low flows. Woodland management required, fell large trees and use as woody debris/flow deflectors in Slea to enhance morphology and trap sediment. Add bat and bird boxes to trees. Bank re-profiling could be used to create a kingfisher nest bank in a private location to deter public disturbance.	Management, specialist design advice required	Wet woodland creation In-channel improvements	✓	✓	9, 10, 11
8	In-channel improvements – additional features	TF 05466 45829	The substrate was visible for much of the stretch, silt accumulated where the channel is wider and deeper. Use clean gravels to create better substrate with riffles; narrow channel with reed beds or woody debris deflectors to improve flow and trap sediment. Creates spawning habitat for trout/foraging habitat for elvers/eels. See Appendix G.	Maintaining capacity of flood water	In-channel improvements	✓	✓	12
9	Improving low flow resilience	TF 05565 45874	Sluice gate drains water from the Slea into Nine Foot River. Investigate the possibility to improve the seal of the sluice gate to prevent water loss from Slea during low flow.	Risk to Nine Foot drying out during low flows	Water quality improvements			13
10	Investigate potential pollution source	TF 05692	Ochre present in small quantity from field drain. Investigate effect on water quality. It may be naturally occurring in the soil,	Identifying source	Water quality improvements			14

⁸ Department of Communities & Local Government, 2012. *National Planning Policy Framework*, London: DCLG.



	Identified opportunity	Grid ref	Scope	Constraints	Primary themes	WFD MM ⁶	BOMS ⁷	Figure no. in App. E
		45692	additional planting at the point source can reduce impacts.					
11	Allotment drain improvements	TF 05784 45983	The allotments hold the potential for a community engagement project to improve ditches / drains which flow into the Sock drain and then into the Slea. Large vegetated buffers required to prevent run off of fertilisers, compost etc. Ditches require submerged aquatic vegetation to trap sediment and enhance biodiversity.	Management of project; decrease in allotment plot size	Water quality improvements community engagement	✓	✓	15, 16
12	In-channel improvements – additional features Riparian habitat improvement – wide buffer strips and tree planting	TF 05959 45588	Some marginal and aquatic vegetation is present; this should be enhanced with additional plug planting protected by boulders. More silt present downstream, use woody debris deflectors to trap sediment and increase flow, and land owner engagement to alter land management to reduce run-off (wider buffers and planting of bankside vegetation and trees).	Land owner agreement	In-channel improvements Water quality improvements, Riverbank habitat improvement	✓	✓	17
13	Investigate potential pollution source	TF 06062 45604	Field drain adjacent to railway embankment with evidence of ochre in the drain, requires water quality investigation. It may be naturally occurring in the soil, a marginal reed bed may improve water quality.	Identifying source	Water quality improvements			18
14	Improve water quality	TF 06036 45750	Stagnant ditch requires measures to improve flow and water quality. Land owner engagement to improve management.	Land owner agreement	Water quality improvements	✓		19
15	In-channel improvements – additional features	TF 06222 45785	Brick-lined channel – use vegetated coir rolls fixed to the wall to improve for biodiversity and amenity use. This could be extended from Electric Station Road to West Bank.		In-channel improvements, Amenity value	✓		20
16	Investigate potential pollution source	TF 06188 45818	Drain adjacent to Westgate Park, evidence of a water quality issue, water is stagnant, turbid and discoloured. Potential misconnections (waste pipe falls into rainwater drain) from residential park. Local engagement required to identify the source and create community scheme to enhance.	Identifying source	Water quality improvements, community engagement			21
17	Remove barrier to fish dispersal	TF 06898 45759	Remove Carre Street tilt gate which is a barrier to fish dispersal upstream. Improvement for brown trout / eel.	Financial, flood risk	In-channel improvements	✓	✓	22



	Identified opportunity	Grid ref	Scope	Constraints	Primary themes	WFD MM ⁶	BOMS ⁷	Figure no. in App. E
18	Improve water quality	TF 06495 45479	Drain surrounding Castle Fields is stagnant and discoloured. Water quality investigation required to identify cause. May improve silt issues downstream.	Identifying source	Water quality improvements			23
19	Meadow habitat creation	TF 06457 45552	Opportunity to enhance Castle Fields into a managed wildflower meadow. Currently used by dog walkers, fouling is a problem.	Management	Meadow habitat creation		✓	24
20	In-channel improvements – additional features Riparian habitat improvement – bank reprofiling	TF 07041 45742	River bank eroding by the slipway and new bridge, may contribute to increased silt downstream. Bank reprofiling required using faggot revetments and backfilling. Plant and use mesh to prevent ducks destroying veg until fully established. Alternative is to use seeded coir matting for longevity. Multiple benefits by narrowing channel, increasing flow, creating habitats and improve amenity value. See Appendix G.	Reduced flood capacity	In-channel improvements, Water quality improvements, Riverbank habitat improvement, amenity value	✓	✓	25
21	In-channel improvements	TF 07231 45881	Enhance faggot revetment – requires backfilling and additional planting with mesh to prevent damage by ducks.		In-channel improvements	✓	✓	26
22	Wetland habitat improvement	TF 07230 45986	The Lollycocks LNR requires improved management. It can be enhanced through additional planting (hedgerow/tree screening along roadside), information sign-post, bird hides etc. Potential for flood storage if connected to Sleas. Anecdotal record of non-native fish species, eradicate to prevent spread into Sleas during flood and by birds such as grey heron.	Management	Wetland habitat creation		✓	27
23	Pest control issue	TF 07279 45945	Evidence of rats (burrows and droppings). Pest control may be required.	Financial Impact on other species such as water vole	Amenity value			28
24	In-channel improvement Remove barrier to fish dispersal	TF 07452 46102	Upstream of Coggleford Mill weir, the Sleas is too wide and flow is reduced. Evidence of vegetation removal, left on banks to rot, unsightly and can wash silt in river during heavy rain. Stricter management required. Maintain / increase reedbed to trap sediment. This will also improve habitats for birds, fish and	Maintain navigable route Financial	Water quality, In-channel improvement (brown trout / eel)	✓	✓	29, 30, 31



	Identified opportunity	Grid ref	Scope	Constraints	Primary themes	WFD MM ⁶	BOMS ⁷	Figure no. in App. E
			invertebrates. The tilt gate is a major barrier for fish dispersal, investigate whether a fish pass is possible up the mill steps.					
25	Water quality In-channel improvements	TF 07452 45982	Rubbish dumped from adjacent houses. Community engagement to educate and encourage scheme to clean up their watercourse. Channel over-wide and low flow, deflectors to trap debris and sediment and increase flow. Bankside vegetation excessively cleared – ensure only done once a year to maintain a buffer from grazing pasture.	Management	Community engagement, water quality	✓	✓	32
26	Improve public access	TF 07553 46138	Existing footpath is bare earth. Potential to lay a formal footpath with benches to encourage use. Also wide enough for a cycle path.	Financial	Amenity value			33
27	Improve habitat management	TF 07705 46236	Evidence of dredging activities. This should be limited to retain in-channel vegetation to trap sediment and maintain diversity of habitats for wildlife. Material should not be left on banks to fall back into the river during heavy rain.	Management	habitat improvements water quality, amenity value,	✓		34
28	Riverbank improvements	TF 07748 46283	Stabilise the bank on the meander through riparian planting. This will also reduce any run-off from industrial estate.	Land ownership	Riverbank improvements, water quality	✓		35
29	Riverbank improvements	TF 07923 46502	Access road in industrial estate is very close to the river, a vegetated buffer strip would reduce any road run-off.	Land ownership	Riverbank improvements, water quality	✓		36
30	Water quality investigation Improving low flow resilience	TF 08043 46581	Large quantity of water lost at pumping station. Investigate potential to restrict pumping further during low flows.	Abstraction permit	Water quality			37
31	Wetland habitat creation	TF 08117 46629	Land next to pumping station is unmanaged and wet in places. Potential to create wetland habitat with flood storage benefits. Fish backwater / offline ponds. See Appendix G.	Land ownership	Wetland habitat creation, amenity value	✓	✓	38
32	In-channel improvements – additional features	TF 08153 46718	This section of the Sleas resembles a canal with a straight channel, steep sided earth banks and minimal vegetation. To increase flow, trap sediment and increase habitat diversity, use woody debris deflectors to mimic meanders.	Land ownership	Riverbank improvements, water quality	✓	✓	39

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	Identified opportunity	Grid ref	Scope	Constraints	Primary themes	WFD MM ⁶	BOMS ⁷	Figure no. in App. E
	Riparian habitat improvement – wide buffer strips and tree planting		Plant banks with tall ruderal vegetation and trees to provide shelter and shade.					
33	In-channel improvements – additional features Riparian habitat improvement – tree planting	TF 08430 46955	Increase in-channel vegetation to narrow channel and increase flow. Gravel bed exposed in areas providing invertebrate and fish habitat. Tree planting required to add shade.	Land owner agreement	Riverbank improvements, water quality	✓	✓	40, 41
34	Water quality improvement Farmland management	TF 08535 47076	Culvert to A17 very silty, likely to be accumulation from surrounding farmland. Landowner engagement required to improve farming practices and reduce run-off from fields.	Land owner agreement	Water quality	✓	✓	42
35	Remove barrier to fish dispersal	TF 08443 47117	Remove weir at the old lock which may be a barrier to fish dispersal.	Financial	In-channel improvement	✓	✓	43

Please note expert advice regarding flood risk management should be sought during the project design stage.



Appendix A: Summary of relevant desk study data

Site Name	Designation	Location	Brief Description
Lollycock field	LNR ⁹	TF 072459	Semi-improved grassland, standing water
Sleaford Fen	LWS ¹⁰	TF 054457	Wet woodland, running water
Sleaford Meadow	LWS	TF 061456	Semi-improved damp grassland

Species Latin Name	Species	Most Recent record	Closest Record to Site	Total No of Records	National Conservation Status	Lincs. LBAP ¹¹
Amphibians						
<i>Bufo bufo</i>	Common toad	2009	TF064450	2	Partially protected ¹² , UK BAP, NERC 2006 ¹³	✓
Mammals						
<i>Arvicola amphibius</i>	Water vole	2011	TF062457	12	Fully Protected ¹⁴ , UK BAP, NERC 2006	✓
<i>Lutra lutra</i>	Otter	2011	TF055458	3	Fully protected EPS, UK BAP, NERC 2006	✓
<i>Lepus capensis</i>	Brown hare	2009	TF065455	4	UK BAP, NERC 2006	✓
Fish						
<i>Anguilla anguilla</i>	European eel	2013	TF085470	14	Eels Reg 2009 ¹⁵ ; UK BAP, NERC 2006, IUCN critically endangered ¹⁶	✓
<i>Salmo trutta</i>	Brown trout	2010	TF085470	12	UK BAP, NERC 2006	✓

⁹ Local Nature Reserve (LNR)

¹⁰ Local Wildlife Site (LWS)

¹¹ Lincolnshire Biodiversity Action Plan 2011 - 2020

¹² Protected from sale and advertising for sale under the Wildlife and Countryside Act 1981 (as amended)

¹³ Included within Section 41 of the Natural Environment and Rural Communities Act 2006

¹⁴ Fully protected under the Wildlife and Countryside Act 1981 (as amended)

¹⁵ The Eels (England and Wales) Regulations 2009

¹⁶ Listed as *Critically Endangered* on the IUCN Red List



Appendix B: Desk study data map



Appendix C: Stakeholder engagement meeting summary

1. Investigate catchment sensitive farming upstream of Sleaford
 - Overall good farming practices
 - Silt management
 - Pesticide use
 - Upstream flood storage
 - NE stewardship scheme
2. Important to enhance river habitat to improve corridor to western habitats
3. Cycle link to Rauceby train station from new development
4. River Slea is ephemeral, naturally dries out upstream of augmentation pump, spring fed – need to improve low flow
5. South of new development – management issues – who owns the land, who will maintain it
 - potential for use of SuDS,
 - country park/public open space
 - wet meadows/woodland, boardwalks, raised cycle paths
6. New development proposed with playing fields and buffer to river
 - should seek to promote and enhance walking and cycling routes within site and in wider countryside,
 - SuDS and swales to enhance corridor and within site with value to people and wildlife
 - possible cycle route into town through new development along disused railway
7. Reed beds and other features along river to narrow channel and increase flow, trap sediment
8. Castlefield – current management is grass cut only, potential for wildflower buffers, community project, Heritage Lottery Funding.
9. Leisure opportunities in town – unique riverside habitat, walkways, more attractive river banks, weed issues restricting use such as canoeing, require wildlife noticeboards, bird hides to encourage walkers, outdoor classrooms. Heart of Sleaford – pedestrian link, waterside walkway, need for bank stabilisation, leisure link to Coggleford mill, orchard by corn exchange, next 2 years to start work
10. Narrow culvert at south gate – traps debris, flood risk
11. Carre Street tilt gate – fish barrier
12. New bridge near carre street – opportunity to encourage community use, river bank in poor condition
13. Duck and rat problem
14. Lollycocks LNR in poor condition
15. Dry area near slipway – owned by Sleaford Civic Trust – litter issues, community project for planting?
16. Coggleford mill weir – reed issues upstream, poor water quality, sewage pipe restricts navigation, fish barrier, silt issues
17. Land opposite mill – currently grazed – opportunity to link to lollycocks field, scrapes?
18. Old river Slea received input from fields, new Slea no input so prone to low flow
19. Railway sidings – potential for habitat corridor, investigate management, invasive species
20. Land north of Slea, east of railway set aside for development
21. Winter abstraction east of railway – possible to return during low flows?



General points

- Green wedges should complement aims of the central lincs green infrastructure study
- Use Biodiversity mapping project report
 - Wet woodland, wet meadows, removal of in-channel obstructions, de-silting, increasing channel features, mosaic of wetland habitats
- Public footpaths to schools and shops
- No fishing – trust have no capability to police it
- National cycle network to east – connect through Sleaford
- Corporate sponsorship to fund projects
- Investigate role/influence on groundwater / topography
- Navigation – aim to open up Slea
- Narrow channel – increase flow
- Land ownership study required



Appendix D: Stakeholder engagement meeting map



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Appendix E: Figures

<p>Figure 1 – brown trout</p> 	<p>Figure 2 – Grey wagtail</p> 
<p>Figure 3 – Grey Heron</p> 	<p>Figure 4 - Upstream</p> 

Figure 5



Figure 6



Figure 7



Figure 8 - downstream



Figure 9 - downstream



Figure 10



Figure 11



Figure 12 – downstream



Figure 13



Figure 14



Figure 15



Figure 16



Figure 17



Figure 18



Figure 19



Figure 20 – upstream



Figure 21



Figure 22 – upstream



Figure 23



Figure 24 - downstream



Figure 25



Figure 26 – downstream



Figure 27



Figure 28



Figure 29 – downstream



Figure 30



Figure 31 – downstream



Figure 32 - downstream



Figure 33 – downstream



Figure 34 - upstream



Figure 35– downstream



Figure 36



Figure 37



Figure 38



Figure 39– downstream



Figure 40– upstream



Figure 41



Figure 42

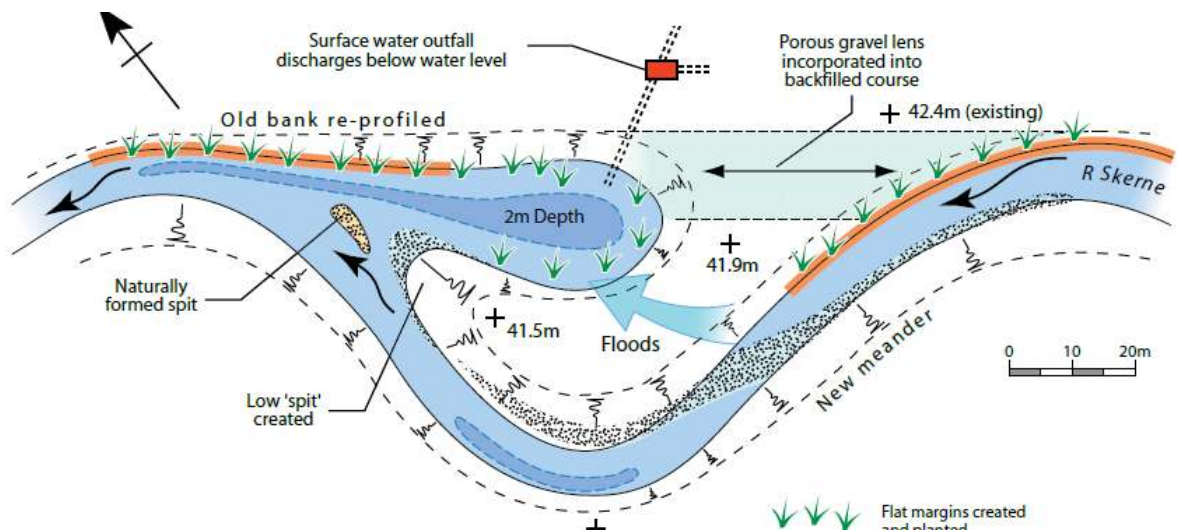


Figure 43 - upstream

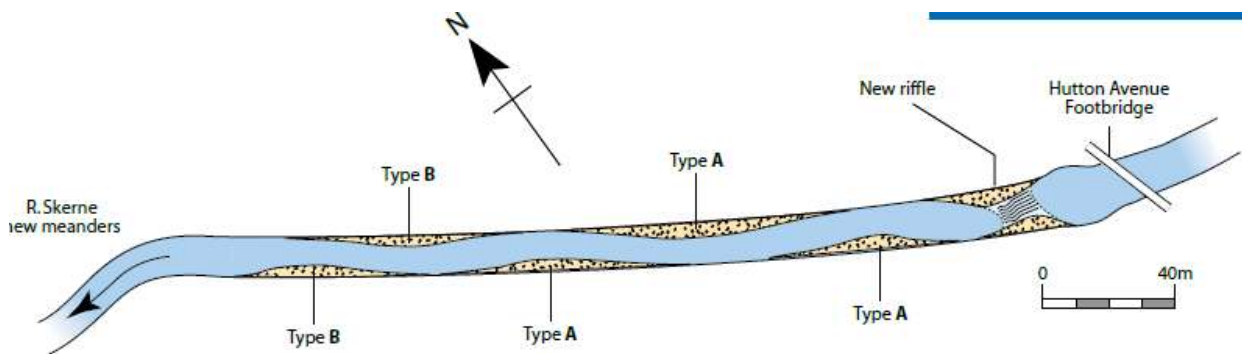


Appendix F: Methodology examples – extracted from The River Restoration Centre (RRC) Manual of River Restoration Techniques¹⁷

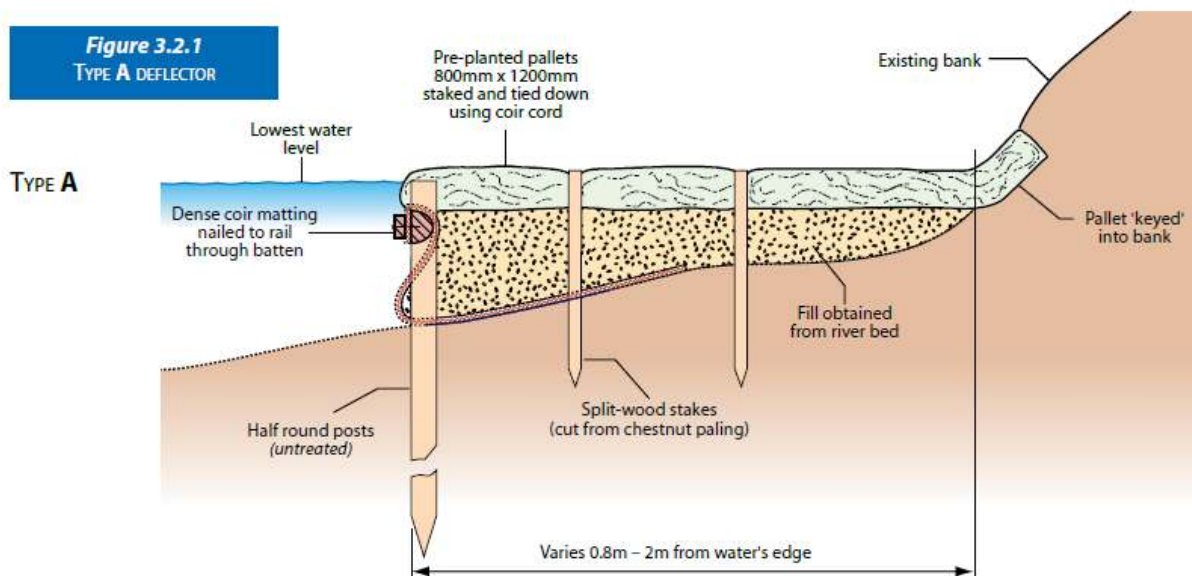
Source: Section 2.1 Creation of backwaters



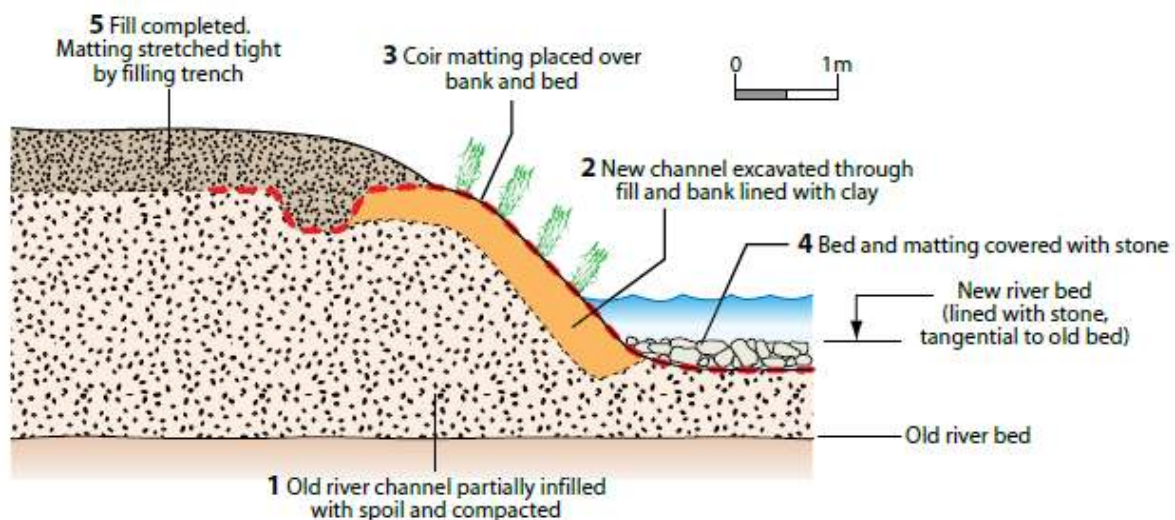
Source: Section 3.1 Current deflectors



Source: Section 3.2 Narrowing with aquatic ledges



¹⁷ Available online: <http://www.therrc.co.uk/manual-river-restoration-techniques>



Appendix G: Map of identified opportunities



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