A38 Derby Junctions

TR010022

Volume 6

6.3 Environmental Statement Appendices

Appendix 8.12c: White-clawed Crayfish Survey in 2015

Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

April 2019

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A38 Derby Junctions Development Consent Order 202[ ]

6.3 Environmental Statement Appendices
Appendix 8.12c: White-clawed Crayfish Survey in 2015

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1	April 2019	DCO Application

A38 Derby Junctions

White-Clawed Crayfish Survey Report

Report No: 47071319-URS-05-RP-EN-017
May 2016

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1. INTRODUCTION

1.1 Background and Scope

1.1.1 On July 14, 2014 AECOM was awarded the contract by Highways England to provide design services regarding the development of the A38 Derby Junctions Scheme (referred to herein as the proposed scheme). This proposed scheme concerns three junctions on the A38 in Derby as follows (refer to Figure 1):

- A38/ A5111 Kingsway junction;
- A38/ A52 Markeaton junction; and
- A38/ A61 Little Eaton junction.

1.1.2 These three junctions are spread over an approximate 5.5 km distance along the A38 to the west and north-west of Derby.

1.1.3 AECOM will be preparing an Environmental Assessment Report (EAR) which will assess whether the proposed scheme has the potential to result in significant environmental effects, taking into account impact avoidance measures that are embedded into the proposed scheme design, as well as standard management activities that will be adopted. In order to support the ecological impact assessment to be reported in the EAR, AECOM has undertaken a series of ecological surveys along the route of the proposed scheme. The extended Phase 1 habitat surveys assessed the potential of watercourses within and directly adjacent to the proposed scheme to support white-clawed crayfish (*Austropotamobius pallipes*) (AECOM Extended Phase 1 Habitat Survey Report 47071319-URS-05-RP-EN-003). Watercourses were identified for white-clawed crayfish surveys on the basis of potentially suitable habitat for native crayfish (refer to the Methodology section for details of watercourses surveyed).

1.1.4 A desk-study for information on historical white-clawed crayfish records from within and adjacent to the proposed scheme has also been undertaken (see Figures 2 and 3).

1.1.5 The white-clawed crayfish surveys were undertaken during the periods July 21 and 23 (Visit 1) 2015 and August 10 and 12 (Visit 2) 2015.

1.1.6 Results of the surveys are documented herein, together with desk-study data and recommendations for further survey work (where necessary).

1.2 Study Site

1.2.1 The proposed scheme (herein the proposed scheme footprint is referred to as the 'Site') encompass the Kingsway and Markeaton junctions, west of the City of Derby and the Little Eaton junction north of Derby (see Figure 1). Plans showing the survey locations for white-clawed crayfish (and American signal crayfish *Pacifastacus leniusculus* – an invasive crayfish species contributing to the population decline of indigenious white-clawed crayfish populations through direct competition and transmission of lethal crayfish plague *Aphanomyces astaci*) are presented as Figure 4 and 5 in Appendix A. The surveys were targeted on suitable watercourses identified within the Site boundary plus a 50 m buffer upstream and downstream. However, the survey was extended further where necessary to take into account a 100 - 200 m sampling site of potentially suitable habitat.

1.2.2 The A38 is an existing and busy arterial 'A' road carrying traffic around the west and north of the City of Derby. South of the Kingsway junction, the road enters a cutting and is bordered by semi-improved grassland and scrub covered verges. The central reservation south of Kingsway junction and the junction island in this location support a mosaic of habitat types, including semi-improved neutral grassland and native broadleaved woodland. Bramble Brook flows from the west of the proposed scheme in this location, through culverts located under the north-bound carriageway and the central reservation before connecting with further culverts located between the junction islands. North of the Kingsway junction there is an area of mixed plantation represented by semi-mature trees on embankment.

1.2.3 The Markeaton junction section of the proposed scheme is bordered to the east by residential properties and to the west by parkland with veteran trees. The outfall from Markeaton Lake (Middle Brook) and Markeaton Brook flow through culverts beneath the existing A38 at the northern extent of the Markeaton junction section of the proposed scheme.

1.2.4 The western boundary of the proposed scheme at Little Eaton junction borders the road bridge over the River Derwent. The existing A38 is on embankment in this location, with the embankments themselves represented by areas of scrub and immature broadleaved plantation habitats. A variety of grassland habitats exist at the base of the embankments in this location.

1.3 Relevant Legislation and Biodiversity Strategies

1.3.1 The white-clawed (or Atlantic stream) crayfish is afforded protection under the Wildlife and Countryside Act (WCA) 1981. This species is listed on Schedule 5 of the Act and is afforded part protection under Section 9(1) making it an offence to intentionally kill, injure or take any of these species. There are additional offences in relation to buying, selling or exchanging any live or dead animal of this species or anything derived from a white-clawed crayfish, under Section 9(5).

1.3.2 White-clawed crayfish are listed on Annex II(a) of the EC Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora, also known as the 'Habitats Directive'. This means that the UK is required to establish Special Areas of Conservation (SACs) to protect the habitat of this species. These sites form part of the Natura 2000 network across Europe. In addition, its inclusion on Annex V of this Directive also restricts the taking, capture or killing of this species in the wild.

1.3.3 White-clawed crayfish are listed within Section 74 of the Countryside Rights of Way (CRoW) 2000 and Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 as species of principle importance for nature conservation in England. The Section 41 list is used to guide decision-makers such as public bodies, including Highways England, in implementing their duty under Section 40 of the NERC Act to have regard to the conservation of biodiversity in England, when carrying out their normal functions. The species covered by the Section 41 list were originally identified as requiring nature conservation action under the (now withdrawn) UK Biodiversity Action Plan (BAP) and continue to be regarded as conservation priorities under the UK Post-2010 Biodiversity Framework. In the National Planning Policy Framework (NPPF), local authorities in England are required to take measures to protect the habitats of these species from further decline, protect the species from the adverse effect of development and refuse planning permission for development

that harms these species unless the need for, or benefit of, the development clearly outweighs that harm.

1.3.4 White-clawed crayfish is designated as “Endangered” on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (2010).

1.3.5 In addition to the UK Post-2010 Biodiversity Framework, local partnerships have been formed to produce Local Biodiversity Action Plans (LBAP). These identify species and habitat which are important at a local level e.g. by County ot Local Authority Administrative Area, for the purpose of conserving and enhancing biodiversity. The Lowland Derbyshire Biodiversity Action Plan lists white-clawed crayfish as an LBAP species.

1.3.6 The white-clawed crayfish is also listed as a local flagship species in the Derby ‘Greenprint for Biodiversity'. This document provides a framework for the conservation of biodiversity within the borough by translating both the UK and LBAP to a local level in order to make them more achievable by the council, local groups and communities.

1.3.7 Highways England, through the national Road Investment Strategy, has set an aspiration that the operation, maintenance, and enhancement of the Strategic Road Network (SRN) should move to a position that delivers no net loss of biodiversity; and, in the long term, Highways England should deliver a net gain in biodiversity across its broader range of works. Highways England published a Biodiversity Action Plan in 2015 to show how it will work with service providers to halt overall biodiversity loss, and maintain and enhance habitats and ecological networks. The Government requires Highways England to demonstrate progress against the Biodiversity Plan, to secure an ongoing annual reduction in the loss of net biodiversity due to its activities. The Biodiversity Plan supersedes the 2002 Highways Agency Biodiversity Action Plan (HABAP 2002), which still carries some relevance as it lists specific species of conservation concern including white-clawed crayfish. The main aim of HABAP 2002 for the white-clawed crayfish was to ensure that new road developments avoid or adequately mitigate any potential impacts on the species.

2. METHODOLOGY

2.1 Desk-based Study

2.1.1 A full desk-based study based on the findings from Derbyshire Wildlife Trust (DWT), online data sources and data supplied by A-One+ Highways Integrated Services was undertaken prior to all ecological surveys and is described in the Extended Phase 1 Habitat Report 2015 (AECOM, 2015).

2.1.2 The Highways England Environmental Information System (EnvIS) was also searched for any white-clawed crayfish records.

2.1.3 Details of white-clawed crayfish records and distribution were also obtained from the Crayfish in Lowland Derbyshire 2007 document; and the white-clawed crayfish species action plan 2007 - 2010 for Lowland Derbyshire.

2.1.4 In addition, the following reports were also checked to gain background local information on white-clawed crayfish:

- 2014 Protected species survey of the Mill Pond off Markeaton Street in Derby by EMEC Ecology for Derby City Council (EMEC Ecology, 2014);
- 2012 White-clawed crayfish survey by Peter Cowley (University of Derby) (Cowley, 2012); and
- 2008 study of crayfish and water quality, Markeaton Brook 2008 (David Rogers Associates, 2008).

2.2 Field Survey Methodologies

2.2.1 The survey methodology was adapted from 'Standardised Survey and Monitoring Protocol for White-Clawed Crayfish *Austropotamobius pallipes*' (Peay, 2002) and 'Monitoring the White-Clawed Crayfish *Austropotamobius pallipes*' (Peay, 2003). This protocol favours manual searching for crayfish where there is sufficient habitat for this method and uses five patches of favourable habitat within a sampling site of 100 - 200 m within a section of 500 m. Within each of these five patches, 10 suitable refuge stones are turned, limiting surveys to 100 stones per sampling site.

2.2.2 Manual searches (i.e. hand-searching) were undertaken within suitable habitat, however, most waterbodies were considered unsuitable for this standard methodology (i.e. they were deep/ turbid watercourses). Therefore, a trapping methodology was employed in such areas with consent from the Environment Agency (see below).

2.2.3 Eight stretches of watercourse were identified as having the suitability to support white-clawed crayfish populations, namely: four within the Markeaton and Kingsway junction section of the proposed scheme (i.e. Sites a1/a2 – Markeaton Lake, Site a3 – Mill Pond 1, Site a4 – Mill Pond 2 and Site a5 – Middle Brook; refer Figure 4, Appendix A and Table 1) and four within the Little Eaton section of the proposed scheme (i.e Sites b1 – River Derwent), Site b2 – Watermeadows ditch, Site b3 – Dam Brook and Site b4 – Boosemoor Brook; refer to Figure 5, Appendix A and Table 1).

2.2.4 Nine survey locations were identified across these eight watercourse stretches: two locations were surveyed using the standard in-channel refuge searches only (i.e. standardised manual search) at Site a5 - Middle Brook and b4- Boosemoor Brook; five locations were trapped where standard in-channel searches could not be

undertaken at Sites a1 and a2 – Markeaton Lake, Site a3 – Mill Pond 1, Site a4 – Mill Pond 2, and Site b2 – Watermeadows ditch; whilst two locations used a combination of both standardised manual searches and trapping at Site b1 – River Derwent and Site b3 – Dam Brook. Refer to Table 1 for survey details.

2.2.5 Fladen folding crayfish traps were used in this study, with traps baited with sardines and set for one night (per visit) in favourable habitat for crayfish in areas of slow flow. Ten traps were set out on all stretches of watercourse except Mill Pond 2 where 15 traps were used. Flow conditions were found to be normal (or low) during both survey visits, with water levels and flow rates remaining constant throughout the study.

2.2.6 In areas with public access, especially Markeaton Park, the traps were set as unobtrusively as practicable, to minimise the risk of interference or theft. No traps were lost or damaged during the survey.

2.2.7 Environment Agency consents were obtained for all trapping locations prior to the surveys commencing in July 2015.

2.2.8 A follow-up crayfish survey (Visit 2) was undertaken on watercourses that failed to identify a crayfish presence on Visit 1.

2.2.9 All surveys were undertaken by fully licensed AECOM ecologists.

2.2.10 Bramble Brook is located within the A38 Kingsway junction, and thus within the proposed scheme boundary. The brook is heavily engineered with both man-made and natural materials with a mix of substrates including bedrock, concrete and silt. There is a lack of rocky substrate i.e. refuges for white-clawed crayfish and thus this watercourse is considered unsuitable habitat to support white-clawed crayfish. Bramble Brook was therefore omitted from the white-clawed crayfish surveys.

Table 1: White-Clawed Crayfish Survey Locations and Methodologies

Survey Locations				Methodologies	
Site Name	**Location**	**Location/s (Grid ref.)**	**Description**	**Standardised Manual Search**	**Trapping**
Kingsway and Markeaton Junction					
Markeaton Lake	Within 50 m of the site boundary to the west of Markeaton junction	a1 – SK 33351 37695 a2 – SK 33752 37319	East and western ends of Markeaton Lake, includes the outflow that flows into Markeaton Brook	No	Yes
Mill Pond 1	Within 50 m of the site boundary to the east of the Markeaton junction	a3 – SK 33811 37152	Linear well stocked coarse fishery, fed by culvert water from Markeaton Lake to the west	No	Yes
Mill Pond 2	Within 250 m of the site	a4 –	Continuation of Mill Pond 1 that runs	No	Yes

Survey Locations				Methodologies	
Site Name	**Location**	**Location/s (Grid ref.)**	**Description**	**Standardised Manual Search**	**Trapping**
	boundary to the east of the Markeaton junction	SK 33872 37078	parallel to Markeaton Street		
Middle Brook	Within 250 m of the site boundary to the east of the Markeaton junction	a5 - From SK 33663 37681 to SK 34075 37276	Section of flowing water that connects the Markeaton Lake outflow with Markeaton Brook	Yes	No
Little Eaton Junction					
River Derwent (A38 Bridge)	Within 50 m of the site boundary to the west of the proposed scheme	b1 – From SK 35930 39830 to SK 35894 40001	A short section of the River Derwent that lies beneath the A38 Abbey Hill Road Bridge	Yes	Yes
Watermeadows ditch	Within 50 m of the site boundary to the south west of the proposed scheme	b2 – From SK 36231 39644 to SK 36365 39688	From A61 Alfreton Road Culvert west to the railway line	No	Yes
Dam Brook	Within the site boundary	b3 - From SK 36232 39645 to SK 36805 39837	From confluence with Boosemoor Brook downstream through culvert to the A61 Alfreton Road culvert	Yes	Yes
Boosemoor Brook	Within 250 m of the site boundary to the east of the proposed scheme	b4 - From SK 36600 39966 to SK 36861 39972	100 m section upstream of the confluence with Dam Brook	Yes	No

2.3 Survey Limitations

2.3.1 There was restricted access to several sections of watercourse channel, especially along the upper reaches of Dam Brook and the entire section of the Boosemoor Brook, where dense hawthorn was present. Additionally, several steep sections of the River Derwent either side of the A38 Bridge were heavily choked by dense bankside stands of hawthorn, tall herbs and bramble restricting access. Sections of these watercourses were however surveyed where access allowed gaining a good representation of the presence/ likely absence of white-clawed crafish in these watercourses. Crayfish habitat within the inaccessible areas of Dam Brook and Boosemoor Brook was considered sub-optimal due to low water levels and dense stands of hawthorn subsequently creating less open water habitat. Therefore, not

accessing these areas is unlikely to affect the findings of this survey. Additionally, increased survey effort (i.e both standardised manual searchs and trapping), was undertaken on Dam Brook and the River Derwent providing confidence in the survey results.

2.3.2 The location of construction compounds and flood attenuation areas is yet to be determined; these areas have not been included within this survey.

3. RESULTS

3.1 Desk-study Results

3.1.1 Biological records were provided by DWT and A-One+ as part of the desk-based investigations. No records were found on EnvIS.

3.1.2 White-clawed crayfish records greater than 10 years old are still considered relevant for this report as white-clawed crayfish rarely cease to exist in known watercourses.

3.1.3 Appendix B provides records of white-clawed crayfish on and within 2 km of Kingsway and Markeaton junctions and Little Eaton junction (see Figures 2 and 3, Appendix A).

3.1.4 White-clawed crayfish have historically been recorded from Markeaton Brook and its tributaries, which feed into the River Derwent in Derby. The watercourses are crossed by the proposed scheme boundary or are in close proximity, with white-clawed crayfish being previously identified from Markeaton Brook, Markeaton Lake, Mill Pond 1 and Mill Pond 2 (all Markeaton), Dam Brook and the River Derwent (Little Eaton).

3.1.5 The most recent record of the species came from DWT and A-One+ dated 2014; a female white-clawed crayfish found within a section of Dam Brook, adjacent to the A38/ A61 Island,during culvert works as part of the Pinch Point Scheme in 2014.

3.1.6 Historically, Markeaton Brook is known to have populations of white-clawed crayfish, as cited in the LBAP. The Land Drainage and Flood Defence team at Derby City Council undertook sympathetic management of bankside vegetation and the City Council commissioned an ecological baseline study and management plan of the Markeaton and Mackworth Brook in 2004. This study included an analysis of the population of white-clawed crayfish. At that time, the City Council was looking towards maintaining the Markeaton Brook catchment as an ark site through partnership action (LBAP, 2007).

3.1.7 However, studies by EMEC Ecology in 2002 and 2006 in Markeaton Brook showed that the distribution of white-clawed crayfish was patchy and gave indication that white-clawed crayfish populations were declining; white-clawed crayfish had not been found since 2004 by the University of Derby's Invertebrate Biology course students during annual sampling (David Rogers Associates, 2008). David Rogers Associates was contracted in 2008 by Derby City Council to ascertain the distribution of crayfish in Markeaton Brook within the Derby City Council administrative area. During the study by David Rogers Associates in 2008 white-clawed crayfish were found at three points; Lens Road SK 331 388, Markeaton Park SK 337 376, and St John's Terrace SK 345 366 (refer to Figure 2). It was considered that there had been a major decline in crayfish populations between 2003 and 2008.

3.1.8 However, a further survey in 2012 by Peter Cowley (University of Derby), identified the presence of both white-clawed and the invasive American signal crayfish within the Markeaton catchment. Peter Cowley's 2012 study recorded white-clawed crayfish at seven (of nineteen) survey sites in the catchment of Markeaton Brook. A total of 49 white-clawed crayfish were recorded across these seven sites, all of which are located upstream (i.e. to the west of the Sturgess Field survey site). Thirty four of the 49 records were from the Markeaton Park survey site, which corresponds with the 2012 data presented in Appendix B. A solitary signal crayfish, was also recorded from

the Markeaton Park survey site at the inlet where Markeaton Brook flows into Markeaton Lake (western end).

3.1.9 In 2014, EMEC Ecology carried out a protected species survey of Mill Pond (shown on Figure 2 as Mill Pond 1 and 2) and determined that the habitat within the section of Mill Pond was considered unsuitable for white-clawed crayfish due to the very deep silt and lack of refuges i.e. stones, rocks, and submerged tree roots (EMEC, 2014). Additionally, the water lacked aeration (e.g. riffles, turbulence or flow) and therefore was considered sub-optimal for white-clawed crayfish. It was therefore considered unlikely that white-clawed crayfish would be present in Mill Pond 1 and 2.

3.2 Field Results

3.2.1 The results of the field surveys carried out in 2015 are shown in Table 2. Site photos are also provided in Appendix C and referenced in Table 2.

Table 2: White-Clawed Crayfish 2015 Survey Results

Site Name	Method	Visit 1 Date/s	Survey 1 Findings	Visit 2 Date/s*	Survey 2 Findings*
Kingsway and Markeaton Junction Section of the Proposed Scheme					
Markeaton Lake (a1) western end inlet SK 33351 37695	Trapping (10 traps)	Jul. 21-22	23 American signal crayfish (all adults), recorded from Site a1.	-	-
Markeaton Lake (a2) (eastern end) (Plate. 2) including outflow) SK 33752 37319	Trapping (10 traps)	Jul. 21-22	No crayfish recorded	Aug. 10-11	No crayfish recorded
Mill Pond 1 (a3) (Plate. 3) SK 33811 37152	Trapping (10 traps)	Jul. 21-22	No crayfish recorded.	Aug. 10 - 11	No crayfish recorded
Mill Pond 2 (a4) (Plate. 4) SK 33872 37078	Trapping (15 traps)	Jul. 21-22	No crayfish recorded.	Aug. 10 - 11	No crayfish recorded
Middle Brook (a5) From – SK 33663 37681 To – SK 34075 37276 (Plate. 5 showing freshwater sponges**)	Standard Methodologies (hand-searching)	Jul. 23	No crayfish recorded.	August 13 2015	No crayfish recorded.

Site Name	Method	Visit 1 Date/s	Survey 1 Findings	Visit 2 Date/s*	Survey 2 Findings*
Little Eaton Junction Section of the Proposed Scheme					
Boosemoor Brook (b4) From – SE 36861 39972 To – SK 36600 39966	Standard Methodologies (hand-searching)	July 23	No crayfish recorded.	Aug. 13	No Crayfish recorded.
Dam Brook (b3) **From – SK 36805 39837** **To – SK 36232 39645**	**Trapping (10 traps) and Standard Methodologies (hand-searching)**	**Jul. 22 - 23**	**A single male white-clawed crayfish was recorded from a trap immediately down-stream of the culvert. The animal was mature, carapace length 50 mm (Plate. 6).** **No crayfish recorded from standard methodologies**	-	-
Watermeadows Ditch (b2) From – SK 36365 39688 To – SK 36231 39644	Trap (10 traps)	Jul. 22-23	No crayfish recorded.	Aug. 11- 12	No crayfish recorded.
River Derwent (b1) From – SK 35894 40001 To – SK 35930 39830 (Plate. 7).	Trapping (15 traps) and Standard Methodologies (hand-searching)	Jul. 22 - 23	No crayfish recorded.	Aug. 11-12	No crayfish recorded.

* The locations where crayfish were recorded during Visit 1 were not included in the follow-up survey (Visit 2) in August 2015. Visit 2 encompassed the sites that failed to record a crayfish presence in Visit 1.

** Freshwater sponges recorded –these are one of the reasons Markeaton Brook System Local Wildlife Site (LWS) has been designated which covers this watercourse).

BOLD indicates the watercourse where white-clawed crayfish were found.

4. DISCUSSION

4.1.1 The results of the survey suggest that white-clawed crayfish populations are absent from all but one of the study sites; the exception being the slow flowing section of the Dam Brook (Site b3) that runs parallel with the A61 adjacent to the A61/A38 Island. Here a single adult male was recorded. No other white-clawed crayfish were recorded from the survey/s.

4.1.2 The positive record from Dam Brook corresponds with a DWT/A-One+ record from the same section of the brook in 2014 where a single female was recorded. This would suggest that a small, possibly residual, population is present in the brook, either in isolation, or possibly as part of a larger population upstream of the study area i.e. within the eastern regions of Dam Brook, outside the Study Site.

4.1.3 Dam Brook connects to Watermeadows Ditch, which subsequently connects to the River Derwent approximately 1.7 km to the south of the proposed scheme.

4.1.4 American signal crayfish were recorded from the survey with 23 adults captured from the inlet at the north-western end of Markeaton Lake (a1) indicating a well-established population. This location corresponds with the solitary signal crayfish record found from Cowley's study on 2012. No other signal crayfish were recorded from the surveys, but the population is likely to be present, at least at low abundance, in areas beyond where it was detected

4.1.5 All surveys were undertaken in optimum survey conditions, and followed both standard procedures and trapping protocols where applicable.

4.1.6 It is highly likely that there is a strong correlation between the increasing numbers of signal crayfish (carriers of the well documented crayfish plague *Aphanomyces astaci*) and the absence of white-clawed crayfish downstream of Markeaton Park. This includes; the rest of Markeaton Lake, Mill Pond 1, Mill Pond 2, the connecting Middle Brook that flows into the lower Markeaton Brook.

4.1.7 Crayfish plague is readily carried by signal crayfish populations and is responsible for losses of white-clawed crayfish populations in many catchments in England and Wales.

5. SUMMARY

5.1.1 White-clawed crayfish surveys were undertaken on watercourses identified as potentially suitable to support white-clawed crayfish from the extended Phase 1 habitat survey: four sites were surveyed within the Markeaton and Kingsway junctions section of the proposed scheme (Markeaton Lake, Mill Pond 1, Mill Pond 2 and Middle Brook); and four within the Little Eaton junction section of the proposed scheme (Boosemoor Brook, Dam Brook, Watermeadows ditch and the River Derwent).

5.1.2 One white-clawed crayfish was recorded from Dam Brook (Site b3,which correlates with a record obtained in 2014). American signal crayfish were recorded from the inlet at the north-western end of Markeaton Lake (Site a1).

5.1.3 Recommendations for mitigation and/ or enhancement of the proposed scheme for white-clawed crayfish, together with any Natural England Licence requirements, and pre-construction surveys will be considered and reported in the Environmental Assessment Report (EAR).

6. REFERENCES

AECOM (2015). A38 Junction - Extended Phase 1 Habitat survey (Report number 47071319-URS-05-RP-EN-003).

Cowley, P.J. (2012) A species distribution model for the white-clawed crayfish, *Austropotamobius pallipes*, (Crustacea, Decapoda, Astacidae) in the Markeaton Brook catchment, Derbyshire, and assessment of a possible conservation site.

David Rogers Associates (2008). A study of crayfish and water quality, Markeaton Brook in 2008.

EMEC Ecology (2014). Protected Species Survey of The Mill Pond Off Markeaton Street in Derby. A report to Derby City Council.

Holdich, D. (2003). Ecology of the White-clawed Crayfish. Conserving Natura 2000 Rivers. Ecology Series No. 1. English Nature, Peterborough.

Lowland Derbyshire Biodiversity Partnership (2011). Lowland Derbyshire Biodiversity Action Plan 2011-2020.

Lowland Derbyshire Local Biodiversity Action Plan (2007). White-clawed crayfish species action plan 2007-2010.

Lowland Derbyshire Local Biodiversity Action Plan (2007). Crayfish in Lowland Derbyshire.

Natural England (2011) Native White Clawed Crayfish. Online at:

http://www.environmentagency.gov.uk/homeandleisure/recreation/fishing/38055.aspx Accessed October 2015

Peay, S. (2002). *A Standardised Survey and Monitoring Protocol for the White-clawed Crayfish in the UK*. Life in UK Rivers LIF 02-11-37. EC LIFE Programme, DG Env.D.1., Brussels, Belgium.

Peay, S. (2003) Monitoring of the White-clawed Crayfish *Austropotamobius pallipes*. Conserving Natura 2000 Rivers Monitoring Series *No.1*, English Nature, Peterborough.

Appendix A - Figures

N

M1 JUNCTION 28

A38/A61 LITTLE EATON JUNCTION

A38/A6 PALM COURT JUNCTION

A38/A52 MARKEATON JUNCTION

A38/A5111 KINGSWAY JUNCTION

A50/A38 JUNCTION

2 0 2 4 6 8 Kilometres

Project Title/Drawing Title

A38 DERBY JUNCTIONS SCHEME LOCATION PLAN

Project Number 47071319		
Drawn GB	Checked SW	Approved SW
Date 04/02/2016	Scale @ A3 1:100,000	Purpose of issue FINAL
Drawing Number Figure 1		Rev 3F

Highways England
Major projects
Piccadilly Gate
Store Street
Manchester
M1 2WD

AECOM
Royal Court
Basil Close, Chesterfield
Derbyshire. S41 7SL
+44 (0) 1246 209221
+44 (0) 1246 209229
www.aecom.com

File Name:\\ch-wip-001\CH_Roads\A38 Derby Jcns - PO1339\12 CAD\12.1 WIP\FIGURE 1.1 - LOCATION PLAN F1.mxd

Lens Road Survey Site (2012)

Lens Road (2008)

Markeaton Park Survey Site (2012)

Sturgess Field Survey Site (2012)

Markeaton Park (2008)

St Johns Terrace (2008)

Middle Brook

Markeaton Brook

Mackworth Brook

Bramble Brook

Markeaton Lake

Mill Pond 1

Mill Pond 2

1993 C
1993 A
1996 A
1993 B
2008 A
1986 A
1986 B
1996 B
2000
2002 A
2012 B
1985 A
2012 A
1975
2002 B
1992 C
1998
1997
2008 B
1992 B
1992 A

Legend

- Site boundary
- 50 m buffer
- 250 m buffer
- 500 m buffer
- 1000 m buffer

Crayfish survey results provided by DCC. Peter Cowley, 2012

- White-clawed crayfish
- White-clawed crayfish + Signal crayfish
- No crayfish

Records provided by Derbyshire Wildlife Trust

- White-clawed crayfish (with date and reference)

Records from David Rogers Associates, 2008

- White-clawed crayfish

200 0 200 400 600 800 1000 Metres

File Name:X:\Highways Agency\47071390 A38 Derby Jcns - Environment\Technical\Ecology\GIS_Chesterfield\project_files\Kingsway\Crayfish\A38 Kingsway Desk study Crayfish 20160303.mxd

Project Title/Drawing Title

A38 DERBY JUNCTIONS
MARKEATON AND KINGSWAY
DESK STUDY
WHITE-CLAWED CRAYFISH RECORDS

Project Number 47071319		
Drawn GSB	Checked DS	Approved PB
Date 03/03/2016	Scale @ A3 1:12,000	Purpose of issue FINAL
Drawing Number Figure 2		Rev 3F

Highways England
Major projects
Piccadilly Gate
Store Street
Manchester
M1 2WD

AECOM
Royal Court
Basil Close, Chesterfield
Derbyshire. S41 7SL
+44 (0) 1246 209221
+44 (0) 1246 209229
www.aecom.com

N

1991 A
1991 B
1992
2014
1983
1989

Legend

- Site boundary
- 50 m buffer
- 250 m buffer
- 500 m buffer
- 1000 m buffer
- White-clawed crayfish records provided by Derbyshire Wildlife Trust (with date and reference)

200 0 200 400 600 800 1000 Metres

Project Title/Drawing Title

A38 DERBY JUNCTIONS
LITTLE EATON
DESK STUDY - WHITE-CLAWED CRAYFISH RECORDS FROM DWT

Project Number 47071319		
Drawn GSB	Checked SR	Approved PB
Date 03/03/2016	Scale @ A3 1:10,000	Purpose of issue FINAL
Drawing Number Figure 3		Rev 3F

Highways England
Major projects
Piccadilly Gate
Store Street
Manchester
M1 2WD

AECOM
Royal Court
Basil Close, Chesterfield
Derbyshire. S41 7SL
+44 (0) 1246 209221
+44 (0) 1246 209229
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File Name:X:\Highways Agency\47071390 A38 Derby Jcns - Environment\Technical\Ecology\GIS_Chesterfield\project_files\Little Eaton\Crayfish\A38 Little Eaton Crayfish Desk study 20160303.mxd

N

Mackworth Brook
Markeaton Brook
Site a1
Site a2
Markeaton Lake
Site a3
Middle Brook
Site a5
Markeaton Brook
Site a4
Mill Pond 1
Mill Pond 2
Bramble Brook
Bramble Brook
Bramble Brook

Legend

- Site boundary
- 50 m buffer
- 250 m buffer
- 500 m buffer
- 1000 m buffer
- Water body
- Direction of flow
- Survey area
- Not suitable for crayfish
- 23 American Signal crayfish
- No crayfish

100 0 100 200 300 400 500 Metres

File Name:X:\Highways Agency\47071390 A38 Derby Jcns - Environment\Technical\Ecology\GIS_Chesterfield\project_files\Kingsway\Crayfish\A38 Kingsway Markeaton Crayfish 20160303.mxd

Project Title/Drawing Title

A38 DERBY JUNCTIONS MARKEATON AND KINGSWAY CRAYFISH SURVEY

Project Number 47071319		
Drawn GSB	Checked DS	Approved PB
Date 03/03/2016	Scale @ A3 1:8,000	Purpose of issue FINAL
Drawing Number Figure 4		Rev 3F

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N

Site b1

River Derwent

Watermeadows ditch

Site b2

Site b3

Boosemoor Brook

Site b4

Dam Brook

Dam Brook

100 0 100 200 300 400 500 Metres

Legend

- Site boundary
- 50 m buffer
- 250 m buffer
- 500 m buffer
- Water body
- Direction of flow
- Survey area
- 1 ♂ White-clawed crayfish
- No crayfish

File Name:X:\Highways Agency\47071390 A38 Derby Jcns - Environment\Technical\Ecology\GIS_Chesterfield\project_files\Little Eaton\Crayfish\A38 Little Eaton Crayfish 20160303.mxd

Project Title/Drawing Title

A38 DERBY JUNCTIONS LITTLE EATON CRAYFISH SURVEY

Project Number 47071319		
Drawn GSB	Checked DS	Approved PB
Date 03/03/2016	Scale @ A3 1:5,000	Purpose of issue FINAL
Drawing Number Figure 5		Rev 3F

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Appendix B – Date Records of White-clawed Crayfish

Date Records of White-clawed Crayfish

White-clawed crayfish records reported in the Tables B1 and B2 are from DWT unless otherwise noted.

Refer to Figures 2 and 3, Appendix A which shows the location of the records.

Table B1: White-Clawed Crayfish Records from DWT– Kingsway and Markeaton Junctions Section of the Proposed Scheme

Grid Reference	Location	Year	Ref.
SK332377	Markeaton Park Greenhouses - located within 1 km to the west of the Markeaton junction section site boundary	1975	-
SK335375	Markeaton Park – located within 500 m to the north of the Markeaton junction section site boundary	1985	A
SK337376	Markeaton Park, streams – located within 250 m to the west of the Markeaton junction section	1986	A
SK337376	Markeaton Park, streams – located approximately 250 m to the west of the Markeaton junction section of the proposed scheme	1986	B
SK345365	Markeaton Brook – located 1 km to the east of the Markeaton junction section site boundary	1992	A
SK345365	St John's Terrace – located within 1.25 km to the east of the Markeaton junction section site boundary	1992	B
SK341369	Mill pond 2 – located within 500 m to the north of the Markeaton junction section site boundary	1992	C
SK340373	Markeaton Brook – located within 250 m to the east of the Markeaton junction site boundary	1993	A
SK340373	Located within 250 m to the north east of the Markeaton junction section of the proposed scheme.	1993	C
SK34043727	Located within 250 m to the east of the Markeaton junction site boundary	1993	B
SK340374	Located within 1 km to the west of the Markeaton junction section site boundary	1996	A
SK334378	Located within 250 m to the north east of the Markeaton junction section of the proposed scheme.	1996	B
SK343367	Markeaton Brook – located within 1 km to the east of the Markeaton junction section site boundary	1997	-
SK343369	Markeaton Brook – located within 1 km to the east of the Markeaton junction section site boundary	1998	-
SK336375	Markeaton Bk, ponds – located within 500 m to the west of the Markeaton junction section site boundary	2000	-

Grid Reference	Location	Year	Ref.
SK331380	Markeaton Brook – located within 1.25 km to the north-east of the Markeaton junction section site boundary	2002	A
SK338371	Mill Pond – Located within 250 m to the east of the Markeaton junction section of the proposed scheme.	2002	B
SK337376	Markeaton Park – located 1 km to the east of the Markeaton junction section site boundary	2008	A
SK345366	St John's Terrace – located within 1.25 km to the east of the Markeaton junction section site boundary	2008	B
SK332377	Markeaton Park – located within 500 m to the west of the Markeaton junction section site boundary	2012	A
SK335375	Located approx. 300 m to the west of the Markeaton junction section of the proposed scheme	2012	B

Table B2: White-Clawed Crayfish Records from DWT – Little Eaton Junction Section of the Proposed Scheme

Grid Reference	Location	Year	Ref.	Comments
SK353385	Darley Abbey – located within 1.75 km to the south of the Little Eaton Junction Section site boundary	1983	-	
SK357384	Breadsall Brook, confluence – located within 1.75 km to the south of the Little Eaton Junction Section site boundary	1989	-	
SK360407	Little Eaton – located within 1 km to the west of the Little Eaton Junction Section site boundary	1991	A	
SK360408	Bottle Brook – located 600 m to the north west of the Little Eaton Junction Section site boundary	1991	B	
SK360407	Little Eaton – located 600 m to the north west of the Little Eaton Junction Section site boundary	1992	-	
SK36433995	Little Eaton Roundabout, road scheme – culvert works within a section of Dam Brook, adjacent to the A38/61. Record located to the south of the Little Eaton junction section, within the site boundary.	2014	-	Record of one female white-clawed crayfish from A-One+ and DWT. White-clawed crayfish translocated near-by.

Appendix C – Site Photos

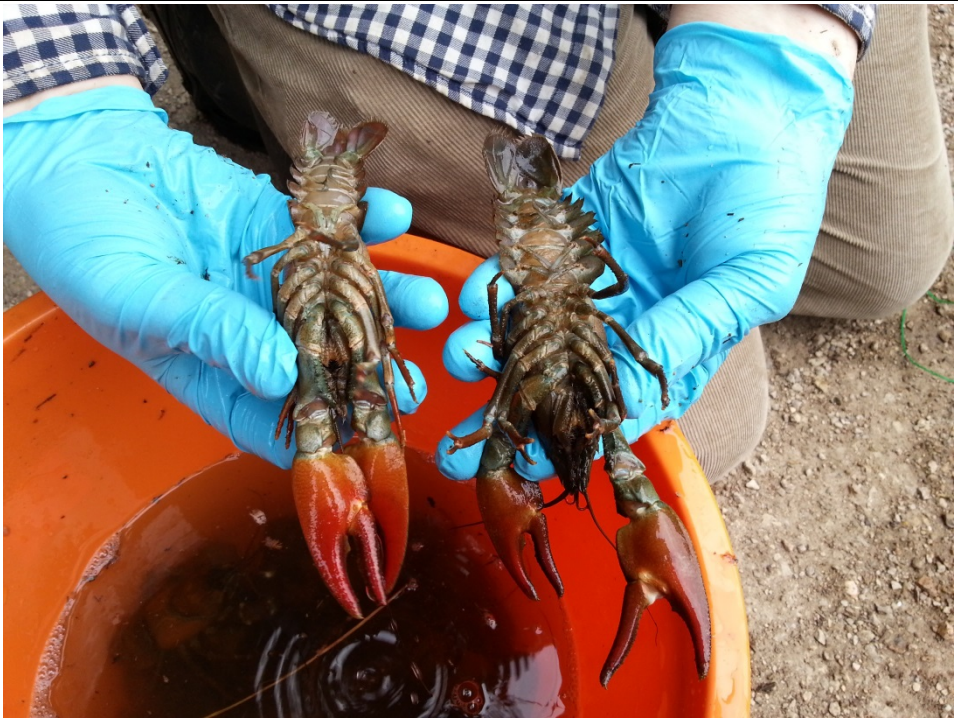
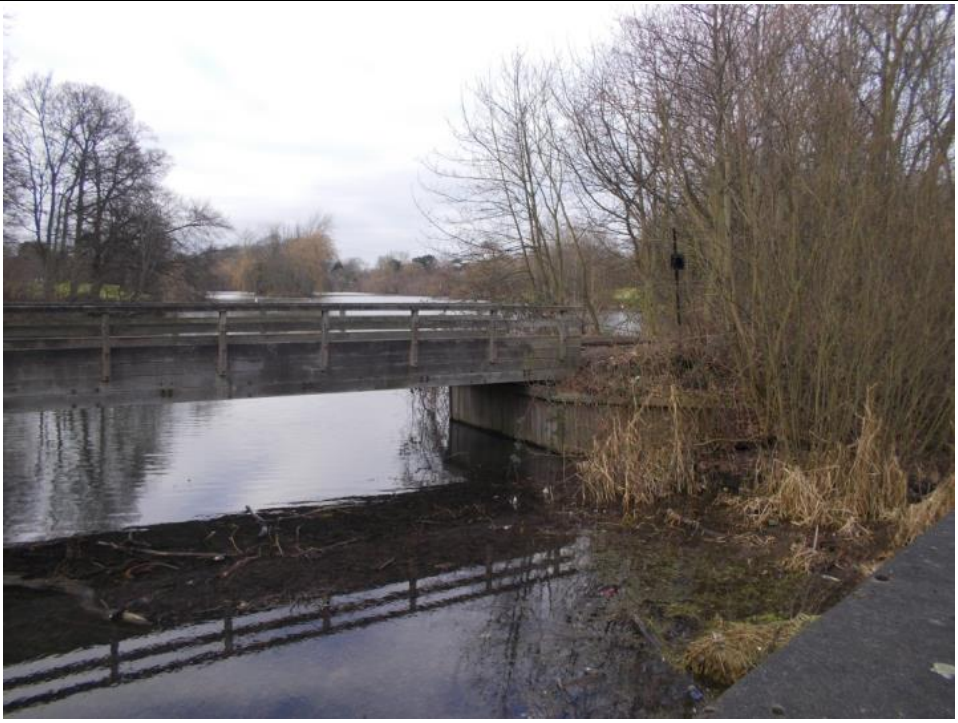
Plate number	Notes	Plate
1	Markeaton Lake north-western end (a1) (signal crayfish)	
2	Markeaton Lake - eastern end (a2) outflow in to Markeaton Brook	

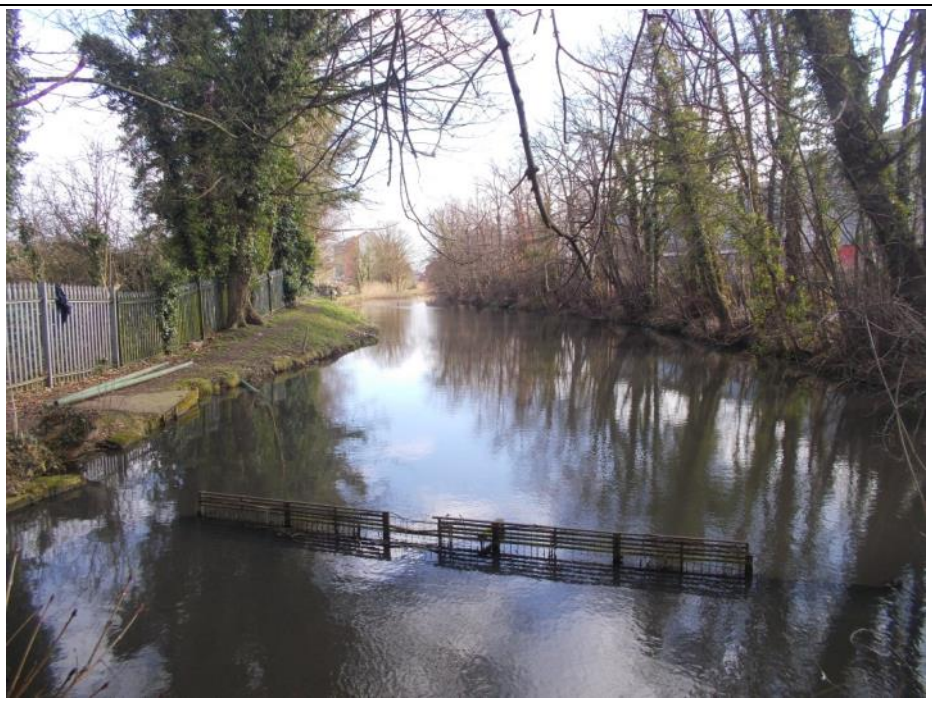
Plate number	Notes	Plate
3	Mill Pond 1 (looking from the north-western end) (a3)	
4	Mill Pond 2 Canal (looking from the south-eastern end) (a4)	

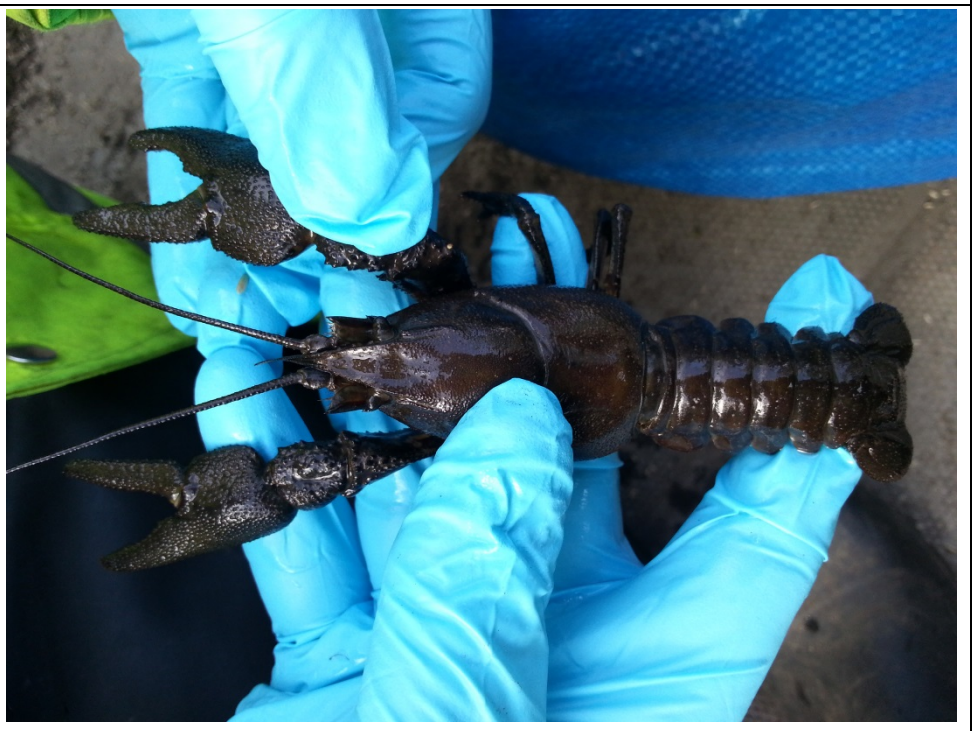
Plate number	Notes	Plate
5	Middle Brook (freshwater sponges) (a5)	
6	Dam Brook (Male white-clawed crayfish) (b3)	

Plate number	Notes	Plate
7	River Derwent (A38 Bridge) (b1)