Lamprey Survey - River Almond and East Pow Burn
September 2008

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Mouchel

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Tables and Figures

1 INTRODUCTION

1.1 Background

1.1.1 AMEC Earth & Environmental (UK) Ltd. was contracted by Mouchel to undertake a lamprey survey in the River Almond and its tributary, East Pow Burn, within the village of Almondbank, Perthshire. The planning area of the proposed flood prevention scheme for the village of Almondbank lies within the Special Area of Conservation (SAC EU code UK0030312) of the River Tay and its two tributaries. Consequentially all planning activities within the SAC require an Environmental Impact Assessment (EIA) as governed by the European Union Directive 85/337/EEC (amended by the Council Directives 97/11/EC and 2003/35/EC) and in accordance with the Environmental Impact Assessment (Scotland) Regulations 1999.

1.1.2 Lampreys are an ancient group of aquatic vertebrates, often described as 'jawless fish'. The juvenile life stage remains buried in fine sediment depositions of rivers and streams. All three species of lamprey found in the United Kingdom – brook lamprey (*Lampetra planeri*), river lamprey (*Lampetra fluviatilis*), and sea lamprey (*Petromyzon marinus*) – are listed in Annex II and V of the EU Habitats and Species Directive (92/43/EC). Previous surveys have reported lampreys to be present in the River Tay and River Almond catchment (APEM 2004). All three of the lamprey species are listed in Annex II of the SAC description as a qualifying feature for the site selection (WEB Ref. 1). The presence of lamprey in the proposed flood defence scheme area would require an appropriate assessment of the potential effects of the design and construction activities on the lamprey population.

1.1.3 The aim of this study is to document the presence/absence of lampreys in the planning area of the proposed flood prevention scheme.

1.2 Ecology and Habitat Requirements of Lamprey

1.2.1 All three species of lamprey are found in UK rivers. The distribution of river and sea lamprey is limited to a line south of the Scottish Great Glen (Maitland & Campbell 1992). The latter are anadromous species, spawning in fresh water in spring / early summer. The freshwater larvae stage (referred to as an ammocoete) develop buried in fine sediments and filter organic particles from the surrounding interstitial space. After several years the larvae undergo a transformation process (metamorphosis); developing fully functional eyes and a mouth suction disc with teeth. Adult sea and river lamprey migrate back into the sea where they prey on smaller fish and mainly live as ecto-parasites attached to larger fish with their mouth sucker.

1.2.2 Brook lamprey complete their entire life cycle in rivers and streams. Preferred spawning grounds are well aerated gravel beds whereas the larval stages are normally found in silt and sand dominated sediments with high organic content. This highlights the importance of a good connectivity between the habitats that lampreys require during the

different life stages, especially for the anadromous forms which migrate between fresh- and salt-water.

1.2.3 The larval stages of brook and river lampreys cannot be distinguished from sea lamprey larvae without laboratory analysis (Gardiner 2003). Only the brook-river lamprey group can be differentiated from sea lamprey larvae by skin pigmentation patterns and, in older larval stages, by the shape of their caudal fin.

1.3 Survey Conditions

1.3.1 The lamprey survey was carried out on 22/09/2008. Weather conditions were dry and warm with light cloud cover and temperatures around 14ºC. Light showers during the week prior to the survey did not have an impact on the low water levels of the River Almond (see Figure 1 and 2 for Almondbank).

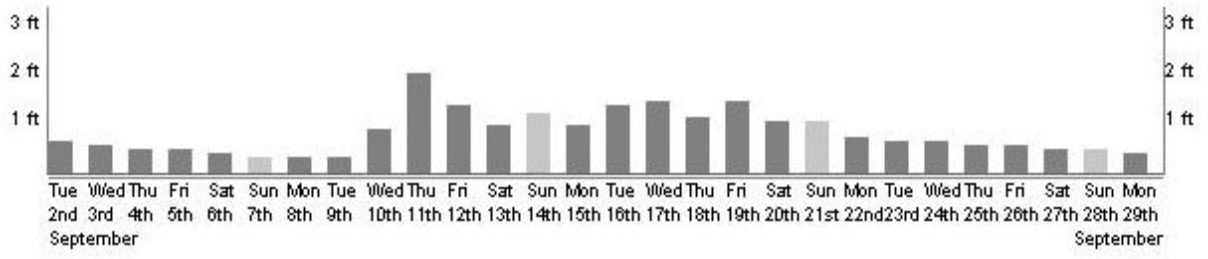


Figure 1: September water levels of the River Almond (WEB Ref. 2)

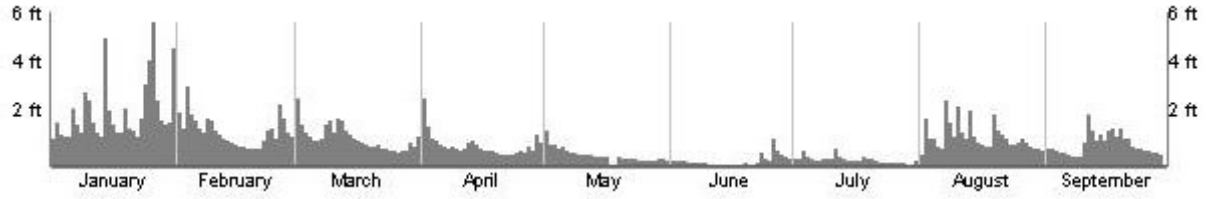


Figure 2: 2008 water levels of the River Almond (WEB Ref. 2)

2 SURVEY METHODOLOGY

2.1 Electrofishing

2.2.1 The survey was conducted following the recommendations by Harvey and Cowx (2003) using an Electracatch electrofishing module with 50 Hz pulsed DC power output (variable voltage). Depending on the accessibility of the survey site, a battery or generator powered electrofishing module was used (see Table 1). Both electrofishing modules were operated with a single copper cathode and a single round anode (30 cm in diameter).

2.2.2 Each 1 m2 sampling site was enclosed by a fine-meshed net to prevent the escape of lamprey once stunned. The predefined area was energised three times for two minutes with a pause of five minutes between each electrofishing cycle. In total five areas were surveyed (three in the River Almond, two in the East Pow Burn). Two samples were taken at each sampling station in close proximity to each other, but covering slightly different sediment types. Ammocoetes were removed from the enclosure, identified, measured and released into the river after the survey. To obtain exact length measurements of lamprey, the larvae would have required anaesthetisation. Such information was not required for this study and as such all length measurements in Appendix C are accurate to 1 cm.

2.2 Site Selection

2.2.1 The five sampling locations were selected during a walkover survey prior to electrofishing, which focused on fine sediment rich deposits along the River Almond and the East Pow Burn. Both rivers are discharge regulated and comprise bank and bed stabilizing measures like gabions, stone walls and concrete embankments. The embankments cause relatively homogenous flow patterns and restrict sedimentation. Consequently, few suitable habitats for ammocoetes were identified during the walkover survey. The selected sites were located in shallow areas behind gravel banks and dead wood, in wide, slowly flowing river sections (Figure 3 and Appendix B – Site Photographs).

2.2.2 Sampling site coordinates were captured with a Garmin GPS MAP60CSx, accurate to ± 5m.

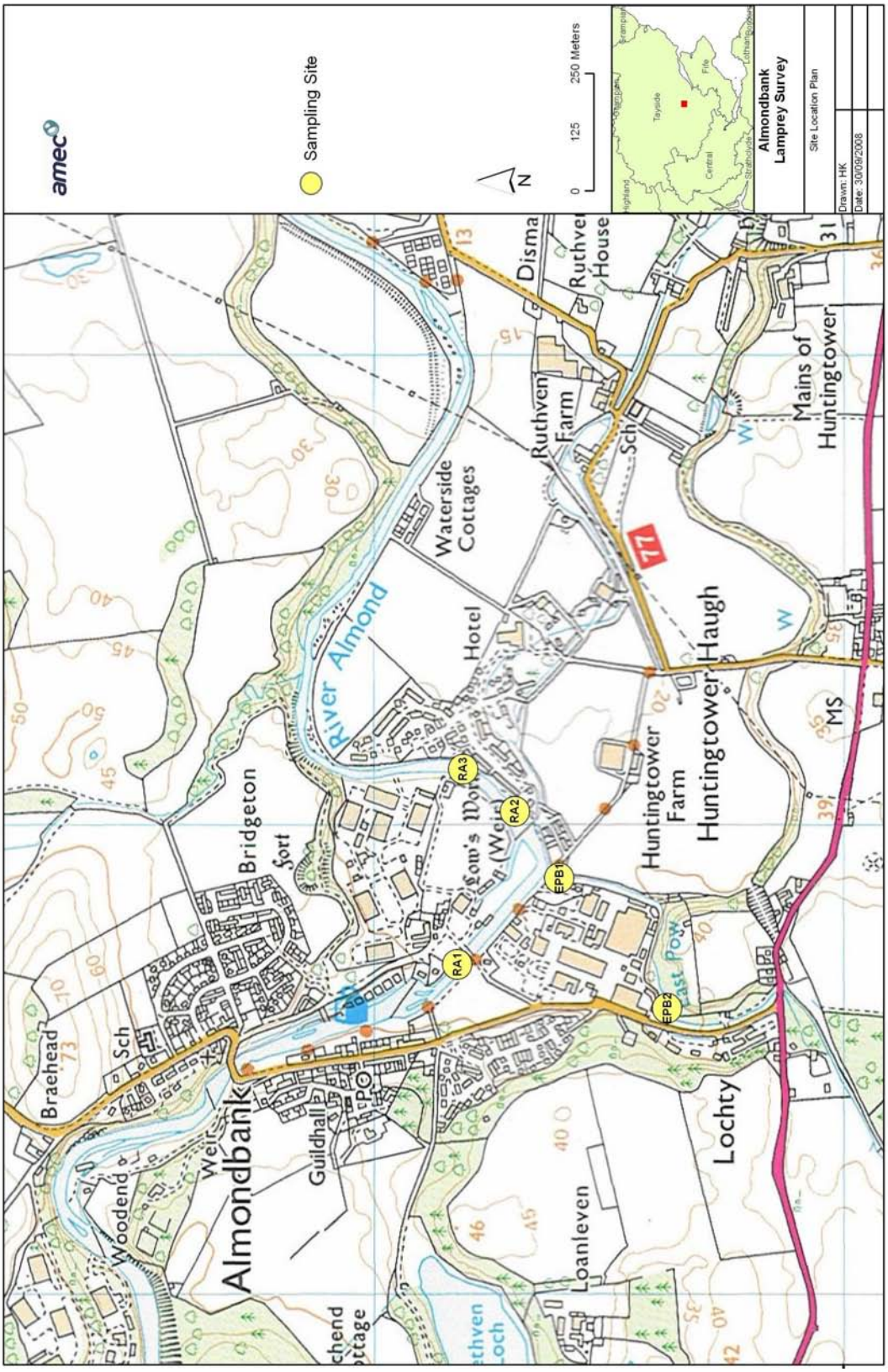


Figure 3: Sampling Locations. Two sub-samples were taken from each marked location (Ordnance Survey Copy Right Licence 100024961)

3 RESULTS AND DISCUSSION

Ammocoetes of river or brook lamprey (indeterminable within the field) were found in the River Almond and the East Pow Burn (Table 1).

Table 1: Abundance of Lampreys per Sampling Site
The sub-sample was taken within a five metre distance from sample no. 1.

Sample ID	Easting	Northing	Battery/Generator Powered Equip.	River/Brook Lamprey Density (m^{-2})	Conservation Status[1]
River Almond					
RA1-1	306703	725821	B	3	unfavourable
RA1-2			B	3	unfavourable
RA2-1	307029	725699	B	0	unfavourable
RA2-2			B	0	unfavourable
RA3-1	307119	725809	B	0	unfavourable
RA3-2			B	1	unfavourable
East Pow Burn					
EPB1-1	306887	725604	B	0	unfavourable
EPB1-2			B	0	unfavourable
EPB2-1	306610	725375	G	4	unfavourable
EPB2-2			G	10	favourable

3.1 Site RA1

3.1.1 The site was situated ca. 40 m upstream from the footbridge across the River Almond. Low flow velocities and large deposits of coarse organic material, mainly branches and leaf material, have resulted in an optimal habitat for lamprey larvae. Three river/brook lamprey ammocoetes were found within the m2 at RA1-1 and the replicate site RA1-2 (Figure 4). The sampling site was 50% shaded by beech and willow branches (compare Appendix A – Survey Protocols).

[1] Harvey & Cowx (2003) provide a tentative abundance classification for lamprey larvae based on UK wide survey data for different stream types. Favourable conservation status for lamprey larvae (m^{-2}, optimal habitat): Sea lamprey 0.2, river/brook lamprey in chalk streams ≥5, in other UK stream types: river/brook lamprey ≥10.

Figure 4: River/brook lamprey larvae. Left ventral, right dorsal view

3.2 Site RA2

3.2.1 RA2 was located approximately 30 m downstream from the Low's Work Weir in the River Almond. At this point emerging grass and shrub vegetation stabilises the fine sediments together with cobbles in an area of reduced flow speeds. No lamprey larvae were found at RA2-1 or RA2-2. The sampling location was only marginally shaded by overhanging willow branches.

3.3 Site RA3

3.3.1 The remaining footings of a former bridge across the River Almond at this point have resulted in fine sediment depositions and accumulations of dead wood along the left-hand bank. One river/brook lamprey larvae was found at RA3-2. RA3-1 did not reveal any lamprey larvae.

3.4 Site EPB1

3.4.1 The outfall of the East Pow Burn comprises a concrete river bed together with stone / concrete stabilised banks around the road bridge. Approximately 15 m upstream from the bridge where the bed reinforcement ends, a mixture of cobble stones and sandy sediments were sampled. Lamprey larvae were not found on either of the replicate sampling sites.

3.5 Site EPB2

3.5.1 Approximately 450 m upstream from the outfall of the East Pow Burn the river bank consists of sand and silt, stabilised by grass and cobbles. Broadleaved trees and shrubs

provide 80% shading. The two adjacent sampling sites revealed river/brook lamprey densities of four (EPB2-1) and ten larvae per m^2 (EPB2-2). The population density at EPB2-2 reflects a favourable conservation status for river/brook lamprey larvae according to Harvey & Cowx (2003). Although the outfall of the East Pow Burn into the River Almond is probably impassable for lampreys during medium/low water levels.

3.5.2 Figure 5 (February 2008, compare Figure 2) shows that this tributary to the River Almond is connected during high water levels, allowing adult lampreys to migrate between the two watercourses during these periods.

Figure 5: Outfall of East Pow Burn at high water level

4 SUMMARY AND RECOMMENDATIONS

4.1.1 During the electrofishing survey on 22/09/2008, river/brook lamprey larvae were recorded in the River Almond and East Pow Burn in the Almondbank area. Although the River Almond has relatively few suitable fine sediment habitats within the surveyed river section, ammocoetes were present at two out of the three sampling sites.

4.1.2 The highest river/brook lamprey densities were found in the East Pow Burn with 10 larvae per m2, representing a favourable conservation status.

4.1.3 The presence of the protected lamprey larvae will require special attention during the further planning and construction phases of the Almondbank flood prevention scheme, particularly as they are listed as a feature of interest within the River Tay SAC citation and will require further detailed consideration under the Conservation (Natural Habitats 7c.) Regulations 2000 and subsequent Scottish amendments.

4.1.4 Because lamprey larvae live buried in the river bed, they require a steady flow of fresh water through the interstitial porous space of the sediments. Construction activities like sheet piling and dewatering of the river bed and banks could have fatal consequences for the lamprey larvae. An appropriate assessment will be required in order to identify potential interference of the scheme with the lamprey habitat and provide mitigation advice.

4.1.5 Suitable mitigation measures should be implemented in the event that construction activities during the implementation of the flood defence scheme are likely to cause disturbance of the river sediments of the River Almond or the East Pow Burn. For example, potential habitats could be identified by a qualified biologist and lamprey larvae could then be removed from the sites using electrofishing equipment.

4.1.6 It is important to note that the proposed flood prevention scheme will have to consider the habitat requirements of lampreys, allowing for free passage in upstream and downstream direction (The Scottish Executive 2000) and maintain or improve the quality of the current habitat.

5 REFERENCES

5.1.1 35/337/EEC: Official Journal of the European Union NO. L 175 , 05/07/1985 P. 0040 – 0048

5.1.2 97/11/EC: Official Journal of the European Union NO. L 073 , 14/03/1997 P. 0005

5.1.3 2003/35/EC: Official Journal of the European Union NO. L 156 , 25/06/2003 P. 0017 - 0025

5.1.4 APEM 2004. Distribution of sea, brook and river lampreys on the River Tay. Scottish Natural.

5.1.5 Harvey & Cowx 2003: Monitoring the River, Brook and Sea Lamprey, *Lampetra fluviatilis, L. planeri* and *Petromyzon marinus*. Conserving Natura 2000 Rivers Monitoring Series No 5, English Nature, Peterborough.

5.1.6 Gardiner 2003: Identifying Lamprey. A field key for Sea, River and Brook Lamprey. Conserving Natura 2000 Rivers Conservation Techniques Series No. 4. English Nature, Peterborough.

5.1.7 Maitland & Campbell 1992: Freshwater Fishes of the British Isles. Harper Collins. London.

5.1.8 The Scottish Executive 2000: River Crossings and Migratory Fish: Design Guidance. The Scottish Executive. Edinburgh.

5.1.9 WEB Ref. 1: http://www.jncc.gov.uk/protectedsites/sacselection/sac.asp?EUCode=UK0030312

5.1.10 WEB Ref. 2: http://www.fishbritain.co.uk/Tay/RiverLevels14.asp

6 Appendix A – Survey Protocols

Appendix 2. HABSCORE data input sheet

Site habitat record

Site identification — Site code RA 1 — Catchment River Almond / Tay

Site name — NGR 306703/725821 — River name River Almond — Survey date 22/09/2008

Riparian shading of the site

What percentage of the water surface of the site is overhung by riparian vegetation? Estimate this percentage, for the three vegetation classes indicated, to the nearest 5%.

Deciduous trees & shrubs	Coniferous trees	Herbaceous vegetation
50%		

Migratory access

What is the accessibility of the site ?	Salmon	Sea trout
Always accessible	X	X
Sometimes accessible		
Never accessible		

Substrate embeddedness

What is the degree of substrate embededdness throughout the site? Tick one box.

High		Medium		Low	X	

Flow conditions

Briefly describe the prevailing flow conditions (as observed at the time of the HABSCORE survey).

Calm < 0.2 m/sec

Upstream land-use considerations

What is the principal land-use immediately upstream of the site? Tick appropriate box(es).

Moor / heathland		Coniferous woodland	X	Deciduous woodland	X	Improved pasture	
Urban development		Rough pasture		Industrial land	X	Arable land	X
Tips / waste		Other					

Potential impacts

Are there likely to be any impacts at the site from the following sources? Tick appropriate box(es).

pH effects		Stocking	X	Pollution		Migration barriers	X
Habitat modification	X	River engineering		Low flows		Flow regulation	
Other							

Width and depth profile at bottom stop net

Record widths to the nearest 0.1m and depths to the nearest 1.0cm.

Channel width	10	Depth within enclosure 0.4m
Depth at ¼ channel width	0.6	
Depth at ½ channel width	1	
Depth at ¾ channel width	0.6	

Section dimensions

Record section lengths and widths to the nearest 0.1 m and depths to the nearest 1 cm.

Section length										
Section width										
Depth at ¼ channel width										
Depth at ½ channel width										
Depth at ¾ channel width										

Substrate

Absent	Scarce	Common	Frequent	Dominant
0%	>0% & <5%	≤5% & <20%	≤20% & <50%	≤50%
A	S	C	F	D

What percentage of the stream bed area in each section is composed of the following substrate types? Enter A, S, C, F or D as appropriate (see above table).

Substrate category											
Bedrock/artificial	A										
Boulders >25.6 cm	A										
Cobbles 6.4-25.6 cm	A										
Gravel/coarse sand 0.2-6.4 cm	D										
Fine sand/silt <0.2 cm	F										
Compacted clay	S										

Flow

What percentage of the water surface area in each section is composed of the following flow types? Enter A, S, C, F or D as appropriate.

Flow category											
Cascade/torrential	A										
Turbulent/broken deep	A										
Turbulent/broken shallow	A										
Glide/run deep	A										
Glide/run shallow	S										
Slack deep	D										
Slack shallow	C										

Sources of cover for >10 cm trout

What percentage of the stream bed area in each section could provide cover (for a >10 cm trout) in the form of submerged overhang, or overhang within 0.5 m of the water surface? Indicate the abundance of cover within the various categories listed below. For 'submerged vegetation' include all macrophytes, mosses and algae providing cover. Estimate as 0, 1, 2, 3, 4, 5, 10, 15, 20, 25 ... 100%.

Source of cover										
Submerged vegetation	A									
Boulders, cobbles, etc.	S									
Tree root systems	S									
Branches and logs	C									
Undercut banks	A									
Other submerged cover	S									
Overhang within 0.5 m	A									
Area of deep water	S									

Appendix 2. HABSCORE data input sheet

Site habitat record

Site identification — Site code RA2 — Catchment River Almond/Tay

Site name — NGR 307079/725699 — River name River Almond — Survey date 22/09/2008

Riparian shading of the site

What percentage of the water surface of the site is overhung by riparian vegetation? Estimate this percentage, for the three vegetation classes indicated, to the nearest 5%.

Deciduous trees & shrubs	Coniferous trees	Herbaceous vegetation
5		

Migratory access

What is the accessibility of the site ?	Salmon	Sea trout
Always accessible	x	x
Sometimes accessible		
Never accessible		

Substrate embeddedness

What is the degree of substrate embededdness throughout the site? Tick one box.

High		Medium		Low	x

Flow conditions

Briefly describe the prevailing flow conditions (as observed at the time of the HABSCORE survey).

Calm < 0.2 m/sec

Upstream land-use considerations

What is the principal land-use immediately upstream of the site? Tick appropriate box(es).

Moor / heathland		Coniferous woodland	x	Deciduous woodland	x	Improved pasture	
Urban development		Rough pasture		Industrial land	x	Arable land	x
Tips / waste		Other					

Potential impacts

Are there likely to be any impacts at the site from the following sources? Tick appropriate box(es).

pH effects		Stocking	x	Pollution	x	Migration barriers	x
Habitat modification		River engineering	x	Low flows		Flow regulation	
Other							

Width and depth profile at bottom stop net

Record widths to the nearest 0.1m and depths to the nearest 1.0cm.

Channel width	15	Depth in enclosure 0.1 m
Depth at ¼ channel width	0.3	
Depth at ½ channel width	0.8	
Depth at ¾ channel width	0.3	

Section dimensions

Record section lengths and widths to the nearest 0.1 m and depths to the nearest 1 cm.

Section length										
Section width										
Depth at ¼ channel width										
Depth at ½ channel width										
Depth at ¾ channel width										

Substrate

Absent	Scarce	Common	Frequent	Dominant
0%	>0% & <5%	≤5% & <20%	≤20% & <50%	≤50%
A	S	C	F	D

What percentage of the stream bed area in each section is composed of the following substrate types? Enter A, S, C, F or D as appropriate (see above table).

Substrate category											
Bedrock/artificial	A										
Boulders >25.6 cm	S										
Cobbles 6.4-25.6 cm	C										
Gravel/coarse sand 0.2-6.4 cm	D										
Fine sand/silt <0.2 cm	S										
Compacted clay	A										

Flow

What percentage of the water surface area in each section is composed of the following flow types? Enter A, S, C, F or D as appropriate.

Flow category											
Cascade/torrential	A										
Turbulent/broken deep	F										
Turbulent/broken shallow	D										
Glide/run deep	A										
Glide/run shallow	C										
Slack deep	A										
Slack shallow	S										

Sources of cover for >10 cm trout

What percentage of the stream bed area in each section could provide cover (for a >10 cm trout) in the form of submerged overhang, or overhang within 0.5 m of the water surface? Indicate the abundance of cover within the various categories listed below. For 'submerged vegetation' include all macrophytes, mosses and algae providing cover. Estimate as 0, 1, 2, 3, 4, 5, 10, 15, 20, 25 ... 100%.

Source of cover											
Submerged vegetation	A										
Boulders, cobbles, etc.	D										
Tree root systems	S										
Branches and logs	A										
Undercut banks	S										
Other submerged cover	C										
Overhang within 0.5 m	A										
Area of deep water	S										

Appendix 2. HABSCORE data input sheet

Site habitat record

Site identification — Site code RA3 — Catchment River Almond / Tay

Site name — NGR 307119/725809 — River name River Almond — Survey date 22/03/2008

Riparian shading of the site

What percentage of the water surface of the site is overhung by riparian vegetation? Estimate this percentage, for the three vegetation classes indicated, to the nearest 5%.

Deciduous trees & shrubs	Coniferous trees	Herbaceous vegetation
10		

Migratory access

What is the accessibility of the site ?	Salmon	Sea trout
Always accessible	x	x
Sometimes accessible		
Never accessible		

Substrate embeddedness

What is the degree of substrate embededdness throughout the site? Tick one box.

High		Medium		Low	x

Flow conditions

Briefly describe the prevailing flow conditions (as observed at the time of the HABSCORE survey).

Slow flowing / stagnant

Upstream land-use considerations

What is the principal land-use immediately upstream of the site? Tick appropriate box(es).

Moor / heathland		Coniferous woodland	x	Deciduous woodland	x	Improved pasture	
Urban development		Rough pasture		Industrial land	x	Arable land	x
Tips / waste		Other					

Potential impacts

Are there likely to be any impacts at the site from the following sources? Tick appropriate box(es).

pH effects		Stocking	x	Pollution	x	Migration barriers	x
Habitat modification	x	River engineering	x	Low flows		Flow regulation	
Other							

Width and depth profile at bottom stop net

Record widths to the nearest 0.1m and depths to the nearest 1.0cm.

Channel width	12	Depth at sampling site 0.3m
Depth at ¼ channel width	0.6	
Depth at ½ channel width	1	
Depth at ¾ channel width	0.3	

Section dimensions

Record section lengths and widths to the nearest 0.1 m and depths to the nearest 1 cm.

Section length										
Section width										
Depth at ¼ channel width										
Depth at ½ channel width										
Depth at ¾ channel width										

Substrate

Absent	Scarce	Common	Frequent	Dominant
0%	>0% & <5%	≤5% & <20%	≤20% & <50%	≤50%
A	S	C	F	D

What percentage of the stream bed area in each section is composed of the following substrate types? Enter A, S, C, F or D as appropriate (see above table).

Substrate category											
Bedrock/artificial	A										
Boulders >25.6 cm	A										
Cobbles 6.4-25.6 cm	S										
Gravel/coarse sand 0.2-6.4 cm	D										
Fine sand/silt <0.2 cm	S										
Compacted clay	A										

Flow

What percentage of the water surface area in each section is composed of the following flow types? Enter A, S, C, F or D as appropriate.

Flow category											
Cascade/torrential	A										
Turbulent/broken deep	A										
Turbulent/broken shallow	A										
Glide/run deep	C										
Glide/run shallow	A										
Slack deep	D										
Slack shallow	S										

Sources of cover for >10 cm trout

What percentage of the stream bed area in each section could provide cover (for a >10 cm trout) in the form of submerged overhang, or overhang within 0.5 m of the water surface? Indicate the abundance of cover within the various categories listed below. For 'submerged vegetation' include all macrophytes, mosses and algae providing cover. Estimate as 0, 1, 2, 3, 4, 5, 10, 15, 20, 25 ... 100%.

Source of cover										
Submerged vegetation	A									
Boulders, cobbles, etc.	S									
Tree root systems	S									
Branches and logs	C									
Undercut banks	A									
Other submerged cover	S									
Overhang within 0.5 m	A									
Area of deep water	S									

Appendix 2. HABSCORE data input sheet

Site habitat record

Site identification — Site code EPB1 — Catchment River Almond/Tay

Site name — NGR 306887/725804 — River name East Pow Burn — Survey date 22/09/2008

Riparian shading of the site

What percentage of the water surface of the site is overhung by riparian vegetation? Estimate this percentage, for the three vegetation classes indicated, to the nearest 5%.

Deciduous trees & shrubs	Coniferous trees	Herbaceous vegetation
70		

Migratory access

What is the accessibility of the site ?	Salmon	Sea trout
Always accessible		
Sometimes accessible	X	X
Never accessible		

Substrate embeddedness

What is the degree of substrate embededdness throughout the site? Tick one box.

High		Medium	X	Low		

Flow conditions

Briefly describe the prevailing flow conditions (as observed at the time of the HABSCORE survey).

laminar < 0.2 m/sec

Upstream land-use considerations

What is the principal land-use immediately upstream of the site? Tick appropriate box(es).

Moor / heathland		Coniferous woodland	X	Deciduous woodland	X	Improved pasture	X
Urban development		Rough pasture	X	Industrial land		Arable land	X
Tips / waste		Other					

Potential impacts

Are there likely to be any impacts at the site from the following sources? Tick appropriate box(es).

pH effects		Stocking	X	Pollution	X	Migration barriers	X
Habitat modification		River engineering	X	Low flows	X	Flow regulation	
Other							

Width and depth profile at bottom stop net

Record widths to the nearest 0.1m and depths to the nearest 1.0cm.

Channel width	5	Depth in enclosure 0.2 m
Depth at ¼ channel width	0.3	
Depth at ½ channel width	1	
Depth at ¾ channel width	1.2	

Section dimensions

Record section lengths and widths to the nearest 0.1 m and depths to the nearest 1 cm.

Section length										
Section width										
Depth at ¼ channel width										
Depth at ½ channel width										
Depth at ¾ channel width										

Substrate

Absent	Scarce	Common	Frequent	Dominant
0%	>0% & <5%	≤5% & <20%	≤20% & <50%	≤50%
A	S	C	F	D

What percentage of the stream bed area in each section is composed of the following substrate types? Enter A, S, C, F or D as appropriate (see above table).

Substrate category											
Bedrock/artificial	A										
Boulders >25.6 cm	S										
Cobbles 6.4-25.6 cm	F										
Gravel/coarse sand 0.2-6.4 cm	D										
Fine sand/silt <0.2 cm	F										
Compacted clay	A										

Flow

What percentage of the water surface area in each section is composed of the following flow types? Enter A, S, C, F or D as appropriate.

Flow category											
Cascade/torrential	A										
Turbulent/broken deep	A										
Turbulent/broken shallow	A										
Glide/run deep	S										
Glide/run shallow	C										
Slack deep	F										
Slack shallow	D										

Sources of cover for >10 cm trout

What percentage of the stream bed area in each section could provide cover (for a >10 cm trout) in the form of submerged overhang, or overhang within 0.5 m of the water surface? Indicate the abundance of cover within the various categories listed below. For 'submerged vegetation' include all macrophytes, mosses and algae providing cover. Estimate as 0, 1, 2, 3, 4, 5, 10, 15, 20, 25 ... 100%.

Source of cover											
Submerged vegetation	S										
Boulders, cobbles, etc.	S										
Tree root systems	C										
Branches and logs	S										
Undercut banks	S										
Other submerged cover	S										
Overhang within 0.5 m	S										
Area of deep water	F										

Appendix 2. HABSCORE data input sheet

Site habitat record

Site identification — Site code EPB 2 — Catchment River Almond

Site name — NGR 306610 / 725375 — River name East Pow Burn — Survey date 22/09/2008

Riparian shading of the site

What percentage of the water surface of the site is overhung by riparian vegetation? Estimate this percentage, for the three vegetation classes indicated, to the nearest 5%.

Deciduous trees & shrubs	Coniferous trees	Herbaceous vegetation
70		

Migratory access

What is the accessibility of the site ?	Salmon	Sea trout
Always accessible		
Sometimes accessible	X	X
Never accessible		

Substrate embeddedness

What is the degree of substrate embededdness throughout the site? Tick one box.

High		Medium	X	Low		

Flow conditions

Briefly describe the prevailing flow conditions (as observed at the time of the HABSCORE survey).

laminar < 0.2 m/sec

Upstream land-use considerations

What is the principal land-use immediately upstream of the site? Tick appropriate box(es).

Moor / heathland		Coniferous woodland	X	Deciduous woodland	X	Improved pasture	X
Urban development		Rough pasture	X	Industrial land		Arable land	X
Tips / waste		Other					

Potential impacts

Are there likely to be any impacts at the site from the following sources? Tick appropriate box(es).

pH effects		Stocking	X	Pollution	X	Migration barriers	X
Habitat modification		River engineering	X	Low flows	X	Flow regulation	
Other							

Width and depth profile at bottom stop net

Record widths to the nearest 0.1m and depths to the nearest 1.0cm.

Channel width	5	Depth at sampling site 0.15 m
Depth at ¼ channel width	0.3	
Depth at ½ channel width	1	
Depth at ¾ channel width	1.2	

Section dimensions

Record section lengths and widths to the nearest 0.1 m and depths to the nearest 1 cm.

Section length										
Section width										
Depth at ¼ channel width										
Depth at ½ channel width										
Depth at ¾ channel width										

Substrate

Absent	Scarce	Common	Frequent	Dominant
0%	>0% & <5%	≤5% & <20%	≤20% & <50%	≤50%
A	S	C	F	D

What percentage of the stream bed area in each section is composed of the following substrate types? Enter A, S, C, F or D as appropriate (see above table).

Substrate category											
Bedrock/artificial	A										
Boulders >25.6 cm	S										
Cobbles 6.4-25.6 cm	I										
Gravel/coarse sand 0.2-6.4 cm	D										
Fine sand/silt <0.2 cm	F										
Compacted clay	A										

Flow

What percentage of the water surface area in each section is composed of the following flow types? Enter A, S, C, F or D as appropriate.

Flow category											
Cascade/torrential	A										
Turbulent/broken deep	A										
Turbulent/broken shallow	A										
Glide/run deep	S										
Glide/run shallow	C										
Slack deep	F										
Slack shallow	D										

Sources of cover for >10 cm trout

What percentage of the stream bed area in each section could provide cover (for a >10 cm trout) in the form of submerged overhang, or overhang within 0.5 m of the water surface? Indicate the abundance of cover within the various categories listed below. For 'submerged vegetation' include all macrophytes, mosses and algae providing cover. Estimate as 0, 1, 2, 3, 4, 5, 10, 15, 20, 25 ... 100%.

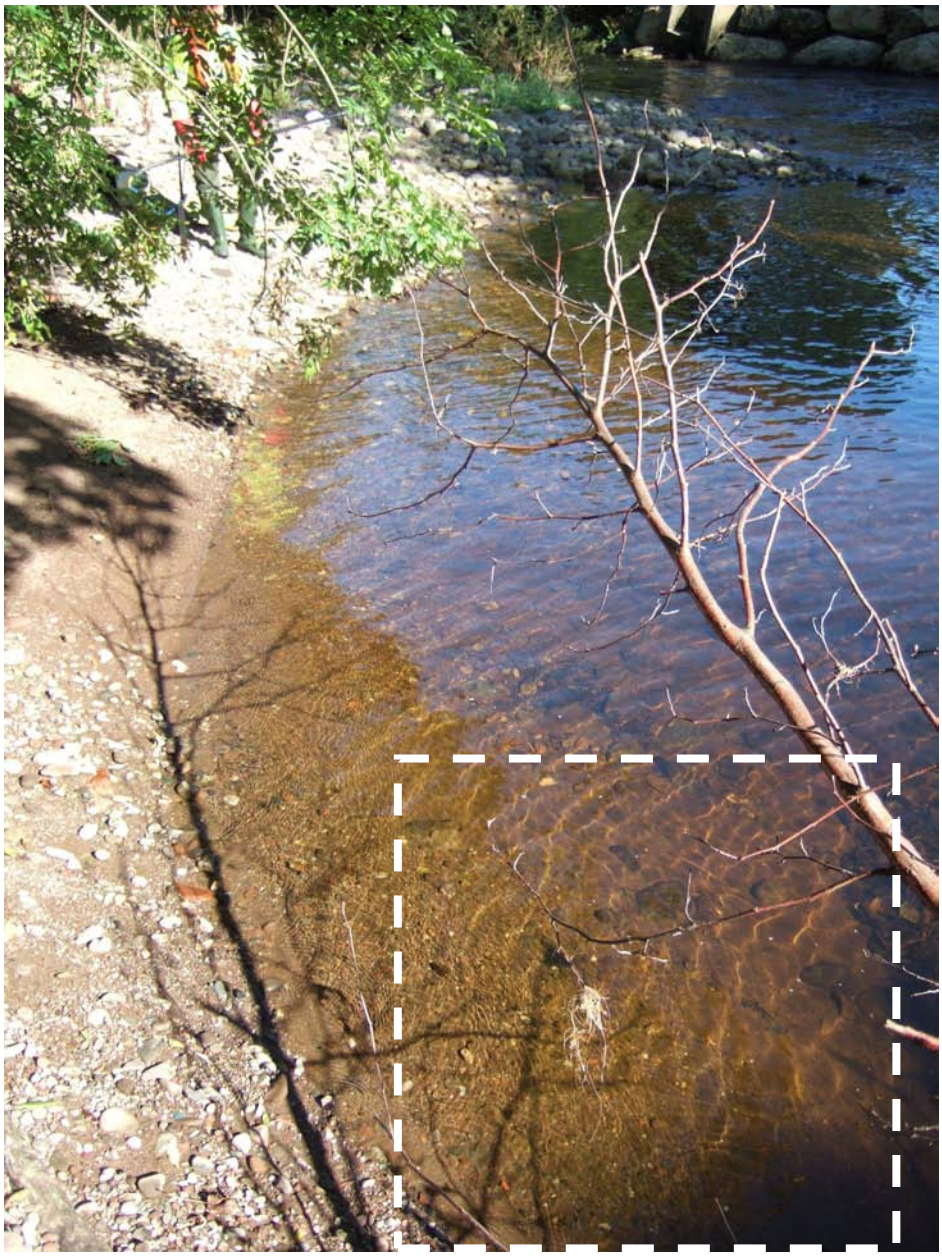
Source of cover										
Submerged vegetation	S									
Boulders, cobbles, etc.	S									
Tree root systems	C									
Branches and logs	S									
Undercut banks	S									
Other submerged cover	S									
Overhang within 0.5 m	S									
Area of deep water	F									

7 Appendix B – Site Photographs

Site	Image
RA1-1	
RA1-2	

Site	Image
RA2-1	
RA2-2	

Site	Image
RA3-1	

Site	Image
RA3-2	

Site	Image
EPB1-1	
EPB1-2	N.A.
EPB2-1	

Site	Image
EPB2-2	

8 Appendix C – Length of Lamprey Larvae in cm

No. of Larvae	RA1-1	RA1-2	RA2-1	RA2-2	RA3-1	RA3-2	EPB1-1	EPB1-2	EPB2-1	EPB2-2
1	10	15	-	-	-	15	-	-	6	10
2	8	8							12	6
3	7	12							14	8
4										12
5										12
6										7
7										8
8										10
9										12
10										10