

DRIGG DITCH

ECOLOGICAL SURVEY

Version 2

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TABLE OF CONTENTS

PAGE NO.

1. INTRODUCTION	1
1.1 Background	1
1.2 Methods	1
2. RESULTS	3
2.1 Drigg Ditch within BNFL site	3
2.2 Drigg Stream within Drigg Coast SSSI/cSAC/European Marine Site	4
2.3 Drigg Coast SSSI/cSAC adjacent to BNFL site	5
2.4 Invertebrates	6
3. DISCUSSION	8
3.1 Drigg Ditch within BNFL site	8
3.2 Drigg stream within Drigg Coast SSSI/cSAC/European Marine Site	8
3.3 Drigg Coast SSSI/cSAC adjacent to BNFL Drigg site	9
3.4 Invertebrates	9
4. CONCLUSIONS	10

TABLES

Table 1 Target Notes

- (a) Drigg Ditch and Stream within BNFL Drigg site
- (b) Drigg Stream outside BNFL site and within Drigg SSSI/cSAC/European Marine Site
- (c) Drigg Coast SSSI/cSAC adjacent to BNFL Drigg site

Table 2 Plant species lists

- (a) Drigg ditch within BNFL Drigg site
- (b) Drigg stream within Drigg SSSI/cSAC/European Marine Site and adjacent fields
- (c) Drigg Coast SSSI/cSAC adjacent to BNFL Drigg Site

Table 3 Other fauna recorded during survey

Table 4 Invertebrate sampling locations

Table 5 Drigg ditch invertebrate samples

FIGURES

Figure 1 Survey area and boundaries of Drigg Coast SSSI/cSAC and European Marine Site

Figure 2 Location of target notes and invertebrate samples

Figure 3 Phase 1 Habitat Map

1. INTRODUCTION

1.1 Background

- 1.1.1 Young Associates was commissioned by BNFL to undertake an ecological survey of the ditch which is located close to the western boundary of the BNFL Drigg site. The slow-flowing/stagnant section upstream of the confluence with the East-West Stream is known as Drigg Ditch, whilst the downstream section which flows out of the site and into the Drigg Coast SSSI/cSAC/European Marine Site is known as Drigg Stream.
- 1.1.2 An area of the Drigg Coast SSSI/cSAC that abuts the northwest BNFL Drigg site boundary was also surveyed in order to identify any potentially sensitive habitats/species. The location of Drigg Ditch and Stream, together with the surveyed parts of the Drigg Coast SSSI/cSAC and European Marine Site, are shown on Figure 1. Figure 1 also shows the boundaries of the SSSI/cSAC and European Marine Site.
- 1.1.3 The ecological survey was required in connection with proposals to construct further vaults in the northwest of the site. These proposals will require a section of Drigg Ditch to be realigned and culverted.
- 1.1.4 A method statement for the ditch survey was produced by Young Associates (dated 30th July 2001); this outlined the objectives and methods for the survey. The objectives of the survey were as follows:
- To conduct a search for pillwort, a rare plant species which had previously been recorded in Drigg Ditch.
 - To characterise the existing ecological value of the Drigg Ditch and Stream, including the potential presence of protected species and/or other species of nature conservation value.
 - To characterise the existing ecological value of the area of Drigg Coast SSSI/cSAC that is located directly adjacent to the BNFL Drigg site. Potential hydrological links between the site and habitats within the SSSI/cSAC were identified.
 - To survey the aquatic invertebrates in Drigg Ditch and Stream.
- 1.1.5 This report presents the findings of the survey and an evaluation of the ecological status of the ditch. The ecological survey was undertaken between 31st July and 2nd August 2001.

1.2 Methods

- 1.2.1 A botanical survey of Drigg Ditch and Stream was conducted. This included a detailed search for pillwort (by hand searching through the mid-channel vegetation) along the section of the ditch where this species had previously been recorded. A species list of dominant and characteristic plant species present in the ditch was also recorded, and target notes were prepared describing features of particular ecological interest.
- 1.2.2 Seven invertebrate samples were taken from the Drigg Ditch and Stream. One of these was from within the SSSI/cSAC/European Marine Site and the remainder were from within the site. Owing to dense vegetation and soft substrate it was mostly not possible to employ the standard kick-sampling method for invertebrate surveys. Kick sampling involves the use of a kicking action to disturb the streambed; the dislodged debris and animals are then caught in an invertebrate net placed immediately downstream. Kick-sampling was carried out wherever

conditions were suitable. Elsewhere, the samples were taken by sweep-netting, which involves passing the net over the ditch bed/vegetation to disturb the substrate/vegetation. Dislodged invertebrates are caught in the net. Both kick-sampling and sweep-netting were carried out for two minutes.

- 1.2.3 A walkover survey was conducted within part of the Drigg Coast SSSI/cSAC. This included a Phase 1 habitat survey, using the standard method¹ (NCC, 1990), and a survey for any evidence of protected species using the watercourse.
- 1.2.4 The target notes are presented in Table 1. Parts (a) and (b) describe the sections of the Ditch/Stream within the site and the SSSI/cSAC/European Marine Site respectively, while part (c) describes the habitats within the area of Drigg Coast SSSI/cSAC adjacent to the BNFL site. Tables 2 (a) to (c) present the plant species lists for the same areas. Fauna species noted in the vicinity of Drigg Ditch and Stream within the site are listed in Table 3. Table 4 describes the invertebrate sampling locations, and the invertebrate survey results are shown in Tables 5 and 6.
- 1.2.5 The locations of the target notes and invertebrate samples are shown in Figure 2. Figure 3 presents the Phase 1 Habitat Map for the survey areas outside the BNFL Drigg site.
- 1.2.6 The survey results are discussed in Section 2. Scientific names of plant and animal species mentioned in the text are given in Tables 2 (a) to (c).

¹ Nature Conservancy Council, 1990. Handbook for Phase 1 habitat survey – a technique for environmental audit. Reprinted JNCC 1993.

2. RESULTS

2.1 Drigg Ditch within BNFL site

Habitat

- 2.1.1 Drigg Ditch and Stream run the length of the south-west side of the site. The banks are steep sided (50 - 60°) and up to 4m high. The channel is mostly 2 - 3m wide with a water depth mostly between 10cm and 30cm, but up to over 1m in places (Young Associates 2001²). Even in the deepest places the water often passes under matted vegetation which slows the flow rate considerably. The channel is also heavily silted. The northern end of the channel (Drigg Ditch) was dry at the time of the survey (Target Note 1): it is only downstream of the confluence with the East-West Stream (i.e. in Drigg Stream) that the flow of water and the depth increase considerably (Target Notes 8 to 10).
- 2.1.2 Drigg Ditch is largely choked by soft-rush, common spike-rush, creeping bent and Yorkshire-fog. The short stretches of open water that persist are often still and some are stagnant (Target Note 1). Downstream of the confluence, the marginal and aquatic vegetation in Drigg Stream is more diverse and well developed, and there are frequent open sections. The channel is bordered by dense stands of reed canary-grass with frequent branched bur-reed and bulrush.
- 2.1.3 The section of Drigg Ditch adjacent to the magazines area is the most botanically rich part of the watercourse. This stretch supports bog pondweed, lesser skullcap, greater bird's-foot-trefoil, lesser spearwort, bog-bean, marsh cinquefoil, marsh violet, water-purslane and the bog-moss *Sphagnum squarrosum* (Target Notes 1 to 4).
- 2.1.4 The vegetation higher up the banks of Drigg Ditch is herb-rich in places and typically supports a rank grassland community with false oat-grass, common knapweed and common bird's-foot-trefoil (e.g. Target Note 5). Dense scrub, mostly of common gorse and/or willow, is frequent, particularly along the northern stretch. There are also some sections of species-rich heathy vegetation adjacent to the magazines area (Target Note 1). Species present in this area include common bent, sweet vernal-grass, mat-grass, bell heather, cross-leaved heath, heather, tormentil, heath milkwort, sheep's-bit, sand sedge, dyer's greenweed, heath rush, hard fern and common spotted-orchid.

Flora

- 2.1.5 A fairly extensive and healthy stand of pillwort is present in the channel adjacent to the magazines area, close to the area where this species had previously been recorded (Target Note 2). The stand extends over an area of at least 3 - 4m by 2 - 3m, although the cover is less dense towards the margins of the area.
- 2.1.6 Pillwort is a Nationally Scarce species of plant, related to ferns, and is included on the 'Long List' of Globally Threatened/Declining Species³. Nationally Scarce plants are defined by the

² Young Associates 2001. *Phase 1 Habitat Survey Drigg, Cumbria*. Unpublished report on behalf of BNFL/BEL/MK Alliance.

³ UK Biodiversity Steering Group. (1995). *Biodiversity: The UK Steering Group Report, Volume 2: Action Plans*. London: HMSO.

statutory conservation agencies as native plants which are not rare enough to be included in the Red Data Book, but occur in one hundred or fewer 10 km x 10 km squares in Great Britain⁴. Pillwort is currently known from 90 10-km squares in Great Britain⁵. Pillwort is also listed as a key species in the Mesotrophic Standing Waters Habitat Action Plan⁶. It is an internationally threatened species that is declining throughout its range (Western Europe)⁷. The UK holds a substantial proportion of the world population, although due to its decline it is now classified as *Vulnerable*.

Fauna

- 2.1.7 Some of the scrub may potentially be used by breeding birds. In particular, the dense, mature gorse scrub adjacent to and to the north of the magazines area offers good cover for birds. As this scrub was very dense and impenetrable in places it was not possible to check the entire area for badgers. Badger footprints (from one animal) were recorded to the north of the magazines area, travelling south-west towards the perimeter conifer plantation. However, no paths or other signs were found entering the scrub. Rabbit burrows were frequent in the sandy substrate of the ditch banks, particularly along the northern part of Drigg Ditch.
- 2.1.8 The bramble and herb-rich grassland may be of value as a nectar source for butterflies. Fifteen species of butterfly were recorded within the vicinity of the ditch corridor, including grayling and dark-green fritillary.
- 2.1.9 Large numbers of smooth and palmate newts were observed in the ditch and a number were caught during the invertebrate sampling. Common frogs were frequent along the ditch corridor, and smaller numbers of common toad were also observed.
- 2.1.10 Two adult common lizards were recorded along the ditch corridor, with one seen basking mid-channel, on matted vegetation, along the northern stretch of Drigg Ditch.
- 2.2 **Drigg Stream within Drigg Coast SSSI/cSAC/European Marine Site**

Habitat

- 2.2.1 There is a short stretch of Drigg Stream which lies outside the BNFL Drigg site but upstream of the point where the watercourse enters the SSSI/cSAC/European Marine Site. This stretch is bounded by improved grassland fields. The channel and margins are well vegetated and at this point the stream is only 1 to 1.5m wide with low, fairly steep earth banks (Target Note 11). As the stream approaches the boundary of the SSSI/cSAC/European Marine Site the increasing influence of brackish conditions is evident, for example the appearance of species such as sea arrowgrass along the bank-top and frequent dead crabs along the tideline (Target Note 2).

⁴ Palmer, M. (1995). *A UK Plant Conservation Strategy: A Strategic Framework for the Conservation of the Native Flora of Great Britain and Northern Ireland*. JNCC.

⁵ Chatters, C. (1996). Conserving Rare Plants in Muddy Places. *British Wildlife* Vol. 7 (5), pp281-286.

⁶ Date unknown. *Cumbria Biodiversity Action Plan: Habitat Action Plans*.

⁷ Pillwort (*Pilularia globulifera*) Biodiversity Action Plan.

- 2.2.2 Within the SSSI/cSAC and European Marine Site, Drigg Stream is bordered on the left bank by semi-improved acid grassland (Target Note 13). The boundary between this community and the communities influenced by periodic tidal inundation is both structurally and floristically distinct. On the right bank, the stream is bordered by reclaimed saltmarsh, grazed by sheep at the time of the survey (Target Note 14). This field still retains a number of species typical of saltmarsh communities. Some areas of this field, further to the southwest, are similar to the acid grassland described in Target Note 13 and there is also a drier acid grassland community. Field cross-drains at 2m intervals are evident in this field.
- 2.2.3 Where Drigg Stream flows into the River Irt it resembles a saltmarsh creek, is approximately 3m wide and deeply incised into the soft sediment (Target Note 16). Zonation of saltmarsh communities is very clear along this stretch of the stream and these communities extend to the boundary of the SSSI/cSAC/European Marine Site. The zonation is less obvious upstream of the boundary, largely owing to agricultural improvement of the adjacent fields. A community dominated by, and consisting almost entirely of, common saltmarsh-grass extends up to about 5m from the top of the channel on either side. A brash line was present approximately 2m inland of this community boundary. A further brash line, containing frequent large pieces of wood, was present between 15 and 30m away from the channel. This brash line denotes less frequent inundation by high tides and closely follows the boundary between this second saltmarsh community and the semi-improved acid grassland community on the left bank and the reclaimed saltmarsh on the right bank. The second saltmarsh community is dominated by red fescue and creeping bent with white clover, sea plantain and saltmarsh rush. These communities are maintained by periodic tidal inundation by water from Drigg Stream.
- 2.2.4 Along the River Irt there is a saltmarsh community similar to that found along the banks of Drigg Stream, with common saltmarsh-grass, glasswort, sea aster, sea plantain and common scurvy-grass present.

Fauna

- 2.2.5 Evidence of breeding water voles was recorded along the stretch of Drigg Stream outside the BNFL site and outside the SSSI/cSAC/European Marine Site. A single latrine, droppings and footprints were recorded. No water vole activity was recorded within the BNFL site.
- 2.2.6 Small amounts of goose droppings were observed on the reclaimed saltmarsh field. Greylag geese were observed on the estuary. A male stonechat was also present in this field.

2.3 Drigg Coast SSSI/cSAC adjacent to BNFL site

Habitat

- 2.3.1 An area of the Drigg Coast SSSI/cSAC that directly abuts the northwest corner of the BNFL site was surveyed. The majority of this area supports dune heath characterised by hummocks of ling and bell heather interspersed with dry acid grassland dominated by common bent, sweet vernal-grass, mat-grass, soft-rush and tormentil (Target Note 17). There are a number of small damp depressions in this area, which support *Sphagnum* spp., *Polytrichum commune*, marsh violet, soft-rush and marsh pennywort.
- 2.3.2 Further to the north-east, and directly adjacent to the BNFL site, there are several drainage lines which support species characteristic of wet heath communities, including round-leaved sundew, bog pondweed, cross-leaved heath, marsh cinquefoil, marsh St. John's-wort, cranberry and common cotton-grass (Target Note 18). Other small depressions and drainage

lines in this area are similarly floristically diverse and support such species as bog-bean, bottle sedge, lesser spearwort, lesser skullcap and heath spotted-orchid.

Fauna

- 2.3.3 A badger 'gate' enters the SSSI/cSAC through the BNFL site perimeter fence. This gate is quite well used and a path leads away from it and onto the SSSI/cSAC.
- 2.3.4 Several dark-green fritillaries were recorded within the survey area, although higher numbers were present towards the front of the dune system.
- ### 2.4 Invertebrates
- 2.4.1 Seven invertebrate samples were taken from Drigg Ditch and Stream: one from within the SSSI/cSAC/European Marine Site and the remainder from within the BNFL site. Table 4 describes the sampling locations and Table 5 presents the results of the invertebrate sampling.
- 2.4.2 A total of 55 different species were recorded, consisting mainly of molluscs (snails), leeches, dragonflies, water bugs and beetles, chironomids (non-biting midges) and oligochaetes (worms). The invertebrate species present are as expected for the slow flowing, silty substrate and weed-dominated ditch habitat. Species such as caddis fly and mayfly that prefer faster flowing, clean water were absent from all of the samples.
- 2.4.3 Only one species of national importance was present within the samples. The water beetle, *Enochrus coarctatus* is listed as a Nationally Notable B species. Nationally Notable B species are classified as scarce and uncommon. However, this species is present throughout England, Wales and Ireland and is typically found in pools with rich vegetation where it lives along the edge of the water amongst the vegetation. Two individuals were present within sample I2.
- 2.4.4 The number of scoring taxa (species or species groups) present at each site varied between 7 (I3) and 15 (I6). The BMWP (Biological Monitoring Working Party) score⁸ was higher at the sites with the greatest variety of taxa. ASPT (Average Score Per Taxon) scores⁹ ranged between 4.2 and 4.7, with the exception of site I7, which scored 3.6. The BMWP and ASPT scores indicate the biological diversity and value of a site. For these samples the ASPT score is low (below 5) and indicates poor diversity and relatively low ecological value of the ditch in terms of the aquatic invertebrate community. This is characteristic of the type of habitat sampled. Table 6 gives the BMWP and ASPT scores for the seven sampling sites.

⁸ The BMWP Score is an index that is calculated on the basis of selected invertebrate families incorporated into a system which can be used to assess the biological condition of a river.

⁹ The BMWP score is divided by the number of taxa to give the ASPT.

- 2.4.5 Three-spined sticklebacks (*Gasterosteus aculeatus*) were present within samples I5, I6 and I7. A flounder (*Platichthys flesus*) was also present in sample I7. Newt larvae (smooth or palmate) were present in I1, I2, I3 and I4. Newt larvae (smooth or palmate) from I1 and I3 were returned to the ditch, as were three adult three-spined sticklebacks (I6), and four flounders, seven elvers and 20 small fish (probably trout) from I7.

3. DISCUSSION

3.1 Drigg Ditch within BNFL site

Habitat and Flora

- 3.1.1 The sections of Drigg Ditch and Stream within the BNFL site support a diverse range of vegetation and habitats. These habitats support a variety of wildlife species, including several which are protected by law and others which are locally or nationally uncommon.
- 3.1.2 Some of the most botanically rich vegetation within the channel is found in the northern part of Drigg Ditch, within the area which would need to be culverted in order to construct Vault 9. This includes a stand of the Nationally Scarce aquatic fern, pillwort. There are also areas of botanically rich vegetation on the ditch banks. The most ecologically valuable of these communities is located within the area proposed for culverting (described in Target Note 1).

Fauna

- 3.1.3 The habitats along the ditch corridor are likely to be used by breeding birds, most notably the area of dense gorse scrub adjacent and to the north of the magazines area. All birds and their nests are protected during the nesting period under the Wildlife & Countryside Act, 1981 (as amended). The nesting season generally extends from March to August, inclusive.
- 3.1.4 Owing to the dense nature of the scrub in the northern part of Drigg Ditch, there is a small possibility that undiscovered badger setts could be located in the ditch banks. However, no evidence of badgers entering the scrub was found. Any undiscovered or new setts constructed along Drigg Ditch (e.g. as a result of badgers enlarging and using existing rabbit burrows) would most likely be occasionally used (outlier) setts.
- 3.1.5 Of the two common lizards recorded during the survey, one was observed within the area proposed for culverting. The habitats present in the vicinity of Drigg Ditch and Stream are suitable for all three species of reptile found at Drigg (common lizard, slow-worm and adder). These species are all afforded protection against intentional killing, injuring and sale under the Wildlife and Countryside Act 1981 (as amended).
- 3.1.6 The Drigg site supports a small population of great crested newts, which are given full protection under the Wildlife and Countryside Act 1981 (as amended) and the Habitats Regulations 1994 (The Conservation (Natural Habitats, &c.) Regulations 1994). The breeding pond for this species is located some 250m from Drigg Ditch, at the nearest point. Drigg ditch is not used as a breeding site by great crested newts, but a single juvenile animal was recorded on several occasions in 2000. This animal was found in Lonesome Pine Weir, downstream of the reach to be culverted. No great crested newts have ever been recorded in the reach to be culverted.

3.2 Drigg stream within Drigg Coast SSSI/cSAC/European Marine Site

Habitat

- 3.2.1 Drigg Stream flows along the western boundary of the BNFL site from the East-West Stream confluence and leaves the site at its southern corner. At this point it crosses agriculturally improved fields before entering the Drigg Coast SSSI/cSAC and European Marine Site, finally meeting the River Irt downstream of the railway crossing. Figure 1 shows the boundary of the SSSI/cSAC and the European Marine Site.

- 3.2.2 Given that Drigg Stream drains directly to a SSSI/cSAC and European Marine Site there will be a need to consider whether any operational activities (e.g. the culverting of Drigg Ditch associated with the proposed Vault 9 construction or the felling of conifer plantations adjacent to the ditch) could impact upon this Site. Understanding the potential effects of such activities on the Drigg Coast SSSI/cSAC and European Marine Site is particularly relevant for determining whether an Appropriate Assessment is needed to accompany the proposals under the Habitats Regulations (The Conservation (Natural Habitats, &c.) Regulations 1994).

Fauna

- 3.2.3 The water vole activity found during the survey was located downstream of the BNFL Drigg site. Although the habitats along Drigg Stream and Drigg Ditch within the site are suitable for water voles, there is no evidence that the species is currently present on any of the watercourses within the BNFL Drigg site.
- 3.2.4 Water voles' places of shelter are protected under Section 9 (4) of Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Under this legislation, it is an offence to damage, destroy or obstruct access to any structure or place which water voles use for shelter or protection, or to disturb water voles while they are using such a place. This includes both 'intentional' (Wildlife and Countryside Act) and 'reckless' disturbance (under the Countryside and Rights of Way Act 2000). Water voles are also listed on the UK BAP Short List of Globally Threatened/Declining Species and are listed as a priority species in the Cumbria Biodiversity Action Plan.

3.3 Drigg Coast SSSI/cSAC adjacent to BNFL Drigg site

- 3.3.1 The dune heath present on the cSAC adjacent to the north-east corner of the BNFL Drigg site would qualify as 'Atlantic decalcified fixed dunes', listed as a European priority interest feature on the cSAC citation¹⁰. This area of the SSSI/cSAC is separated from the BNFL Drigg site by the perimeter fence and road. The habitat present on the SSSI/cSAC does not continue on the inside of the boundary fence, where both broad-leaved and conifer plantations have been planted. However, there is some willow carr and wet grassland inside the fence that may be hydrologically connected with the habitats in the cSAC.
- 3.3.2 The willow carr and wet grassland inside the fence may be affected by activities on site, such as the proposed culverting of Drigg Ditch and the felling of conifers. Given that there are potential hydrological connections between the habitats inside and outside the fence, it will be necessary to consider whether planned activities could have a measurable effect on the cSAC.

3.4 Invertebrates

- 3.4.1 The invertebrate communities present in Drigg Ditch have low diversity and are of relatively low ecological value overall, as would be expected for the type of habitat. One Nationally Notable B species of water beetle was recorded in the sample taken just downstream of the stand of pillwort. However, this species is common and widespread throughout England, Wales and Ireland, and its status as a Nationally Notable B species may be reviewed (J. Robinson, invertebrate specialist, *pers. comm.*).

¹⁰ Drigg Coast cSAC citation. Compiled 17.1.01.

4. CONCLUSIONS

- 4.1.1 The reaches of Drigg Ditch and Stream within the BNFL site support a diverse range of vegetation and habitats, and are thus of some ecological value. Sections which support particularly diverse vegetation communities include the northern part of Drigg Ditch, which is proposed to be culverted to enable the construction of Vault 9. This section has diverse vegetation both in the channel and on the banks, and includes a substantial stand of the Nationally Scarce aquatic fern, pillwort. Other species recorded in this section include common lizard and a Nationally Notable species of water beetle. The habitats present are also suitable for a range of other species, including breeding birds, butterflies and protected reptile species.
- 4.1.2 Further downstream, Drigg Stream flows out of the BNFL site and through agriculturally improved fields before entering the Drigg Coast SSSI/cSAC/European Marine Site. Saltmarsh vegetation is present along the banks of the stream. Water voles, whose burrows and other places of shelter are statutorily protected, are present in this part of the stream.
- 4.1.3 The area of the Drigg Coast SSSI/cSAC adjacent to the BNFL Drigg site supports heathland habitats which may be hydrologically linked to habitats within the BNFL Drigg site. There is therefore the potential for activities within the site to affect qualifying features of the European protected site.

TABLES

Table 1 Target Notes

(a) Drigg Ditch and Stream within BNFL Drigg site

Number	Description
1	<p>Adjacent to Vault 8, channel is choked and scrubbing over with grey willow, broom, bramble and European gorse. The channel is, therefore, heavily shaded. There is very little flow/no flow. Some of this scrub may potentially be of value to breeding birds as it offers good cover in places. Whitethroat, wren and willow warbler were recorded in this scrub. The bramble represents a valuable nectar source e.g. gatekeeper butterflies were abundant.</p> <p>The bed of the channel is 2 - 4m below the bank top. The banks are 45° to 50°. Rabbit burrows are abundant in the steep bank sides.</p> <p>There are some very short stretches of shallow, stagnant water further to the south (the water is up to about 15cm deep in places but is covered by matted rushes).</p> <p>Approximately 10 - 20m north of the magazines area, there is a small patch of species-rich heathy vegetation on the ditch banks. Species present include common bent, sweet vernal-grass, mat-grass, bell heather, cross-leaved heath, ling, tormentil, heath milkwort, sheep's-bit, sand sedge, dyer's greenweed, heath rush, hard fern, bramble and common spotted-orchid. The channel at this point is dominated by bog pondweed, marsh bedstraw, marsh pennywort, soft-rush and common spike-rush. Lesser skullcap is also present.</p> <p>Alongside the magazines area the channel is still heavily shaded in places by common gorse and grey willow</p>
2	<p>Fairly extensive and healthy patch of pillwort growing right across the ditch, which is approximately 2 - 3m wide at this point and full of almost stationary water. The pillwort is located in a slightly more open stretch where there is less overhanging common spike-rush and soft-rush. Lesser spearwort, greater bird's-foot-trefoil and <i>Sphagnum squarrosum</i> are also abundant within this stretch. The patch of pillwort is densest in the centre of the channel, away from the stronger competitive growth of marginal plants. The patch of pillwort extends to at least 3 - 4m x 2 - 3m – although it is less dense towards the edges of this area. More sparse cover of pillwort extends for a further 2 - 3m downstream.</p> <p>The water is ca. 1 - 1.2m deep below the matted vegetation and very silty. The bank is only ca. 1m high at this point and the channel widens to ca. 3 - 4m. There are occasional hawthorn and common gorse present on the banks.</p>
3	<p>This section is quite open with little scrub on the banks and in the channel; soft-rush and common spike-rush are less dominant. Bog pondweed, lesser spearwort and sharp-flowered rush are frequent. Bulbous rush, greater bird's-foot-trefoil, <i>sphagnum</i> and creeping forget-me-not are also present. The water is still silty and up to 60cm deep.</p>
4	<p>The channel becomes shallower (10 - 15cm) and much narrower (1 - 2m), with very little flow, almost drying up, at this point. It is dominated by greater bird's-foot-trefoil, bulbous rush and sharp-flowered rush. There are short stretches which hold more water.</p>
5	<p>At this point the channel is densely matted with soft-rush, creeping bent, Yorkshire-fog and common spike-rush. The banks down to the ditch are</p>

Number	Description
	quite herb-rich in places supporting, for example, false oat-grass/common knapweed/common bird's-foot-trefoil grassland.
6	The channel is increasingly grass-dominated (Yorkshire-fog, creeping bent and floating sweet-grass) and matted. There is little flow and the water is mostly fairly shallow (10 - 15cm). The surface of this vegetation is quite firm in places. There are some short shaded sections but it is mostly quite open.
7	Downstream of the weir there is a short section of open water and then the channel is choked with matted vegetation again (Yorkshire-fog, soft-rush, etc.). Some stretches of the ditch banks are dominated by bramble. There are some small stands of bulrush in this stretch of the ditch.
8	Downstream of the weir the vegetation, particularly the marginal stands, is more diverse and there is more water below the confluence with the east-west stream. The channel is bordered by dense stands of reed canary-grass with branched bur-reed and water-cress in the channel.
9	Below the bridge the channel is wider, up to 3m, with some short open stretches. The water is up to at least 1m deep and the vegetation is more diverse with reed canary-grass, branched bur-reed, fool's water-cress and water-cress abundant.
10	This stretch contains extensive areas of open water, fringed by floating sweet-grass and water-starwort. The bed is silty and it is shaded by the adjacent conifer blocks.

(b) Drigg Stream outside BNFL site and within Drigg SSSI/cSAC/European Marine Site

Number	Description
11	Drigg Stream outside the BNFL site and outside the SSSI/cSAC. Channel is choked with reed canary-grass. Wild celery and dense grass/tall herbs on the bank. Earth banks, reasonable flow – similar to downstream end of channel on site. Channel is ca. 1 - 1.5m wide, water level to bank top is approximately 1m and the banks are fairly steep (30 - 40°). However, 5 - 10m downstream the flow is much reduced and the channel is narrower (ca. 50cm). Channel is well silted up, but 50 - 70cm wide.
12	Increasing influence of brackish conditions, as noted by presence of sea arrowgrass, lesser sea-spurrey, etc. The channel appears to be regularly over-topped, with water extending up to 3 - 4m from the bank top. A number of saltmarsh plants are present in this area and dead crabs were found along the tideline.
13	Drigg Stream within the SSSI/cSAC and European Marine Site. Semi-improved acid grassland. Common bent, sweet vernal-grass, soft-rush, Yorkshire-fog, white clover, oval sedge, sand sedge, tormentil, common bird's-foot-trefoil, lesser stitchwort, autumn hawkbit, heath bedstraw, creeping buttercup and heath woodrush. Tidally influenced area along creek – dominated by red fescue, common saltmarsh-grass and saltmarsh rush with sea milkwort, sea arrowgrass, creeping bent, sea plantain and thrift. Evidence of improvement and grazing – white clover, etc. This vegetation community is maintained by periodic inundation from the creek.
14	<p>Reclaimed saltmarsh (still retains many species typical of saltmarsh despite improvement). Creeping bent, marsh foxtail, perennial rye-grass, glaucous sedge, autumn hawkbit, silverweed, marsh pennywort, common spike-rush, mat-grass, thrift, sea arrowgrass, saltmarsh rush, sea plantain, sea milkwort present. White clover frequent. Clumps of soft-rush and parsley water-dropwort. Fairly heavily grazed by sheep.</p> <p>Some areas are similar to the area of acid grassland found on the opposite side of the creek (Note 13). In other places there is comparatively dry acid grassland with tormentil, common bent, heath rush, mat-grass, heath rush, compact rush, heath milkwort and cross-leaved heath. Stonechat and common frog recorded in this area. There are field cross-drains evident approximately every 2m across the field. A small number of goose droppings were recorded on these fields.</p>
15	Heath pearlwort present along boundary. Adjacent to the main channel there is a saltmarsh vegetation community similar to that found along Drigg Stream: common saltmarsh-grass, glasswort, sea aster, sea plantain and common scurvy-grass. There are several patches of sea club-rush on the banks of the channel.
16	<p>Where Drigg Stream meets the main channel (River Irt) it looks more like a saltmarsh creek, as it is approximately 3m wide and deeply incised into the soft sediment. There is a small fenced off section at this point that has allowed stands of sea club-rush to spread. Along the banks common saltmarsh-grass, red fescue, sea arrowgrass, sea plantain and sea aster are present (occasionally inundated by tides). This vegetation community extends along the channel to the cSAC boundary. Upstream of this the tidal extent and influence declines.</p> <p>The common saltmarsh-grass dominated community only extends up to about 5m from the top of the channel on either side. A brash line was evident</p>

Number	Description
	<p>approximately 2m inland of this community boundary. A further brash line, containing frequent large pieces of wood, was recorded between 15 - 30m away from the channel. This denotes less frequent inundation by high tides. This brash line closely mirrored the boundary between the second saltmarsh community and the acid grassland community described above in Target Note 13 on the left bank and the reclaimed saltmarsh on the right bank. This boundary is also both structurally and floristically obvious. The second saltmarsh community is dominated by red fescue, creeping bent, white clover, sea plantain and saltmarsh rush. The cover of common saltmarsh-grass is significantly less in the reclaimed saltmarsh.</p>

(c) Drigg Coast SSSI/cSAC adjacent to BNFL Drigg site

Number	Description
17	<p>Dune heath denoted by hummocks of ling and bell heather interspersed with dry acid grassland dominated by common bent, sweet vernal-grass, mat-grass, soft-rush and tormentil. Frequent species include autumn hawkbit, sand sedge, red fescue, cross-leaved heath in damper areas, heath grass, heath bedstraw, heath rush, marram and common bird's-foot-trefoil. Wild thyme, yarrow and harebell are present on anthills and other hummocks. Dark green fritillary butterfly recorded in this area, but greater numbers were present at the front of the dunes.</p> <p>There are some small depressions in this area, which support <i>Sphagnum</i> spp., <i>Polytrichum commune</i>, marsh violet, soft-rush and marsh pennywort. Several ditches are present and one area appeared to have been cut previously as it was flat with visible lines in the vegetation growth.</p>
18	<p>Channel with wet heath vegetation ending in small area of willow carr on the BNFL Drigg site. This drainage line was floristically diverse and supported round-leaved sundew, bog pondweed, marsh pennywort, cross-leaved heath, marsh cinquefoil, soft-rush, <i>Polytrichum commune</i>, greater bird's-foot-trefoil, bulbous rush, <i>Sphagnum</i> spp., marsh violet, marsh St. John's-wort, cranberry, purple moor-grass, common marsh-bedstraw, marsh horsetail and common cotton-grass. There are several other small depressions and drainage lines in this area which support a number of other species including bogbean, bottle sedge, lesser spearwort, lesser skullcap and heath spotted-orchid. A number of the depressions had dried up and were largely dominated by soft-rush and <i>Sphagnum</i> spp.</p> <p>A badger 'gate' enters this area through the BNFL boundary fence. This gate is well used and a path leads away from it. Common frog also recorded.</p>

Table 2 Plant species lists

(a) Drigg ditch within BNFL Drigg site

Scientific Name	Common Name
<i>Achillea ptarmica</i>	Sneezewort
<i>Agrostis capillaris</i>	Common Bent
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Alopecurus geniculatus</i>	Marsh Foxtail
<i>Angelica sylvestris</i>	Wild Angelica
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Anthyllis vulneraria</i>	Kidney Vetch
<i>Apium nodiflorum</i>	Fool's Water-cress
<i>Arrhenatherum elatius</i>	False Oat-grass
<i>Blechnum spicant</i>	Hard Fern
<i>Callitriche</i> agg.	Water-starwort
<i>Cardamine flexuosa</i>	Wavy Bitter-cress
<i>Cardamine pratensis</i>	Cuckooflower
<i>Carex arenaria</i>	Sand Sedge
<i>Carex hirta</i>	Hairy Sedge
<i>Carex viridula</i>	Yellow Sedge
<i>Centaurea nigra</i>	Common Knapweed
<i>Cirsium palustre</i>	Marsh Thistle
<i>Crataegus monogyna</i>	Hawthorn
<i>Cytisus scoparius</i>	Broom
<i>Dactylorhiza fuchsii</i>	Common Spotted-orchid
<i>Dryopteris affinis</i>	Scaly Male-fern
<i>Eleocharis palustris</i>	Common Spike-rush
<i>Erica cinerea</i>	Bell Heather
<i>Erica tetralix</i>	Cross-leaved Heath
<i>Filipendula ulmaria</i>	Meadowsweet
<i>Galium palustre</i>	Common Marsh-bedstraw
<i>Genista tinctoria</i>	Dyer's Greenweed
<i>Glyceria fluitans</i>	Floating Sweet-grass
<i>Holcus lanatus</i>	Yorkshire-fog
<i>Holcus mollis</i>	Creeping Soft-grass
<i>Hydrocotyle vulgaris</i>	Marsh Pennywort
<i>Jasione montana</i>	Sheep's-bit
<i>Juncus acutiflorus</i>	Sharp-flowered Rush
<i>Juncus bufonius</i>	Toad rush
<i>Juncus bulbosus</i>	Bulbous Rush
<i>Juncus effusus</i>	Soft-rush
<i>Juncus squarrosus</i>	Heath Rush
<i>Lemna minor</i>	Common Duckweed
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil
<i>Lythrum portula</i>	Water-purslane
<i>Mentha aquatica</i>	Water Mint
<i>Menyanthes trifoliata</i>	Bogbean
<i>Myosotis laxa</i>	Tufted Forget-me-not
<i>Myosotis secunda</i>	Creeping Forget-me-not
<i>Nardus stricta</i>	Mat-grass
<i>Persicaria amphibia</i>	Amphibious Bistort

Scientific Name	Common Name
<i>Phalaris arundinacea</i>	Reed Canary-grass
<i>Pilularia globulifera</i>	Pillwort
<i>Potamogeton natans</i>	Broad-leaved Pondweed
<i>Potamogeton pectinatus</i>	Fennel Pondweed
<i>Potamogeton polygonifolius</i>	Bog Pondweed
<i>Polygala serpyllifolia</i>	Heath Milkwort
<i>Polytrichum commune</i>	A moss
<i>Potentilla anserina</i>	Silverweed
<i>Potentilla erecta</i>	Tormentil
<i>Potentilla palustris</i>	Marsh Cinquefoil
<i>Prunella vulgaris</i>	Selfheal
<i>Ranunculus flammula</i>	Lesser Spearwort
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Rorippa nasturtium-aquaticum</i>	Water-cress
<i>Rubus fruticosus</i> agg.	Bramble
<i>Rumex obtusifolius</i>	Broad-leaved Dock
<i>Salix caprea</i>	Goat Willow
<i>Salix cinerea</i>	Grey Willow
<i>Scrophularia auriculata</i>	Water Figwort
<i>Scutellaria minor</i>	Lesser Skullcap
<i>Solanum dulcamara</i>	Bittersweet
<i>Solidago virgaurea</i>	Goldenrod
<i>Sparganium erectum</i>	Branched Bur-reed
<i>Sphagnum squarrosum</i>	A moss
<i>Stellaria uliginosa</i>	Bog Stitchwort
<i>Teucrium scorodonia</i>	Wood Sage
<i>Tussilago farfara</i>	Colt's-foot
<i>Typha latifolia</i>	Bulrush
<i>Ulex europaeus</i>	Common Gorse
<i>Urtica dioica</i>	Common Nettle
<i>Veronica beccabunga</i>	Brooklime
<i>Veronica chamaedrys</i>	Germander Speedwell
<i>Viola palustris</i>	Marsh Violet

(b) Drigg stream within Drigg SSSI/cSAC/European Marine Site and adjacent fields

Scientific Name	Common Name
<i>Agrostis capillaris</i>	Common Bent
<i>Agrostis stolonifera</i>	Creeping Bent
<i>Alopecurus geniculatus</i>	Marsh Foxtail
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Apium graveolens</i>	Wild Celery
<i>Armeria maritima</i>	Thrift
<i>Aster tripolium</i>	Sea Aster
<i>Bolboschoenus maritimus</i>	Sea Club-rush
<i>Callitriche</i> agg.	Water-starwort
<i>Calystegia sepium</i>	Hedge Bindweed
<i>Carex arenaria</i>	Sand Sedge
<i>Carex flacca</i>	Glaucous Sedge
<i>Carex otrubae</i>	False Fox-sedge
<i>Carex ovalis</i>	Oval Sedge
<i>Cochlearia officinalis</i>	Common Scurvygrass
<i>Dactylis glomerata</i>	Cock's-foot
<i>Eleocharis palustris</i>	Common Spike-rush
<i>Epilobium hirsutum</i>	Great Willowherb
<i>Erica tetralix</i>	Cross-leaved Heath
<i>Festuca rubra</i>	Red Fescue
<i>Galium saxatile</i>	Heath Bedstraw
<i>Glaux maritima</i>	Sea Milkwort
<i>Holcus lanatus</i>	Yorkshire-fog
<i>Hydrocotyle vulgaris</i>	Marsh Pennywort
<i>Juncus conglomeratus</i>	Compact Rush
<i>Juncus effusus</i>	Soft-rush
<i>Juncus gerardii</i>	Saltmarsh Rush
<i>Juncus squarrosus</i>	Heath Rush
<i>Lolium perenne</i>	Perennial Rye-grass
<i>Leontodon autumnalis</i>	Autumn Hawkbit
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil
<i>Luzula multiflora</i>	Heath Wood-rush
<i>Nardus stricta</i>	Mat-grass
<i>Oenanthe lachenalii</i>	Parsley Water-dropwort
<i>Persicaria amphibia</i>	Amphibious Bistort
<i>Phalaris arundinacea</i>	Reed Canary-grass
<i>Plantago maritima</i>	Sea Plantain
<i>Polygala serpyllifolia</i>	Heath Milkwort
<i>Potentilla anserina</i>	Silverweed
<i>Potentilla erecta</i>	Tormentil
<i>Puccinellia maritima</i>	Common Saltmarsh-grass
<i>Ranunculus hederaceus</i>	Ivy-leaved Crowfoot
<i>Ranunculus repens</i>	Creeping Buttercup
<i>Ranunculus sceleratus</i>	Celery-leaved Buttercup
<i>Sagina subulata</i>	Heath Pearlwort
<i>Salicornia</i> sp.	Glasswort
<i>Sparganium erectum</i>	Branched Bur-reed
<i>Spergularia marina</i>	Lesser Sea-spurrey
<i>Stellaria graminea</i>	Lesser Stitchwort

Scientific Name	Common Name
<i>Trifolium repens</i>	White Clover
<i>Triglochin maritimum</i>	Sea Arrowgrass
<i>Ulex europaeus</i>	Common Gorse
<i>Urtica dioica</i>	Common Nettle

(c) Drigg Coast SSSI/cSAC adjacent to BNFL Drigg Site

Scientific Name	Common Name
<i>Achillea millefolium</i>	Yarrow
<i>Agrostis capillaris</i>	Common Bent
<i>Ammophila arenaria</i>	Marram
<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass
<i>Calluna vulgaris</i>	Heather
<i>Campanula rotundifolia</i>	Harebell
<i>Carex arenaria</i>	Sand Sedge
<i>Carex flacca</i>	Glaucous Sedge
<i>Carex panicea</i>	Carnation Sedge
<i>Carex rostrata</i>	Bottle Sedge
<i>Cerastium fontanum</i>	Common Mouse-ear
<i>Cirsium arvense</i>	Creeping Thistle
<i>Cirsium palustre</i>	Marsh Thistle
<i>Dactylorhiza maculata</i>	Heath Spotted-orchid
<i>Danthonia decumbens</i>	Heath-grass
<i>Drosera rotundifolia</i>	Round-leaved Sundew
<i>Equisetum palustre</i>	Marsh Horsetail
<i>Erica cinerea</i>	Bell Heather
<i>Erica tetralix</i>	Cross-leaved Heath
<i>Eriophorum angustifolium</i>	Common Cotton-grass
<i>Euphrasia officinalis</i>	Eyebright agg.
<i>Festuca rubra</i>	Red Fescue
<i>Galium palustre</i>	Common Marsh-bedstraw
<i>Galium saxatile</i>	Heath Bedstraw
<i>Hieracium</i> agg.	Hawkweed
<i>Holcus lanatus</i>	Yorkshire-fog
<i>Hydrocotyle vulgaris</i>	Marsh Pennywort
<i>Hypericum elodes</i>	Marsh St. John's-wort
<i>Juncus bulbosus</i>	Bulbous Rush
<i>Juncus conglomeratus</i>	Compact Rush
<i>Juncus effusus</i>	Soft-rush
<i>Juncus squarrosus</i>	Heath Rush
<i>Leontodon autumnalis</i>	Autumn Hawkbit
<i>Lotus corniculatus</i>	Common Bird's-foot-trefoil
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil
<i>Luzula multiflora</i>	Heath Wood-rush
<i>Menyanthes trifoliata</i>	Bogbean
<i>Molinia caerulea</i>	Purple Moor-grass
<i>Nardus stricta</i>	Mat-grass
<i>Poa pratensis</i>	Smooth Meadow-grass
<i>Polytrichum commune</i>	Star-moss
<i>Potamogeton polygonifolius</i>	Bog Pondweed
<i>Potentilla erecta</i>	Tormentil
<i>Potentilla palustris</i>	Marsh Cinquefoil
<i>Ranunculus flammula</i>	Lesser Spearwort
<i>Rumex acetosella</i>	Sheep's-sorrel
<i>Scutellaria minor</i>	Lesser Skullcap
<i>Sphagnum</i> sp.	A Moss
<i>Stellaria graminea</i>	Lesser Stitchwort

Scientific Name	Common Name
<i>Trifolium repens</i>	White Clover
<i>Thymus polytrichus</i>	Wild Thyme
<i>Ulex europaeus</i>	Common Gorse
<i>Ulex gallii</i>	Western Gorse
<i>Vaccinium myrtillus</i>	Bilberry
<i>Vaccinium oxycoccos</i>	Cranberry
<i>Veronica serpyllifolia</i>	Thyme-leaved Speedwell
<i>Viola palustris</i>	Marsh Violet

Table 3 Other fauna recorded during survey

Drigg Ditch/Stream and adjacent area within BNFL Drigg site

Latin Name	Common Name
Butterflies	
<i>Aglais urticae</i>	Small tortoiseshell
<i>Argynnis aglaja</i>	Dark green fritillary
<i>Hipparchia semele</i>	Grayling
<i>Inachis io</i>	Peacock
<i>Lasiommata megera</i>	Wall brown
<i>Lycaena phlaeas</i>	Small copper
<i>Maniola jurtina</i>	Meadow brown
<i>Pieris brassicae</i>	Large white
<i>Pieris napi</i>	Green-veined white
<i>Pieris rapae</i>	Small white
<i>Polygonia c-album</i>	Comma
<i>Polyommatus icarus</i>	Common blue
<i>Pyronia tithonus</i>	Gatekeeper
<i>Thymelicus sylvestris</i>	Small skipper
<i>Vanessa atalanta</i>	Red admiral
Odonata	
<i>Enallagma cyathigerum</i>	Common blue damselfly
<i>Pyrrhosoma nymphula</i>	Large red damselfly
<i>Sympetrum striolatum</i>	Common darter
Amphibians/Reptiles	
<i>Bufo bufo</i>	Common toad
<i>Lacerta vivipara</i>	Common lizard
<i>Rana temporaria</i>	Common frog
<i>Triturus sp.</i>	Smooth/palmate newt larvae

Table 4 Invertebrate sampling locations

Number	Description
I1	Sample taken in short stretch of shallow, stagnant water (up to about 15cm deep in places but covered by matted rushes). Matted and tall vegetation made it difficult to sample. Sample sweep netted, as not possible to do kick-sample. The substrate is very silty. Young palmate/smooth newt larvae present in the sample were returned to the water.
I2	Sample taken just downstream of patch of pillwort. Vegetation similar to that described in Target Note 2 (Table 1(a)) except there was no pillwort present. Sample taken by sweep-netting rather than kick-sampling owing to soft substrate and dense vegetation.
I3	Sample taken in short open stretch with common duckweed, lesser spearwort and bog pondweed. Up to ca. 50 - 60cm deep with deep, soft silt. Again sweep-netted owing to soft substrate. Lots of newt larvae present.
I4	Sample taken between weirs – no real open stretches where it was possible to do a kick-sample and thus sweep-netted in section choked by vegetation and dominated by floating sweet-grass. Water depth up to ca. 25cm.
I5	Sample taken just downstream of confluence with East-West Stream. Marginal vegetation dominated by reed canary-grass, channel ca. 2 - 2.5m wide and up to 1.2 - 1.3m deep. Water mint, water-cress, water-starwort, meadowsweet and branched bur-reed present. Some rubble on streambed allowed limited kick-sampling.
I6	Sample sweep-netted owing to silty substrate, taken in heavily choked section. Mid-channel dominated by floating sweet-grass and branched bur-reed. Reed canary-grass, soft-rush, fool's water-cress and wild celery present on banks. Water up to ca. 1m deep. Three adult three-spined stickleback returned to the stream.
I7 (SSSI/cSAC)	Sample taken just inside Drigg Coast SSSI/cSAC boundary, just upstream of small bridge. Channel ca. 50cm wide, free flowing. Banktop ca. 1.1m above water level. Silty bed. Banks dominated by creeping bent. Four small flounder, seven elvers and over 20 small fish (probably trout) were returned to the stream.

TAXON	STATUS	SAMPLE									
		I1	I2	I3	I4	I5	I6	I7			
Dryopidae											
<i>Dryops luridus</i>	common		1								
Dytiscidae											
larvae indet		2			10						1
<i>Ababus bipustulatus</i>	common	2	2	4	4						
<i>Agabus guttatus</i>	common	3	2								
<i>Agabus paludosus</i>	common	2	1	2	7						
<i>Colymbetes fuscus</i>	common			1							
<i>Ilybius fuliginosus</i>	common		1		2	3	19				
<i>Dytiscus semisulcatus</i>	common			1	1						
<i>Hydroporus palustris</i>	common				1	6	1				
<i>Hydroporus striola</i>	common		4								
<i>Hydroporus umbrosus</i>	common		2								
<i>Hydroporus nigrita</i>	common										
<i>Stictotarsus duodecimpustulatus</i>	common				2	8	20				2
Halipilidae											
Larvae indet						7	1				3
<i>Halipilus lineatocollis</i>	common		1				4				
Scirtidae											
<i>Cyphon sp larvae</i>		1	13								
ODONATA											
Aeshnidae											
larvae indet				3							
Coenagrionidae											
nymphs indet		2	3	6							
<i>Pyrrohosoma nymphula</i>	common			2							
<i>Enallagma cyathigerum</i>	common			2							
Libellulidae											
larvae indet				27							
<i>Sympetrum striolatum</i>	common	1	1	5			1				

TAXON	STATUS	SAMPLE										
		I1	I2	I3	I4	I5	I6	I7				
Hydrobiidae												
<i>Potamopyrgus antipodarum</i>	common		4						3			6
Lymnaeidae												
<i>Lymnaea peregra</i>	common			1		2		2				2
Sphaeriidae					1			1				6
HYDRACARINA												3
LEPIDOPTERA				4								
OLIGOCHAETA		5	9	3					4			28
POLYCHAETA												1

Table 6 Number of scoring taxa, BMWP and ASPT scores for each sample

Sample	No. of scoring taxa	BMWP	ASPT
I1	8	37	4.6
I2	13	60	4.6
I3	7	33	4.7
I4	10	46	4.6
I5	13	55	4.2
I6	15	68	4.5
I7	11	40	3.6

FIGURES