**ENVIRONMENT AGENCY**

# RIVER KENNET – RIVER WALK SURVEY

**DRAFT REPORT**

**June 2012**

**APEM REF: 412008**

**CLIENT:** **ENVIRONMENT AGENCY**

**ADDRESS:** **Environment Agency**
**King's Meadow House**
**King's Meadow Road**
**Reading**
**RG1 8DQ**

**PROJECT No:** **412008**

**DATE OF ISSUE:** **June 2012**

---

**PROJECT PRINCIPAL:** **Dr David C. Bradley, MIEEM, MIFM**

**PROJECT MANAGER:** **Tom House, MSc**

**REPORT AUTHORS:** **Emily Long, MSc**
**Tom House, MSc**
**Peter Dennis, MSc, MIFM**

---

APEM LTD
Riverview, A17 Embankment Business Park,
Heaton Mersey, Stockport SK4 3GN
Tel: 0161 442 8938 Fax: 0161432 6083
Registered in England No. 2530851
Website: www.apemltd.co.uk

# CONTENTS

# 1 INTRODUCTION

## 1.1 Background to the project

The Water Framework Directive (WFD) requires water bodies throughout Europe to meet the set requirement of Good ecological status or potential on set timescales. The Environment Agency (EA) is the Competent Authority for WFD and has constructed River Basin Management Plans (RBMPs) in order to the assess status of water bodies and drive actions to meet these requirements. In support of the second phase of the RBMPs the Coalition Government, in March 2011, announced their commitment to the *catchment approach* for delivering sustainable, cost-effective environmental improvement schemes, for the benefit of both the environment and society. At the heart of this approach is that decision making will be done at the catchment scale, with stakeholders working together to deliver actions locally. One of the aims of the catchment approach is to reduce diffuse pollution, which in its many forms, including runoff of excessive fine sediment, fertilizers, farm slurry, septic tanks and spoil heaps, is a major reason for failure to meet Water Framework Directive (WFD) targets. Although the catchment approach supports the WFD it should be noted that the two ideologies operate on differing scales, the catchment approach on a river catchment scale, and WFD on a smaller water body scale.

While point sources of pollution are often relatively well known, identifying the sources of diffuse inputs of these pollutants to rivers is more challenging. As a result, the evidence base for diffuse pollution needed to underpin catchment delivery is lacking. Until recently there was no standardised or tested methodology for undertaking walkover surveys of rivers to identify and classify sources of diffuse pollution in catchments. Since 2009, APEM has been working in partnership with the EA to develop methods and deliver walkover surveys of rivers across England and Wales. The purpose of these surveys is to identify key sources of diffuse pollution in water bodies that are failing to achieve good status under the WFD and to provide a robust evidence base to support catchment delivery.

The aim of this project was to use a catchment-scale methodology to identify and classify diffuse inputs of fine sediment, phosphates, ammonia and diffuse pollutants within a number of failing water bodies in the River Kennet catchment. The surveys expand on the work initiated during the Rural Sediment Tracing Project carried out in England by APEM between 2009 and 2011 (APEM, 2010, 2011). The previous work used catchment-scale walkover surveys to identify sources of fine sediment input to river channels in a number of catchments throughout England. Diffuse sources of phosphates and ammonia share similar pathways to fine sediment, enabling their sources to be identified visually in the field. In many cases fine sediment and sources of phosphates and ammonia are found in combination and may enter a river together from the same source. The sediment tracing methodology used by APEM (2010 and 2011) is therefore well suited for adaptation to allow for the identification of nutrient pollution sources in addition to fine sediment. Further to this, a second phase of investigation was carried out, following the results of the walkover survey. This allowed a further assessment of water quality, including nutrient analysis, nitrogen and phosphorous and suspended solids, to fully assess the extent and impact of

potentially severe inputs originally identified. Methods and analysis of this extension to the project can be seen in Section 4.

The walkover surveys were carried out in six different water bodies in the Kennet and Pang catchment of the Thames river basin. The selected water bodies were those prioritised by local Environment Agency staff because of their failure to meet WFD standards. The water bodies on which walkover surveys were carried out are listed in Table 1.1 and shown in Figure 1.1.

## 1.2 Purpose of this report

The aim of this report is to describe and summarise the findings of the surveys carried out on the River Kennet water bodies. The water bodies are shown in **Figure 1-1** and listed in **Table 1-1**.

**Table 1-1 Water bodies on the Kennet on which walkover surveys were performed**

| Water body name | Water body ID | Water Body Typology |
|---|---|---|
| Upper Dun | GB106039017350 | 2, 2n |
| Shalbourne (Source to Kennet at Hungerford) | GB106039017370 | 2, 2n |
| Inkpen Stream (Source to Kennet) | GB106039017360 | 2, 2n |
| Middle Kennet (Marlborough to Newbury) | GB106039023172 | 5, 4n |
| Kennet and Avon Canal and Dun above Hungerford | GB106039017398 | 2, 2n |
| Froxfield Stream | GB106039017430 | 2, 2n |

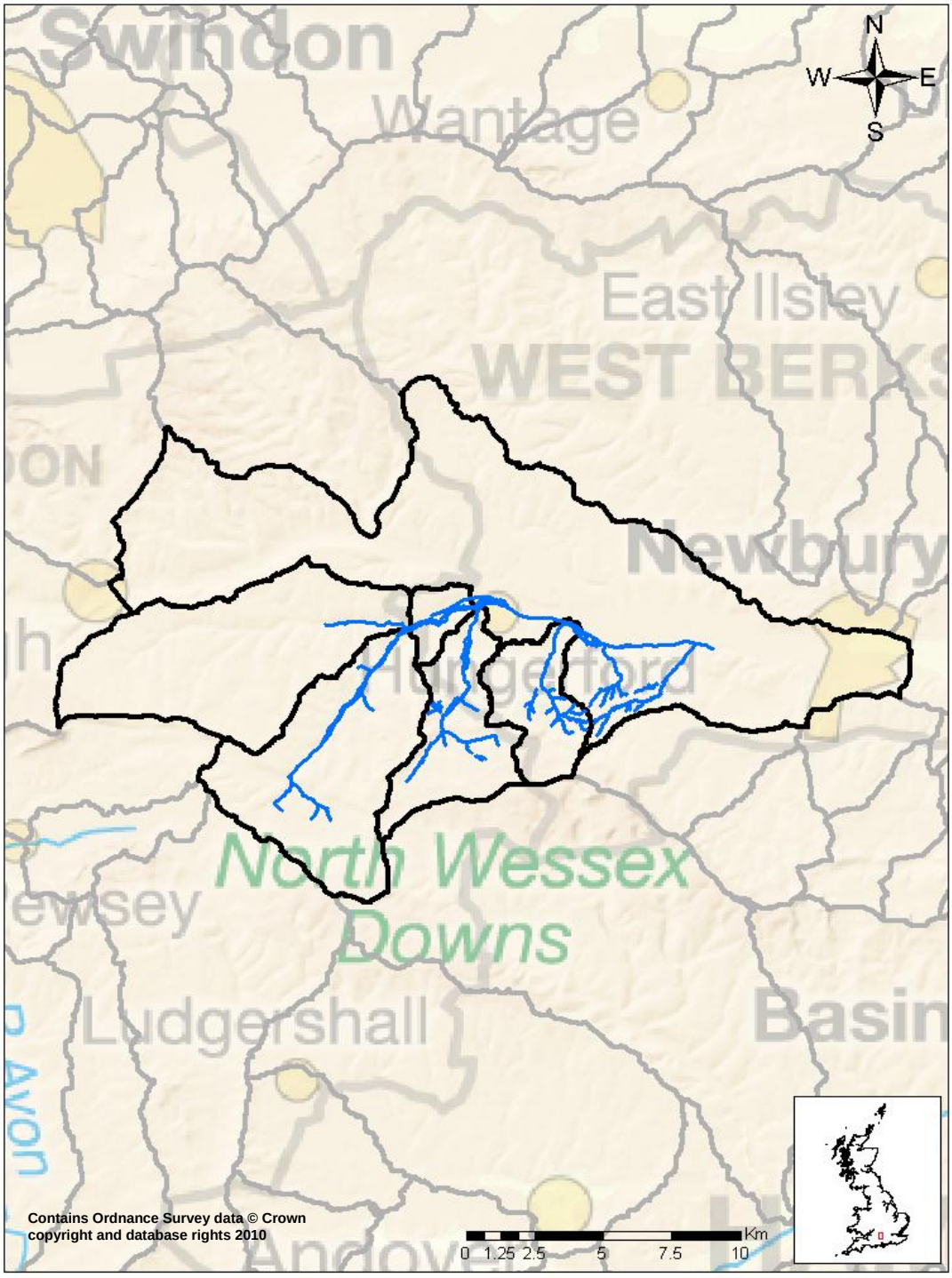


**Figure 1-1 Location of the survey reaches on the River Kennet. Water body outline shown in black, with river walkover extent shown in blue**

## 1.3 River Kennet water bodies

The River Kennet in the south of England is an important chalk stream, running over 45 miles in length. The Kennet is the largest tributary of the River Thames, joining the Thames at the Kennet Mouth near Reading and contributing to nearly half of the water entering the Thames through the summer months. The Kennet is sourced from a collection of tributaries which run from the North of Avebury near Uffcott and Broad Hinton which join Swallowhead Spring near Silbury Hill. From its source the river flows through a collection of large towns including Marlborough, Hungerford and Newbury, being joined by the River Og at Marlborough and the River Dun at Hungerford. The upper reaches of the Kennet are designated as a Site of Special Scientific Interest, whilst the lower reaches, which are navigable, contribute to a network of canals connecting Bristol and London.

The Kennet is famous for its brown trout fisheries, with the chalk stream habitat providing ideal spawning environments. In addition to this the river is known to support populations of Water Voles (*Arvicola amphibious*), Grass Snake (*Natrix natrix*), Reed Bunting (*Emberiza schoeniclus*) and brook lamprey (*Lampetra planeri*).

At present only 34% of water bodies within the Kennet catchment are categorised as reaching Good Ecological Status or Potential under the WFD guidelines. Reasons limiting the achievement of Good Ecological Status or Potential include: high turbidity resulting from high sediment loads; diffuse pollution from agricultural land; point source pollution from sewage treatment works (STW); and water abstraction from the aquifer.

Land use around the Kennet is largely arable farming, inter-dispersed with larger towns such as Hungerford. The soils in the area are slightly acid, base-rich loamy soils, with some clay to the west of the survey area.

## 1.4 Walkover Methodology

The project involved a team of trained field scientists undertaking standardised and systematic walkover surveys along continuous reaches on the River Kennet and its tributaries. The survey was conducted between 27th and 29th February under dry and sunny conditions. The team consisted of four field scientists, led by a highly experienced Team Leader, working individually. A 'leap-frogging' approach was adopted, with individuals walking along the river to a predefined location where a vehicle had been left by a team member who had walked upstream from that point. Critical point sources of pollution entering the watercourses were classified and mapped. The origins of these sources were traced by walking, where possible.

Surveys were carried out in both urban and rural environments and therefore covered a wide range of types of potential pollution input. The perceived threats posed by inputs of pollution sources were classified on a scale of Grade 1 to Grade 3, where Grade 1 is the most severe. Pollution sources from organic and sediment inputs were identified from evidence of overland flow run-off pathways into rivers from agricultural land, as well as non-agricultural pollution sources, such as CSOs and urban run-off. The criteria by which the grades were defined for diffuse organic pollution and fine sediment inputs are provided in Table 1-2 and Table 1-3. The criteria for grading the severity of sources of nutrient pollution are given in Table 1-4

(N.B. This grading system is not to be confused with the EA Common Incident Classification System (CICS)).

The category of each pollution source was recorded as shown in Table 1-5. This facilitated analysis of the types of land use practice that are causing high levels of input of sediment and other pollutants into watercourses in the area as a whole. Additional details were provided for Grade 1 (the most severe), providing specific information to allow remediation of these inputs. The location of each source was recorded in the field using a GPS. This allowed subsequent GIS analysis of the spatial distribution of sources.

Field handbooks, which clearly defined the different grades of pollution found in urban and rural environments using text and photographic examples, were provided to each field worker. The urban and rural handbooks were used interchangeably according to the environments encountered during the survey.

**Table 1-2 Definitions and examples of fine sediment sources of Grades 1 to 3, as classified during the walkover survey**

| Grade | Definition | Example |
|---|---|---|
| **1** | Observed (or potential for) widespread deposition of in stream sediment causing localised and widespread impacts more than 100m from the point or diffuse source. | • Fields with major erosion gullies<br>• Fields with evidence of large-scale overland flow<br>• Major in stream works (such as dredging)<br>• Heavily poached and trampled fields<br>• Farm tracks with evidence of overland flow<br>• Drains and ditches discharging large quantities of fine sediment |
| **2** | Observed (or potential for) local deposition of in stream sediment causing noticeable impacts within 100m of the point or diffuse source. | • Fields with evidence of localised run-off<br>• Localised poaching<br>• Drains and ditches discharging small quantities of fine sediment |
| **3** | Minimal observed (or potential for) deposition of in stream sediment with much localised deposition in the immediate vicinity of the input. | • Minor land drains<br>• Ditches<br>• Road drains and other pipes<br>• Minor stocking drinking areas and other points of livestock access |

**Table 1-3 Definitions and examples of organic pollution inputs of Grades 1 to 3, as classified during the walkover survey**

| Grade | Definition | Example |
|---|---|---|
| **1** | Concentrated input of organic material directly into the river with impacts more than 100 m downstream; observed presence of sewage fungus. | • Sewage pipe discharging into river<br>• Slurry or manure run-off directly into river via ditch<br>• Sewage fungus present in river or ditch flowing into river |
| **2** | Evidence of organic material input into the channel with localised impacts; no sewage fungus present. | • Run-off from farmyard track into river, where organic material observed on track<br>• Manure heap situated in riparian area, with evidence of run-off into channel |
| **3** | Organic material observed within the riparian area, with potential for transport into the river. | • Livestock feeding area adjacent to channel<br>• Muck spreading on land with potential for overland flow into channel |

**Table 1-4 Definitions and examples of nutrient pollution inputs of Grades 1 to 3, as classified during the walkover survey**

| POINT SOURCE SEVERITY | | |
|---|---|---|
| **Grade** | **Definition** | **Examples** |
| **1** | Observed (or potential for) widespread discharge causing localised and widespread impacts exceeding 10m from the point source. | • Large active outflow pipes or CSOs discharging high risk material<br>• Change in river profile around the point source, i.e. large pool<br>• Widespread change in in stream vegetation and increased algal growth downstream of source<br>• Discolouration of water or substrate downstream of a point source |
| **2** | Observed (or potential for) localized discharge causing noticeable in stream impacts up to 10m of the point source. | • Historical localised evidence of pipes discharging moderate risk material<br>• Localised change in in stream vegetation<br>• Drains and ditches discharging moderate discharges |
| **3** | Minimal observed (or potential for) discharge localised impact in the immediate vicinity of the input. | • Minor land drains and small gauge pipes with very localised impacts to in stream habitat<br>• Historical evidence of inflows from minimum risk sources such as road surface run-off |

**Table 1-5 Categories of pollution sources (applicable to both urban and rural environments)**

| Category | Source | Type | Abbreviation |
|---|---|---|---|
| **A** | Arable | Overland runoff (cropland) | OR |
| | | Arable field drain | FD |
| | | Arable drainage pipe | ADP |
| | | Spreading | ASP |
| **B** | Livestock | Farmyard surface runoff | FR |
| | | Farmyard discharge (infrastructure) | FD |
| | | Poaching – direct input | PO |
| | | Overland runoff (Grassland) | POR |
| | | Drainage ditch | PDD |
| | | Over-grazing | OG |
| | | Spreading | LSP |
| **C** | Conduits | Road | RR |
| | | Track | TR |
| | | Drainage ditch (non-agricultural) | DD |
| | | Footpath | FP |
| | | Pipe | PI |
| **D** | Domestic & Industrial | Sewage treatment works | STW |
| | | Combined Sewage Overflow | CSO |
| | | Urban run-off | UR |
| | | Septic tank | ST |
| | | Industrial Effluent | IE |
| | | Construction site | CS |
| | | Dredging | DR |
| | | Bank Clearance | DBC |
| **E** | Other | Spoil heap | SH |
| | | Unknown | UK |
| | | Other | OT |
| | | Woodland run-off | WR |
| | | Road works | RW |

# 2 WALKOVER SURVEY RESULTS

In this section, an overview of the issues recorded in the water body surveyed is provided in the form of maps and tables. In addition, every potential source of pollution classed as a Grade 1 during the survey is described, giving information about its location, the type of input and the likely cause of the input. It is intended that this information will provide a comprehensive picture of the main catchment issues that are impacting on the River Kennet, allowing remediation measures to be targeted at the worst affected locations. A priority rating is also given from LOW – HIGH providing support for local EA teams during catchment management decisions.

## 2.1 Overview of issues within the River Kennet

A map of every potential pollution input recorded on the River Kennet is shown below (Figure 2-1). Pollution inputs classed as Grade 1 are shown on Figure 2-2, and are listed, together with their type and locations in Table 2-1. Further details of every recorded pollution input can be found in the GIS output (Appendix 1).

**Table 2-1 Summary of potential Grade 1 pollution inputs recorded on the River Kennet**

| Site | Grid reference | Description |
|---|---|---|
| 7 | SU3787964581 | Potential runoff via track. Loose sediment throughout area. |
| 37 | SU3243368780 | Sloped track surrounded by arable fields. High potential for sediment runoff |
| 54 | SU3270463328 | High potential for road runoff. Road on slope and drains leading into stream, with arable fields located at the top of the road. Potential for high sediment input. |
| 60 | SU3335162915 | Track with very high levels of sediment and 2 adjoining arable fields. |
| 69 | SU4036966348 | Lots of sediment on road surface, reasonable gradient leading towards the river over a significant distance in both directions. |
| 71 | SU3997265937 | Grey water with a detergent odour. The river is currently dry upstream and downstream of this grey water which is present for around 30m. No obvious source seen but there was a farm about 150m from the river. |
| 89 | SU2869166333 | Potential for fine sediment input due to large arable fields, reasonably steep gradients and numerous pathways. |
| 90 | SU2843466225 | Large potential for fine sediment input due to arable fields, reasonably steep gradients and numerous pathways. |
| 101 | SU2799564354 | Arable field close to the canal bank has a reasonable slope towards the canal. Crop cover at time of survey, although exposed sediments can be seen. |
| 124 | SU3180564006 | Arable field with high volume of exposed sediment. There is a steep gradient towards the river. |
| 129 | SU3130163285 | Track running towards river with muddy RHB and arable field on LHB. The field shows severe gullying in past. |
| 139 | SU3663264624 | Small well hidden pipe with sewage fungus present in and around pipe. Strong obnoxious odours present. |
| 182 | SU3594464343 | Pipe discharging with strong odour and sewage fungus present. |
| 183 | SU3591664327 | Pipe outlet with sewage fungus present with strong odour. Sediment plume affects water quality for >100m. Source unclear. |
| 185 | SU3522465079 | Road ditch which connects to Kennet. Sewage fungus present with strong odour. Appears to come from a misconnection. |
| 187 | SU3675367817 | Overflow from canal which is sediment rich. Clear decrease in water quality from this input. |

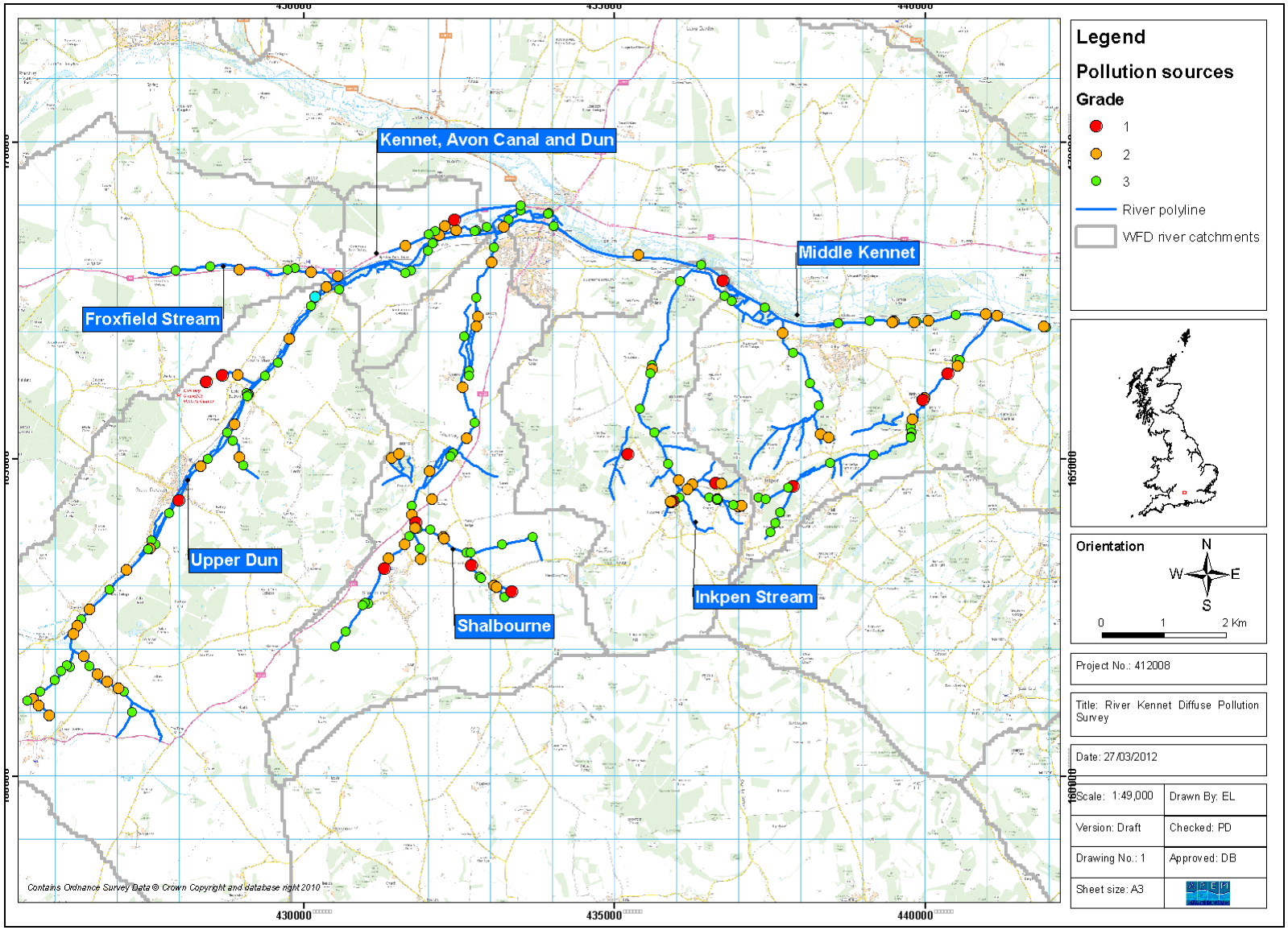


**Figure 2-1 Map showing potential pollution sources recorded on the River Kennet**

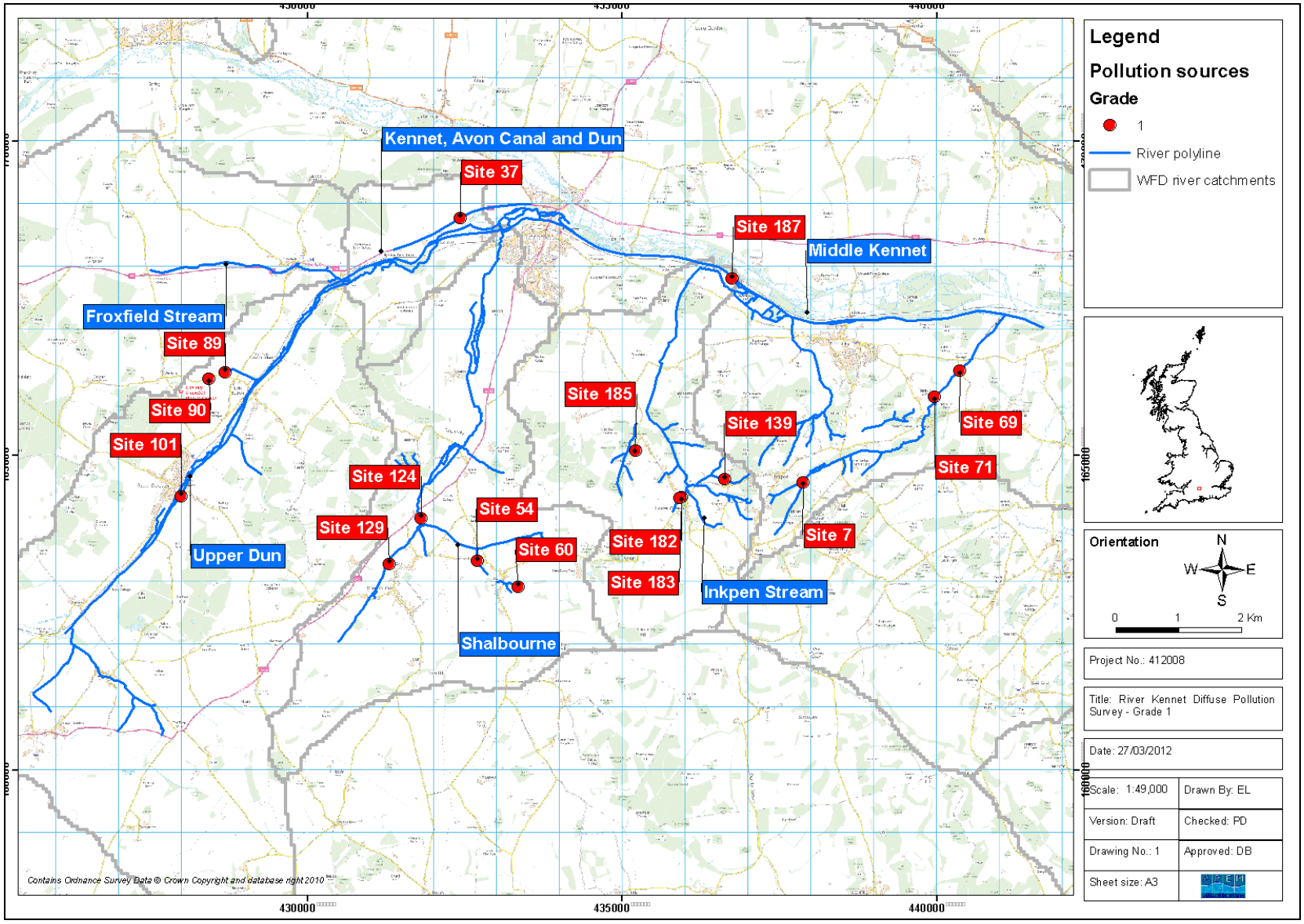


**Figure 2-2 Map showing every potential Grade 1 pollution input on the River Kennet**

## 2.2 Grade 1 pollution inputs

On the following pages a description of every pollution input recorded as a Grade 1 is provided, together with images of the source. Further images and video footage of Grade 1 sources are included within the GIS (Appendix 1).

| | | | |
|---|---|---|---|
| **Site Number** | 7 | **River/Beck** | Kennet |
| **Date** | 27/02/12 | **NGR** | SU3787964581 |
| **Pollutant type** | Sediment | **Priority** | Low |
| **Source category** | Track | **Source type** | Conduit |
| **Land use** | **LHB:** Woodland | **RHB:** Woodland | |
| **Vegetation** | **LHB:** Broadleaf woodland | **RHB:** Broadleaf woodland | |

**Synopsis:**

Track with high levels of unconsolidated sediment with high potential for runoff following a rain event. Track is steeply sloping towards stream and runs through woodland connecting two main roads. Some evidence of past runoff. Impacts are likely to be low and localised due to size of track and surrounding land use (woodland).

| | | | |
|---|---|---|---|
| **Site Number** | 37 | **River/Beck** | Kennet |
| **Date** | 28/02/12 | **NGR** | SU3243368780 |
| **Pollutant type** | Sediment/Phosphate | **Priority** | Low |
| **Source category** | Overland run-off/Track | **Source type** | Arable field/Conduit |
| **Land use** | **LHB:** Road | **RHB:** Arable field | |
| **Vegetation** | **LHB:** Concrete | **RHB:** Arable/Grass verge | |

**Synopsis:**
Evidence of sediment run-off from arable fields. Run-off is channelled down a sloping track between two fields into a ditch connected to the watercourse. The ditch was dry at the time of survey and both fields have small buffer zones (~2m of grass). There was however clear evidence of historical run-off events with high sediment accumulations in the ditch suggesting a high potential for fine sediment to enter the watercourse.

| | | | |
|---|---|---|---|
| **Site Number** | 54 | **River/Beck** | Kennet |
| **Date** | 29/02/12 | **NGR** | SU3270463328 |
| **Pollutant type** | Sediment/Phosphate | **Priority** | Moderate |
| **Source category** | Overland run-off/Track | **Source type** | Arable field/Conduit |
| **Land use** | **LHB:** pasture/pumping station | **RHB:** arable land | |
| **Vegetation** | **LHB:** crops | **RHB:** crops | |

**Synopsis:**

Evidence of surface runoff from two arable fields running parallel with road (SU3266263350). Road slopes down to the tributary, with fine sediment accumulation evident at time of survey. Furrows were present from past run-off events, cutting into banks. A drain and pipe also runs off the road into the brook at SU3270463328 (Source).

| | | | |
|---|---|---|---|
| **Site Number** | 60 | **River/Beck** | Kennet |
| **Date** | 29/02/12 | **NGR** | SU3335162915 |
| **Pollutant type** | Sediment/Phosphate | **Priority** | Moderate |
| **Source category** | Overland run-off/Track | **Source type** | Arable field/Conduit |
| **Land use** | **LHB:** Arable field | **RHB:** Arable field | |
| **Vegetation** | **LHB:** Grass | **RHB:** Maize | |

**Synopsis:**

High potential for fine sediment runoff via extensively used farm access track that crosses brook. The track runs between two arable fields creating a high potential for overland runoff as both the track and fields slope towards the brook. Sediment on the track has been unconsolidated up by heavy machinery. Small woodland borders the track and brook intersection.

| | | | |
|---|---|---|---|
| **Site Number** | **69** | **River/Beck** | Kennet (Trib 1) |
| **Date** | 27/02/12 | **NGR** | SU4036966348 |
| **Pollutant type** | Sediment | **Priority** | Moderate |
| **Source category** | Conduit | **Source type** | Road |
| **Land use** | **LHB:** Arable crops | **RHB:** Arable crops | |
| **Vegetation** | **LHB:** Arable crops | **RHB:** Arable crops | |

**Synopsis:**

Evidence of fine sediment accumulation in brook. Sediment transported to the brook via a road acting as a conduit for run-off with high ground seen on both sides. Potential for high inputs during wet weather events.

| | | | |
|---|---|---|---|
| **Site Number** | 71 | **River/Beck** | River Kennet |
| **Date** | 27/03/12 | **NGR** | SU3997265937 |
| **Pollutant type** | Unknown | **Priority** | High |
| **Source category** | Other | **Source type** | Unknown |
| **Land use** | **LHB:** Woodland | **RHB:** Rough pasture | |
| **Vegetation** | **LHB:** Scrub/young trees | **RHB:** Grasses/bracken | |

**Synopsis:**

Grey water running through brook for around 30m with an odour of detergent present. The river is currently dry upstream and downstream of this stretch. No obvious source could be seen but there was a farm about 150m from the river.

| | | | |
|---|---|---|---|
| **Site Number** | 89 | **River/Beck** | River Dun |
| **Date** | 28/02/12 | **NGR** | SU2869166333 |
| **Pollutant type** | Sediment | **Priority** | High |
| **Source category** | Arable/Conduits | **Source type** | Overland runoff (cropland)/Road/Track |
| **Land use** | **LHB:** Arable crops | **RHB:** Arable crops | |
| **Vegetation** | **LHB:** Arable crops | **RHB:** Arable crops | |

**Synopsis:**

Significant potential for fine sediment input from large arable fields with moderate gradient and numerous pathways including a track and a road. Also potential input of fine sediment from the road and the track which act as conduits. Evidence of historical discharges and in stream fine sediment accumulations.

| | | | |
|---|---|---|---|
| **Site Number** | **90** | **River/Beck** | River Dun (Trib) |
| **Date** | 28/02/12 | **NGR** | SU2843466225 |
| **Pollutant type** | Sediment | **Priority** | Moderate |
| **Source category** | Arable | **Source type** | Overland runoff (cropland) |
| **Land use** | **LHB:** Arable crop | **RHB:** Arable crop | |
| **Vegetation** | **LHB:** Arable crop | **RHB:** Arable crop | |

**Synopsis:**

Large potential for fine sediment input due to large arable fields, reasonably steep gradients and numerous pathways including a track used to access the fields and the road. Also potential input of fine sediment from road surface.

| | | | |
|---|---|---|---|
| **Site Number** | 101 | **River/Beck** | Kennet (Canal) |
| **Date** | 28/02/12 | **NGR** | SU2799564354 |
| **Pollutant type** | Sediment | **Priority** | Moderate |
| **Source category** | Arable | **Source type** | Overland runoff (cropland) |
| **Land use** | **LHB:** Rough ground | **RHB:** Arable crop | |
| **Vegetation** | **LHB:** Rough vegetation/Scrub | **RHB:** Arable crop | |

**Synopsis:**

Arable field has a moderate gradient towards the canal. Widespread evidence of previous overland movement of fine sediment via track towards the water body. Fine sediment accumulations reported downstream of the site.

| | | | |
|---|---|---|---|
| **Site Number** | 124 | **River/Beck** | Kennet (Trib) |
| **Date** | 29/02/12 | **NGR** | SU3180564006 |
| **Pollutant type** | Sediment | **Priority** | Low |
| **Source category** | Arable | **Source type** | Overland runoff (cropland) |
| **Land use** | **LHB:** Arable crop | **RHB:** Woodland | |
| **Vegetation** | **LHB:** None | **RHB:** Trees | |

**Synopsis:**

Arable field adjacent to the watercourse. Evidence of previous sediment movement from the field across the buffer strip which has only minimal vegetation cover. The field has been recently ploughed across the gradient which demonstrates good practice.

| | | | |
|---|---|---|---|
| **Site Number** | 129 | **River/Beck** | Kennet (Trib) |
| **Date** | 29/02/12 | **NGR** | SU3130163285 |
| **Pollutant type** | Sediment | **Priority** | Moderate |
| **Source category** | Arable/Conduits | **Source type** | Overland runoff (cropland) |
| **Land use** | **LHB:** Arable crop | **RHB:** Woodland | |
| **Vegetation** | **LHB:** Arable crop | **RHB:** Trees | |

**Synopsis:**

An extensively eroded track runs down a moderate gradient towards the watercourse. On LHB the track leads uphill to an arable field with exposed sediment and the field is on a steep gradient. Evidence of fine sediment movement down the track was recorded, with accumulations observed downstream of the site. A ditch running between the track and another arable field could also act as a pathway. There is gullying on steeper parts of the field. High potential for run-off during wet weather events

| | | | |
|---|---|---|---|
| **Site Number** | 139 | **River/Beck** | Kennet (Trib 3) |
| **Date** | 28/02/2012 | **NGR** | SU3663264624 |
| **Pollutant type** | Bacteria | **Priority** | Moderate |
| **Source category** | Anthropogenic & Industrial | **Source type** | Septic tank / Combined sewage overflow |
| **Land use** | **LHB:** Pasture | **RHB:** Pasture | |
| **Vegetation** | **LHB:** Grass | **RHB:** Grass | |

**Synopsis:**

Small pipe with sewage fungus present in and around pipe on RHB. Strong obnoxious odours considering size of pipe. Pipe is approximately 1m upstream of culvert. Direction of pipe can be seen from disturbed land where pipe was lay. Leads to a manhole in a garden which also smells strongly of obnoxious odours. Most likely to be from a septic tank or misconnected sewage system.

| | | | |
|---|---|---|---|
| **Site Number** | 182 | **River/Beck** | Kennet (Trib 3) |
| **Date** | 28/2/12 | **NGR** | SU3594464343 |
| **Pollutant type** | Bacteria, nutrients. Organic. | **Priority** | Moderate |
| **Source category** | Conduit | **Source type** | Pipe |
| **Land use** | **LHB:** Pasture | **RHB:** pasture and fallow | |
| **Vegetation** | **LHB:** grasses, shrubs | **RHB:** grasses, shrubs | |

**Synopsis:**

Pipe discharging continuous low flow with strong odour of sewage. Pipe appears to be flowing from "The Swan Inn" and "The organic Beef Company". Possible Septic tank overflows. Evidence of historical discharges over a long period of time.

| | | | |
|---|---|---|---|
| **Site Number** | 183 | **River/Beck** | Kennet (Trib 3) |
| **Date** | 28/2/12 | **NGR** | SU3591664327 |
| **Pollutant type** | Sediment and organic | **Priority** | Moderate |
| **Source category** | Conduit | **Source type** | Pipe |
| **Land use** | **LHB:** Pasture | **RHB:** Car park | |
| **Vegetation** | **LHB:** Grasses/ shrubs | **RHB:** N/A | |

**Synopsis:**

Pipe on LHB discharging continuously with sewage fungus and odour at outfall. Sediment plume affecting water quality for >100 m. Unknown source but outfall is located adjacent to road, although no connectivity evident. Need to return during a wet weather event to substantiate the nature and full extent of the discharge.

| | | | |
|---|---|---|---|
| **Site Number** | 185 | **River/Beck** | Kennet (Trib 3) |
| **Date** | 28/2/12 | **NGR** | SU3522465079 |
| **Pollutant type** | Organic | **Priority** | High |
| **Source category** | Conduit | **Source type** | Pipe |
| **Land use** | **LHB:** Road | **RHB:** Pasture | |
| **Vegetation** | **LHB:** N/A | **RHB:** Grasses | |

**Synopsis:**

Road ditch that eventually connects with tributary of the Kennet. Approximately 100 m of ditch with sewage fungus present and strong odour. Source appears to be a misconnection with main sewer- further inspection of pipelines required.

| | | | |
|---|---|---|---|
| **Site Number** | 187 | **River/Beck** | River Kennet |
| **Date** | 28/02/12 | **NGR** | SU3675367817 |
| **Pollutant type** | Sediment | **Priority** | High |
| **Source category** | Other | **Source type** | Canal overflow |
| **Land use** | **LHB:** Canal | **RHB:** Woodland | |
| **Vegetation** | **LHB:** None | **RHB:** Small trees/scrub | |

**Synopsis:**

Weir/sluice, canal flowing into tributary 3. WQ upstream is good, not turbid. From this point downstream, the tributary is highly turbid with fine sediment accumulations recorded downstream of the confluence. All inflows south from this point, joining tributary 3 are running clear. Major sediment loading at this location. source: Canal

## 2.3 Analysis of the River Kennet Walkover Survey

Throughout the survey, 202 pollution inputs or potential pollution inputs were identified. Of these, 16 (8%) were classified as Grade 1, 71 (35%) were classed as Grade 2 and 115 (57%) as Grade 3 (Table 2-2). Pollution sources were widely distributed across the whole area surveyed, with a higher density of pollution inputs identified on tributaries of the River Kennet than the main stem itself. The Upper Dun (GB106039017350), Shalbourne (GB106039017370), and Kennet and Avon Canal (GB106039017390) had the highest density of pollution sources within the water bodies surveyed. The majority of sources identified were located in the headwaters of the tributaries to the south of the Kennet.

**Table 2-2 Number of pollution sources recorded under each grade in the River Kennet**

| Grade | Frequency | Percentage |
|---|---|---|
| 1 | 16 | 8 |
| 2 | 71 | 35 |
| 3 | 115 | 57 |
| Total | 202 | 100 |

The 16 Grade 1 classified pollution sources were distributed throughout all of the water bodies surveyed, except Froxfield Stream (GB106039017430)). A total of five Grade 1 sources were identified on Inkpen Stream (GB106039017360, four on the River Shalbourne (GB106039017370), three on the Upper Dun (GB106039017350) and Middle Kennet (GB106039023172) and one within the Kennet, Avon Canal and Dun water body.

The Grade 1 sources identified on the Upper Dun were seen in the headwaters to the south of the water body with one source identified in Great Bedwyn, and two sources identified further north on a small stream joining the Upper Dun by Little Bedwyn. The River Shalbourne also had a higher density of pollution sources in the headwaters to the south of the main River Kennet, including the five Grade 1 classified sources. Two of these sources were identified on a small tributary of the headwaters running through Ham, one to the east of this small tributary, running into the River Shalbourne from the town of Shalbourne, and the remaining Grade 1 source identified was located at the confluence of these small headwaters to the north of Shalbourne and Ham below the A338. Inkpen Stream had four Grade 1 sources; again these were in the headwaters. One source was in the eastern headwaters on Wavers Lane (Site 139), two just to the north of Lower Green, and one to the north on Sadlers Road. The two sources to the north of Lower Green were very close in proximity which might increase the impact on this section of the watercourse. The remaining source was within the water body boundaries, but was located on the Kennet and Avon Canal. The Middle Kennet again showed a distribution of Grade 1 sources in the headwaters and middle reaches, decreasing towards the main stem of the River Kennet. All Grade 1 sources within this water body were on Peartree Bottom tributary, one by Peartree Cottage, one by Kintbury Holt Farm and one to the east of the town of Inkpen. The remaining Grade 1 source was seen on a small drain running alongside the A4 above the River

Dun and Kennet and Avon Canal by Hungerford. The close distribution of several Grade 1 sources to one another might increase the overall impact on the watercourse.

The 16 Grade 1 pollution sources identified were largely the result of pollution transported via conduits (11 records, 64%), with pollution from arable farming also scoring highly (8 records, 47%) and a small number of records from other sources (2 records, 10%) and domestic and industrial pollution (1 record, 6%) (
Figure 2-3). A higher number of categories are recorded than sites identified, as one source may have multiple pollution sources attributable to it, for example, run-off from an arable field which is transported to the watercourse via a track represents both pollution from arable farming and conduits. Of the 11 records of pollution via conduits six, were primarily assigned the category resulting from pipes (3 records), road run-off (2 records) and track run-off (1 record). The remaining five records of pollution via conduits were primarily attributed to arable farming via overland run-off, facilitated by roads and tracks with a secondary classification of conduits. All records of pollution from arable farming resulted from overland run-off from arable fields. Pollution classified as other, was the result of one unknown source and one canal overflow input seen to be carrying a high sediment load. The one Grade 1 domestic and industrial categorised source resulted from a septic tank misconnection or overflow. It is clear to see that arable farming and overland run-off from the surrounding area is the largest threat to the watercourse, being attributable to a high number of severely graded inputs identified.

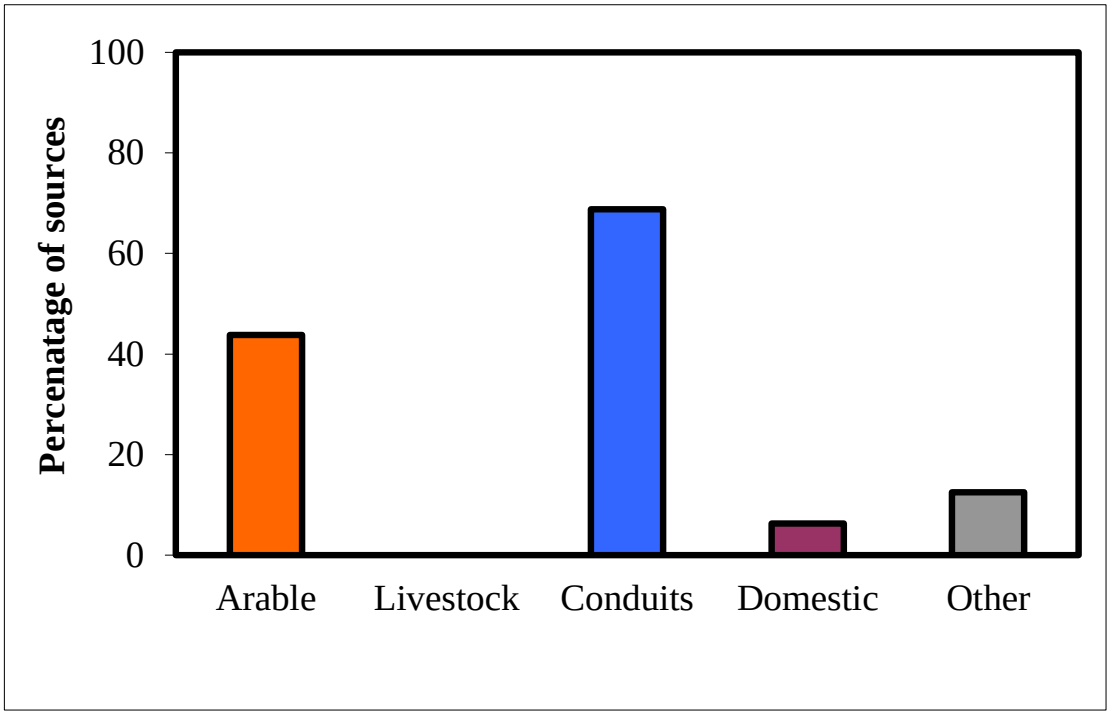


**Figure 2-3 Percentage contribution of each category to Grade 1 pollution sources on the River Kennet. (N.B. percentages add up to more than 100 as some sources included more than one category)**

Pollution sources of all Grades showed a similar pattern across categories as reported for Grade 1 sources (Figure 2-4), with pollution via conduits attributable to the majority of pollution sources identified (96 records, 47%). Second to this in frequency was pollution from arable farming (69 records, 34%), followed by pollution from livestock farming (31 records, 15%),

pollution from other sources (19 records, 10%) and pollution from domestic sources (10 records, 5%).

Pollution resulting from transport via a conduit was largely the result of road, track and foot path run-off (58 records), with a smaller number of inputs recorded as resulting from pipes (19 records) and drainage ditches (2 records). Pollution from road, track and footpath run-off is likely to contain a high volume of sediment, as well as potentially containing litter and other organic or inorganic substances. Where run-off from tracks and roads is also linked to arable farms and run-off from fields, sediment load would be expected to be high and potentially nutrient-rich. The smaller number of pollution via conduits that resulted from pipes was largely attributable to urban drainage. With many of these pipes linked to drainage systems the full extent of impact resulting from these sources is likely to be underestimated without further sampling under wet weather conditions.

Pollution from arable farming comprised 34% of all pollution inputs and was attributable to overland run-off and a field drain. Overland run-off from arable fields, especially where a gradient towards the watercourse is present, may result in high volumes of sediment and fertiliser entering the watercourse. This is likely to increase during periods of wet weather.

Pollution from livestock farming was largely the result of poaching and overland run-off from grassland with smaller numbers of pollution inputs attributable to overgrazing, farmyard discharge and farmyard surface run-off. Poaching of the watercourse as well as overland run-off from livestock fields will likely contain high volumes of fine sediment, and faecal matter. These are also likely to be contained within run-off and discharge from farm yards. In addition to this, four occurrences of woodland run-off were recorded, as was pollution from a spoil heap located too close to the watercourse.

Domestic and industrial pollution was the least frequently recorded category of pollution inputs, only responsible for 10% pollution sources identified. Sewage treatment works (STW) were responsible for seven of the nine sources recorded under this category, whilst the remaining two sources were the result of septic tanks.

Overall overland run-off from arable fields, in combination with run-off from roads and tracks were the largest pollution sources recorded throughout the River Kennet catchment. Pollution from these sources is likely to contain high volumes of sediment, and nutrients when run-off comes from arable fields. This will reduce water quality; reducing light attenuation and clogging up gravels which provide spawning grounds for salmonids.

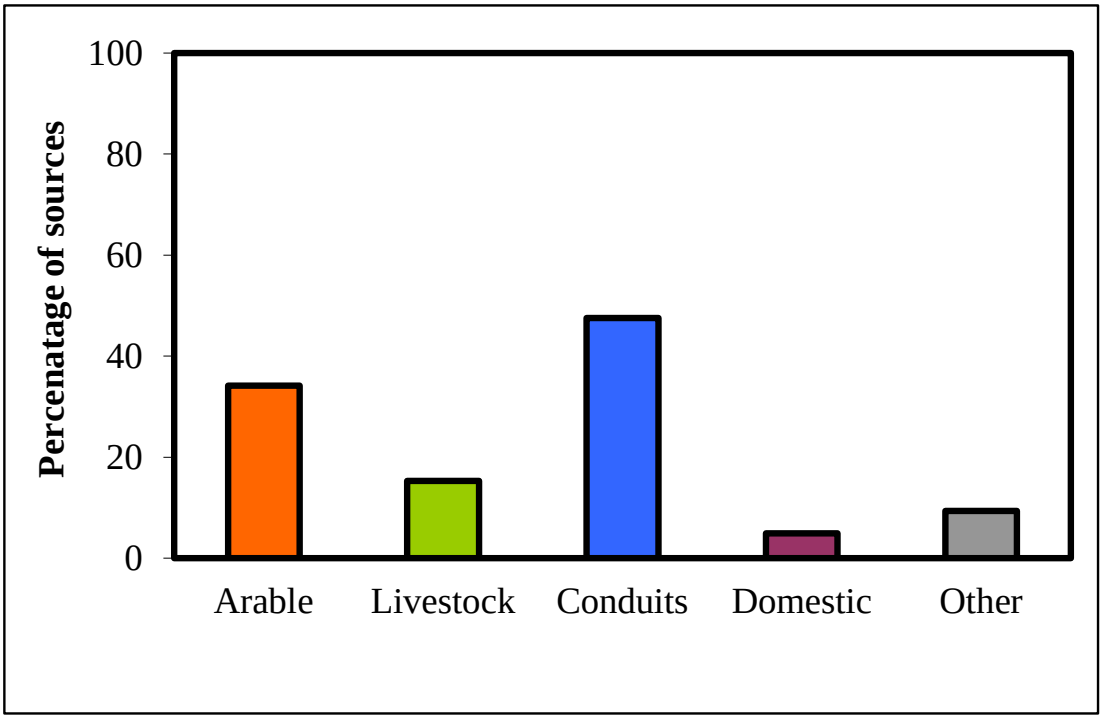


**Figure 2-4 Percentage contribution of each category to pollution sources of all grades in the River Kennet. (N.B. percentages add up to more than 100 as some sources included more than one category)**

# 3 RIVER KENNET CATCHMENT WALKOVER SUMMARY

## 3.1 Main issues in the River Kennet

The results of the walkover indicate that pollution from conduits was the main contributing pollution source within the River Kennet catchment, responsible for 48% of pollution sources from all grades and 69% of Grade 1 sources. Conduits were most frequently recorded as run-off from roads, paths and footpaths both from the pathways themselves and run-off channelled down the conduit from arable and livestock fields. Although the majority of conduits transport surface run-off, a small number were attributable to pipes from urban and domestic drainage systems and were located closer to urban centres and housing.

Pollution from arable fields was the second most frequently reported category of pollution source, contributing 34% of pollution inputs of all grades and 44% of Grade 1 sources. Pollution from arable farming was nearly exclusively the result of overland run-off. Pollution from this source is likely to carry high volumes of sediment and potentially small volumes of excess fertiliser, this may act to increase turbidity in the water column and provide additional nutrients to the watercourse, potentially resulting in eutrophication. Over land run-off from arable farming was frequently reported to be facilitated through the use of conduits such as tracks and pathways, allowing the run-off from nearby and adjacent fields to be carried to the watercourse. The only pollution source identified which was not the result of overland run-off was the result of a field drain. This is equally likely to contain high volumes of sediment and excess fertiliser.

Other pollution sources identified included pollution from livestock fields, domestic and industrial sites and ‘other’ sources. Livestock fields were largely the result of overland run-off and poaching, with small contributions from field drains and trampling by livestock. Both poaching and overland run-off from livestock fields has potential to allow large volumes of sediment to enter the water course. Pollution from ‘other’ sources was recorded from woodland run-off, a spoil heap, and other sources. Pollution under this category from ‘other’ is recorded where pollution is identified, but the true origin of the pollution was unclear. Pollution resulting from domestic origins was identified from sewage treatment works and septic tanks.

The pollution sources identified are indicative of the land use in the area, with the largest contributions resulting from arable and livestock fields. Further to this, the most impacted stretches of river were seen in the headwaters of tributaries adjoining the River Kennet in the most rural areas. The Upper Dun (GB106039017350), Shalbourne (GB106039017370) and Kennet and Avon Canal (GB106039017390) were the most impacted water bodies, showing a very high density and close distribution of pollution sources. Froxfield Stream (GB106039017430), Middle Kennet (GB106039023172) and Inkpen Stream (GB10603907360), showed a sparser distribution of pollution sources, with Froxfield Stream identified as the only water body not to hold a Grade 1 pollution source. As well as showing the densest distribution of sources, Grade 1 sources were also identified in the headwaters of all water bodies except Froxfield stream, which had no Grade 1 pollution sources.

## 3.2 Limitations

The survey methodology limits the assessment of issues affecting the water bodies to those that can be detected visually; inputs of certain pollutants, such as those that are soluble in water are highly toxic at low concentrations, are less easy to detect. While fine sediment can act as a visual proxy for inputs of phosphate, which is transported bound to sediment, of phosphate in the water cannot be determined by the method. Furthermore, at the time of the survey many of the pollution inputs may not be active. Assessment of the severity (grade) of an input must be inferred from evidence of impacts and the visible characteristics of the source. A more accurate means of assessing the relative severities of types of pollution input would be to undertake sampling during run-off events. This would also allow detection of the types of pollutant present.

The surveys provide a snapshot of issues in the catchments at one point in time. Surveys were carried out in early spring when vegetation levels are low, making it an optimum time to detect sources of pollutant run-off. However, the surveys may miss certain issues that become apparent seasonally, such as invasive species or run-off from spreading. This should be taken into account when interpreting the survey results.

In order to provide further evidence of the most serious pollution issues in each water body, water sampling during wet weather events would be required. This would allow quantification of pollution inputs and confirm the results of the field walkovers.

## 3.3 Recommendations

Run-off from roads, footpaths, and arable and livestock fields were the largest sources of pollution identified throughout the River Kennet catchment surveyed. As pollution resulting from run-off is likely to contain high volumes of sediment and potentially volumes of excess fertiliser or organic matter from livestock, which is detrimental to the watercourse, it is recommended that actions be put into place to reduce these sources. The introduction, better execution, and/or better enforcement of Catchment Sensitive Farming (CSF) techniques throughout the catchment could be applied to both arable and livestock fields to try and reduce soil run-off and erosion. Under this approach the application of buffer zones, on both arable and livestock fields and field corners, under sowing of crops and stubble creation may be used to reduce run-off to the watercourse, whilst beetle banks may act to reduce the flow across a gradient, trapping overland flow.

In addition to the creation of barriers, the reduction of vehicle access may act to reduce soil compaction, whilst only grazing livestock on the flatter areas of the land, as well as providing a sufficient barrier between animals and the watercourse would also be beneficial. Sufficient barriers between livestock and the watercourse will reduce poaching and trampling, which allows high volumes of sediment to enter the watercourse. Restricted vehicle access, particularly between fields if an alternative is available would also help to reduce pollution via road and track run-off and the reduction of vehicle use would reduce the channelling affect between fields and rivers reducing pollution via conduits.

As the highest density of pollution sources has been identified in the upper reaches of the water bodies assessed, it would be recommended that actions are focused in these areas initially. This would allow the most severely impacted areas to be reduced, and water quality downstream of

this point to improve. Actions should also focus on the Upper Dun, Salbourne and Kennet, Avon Canal and Dun water bodies in the first instance due to the high density of pollution inputs, and Grade 1 inputs across these reaches.

# 4 FOLLOW ON WORK – WET WEATHER SAMPLING

In order to provide further evidence of the most serious pollution issues identified within the Kennet walkover survey, water sampling during wet weather conditions was undertaken.

## 4.1 Methodology – Wet Weather Sampling

Wet weather sampling was undertaken on the River Kennet at all Grade 1 classified sites (16 sites) on 25th April 2012. Rainfall averaged 1-2mm/hr. over the 23rd and 24th April prior to sampling. Four scientists, in teams of two revisited all Grade 1 classified sites and collected water in sterile bottles from the identified source as well as a point upstream and downstream of this point. Samples were kept cold during transportation to the laboratory and analysed to determine suspended solid concentration and the concentrations of ammonia, nitrates, phosphorous and orthophosphate. Analysis of water samples was undertaken by Eurofins UK.

## 4.2 Results and Analysis

A total of 16 sites (Table 2-1) were revisited for water analysis. Complete sets of source and bracket samples were collected at 11 of these sites. Suspended solid and nutrient concentrations were determined and are discussed in the following sections.

### 4.2.1 Suspended Solids

The concentration of suspended solids recorded throughout the Kennet ranged from 9.5-5520 mg/l. Suspended solids can act to reduce light attenuation through the water column, scour river beds, and clog and smother gravels which can act as spawning grounds to salmonid fish. The Fresh Water Fish Directive gives a guideline standard of an annual mean concentration of suspended solids of 25mg/l. This level was exceeded in 89% of the samples collected, indicating a high concentration across the water body impacting on water and habitat quality. It should be noted, however, that the sampling undertaken only provides a snapshot of conditions, and whilst the guideline is set at 25mg/l the nature of suspended solids in rivers is such that, while the annual mean concentration might not exceed 25mg/l there could be short periods of the year when concentrations significantly exceed this. As continued sampling is not currently in place it is not possible to estimate the average levels of suspended solids to evaluate the normality of the levels recorded.

The results of suspended solid analysis are shown in Figure 4-1. Sites 69, 71, 90 and 139 show the expected results from a bracket sample, with an increase in concentration from the upstream to downstream sampling location, and a notable peak in concentration at the source. In comparison to this Sites 7, 54, 182, 183 and 187 all indicate a higher downstream than upstream concentration but with a depressed value seen at the source. This indicates that the sources identified were not the main contributors to suspended solids throughout these river sections, and other inputs may be operating. Site 7 and 54 were the result of road and track run-off which impact over a larger area, therefore despite showing an increase downstream, the point of sampling only indicates a small fraction of the overall impact and maybe misrepresentative. Sites 182, 183 and 187 were all attributed to pipes which may be contributing other forms of pollution to the watercourse than suspended solids, most commonly resulting from drainage systems from more anthropogenic surfaces, therefore contributing little to this parameter. Site 60 highlights another scenario, with the upstream sample showing a higher concentration than

the downstream sampling location, but with an extremely high spike at the source. This pollution input was the result of track and road run-off running between two arable fields at a steep gradient. This spike in suspended solid concentration is indicative of the high levels of run-off, which maybe quickly diluted or settle out of suspension as they enter the watercourse.

The results indicate that the upper, eastern stem of the River Shalbourne was the most highly affected by sedimentation, with Sites 54 and 60 showing the highest concentrations of suspended solids across the sampling area. Peartree Bottom located to the south of the eastern extent of the River Kennet also showed slightly elevated concentrations whilst Inkpen Stream and the Upper Dun showed significantly lower concentrations, with the exception of a high peak concentration at the source of Site 139. Despite the lower concentrations seen across some water bodies, nearly all samples exceeded the guideline standards.

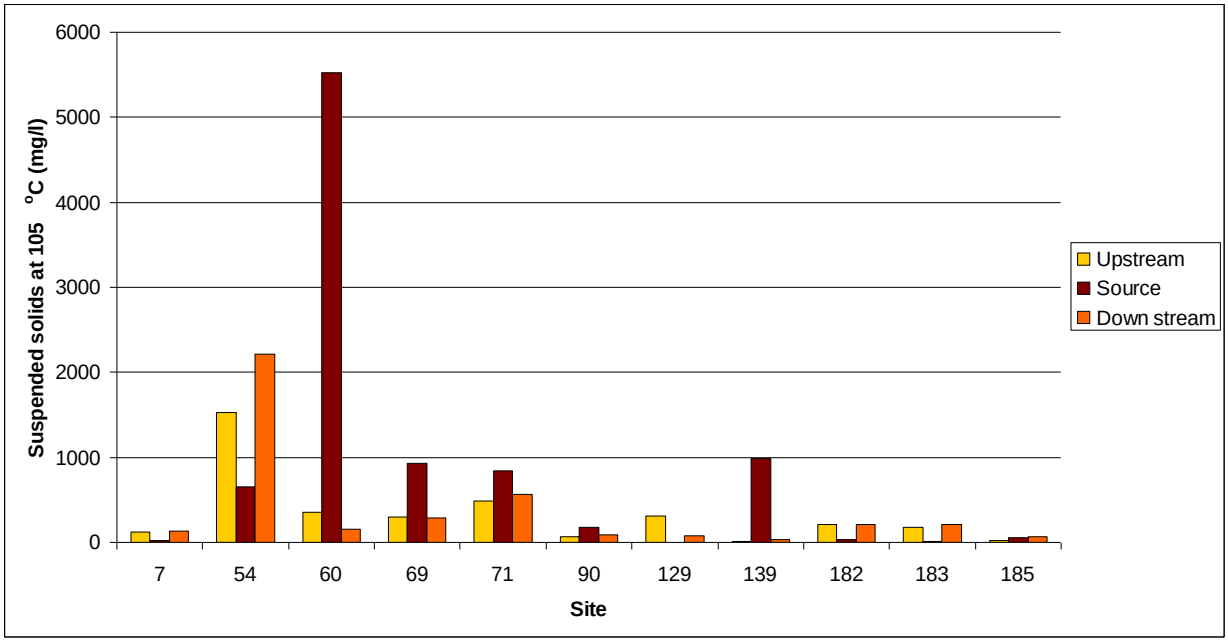


**Figure 4-1. Suspended solid concentrations in all sites surveyed.**

### 4.2.2 **Nitrogen**

Nitrogen and various associated compounds were analysed from the wet weather water samples, results of these are summarised in Table 4-1and shown in Figure 4-2.

The guidance given by the Nitrates Directive indicates that concentrations of total nitrogen should not exceed 50mg/l in the 95$^{th}$ percentile. As only one set of results were collected it is not possible from these to gain a value at the 95$^{th}$ percentile; however, it is possible to see from our results that this value is not exceeded, with the highest value recorded totalling 14.1mg/l (Site 187 Source). Despite total nitrogen remaining within acceptable levels Ammoniacal nitrogen was seen to exceed guidance concentrations set by the Water Framework Directive (WFD) (Table 4-2) in some instances. Using the samples collected as a snapshot indication of chemical status, three sites were consistent with a Poor classification, four Moderate, four Good, and one High (Site 22). The sites classified as Poor were the result of two pipes from unknown sources (Site 182 and 183), and one domestic septic tank (Site 139).

Sites 182, 183 and 139 showed the highest concentrations of Nitrogen compounds across the catchment and were all traced to the sources. These sites are all located on Inkpen Stream indicating that this water body was the most severely affected by Nitrogen enrichment. Nitrogen concentrations across the remaining water bodies are comparable to each other and show a lower degree of enrichment.

**Table 4-1. Summary of Nitrogen compounds analysed from wet weather samples. DS indicates the downstream sample, S the source and US the upstream sampling point.**

| Site | NGR | River Typology | Total Nitrogen mg/l | Ammoniacal Nitrogen mg/l |
|---|---|---|---|---|
| **007 DS** | SU3788264591 | 5 | 3.78 | 0.175 |
| **007 S** | SU3787964595 | 5 | 1.35 | <0.0300 |
| **007 US** | SU3787464585 | 5 | 3.71 | 0.175 |
| **054 DS** | SU3270563324 | 2 | 6.22 | 0.0317 |
| **054 S** | SU3270463325 | 2 | 6.12 | 0.107 |
| **054 US** | SU3270163323 | 2 | 7.46 | 0.662 |
| **060 DS** | SU3335162915 | 2 | 10.3 | 0.19 |
| **060 S** | SU3334262918 | 2 | 4.72 | 0.0736 |
| **060 US** | SU3335562909 | 2 | 10.8 | 0.287 |
| **069 DS** | SU4039066362 | 5 | 6.09 | 0.319 |
| **069 S** | SU4037066348 | 5 | 0.95 | 0.142 |
| **069 US** | SU4036166340 | 5 | 6.9 | 0.299 |
| **071 DS** | SU3996865919 | 5 | 6.27 | 0.218 |
| **071 S** | SU3996565931 | 5 | 3.24 | 0.574 |
| **071 US** | SU3996865919 | 5 | 6.51 | 0.204 |
| **090 DS** | SU2842866227 | 2 | 3.78 | 0.1 |
| **090 S** | SU2842466222 | 2 | 7.25 | 0.381 |
| **090 US** | SU2841166225 | 2 | 1.92 | <0.0300 |
| **129 DS** | SU3131363277 | 2 | 4.24 | <0.0300 |
| **129 S** | | 2 | 0 | 0 |
| **129 US** | SU3131663260 | 2 | 4.13 | <0.0300 |
| **139 DS** | SU3663764619 | 2 | 3.38 | 0.148 |
| **139 S** | SU3662864621 | 2 | 3.73 | 2.21 |
| **139 US** | SU3662664625 | 2 | 3.46 | 0.0607 |
| **182 DS** | SU3594864345 | 2 | 5.25 | 0.314 |
| **182 S** | SU3593964339 | 2 | 14.1 | 12.7 |
| **182 US** | SU3593064336 | 2 | 5.19 | 0.268 |
| **183 DS** | SU3593064336 | 2 | 5.19 | 0.268 |
| **183 S** | SU3591364331 | 2 | 8.89 | 2.85 |
| **183 US** | SU3591264329 | 2 | 5.18 | 0.237 |
| **187 DS** | SU3677367800 | 2 | 2.16 | <0.0300 |
| **187 S** | SU3675367817 | 2 | 2.3 | 0.0328 |
| **187 US** | SU3674867824 | 2 | 2.21 | 0.037 |

Although Nitrogen concentrations were not exceeding guidelines set out by the Nitrates directive, a number of sites were failing to comply with WFD guidelines, indicating a potential detrimental impact on the watercourse.

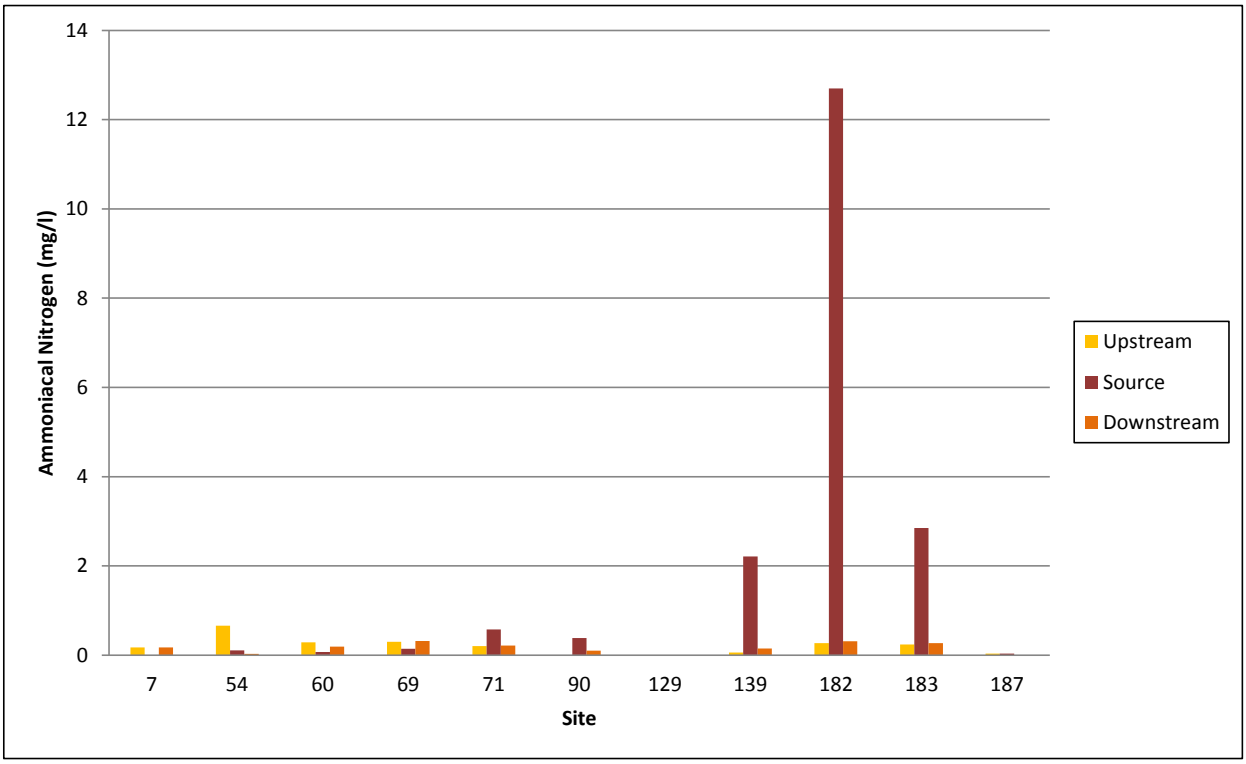


**Figure 4-2 Ammoniacal Nitrogen concentrations across water sampling sites in the River Kennet.**

**Table 4-2. WFD Ammonia as nitrogen (mg/l) guideline standards**

| Type | High | Good | Moderate | Poor |
|---|---|---|---|---|
| **1, 2, 4, and 6** | 0.2 | 0.3 | 0.75 | 1.1 |
| **3, 5, and 7** | 0.3 | 0.6 | 1.1 | 2.5 |

### 4.2.3 **Phosphorous**

Phosphorous concentrations were relatively high throughout the catchment with orthophosphate concentrations indicating that 55% of samples indicated a Moderate to Poor classification, with only 45% indicating a Good or High Classification (Table 4-4). The results are summarised in Table 4-3 and shown in Figure 4-3.

**Table 4-3 Summary of Phosphorous compounds detected through water analysis. DS indicates the down steam sampling point, S the source, and US the upstream sample.**

| Site | National Grid Reference | Orthophosphate (mg/l) | Total Phosphorous (mg/l) |
|---|---|---|---|
| **007 DS** | SU3788264591 | 0.065 | 0.264 |
| **007 S** | SU3787964595 | 0.0481 | 0.113 |
| **007 US** | SU3787464585 | 0.0576 | 0.213 |
| **054 DS** | SU3270563324 | 0.766 | 2.18 |
| **054 S** | SU3270463325 | 0.545 | 1.68 |
| **054 US** | SU3270163323 | 0.791 | 3.06 |
| **060 DS** | SU3335162915 | 1.03 | 2.91 |
| **060 S** | SU3334262918 | 1 | 8.48 |
| **060 US** | SU3335562909 | 0.698 | 1.2 |
| **069 DS** | SU4039066362 | 0.104 | 0.571 |
| **069 S** | SU4037066348 | 0.123 | 1.12 |
| **069 US** | SU4036166340 | 0.0992 | 0.654 |
| **071 DS** | SU3996865919 | 0.0599 | 0.833 |
| **071 S** | SU3996565931 | 1.78 | 4.97 |
| **071 US** | SU3996865919 | 0.0388 | 0.824 |
| **090 DS** | SU2842866227 | 0.112 | 0.247 |
| **090 S** | SU2842466222 | 0.151 | 0.42 |
| **090 US** | SU2841166225 | 0.0739 | 0.193 |
| **129 DS** | SU3131363277 | 0.74 | 0.984 |
| **129 US** | SU3131663260 | 0.722 | 0.944 |
| **139 DS** | SU3663764619 | 0.0588 | 0.197 |
| **139 S** | SU3662864621 | 0.847 | 9.39 |
| **139 US** | SU3662664625 | 0.0568 | 0.106 |
| **182 DS** | SU3594864345 | 0.933 | 1.22 |
| **182 S** | SU3593964339 | 1.1 | 2.58 |
| **182 US** | SU3593064336 | 0.918 | 1.15 |
| **183 DS** | SU3593064336 | 0.918 | 1.15 |
| **183 S** | SU3591364331 | 1.16 | 1.26 |
| **183 US** | SU3591264329 | 0.94 | 1.19 |
| **187 DS** | SU3677367800 | <0.0200 | 0.141 |
| **187 S** | SU3675367817 | <0.0200 | 0.111 |
| **187 US** | SU3674867824 | <0.0200 | 0.086 |

Peartree Bottom, located in the Middle Kennet water body, had relatively low concentrations of phosphate throughout its sampling sites (Sites 7, 71 and 69), with the exception of the 'source'

at Site 71, which shows an elevated peak and the highest concentration seen across the catchment. Downstream of this input, concentrations were similar to upstream, indicating rapid dilution in the watercourse. Therefore this site shows a highly concentrated input from an unknown source, but a low impact on the watercourse overall.

Sites 54 and 60 on the eastern headwaters of the River Shalbourne and Sites 129, 182, 183 and 139 located in the headwaters of Inkpen Stream all had the concentrations of Phosphorous compounds in the catchment. Site 187, located on the River Kennet within the Middle Kennet water body had the lowest concentrations, indicating a classification of High chemical status for all samples taken. This highlights the good water quality of the main River Kennet at this point, and implements pollution from the headwaters of tributaries as the main factors affecting WFD compliance.

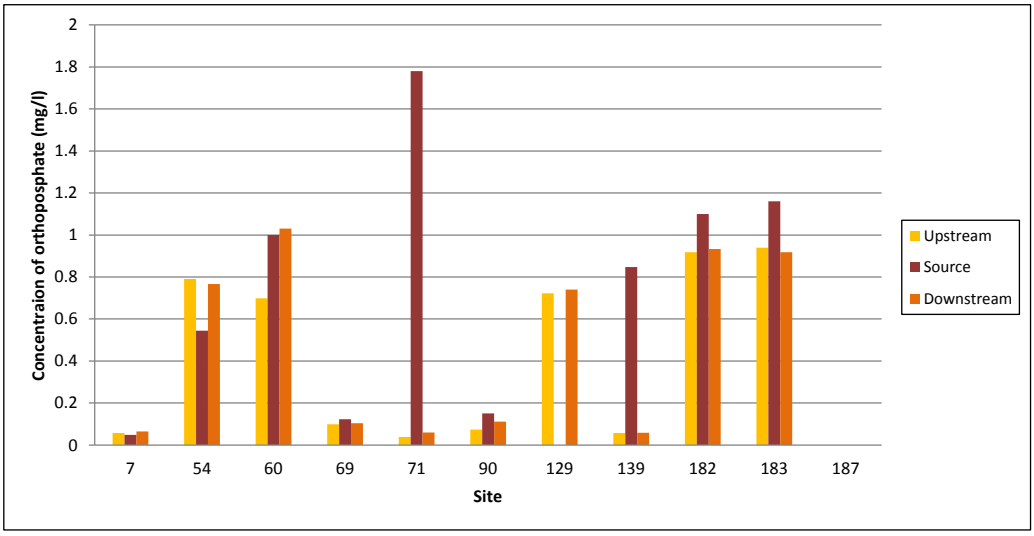


**Figure 4-3 Concentration of Orthophosphate (mg/l) across water sampling sites on the River Kennet (Site 129 only received sampling at the upstream and downstream sites, with no record taken at the source).**

**Table 4-4 WFD orthophosphate (mg/l) guideline standards**

| Type | High | Good | Moderate | Poor |
|---|---|---|---|---|
| **1n** | 0.03 | 0.05 | 0.150 | 0.50 |
| **2n** | 0.02 | 0.04 | 0.10 | 0.50 |
| **3n & 4n** | 0.05 | 0.12 | 0.25 | 1.00 |

## 4.3 Summary

The water sampling results provide a further insight into the sources of diffuse pollution affecting the River Kennet. The results obtained indicate that excessive input of fine sediment is the major diffuse pollution issue in the River Kennet catchment. This is consistent with the walkover results, which indicated that surface run-off from roads, and tracks often originating from fields, was the largest pollution pathway. Suspended solid concentration in water was highest on the River Shalbourne (GB106039017370) and Peartree Bottom in the Middle Kennet water body (GB106039023172). Following suspended solid concentrations, Phosphorous concentrations were also high throughout the catchment, with many sites indicating a Moderate-Poor chemical status. Identification of these major sources of concentrated Phosphorous compounds is useful to guide direct mitigation and remediation efforts. Phosphate concentrations were consistently high through The River Shalbourne and Inkpen Stream indicating that these water bodies are the most adversely affected.

Nitrate concentrations did not exceed the guidelines set by the Nitrates Directive, but did exceed WFD standards at the majority of sites. Nitrate concentrations were peaked at Sites 182 and 183 on Inkpen Steam. These Sites were in close proximity to each other and might exert an amplified combined effect on the water quality of the watercourse. Results from Inkpen Stream show high Nitrogen concentrations discharging at all sites sampled. However, overall concentrations were relatively low in the watercourse, indicating rapid dilution of inputs.

The results from both the walkover survey and water sampling provide evidence of pollution sources throughout the River Kennet. The survey highlighted the River Shalbourne and Inkpen Stream as the most impacted water bodies, subject to multiple pressures. The River Shalbourne received high concentrations of suspended solids and Phosphorous, whilst Inkpen Stream received high concentrations of Phosphorous and Nitrogen compounds. This information is useful to guide remediation and mitigation techniques effectively.

# 5 References

APEM (2010) Rural Sediment Tracing Project – National Summary Report. APEM Scientific Report 410987

APEM (2011) Rural Sediment Tracing Project – National Summary Report. APEM Scientific Report 410407

# APPENDIX 1 – CD OF GIS OUTPUTS

**Instructions**

- All fine sediment and organic material inputs identified during the River Kennet diffuse pollution survey can be seen and interrogated using the CD attached below. Sites can be automatically activated as themes upon opening the ArcMap file.

- The characteristics of each of the sources, including its exact location (10-figure NGR), type of input and its suspected source can be interrogated by opening the attributes table for the sediment sources theme.

- All images and video footage of each Grade 1 pollution site, along with a profile synopsis, are hyperlinked to corresponding points. To view this information simply hover over the site using the hyperlink tool and click on the dot icon when it becomes highlighted.