



## Nitrate vulnerable zone designation 2012 (Groundwater)

Mae fersiwn Cymraeg o'r ddogfen hon ar gael

A Welsh version of this document is also available

Version 1.1, revised 27 June 2012

# Evidence of Groundwater Water Nitrate Pollution 2012

## **INTRODUCTION**

This document is intended to provide a summary of the evidence used in assessing the need for nitrate vulnerable zone (NVZ) designation under the Nitrates Directive reference(91/676/EEC of 12th Decmeber 1991). A full description of the methods used is given in the detailed methodologies for Surface Water, Groundwater and Eutrophic Water reports which are available from the Defra and Welsh Government websites. These methods were developed under the guidance of a Review Group convened by the Defra and the Welsh Government which included representatives from the farming and water industries as well as independent academic experts.

NVZ areas are designated based on a combination of both monitored water quality data and modelled nitrogen loadings that are based on the agricultural census and other data.

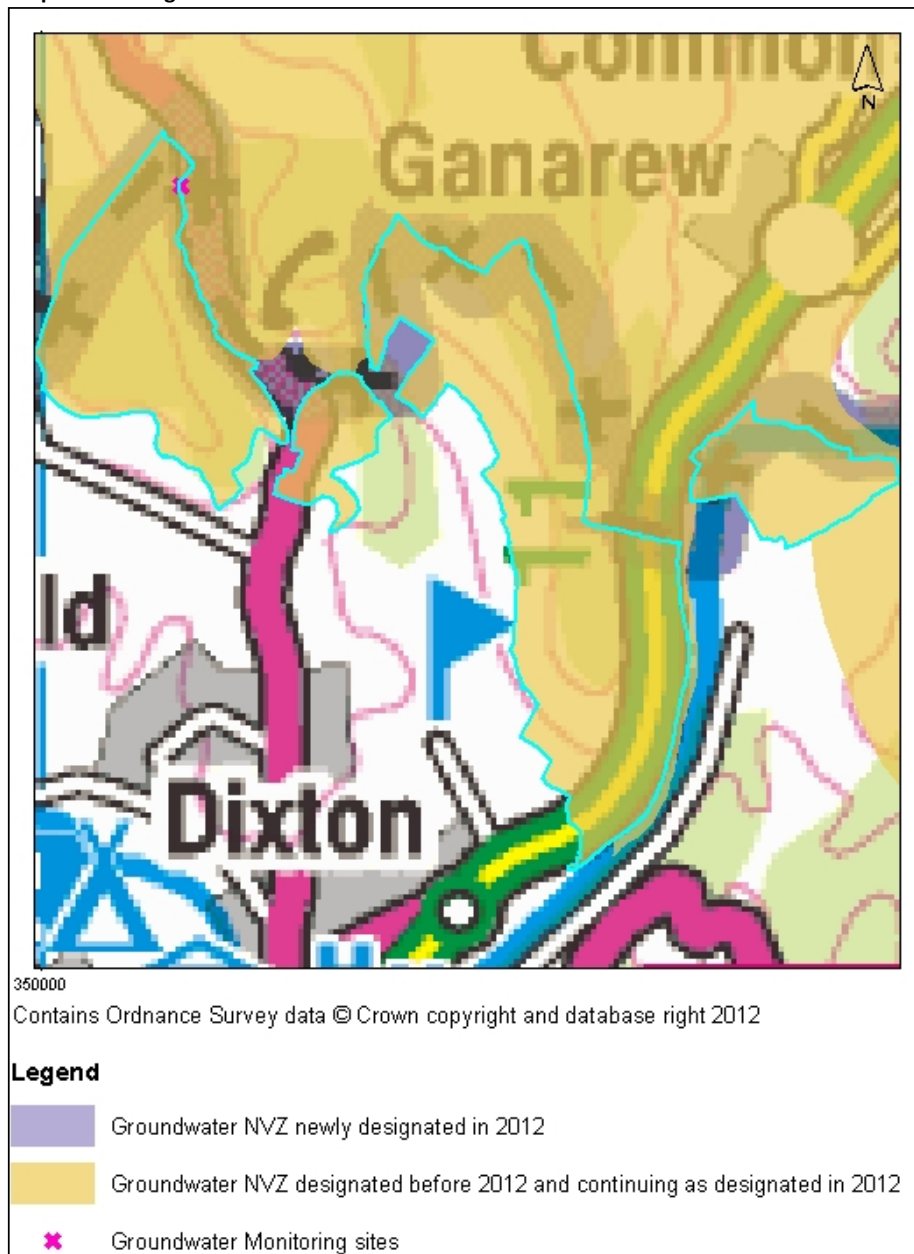
The concentration data is presented as milligrams of Nitrogen per litre. Please note 50 mg per litre of Nitrate is equivalent to 11.3 mg per litre as Nitrogen (N). Monitoring sites which exceed the concentration of 11.3 mg N/l set by the Nitrates Directive may lead to designation of all land draining to this point.

Note that for land already designated as a groundwater NVZ prior to this assessment, the land will remain designated even if the 95%ile concentration is now below 11.3 mg N/l. At least two cycles of low Nitrate concentrations are needed to show a sustained decrease that would then be considered for removal from NVZ designation.

For each NVZ area, monitoring data in combination with information on land-use indicate that concentrations of nitrates in one or more groundwaters are likely to exceed the level set out in the EU Nitrates Directive. Agricultural sources are likely to make a significant contribution to the observed or expected concentration of nitrate. Hence the land area draining to these groundwaters has been identified for designation as a Nitrate Vulnerable Zone.

ID of designated NVZ:140

Map of the designated area.



## Description of the boundary

Surface Water Zone designations are applied at a waterbody scale, for groundwater zones, other factors such as geology need to be taken into account. Physical boundaries influencing groundwater NVZs delineation have been defined based on expert discussion at local level. The following represents a selection of the types of boundaries that have been used to delineate the NVZs and determine the land draining to a polluted groundwater.

- Geological boundaries such as faults and geological contacts.
- Surface water catchment boundaries.
- Groundwater level contours.
- High permeability drift outcrops.
- Low permeability drift outcrops.
- Rivers, acting as groundwater catchment divides.
- Coastlines.
- Solution features.

For NVZ area 140 the boundary is based on;

*Hereford (ID 140) The boundaries of the NVZ delineate a large outcrop of major aquifer the north-western corner is delineated using the contact between the Old Red Sandstone within the NVZ and the Silurian-Ludlow formations to the west. The western boundary is delineated using surface water catchment boundaries and rivers to create surface water and possible groundwater divides, containing the nitrate rich groundwater to the local groundwater catchment in the argillaceous sandstone aquifer to the East. The southern boundary is delineated using the contact between the Old Red Sandstone in the North and the limestone formations to the South. The eastern boundary is the surface water catchment boundaries. These surface water catchment boundaries may act in places as groundwater divides locally also.*

ID of monitoring site(s):

*45443, 57043, 57050, 57057, 58031, 58109, 58133, 58149, 58156, 58158*

Previously designated area, new area or new area adjacent to previously designated area: *Previously designated area*

Total new area designated (Km2): 2.76

## Monitored Nitrate data for sites in zone ID: 140

For the 2012 designations monitoring data was analysed where available for the years 1980 - 2009. Where sufficient data was available results were projected to give a predicted concentration in 2027. For the earlier 2008 designation, monitoring data was analysed to 2006 and trend predicted to 2021. The results of the analysis were then compared to the standard of a 95%ile value of 11.3 mg N /l. See section 3 of the Groundwater Methodology report for more details.

The following tables summarise the nitrate concentrations for monitoring sites that either exceed the threshold or show increasing trend for nitrate. Data for these and other nearby sites are presented in Appendix A

**This area was designated in 2008.**

**Results for 2008 monitoring data.**

Monitoring Site ID	350600-216700-A4638
Easting	350600
Northing	216700
Total Inorganic Nitrogen concentration 95%ile (mg/l)	5.22
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	45443
Easting	356058
Northing	219331
Total Inorganic Nitrogen concentration 95%ile (mg/l)	13.67
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	57050
Easting	351364
Northing	225409
Total Inorganic Nitrogen concentration 95%ile (mg/l)	22.62
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	57053
Easting	357014
Northing	219444
Total Inorganic Nitrogen concentration 95%ile (mg/l)	19.39
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	57057
Easting	351114
Northing	219564
Total Inorganic Nitrogen concentration 95%ile (mg/l)	14.42
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	58031
Easting	338230
Northing	260620
Total Inorganic Nitrogen concentration 95%ile (mg/l)	10.19
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	41.49
Trend (upward, downward, stagnation):	Upward

Monitoring Site ID	58109
Easting	359120
Northing	252320
Total Inorganic Nitrogen concentration 95%ile (mg/l)	15.16
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	52.86
Trend (upward, downward, stagnation):	Upward

Monitoring Site ID	58133
Easting	348017
Northing	227945
Total Inorganic Nitrogen concentration 95%ile (mg/l)	12.93
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	58133
Easting	348017
Northing	227945
Total Inorganic Nitrogen concentration 95%ile (mg/l)	12.93
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	58149
Easting	363233
Northing	224574
Total Inorganic Nitrogen concentration 95%ile (mg/l)	13.92
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	58156
Easting	349577
Northing	257223
Total Inorganic Nitrogen concentration 95%ile (mg/l)	17.9
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA
Trend (upward, downward, stagnation):	NA

Monitoring Site ID	58158
Easting	349579
Northing	257223
Total Inorganic Nitrogen concentration 95%ile (mg/l)	19.64
Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)	NA

<i>Trend (upward, downward, stagnation):</i>	NA
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**Results for 2012 monitoring data.**

<i>Monitoring Site ID</i>	45443
<i>Easting</i>	356058
<i>Northing</i>	219331
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	8.23
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	8.23
<i>Trend (upward, downward, stagnation):</i>	Stagnation

<i>Monitoring Site ID</i>	57050
<i>Easting</i>	351093
<i>Northing</i>	225519
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	34.05
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	34.05
<i>Trend (upward, downward, stagnation):</i>	Stagnation

<i>Monitoring Site ID</i>	57053
<i>Easting</i>	357015
<i>Northing</i>	219440
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	23.11
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	23.11
<i>Trend (upward, downward, stagnation):</i>	Stagnation

<i>Monitoring Site ID</i>	57057
<i>Easting</i>	351114
<i>Northing</i>	219564
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	15.36
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	15.36
<i>Trend (upward, downward, stagnation):</i>	Stagnation

<i>Monitoring Site ID</i>	58031
<i>Easting</i>	338230
<i>Northing</i>	260620
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	13.57
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	13.57
<i>Trend (upward, downward, stagnation):</i>	Stagnation

<i>Monitoring Site ID</i>	58109
<i>Easting</i>	359120
<i>Northing</i>	252320
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	18.46
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	18.46
<i>Trend (upward, downward, stagnation):</i>	Stagnation

<i>Monitoring Site ID</i>	58133
<i>Easting</i>	348017

<i>Northing</i>	227945
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	27
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	44.89
<i>Trend (upward, downward, stagnation):</i>	Upward

<i>Monitoring Site ID</i>	58133
<i>Easting</i>	348017
<i>Northing</i>	227945
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	27
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	44.89
<i>Trend (upward, downward, stagnation):</i>	Upward

<i>Monitoring Site ID</i>	58156
<i>Easting</i>	349577
<i>Northing</i>	257223
<i>Total Inorganic Nitrogen concentration 95%ile (mg/l)</i>	22.75
<i>Future predicted 95%ile Total Inorganic Nitrogen estimate (mg/l)</i>	22.75
<i>Trend (upward, downward, stagnation):</i>	Stagnation

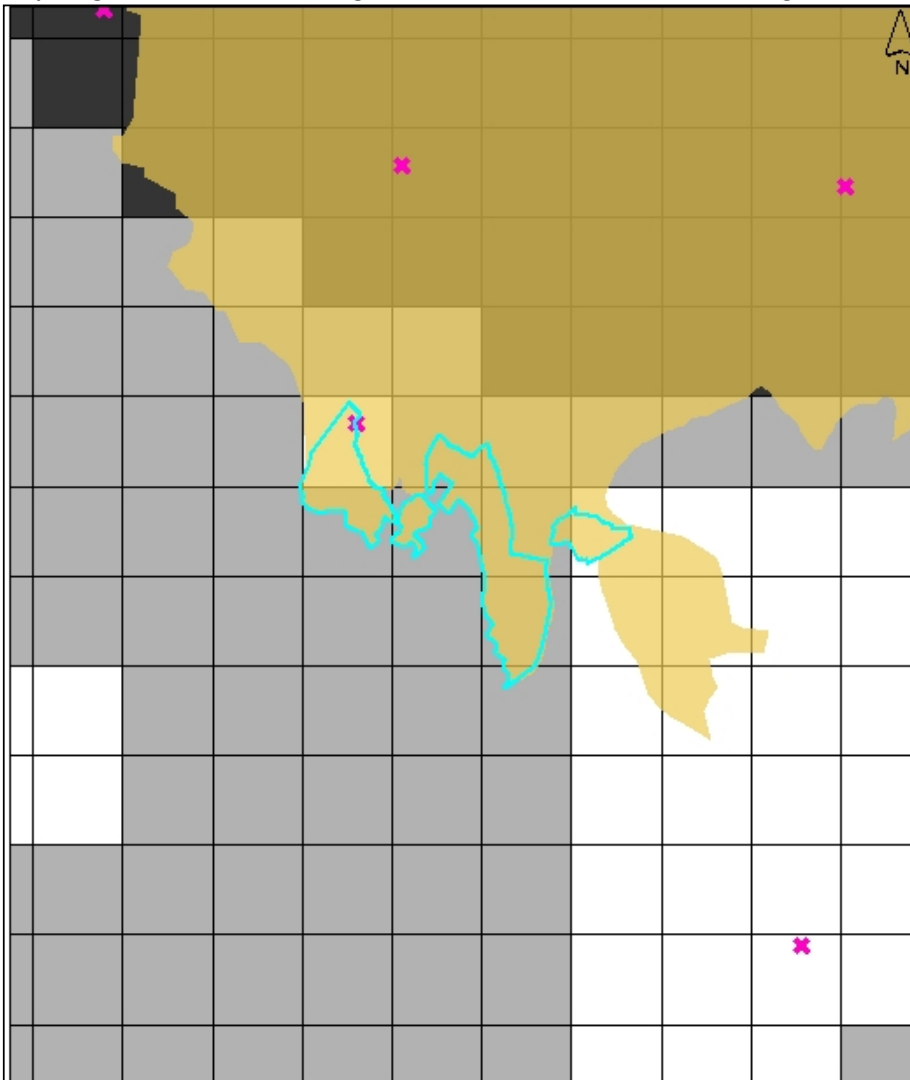


## Land Use Model results

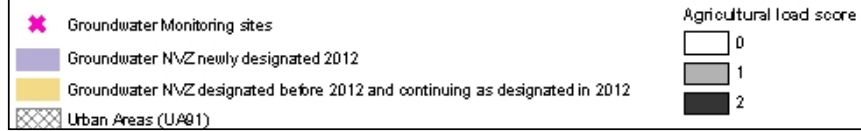
Urban and agricultural load were included in the assessment to identify if agriculture provides a main contribution of nitrate to the groundwater.

The following maps and associated figures indicate the annual average concentration of nitrate from agriculture contained in soil water. The figures are derived from farm scale research undertaken for Defra and are extrapolated based on farming land-use data for the land area covered by this report obtained in 2010 and long-term average rainfall based, using a model called NEAP-N developed by ADAS. The maps indicate those areas within the catchment with higher or lower levels of potential agricultural nitrate leaching to the groundwater.

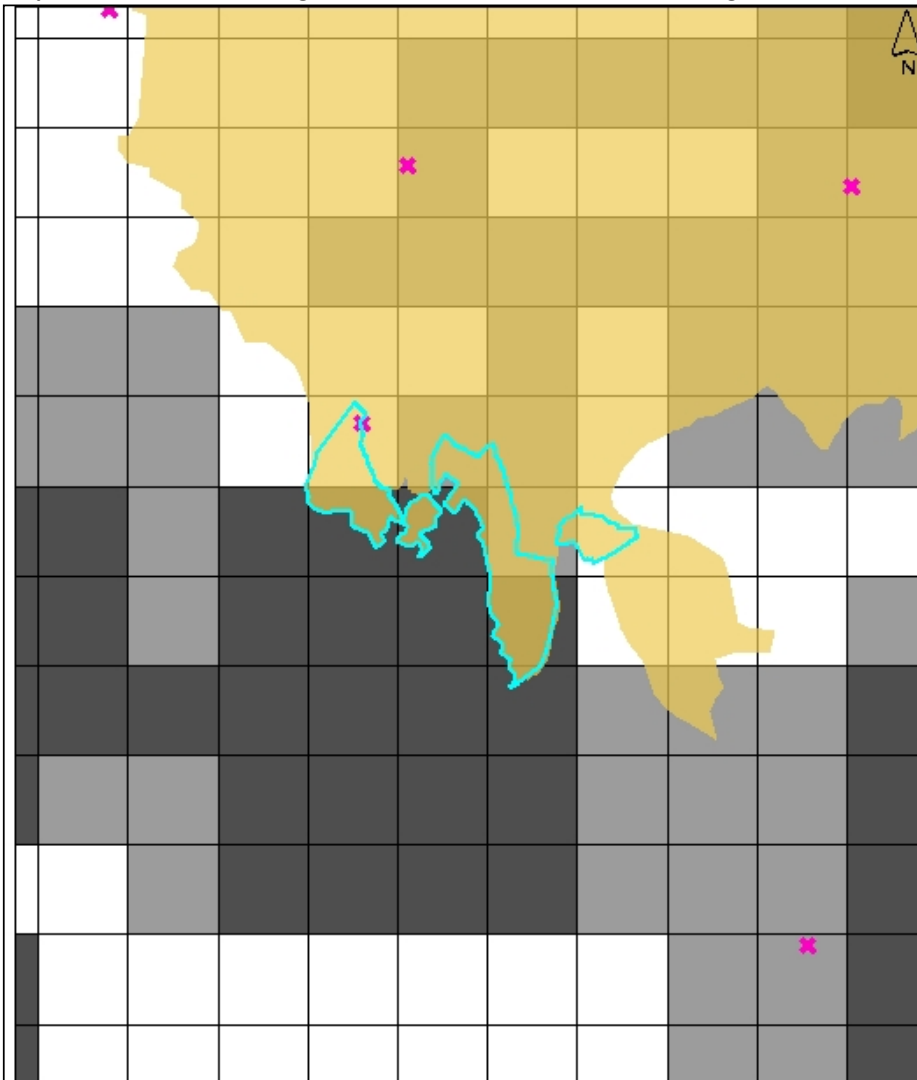
Map of agricultural load in the designated area. Load score is shown on 1km<sup>2</sup> grid.



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Map of urban load in the designated area. Load score is shown on 1km2 grid.



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## **Additional Lines of evidence**

Advice was sought from local Environment Agency staff to identify any additional data that could be used in the risk model to improve the robustness of the decision making process. Examples include the location of point sources (e.g. industrial or septic discharges), monitoring data from different groundwater bodies and monitoring data from related surface waters. See section 6 of the Groundwater Methodology report for more details.

For this area, no lines of evidence have been modified from local Environment Agency staff.

## Appendix A: Environment Agency monitoring data

This appendix presents historical concentration data at every monitoring site. For the 2012 designation, samples collected before 1980 were excluded because they may not be indicative of present day groundwater quality.

Monitoring point ID	Easting	Northing	Date	Nitrate (mg N / l)
45443	356058	219331	07/11/2000	16.1
45443	356058	219331	20/03/2002	13.4
45443	356058	219331	30/10/2002	4
45443	356058	219331	04/03/2003	4.9
45443	356058	219331	22/09/2003	10
45443	356058	219331	19/02/2004	17.7
45443	356058	219331	22/07/2004	16.4
45443	356058	219331	17/03/2005	15.6
45443	356058	219331	11/05/2005	14.1
45443	356058	219331	24/03/2006	10.8
57050	351093	225519	12/08/2005	20.6
57050	351093	225519	07/04/2006	16.1
57057	351114	219564	18/11/2005	13.1
57057	351114	219564	12/04/2006	14.5
57057	351114	219564	20/09/2006	18.1
58031	338230	260620	06/02/2001	6.8
58031	338230	260620	05/04/2002	4
58031	338230	260620	06/11/2002	11.4
58031	338230	260620	12/03/2003	8.2
58031	338230	260620	23/09/2003	12.2
58031	338230	260620	01/03/2004	11.2
58031	338230	260620	04/08/2004	5.3
58031	338230	260620	19/04/2005	12
58031	338230	260620	22/08/2005	12.3
58031	338230	260620	03/04/2006	9.2
58031	338230	260620	20/09/2006	12.9
58031	338230	260620	05/12/2006	14.8
58109	359120	252320	06/02/2001	11.5
58109	359120	252320	05/04/2002	11.2
58109	359120	252320	07/03/2003	10.3
58109	359120	252320	16/09/2003	12.8
58109	359120	252320	01/03/2004	17.4
58109	359120	252320	03/08/2004	16.3
58109	359120	252320	20/04/2005	14.6
58109	359120	252320	16/08/2005	15.7
58109	359120	252320	04/04/2006	9.6
58109	359120	252320	01/12/2006	35.8
58133	348017	227945	12/08/2005	12
58133	348017	227945	07/04/2006	4.9
58133	348017	227945	11/09/2006	14.3
58149	363230	224570	10/04/2002	4.1
58149	363230	224570	05/03/2003	1.7
58149	363230	224570	11/09/2003	21.1
58149	363230	224570	18/02/2004	23.8
58149	363230	224570	03/12/2006	16.8
58156	349577	257223	07/11/2002	12.2
58156	349577	257223	12/03/2003	4.7
58156	349577	257223	01/03/2004	13.6
58156	349577	257223	04/08/2004	19.7
58156	349577	257223	29/03/2005	22.8
58156	349577	257223	22/08/2005	24

58156	349577	257223	20/03/2006	24.9
58156	349577	257223	20/09/2006	18
58156	349577	257223	05/12/2006	20.6
58158	349577	257223	07/11/2002	13.7
58158	349577	257223	12/03/2003	15
58158	349577	257223	24/09/2003	19
58158	349577	257223	01/03/2004	17.8
58158	349577	257223	04/08/2004	18.2
58158	349577	257223	14/04/2005	19.1
58158	349577	257223	22/08/2005	22
58158	349577	257223	03/04/2006	16.9

## **References**

<http://www.defra.gov.uk/food-farm/land-manage/nitrates-watercourses/nitrates/>

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