DATASHEET: Nitrate Vulnerable Zone (NVZ) designation
2017 - Surface Water

NVZ ID: S699 NVZ Name: Worton Str - source to conf Semington Bk NVZ

Publication Date: June 2016
This document contains a summary of the evidence used to designate NVZ S699 - Worton Str - source to conf Semington Bk. It was produced in June 2016 by the Environment Agency on behalf of the Secretary of State for Environment, Food and Rural Affairs.

Worton Str - source to conf Semington Bk is an existing waterbody designation. There are currently no polluted sample points in the waterbody that designates this NVZ, and, in total, no polluted sample points in the entire NVZ including the designating waterbody and any area upstream of the designating waterbody. We did not use monitoring evidence in proposing this designation. Our modelling assessment shows that water quality in this NVZ has remained stable in the 2017 NVZ review period compared to the previous NVZ review. Based on our modelling assessment we have low confidence that the water is not polluted. Water quality has neither improved nor deteriorated sufficiently to require a change in NVZ status, therefore it is proposed that the existing designation is retained.

The contribution of agriculture to the observed nitrate pollution in this NVZ has been assessed and we are confident that agriculture is an important contributor to nitrate pollution.

This NVZ was first designated in 2013 because of a failing sampling point in the headwaters. That sampling point had insufficient data to be included in the current review. Despite current evidence suggesting the proposed designation is not affected by pollution, we must have high confidence that a designation will not become affected by pollution in the future before a designation may be removed. In this case the designation has not met the criteria for de-designation.
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1 Introduction

NVZ name: Worton Str - source to conf Semington Bk
NVZ ID: S699

This document provides a summary of the evidence used in proposing an area of land as one which should be, or should continue to be, designated as a Nitrate Vulnerable Zone (NVZ) for the purposes of the Nitrate Pollution Prevention Regulations 2015.

A full description of the methods used in developing the NVZ proposals is set out in the detailed methodology for surface water NVZs, available via apps.environment-agency.gov.uk/wiyby/141443.aspx. These methods were developed under the guidance of a review group convened by the Department for Environment, Food & Rural Affairs for the last NVZ review (2011-2013), which included representatives from the farming and water industries as well as independent academic experts. Minor refinements to the methods have been made for the current review.

Under the surface water method an NVZ is designated if the water is affected by pollution or could be affected by pollution.

Please note that the area of NVZ designation may change during the appeals process. The definitive NVZ area can be seen on the What's in Your Backyard (WIYBY) website apps.environment-agency.gov.uk/wiyby/141443.aspx.

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1.1 Core principles

1. Each NVZ review takes the previous designations as its starting point and most designations are continuations of those designations.
2. Evidence of pollution is based on a combination of monitoring data, recent and longer term trends, and modelled data.
3. A water is affected by pollution if our monitoring or modelling evidence, or a combination of the two, confidently calculates that the 95\textsuperscript{th} percentile\textsuperscript{1} concentration of nitrate exceeds 50 mg l\textsuperscript{-1} (as nitrate (NO\textsubscript{3})).
4. A water could be affected by pollution if our monitoring evidence indicates 95\textsuperscript{th} percentile concentrations will exceed 50 mg l\textsuperscript{-1} nitrate in the near future (2020).
5. We include all inorganic nitrogen (N) compounds in our assessment, not just nitrate. 50 mg l\textsuperscript{-1} nitrate (as NO\textsubscript{3}) is equivalent to 11.3 mg l\textsuperscript{-1} nitrogen (as N). As nitrogen can readily transform we include all commonly monitored forms of inorganic nitrogen; nitrate, nitrite and ammonium (referred to as Total Inorganic Nitrogen (TIN) when summed). All water quality data presented here is TIN and is compared to 11.3 mg l\textsuperscript{-1} to determine if the water is affected by pollution or could be affected by pollution.
6. If a sample point is downstream of a sewage treatment works or other point source consented discharge\textsuperscript{2} we assess whether the sample point is representative of the wider water quality of the catchment, in terms of TIN. We do not automatically discount such sample points as a comprehensive screening procedure is used to determine if a sample point should be removed from our analysis.
7. We use the Water Framework Directive river waterbodies as our units of assessment. If one part of that waterbody is affected by pollution or could be affected by pollution then the entire waterbody is designated. This is the case even if the sole monitoring point that shows evidence of pollution is in the upper (upstream) section of the waterbody and downstream monitoring points show no evidence of pollution. For ‘catchment’ designations the designated NVZ is all land that drains to the designating waterbody. For ‘waterbody’ designations the designated NVZ covers only the designating waterbody.
8. All existing designations are continued unless we can be confident that the water is no longer affected by pollution and will not become affected by pollution. We have already considered whether existing designations are eligible for removal.
9. The development of proposed designations involves close working between national and area office Environment Agency staff with quality assurance through discussions at workshops.

We review the evidence every four years, and we believe that NVZ designation is justified in the area that is described in this data sheet.

\textsuperscript{1}A 95\textsuperscript{th} percentile is the value exceeded by 5% of samples. It is used instead of a maximum value as it is more stable and less sensitive to extreme events.

\textsuperscript{2}Consented discharge means all point source discharges that are consented to discharge to controlled waters by the Environment Agency. This includes sewage treatment works (sometimes also referred to as waste water treatment works), industrial discharges, private sewage discharges, intermittent sewage discharges, landfills & all other discharge types.
Designations under the surface water method use a combination of monitored and modelled information. Water quality data from our monitoring and modelling assessments are put into one of six classes, where enough data is available, that reflects how confident we are that the 95\textsuperscript{th} percentile will exceed 11.3 mg l\textsuperscript{-1}. We combine the monitoring and modelled data using the matrix shown in figure 1 to identify those waters that are affected by pollution or could be affected by pollution. The combinations marked in red indicate a new designation should be recommended where there is not an existing NVZ designation (an ‘X’ indicates that extra checks should be undertaken before a designation is proposed). Where there is already an NVZ designation, the designation is continued unless there is sufficient evidence for de-designation.

The 1 to 6 classes used in the matrix are explained in table 2. A class of zero is given where there are no suitable sample points within the waterbody, so a monitoring class can’t be given, or where the waterbody was not large enough to be used in the modelling assessment.
Table 2: Matrix class descriptions

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High confidence 95th percentile concentration is below 11.3 mg/L</td>
</tr>
<tr>
<td>2</td>
<td>Moderate confidence 95th percentile concentration is below 11.3 mg/L</td>
</tr>
<tr>
<td>3</td>
<td>Low confidence 95th percentile concentration is below 11.3 mg/L</td>
</tr>
<tr>
<td>4</td>
<td>Low confidence 95th percentile concentration is above 11.3 mg/L</td>
</tr>
<tr>
<td>5</td>
<td>Moderate confidence 95th percentile concentration is above 11.3 mg/L</td>
</tr>
<tr>
<td>6</td>
<td>High confidence 95th percentile concentration is above 11.3 mg/L</td>
</tr>
<tr>
<td>0</td>
<td>Monitoring or modelling classification not available</td>
</tr>
</tbody>
</table>

The designating waterbody has had the following waterbody scores in the last three NVZ reviews (table 3):

Table 3: Matrix scores for the last three NVZ reviews

<table>
<thead>
<tr>
<th>Year</th>
<th>Monitoring scores</th>
<th>Modelling scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2013</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>2017</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Worton Str - source to conf Semington Bk is an existing waterbody designation. We did not use monitoring evidence in proposing this designation. Our modelling assessment shows that water quality in this NVZ has remained stable in the 2017 NVZ review period compared to the previous NVZ review. Based on our modelling assessment we have low confidence that the water is not polluted. Water quality has neither improved nor deteriorated sufficiently to require a change in NVZ status, therefore it is proposed that the existing designation is retained.

Despite current evidence suggesting the proposed designation is not affected by pollution, we must have high confidence that a designation will not become affected by pollution in the future before a designation may be removed. In this case the designation has not met the criteria for de-designation.

Figure 2 shows the area covered by this NVZ.

- The pink outline indicates the extent of this NVZ.
- The yellow area shows any surrounding area covered by other surface water NVZs.
- The black hatched area shows the designating waterbody that is either affected by pollution or could be affected by pollution.
Figure 2: Overview of designated catchment

NVZ ID; S699 - NVZ Name; Worton Str - source to conf Semington Bk NVZ
3 Monitoring Evidence

Monitoring evidence was not used in this designation. There were not any tributary monitoring points with sufficient data in the designation waterbody. Table 4 will contain NA (Not Available) values.

Table 4: Summary of monitoring evidence

<table>
<thead>
<tr>
<th>NVZ</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of sample points in the designating waterbody</td>
</tr>
<tr>
<td></td>
<td>Number of sample points in the entire designated NVZ</td>
</tr>
<tr>
<td></td>
<td>Number of sample points with 95th percentile TIN greater than 11.3 mg/l in the designating waterbody</td>
</tr>
<tr>
<td></td>
<td>Number of sample points with 95th percentile TIN greater than 11.3 mg/l in the entire designated NVZ</td>
</tr>
<tr>
<td></td>
<td>Most polluted sample point in the designating waterbody</td>
</tr>
<tr>
<td></td>
<td>Current monitored 95th percentile concentration (class)</td>
</tr>
<tr>
<td></td>
<td>High confidence lower and upper bounds for current monitored 95th percentile concentration</td>
</tr>
<tr>
<td></td>
<td>Moderate confidence lower and upper bounds for current monitored 95th percentile concentration</td>
</tr>
<tr>
<td></td>
<td>Trend (future) 95th percentile concentration (class)</td>
</tr>
<tr>
<td></td>
<td>High confidence lower and upper bounds for trend 95th percentile concentration</td>
</tr>
<tr>
<td></td>
<td>Moderate confidence lower and upper bounds for trend 95th percentile concentration</td>
</tr>
</tbody>
</table>

There are currently no polluted sample points in the waterbody that designates this NVZ, and, in total, no polluted sample points in the entire NVZ including the designating waterbody and any area upstream of the designating waterbody. This is a waterbody designation, only monitoring points relevant to a waterbody designation are used in table 4, although all monitoring points are used in the counts at the top of table 4.

Graphs for all monitoring points in this NVZ designation are included in appendix 1.

In figure 3, the small crosses represent the outlets of consented discharges. Any monitoring point that is too close (within the mixing zone) to a consented discharge of nitrogen compounds and therefore not representative of the water quality of the waterbody or is otherwise not representative of the water quality within the waterbody is excluded from the analysis.
Figure 3: Overview of monitoring locations and classes with point source locations

NVZ ID; S699 - NVZ Name; Worton Str - source to conf Semington Bk NVZ
4 Modelling Evidence

Our modelling (referred to as the land use model) predicts the underlying risk of pollution from the land use within the proposed NVZ designation. It allows us to assess whether a waterbody is affected by pollution even if we have no monitoring data or where the monitoring data is not suitable for use in this assessment.

The land use model uses information on:

- Agricultural N losses
- Consented discharges
- Diffuse urban N losses
- Residential properties not connected to sewer networks

The water quality data used in the monitoring evidence chapter is also used in the development of the land use model.

Table 5: Summary of waterbody modelling evidence

<table>
<thead>
<tr>
<th>NVZ</th>
<th>Land use model 95th percentile concentration (class)</th>
<th>8.74 (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High confidence lower and upper bounds for land use model 95th percentile concentration estimate</td>
<td>2.76 - 27.7</td>
</tr>
<tr>
<td></td>
<td>Moderate confidence lower and upper bounds for land use model 95th percentile concentration estimate</td>
<td>5.45 - 14.02</td>
</tr>
</tbody>
</table>

11.3 mg/l TIN

Figure 4 shows the concentration of the 95th percentile TIN concentration land use model prediction, plus the upper and lower, moderate and high confidence bounds in relation to 11.3 mg/l TIN.

Figure 5 shows how the model predictions vary across the designated area. If any waterbodies are not coloured on figure 5 this is because that the waterbody or the upstream area of the waterbody has an area less than 20 km². Figure 5 is included even if the land use model was not used in this designation.
Figure 5: Landuse modelling predictions

NVZ ID; S699 - NVZ Name; Worton Str - source to conf Semington Bk NVZ
5 Supporting Evidence

5.1 Contribution of agriculture to nitrogen losses

5.1.1 Sectoral load apportionment from land use analysis inputs

We consider a range of the most important nitrogen sources in an NVZ designation in our land use analysis. Based on the data that is input to that analysis, we can estimate the contribution of each source to the total losses of nitrogen within the designated area.

We present two figures for load from consented discharges. The maximum value is based on discharge consent conditions (the conditions consented discharges may not exceed). Therefore the maximum value represents the load emitted from a combination of the greatest flow and the greatest concentration of nitrogen compounds that all consented discharges in the catchment may legally emit. The minimum value is based on information from consented discharges with flow and nitrogen concentration monitoring, so represents the most likely load from all consented discharges in the catchment.

Table 6 shows estimated load across the designated area by individual sectors. The minimum agricultural contribution is based on the maximum consented discharge value, while the maximum agricultural contribution uses minimum consented load. For the agricultural load, diffuse urban load and the unsewered residential properties load there is a single value only.

Table 6: Summary of sources of pollution by nitrogen compounds

<table>
<thead>
<tr>
<th>Source</th>
<th>Minimum agricultural contribution</th>
<th>Maximum agricultural contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consented discharges (kg y(^{-1}))</td>
<td>2135.64</td>
<td>2135.64</td>
</tr>
<tr>
<td>Diffuse urban (kg y(^{-1}))</td>
<td>431.53</td>
<td>431.53</td>
</tr>
<tr>
<td>Unsewered residential properties (kg y(^{-1}))</td>
<td>344.24</td>
<td>344.24</td>
</tr>
<tr>
<td>Agriculture (kg y(^{-1}))</td>
<td>18923.26</td>
<td>18923.26</td>
</tr>
<tr>
<td>Total catchment load (kg y(^{-1}))</td>
<td>21834.68</td>
<td>21834.68</td>
</tr>
<tr>
<td>% of total load from agriculture</td>
<td>86.00</td>
<td>86.00</td>
</tr>
</tbody>
</table>

Figures 6 and 7 show the information in table 6 presented as percentage apportionment to individual sectors. Figure 6 shows the minimum agricultural contribution and figure 7 shows the maximum agricultural contribution.

Regardless of whether load apportionment estimates are available for this NVZ, a full list of discharges is included in appendix 2.
5.1 Contribution of agriculture to nitrogen losses

Figure 6: Percentage apportionment to sectors using the minimum agricultural load estimate and the maximum consented discharge load estimate from 2017 NVZ designation land use analysis

Figure 7: Percentage apportionment to sectors using the maximum agricultural load estimate and the minimum consented discharge load estimate from 2017 NVZ designation land use analysis
5.1.2 Sectoral load apportionment from SEPARATE framework

SEPARATE (SEctor Pollutant AppoRtionment for the AquaTic Environment) is a national scale multiple pollutant source apportionment framework developed by ADAS, Rothamsted Research, Centre for Ecology and Hydrology and the Environment Agency. SEPARATE uses data on sources of total nitrogen including agricultural practice, sewage treatment works, combined sewer overflows, storm tanks & septic tanks to apportion the load input to the aquatic environment into individual sectors.

Outputs from the SEPARATE model are not available for this NVZ designation.

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5.1.3 Sectoral load apportionment from SIMCAT-SAGIS

SIMCAT (SIMulated CATchment) is a well-established river water quality model with a long history of use in the UK. It has recently been incorporated into a source apportionment framework, SAGIS (Source Apportionment Geographical Information System), to allow apportionment of a range of pollutants to various sectors, including agriculture. For catchment designations we provide the annual mean nitrate as N concentration SIMCAT predicts at the farthest downstream point of the proposed NVZ designation and the proportion of that concentration from diffuse sources\(^4\).

Table 7: SIMCAT-SAGIS predictions for this designation

<table>
<thead>
<tr>
<th>Result</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual mean SIMCAT prediction nitrate as N concentration at outlet of designated area (mg l(^{-1}))</td>
<td>10.28</td>
</tr>
<tr>
<td>Percentage of annual mean concentration predicted to be from diffuse source (%)</td>
<td>34.00</td>
</tr>
</tbody>
</table>

\(^4\)In SIMCAT-SAGIS diffuse sources include agriculture, but not solely agriculture. We provide the proportion from diffuse source figure to give context, and hopefully, corroboration to the other load apportionment methods presented above.
5.2 Land cover & livestock

We have used land cover and livestock information as part of the method to derive this designation. It is used to drive the NEAP N model\(^5\) and the estimate of urban N load\(^6\) which are both input to the land use model. We take our land cover and livestock data from the 2014 Defra June agricultural survey\(^7\). We have included the data below for this designation.

![Image of land cover data]

**Figure 8: Landcover by area within proposed NVZ designation from 2014 Defra agricultural survey**

**Table 8: Count of livestock within proposed NVZ designation from 2014 Defra agricultural survey**

<table>
<thead>
<tr>
<th>Livestock Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td>1094</td>
</tr>
<tr>
<td>Sheep</td>
<td>741</td>
</tr>
<tr>
<td>Pigs</td>
<td>761</td>
</tr>
<tr>
<td>Poultry</td>
<td>751168</td>
</tr>
<tr>
<td>Other livestock</td>
<td>37</td>
</tr>
</tbody>
</table>

---


\(^7\)Defra, 2015. Agriculture in the United Kingdom 2014. HMSO.
5.3 Agricultural load over time

Figure 9 shows how the nitrate available for leaching from agricultural sources, as predicted by the ADAS NEAP N model\(^8\), varies over time for this NVZ designation. The data is presented relative to a baseline (the year 2000). The NEAP N model uses long term average climate data, so changes in nitrate available for leaching is due primarily\(^9\) to changes in cropping and livestock within the NVZ.


\(^9\)NEAP N has been developed over time so a portion of any temporal variation may be due to changes to the model or model parameters.
5.4 Workshop discussion

As part of the designation process the Environment Agency held a series of workshops with EA area office staff and invited partners, including representatives from the farming industry.

The purpose of the workshops was to discuss any proposed NVZ designations where the evidence supporting designation was uncertain or contradictory, or where there were new or modified designations. We were not able to discuss every designation, but where discussion did take place abridged notes are provided below.

The workshop discussion focussed on the appropriate boundary for the NVZ. It was agreed that the Cycle 2 WFD boundary was the most realistic boundary available.
6 Appendices

6.1 Appendix 1 - Sample point time series graphs

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Figure A1: Z9420103 - WORTON STM. HEATH BR

Site: Z9420103SW

Concentration of nitrate as N (mg/l)

Year

NVZ ID; S699 - NVZ Name; Worton Str - source to conf Semington Bk NVZ
6.2 Appendix 2 - Discharge consent conditions

We present two figures for load from consented discharges (points sources). The maximum value is based on discharge consent conditions (the conditions consented discharges may not legally exceed). Therefore the maximum value represents the maximum possible legal load emitted from each discharge. The minimum value is based on information from flow and water quality monitoring and represents the most likely load from each discharge. Where there is not flow and water quality monitoring in place the minimum and maximum loads will be the same.

Table 9: Summary of sources of nitrogen compounds within NVZ S699

<table>
<thead>
<tr>
<th>Source type</th>
<th>Source sub-type</th>
<th>Source name</th>
<th>Lower load (N kg yr(^{-1}))</th>
<th>Upper load (N kg yr(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point source</td>
<td>Household, commercial and industrial waste landfills</td>
<td>MONUMENT HILL OLD CULVERT</td>
<td>2099</td>
<td>2099</td>
</tr>
<tr>
<td>Point source</td>
<td>Sewage Disposal Works - water company</td>
<td>URCHFONT STW (HUMUS)</td>
<td>36.89</td>
<td>36.89</td>
</tr>
<tr>
<td>Diffuse - urban</td>
<td>Diffuse urban N</td>
<td>Various losses from urban areas</td>
<td>431.5</td>
<td>431.5</td>
</tr>
<tr>
<td>Diffuse - agricultural</td>
<td>Arable land</td>
<td>Cropping practices, applied fertilisers and atmospheric deposition to arable land</td>
<td>14047</td>
<td>14047</td>
</tr>
<tr>
<td>Diffuse - agricultural</td>
<td>Permanent grassland</td>
<td>Losses from permanent grassland</td>
<td>4569</td>
<td>4569</td>
</tr>
<tr>
<td>Diffuse - agricultural</td>
<td>Rough grazing land</td>
<td>Losses from rough grazing land</td>
<td>242.5</td>
<td>242.5</td>
</tr>
<tr>
<td>Diffuse - other</td>
<td>Woodland and inland water</td>
<td>Losses from woodland and inland water</td>
<td>64.52</td>
<td>64.52</td>
</tr>
<tr>
<td>Diffuse - septic tanks</td>
<td>Septic tanks N</td>
<td>Discharges from septic tanks for residential properties</td>
<td>344.2</td>
<td>344.2</td>
</tr>
</tbody>
</table>
End of document
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