Nitrate Vulnerable Zone (NVZ) designation, 2017 Eutrophication (lakes)

Publication Date: June 2016

NVZ Name: The Loe
NVZ ID: EL110
Evidence of eutrophication 2017

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 eutrophication-related NVZs, available via http://apps.environment-agency.gov.uk/wiyby/141443.aspx. These methods were developed under the guidance of a review group convened by the Defra 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.

NVZs are areas of land that drain to polluted waters and which contribute to the pollution of those waters. Polluted waters include those which are eutrophic or may in the near future become so if the Regulations were not to apply there.

Eutrophication is defined as “the enrichment of water by nitrogen compounds, causing an accelerated growth of algae and higher forms of plant life to produce an undesirable disturbance to the balance of organisms present in the water and to the quality of the water concerned”.

For both freshwaters and saline waters, a weight-of-evidence based approach to assessing the risks and impacts of eutrophication was employed. The evidence for individual water bodies was assessed against a national suite of criteria for eutrophication in the different categories/types of water for review. The criteria are both quantitative and qualitative and reflect scientific understanding of the process and effects of eutrophication. They are broken down in the same way for each water category as follows:-

- Nutrients
- Plants/algae
- Secondary and other effects

For each designated or candidate water body which might meet the criteria for eutrophication, a datasheet such as this one was completed, bringing together information about the water body, its catchment, its uses, evidence of eutrophication and the sources of nitrogen input.

This document is a record of the evidence used in the designation process, including results from national monitoring and assessment programmes, and further information supplied by Area staff. The proposals for NVZ designation are made as a result of close working between Area and national Environment Agency teams, with further quality assurance for the eutrophication designations through the use of a national expert panel.

An accompanying guide to these datasheets is available, which provides an explanation of the contents, acronyms and technical terms.

Some features of the maps within this report are based on digital spatial data licensed from the Centre for Ecology and Hydrology, ©. Please note that any maps shown here have not used detailed field boundaries and therefore represent the indicative 'soft' boundary only. The definitive NVZ area can be seen on the “What’s in Your Backyard” (WiYBY) website ((http://apps.environment-agency.gov.uk/wiyby/141443.aspx).
Section 1. Lake and catchment characteristics

WB ID: 46556  2013 NVZ status: Designate

Lake attributes

<table>
<thead>
<tr>
<th>EA Area</th>
<th>Devon and Cornwall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake grid co-ordinates (Easting/Northing)</td>
<td>164801 / 24843</td>
</tr>
<tr>
<td>Lake waterbody area (ha)</td>
<td>53.8</td>
</tr>
<tr>
<td>WFD Lake Typology</td>
<td>Moderate alkalinity, shallow, large, lowland</td>
</tr>
<tr>
<td>Lake Alkalinity (ueq/L)</td>
<td>496</td>
</tr>
<tr>
<td>Mean lake depth (m)</td>
<td>4</td>
</tr>
<tr>
<td>Is the lake heavily modified according to WFD?</td>
<td>No</td>
</tr>
<tr>
<td>Does stratification occur?</td>
<td>Well mixed</td>
</tr>
<tr>
<td>Is this waterbody a reservoir?</td>
<td>No</td>
</tr>
</tbody>
</table>

Natural or artificial lake:
--- Loe Bar separates Cornwall's largest freshwater pool, The Loe, from the sea. The outlet and levels are actively managed to maintain the freshwater environment.

Type of artificial lake:
--- Freshwater lake formed by shingle bar damming the Cober River at the beach.

Lake perimeter (% artificial)
(Parts of the western edge are stone-laid banks. The shingle bar itself to the SW forms an artificial (?) bank.)

Significant changes in lake level due to seasonal drawdown:

Pumped storage or other reservoir:
0

Information on abstraction (if available)
Lake catchment attributes

<table>
<thead>
<tr>
<th>Lake catchment area (ha)</th>
<th>5381</th>
</tr>
</thead>
<tbody>
<tr>
<td>If pumped, pumped catchment area (ha)</td>
<td>---</td>
</tr>
</tbody>
</table>

Hydrological character
--- GW only plays a small part.

Comments on accuracy of lake catchment:

Is the map representative of the natural catchment?
--- Some water is pumped into the Cober catchment from Stithians Reservoir and an equivalent volume is abstracted at the top of the catchment. Hence some influence of the Stithians reservoir catchment.

Is the map representative of the artificial catchment?

---

NVZ Name: The Loe
NVZ ID: EL110

Please note that the map above has not used the detailed field boundaries and is the indicative 'soft' boundary. The definitive NVZ area can be seen on the Environment Agency website (www.environment-agency.gov.uk)
**Section II - Waterbody uses**

**Water Supply:**  
Controlled water (Section 104 of Water Resources Act):

**Public Water Supply:**

**Drinking Water Protected Area:**  
No

**UWWTD designation**  
Yes

**Used for hydropower or flow regulation:**  
--- There is a culvert to control the discharge from the pool.

**Recreational use:**

**Accessibility to public:**

**Recreational fishing:**  
--- There is some angling for brown trout although the lake is now dominated by perch and coarse fish- tickets are possibly available via the National Trust.

**Contact watersports**  
--- The lake itself is not used for recreation.

**Nature of watersports (if applicable):**  
---

**Other public benefit visits:**

- Walking, bird watching, there is cycle track from Helston to Loe Bar.

**Conservation status:**

**Conservation value of lake:**

**Habitats Directive site:**  
--- SSSI

**SPA or SAC for aquatic interest features**  
--- The pool supports several locally rare aquatic plant species including Six-stamened Waterwort Elatine hexandra, Perfoliate Pondweed Potamogeton perfoliatus, Shoreweed Littorella uniflora, Horned Pondweed Zannichellia palustris, and Amphibious Bistort Polygonum amphibium. One noteworthy species of alga, Stonewort Alga Nitella hyalina, has also been recorded.

**SSSI or local conservation designation:**  
--- Lake and its surrounding wetland areas are designated as SSSI along with the vegetated shingle bar.

**Description of Aquatic interest features:**  
--- Aquatic macrophytes, birds, wet woodland, geological features of shingle bar.
Total oxidised nitrogen (TON) data

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean summer TON (mg/l)</td>
<td>3.6</td>
</tr>
<tr>
<td>Total number of summer TON samples</td>
<td>16</td>
</tr>
<tr>
<td>75th percentile annual TON (mg/l)</td>
<td>5.5</td>
</tr>
<tr>
<td>Total number of TON samples</td>
<td>42</td>
</tr>
<tr>
<td>Confidence of annual 75th %ile TON exceeding 1 mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Confidence of annual 75th %ile TON exceeding 2 mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Date range of TON samples</td>
<td>2011 - 2014</td>
</tr>
</tbody>
</table>

TON monitoring data

 NVZ Name: The Loe
 NVZ ID: EL110
### Total nitrogen (TN) data

<table>
<thead>
<tr>
<th>Mean annual TN (mg/l)</th>
<th>4.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of TN samples</td>
<td>45</td>
</tr>
<tr>
<td>Confidence of annual mean TN exceeding 1 mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Confidence of annual mean TN exceeding 2 mg/l</td>
<td>High</td>
</tr>
<tr>
<td>Date range of TN samples</td>
<td>2011 - 2014</td>
</tr>
</tbody>
</table>

#### TN monitoring data

![TN Monitoring Data Graph](image)

Does any other (e.g. EA non-WFD, or third party) monitoring data for the lake provide improved evidence of significantly elevated nutrient nitrogen?
Total phosphorus (TP) data

<table>
<thead>
<tr>
<th>Annual geometric mean TP (ug/l)</th>
<th>67</th>
</tr>
</thead>
<tbody>
<tr>
<td>WFD face value TP class</td>
<td>Poor</td>
</tr>
<tr>
<td>Confidence of moderate or worse TP status</td>
<td>100%</td>
</tr>
<tr>
<td>Date range of TP samples</td>
<td>2011 - 2014</td>
</tr>
</tbody>
</table>

TP monitoring data

Does any other (e.g. EA non-WFD, or third party) monitoring data for the lake provide improved evidence of significantly elevated nutrient phosphorus?
Nitrogen loading estimates based on catchment map area

<table>
<thead>
<tr>
<th>Nutrient source</th>
<th>Leached N (kgN/yr)</th>
<th>Conc. (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>From all agricultural sources</td>
<td>170975</td>
<td>5.5</td>
</tr>
<tr>
<td>From agricultural sources minus atmospheric deposition</td>
<td>165888</td>
<td>5.3</td>
</tr>
<tr>
<td>From urban sources</td>
<td>3994</td>
<td>0.1</td>
</tr>
<tr>
<td>From all sources</td>
<td>174969</td>
<td>5.6</td>
</tr>
<tr>
<td>From all sources (minus atmospheric deposition)</td>
<td>169881</td>
<td>5.5</td>
</tr>
<tr>
<td>Ranking based on nitrogen loading from agricultural sources</td>
<td></td>
<td>59</td>
</tr>
</tbody>
</table>

Local assessment 2015

Significance of loading from agricultural sources to the catchment of the lake

Significance of loading from human habitation to the catchment of the lake

--- Principal source of elevated Phosphate is Helston STW, RNAS Culdrose STW (private MoD). Heslton STW is likely cause on NH3 WFD failure in Lower Cober The STW lies just above the Lake is the qualifying works and receives phosphate stripping.

Significance of any other sources of nutrient loading to the lake or its catchment

NVZ Name: The Loe
NVZ ID: EL110
### Chlorophyll data

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual mean Chlorophyll (ug/l)</td>
<td>15</td>
</tr>
<tr>
<td>total number of Chlorophyll samples</td>
<td>46</td>
</tr>
<tr>
<td>WFD face value Chlorophyll class</td>
<td>Moderate</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>100%</td>
</tr>
<tr>
<td>Chlorophyll Good/Moderate boundary value</td>
<td>9</td>
</tr>
<tr>
<td>Date range of Chlorophyll samples</td>
<td>2011-2014</td>
</tr>
</tbody>
</table>

#### Chlorophyll monitoring data

![Chlorophyll monitoring data graph](image_url)
Other responses

<table>
<thead>
<tr>
<th></th>
<th>Phytoplankton (Pluto EQR)</th>
<th>Macrophytes (EQR)</th>
<th>Diatoms (EQR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EQR</td>
<td>0.19</td>
<td>0.3</td>
<td>0.6</td>
</tr>
<tr>
<td>Total number of samples/surveys</td>
<td>28</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>WFD face value class</td>
<td>Poor</td>
<td>Poor</td>
<td>Moderate</td>
</tr>
<tr>
<td>Confidence of moderate or worse status</td>
<td>100%</td>
<td>100%</td>
<td>88.7%</td>
</tr>
<tr>
<td>Date range of samples</td>
<td>2011 - 2013</td>
<td>2008 - 2011</td>
<td>2011 - 2013</td>
</tr>
</tbody>
</table>

Number of years when algal blooms were observed based on reactive monitoring 2010-2015: 0

Does any other (e.g. EA non-WFD, or third party monitoring data for the lake provide improved evidence of eutrophication? (local judgement)
--- 0

To which biological element(s) does it relate?
---

**Palaeolimnology**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Change as Square Chord Distance</td>
<td></td>
<td>0.36</td>
</tr>
<tr>
<td>Change in Diatom community</td>
<td></td>
<td>No data</td>
</tr>
</tbody>
</table>

Evidence that designated aquatic interest features associated with the lake show evidence of eutrophic disturbance? (local judgement)

Strength of evidence (local judgement)
---

Local judgement on the evidence of eutrophic disturbance
--- 0
Comments and decisions

WFD Weight of evidence for eutrophication:
Certainty of eutrophication problem based on core WFD tools: Very certain
Certainty of eutrophication problem based on overall weight of evidence: Very certain

WFD overall ecological status: Poor
Confidence in WFD status: Very Certain

Current assessment of weight of evidence supporting designation in 2017

First national panel
Recommended action: Existing designation - check needed

Comments from first panel:
Existing designation - N remains >2 mg/l and there is evidence of ecological impact for eutrophication. Recommend continued designation.

Second national panel
Comments from second national panel:
Agreed with provisional decision to continue designation

Recommendation: Continued designation

Local summary and recommendation:
Environment Agency monitoring data shows that The Loe continues to be eutrophic. There is high confidence that TON exceeds 2mg/l as a 75th %ile, and high confidence that annual mean total nitrogen exceeds 2mg/l. The Loe is classed as Poor for total phosphorus (very certain), phytoplankton and macrophytes; and Moderate for chlorophyll and diatoms. Therefore recommend continued NVZ designation.
## 2017 Recommendation:
Continued designation

## 2013 Decision:
Designate

## 2008 Decision:
Designated

### Lake Description:
The Loe Pool is formed by shingle bar that separates Cornwall's largest freshwater pool from the sea. It is moderate alkalinity, shallow well mixed lake. The outlet and water levels are actively managed to maintain the freshwater environment.

### Why the lake should be designated as a Polluted Water (eutrophic):

The Loe is an existing eutrophic waters NVZ designation. Nitrogen concentrations are significantly elevated compared to the 1-2 mg/l threshold range. Agriculture makes a significant contribution to nitrogen concentrations in the lake, although there are also inputs from Helston STW and other small discharges in the catchment. The ecology of the lake has been affected by high nutrient levels.

### Nitrogen:

The 75th percentile TON concentration is 5.5 mg/l, and mean annual TN is 4.9 mg/l, both significantly exceeding the 1-2 mg/l threshold. The concentrations are not significantly reduced compared to the previous review.

### Phosphorus:

The WFD classification for total phosphorus is Poor status.

### Ecological response:

Overall phytoplankton and macrophytes are both at Poor status for WFD, chlorophyll and diatoms are both at moderate status, indicating a eutrophic impact.

### Supplementary evidence:

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**NVZ Name:** The Loe  
**NVZ ID:** EL110
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