

# Linlithgow Loch

## An environmental improvement action plan

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### Area history

Linlithgow Loch is owned by Scottish Ministers and managed by Historic Scotland. It is a shallow, freshwater, low altitude loch in West Lothian, in a small and predominantly rural catchment. The loch is naturally eutrophic and is at risk from nutrient pressures.



### Amenity values include:

- as a tourist attraction alongside Linlithgow Palace;
- as a venue for recreational water-sports;
- as a stocked fishery;
- as a Site of Special Scientific Interest (SSSI);
- as a home to a large population of resident birds.

### Linlithgow Loch Catchment Management Group (LLCMG)

This group was set up in 2005. Stakeholders include:

- The Scottish Environment Protection Agency (SEPA) – represented by Ecology and Environmental Protection and Improvement staff;
- Scottish Natural Heritage (SNH);
- Historic Scotland (HS);
- West Lothian Council (WLC);
- Scottish Water;
- National Farmers Union Scotland (NFU Scotland);
- Forth Federation of Anglers;
- Scottish Canals;
- River Avon Federation.

The group meets four times a year and aims to:

- characterise pressures on the loch;
- set achievable objectives;
- undertake a series of catchment-wide improvements, similar to the project carried out for the Loch Leven catchment management plan;
- inform and educate the public about issues on and around the loch.

### Nutrient pressures

- Urban/road runoff
- Farming
- Combined sewer overflows
- Birds
- Fish stocking
- Loch sediments

### Other pressures

- Boat movements
- Invasive species
- Threats to biodiversity
- Flooding



Scum forming at loch outflow,



### Specific group objectives

Under the Water Framework Directive, Linlithgow is considered a non-baseline loch (< 50 Ha) and is too small to be included in SEPA's first round of loch classification.

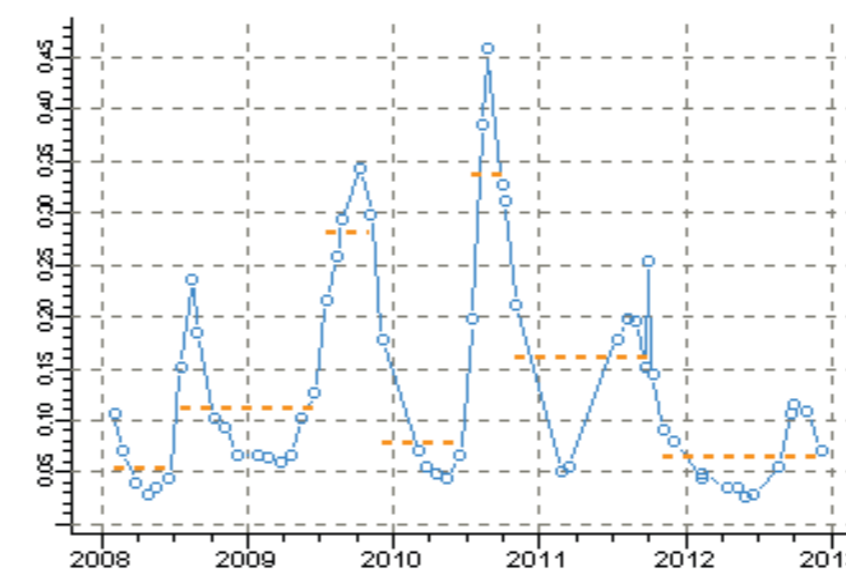
In 2008, SNH and SEPA jointly agreed interim targets for Total Phosphorous (TP), Chlorophyll *a*, Secchi depth and maximum macrophyte rooting depth within the loch, up to 2014. Further ecology monitoring was also set up, based on targets set in the Loch Leven project, and is to be reviewed in 2015.

In 2010, a catchment-wide project was initiated by the Scottish Agricultural College (SAC) and the Centre for Ecology and Hydrology (CEH) to investigate the water quality problems. The key aim of this project is to highlight the drivers of phytoplankton biomass by identifying phosphorus and nitrogen sources to the loch, both within the catchment and in the loch, and to propose a list of suitable control measures. Funding for survey work was provided by West Lothian Council (WLC), HS, CEH, SEPA and SNH. However SEPA also monitors the loch as an Environmental Improvement Action Plan (EIAP).

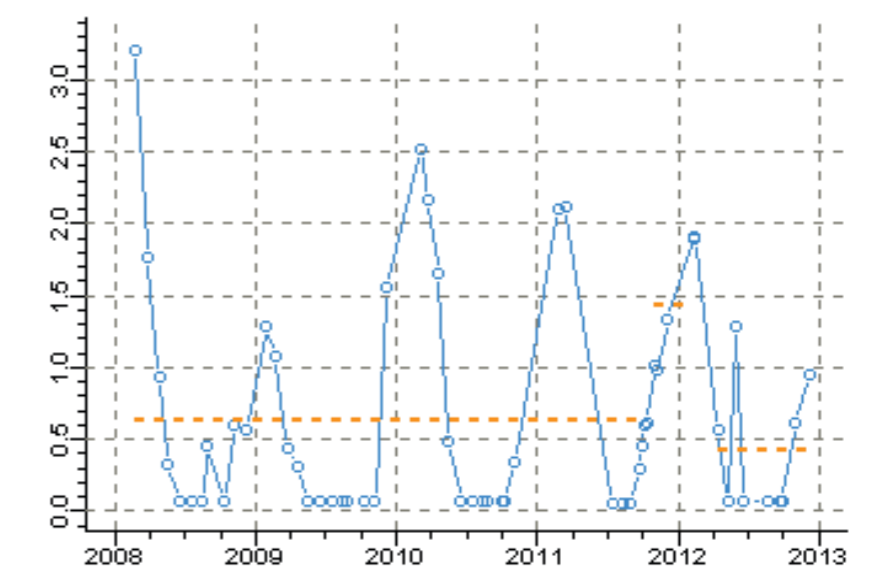
### Current and proposed monitoring by SEPA

#### Chemical monitoring

Long-term data sets are available for Total Phosphorous (TP), Total Oxidised Nitrogen (TON) and Chlorophyll *a* (see graphs). Monitoring is also carried out on the Bells & Hatchery Burns, plus other discharge points.



Variations in TP levels in Linlithgow Loch (2008-12)  
Target TP<sup>1</sup>: 0.05 mg L<sup>-1</sup> [ $< 0.1 \text{ mg L}^{-1}$ ]<sup>2</sup>  
Current level: 0.133 mg L<sup>-1</sup> (based on 3 year mean, 2010-12)



Variations in TON levels in Linlithgow Loch (2008-12)  
Current level: 0.731 mg L<sup>-1</sup>  
(based on 3 year mean, 2010-12)  
No target set for TON.

#### Ecological monitoring

Proposed jointly by SEPA and SNH in 2008, this is based on the objectives set for Loch Leven and needs to be reviewed one year after the chemical objectives:

- Secchi depth (monitored by HS): maintain at/near the current level of 2.4 m [3-1.5].
- Maximum macrophyte rooting depth: 3m (constrained by mean loch depth)<sup>3</sup>.

SEPA's 2007 Macrophyte survey results indicated a high confidence of the loch being at 'moderate' status (using in-house 'LEAFPACS for Lakes' model). Species found in the survey were similar to condition site monitoring studies carried out by SNH in 2004 and 2007.

CPET (Chironomid Pupal Exuviae Technique) sampling at the outflow (2008 - 2011) indicates the loch is at moderate status with high confidence.

Phytoplankton sampling (2009 -11) indicates the loch is at poor status, with a high confidence.

Continue recording/sampling algal blooms as they occur and advise the appropriate authorities. Blooms were recorded in 2009, 10, 11 and 12. A reporting procedure and signage for loch users has been agreed by the LLCMG.

SEPA carried out an ecology survey on the Bells Burn in 2011 to provide evidence to Scottish Water, in support of the case for First Time Sewerage Provision for residential properties on Edinburgh Road. A second survey was undertaken on the Hatchery Burn to assess the impact of motorway runoff.

#### Notes for monitoring

<sup>1</sup> Target set by SNH/SEPA (2008).

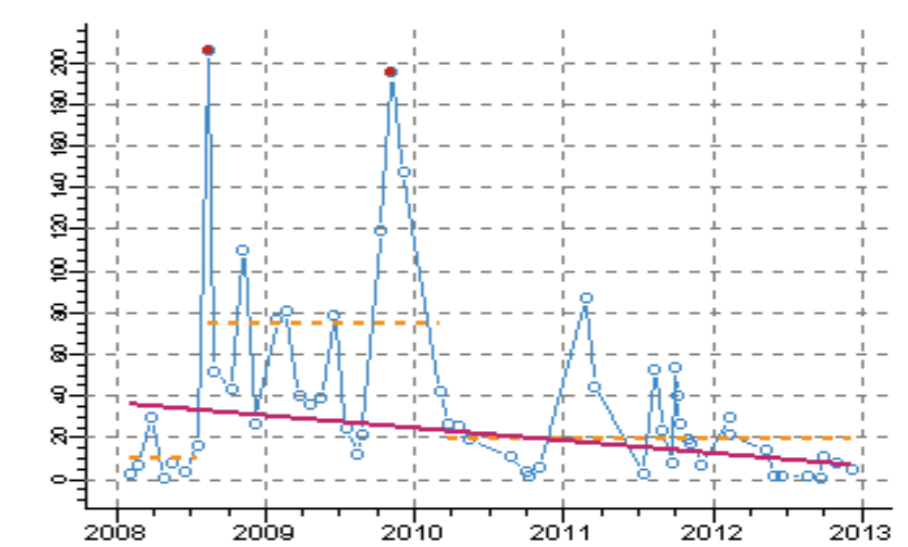
<sup>2</sup> Figures in square brackets are levels for eutrophic lochs, set by OECD (Organisation for Economic Co-operation and Development)

<sup>3</sup> Mean loch depth is 3m, although a small area (The Rickle) goes as deep as 9m.

#### Other objectives

- Consider using planning gain for catchment-wide improvements (WLC).
- Educate loch users and residents about boat disturbance of sediments, fish stocking, bird feeding and drainage issues. Currently the Yellowfish campaign is being rolled out across primary schools in the area by HS to educate youngsters about the connection between road drains and the Loch.
- NFU Scotland will encourage landowners to undertake farm management plans, with advice and support from SAC.
- Address ongoing CSO and surface water drainage issues with improvements to the infrastructure (Scottish Water, 2009-14). In 2010, Scottish Water carried out improvements to the St Ninian's Road CSO, extending it further out into the Loch, at Town Bay.

**Caveat:** Like Loch Leven, once Linlithgow Loch is officially classified under WFD - and water quality has improved to 'good' status - it would still only achieve an overall 'moderate' status. This is due to morphological pressures, such as hard bank engineering and the presence of sluice gates which regulate water levels in the loch.



Variations in Chlorophyll *a* levels in Linlithgow Loch (2008-12)  
Target Chlorophyll *a*<sup>1</sup>: 15-25 µg L<sup>-1</sup>  
[peak concentration: 25 µg L<sup>-1</sup>]<sup>2</sup>  
Current level: 20.5 µg L<sup>-1</sup>: (based on 3 year mean, 2010-12)  
Light can also influence Chlorophyll *a* production

### Surface water objectives and current status of Linlithgow Loch

