Viking Wind Farm

Freshwater diatom survey, April 2025

Report to SSE

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Introduction

This report evaluates the results of diatom sampling in April 2025. Data for the three control lochs contributes to our understanding of the scale of natural variation which will, in turn, assist data interpretation in the future.

Materials and methods

All methods are identical to those used in the baseline report (Kelly 2020). A list of samples included in this survey is given in Table 1 and a guide to trends in diatom metrics is given in Table 2.

 Table 1. List of samples analysed during this study. "Type" divides the samples into calcareous, soft or very soft water and sub-divides these into "target" (i.e. likely to be influenced by construction) and "control" lochs.

Sample	Loch	Location	Code	Date	Type (1)	Type (2)
125019	Smerla Water	near northern outflow	SM1L	27/4/2025	Very soft water	Control
125020	Smerla Water	near southern outflow	SM2L	27/4/2025	Very soft water	Control
125007	Gossa Water	SW corner	GO1L	28/4/2025	Soft water	Impact
125008	Gossa Water	near outflow	GO2L	28/4/2025	Soft water	Impact
125009	Lamba Water	potential impact zone	LB1L	28/4/2025	Very soft water	Impact
125010	Lamba Water	near outflow	LB2L	28/4/2025	Very soft water	Impact
125011	Maa Water	near SE inflow	MAA1L	28/4/2025	Very soft water	Impact
125012	Maa Water	near outflow	MAA2L	28/4/2025	Very soft water	Impact
125013	Truggles Water	inflow on E side	TR1L	28/4/2025	Very soft water	Impact
125014	Truggles Water	near outflow	TR2L	28/4/2025	Very soft water	Impact
125021	Laxo Water	inflow area	LA1L	27/4/2025	Soft water	Control
125022	Laxo Water	near outflow	LA2L	27/4/2025	Soft water	Control
125015	Sand Water	west side	SA1L	28/4/2025	Calcareous	Impact
125016	Sand Water	near inflow	SA2L	28/4/2025	Calcareous	Impact
125017	Sand Water	east side	SA3L	28/4/2025	Calcareous	Impact
125018	Sand Water	near outflow	SA4L	28/4/2025	Calcareous	Impact
125023	Petta Water	north end	PE1L	27/4/2025	Calcareous	Impact
125024	Petta Water	near outflow	PE2L	27/4/2025	Calcareous	Impact
125025	Loch of Skellister	NW shore	SK1L	27/4/2025	Soft water	Impact
125026	Loch of Skellister	near outflow	SK2L	27/4/2025	Soft water	Impact
125027	Loch of Benston	south side	BE1L	27/4/2025	Calcareous	Control
125028	Loch of Benston	near outflow	BE2L	27/4/2025	Calcareous	Control

Fig.	Explanation	Comment
a.	LTDI2 – indicates impact of nutrients on biota.	High values = bad
b.	DAM – indicates impact of acidification.	Low values = bad.
с.	Ntaxa = number of taxa.	A very basic measure of diversity. Values could drop due to loss of species but could, conceivably, increase if there were localised changes allowing different species to thrive. Although nominally "two-tailed", in practice, reductions in diversity are more likely to indicate a problem than increases
d.	Motile	Percent of diatom valves which belong to motile taxa – these would have a competitive advantage in situations where light or other resources are limiting, because they can adjust their position within the biofilm.
e.	EpiRho (only for calcareous lochs)	Proportion of diatoms capable of nitrogen fixation (members of the genera <i>Epithemia</i> and <i>Rhopalodia</i>). Indicates increased N stress (which could occur in response to P enrichment as well as to absence of sufficient N). These genera would disappear if N supply increased so this is a two-tailed test. Lower limit defined as 0.

Table 2. Interpretation of trends in diatom metrics

Results

General comments

Lochs are reported separately. Values of each parameter are plotted along with "warning" and "action" limits where the former are the 25th and 75th percentiles of data collected during the scoping and baseline studies, and in the period before work in each catchment started, whilst the latter are the minimum and maximum values. Neither of these limits is ideal but it does allow deviations from pre-construction conditions to be followed.

Calcareous lochs

Sand Water

None of the metrics show concerning trends. One sample (SA4L) had a LTDI2 value that exceeded the action limit, but the other three ensured that the mean LTDI2 was only slightly above the warning limit. The most likely reason for the high LTDI2 at SA4L is a high proportion of *Pseudostaurosira brevistriata* and related taxa which, as has been explained in previous reports, has a wide ecological tolerance and does not necessarily indicate a problem. DAM again remains low but strong indicators of acid conditions (e.g. *Eunotia* spp) were not abundant.



Fig. 1. Variation in diatom metrics over time in Sand Water. Vertical line indicates the approximate start of the construction phase, and the arrows indicates the approximate date of the 2020 incidents and also, for Motile, the date of the incident in July 2023. Green lines indicate warning limits and orange lines indicate action limits.

Petta Water

In contrast to February 2025, the two samples from Petta Water had very similar compositions in April, both dominated by *Achnanthidium sieminskae*. As a result, both LTDI2 and DAM were in the "safe" zone and none of the other metrics showed any concerning trends.



Fig. 2. Variation in diatom metrics over time in Petta Water. Green lines indicate warning limits and orange lines indicate action limits.

Loch of Benston

This is the control loch of the calcareous group although it is different in character to Sand Water and Petta Water, with greater influence of both agricultural runoff and septic tanks generally generating higher LTDI2 values. Results do not have any direct implications for construction work but will help to disentangle the effect of local (i.e. construction) versus regional drivers if Petta Water or Sand Water show any unexpected changes. There has been a weak but significant decline in LTDI2 over the course of the study, accompanied by a fall in the proportion of motile valves and, since 2023, an increase in DAM (though neither of these trends are significant).



Fig. 3. Variation in diatom metrics over time in Loch of Benston. Green lines indicate warning limits and orange lines indicate action limits.

Very soft water lochs

Lamba Water

The trends for LTDI2 and DAM were both within their respective warning limits although one LTDI2 record (LB2L) was slightly above the warning limit. No other metrics showed concerning trends.



Fig. 5. Variation in diatom metrics over time in Lamba Water. Green lines indicate warning limits and orange lines indicate action limits.



Maa Water



Fig. 6. Variation in diatom metrics over time in Maa Water. Green lines indicate warning limits and orange lines indicate action limits.

Truggles Water

None of the trendlines show any cause for concern.



Fig. 7. Variation in diatom metrics over time in Truggles Water. Green lines indicate warning limits and orange lines indicate action limits.

Smerla Water

As Smerla Water is a control loch, warning or action limits have been plotted simply to enable comparisons with the other lochs as construction activities proceed. In this case, there appears to be a slight upward trajectory of LTDI2, despite this loch being well away from any construction activity. Regional drivers, such as the warmer than average spring, may be responsible for some of these patterns.

Fig. 8. Variation in diatom metrics over time in Smerla Water. Green lines indicate warning limits and orange lines indicate action limits.

Soft water lochs

Loch of Skellister

LTDI2 values are higher than recorded in February, with one (SKL2) exceeding the warning limit. Values for motile were also between warning and action limits. These shifts are most likely due to the cumulative effect of low numbers of a number of *Nitzschia* spp. The long period of relatively warm, stable weather is a likely driver of this effect and no action is needed unless effects are also recorded in the next round of samples.

Fig. 10. Variation in diatom metrics over time in Loch of Skellister. Green lines indicate warning limits and orange lines indicate action limits.

Gossa Water

As for Loch of Skellister, LTDI2 was higher than recorded in February 2025, though still not exceeding the action line. The most likely reason for this is a high proportion of *Pseudostaurosira brevistriata*, whose effect on trends has been noted in previous reports. This is unlikely to be the result of any activities related to construction. Other metrics are within warning limits, apart from GO1L, where motile valves are between the warning and action limits.

Fig. 11. Variation in diatom metrics over time in Gossa Water. Green lines indicate warning limits and orange lines indicate action limits.

Laxo Water

As is the case for Loch of Benston and Smerla Water, Laxo Water is a control loch and shows the scale of variation in metrics that can be expected with minimal human activity in the catchment. As for other soft water lochs, there is a slight increase in LTDI2 and motile compared to February 2025, suggesting that this is due to regional drivers and is not related to operations.

Fig. 12. Variation in diatom metrics over time in Laxo Water. Green lines indicate warning limits and orange lines indicate action limits.

Conclusions and recommendations

No further action is required, based on these data.

References

Kelly, M.G. (2020). Viking wind farm: freshwater diatom baseline survey. Report to SSE, September 2020. Bowburn Consultancy, Durham.