



## Day 2 - Webinar 2 - Recovery and Remediation of Eutrophic Lakes

**Question 1** Are there any similar schemes further south?

**Answer** Answer to come

**Question 2** How does the timescale for improvement in Upper and Lower Macnean compare with other lakes in Ireland?

**Answer** Answer to come

**Question 3** Where should the initial focus be for an assessment of external loads to lakes?

**Answer** Answer to come

**Question 4** What mitigation measures would you like to see regarding discharges from septic tanks?

**Answer** Answer to come

**Question 5** Does the type of Phosphorous used have different impacts? E.g. use of superphosphate?? Or if ammonium of phosphate etc... Used have other different impacts??

**Answer** Answer to come

**Question 6** How does summer stratification of lakes affect the residence time?

**Answer** Answer to come

**Question 7** What is the actual legal basis for being able to add the Al or Fe salts to a waterbody

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**Answer**      **Answer to come**

**Question 8**      What can be done with the sediment with the legacy P or locked up P can this sediment be repurposed or even recycled to reduce the mining and imports of synthetic P for example??

**Answer**      **Answer to come**

**Question 9**      Does the type of grass grown have any impacts? Or say using mixed species swards have any impacts in terms of P requirements?

**Answer**      **Answer to come**

**Question 10**      Are there any biological processes of fungi or bacteria that can have an impact either to also interact with the sediment leading to more P to be released? Or any that can metabolise the P??

**Answer**      **Answer to come**

**Question 11**      Are any heavy metals been found in the lakes coming from the sources of P say if from rock phosphate for example as shown in some research??

<https://link.springer.com/article/10.1007/BF00747683>

**Answer**      **Answer to come**

**Question 12**      What changes happened that caused such a dramatic lowering of lake status?? Are there any signs of changes occurring to reverse the trend??

**Answer**      **Answer to come**

**Question 13**      What impacts occur as the pond weed or algae from the enrichment bio grade??

**Answer**      **Answer to come**

**Question 14**      How widespread is the problem of eutrophic lakes, especially smaller ones in Ireland?

**Answer**      With the smaller lakes, the best indication is from the survey of 200 lakes in 1996 and 1997, known as the Ecological Assessment of Irish Lakes, and of 614 lakes from 1988 to 1990, known as the Northern Ireland Lakes Survey. Some judgement is needed, as the degree of eutrophication varies and these surveys tend to focus on lakes in the lowlands. Overall, maybe around one third of those lakes were fairly eutrophic, based on their phosphorus concentration, and they were mainly in the lowlands. As mentioned in the presentation, the quality or status of lakes is based on the alga, plants, invertebrates and fish; in effect, we ask the plants and animals how healthy they feel!

**Question 15**      Have others completed a risk assessment of the use of aluminium salts to improve lake quality?

**Answer**      As far as we know, no one has completed this type of assessment, based on the two elements noted in the presentation. We have seen a few which look like the local risk assessment and liaison we developed; they focus on use of the lake, its conservation status, etc. We hope that the evidence we

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gathered and assessed gives confidence that the lake quality would be improved without any “side effects”.

**Question 16** What by-products were found in the Lake sediments as a result of using the Aluminium and Ferric salts, normally these create volumes of "sludge" by-products when used in waste water treatment

**Answer** The specific “by product” that is desired is insoluble aluminium phosphate or iron phosphate in the sediment. By chemically fixing phosphorus in the sediment, the driver of eutrophication is reduced or removed. As you say, a floc of aluminium or iron hydroxide is formed when the salts are added to water, as is used to remove colour, some metals and solids in the production of drinking water. In lakes, the floc settles to the surface of the sediment, similar to the settling of an algal crop. The floc and algae then get mixed into the sediment. This happens relatively quickly during the late spring to autumn period by the activities of midge larvae; they “wiggle” and move sediment upward and downward and so mix in the floc. Mixing of sediment by wind in shallower waters adds to this.

**Question 17** What is the actual legal basis for being able to add the Al or Fe salts to a waterbody

**Answer** That’s a very good question! Every three months in CatchmentCARE, there are two meetings, one in the morning of the partners and in the afternoon of the Steering Group. Your question has been discussed on three occasions and enquires made with the relevant government agencies. No legal basis was identified. It’s an unusual situation; we would not be disposing of waste water or a chemical, but seeking to improve the quality of the lakes. However, a local approval group was set up to consider the proposal. Representatives from Monaghan County Council, Irish Water and Inland Fisheries Ireland were briefed (quite a few documents were provided!) and the group met in February and the consensus was that the proposal to remediate Grove Lough is a good idea. As mentioned in the presentation, we are awaiting permission to sample the fish, as part of the monitoring programme.

**Question 18** Is the use of Barley straw on lakes with algal problems of benefit. Any comments on this measure and potential effectiveness would be appreciated

**Answer** I know of some angling clubs that use these and, by filtering and absorbing algal crops, they do work. They are not a permanent solution but could be a benefit for a summer.

**Question 19** Do you think the weather (rainfall) pattern has changed, with more intense rainfall happening more often, and this in turn has and/or will increase the Phosphorous load entering lakes, even with proper application rates on agricultural land?

**Answer** In general, P loads to lakes are influenced by a source pressure (P from soils) and a runoff vector. If the runoff increases, then the P load can also increase. Rain intensity, runoff connectivity and seasonality can all affect this runoff vector. Up to now, the evidence relating to a changing climate in Ireland and P from soils is investigated more for P concentrations in rivers rather than P loads to lakes – although the two are clearly related. See these papers for further info:

<https://www.nature.com/articles/s41598-018-19143-1.pdf>

<https://www.sciencedirect.com/science/article/pii/S0048969721026474>

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**Question 20** Will the natural variability in the small lakes impact negatively in the wider application of the remedial measures.

**Answer** Yes, there is great variability in the size, depth, water colour and flushing of the small lakes, but much less in how they respond to increases in the concentration of nutrients; we have models that indicate how the amount of algae increase with the concentration of phosphorus and those lake properties have almost no effect. As a result, we can use the concentration of phosphorus in the water and in the sediment to estimate the dose of aluminium salts needed to improve the lake, as described in the presentation. One lake property, however, is important! The alkalinity of the lake water needs to be above a certain value for the lake to be suitable for this remediation method, otherwise there is a possibility undesired effects.

**Question 21** Does the diversity of soil biology/soil microbiome have an impact as Christine Jones/Elaine Ingham describe??

**Answer** A healthy soil (in terms of micro-biology) can help to recycle P and so reduce P recalcitrance. So can optimum soil ph. This latter legacy store is more prone to long-term accumulation and exposure to runoff.

**Question 22** Is soil compaction an issue causing too increased loads?

**Answer** Locally, this can be an issue and especially where this compaction leads to pugging and erosion on grassland systems. However, more widely, P surpluses in soil (above optimum for agronomic needs) caused by legacy/recalcitrant stores, and incidental loads (rain following slurry amendment), are likely to be more important.