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APEM Group

Lough Carra

Initial Marl Crust Surveys 2022



Report prepared by Woodrow, APEM Group.

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STATEMENT OF AUTHORITY

This report was written by Philip Doddy.

Philip is a Senior Ecologist at Woodrow. He has completed a PhD in Aquatic Sciences, a BSc (Hons) in Freshwater & Marine Biology, and a Diploma in Amenity Horticulture. He is an Associate member of the Chartered Institute of Ecology and Environmental Management (CIEEM). Philip carries out botanical monitoring, site surveys and habitat mapping, and compiles Ecological Impact Assessments (EclAs), Appropriate Assessment (AA) screening reports, subsequent Natura Impact Reports (NISs), and vegetation monitoring reports. He has also carried out research on calcareous lakes and pools, microbial communities, and ecological succession. Philip regularly supports local community groups in their biodiversity conservation and enhancement projects.

Philip Doddy – Qualifications:

PhD – Aquatic Sciences, Galway-Mayo Institute of Technology, 2019.

BSc (Hons) – Freshwater & Marine Biology, Galway-Mayo Institute of Technology, 2013.

Diploma - Amenity Horticulture, Teagasc, National Botanic Gardens, Dublin, 2001.

CONTENTS

INTRODUCTION	4
Background and Scope	4
Site Location	4
METHODOLOGY	4
Site Visits	4
Laboratory Analyses	4
RESULTS & DISCUSSION	7
REFERENCES	9

INTRODUCTION

Background and Scope

Woodrow APEM Group was commissioned by Mayo County Council, as part of the Lough Carra LIFE Project, to carry out initial sampling and analysis of marl crusts in the southern basin of Lough Carra. Marl crust characteristics are known to be indicative of nutrient status and ecological quality in marl lakes (Doddy *et al.* 2019a; Doddy *et al.* 2019b). While more comprehensive surveys and analyses of marl crusts in Lough Carra are planned during the course of the LIFE Project, this initial work was done to help establish a baseline for conditions in the southern basin of the lake.

Site Location

An area in the southern basin of Lough Carra, south of the mouth of Annie's River, was chosen for this initial round of sampling and analysis. Since Annie's River and its tributaries flow through significant areas of farmland, it was postulated that the river may be a significant conduit for nutrients entering Lough Carra. It is also known from previous work (e.g. Doddy *et al.* 2019b) that this part of the southern basin is already suffering the effects of nutrient pollution.

This region where sampling took place is shown in **Figure 1**.

METHODOLOGY

Site Visits

Thirteen sampling points were defined in advance, in 100-metre increments from the mouth of Annie's River. Site visits were conducted in September 2022. It was found that Point 1, at the river mouth, was inaccessible, and the position of Point 2 was also altered slightly to allow for access. The points that were sampled are shown in **Figure 2**.

Small areas of marl crust were removed from the limestone substrate at each point, using a knife, and stored in plastic labelled containers with screw-on lids. The location was noted and photographs were taken. Samples were stored in a domestic freezer in advance of laboratory analysis.

Laboratory Analyses

Chlorophyll a was measured in marl crust samples using spectrophotometry, carried out in Atlantic Technological University, Dublin Road, Galway. Two replicate samples of marl crust were prepared from material taken at each of the twelve sampling stations shown in **Figure 2**. Samples were prepared and processed as described by Roden *et al.* (2020a).

Figure 1: Lough Carra and the surrounding area. Marl crust sampling was conducted in the region south of the mouth of Annie's River, indicated in red.

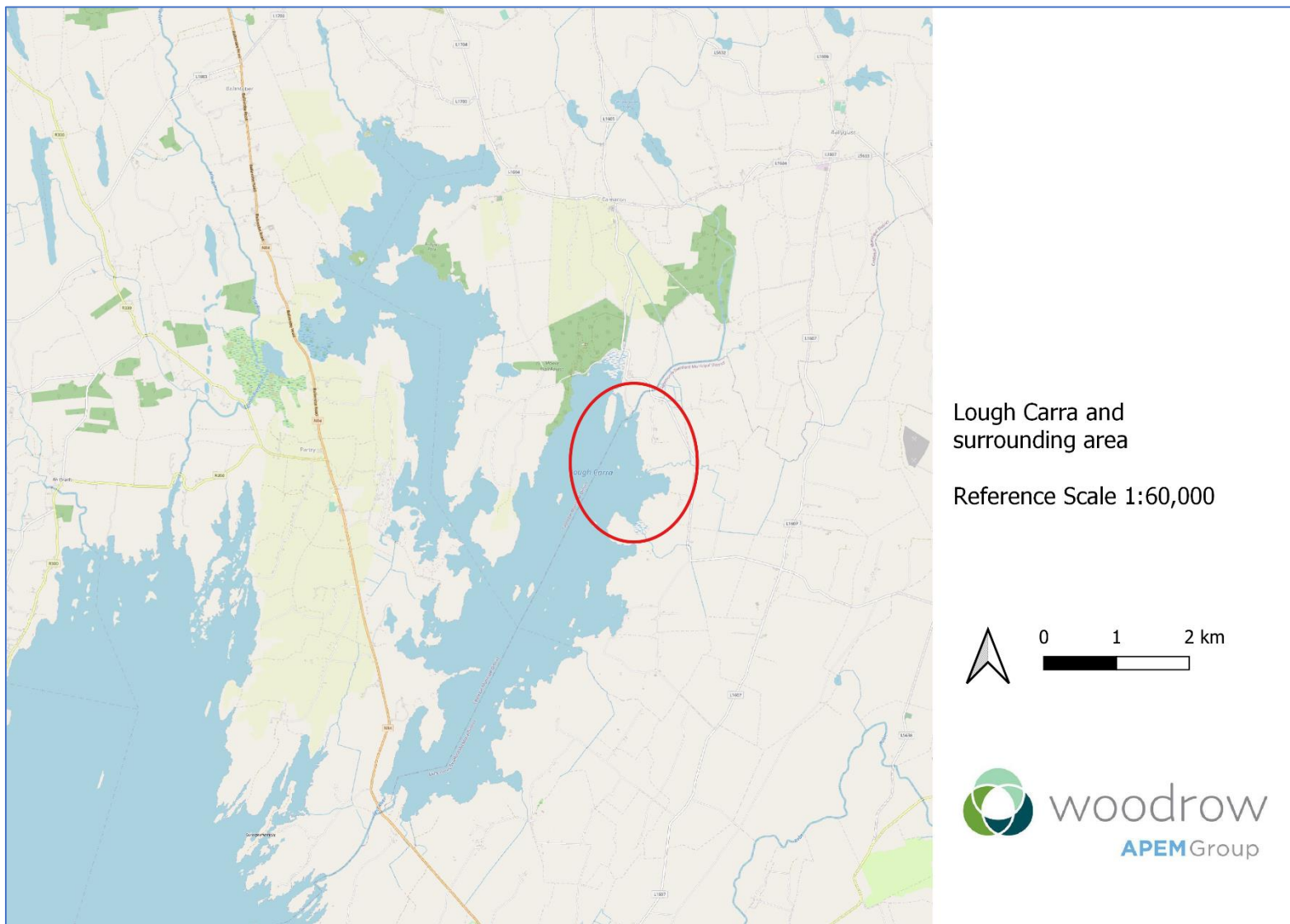
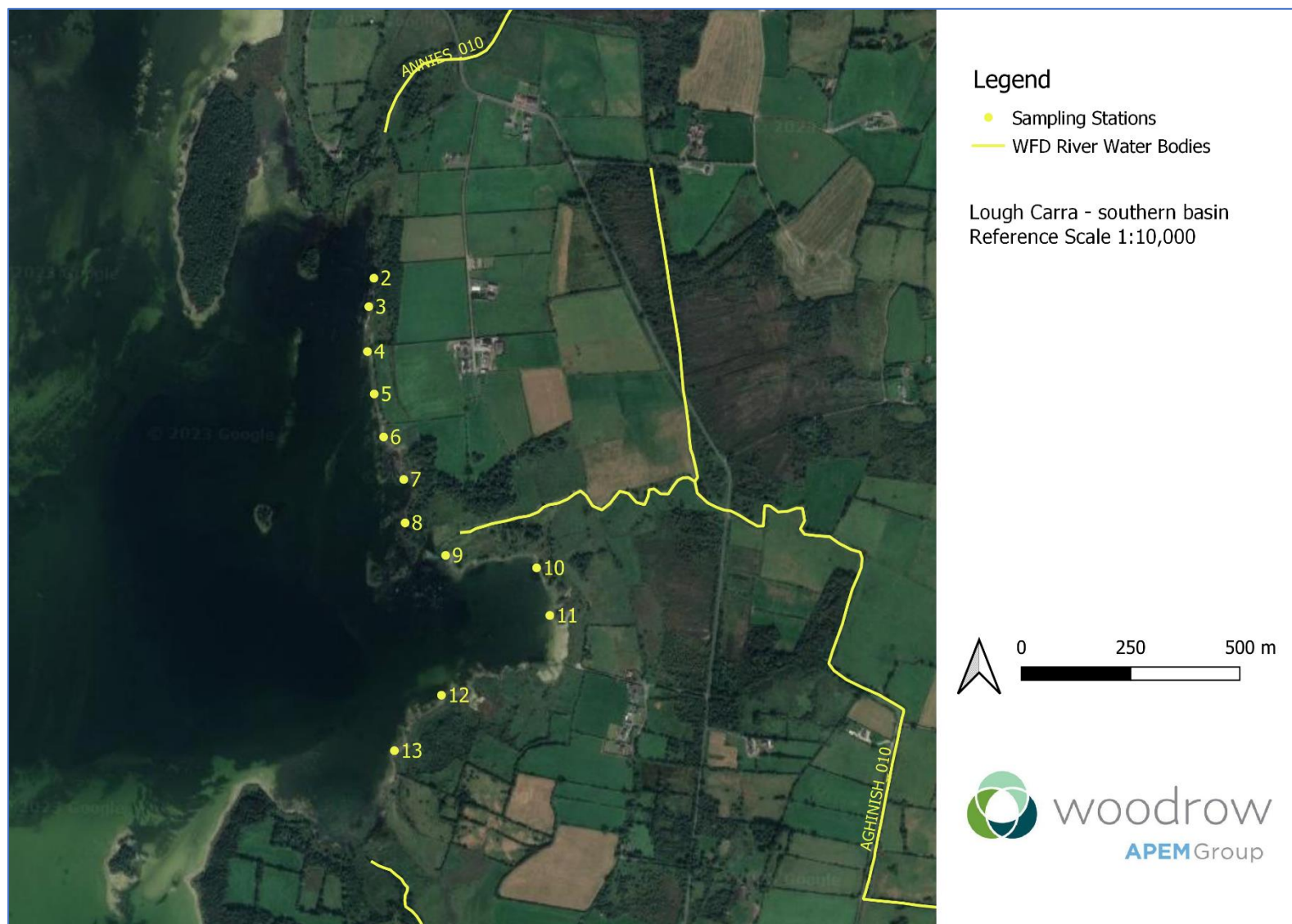


Figure 2: Sampling stations in Lough Carra – southern basin



RESULTS & DISCUSSION

Chlorophyll a concentration for each marl crust sample from Lough Carra's southern basin are given in **Table 1**. For comparison, **Table 2** shows mean chlorophyll a concentration recorded in marl crust in a selection of other Irish marl lakes (Doddy *et al.* 2019a), ranging from very good quality lakes, such as Cooiloorta, to badly nutrient-polluted lakes such as Cullaunyeeda. Photographs from each sampling station are given in **Appendix 1**.

Table 1: Chlorophyll a concentration in marl crust in Lough Carra's southern basin (2022)

Sampling Station	Location		Chlorophyll a concentration in marl crust ($\mu\text{g}/\text{cm}^3$)	
	Latitude	Longitude	Replicate 1	Replicate 2
2	53.703424	-9.214917	59	48
3	53.702838	-9.21516	91	105
4	53.701915	-9.215181	64	61
5	53.701047	-9.214923	102	90
6	53.700167	-9.214571	82	78
7	53.699301	-9.213848	72	74
8	53.698411	-9.213776	93	80
9	53.697758	-9.212353	139	139
10	53.697533	-9.209192	100	94
11	53.69656	-9.208706	89	85
12	53.694885	-9.212414	42	41
13	53.693729	-9.214012	59	60

Table 2: Chlorophyll a concentration in a selection of Irish marl lakes (mean values, 2016). Source: Doddy *et al.* (2019a).

Lake	Mean chlorophyll a concentration in marl crust ($\mu\text{g}/\text{cm}^3$)
Cooiloorta	18
Lough Bunny	21
Muckanagh Lough	26
Lough Owel	30
Lough Derravaragh	70
Lough Ennell	85
Cullaunyeeda	104

The results from Lough Carra's southern basin show that chlorophyll concentration in the marl crust is generally very high, indicating a high level of nutrient pollution. The mean of all 24 samples taken was $81 \mu\text{g}/\text{cm}^3$, which is higher than Lough Derravaragh, a lake in the midlands which suffers from serious nutrient-pollution (Roden *et al.* 2020b). The highest figures of all came from samples taken at the mouth of the Cloondaver Stream (Station 9). These figures are higher than any recorded in previous studies of marl crusts in Ireland (Doddy *et al.* 2019a; Doddy *et al.* 2019b) and suggest that this stream is an important conduit for nutrients entering the lake.

While there are variations in the results between the various sampling stations (**Table 1**), there is no general trend in accordance with distance from the mouth of Annie's River. Since two other streams, including the Cloondaver Stream, also enter Lough Carra along this section of shore (**Figure 2**), it appears that nutrients entering the lake via these streams are also having an influence on nutrient pollution in the area.

In conclusion, these results show that the southern basin of Lough Carra is in a state of severe ecological decline as a result of nutrient pollution. These results also provide a baseline for future surveys and analysis of marl crust in this part of Lough Carra.

REFERENCES

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APPENDIX 1: SITE PHOTOGRAPHS

STATION 2



STATION 3



STATION 4



STATION 5



STATION 6



STATION 7



STATION 8



STATION 9



STATION 10



STATION 11



STATION 12



STATION 13

