**SUMMARY OF SMALL RESEARCH PROJECTS FUNDED BY *RELU* AS PART OF THE *“UNDERSTANDING AND ACTING IN LOWESWATER: A COMMUNITY APPROACH TO CATCHMENT MANAGEMENT” PROJECT (2007-2010)***

***Project 1: TITLE:***

LOWESWATER CARE PROJECT

Survey of local washing practices and septic tank operation
in relation to domestic phosphorous inputs to Loweswater Lake.

This study is one of several being carried out by local people within the framework of the Loweswater Care Project. This one is being undertaken by Leslie Webb, who lives at Latterhead in Loweswater. He is an Environmental and Chemistry Consultant, now working in the Pulp and Paper Industry, but with previous professional experience in the chemistry of cleaning compounds and of domestic sewage treatment.

The main factor controlling the growth of algae in Loweswater Lake is the level of available phosphorous compounds. The main sources of phosphorous are summarised in the yellow box.

Sources of phosphorous:

1. run-off from land treated with fertilisers.

2. animal husbandry in terms of the land spreading of manure
 and of run-off from farmyards.

3. sewage discharges from septic tanks and other treatment plants at dwellings - this phosphorous comes from toilets, food preparation and the use of phosphates in cleaning compounds.

A previous report on farming practices states that the most obvious management option to reduce the available phosphorous load to the lake is to ensure that all of the septic tanks within the catchment are well-maintained and working efficiently. Key factors determining the phosphorous load from domestic sources are the contribution of domestic washing products to raw domestic phosphorous loads and the efficiency of the installed septic tanks.

The project has three elements to investigate this further:

 a survey of the use of domestic washing products (notably in relation to their phosphorous content) at properties draining to the lake

This would include getting information on the awareness of residents of the contribution from washing products to this problem, whether they would be willing to change to zero/low-phosphorous products and, if so, what extra cost would be acceptable. This would also include asking people to measure the time taken to use a container of washing product, from which the phosphorous usage over time could be estimated and compared with published per capita data for domestic sewage.

Factors that need to be recognised in looking at alternates are the environmental impacts of the chemicals used to replace phosphorous compounds in such products and the low hardness of the local water in relation to there being no/little need for components in the washing product to negate its adverse effect on washing.

 a survey of phosphorous-free domestic washing products and their local availability

A database will be produced with a description of each plant which previous research has shown do vary quite widely in type and design details. Key factors include:
- frequency of sludge removal so that the secondary bio-filter is not clogged
- nature of the septic tank filter media in relation to ability to adsorb
 phosphates
- discharge to ground or direct to stream.

Benefits from successful project

- lowered phosphorous inputs to domestic sewage and outputs from
 domestic treatment systems.

- recognition by local non-farming residents that they can do something
 to help mitigation of the algal problem

- better understanding of key treatment system operational factors to
 produce discharges of the best possible quality..

 a survey of the operational state of the existing septic tanks, notably in relation to their ability to remove phosphorous.

It is hoped to complete the study by the end of 2009 and generate the benefits in the green box.

***2) TITLE: Linking soil phosphorus measurements to phosphorus in watercourses***

**Stephen Maberly, Centre for Ecology and Hydrology (CEH), Lancaster University**

**Summary of Proposed activity:** Make targeted measurements of phosphorus in soils and adjacent streams to relate soil-P measurements to losses of P to streams and ultimately the lake using collections by interested locals in LCP.

**Main Aims of Proposed activity:** To link the measurements of soil-P to the ability of the soil to release P to water courses in order to quantify losses of P from fields to the water and link to fertiliser application rates.

**By what Means will the Aims be Achieved:** Make soil EPC0 and DESPRAL measurements of P-availability at 3 locations from say 3 field types (linked to the recently performed soil-P measure-ments)- with 3 replicates would be 27 measurements in total. Measure total P and soluble reactive P (would need to be filtered immediately and frozen) in nearby streams under different flow conditions using local people to collect the samples. Upstream-downstream sampling will be carried (using the same principal as in the project on septic tanks) for streams flowing through fields of high or low soil-P index. Relate the soil-P availability measurements carried out in the catchment to P-concentrations in water and estimate losses as a load of P to the lake.

**Why is it Important?** A central natural-science part of this project is to link activities on the land to the ecology of the lake. This work will strengthen that link by relating the soil-P measurements in the fields to the transferability of P to watercourses.

**Who is involved?** Interested local residents and farmers to collect the samples. CEH analytical labs at Lancaster and Bangor to undertake the analyses.

**Desired Outcomes:** A simple way to link field management and fertilizer application rates to losses of P to watercourses and the lake**.**

***3) TITLE: Hydrogeomorphological investigation of the main streams feeding into and out of Loweswater lake.***

**Lisa Norton, CEH Lancaster) and Jeremy Barlow (National Trus)**

**Summary of Proposed activity:** Employment of an experienced hydrogeomorphologist to survey the streams flowing into Loweswater lake in order to provide information on potential causes ofsediment movement into the lake and factors that may limit the potential of these streams as spawning areas for fish. Production of a report discussing the findings and potential mitigation measures and informal feedback of findings to a community meeting. The work will consider and review the stream’s hydro-morphological dynamics, initially based on a review of historical data (including NT archaeological data) and mapping observed changes in the planform position of the rivers within the catchment of the lake. Following this, catchment review of sediment vulnerability of the catchment will be undertaken using remote sensing information and analysis of Digital Terrain Data for the catchment (OS, SAR, or LiDAR data) following protocols est. in the Wharfedale RELU project lead by Durham University.

This will provide background information on channel long section gradients and also enable targeting of specific stream reaches for detailed field walking. Field walking of the main stream reaches will be undertaken by Dr. Nick Haycock, recording channel and Floodplain geomorphological features, alluvial and colluvial depositing and the macro-valley scale dynamics of the river system. Detailed inspection of current bank and bed erosion will also be inspected and mapped, with photographic record taken of left and right bank features. Exposed gravel features will be insected for sediment size range and also evidence of fine silt accumulation within potential spawning gravels. Field walking will follow a subset of geoRHS protocols. Upon completion of field work, the report will document historical and current geomorphology of the valley and river system and report on issues and potential opportunities and conflicts in relation to the lake management and sediment/fisheries issues.

**Main Aims of Proposed activity:** Recent informal surveys (relating to fish populations) of the inflow to Loweswater with Maggie Robinson of the Eden Rivers Trust (now Natural England) revealed a number of potential issues relating to stream hydrogeomorphology and changes in stream manage-ment by the Environment Agency at the inflow to Loweswater. These issues include movement of sediment into the lake and resulting potential impacts on movement of fish upstream from the lake. Similarly, there is a lack of understanding about the extent to which changes in management of the outflow of the lake may have resulted in impacts on the lake including sediment retention and reduced outflow. The aim of this project will be to get an expert opinion on the hydrogeomorphological status of the in and out flows of the Lake which will help towards deciding on management options to improve the catchment.

**By what Means will the Aims be Achieved:** Report, presentation and discussion with the community of findings and potential management options**.** The report will consist of a reach based description of the river system along the lines of a fluvial audit. This will be supported with maps at A3 with corresponding data available to the client in ArcInfo GIS data layers. All photos with be GPS coordinated and provided in hardcopy and digital formats.

**Why is it important?** Because there are perceptions within the community that changes in the management of these inflows and outflows may contribute to lake quality issues as well as to localised flooding and it would be good to get an expert opinion. The project will build on the protocols and knowledge based in other RELU projects based in the Lake District and Yorkshire Dales. The report will be available to the RELU community and add to the survey data help by NT, EA and RELU for the Lake District.

**Who is involved?** Dr Nick Haycock, Lisa Norton and National Trust representative (latter two at no cost).

**Desired Outcomes:** A better understanding of the influences on sediment movement into and out of the streams and the lake at Loweswater and how this might relate to 1) pollution impacts on the lake, 2) fish populations in the streams and the lake, 3) localised flooding of streams and the lake.

***4 )TITLE: Tourism in a Quiet Valley***

David Davies and Emer Clarke

**Summary of Proposed Activity** : Via members of the LCP, and beyond where appropriate, to explore local understandings and feelings about the future of Loweswater – especially in regard to Loweswater as a tourist destination. Describe in summary the current forms of tourism which exist in Loweswater . Explore Loweswater residents’ ideas/hopes/fears for different forms of tourism in Loweswater. Research the potential and capacity for change and innovation in the forms of tourism possible in the valley which has expressed support for “quiet tourism”.

**Main Aims of the Proposed Activity:** to understand the role/scope/quality of current tourism in Loweswater ; to establish whether LCP members support the idea of innovation in tourism in Loweswater; to examine the role of “ institutions” in the development of tourism in Loweswater.

**By what Means will the Aims be Achieved?** Research will be carried into existing forms of tourism and tourist activities in Loweswater (e.g. visitor numbers; overnight stays at camping barn, bothies, hotels; typical visitor activities; visitor values). This will be achieved through data and statistics collections and via appropriate observational methods with the membership of the LCP and University Research Team; Beginning with the membership of the LCP, local people’s view on the future of Loweswater, and forms of tourism as a part of that future, will be surveyed by questionnaire and semi-structured interviews ; a relatively small number of respondents is envisaged (up to 12); Based on the results and reflexive analysis of interviews, ideas for future forms of tourism in Loweswater will be explored.

**Why is it Important?**

This research will address the question of what kind of *future* Loweswater might have and will look in particular at the role of tourism in the collective imagination of the Loweswater Care Project. The research will add to and complement the knowledge base of the overall RELU project which aims to understand the interrelatedness of ecology, economy and society in Loweswater. The emphasis on asking local residents and businesses to look forward has not, so far, been a strong aspect of the RELU project. This project would get people thinking about the future and what desires and responsibilities people feel about the future of Loweswater.

**Who will be involved ?**

Professor David Davies , resident of Thackthwaite, Loweswater, and formerly of the Universities of Derby, Surrey and Birmingham. Emer Clarke, resident of the catchment and expert in Learning and Skills Development; Director of the LSC for Cumbria. Membership of the LCP and residents of Thackthwaite, Lorton and Loweswater. Local organisations and businesses.

**Desired Outcomes:** An in-depth understanding of the way that local residents and businesses see the future of the catchment of Loweswater; Understanding of the potential economic and social challenges facing the area; Understanding of the role of tourism in the current economic, ecological and social viability of the catchment; A bottom-up exploration of forms of tourism that LCP residents could imagine seeing in the catchment in the future.

***5) TITLE: Linking historical land-use changes with paleolimnological records of nutrient changes in Loweswater lake***

**Angus Winchester and Helen Bennion**

**Summary of Proposed activity:** Historical records of land use and land management will be linked with an existing paleolimnological study. This will allow periods of change in diatom composition and inferred concentration of total phosphorus to be identified in order to match to historical changes in land use.

**Main aims of Proposed Activity:** To understand how historical changes in the catchment have influenced Loweswater in the past to place recent changes into a broader historical context.

**By what Means will the Aims be Achieved:** Data from an existing, dated, lake core from Lowes-water (Bennion) will be matched with historical records of change from the catchment (Winchester). A postgraduate history student from Lancaster University will be employed under the direction of Angus Winchester to undertake the necessary research in the Parish Summaries of Agri-cultural Stats since 1866 at The National Archives, Kew, and also to work on 16th/17th-century probate inventories for Loweswater, which are held in Lancashire Record Office, Preston.

**Why is it important?**

The project will identify a baseline of lake response to initially low-levels of alteration in the catch-ment leading up to the more intensive changes that occurred after about the 1950s. It would also help to identify the major drivers of change within the catchment over a historical time-period.

**Who is involved?** Helen Bennion (UCL), Angus Winchester (LU) and a student.

**Desired outcomes:** A report detailing historical changes in land use and their effect on the lake ecology. This will provide an important baseline for our contemporary studies on the impacts of processes within the catchment on lake ecology**.**

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