Department of the Environment
and the
Severn Trent Water Authority

389/1

NITRATES IN GROUND WATER CONTROL THROUGH PROTECTION ZONES

Proposals for
THE ECONOMIC COMPONENT OF THE STUDY

Submitted by
LAURENCE GOULD CONSULTANTS LIMITED

July 1986

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I. INTRODUCTION

A meeting was held on 16th June between Dr. A. Skinner and Mr. R. Harris of the Severn Trent Water Authority (STWA) and Mr. H.D. Thompson and Mr. C.H. Mathias of Laurence Gould Consultants Limited (LGC). The discussions centred around STWA's proposals for a study to assess the impact of various land use and nitrogen fertiliser control options as a means to regulate the level of nitrate present in groundwater in a specific area of Staffordshire. During the meeting LGC were requested to prepare proposals for the economic component of the study. LGC has pleasure in submitting these proposals for consideration by the Department of Environment (DOE).

II. BACKGROUND

In 1985 LGC completed a Research Contract for the DOE entitled 'Reduction of Nitrate in Water Supplies: An Economic Study of Water Treatment Compared with the Effects of Lower Fertiliser Usage'. The study concentrated on two aquifers, one in Lincolnshire, the other in Cambridgeshire. Following its publication, STWA studied the report and came to the conclusion that although the study was useful the findings may not be specifically relevant to the Authority due to the different characteristics of the groundwater nitrate problem and intensity of agriculture within STWA's catchment area.

Although the nitrate problem in the STWA catchment area is not serious at present, STWA believe that, in the long term, continuation of existing farming practices will mean that the level of nitrate in groundwater will exceed the European Economic Community (EEC) limits of 50 mg/litre in many parts of their catchment area. However, STWA also believe that due to the lower intensity of farming practices, compared with East Anglia, and the different aquifer and meteorological characteristics, that the ultimate level of nitrates can possibly be controlled by a policy of restricting land and nitrogen fertiliser usage, thereby removing the need to treat the groundwater at some point in the future.

STWA have therefore instigated a study in which the objectives are to:

- identify those control policies which will prevent the long term level of nitrates exceeding EEC admissible levels;

- establish whether it is practical to introduce one or a combination of several of the control policies identified as being feasible;

- evaluate the financial impact on farms subjected to the alternative control measures identified;

- undertake a financial assessment of the proposed options considered to be feasible for the study area as a whole.

STWA have selected a study area of approximately 3200 hectares near Stoke-on-Trent in Staffordshire which is considered to be representative in terms of both aquifer characteristices and farming practices. Work has commenced on collecting and collating historical data on land use, nitrate concentration and the aquifer modelling components of the study. To this end STWA have enlisted the assistance of the Water Research Centre (WRC), the British Geological Survey (BGS) and the Ministry of Agriculture, Fisheries and Food (MAFF) and have approached LGC to undertake the economic component of the study. It is anticipated that close liaison will be maintained throughout the assignment with WRC and MAFF in the preparation of data.

III. APPROACH

A. LIAISON

The Consultants are sensitive to the growing public concern being expressed about the increase in nitrate levels in water supplies resulting from the greater use of nitrogen fertiliser on crops and grassland. This, together with the current public debate on conservation and surplus production has led to an increase in farmer's sensitivity on these issues. There is therefore a need for liaison with interested bodies in order that the water and agricultural industries can together seek to develop practical policies in the best interests of the community. Close liaison throughout the study is therefore considered to be vital and the Consultants will participate in meetings with all parties involved and direct liaison will be maintained with team members.

B. FARMER INTERVIEW SURVEY

Our experience in collecting the statistical and agricultural data for the DOE Research Contract has led to the conclusion that a similar approach is not appropriate for a small study area of 3200 hectares. Consequently, it is proposed that following discussions with the National Farmers Union (NFU) and the Country Landowners Association (CLA) a farmer interview survey is undertaken throughout the area to establish:

- existing and future level of nitrogen fertiliser usage if no control measures are introduced;
- enterprise performance levels;
- current cropping and stocking;
- livestock production systems;

- proposed changes in farming systems if no nitrogen fertiliser or land use restrictions are imposed;

- future farm investment policies assuming no control measures are introduced;

This data would be used as a cross check on the statistical information collected by other team members and to provide a detailed and factual framework upon which the economic analysis can be based. In addition, the survey will be used to gather farmer's opinions and their response, in terms of charges in farm policy, to the feasible restriction options identified.

It is estimated that there are some 15 farmers within the study area.

C. FINANCIAL AND ECONOMIC ANALYSIS

1. Impact of Feasible Land Use Control Measures on Farm Profitability

In conjunction with MAFF, the effects of nitrogen fertiliser restriction options on livestock and arable enterprise performance levels will be demonstrated. To this end close liaison will be maintained with MAFF and the results of the interview survey will also be taken into account when considering resultant changes in farm policy. The impact of land use controls will also be shown.

The financial effect of the feasible restriction options will be demonstrated by a series of farm budgets for typical farms identified during the interview survey. The budgets will indicate levels of profitability if no controls are imposed and a comparison made with levels of profitability under the various restriction options considered feasible.

2. Financial Analysis

The results of MAFF's and LGC's agronomic investigations into current and future levels of agricultural production and fertiliser usage within the study area as a whole would be converted into financial data. A similar conversion would be undertaken for the depressions in enterprise performance caused by reduced levels of nitrogen fertiliser usage and land use controls assumed.

A series of annual cash flows would be constructed showing the effect of the various control options which would be compared with the annual cash flow for the current and likely future pattern of agricultural production and fertiliser usage, assuming no controls are introduced. The annual agricultural disbenefits for each scenario would be determined by deducting the relevant cash flow from the cash flow representing the currently planned level of production. Where appropriate, other factors such as a possible reduction in farm overhead costs, would be incorporated into the cash flow streams.

The analysis will use discounted cash flow techniques. The Present Value of agricultural disbenefits would be compared with the Present Value of the engineering capital and annual operating costs saved by not having to lower the level of nitrate to 50 mg/litre, for each option considered. A range of discounted measures of project worth would be used to compare the various options, (e.g. Benefit : Cost Ratios and Internal Rates of Return).

3. United Kingdom Economic and European Community Economic Analyses

These analyses would be undertaken if required.

a. United Kingdom Economic Analysis

This analysis would represent the effect of the alternative feasible options from the point of view of the United Kingdom. In principle it would be similar to the financial analysis but would use commodity values that are published by MAFF.

b. European Community Economic Analysis

The analysis of the various scenarios in financial terms measure the benefits or disbenefits to the individuals concerned. If required, an European Community economic analysis would be undertaken to convert the engineering costs and agricultural disbenefits used in the financial analysis to those which more accurately measure their value to the European Community economy (efficiency or economic prices). This method, based upon the authoritative method postulated by J. Price Gittinger, is used by the World Bank (and with minor variations by most international agencies concerned with capital transfer) when assessing the economic viability of agricultural projects prior to approving loan finance for their implementation. This methodology is internationally recognised and is therefore considered an appropriate approach for comparing the effects of land use restrictions, and reduced nitrogen fertiliser usage and water treatment costs.

As it is based on efficiency prices the analysis assesses the effects of the various options on Community income. In calculating the efficiency prices the methodology is consistent with other methodologies but the analysis stops with the determination of efficiency prices and does not attempt to weight those values to allow for the effects on income distribution.

The changes needed to convert the costs, benefits or disbenefits used in the financial analysis can be divided into three steps.

i. Direct Transfer Payments are excluded. These are payments that do not represent the use of real resources but only the transfer of resources from one person to another (e.g. taxes, duties and subsidies).

ii. Adjustments are made for the distortions in the farm gate prices due to subsidies received by producers through the CAP 1/. The effect of these subsidies are eliminated by determining the value of agricultural commodities in border prices (the cif 2/ value for imported items and the fob 3/ value for exported items). The border prices are then adjusted for transport and marketing costs between the point of import or export and the study area.

1/ Common Agricultural Policy of the European Economic Community.

2/ Carriage insurance and freight - the value of the commodity on the ship at the dockside at the importing port.

3/ Free on board - the value of the commodity on the ship at the dockside of the exporting port.

iii. Adjustments are made for distortions in the prices of the capital and operating costs of the various options (e.g. the water treatment works and any agricultural costs saved). This is a more complex process and involves revaluing in border prices the disaggregated components which are traded internationally.

IV. STAFFING AND TIMING AND COSTS

A. STAFFING

The nominated consultant to undertake the economics component of the study is Mr. C.H. Mathias. Mr. Mathias was Team Leader and Senior Economist on the Research Contract undertaken for the DOE. His curriculum vitae is presented in Appendix I.

B. TIMING

It is understood that the draft final report will be completed in May 1987. LGC wish to confirm that this deadline can be met.

C. FEES

The budgeted cost for the assignment is as follows:

Stage 1 : Financial Analysis

	£	£
Consultancy Fees	11,400	
Expenses	700	
Sub-total	12,100	12,100

Stage 2 : UK and EEC Economic Analysis (Optional)

Consultancy Fees	4,275	4,275
Total		16,375

In addition, VAT would be charged at the prevailing rate.

V. CONCLUSION

Laurence Gould Consultants Limited is well equipped to contribute the specialised economic input to this assignment (see Appendix II) and is able to provide considerable relevant experience. The Consultants' would welcome the opportunity to discuss these proposals with DOE and STWA, amend them if necessary, in the light of budgetary and timing constraints, and look forward to receiving further instructions.

for LAURENCE GOULD CONSULTANTS LIMITED

H.D. THOMPSON
Managing Director

APPENDIX I

CURRICULUM VITAE

NAME:	MATHIAS, Christopher Hawes
DATE OF BIRTH:	1946
NATIONALITY:	British
MARITAL STATUS:	Married
QUALIFICATIONS & PROFESSIONAL AFFILIATIONS	B.Sc. (Agric.) Wye College, London University Post Graduate Diploma in Farm Business Administration, Wye College. Member of the Institution of Water Engineers and Scientists Member of Agricultural Economics Society Member British Institute of Management. Member of the International Commission of Irrigation and Drainage
EXPERIENCE:	Mr. Mathias joined Laurence Gould Consultants Limited in 1969 as a Farm Management Consultant, following eighteen months working as a farm manager on a 220 ha mixed farm. After three years in the Farm Management Division, Mr. Mathias transferred to Farm Appraisals and in 1973 assumed overall responsibility for the Division. Two years later he moved to the UK Studies Division and since then has specialised in assignments requiring skills in land use, feasibility studies, agricultural economics and project analysis, both in the UK and overseas. Mr. Mathias also owns and manages a 110 ha arable farm. Apart from his farm planning experience other relevant assignments are as follows:
Ongoing	Consultant to the Severn Trent Water Authority advising on the Agricultural monitoring of the Shropshire Groundwater Scheme. Responsible for the assessment and negotiation of claims that may arise from the draw down of the water table during pumping.
1986	Study Consultant in the environmental team advising Thames Water Authority on the Lower Colne Study. Specific responsibilities include agriculture, fish farming, ownership of land and river structures and assistance in creating a data base for recreation and amenity interests.

MATHIAS C.H. Continued .....

Team Leader and financial analyst on a study to determine the feasibility of a starch plant. The assignment is being undertaken for the Potato Marketing Board. The study components include process and civil engineering, site selection, effluent control, marketing, transport and finance.

Member of an integrated study group undertaking an environmental impact assessment of the Wimbleball pumped storage scheme. The assignment is being undertaken for the SWWA and specific responsibilities are to examine the effect of the proposed pipeline routes on agriculture, land holdings and land drainage with a view to determining the most easily promotable option at a Public Enquiry.

Member of a team undertaking an environmental impact assessment in the design stage of a reservoir scheme for WWA. Responsibilities include maintaining liaison with agricultural representative organisations, MAFF, County and Local Councils and determining the effects of the various options on land drainage, the viability of farms, disruption and restoration requirements.

1985 Member of an integrated study group advising WWA on the land use, agricultural, environmental and recreational aspects of a number of possible reservoir and pumping station sites and pipeline routes in the Bristol/Avon area.

Member of an integrated team advising WWA on the planning, land use, agricultural and environmental aspects of various engineering options to improve the water resources in Somerset. In association with consulting engineers, the objectives of the study were to determine a short list of options ranked according to the likely ease of promotion at a Public Enquiry.

Study Consultant and economist on a research study into future land use changes in England, Scotland and Wales. Projections were made of the extent and location of land use changes. The study was undertaken on behalf of the Nature Conservancy Council.

Member of a small team which undertook a detailed investigation for the Department of the Environment into the Financial Guidelines under the Wildlife and Countryside Act 1981. Improvements to the Guidelines were recommended and specific responsibilities included the projection of the cost to Government over the next five years under the existing and proposed Guidelines.

Team Leader and Economist on a research contract to ascertain the comparative costs involved in reducing nitrate in water supplies. The study was undertaken in association with the Water Research Centre and Balfours for the Department of the Environment and the components included water treatment engineering, aquifer modelling, agriculture and economics.

1984 — Consultant to a major potato crisp manufacturer on their pricing and acquisition policy.

Study Consultant to Wessex Water Authority on the Brue Valley Flood Alleviation Scheme covering some 11,000 ha.

1984 — Team Leader for land use, landscaping, environmental and water resource aspects of a rural planning study on behalf of Sir William Halcrow and Partners for a public authority.

1983 — Team Leader for a survey of Thameside Drainage on behalf of the Thames Water Authority. The study components included environmental aspects, urban property, engineering, agriculture and economics.

Agricultural Advisor to Severn Trent Water Authority on the preparation of the proof of evidence for the House of Lords Select Committee Hearing on the River Soar Navigation Bill.

Agriculturalist and Economist for River Ray (Oxon) Land Drainage Scheme. The investigation included a benefit study of 5,700 ha with consideration of engineering and environmental aspects.

1983/82 — Study Consultant for agricultural benefit assessment for River Blithe Improvement Scheme for Severn Trent Water Authority. The benefit area is some 2,430 ha. The assignment included the forecasting of the likely rate of agricultural uptake following an assessment of conservation interests.

MATHIAS C.H. Continued ...

1982	Wrote and installed a project analysis program for use on ULG's (sister company of LGC) mainframe computer. From inputted base data, the program builds up the information into a project cash flow in either economic or financial terms.
	Economist/ Business Analyst on a team investigating the feasibility of establishing a venison processing and marketing co-operative in Scotland. The Study included a full business analysis of a company which processed and exported venison and other game before recommending whether the co-operative should acquire the company.
1981	Investigated the feasibility of installing a 3,500 tonne per annum seed processing plant. The assignment included a detailed analysis of producer benefits and an application for grant aid.
1981/80	Study Leader for feasibility study of Soar Valley Improvement Scheme for Severn Trent Water Authority. This scheme applies to an agricultural area of some 3,000 ha. The assignment included the forecasting of the likely rate of agricultural uptake with associated costs and benefits after accounting for conservation interests.
1980/1979	Study Leader and Project Economist on team investigating agricultural and urban benefits from proposed flood control measures by Severn Trent Water Authority on the River Severn. The project area extended to 24,500 ha.
1979	Team Leader on a study to advise the N.C.B. on the management policy of their 14,500 ha Estate in South-Wales, including 4,000 ha of Common Land. The assignment involved land use classification, assessment of farm profitability, landlords repair liability and the valuation of some 50 tenanted holdings in order to devise a management strategy.
1978	Pakistan: Project Economist on a team studying the potential benefits from reclaiming 100,000 ha of land affected by waterlogging and salinity in the Punjab. Study undertaken in conjunction with Consulting Engineers for ODA.

MATHIAS C.H. Continued ...

1977 Undertook several insurance assignments, including assessment of quantum and public liability and negotiation of settlements. Acted as expert witness at Agricultural Land Tribunals in succession of tenancy cases.

Undertook a full business appraisal of one of the largest top fruit farms in the UK.

Economist on a team studying the potential agricultural benefits from constructing a barrage across the River Yare from Rendle, Palmer and Tritton as part of the feasibility study prepared for Anglian Water Authority.

1976 Marketing Economist on a team examining the feasibility of integrating two Scottish farmer co-operatives producing frozen vegetables.

Economist on a team undertaking a regional farmer attitude survey to determine the feasibility of establishing a sugar beet factory in North-West England.

1975 Sudan: Project Economist on a team studying the technical, financial and marketing requirements for a large scale beef and sheep fattening complex, including the establishment of a pumped irrigation system.

1974 Iran: Member of an investment study team for the development of a large scale dairy complex.

APPENDIX II

RELEVANT EXPERIENCE

RELEVANT EXPERIENCE

1. Environmental Studies

Department of the Environment - Reduction of Nitrate in Water Supplies : An Economic Study of Water Treatment Compared with the Effects of Lower Fertiliser Usage

A comprehensive technical and economic study undertaken by Laurence Gould Consultants in association with Balfours and the Water Research Centre into the water treatment costs that would be saved by reducing nitrates in groundwater compared with the agricultural disbenefits caused by restricting nitrogen fertiliser usage. Two catchment areas of some 20,000 ha. each were investigated. The study included an analysis of the water treatment options, aquifer modelling of nitrate concen-trations, crop yield and land use projections under different fertiliser restriction scenarios and a full financial and economic analysis.

Department of the Environment - Wildlife and Countryside Act 1981 - A Review of the Financial Guidelines for Management Agreements

The study comprised a detailed investigation into the current financial guidelines, including interviews with the major Conservation authorities, National Parks, MAFF and District Valuers. Improvements to the financial guidelines were recommended and projections of the cost to Government over the next five years were made under the existing and proposed guidelines.

Nature Conservancy Council - Changes in Land Use in England, Scotland and Wales - 1985 to 1990 and 2000

An assessment of the potential area of land in Great Britain that might be released from agricultural production. Factors affecting the choice of land which might be released were identified and the likely geo-graphical location of the land was indicated. An assessment was also made of the nature of land use following its release from agricultural production.

Nature Conservancy Council - Negotiation of Management Agreements

Management Agreements have been negotiated under the Wildlife and Countryside Act 1981 for both the Nature Conservancy Council and individual land owners.

Reservoir Site Study

Laurence Gould Consultants Limited were responsible for the land use, conservation and environmental aspects of the study. The assignment covered a wide range of aspects leading to the selection of a short list of preferred reservoir sites for possible promotion at a Public Enquiry.

Thames Water Authority - Lower Colne River Management Study

Member of a co-ordinated study group advising TWA and Sir William Halcrow and Partners on the environmental impact of various engineering options for improving the river management of the Lower Colne. Specific responsibilities are for land use, establishment of land ownership and advice on some recreational aspects.

Wessex Water Authority - Somerset Water Resources

Member of an integrated team advising WWA on the planning, land use, agricultural and environmental aspects of various engineering options to improve the water resources in Somerset. In association with consulting engineers, the objectives of the study are to determine a short list of options ranked according to the likely ease of promotion at Public Enquiry.

Wessex Water Authority - Bristol Avon Reservoir Study

Member of an integrated study group advising WWA on the land use, agricultural, environmental and recreational aspects of a number of possible reservoir and pumping station sites and pipeline routes.

South West Water Authority - Wimbleball Pumped Storage Scheme

Member of an integrated team undertaking an Environmental Impact Assessment on behalf of SWWA. Specific responsibilities were to examine the effect of proposed pipeline routes on agriculture, land holdings and land drainage with a view to determining the most easily promotable option at a Public Enquiry. The investigations incorporated relevant conservation issues.

2. Water Authority Land Drainage/Flood Alleviation Assignments

Anglian Water Authority - Preliminary Identification of Potential Benefits from Flood Control of the Yare Basin

A preliminary economic and financial appraisal was undertaken to establish the likely benefits and cost of improving agricultural production for a range of alternative flood control measures.

Anglian Water Authority - Detailed Appraisal of Agricultural Development following Instigation of Flood Control Measures of the Yare Basin

A telephone and personal farmer interview programme was carried out to help assess attitudes and intentions towards land improvement following flood control and drainage works on 28,000 ha. A full economic and financial appraisal of the costs and benefits over a twenty year period was undertaken.

Anglian Water Authority - Detailed Appraisal of Likely Agricultural Development following Instigation of Flood Control Measures of the River Blithe

A personal interview programme was undertaken of the principal farmers/landowners in the study area of 7,250 ha. and an analysis made of the present and probable future farming operations. A full economic analysis was made of the alternative proposals.

Anglian Water Authority - Lincoln Flood Alleviation Scheme

An urban benefit assessment for the City of Lincoln in association with Sir William Halcrow and Partners and Middlesex Polytechnic. The study involves detailed mathematical modelling of channel flows for different flood events and a complete land use survey of the city area likely to be affected by different flood events.

Anglian Water Authority - Public Inquiry into the Lincoln Flood Alleviation Scheme

Laurence Gould Consultants were retained to submit evidence on the agricultural implications of the proposed flood alleviation schemes. Preparation for the Inquiry included making a detailed assessment of the implications for all farmers potentially affected in the proposed washland areas. The Inspector recommended that the Scheme should proceed.

Severn Trent Water Authority - Feasibility Study of Flood Alleviation Scheme for the River Severn between Avonmouth and Worcester

A comprehensive feasibility study was prepared for an area of 24,500 ha. Agricultural benefits and costs were assessed for sixteen sub-project areas. The Consultant was responsible for co-ordination of all the study components, including engineering and conservation, and carried out the financial appraisal of the alternative options.

Severn Trent Water Authority - Study of Soil Moisture Monitoring of the Shropshire Groundwater Scheme

A technical appraisal of alternative soil moisture monitoring techniques leading to costed recommendations for the Shropshire Groundwater Scheme area. To help with the design of the monitoring programme, a land units map was drawn up based on single parameter classification of the project area, for example, soils, land use, soil moisture regimes.

Severn Trent Water Authority - Soar Valley Improvement Scheme : Detailed Assessment of Agricultural Benefits and Costs

A telephone and personal farmer interview survey, together with statistical anlaysis of parish data, was undertaken in order to prepare a detailed financial appraisal of the likely benefits and costs for improved agricultural practices following implementation of a proposed flood alleviation scheme. The project area covered some 3,000 ha. and was sub-divided into six river reaches.

Severn Trent Water Authority - Consultancy Retainer for Soil Moisture Monitoring and Agricultural Aspects of the Shropshire Groundwater Scheme

The provision of advice on the installation of soil moisture monitoring sites, and the analysis and reporting on the results obtained annually. Also, guidance on the agricultural implications of the scheme, Phase I of which will apply to some 3,300 ha.

Severn Trent Water Authority - River Blithe Improvement Scheme

An agricultural benefit study of some 1,050 ha. subject to land drainage and flooding. The study included land capability assessment and an attitude survey of a representative sample of farmers in the area to establish likely agricultural improvements following an improvement scheme.

Severn Trent Water Authority - House of Lords' Select Committee Hearing on the Soar Valley Bill

Laurence Gould Consultants were the retained Consultant to prepare and present the agricultural case on behalf of STWA at this Hearing. The agricultural proof of evidence included a full economic appraisal to demonstrate the viability of the STWA proposal. The select committee ruled that STWA should be awarded the Bill.

Thames Water Authority - River Ray (Oxon) Land Drainage Scheme

A comprehensive study of the River Ray catchment area, covering some 5,700 ha. The study comprised agricultural, engineering, environmental and financial appraisal components. Laurence Gould Consultants had overall responsibility for the assignment, in association with Sir William Halcrow and Partners and Monks Wood Experimental Station, ITE.

Thames Water Authority - Survey of Thameside Drainage

A survey of some 16,000 ha. of land effected by the river Thames between Lechlade and Marlow. The assignment included agricultural, urban, engineering, conservation, navigation and economic components.

Wessex Water Authority - Brue Valley Flood Alleviation Scheme

The study area amounted to some 11,000 ha. and the study components comprised agriculture, conservation, financial and economic appraisal. Wessex Water Authority were responsible for the engineering component of the study. An attitude survey of 100 farmers in the area farms was an important part of the overall benefit assessment.