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BURA IRRIGATION SETTLEMENT PROJECT

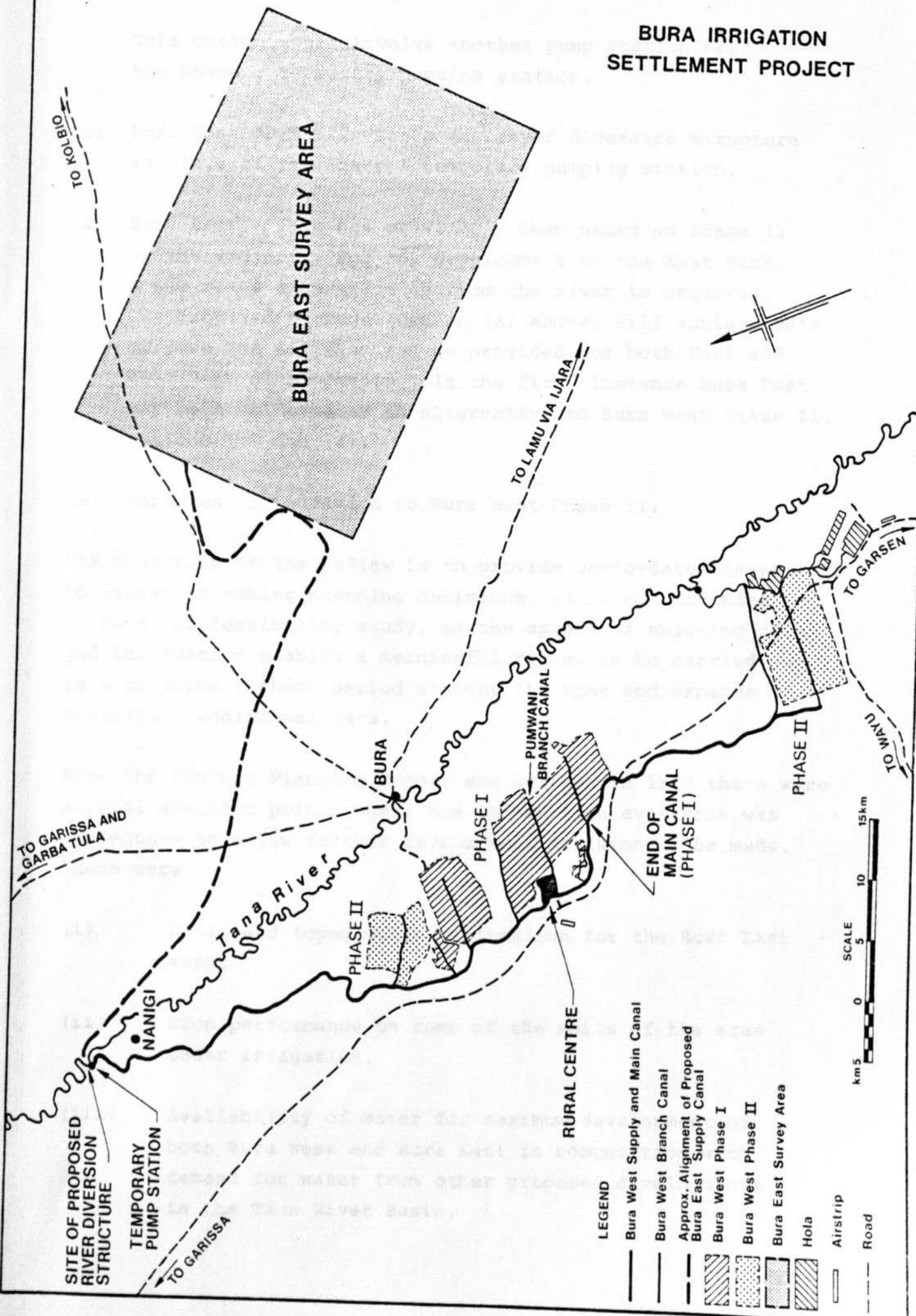
SUBMISSION NR W.12

PROJECT ECONOMIC REVIEW, 1981

MAY 1981

Sir M. MacDonald & Partners Limited
Consulting Engineers
Demeter House, Station Road
Cambridge, England

BURA IRRIGATION SETTLEMENT PROJECT



This option would involve another pump station near the Phase I temporary pumping station.

- (c) Bura West Phase II with a new river diversion structure in place of the Phase I temporary pumping station.
- (d) Bura East. This has previously been named as Stage II of the Project. For any development on the East Bank, a new means of extraction from the river is required. The proposed barrage (Option (a) above) will achieve this purpose and offtakes can be provided for both East and West Bank developments. In the first instance Bura East may be considered as an alternative to Bura West Phase II, options (b) and (c).
- (e) Bura East in addition to Bura West Phase II.

The objective of the review is to provide up-to-date assessments to assist in making planning decisions. It is not intended to be a new feasibility study, as the extent of existing data and information enables a meaningful review to be carried out in a relatively short period without the time and expense of collecting additional data.

When the Project Planning Report was written in 1977 there were several specific points where the information available was inadequate to allow further development decision to be made. These were

- (i) Soils and topographic information for the Bura East area.
- (ii) Crop performance on some of the soils of the area under irrigation.
- (iii) Availability of water for maximum development of both Bura West and Bura East in competition with demand for water from other proposed developments in the Tana River Basin.

The situation has now changed to the extent that soils and topographical surveys have been carried out in Bura East and these have shown that the area of soils of high suitability for irrigation in Bura East is less than was originally hoped. This has therefore increased the importance of the soils of marginal or untried suitability for which crop performance trials were recommended in the Project Planning Report. Conversely, it means that the availability of water is less likely to be a critical factor. For this reason it is concluded that new hydrological studies are beyond the scope of the present Economic Review.

It is assumed that crop performance trials will be incorporated in the first areas of Bura West Phase I to be cultivated under irrigation later this year, but clearly data and information from them will not be available for the 1981 Economic Review. Some preliminary conclusions may, however, be obtained from the recent work on the Hola Irrigation Scheme and from a detailed examination of the recently completed Kenya Soil Survey report on the Bura East area. This could hopefully lead to the equation of areas on East and West banks with appropriate crop yield predictions which would only need to be confirmed when the crop performance trials are carried out.

The following aspects will be examined

- (i) Areal extent of the soils of high and marginal suitability
- (ii) Infiltration rates on topsoil and subsoil horizons
- (iii) Sub-soil hydraulic conductivities
- (iv) Estimates of deep percolation
- (v) Probable behaviour of salts and alkali components when the soils are irrigated
- (vi) Feasibility of land-levelling when saline-alkali subsoils are close to the surface.

3. Detailed Terms of Reference

These are as follows :-

3.1 Collection of Data

The NIB will make arrangements for the Consultants' staff to have access to all existing data and information available at the offices of the NIB, the TRDA and appropriate departments of the Ministries of Agriculture and Economic Planning and will give permission for copies to be made where this is necessary for further analysis or reproduction of the data in the Consultants' Report.

3.2 Soils Survey Review

An experienced Soils Specialist will review all pedological factors controlling development in both Bura West and Bura East. This will entail visiting the areas identified by previous soil surveys, examining all data and information collected in the recently completed Bura East Soil Survey and comparing this information with the equivalent data available for the Bura West command. Sample areas in the Lower Tana basin with similar soils which are currently or have previously been irrigated will also be visited and compared with the soils of the Bura East and West areas.

The following aspects will be examined

- (i) Areal extent of the soils of high and marginal suitability
- (ii) Infiltration rates on topsoil and subsoil horizons
- (iii) Sub-soil hydraulic conductivities
- (iv) Estimates of deep percolation
- (v) Probable behaviour of salts and alkali components when the soils are irrigated
- (vi) Feasibility of land-levelling when saline-alkali subsoils are close to the surface.

The study of the above factors will be made in conjunction with the agronomic studies and will be varied as necessary to provide the information required by the agronomist.

3.3 Crop Yield Productions *projections*

Previous studies and reports have recorded the need for crop performance trials on the predominant soils of the project. The recent soils survey results on Bura East have emphasised this need and, until some crop trials under irrigation are carried out on these soils, it will be difficult to predict crop yields with confidence. Nevertheless it is necessary to make provisional crop yield predictions now based on present information and data. This will permit the comparison of the different development options even though the precise economic evaluation may have to be confirmed at a later stage when crop trial data are available.

It is proposed, therefore, that a senior agronomist with experience of irrigated crop performance in various conditions in East Africa should join the review team. His task will be to review and update the previous agricultural studies in the light of changes which have occurred in the last four years. He will examine in detail the recently acquired soil survey information and work in close conjunction with the Soil Scientist in this task. He will also visit the Hola Irrigation Scheme and any other local schemes where irrigation is or has recently been used and study all crop production figures available in relation to all relevant factors including soils, climate, water quality, seed type and quality, fertilizer application and cultivation practice.

These studies will lead to a short report containing the range of crops for which future development can be planned with, for each crop, a prediction of the yields likely to be achieved on the various parts of the project together with any qualification which may be necessary where any uncertainties need to be resolved before final development decisions are made.

3.4 Bura West Phase I Completion Options

A short report entitled "Note on Physical and Financial Status - March 1981" has already been prepared by the Project Consultants on this subject. Because of financial shortages, various means of adjusting current and future contract commitments were considered with the objective of reducing the immediate cash requirements.

The Economic Review will examine in more detail the effect of delaying development of the part of the Phase I area lying south of the Pumwani Branch Canal by one year and evaluate the impact on cash flow and economic returns in greater detail.

3.5 River Diversion Structure

The Interim Design report on the proposed river diversion structure has just been revised by the Project Consultants and the revision is currently being printed for submission to the NIB. This report gives cost estimates and economic comparisons of the alternative means of supplying water (by barrage diversion or by pumping stations) to three development options :-

- (a) Bura West Phase I with no further development
- (b) Bura West Phase I plus 30 cumec diversion to Bura East (or Bura East and Bura West Phase II)
- (c) Bura West Phase I plus Bura West Phase II

All the data and information contained in this report will be suitable for use in the 1981 Economic Review in the evaluation of project options.

The conclusions are broadly that a barrage is to be preferred if development of the order of 30 cumec demand is to be implemented at any time, and that a barrage is also to be preferred, but with marginal difference in economics, if Phase II only is to be developed in the foreseeable future.

3.6 Bura West Phase II - Engineering Study

The engineering and building works required for enlarging the irrigable area on the Bura West project from 6,700 hectares (as in Phase I) to a total of 12,200 hectares, will be assessed. Such design work as is necessary will be taken only so far as is necessary to establish technical feasibility and to list and evaluate the works to be constructed.

These works will include, inter-alia,

- (i) The Phase II Pump Station. (Note that, although listed here, it is unlikely to be needed as the construction of a new river diversion structure is recommended as better option for this case).
- (ii) Increasing the capacity of the Phase I Supply and Main Canals
- (iii) Branch and minor canals and drains to the irrigable areas and associated structures and access roads
- (iv) Land levelling and other in-field works
- (v) Flood protection works
- (vi) Extension of the project road system
- (vii) Housing and associated infrastructure (which will involve an assessment of the extensions necessary to the project management organisation for the operation and management of the completed project).

3.7 Bura East - Engineering Study

An examination will be made of the project area and in particular of the location of the various blocks of better class soils within levels commanded from the proposed new barrage. From this examination and from the topographic and land class maps prepared by the recent surveys, a provisional irrigation layout will be prepared. In the limited time available it will not be possible to consider more than one general scheme and subsequent design studies (beyond the scope of this Review) will probably make considerable adjustments to minimise construction costs and maximise the irrigable area. However the first layout will be designed to include all reasonably sized parcels of good land together

with adjacent areas of marginal land to which irrigation can be provided at minimal additional cost.

For the scheme evolved above, cost estimates would then be prepared.

In all the above engineering studies, (Sections 3.4, 3.5, 3.6 and 3.7) costs will be estimated, where possible, on the basis of designs and data provided during the implementation of Phase I. Technical feasibility will rely on existing topographical survey and sub-soil information.

3.8 Project Economics

An Economic Review was carried out by the Project Consultant in June 1979. This was confined to the Bura West Phase I. The 1981 review has the same objectives but will extend to cover the options listed in preceding paragraphs.

An Agricultural Economist with wide experience of project appraisals of this type will carry out the economic and financial analysis. This will be based on crop production estimates provided by the Agronomist and engineering cost estimates provided by the Review team Engineer.

The Agricultural Economist will be responsible for estimating farm costs and market prices, for preparing cost and benefit streams, and for calculating the internal rates of return for the various options considered.

3.9 Review Conclusions

It will be the aim of the Review team to present a short report containing the economic analysis of each alternative together with the forecasted cash flow requirements.

4. Staffing and Programme

4.1 Review Team

The proposed Review Team could be mobilised to start work about 8th June provided that this submission is approved by 22nd May. The team would come under the overall direction of Mr P Chesworth, the Consultant's Resident Representative in Nairobi although, because of other heavy commitments on the project, Mr Chesworth is expected to be involved only at the initial stages for briefing the Review team and at the final stages when the report drafts are being prepared.

The Review team will comprise two full time members, namely, an Agricultural Economist and an Engineer. Additionally two short inputs from a Soils Specialist and an Agronomist will be required. The above team will carry out most of their work in Kenya visiting the project area and preparing designs, cost estimates, economic and financial analyses and draft sections of the report in Nairobi. A small input will be required by staff at the Consultant's Head Office where the report will be finalised.

The participation of NIB staff members will be welcomed as far as possible and all data and information collected, all figures calculated will be available for NIB inspection during the course of the team's work in Nairobi.

4.2 Staff Nominated

The following staff are nominated for the posts on the Review Team. C.V.'s are included in Appendix A.

Agricultural Economist	:-	Mr D H Potten
Engineer	:-	Mr K Howells
Soils Specialist	:-	Mr F Collier
Agronomist	:-	Mr R Goodyear

4.3 Programme

The programme (Figure 2) has been drawn up with a start date of 8th June to enable the Review to be completed by the end of July so that the report can be available in early August. It is proposed that the report should be drafted in Kenya.

A total of 19 man weeks of time will be required by the Review Team in Kenya. The work loads of the engineer and the economist are particularly heavy and therefore we propose that 4 man weeks of additional staff time should be included in the budget provisions. This would allow for some of the cost estimating work to be delegated to engineering staff in the Consultant's Head Office, or alternatively for an additional assistant to join the team in Kenya to assist both the engineer and the economist as necessary when the work is at its peak.

An allowance of 4 man weeks of time by a draughtsman is also required so that a limited number of maps and figures can be included in the report. These will include outline drawings of the layout of the proposed irrigation works for Bura West Phase II and Bura East areas.

It is assumed that these maps and figures would be prepared in the UK and that the report will also be printed in the UK. One week has been allowed for printing and binding the report.

Alternatively, if drawing office and printing facilities are available in Nairobi which can produce the maps and figures and do the printing and binding within the very tight schedule required, then these facilities will be used in preference to using the Consultant's UK facilities.

The report as presented in August may be considered as a draft report for formal comment or may be used as a working paper, as the NIB wish and time permits. The submission estimate does not include for time required to make changes if required by the NIB or for reprinting.

BURA PROJECT ECONOMIC REVIEW 1981 - PROPOSED PROGRAMME

Staff Member	June							July			August		Man Weeks	
	Month:	15	22	29	6	13	20	27	3	10	In Kenya	In U.K.		
	Dates:	8	15	22	29	6	13	20	27	3	10	10		
Week Nr:	1	2	3	4	5	6	7	8	9	10	2	0		
Soil Specialist											3	0		
Agronomist											7	0		
Agricultural Economist											7	0		
Engineer											7	1		
H.O. Support Staff											-	4		
H.O. Draughtsman											-	4		
											19	9		
											Total Man Weeks			

Time in U.K.

Time in Kenya

KEY

5. Administrative Arrangements

It is assumed that the NIB will provide the following facilities for the use of the Review Team in Kenya, without charge to the Consultant :-

- (i) Office accommodation comprising at least two rooms with adequate furniture (including one drawing board and stand) and all necessary stationery etc for the four-man Review Team
- (ii) Clerical assistance including typing facilities of a standard adequate for final report text preparation; also filing and photocopying facilities
- (iii) Transport in Nairobi for visiting other offices such as Ministries, KSS, etc
- (iv) Transport and accommodation during visits outside Nairobi, including travel by air from Nairobi to the project and back and field transport to visit Bura East, Bura West and other projects if necessary.

Sub total	KSh 5,218.0
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(ii) Man Work in Kenya (Schedule B3.2(a))

Designation	Assumed Basic Salary	Monthly Salary Rate	Number of Months	Amount
Engineer	9,000	3,333	1.75	5,832.75
Agricultural Economist	12,665	4,388	1.75	7,679.00
Soil Scientist	17,350	6,000	0.50	3,000.00
Agrochemist	17,350	6,000	0.75	4,500.00
Sub total				KSh 20,612.8

(iii) Accommodation Charge in Kenya (Schedule B3.2(b))

4.75 man months at KSh 9,000 / month = KSh 42,750

6. Cost Estimate (Schedule S3.4)

It is assumed that the Economic Review is considered as an Additional Service as defined in Section 5 of the Agreement for Consulting Services for Bura West, Phase 1, dated April 1978, and that remuneration to the Consultant will be made according to Schedule 3 of the Agreement. The following cost estimate has been prepared in accordance with the above assumption.

(i) For Work in the Consultant's Head Office (Schedule S3.1)

Designation	Assumed Basic Salary £	Daily Charge Rate	Number of Days	Amount £
Senior Staff	12 000	157.9	5	789.5
Assist. Staff	9 000	118.4	20	2 368.0
Draughtsman	5 000	65.8	20	1 316.0
Partner (Supervision)	19 326	254.3	3	762.9
			Sub total	<u>£ 5 236.4</u>

(ii) For Work in Kenya (Schedule S3.2(a))

Designation	Assumed Basic Salary £	Monthly Daily Charge Rate	Number of Months	Amount £
Engineer	9 000	3 113	1.75	5 447.8
Agricultural Economist	12 665	4 380	1.75	7 665.0
Soil Scientist	17 350	6 000	0.50	3 000.0
Agronomist	17 350	6 000	0.75	4 500.0
			Sub total	<u>£ 20 612.8</u>

(iii) Accommodation Charge in Kenya (Schedule S3.2(b))

4.75 man months at KSh 9,000 / month = KSh 42 750

(iv)	Reimbursable Expenses (Schedule S3.4)	
(a)	Air Fares 4 Nr. Economy Class Return Fares, London - Nairobi at £942	£3 768.0
(b)	Other Travel Expenses Estimated at 4 x £100	400.0
(c)	Air Freight charges on baggage containing books, equipment etc. required by Review Team staff Estimated at £800	800.0
(d)	Printing of drawings and report text in U.K. (assuming 30 copies of report are required). Estimated at £1 500	<u>1 500.0</u>
	Sub Total	<u>£6 468.0</u>

Summary Cost Estimate	£	KSh
(i) Staff time in U.K.	5 236.4	-
(ii) Staff time in Kenya	20 612.8	-
(iii) Accommodation in Kenya	-	42 750
(iv) Expenses	6 468.0	-
(v) 15% Contingencies	4 847.8	6 413
Totals	<u>£37 165.0</u>	<u>KSh 49 163</u>

POTTEN, D H - Agricultural Economist
B Sc (Hons) Economics, London School of Economics 1967
M.A. London School of Oriental and African Studies 1970

APPENDIX A

BIOGRAPHICAL RECORDS

Biographical Records for the staff nominated for the Review Team are given in the following pages in the order given below.

Agricultural Economist	D H Potten
Engineer	K J Howells
Soil Scientist	F W Collier
Agronomist	R Goodyear

The Economist, Agronomist and Soil Scientist are senior permanent staff members of the Sub-Consultants, Hunting Technical Services Limited.

All engineering input will be provided by permanent staff of the Project Consultants, Sir M. MacDonald and Partners Limited.

In addition he collaborated in a paper presented to an International Conference on the Okavango, which was held in Gaborone in August, 1974 (later published in Proceedings of the Okavango Symposium, 1977) and he edited the Technical Document produced by the project as a whole, a Preliminary Survey of the Economy of the Okavango Delta.

From 1975 to 1978 Mr. Potten was employed by the Institute of Overseas Development as an Economist on a Technical Cooperation assignment to the New Highlands.

For 18 months he worked with a French colleague in the Joint Office of Development and Planning, an economic research and advisory body which was set up and produced over 30 reports on aspects of the New Highlands economy.

In February, 1978 he was appointed Chief Grouping Officer to head a New Central Planning Office, establish procedures for and coordinate and coordinate policy-making, and to prepare a Development Plan. The 1978-1982 Transitional Development Plan prepared by the Central Planning Office, was adopted by the New Highlands Representative Assembly in August, 1978.

POTTEN, D.H. - Agricultural Economist

B.Sc. (Hons.) Economics, London School of Economics 1967
M.A. London School of Oriental and African Studies 1970

BORN: 1946

NATIONALITY: British

BACKGROUND AND EXPERIENCE:

From 1967 to 1969 Mr. Potten was a tutor in economics at the Chinese University of Hong Kong, (Chung Chi College), where he taught economic theory.

Following a year studying for an M.A. (Area Studies) at the London School of Oriental and African Languages, he joined the United Nations Association International Service in London where he was engaged in recruiting and training volunteers for service overseas.

In 1971 Mr. Potten went to Botswana as a Junior Professional Officer with the United Nations Development Programme. He spent two years in that position, assisting with the programming and administration of U.N. Technical Assistance.

From 1974 to 1976 Mr. Potten worked for the Government of Botswana, Department of Water Affairs, under a British Operational Assistance contract. His main work during this time was as Project Coordinator between Government and UNDP/FAO experts carrying out the Okavango Delta Investigation. This study was a multi-disciplinary study concerned with the possible development of resources in the Okavango Swamp and with the ecological impact of future changes in the water regime. Mr. Potten was the government officer responsible for disbursement of funds, employment of local staff and technical liaison with the UNDP/FAO team. In this role he had to participate in the work of many disciplines and ensure that the local staff were adequately informed on the progress of the study and the policy issues raised by it.

In addition he collaborated in a paper prepared for an International Conference on the Okavango, which was held in Gaborone in August, 1976, (later published in Proceedings of the Okavango Symposium, 1977) and he edited the first major Technical Document produced by the project as a whole, a Preliminary Survey of the Resources of the Okavango Delta.

From 1976 to 1978 Mr. Potten was employed by the Ministry of Overseas Development as an Economist on a Technical Cooperation assignment in the New Hebrides.

For 18 months he worked with a French colleague in the Joint Office of Development Planning, an economic research and advisory body which, inter alia, produced over 30 reports on aspects of the New Hebrides economy.

In February, 1978 he was appointed Chief Planning Officer to head a new Central Planning Office, establish procedures for aid coordination and economic policy-making, and to prepare a Development Plan. The 1978-1980 Transitional Development Plan, prepared by the Central Planning Office, was adopted by the New Hebrides Representative Assembly in August, 1978.

HUNTING TECHNICAL SERVICES LIMITED:

Mr. Potten joined Hunting Technical Services Limited as a permanent member of staff in December 1978.

His first assignment was for thirteen months as Senior Economist on the Sabah Regional Planning Study, in Malaysia. He had overall responsibility for all the economic studies carried out as part of this study. His own work included macroeconomic analysis, the projection of overall macroeconomic trends for a twenty year period, the formulation of alternative development strategies, and the development of a labour supply based economic growth model. He participated in sector studies in the forestry, fisheries, agriculture and mining sectors and prepared financial and economic analyses for prefeasibility studies in afforestation, tree crop development, glass manufacturing and timber processing.

In 1980 Mr. Potten was assigned as economist to the Banaba Island Resource Survey. This assignment involved fieldwork in Fiji, Nauru, Kiribati and on the island of Banaba in Kiribati. Mr. Potten organised a demographic survey on the island and studied all aspects of economic activity, including transportation, tourism potential, commercial activities, employment, incomes and financial resources. On return to the United Kingdom he proposed the agricultural economic analyses, carried out overall financial analyses for three different development options for the island, coordinated the inputs of 12 other team members and edited the draft final report.

In January 1981 he was assigned as Agriculturalist Economist to a World Bank financed Crop Intensification and Research Project in Sind Province in Pakistan. This input to the project included investigation of farmers credit requirements, coordination of the studies of seed, fertiliser and research requirements for the project conducted by other team members, economic and financial analysis, report preparation and the drafting of a loan application.

Languages

French, Chinese (Cantonese).

Publications:

'Okavango Bibliography'. 1st edition, July 1974. 2nd edition, November 1975 (61pp) BOT/71/506 Technical Note No. 1.

'Settlement and Resettlement in Ngamiland with Particular Reference to the Nxaragha Valley'. November, 1975 (44pp plus maps, etc.) BOT/71/506 Technical Note No. 4.

'Aspects of the Recent History of Ngamiland'. November, 1975 (29pp plus maps) BOT/71/506 Technical Note No. 5 Published in Botswana Notes and Records, Vol. 8, 1976.

'ETSHA - A Successful Resettlement Scheme'. Published in Botswana Notes and Records, Volume 8, 1976.

NAME & POST: K.J. HOWELLS - Engineer

QUALIFICATIONS: B.Sc. (Hons. 1st Class), University College,
Swansea, 1974

BORN: 16.6.1953

NATIONALITY: British

BACKGROUND AND EXPERIENCE:

Before graduating, Mr. Howells worked for a period with the Brecon Borough Council on road maintenance and drainage schemes, including field survey work.

Sir M. MacDonald & Partners

On joining the Firm in July 1974 Mr. Howells was attached to a team of engineers working on the feasibility study for the South Chad Irrigation Project (Eastern Area), and was concerned mostly with the design of the drainage system and of drain structures.

In April 1975, Mr. Howells was assigned to the Design Stage of the same project, and was involved in most aspects of the project, notably in the design of the open drainage system; calculation of earthwork volumes; design of culverts; preparation of bills of quantities; and setting out details for the canalisation and drainage systems. He was then concerned with the preparation of the Design Report.

During 1975 Mr. Howells was also concerned with the design of canal structures for the Aflaj Irrigation Project, Saudi Arabia, and with the preparation of addenda to the tender documents for the Buildings Contract on the Lower Khalis Irrigation Project, Iraq. He later worked on sample calculations for pipe culverts and also Quantities and Engineer's Estimate for one of the Irrigation, Drainage and Land Development Contracts on this Project.

In early 1976, his work included purchase of equipment for the South Chad Project Pre-design Survey, tender analysis for the Gesira Power Station Project, Somalia, contouring maps and plotting from aerial photographs for the Juba Sugar Project, Somalia, and some checking and estimating work for the Rahad Project, Sudan. He then spent three months in Nigeria engaged on the South Chad Pre-design Survey Report and, later, on design and tender document preparation work in connection with various stages of the South Chad Project. Mr. Howells also wrote a computer program to design night storage canals, and revised the canal and drain earthworks programs. Later he was engaged on canal and drain design, night storage reservoir design, computing earthworks and checking and revising standard designs in connection with the Juba Sugar Project, Somalia.

In November 1976 he was appointed Assistant Team Leader on Stage II of the South Chad Irrigation Project, Nigeria. His work included the preparation of computer programs for canal design and earthworks.

In April 1977, Mr. Howells was involved in reviewing existing designs for Phases I and II of the Bura Project, Kenya, and preparing a report on these.

In September 1977 he was appointed Design Team Leader on Stage III of the South Chad Project, responsible for the supervision of the design of the canals, layouts, structures, etc. He also spent some time modifying existing computer programs for the design of canals and drains. During 1978 Mr. Howells conducted a feasibility study for an extension to the South Chad Irrigation Project including the design for a proposed sprinkler layout.

In September 1978 Mr. Howells was appointed to the Lower Khalis Irrigation Project in Iraq which will eventually provide irrigation, land development drainage for 50 000 ha, together with buildings and monitoring equipment. Initially he was engaged on site design of structures and in-field works but from April 1979 became responsible for the site supervision of contractors' works including canal and drain structures, field drainage, canal lining and earthworks. In March 1980 he was also made responsible for the running of the site laboratory involving materials testing and quality control.

In October 1980 Mr. Howells returned to the Irrigation and Drainage department in Head Office, Cambridge, and since then has been mainly concerned with computer program development for sprinkler irrigation system design, preliminary design of a piped drainage disposal system in Iraq and with the design of a small pumping station and rising main for irrigation supply to the gardens of the Rahad Project Headquarters, Sudan. In addition, he has also been engaged on checking of contractor's alternative designs for hydraulic structures on the Bura Project, Kenya, and with re-design of a main canal escape regulator for the same project.

COLLIER Frederick W. - Soil Scientist

B.Sc Chemistry (Wales) 1956

B.Sc. Hons Soil Science and Biochemistry (Wales) 1957

M.Sc. Soil Science (Wales) 1960

C.Chem; M.R.I.C;

M.I.Biol. M.I.M.M.

BORN : 1934

NATIONALITY: British

BACKGROUND AND EXPERIENCE:

1957-1958; after graduation in 1957 continued as a member of a multidisciplinary postgraduate research team studying the intensity of grazing by sheep of upland pastures in Snowdonia, North Wales. His particular contribution was a study of the distribution of trace elements in rocks, soil and plant material and their relationship to pasture usage. Particular emphasis was placed upon the occurrence and distribution of copper and cobalt. Areas of copper and cobalt deficiency were identified and mapped. The laboratory work involved the calibration and operation of a D.C. arc spectrographic unit.

1958-1962 joined the Overseas Civil Service as a research officer and was seconded to the Chemistry department, Ministry of Agriculture, Kenya. Employed, initially as a member of a US-AID team, on soil and land classification studies for agricultural development. The work varied from reconnaissance level regional mapping studies to detailed investigations for irrigation and drainage schemes. The major cash crops involved included - sugar cane, tea, coffee, cotton, sisal and pyrethrum. Aerial photography was used extensively for the interpretation of geomorphology, soils, vegetation and land use and preparation of natural resource maps.

HUNTING TECHNICAL SERVICES LIMITED

1962-1964 appointed geomorphologist and soil scientist on the UNDP rural development project in Kordofan province of the Sudan. Responsible for the reconnaissance scale study and mapping of geomorphology, soils and land use of some 80,000 square kilometres. The major agricultural crops in the region were pennisetum millets, sorghum, maize, sesame, groundnuts and cotton.

1964-1966 soil scientist in charge of the reclamation section, Lower Indus Project, Pakistan. This was a major study for the rehabilitation and improvement of the southern part of the Indus Plains and covered an area of nearly five million hectares of irrigated land, of which a large proportion was affected by waterlogging and salinity. Mr. Collier was responsible for the direction and supervision of a team of soil scientists engaged on salinity, irrigation, drainage and leaching studies. In addition to project-wide investigations a pilot project scheme was operated to study soil reclamation by leaching, use of amendments and green manure crops, field drainage and agronomic inputs. He also evaluated and set groundwater quality criteria for irrigation and developed suitable mixing ratios for use of saline groundwater.

1966-68 moved to head office to design, equip and supervise new chemical laboratories. Responsible for the organisation and development of methods for the analysis of soils, waters and plant material, including the application of atomic absorption techniques, staff recruitment and training and general laboratory administration.

1968-69 appointed to the Cyprus land use survey. Responsible for the development of air-photo interpretation keys and the supervision of a team of specialists engaged on a photo-interpretation study of the present land use over the entire island. Land use was mapped over two crop seasons, summer and winter and the results displayed on a series of maps at 1:25,000 scale. Colour film was used for part of the survey area and extensive comparisons for ease of interpretation made against the normal panchromatic film.

1970 consultant in soil and land classification to the South East Johor Project, Malaysia. This involved the preparation of a Master Plan for regional development of 30,000 square kilometres.

Consultant in soil and land classification aspects to the Yom Basin Study, Thailand. Work involved soil survey of 3,000 square kilometres at semi-detailed and detailed level for irrigation development. Crops included rice, maize, groundnuts, soya bean, tobacco, cotton and pulses.

Later in the same year Mr. Collier mapped and classified the soils at the University Farm, Chiangmai, Thailand, devised soil conservation measures and produced a land use plan for development.

1971 appointed Head of the newly formed department of Environmental Chemistry with overall responsibility for administration and supervision of the chemical analysis aspects of all Hunting's natural resources and pollution investigations in the agricultural and geological fields.

1972 soil Consultant to the IBRD Balikh Basin (Syria) appraisal mission. Responsible for the evaluation of soil survey and land classification studies for the irrigation of soils from the Tabqa Dam on the Euphrates. Particular attention was paid to the problems of irrigation of the highly gypsiferous soils which constituted a large part of the proposed irrigation scheme. In this context a field visit and specialist consultations were held with soil scientists working in the Ebro valley of Spain, where gypseous soils have been irrigated for long periods.

1973 assigned as project manager and senior soil specialist on the Niger Valley (Nigeria) schemes for the development of irrigated land adjacent to the River Niger. Detailed soil surveys were carried out in two separate areas comprising some 8,000 hectares and the land classified for its suitability for cropping to sugar cane and rice.

Later in the year Mr. Collier was attached as a soil and agronomy specialist to the Wadi Najran (Saudi Arabia) feasibility study. He was responsible for reconnaissance level soil investigations, mapping of natural vegetation, groundwater quality assessment for irrigation and calculation of water requirements for crops and natural vegetation.

1974 appointed soil supervisor on the South Chad irrigation project and the Magba soil survey project, both located in northern Nigeria.

Mr. Collier was then employed as a soil physicist on the Amibara irrigation project, Middle Awash Valley, Ethiopia. He was responsible for soil physics studies, salt and water balance investigations, salinity hazard identification and field drainage criteria on the proposed 10,000 hectare irrigation scheme.

Appointed Associate Director to Hunting Technical Services with special responsibilities for land resources studies.

In the latter half of the year Mr. Collier attended the 13th International Course on Land Drainage, International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands.

1975 senior soil scientist engaged on soil surveys and selection of land for sugar cane development in the north of the Ivory Coast. Later responsible for the organisation and supervision of a detailed soil survey of 20,000 hectares for sugar cane production under irrigation from the Bandama river.

1976 leader of an ODM sponsored agricultural mission to Lake Nasser, Arab Republic of Egypt. His duties included discussions and liaison with the Lake Nasser Development and High Dam Authorities, field studies, review and evaluation of agricultural data and provision of guidelines for the establishment of an agricultural research centre and an agronomic investigation programme.

In 1976 Mr. Collier was appointed principal soil scientist with overall technical and administrative responsibility for soil and land use investigations in all HTS projects.

His duties include:

- supervision of all company analytical laboratories;
- assessment of technical requirements of projects;
- supervision of field teams;
- technical backup support;
- interpretation of chemical data;
- editing of technical reports;
- liaison with HTS Area Managers and clients.

1978 soil and agricultural specialist on the Kuwait Effluent Re-use Study. Responsible for soil studies, evaluation of quality of treated sewage effluent, crop-water-soil relationships and recommendations for re-use for agriculture, forestry and amenity purposes.

1979 land reclamation specialist on the UNDP integrated agricultural development scheme, Suez Canal region of Egypt. Duties included the calculation of water requirements to reclaim ultra-saline soils, programming of reclamation schedules, crop rotations and estimated crop yields during the reclamation and the chemistry of soil and water systems.

1980 soil and agricultural specialist on the Greater Cairo Effluent Re-use Study. Work included soil survey and land classification and selection of areas for disposal of effluent; evaluation of quality of effluent for agricultural use; the chemistry and physics of soil-crop-water relationships; crop rotations; crop water requirements; agronomic practices including use of shelter belts.

Apart from a general supervisory role exercised in projects in many parts of the world

since 1976 he has had a personal involvement in the land resources studies associated with the following projects:

- Bahrain - Agricultural Potential Review
- Land use Mapping Project
- Groundwater Development Study

- Bangladesh - North Bangladesh Tubewell Project

- Brazil - Massangano Irrigation Project

- Egypt - Integrated Agricultural Development Study, Ismailia

- Kenya - Turkwel Gorge Feasibility Study

- Nigeria - South Chad Irrigation Project
- Kirinowa Extension, South Chad Irrigation Project
- Yola-Jimetta Irrigation Project
- Gongola River Basin Project
- Donga River Basin Study
- Taraba Valley Prefeasibility Study
- Yedseram Valley Appraisal Study

- Somalia - Dujuma Settlement Area
- Inter Riverine Agricultural Development Study
- Janaale-Buulo Mareerta Study
- Fanoole Settlement Project
- Hombooye Settlement Study
- Moganbo Irrigation Project

- Saudi Arabia - Umm Er Radhuma Groundwater Development Study

- Syria - Sewage Effluent Control in Damascus, Homs and Hama

- Tanzania - Sugar Cane Development in the Maharunga Basin

- Yemen Arab Republic - Ma'rib Dam Feasibility Study

Professional Association:

Member of British Society of Soil Science, International Society of Soil Science, Photogrammetric Society, Fellow of Chemical Society.

GOODYEAR Robin - Agronomist

B.Sc. Agric. (Leeds) 1960

Dip. Trop. Agric. (Trinidad) 1962

BORN: 1936

NATIONALITY: British

BACKGROUND AND EXPERIENCE:

Following completion of postgraduate studies in 1962 Mr. Goodyear was appointed Agronomist at the Central Region Research Centre, Ilonga, Tanzania. For five years, from 1962 to 1967, Mr. Goodyear was responsible for the formulation of the agronomic experimental programmes for a wide range of crops. The work included the design, lay-out and implementation of crop trials under both rain-fed and irrigated conditions, the statistical analysis of results and the interpretation and reporting of these results. In the last two years of this period his duties included overall technical supervision of agronomic research at Ilonga and at the five Central Region Research sub-stations which covered differing environmental conditions from sea level to an altitude in excess of 6,000 ft.

The major crops with which Mr. Goodyear was concerned at Ilonga were maize, sorghum, soya beans, sesame, rice, groundnuts, kenaf, various pulses, sugar cane and cotton. Other crops which featured in the experimental programmes at the sub-stations for which he was latterly responsible for included coconuts, cashew, flue-cured tobacco and wheat.

During the five years at Ilonga Mr. Goodyear was closely associated with several plant breeding, varietal testing and seed bulking programmes. These programmes included the Tanzanian programmes for the production of improved (synthetic) maize, soya bean and sesame varieties and the East African hybrid maize and sorghum programmes. He was also involved in the cane flowering trial programme carried out to determine optimum siting of the East African cane breeding centre. In the last two years at Ilonga he initiated a rice improvement programme making a nation-wide collection of indigenous varieties and beginning the selection process.

Mr. Goodyear was responsible for all long term fertility and rotational trials in the Region and also for the Regional fertiliser programme. NPK factorial trials with either maize or rice were used to provide information on which to base preliminary fertiliser recommendations.

As a result of his involvement in agronomic research at the Central Region Research Centre and resultant contact with specialist officers Mr. Goodyear derived a broad knowledge of pests and diseases of the crops with which he has worked.

HUNTING TECHNICAL SERVICES LIMITED:

He joined Hunting Technical Services in 1967.

From 1967-68 Agriculturist on the U.N.D.P. Special Fund Water Control Project - Somalia. Mr. Goodyear's initial duties on this Project involved a review of resources in the lower Shebelli valley and of the existing extent and forms of development. He then assisted with the selection of potential irrigable areas and subsequent study of feasibility of

development of 3,000 ha for controlled irrigation and 10,000 ha for flood irrigation. For the feasibility study his responsibilities included the selection of crops and cropping patterns, the calculation of crop water requirements, the supply of data on the requirements for labour, mechanisation and agricultural inputs used in the preparation of farm budgets. He also formulated plans for the provision of ancillary services including extension, research, training and credit facilities, for the supply of improved seeds and other agricultural inputs, and for the provision of adequate storage, processing and marketing facilities. The major crops dealt with in this Project included rice, groundnuts, cotton, sesame, bananas and sugar cane.

From 1969-71 Agronomist on the Llanos de Cocle Project Rep. de Panama. In this Project Mr. Goodyear was responsible both for the agricultural investigations involved in the pre-investment studies of irrigation developments on the Llanos de Cocle and also for undertaking a comprehensive programme of crop trials. For the agricultural investigations, carried out in the first year, his scope of work was essentially similar to the feasibility study in Somalia, with major emphasis on mechanised rice and sugar cane production. Following an extension of this Project in June 1970 for a further year he continued with an enlarged crop trial programme. The work included the establishment of three experimental areas for irrigated agronomic trials, the supervision of field work and the design and analysis of field experiments involving a wide range of crops.

From 1971-72 Agriculturist on the Kediri-Ngandjuk Project E. Java, Indonesia, financed by the UK Ministry of Overseas Development. In late 1971 he was appointed as agriculturist to a team undertaking a study to identify rehabilitation and development projects in an area covering 2,500 sq km of irrigable land in the Middle Brantas basin in E. Java. This work included a study of existing agricultural systems and inputs, their demands for available water, and the planning of improved agricultural enterprises for financial and economic evaluations. The agricultural infrastructure of the area was also examined and recommendations were made for improvements. Major crops of the area are rice, sugar cane, groundnuts and soya beans.

In 1972 Agriculturist on the Madura Reconnaissance Survey E. Java, Indonesia. In 1972 Mr. Goodyear carried out detailed investigations on the agriculture of Madura island, as part of a reconnaissance survey of the water resources of the island. Following the identification of several potential irrigation development projects he was responsible for the agricultural aspects of subsequent feasibility studies.

In 1973 Forage Crop Agronomist on the Angolan Livestock Study. His responsibilities in this national study of livestock development potential included broad assessments of the production potential of natural grasslands in Angola and the agricultural aspects of feasibility studies of a range of specific livestock development projects.

From 1973-74 Irrigation Agronomist on implementation of Kediri Ngandjuk Project - Phase I E. Java, Indonesia. His duties on this project were concerned with the irrigated agriculture. Detailed studies were carried out on present cropping patterns, cultural practices, irrigation water use, land tenure and on the agricultural infrastructure of the area. He advised and assisted with tubewell operation, water allocation and integration with surface supplies, with the procurement and use of agricultural inputs, and with the problems of payment for tubewell water. Particular attention was paid to the sugar cane crop and improvement of traditional cultural practices.

In 1975 Agriculturist on the U.N.D.P. Kagera River Basin Study in Tanzania, Rwanda

and Burundi. He was assigned as agriculturist to a team working on the preparation of a Master Plan for Agricultural Development of the Kagera River Basin. This work involved a general review of existing agriculture in the river basin; a review of existing and proposed drainage and irrigation projects; the agricultural aspects of a number of pre-feasibility and feasibility studies of projects specifically requested by the three governments.

In 1975 Agriculturist on the Jowhar Sugar Study Somali Republic. The study was concerned with an apparent salinity problem on the Jowhar Estate. The agriculturist's duties were designed to provide detailed information on this problem. A detailed examination of present agronomic and irrigation practices on the estate was made. The cane water requirements were calculated and past production trends were related to the availability of irrigation water. Recommendations were drawn up for future improvements and maintenance of cane yields.

In 1976 he was appointed Agriculturist to the S.E. Sulawesi Transmigration Area Development Project, financed by the Asian Development Bank. The first phase of the project involves the preparation of plans for the integrated agricultural development and settlement of farmers on 180,000 hectares. His duties included a review of existing agricultural practices, the preparation of suitable cropping patterns for different sized smallholdings, proposing measures for soil and water conservation and planning the operation of pilot farms.

In March 1977 he went to Chile as Co-Director of the Mataquito Basin Irrigation Development Study. This study covered 100,000 hectares of existing irrigation and was concerned with means of improving the reliability of water supply and the efficiency of its use in a highly complex system of abstraction. The main crops involved were wheat, sugar beet, maize, potatoes, apples and vines.

In April 1978 he continued working in Chile as the Senior Agriculturist on the Aconcagua Project, which involved feasibility studies of the improvement of irrigated agriculture in the Aconcagua valley and two small adjacent valleys, and of the expansion of the irrigated land area in the present dry coastal lands with suitable topography. This project was financed jointly by the World Bank and the Government of Chile. Mr. Goodyear was concerned initially with the definition of present farm types and farming systems and estimates of present levels of agricultural production. For this purpose a farm survey was carried out under his supervision covering 800 farms, and the results of this survey were analysed by computer. In the second phase of the Aconcagua Project Mr. Goodyear was responsible for the formulation of a development programme for irrigated agriculture in the Project Area coinciding with the planned improvement in irrigation water supplies. The main crops involved were table grapes, peaches, apricots and walnuts; onions, tomatoes, artichokes, green beans and peas; wheat, maize, potatoes, dry beans; alfalfa.

Following the completion of the Aconcagua Project in August 1979 Mr. Goodyear was appointed Deputy Chief Agriculturist, joining the HTS Head Office team. During his first year in this post he carried out short support missions to projects in Tanzania, Iraq, Indonesia and Malawi, all of which were concerned with irrigation development studies.

Languages:

Spanish, Kishwahili and some Indonesian