MERCY CORPS INTERNATIONAL, QUETTA

and

THE OFFICE OF THE AID REP, ISLAMABAD

REHABILITATION OF IRRIGATED AGRICULTURE IN AFGHANISTAN'S ARGHANDAB AND HELMAND VALLEYS

REPORT ON PROJECT IDENTIFICATION MISSION

by

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1. INTRODUCTION

1.1 Background

Mercy Corps International (MCI) is a US based Non-Government Organisation (NGO) engaged in relief and development activities at various locations around the world, including Afghanistan.

Current activities in Afghanistan include agricultural training and rehabilitation works; human and animal health care and the reconstruction of a major hydraulic structure on the Helmand River, namely the Darweshan Irrigation Scheme intake works.

In respect of the latter activity, a site engineer has been resourced and seconded to MCI by UNDP-OPS, which is also providing the capital budget for the works. Even so, the need for additional short term consultancy support from an irrigation specialist was recognised, and USAID were approached as a possible source of finance to cover the consultancy.

USAID's eventual agreement resulted in the engagement of an irrigation specialist. [illegible] rather than expend the consultancy entirely on the Darweshan Intake works, [illegible] extend the consultant's brief to include a survey of the rehabilitation requirements for irrigated agriculture in portions of two river valleys in South East Afghanistan, i.e. the [illegible] around Kandahar and Panjwai and the Helmand river south and west of Lashkar gah.

The following report comprises the results of the consultancy, although additional material has been prepared in the specific respect of the Darweshan intake works.

1.2 Terms of Reference

The consultant was required to:

(i) become familiar with all aspects of MCI's irrigation repair programmes;

(ii) meet with other O/AID/REP (e.g. ARR, VITA, IRC) and UN agencies involved in irrigation repair programmes to get an overview of work being done and make comparisons with MCI programmes;

(iii) travel to the project sites in Kandahar and Helmand Provinces of Afghanistan for a firsthand view of the project activity and site needs;

(iv) prepare a report outlining priority areas and specific sites for the involvement of MCI in irrigation rehabilitation programmes, consistent with the project goals and implementation capability of MCI;

(v) provide specific technical recommendations for implementation of specific projects (e.g. technical approach, time, labour and material estimates, etc);

(vi) make a brief visit to the Darweshan Diversion Repair Project, not spending more than two days, check the progress of the project and provide recommendations for appropriate changes to the work plan or method of implementation.

1.3 Comments on the Terms of Reference

In reading background documents prior to the formal briefing with AID-REP in Islamabad it became clear that two crucial issues had not been met by the Terms of Reference. First the increasing problems of salinity in many of the agricultural areas suggest that attention should be paid to drainage considerations. Second and related to the first, there was reason to suspect shortcomings in on-farm water management skills.

It was agreed at the formal briefing that the consultant should also look at these issues, but confining his attention to rehabilitation of existing drainage works; the possibility of installing new drains at field level and the needs for training in and facilitation of on-farm water management.

During the field visits it became clear that the nature of many of the interventions required were such that it would be very difficult and misleading to attempt to quantify the material and manpower inputs on the basis of rapid rural appraisal. This matter was discussed with MCI's Agriculture Programme Manager who agreed that, in such cases, qualitative descriptions identifying and justifying suitable technical approaches would suffice. Because of this it is stressed that this report presents the results of what must be seen as a project identification mission. Implementation of the various components should only proceed on the basis of site specific project preparation studies, which would be a normal next phase for any well thought out programme.

1.4 Timing of Mission

The mission took place during February and March, 1992 and proceeded very much according to plan.

It should be stressed at this juncture that the smooth running of the mission, especially as regards the cross-border component, was entirely due to MCI's excellent connections and logistic capabilities within Afghanistan.

2. OVERVIEW OF LOCATIONS VISITED AND INTERVENTIONS IDENTIFIED

This chapter is intended to briefly introduce the reader to the two areas investigated by the consultant. It is divided into two main sections, the first dealing with agricultural areas being irrigated from the Arghandab river (though without necessarily being in the Arghandab valley itself) the second deals with the three large-scale irrigation schemes situated to the South and West of Lashkagar and abstracting water from the Helmand River. Identified problems and constraints are listed and briefly commented on. More detailed discussions of the problems and possible solutions are presented in the subsequent two chapters.

Before proceeding with this and subsequent chapters, however the reader's attention is drawn to an album of photographs which illustrate many of the issues and problems identified (numbers on the back of the photographs correspond to numbers given in the text).

2.1 Arghandab Area

2.1.1 General

The area visited during the mission is delineated on Figure 2.1. It is roughly triangular in shape and is bounded to the North West by the right bank of the Arghandab river which flows approximately from North East to South West and to the South by the Dori river. The confluence of the two rivers forms the apex of the triangle which then stretches some 45 km to the East.

Four basic agro-ecological zones are involved:

(1) The area is interspersed with barren mountains, many of which have scree deposits at their feet (see photograph 2). These mountains tend to run parallel to the Arghandab river and together comprise a series of ridges;

(2) Lying between the Arghandab and Dor rivers, are extensive flat plains of deep loose silty-sands sloping gently from North to South (see photographs 33 and 66). These plains have been almost entirely cultivated with wheat and raisins (see photographs 3 and 69) predominating, although some alfalfa was observed along with some general grazing areas (see photograph 62);

(3) Seasonable swamps are encountered immediately to the South and West of Panjwai (see photographs 63 and 64);

(4) On the immediate right bank of the Arghandab is a strip pedologically and economically similar to those in zone 2 above, but instead of being flat the land tends to undulate gently. This strip varies in width and slopes up moderately from the river until loose generally gravelly soils covered with coarse, seasonal pasture are reached (see photograph 4). The interface between the two soils can be regarded as the boundary of the area of interest.

The Arghandab river is flowing through essentially mature landscape (see photograph 5) and is still incising its course with minimal meandering along most of the section in question. All alluvial deposits are very large grain (see photograph 46) which indicates that the river is fairly young in relation to its environs - although by the time that it passes Panjwai significant meanders are beginning to form. The Dor on the other hand exhibits a strong meandering tendency not adequately indicated by the figure.

During the course of the Russian occupation of Afghanistan the area was the scene of prolonged and intense military activity. Examples of destroyed military hardware is everywhere in evidence, but more telling are the myriad bomb and shell craters which pepper the landscape along with the almost total destruction of buildings.

As result of the military activity and the associated de-population of the area there is an urgent need for rehabilitation on a broad front. The efforts of the slowly returning refugees will not be enough without adequate resourcing and technical assistance.

Already however, elements of the infrastructure are slowly being restored. New or reconstructed homesteads are much in evidence as are rehabilitated vineyards and raisin drying sheds. The bazaars are bustling once more with normal peacetime economic activities. This is of course encouraging but does not address the pressing issues affecting agricultural production in this once prosperous area.

There are two overriding problems:

(1) The irrigation systems, which are essential for reliable agricultural production are inoperative due to (i) war damage, (ii) looting of essential equipment, and (iii) general dilapidation due to the total lack of maintenance activities during the Russian occupation and subsequent inter-factional fighting. In addition to these problems, which have their origins in recent history, there are occasional examples of problems with more fundamental causes;

(2) The area has become highly salinated (see photographs 51, 52 and 71) due to poor drainage and high water tables. Attempts by the returning refugees have been frustrated by a lack of technical knowledge and equipment.

In general it is possible to conclude that the area has by no means reached the point of no return, but much has to be done, particularly in the irrigation and drainage sectors. The level of reconstruction activity already in progress would suggest that any donor/agency involvement would be more than matched in effort by returnee farmers. The remainder of this section therefore introduces the various interventions that were identified by the consultant during the short time available.

2.1.2 <u>Location 1 Figure 2.1 - Harambanee Drainage Area</u>

Refugees are returning slowly to their homes but are finding the rehabilitation of their bomb cratered fields very arduous. The problems are greatly exacerbated by very high water tables and resulting salinity.

2.1.3 <u>Location 2 Figure 2.1 - Gurgan Aqueduct</u>

The Gurgan aqueduct used to convey water over the Tarnak river. The aqueduct has been completely destroyed by high river flows and inappropriate construction technology (see photographs 30, 31 and 32). A new aqueduct is required.

2.1.4 Location 3 Figure 2.1 - Panjwai Irrigation Canal Offtake

The intake works feeding this important irrigation canal have been badly damaged by the Arghandab river (see photographs 46-49). Complete remodelling of the works is therefore required.

2.1.5 Location 4 Figure 2.1 - Panjwai Drainage Area

A system of field drains is urgently required to drain this badly waterlogged area (see photographs 63 and 64) into a recently constructed collector drain skirting the area to the South West.

2.1.6 Location 5 Figure 2.1 - Malajat Drainage Area

Damaged canal banks have resulted in the ingress of irrigation supplies into the drainage system causing very high water tables and salinity problems (see photographs 65 -72). Canal bank repairs, field drains and a re-aligned collector drain will be necessary to rehabilitate the area.

2.1.7 Location 6 Figure 2.1 - Rahman Wash

The Sangisar irrigation canal crosses a natural drainage channel at this location. Breaches have been traditionally repaired by manual labour, but neglect over the past ten years, coupled with excessive flooding have greatly exacerbated the problem (see photographs 34-40). Repair works and a more permanent solution are required.

2.1.8 Location 7 Figure 2.1 - Zahir Shahi Canal Offtake

This major structure requires new irrigation control and river gates (see photographs 42 and 43).

2.1.9 Location 8 Figure 2.1 - Zahir Shahi Bifurcation

This structure requires minor but essential repair work on its four radial gates (see photograph 41).

2.1.10 Location 9 Figure 2.1 - Babawali Distribution Structures

This complex of hydraulic structure has been constructed to divert supplies from the Zahir Shahi system into five traditional irrigation canals. Flow control gates and earthworks require rehabilitation (see photographs 44 and 45).

2.1.11 Location 10 Figure 2.1 - Jui Lahore Canal

This is an ancient canal which was constructed during a time when the Arghandab river bed levels were much higher. Over the ensuing years bed levels have inevitably dropped leaving the offtake high and dry. All attempts to resolve this problem have failed, a more drastic solution is called for (but is possibly not going to be practicable or justifiable). Short of a major cross river structure, pumped supplies are possibly the only simple solution, but O&M exigencies will probably preclude this approach. No further attention is therefore paid in this report to this project.

2.1.12 Location 11 Figure 2.1 - Manar Canal

This ancient canal has the same problems as the preceding case but not to the same extent. Save the Children Fund has resourced some helpful but incomplete reconstruction works. Additional inputs are required.

2.2 Helmand

2.2.1 General

The Helmand is Afghanistan's largest river which, in the area visited, flows essentially North South from Lashkagar, a government held town. Just South of Lashkagar the Helmand River is joined by the Arghandab.

Hereon the river could be classified as being "mature" and flows through a flood plain bounded by deserts on each side (see photographs 50 and 53). The flood plain comprises uniform sandy silts of good fertility (see photograph 6) interspersed with deposits of river-run gravels and pebbles. As would be expected the river shows a strong meandering pattern, with wavelengths significantly in excess of 1 km. Deposits building up behind the meanders as they move progress slowly downstream include silts.

There are three major agricultural areas in the general area under consideration. Darweshan is the most southerly, then to the South West of Lashkagar is the Boghra system (which feeds the two areas of Marja and Nadi Ali) while the Shamalam system begins just South of Laskkagar. The Boghra and Shamalan systems are separated by a small area of high ground otherwise the areas are for all intents and purposes contiguous. All three are irrigated by water abstracted from the Helmand river.

It is possible therefore to think in terms of two agro-ecological zones:

(1) The Helmand flood plain which comprises extensive arable production with some limited livestock. Production focuses on wheat (see photographs 7 and 8), with some raisins, cotton and alfalfa. It is also reported that opium poppies have been grown in the region but no evidence of this was seen by the consultant;

(2) The higher ground between Marja and Shamalan systems which is covered with coarse grazing material.

As with the Arghandab area, Helmand Valley has also seen its share of military activity with resulting devastation, although not to the same extent. Cratering of fields for instance is actually quite insignificant, but nonetheless damage to homes and other buildings has been very extensive.

Many of the area's erstwhile inhabitants are reported as still being in refugee camps in Pakistan, but those who have remained or returned are beginning reconstruction activities in their settlements and homesteads. Furthermore, considerable activity has clearly been focussed on canal maintenance and in fact was observed by the consultant even on a Friday. The people are therefore keen to restore their situations to normality once more and to this end are expending both time and effort (see photograph 15).

All three schemes were visited by the consultant, although prevailing security problems precluded detailed inspections of Marja and part of the Shamalan scheme.

The same problems were generally in evidence at all three schemes thus they are not treated separately in the following paragraphs - except in the case of significant specific items which will be obvious to the reader.

Thus:

(1) practically all irrigation water control structures require new gates and/or winding gear; no effective flow control is possible at any point in the three schemes (see photographs 17 and 19-23);

(2) canal banks are in essentially very good condition, but some portions require reconstruction as a matter of some priority, especially downstream of certain cross-regulators where undercutting is being caused by reverse eddies (see photographs 18 and 24-26);

(3) some cross regulator stilling basins have damaged appurtenances which should be repaired if major downstream damage is to be avoided (see photographs 28 and 29);

(4) one cross regulator on the Darweshan system needs complete reconstruction (see photograph 27);

(5) urgent river bank protection works are required at a point where the Helmand river will soon begin to encroach on the Darweshan main canal earthworks (see photograph 50);

(6) access roads along the main and secondary canals need grading (see photograph 14, right hand side);

(7) no flow measuring devices were in evidence, good irrigation management requires that consideration is given to the provision of suitable facilities;

(8) as a result of poor irrigation management and other factors, waterlogging and resulting salinity problems are extant over much of the project areas leading to massive yield decreases and farm abandonment (see photographs 55-60). This is especially so at Marja (see photograph 56). There is a need therefore for extension activities addressing the disciplines of on-farm water management (at present, due to the poor performance of the irrigation systems many farmers are irrigating from the drains (see photograph 78), thus accelerating the salinisation process); this training element should also address the question of micro land levelling (see photograph 61);

(9) existing drainage systems need major rehabilitation and remodelling works as a matter of some urgency (see photographs 73-77 and 79-82);

(10) it is clear that the existing drainage systems were only intended to handle surface run-off and as such are not adequate to draw down water tables, a field drainage system is therefore required;

(11) if the drainage issues are addressed completely then the possibilities of a leaching programme should be considered.

Not included in the above list, is the need for reconstruction of the Darweshan irrigation intake works. But this is already in progress with MCI as implementing agency under UNDP-OPS funding and as such is not addressed in the main text. Instead it is covered in Appendix B.

3 DETAILS OF INTERVENTIONS REQUIRED FOR THE ARGHANDAB SYSTEMS

3.1 Harambanee Drainage Area

This area used to support some 1,000 families who, before the military situation sent them fleeing to refugees camps in Pakistan, used to grow a main crop of wheat and a second crop of horticulture from their land. Wheat yields were impressive at a claimed Figure of 1,250 kg/jerib (6.25 tonnes per ha) and the horticultural crops were successfully exported to Pakistan making the area prosperous in local terms.

Those families who have already returned from the refugee camps are reconstructing their war damaged homestead compounds and attempting to begin farming once more. The area in question was irrigated and drained by simple infrastructure provided by the pre-invasion government. But ten years of war and neglect have resulted in severe damage to the crucial infrastructure which the people are attempting to repair or reinstate. Their efforts with respect to the simple irrigation systems are perfectly satisfactory (see photographs 9 and 10) but little success is being enjoyed with their attempts to drain the area. The mission was taken to see several small, self-help drains, but in none was the water flowing, indicating an inability of the people to align the channels properly.

Yet the high water table which characterises the area will have a detrimental effect on crop yields and soil chemistry and must therefore be dealt with.

The fact that the people are proving able to rehabilitate their irrigation channels while remaining unable to sort our their drainage is explained by the prior existence of the irrigation channels which just need cleaning out, whereas the drains require excavation from scratch.

To do this successfully will require the following inputs:

(i) A simple topographic survey of the area in question.

This will take an experienced and properly equipped surveyor no more than one month including the preparation of contoured base maps - his labourers can be supplied by the community;

(ii) A rational drainage layout design based on soil conductivity tests.

This will require some two weeks of a drainage expert's time once the above mapping has been finalised;

(iii) Accurate pre-construction setting out.

This will require approximately two weeks of a surveyor's time along with a supply of timber of timber pegs and string neither of which will be re-usable;

(iv) Possible assistance in the form of an excavating machine of some sort or a suitably equipped tractor plus fuel and lubricants, etc;

(v) Supervision during excavation.

The actual period of implementation cannot be estimated prior to the preparation of the drainage system design but it is very unlikely to span more than one cropping season.

In addition to very obvious drainage problems pertaining in the area, it was reported that two main canals feeding the area have been damaged leading to disrupted supply in the field channels. This problem is addressed in section 3.9 below.

3.2 Gurgan Aqueduct

The western end of the tongue of land lying between the Tarnak and Dori rivers used to be irrigated from the Arghandab river via the Zahir Shahi/Babawali system.

To reach the area in question, however, water has to be conveyed across the Tarnak river which is too deeply incised and possibly not reliable enough to irrigate from directly.

Two previous attempts at conveyance structures have comprised open flumes which crossed the Tarnak supported on six plinths. Both attempts have failed due to the plinths falling over.

Foundation conditions at the site are very difficult. Detailed inspection was not possible due to the depth and velocity of flow in the river. It appears however that the bed comprises deep layers of friable silt as shown in photograph 32. Such material cannot be expected to provide safe foundation for a structure of this nature.

Clearly a different approach is required, i.e. one that is not affected by possible flood damage or inadequate foundations.

It is considered by the consultant that the river is not so wide as to preclude the possibility of used a cable stayed crossing (pipe or flume). In other words, two supporting towers should be constructed, one on each bank. The actual crossing can then be suspended from cables strung between the two towers and anchored back to solid ground. Of the two possible crossing types, the pipe alternative would be most favourable as it will prove much lighter than concrete flume.

Such a crossing will need to be designed by a structural engineer experienced in the design of cable stayed structures and is likely to prove complicated to construct. Thus highly experienced and specialist involvement will be required at every stage during the implementation of the solution. This is therefore not really an opportunity for MCI except perhaps as regards a purely co-ordinating role.

3.3 Panjwai Irrigation Canal Offtake

The Panjwai irrigation canal supplies some 15,000 jeribs (3,000 ha) of mixed wheat and barley land with crucial irrigation supplies with almost 2,000 families depending on it.

The canal itself is fairly well maintained (see chapter 6) and conveys water to the farms from a free offtake at the Arghandab river. At the offtake the river course is highly braided and unstable (see photograph 46).

Since the original offtake collapsed (see photograph 48) various attempts to provide new offtakes have been frustrated by the shifting alignment of the various branches of the river. The current solution comprises a stick weir (photograph 46) which deflects flow into the lead canal, approximately 1.5 km upstream from the old offtake. It has been sited so far upstream of the original offtake in order to regain the command that river alignment and bed changes have reduced at the original site.

Downstream of the old offtake the canal is in a good state of repair but the new lead canal has not been adequately planned or executed. Photograph 47 for instance shows a portion of the canal over 50 m wide and contained by a very flimsy embankment, a more rational and durable approach is therefore called for.

The shifting nature of the river, however, means that construction of a completely durable Panjwai main offtake will not be practical or cost effective. It is, however, possible to greatly improve on the existing situation.

First of all, to ensure command, any new offtake must, like the existing temporary structure, be sited a distance upstream of the original structure. Some 2 km upstream of the old intake the river's left bank is characterised by an approximately semi-circular deposit of coarse material (marked by three crosses on photograph 49).

Figure 3.1 comprises a sketch plan (not to scale) which indicates how a possible new offtake might be aligned in relation to this deposit. Its situation at the extremity of the semi-circular deposit takes advantage of the sizable stream being deflected by the steep hard hillside.

The works as suggested comprise a deflection weir. By means of the weir, water is deflected into a lead channel down which it flows to the site of the old offtake which should be reinstated as a means of controlling inflow. There is very little freeboard available in the river for much of the year. Thus a weir spanning the whole river, as well as being extremely expensive, would also have a potentially dangerous backwater profile during high flows. This would result in flooding of upstream land that is currently being returned to economic use in the form of orchards.

Clearly, this is only one suggestion based on a short inspection of the site in the time available. Before actual implementation, a more detailed analysis of this and possibly other options must be undertaken by a qualified irrigation or hydraulic structures specialist. Even so the following schedule of materials and manpower requirements will provide a reasonable basis for planning.

Some 16,000 cubic metres of gabion baskets will be required for the proposed embankment and deflection weir and 900 cubic metres of Reno mattresses (flat gabion baskets normally 0.3 m in thickness) for the protection works. Although not perfect, the coarse material comprising the myriad banks which characterise the river here will be suitable for filling the gabion baskets.

The original control structure can be reinstated with some 5 cubic metres of reinforced concrete and new vertical lift gates.

At least three skilled masons will be necessary to supervise the works which will require some 20,000 mandays to complete assuming that the gabion baskets are to be filled by hand.

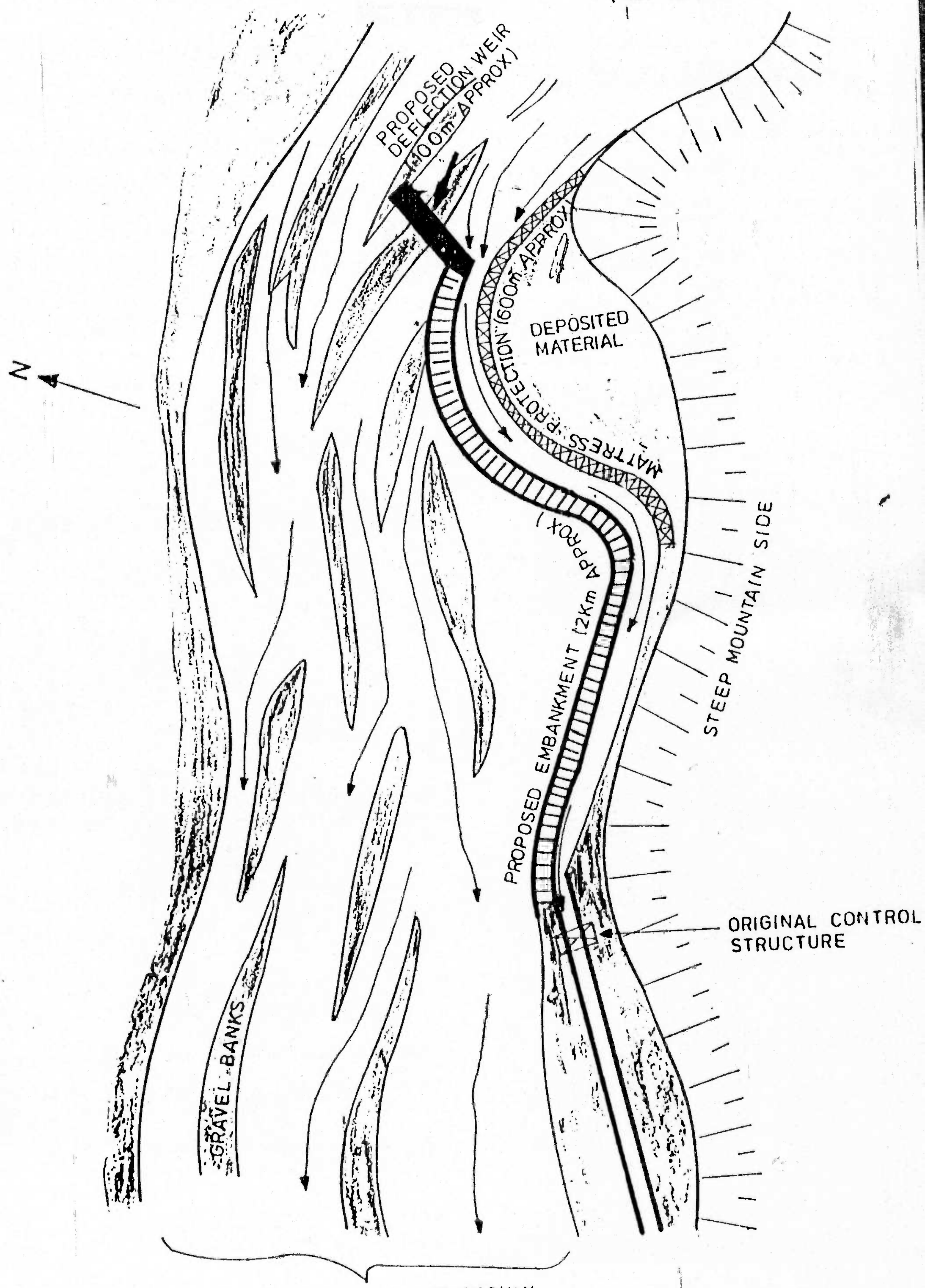
3.4 Panjwai Drainage Area

Land lying to the South and East of Panjwai township suffers from poor drainage and resulting salinity. It is well served by irrigation systems, originating either at the Panjwai offtake (as discussed above) or the Babawali distribution complex (see section 3.9) below. It therefore represents a high potential crop growing area, particularly in respect of wheat and raisins.

FIGURE 3.1

SCHEMATIC SKETCH OF PROPOSED NEW LAYOUT AT PANJWAI IRRIGATION OFFTAKE

(Not to scale)



Drainage however is crucial and to this end a collector drain has already been excavated along the southern border of the swampy area as indicated on Figure 2.1 and photograph 64.

Without a series of field drains, however, the collector drain will be limited in usefulness. Help is therefore needed to design and install a simple drainage system.

The inputs required are the same as those at Harambanee, although actual implementation may take a little longer since, despite being a smaller area, access around Panjwai's swampy area is much more problematic than at Harambanee.

In terms of execution however, there are likely to be planning and logistics advantages and hence cost savings if MCI undertake the Harambanee and Panjwai projects with one team.

3.5 Malajat Drainage Area

This area is situated immediately due South of Kandahar city and is well served by a gradually converging network of fairly large drains. The name given above is that given to the mission during the field trip. The general plan drawing of the network as on file at the Helmand valley Authority headquarters in Lashkagar refer to the system as the "Karz-Zakir Unit Outlet Drains" and the reader's attention is drawn to the HVA drawing bearing that title, numbered 760-15 and dated 30th of September 1969. This large scale drawing is in full agreement with the drainage layout as indicated on Figure 2.1, the relevant portion of which has been enlarged to produce Figure 3.2.

At present however, water is not moving in the drains and water tables are extremely high. This is seriously affecting agricultural redevelopment in the area particularly as regards the preparation of new raisin fields (see photograph 69). Despite the excessively high water tables observed during the field trip there was ample visual evidence that water tables had been even higher a short while before as in many locations soil was saturated across a layer some 15 cms above the water table (see photographs 66-68) a phenomenon not easily explained by capillary rise.

There are two apparent reasons for the water logging.

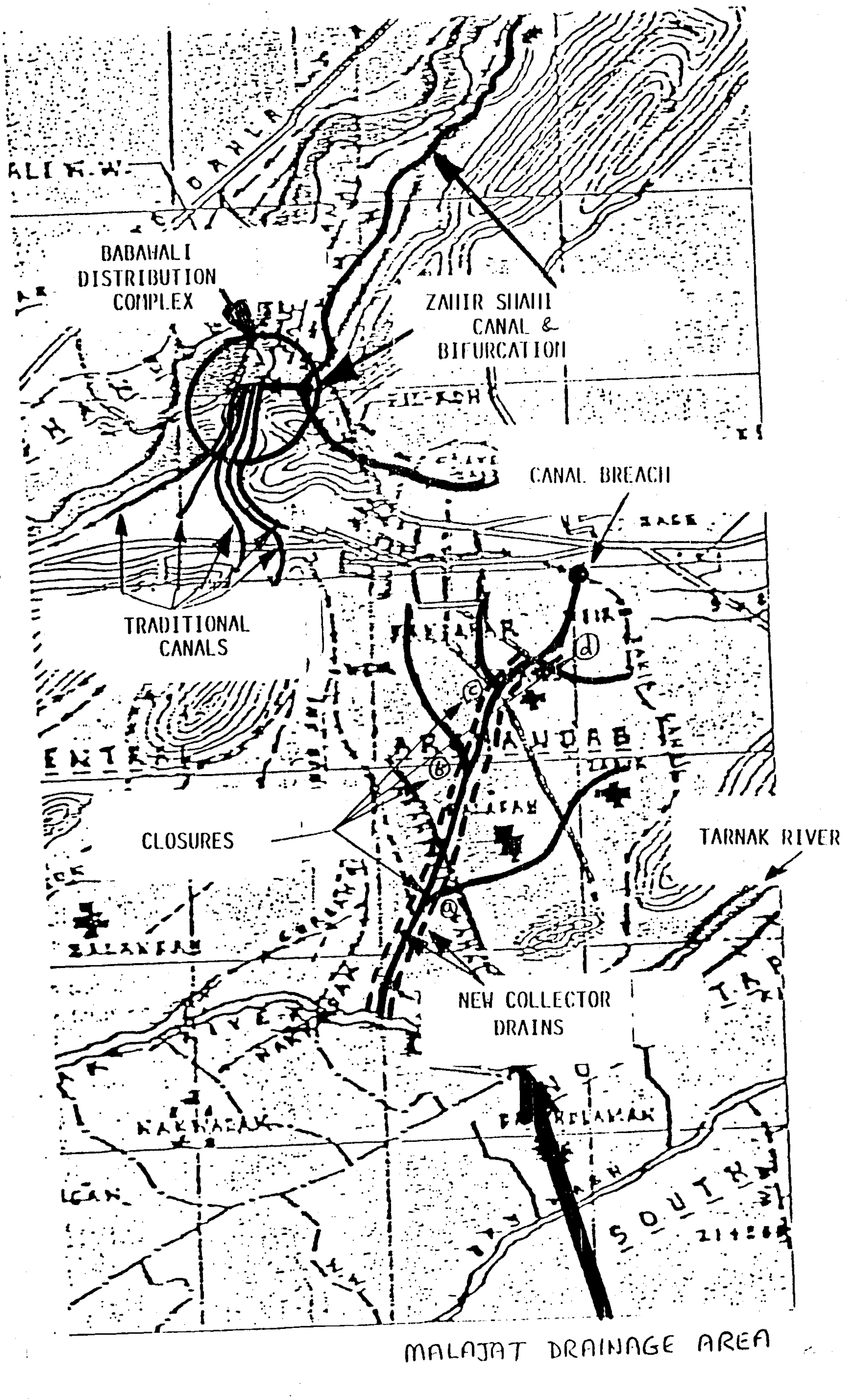
First, flows in the drains are impeded by silt and vegetation (see photograph 65). Secondly and more importantly, water flowing through a breach in an irrigation canal flowing through Kandahar city is entering one of the Malagat drains as shown in Figure 3.2. This water was seen to be backing up into other drains in the system (see photograph 70). So instead of drawing water tables down, the drains are actually delivering water thereby contributing to rather than solving the problem.

To make matters worse, however, farmers are actually pumping water from the drains for irrigation purposes thus accelerating the salinisation of the soils.

The simplest solution to the problem, in technical terms at least, would be to repair the canal breach in Kandahar city and clean out the drains. But the city is still in government hands thus there is no guarantee that the canal will be repaired and kept water tight.

It may therefore be considered necessary to isolate the drain which is carrying the irrigation water. This can be easily carried by closing off the tributary drains with earth dams at their point of confluence with the drain to be isolated.

Figure 3.2
Malajat Drainage Area and
Babawali Distribution complex



Two new collector drains would then be required one to drain the area to the right of the isolated drain into the Tarnak river, the other the left side, into the same river.

Both drains would be some 8 km in length and would require excavating at a rate of 25 cubic metres cut to spoil per metre. Excavation on this scale would best be carried out mechanically. Various approaches would be appropriate ranging from a tractor with a back acting bucket to a motorised box scraper.

Closing off the tributary drains could be done by hand labour at something close to 75 mandays per closure. This figure assumes that 75 cubic metres of fill material are required per closure at a rate of 1 cubic metre per manday. The closure works will be accomplished more easily if sand bags can be utilised to form coffer dams upstream and downstream of the dam. At least four such closure dams will be required marked a, b and c on Figure 3.2.

Drain clearing could also be carried out by hand labôur. The scale of the clogging is not great and the problem tends to be localised. A reasonable estimate of manpower requirements would assume that a team of ten labourers could undertake the work in less than two months.

Finally, and not so far returned to, there are serious breaches in the drain banks which have most likely been caused by shell or missile fire (see photograph 68). These again can repaired by hand labour.

To summarise therefore, the Malagat drainage system requires:

(i) 16 km by 25 cubic metres/metre of machine excavation for two new collector drains;

(ii) 300 labourer mandays to close the tributary drains or the equivalent in machine time;

(iii) 500 labourer mandays to clear out the collector drains;

(iv) manpower as required to repair breached banks (actual amount not known without detailed survey of entire system).

If MCI decides to proceed with this project it should be noted that there is a chance that a system of field drains may also be required. Any field drainage requirements could be addressed along the same lines as the Harambanee and Panjwai drainage areas and even by the same team.

> [note: military activity since the preparation of this report have resulted in the fall of Kandahar city to mujahidin forces. This situation is likely to pertain indefinitely. Thus it may now be decided to repair the breach in the canal referred to above in which case major remodelling of the Malagat drainage system will not be required. Instead it will be sufficient to reinstate the drainage system as originally envisaged and de-silt where necessary.]

3.6 Rahman Wash

The Sangisar canal conveys water from the Arghandab River to some 15,000 jeribs (3,000 ha) on its right bank. The predominant crop is raisins although some wheat and barley is grown.

Approximately 13 km downstream from the offtake (which is in good repair) the canal crosses a seasonal natural drainage channel, the Rahman Wash which regularly washes the canal out. Some of the flood water then proceeds down the canal depositing coarse material while the rest spills over the farm land which extends for some 500 metres between the canal's left bank and the Arghandab river.

Normally the resulting breach is repaired in time for the irrigation season but unusually high floods in recent years have resulted in damage considerably greater than usual. A more permanent solution is called for.

The solution will have two objectives, first the canal has to be protected from the destructive floods flowing down the wash. Secondly, the flood water have to be passed safely to the river.

There are at least three ways to meet the first objective:

(i) A tank style crossing

A tank crossing comprises a large pool into which both canal and drain can pass through the nature of the relevant outflow structures tends to force excess flows to continue down the drainage system rather than enter the canal system. This approach is best suited to more undulating topography than that which pertains at the site in question and is not considered appropriate in this case;

(ii) A Siphon carrying the drain under the canal;

(iii) A Siphon carrying the canal under the drain.

As a general rule it is always best to apply a restriction to the channel containing the known, in this case the canal. Thus the solution proposed will be to construct a masonry and/or concrete siphon which will carry the irrigation water under the wash, thereby allowing the flood waters to flow unimpeded to the river.

Which brings us to the second objective, i.e. the safe passage of the flood waters to the river. There is really only one sensible approach and that is to simply excavate a channel from the canal to the river. The channel of course should have a similar cross section to the wash itself. Unfortunately, such a channel will have to pass over existing and intact farm land (pomegranates, raisins, fodder and some cereals). Apparently, however, farmers benefiting from the Sangisar canal are prepared to club together to pay for an easement along the line of the extended wash.

A possible arrangement of the proposed works is shown in Figure 3.3. It is a schematic arrangement only. The works should be subjected to a detailed design exercise by a suitably qualified expert. Of importance during the design analysis will be the matter of how fast the flow through the siphon will have to be in order to avoid siltation within the structure. To an extent this could be self regulating (in other words as the siphon begins to clog, the velocity increases until a state of equilibrium is reached). Of course, increased velocity is only achieved at the cost of head. Thus the analysis should also consider how much head can be expended across the structure and how much water can be allowed to backup upstream of the structure's intake, this backup may itself have a siltation pay-off due to reduced velocities.

Thus it should be clear that the structure will be fairly complex to design hence the need for an expert in the initial stages but, in respect of construction, the exercise is well within MCI's capabilities.

An estimate of manpower and materials required, etc. would be as follows:

Some 250 cubic metres of reinforced concrete would be required for the structure itself. Earthworks would involve approximately 1,000 cubic metres of cut, with some 250 cubic metres being returned as backfill around the siphon with the remainder being used to form the embankments around the siphon inlet and outlet.

The extension to the wash itself will involve another 15,000 cubic metres of cut to spoil.

Clearly a large workforce is going to be required to implement this project say 50 labourers for three months. Supervision staff will include a qualified site civil engineer and 10 skilled masons or foremen.

3.7 Zahir Shahi Canal Offtake

The Zahir Shahi system abstracts water from the Arghandab river and conveys it to the plains between the Arghandab and Tarnak rivers, via a system of canals both traditional and new. The mission was able to inspect the system between the river offtake and the first major structure, namely the Babawali distribution complex, some 16.6 km downstream.

The works were constructed some forty years ago and are still in generally excellent condition (see photographs 11 and 12). There are some problems with siltation and poor water control (as evidenced by the almost non-existent freeboard in photograph 11). Poor water management is in part due to the lack of gates and/or lifting cables at key structures.

The most important problem is found at the river offtake structure itself where the river sluice gates are completely missing (see photographs 42 and 43), thus there is no means of controlling water levels and diversions during periods of low flow.

As it happens, however, replacement gates have already been fabricated in a workshop in Manzel Bagh, a sector in Kandahar city. These new gates requires transportation to site and installation. A budget cost of Afs 2,000,000 was quoted as being required. Furthermore the mission was assured that logistically it is possible to move things in and out of Kandahar.

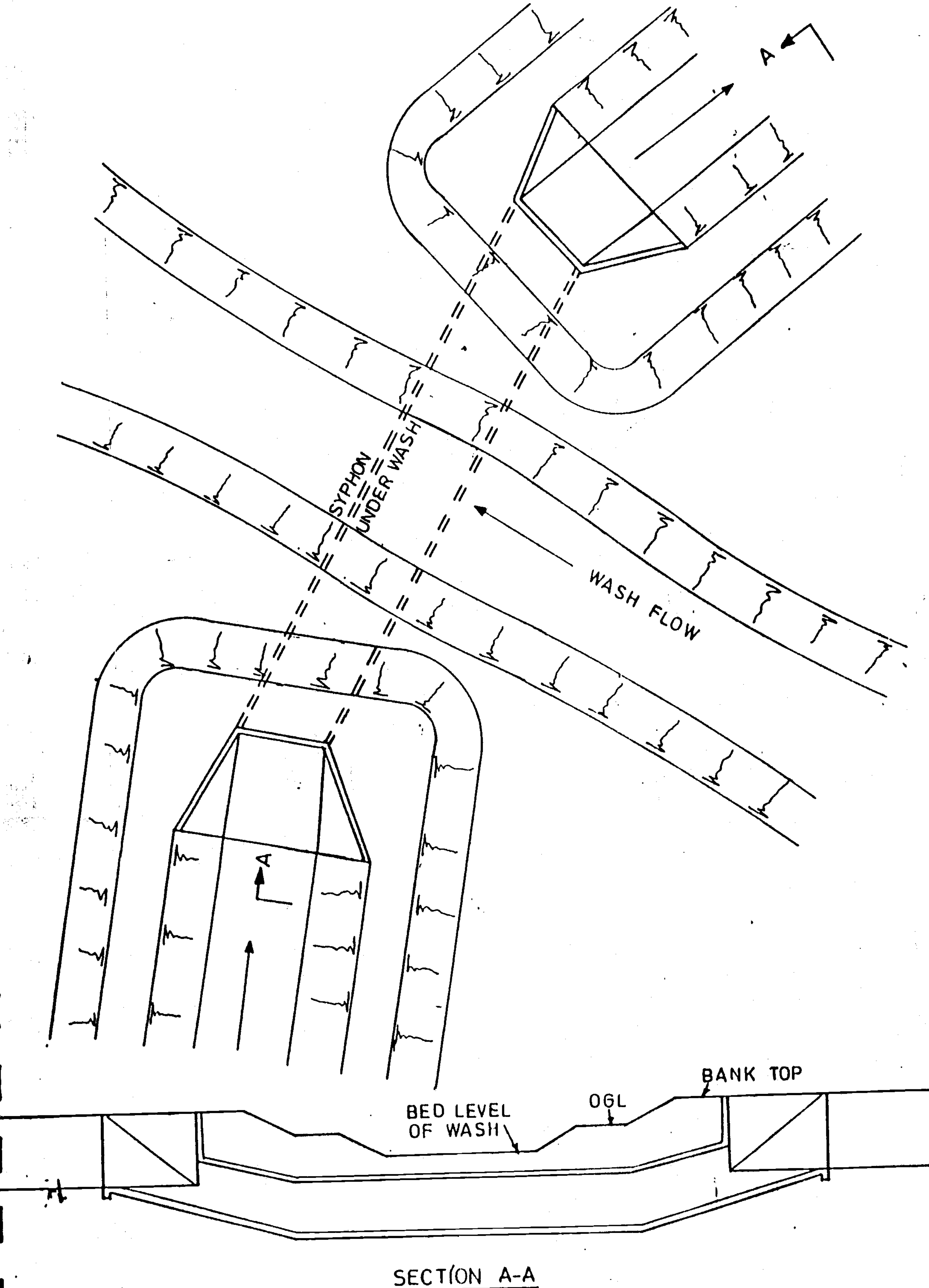
Assuming that this is so, then this is an ideal opportunity for MCI, especially given the experience that the organisation is gaining in heavy gate work at Darweshan.

Resources required are fairly straightforward and comprise transportation and lifting equipment and skilled/semi-skilled labour (such as is deployed at Darweshan) and the whole exercise would take no more then two weeks to complete.

FIGURE 3.3

SKETCH OF PROPOSED NEW ARRANGEMENT AT RAHMAN WASH

(Not to scale)



3.8 Zahir Shahi Bifurcation

This structure diverts a proportion of the flow from the main Zahir Shahi canal to five tradition canals via the Babawali distribution complex.

The structures are more or less intact although a small amount of reinforced concrete work is necessary to repair the walkways.

Photograph 41 shows the gates which control flow into the Babawali lead channel, a similar arrangement controls the flow continuing downstream along the main canal. The photograph clearly shows water overtopping the radial control gates. This is because the gates cannot be lifted as the cables have been removed. This may account for the high water levels indicated in photograph 11 which was taken a short way upstream of the structure. It may also explain some of the siltation (which was most noticeable immediately upstream of the structure).

All that is needed to put things right would be about 3 cubic metres of reinforced concrete and some 50 m of lifting cable, plus skilled and semi skilled labour as above.

Given the simplicity of the intervention needed at this structure the consultant wondered why the local people could not sort the problem out for themselves. The answer given was simply that no materials are available and even if there were "Who could pay for it?"!

3.9 Babawali Distribution Complex

Water leaving the Zahir Shahi canal via the above bifurcation is conveyed along a branch canal which intercepts five traditional canals some 5 km downstream of their original offtake (see Figure 3.2).

A series of gates then pass water in to the tradition canals which run parallel to one another for some distance before radiating out to their respective command areas (see photograph 45).

Given its age the Babawali distribution complex is in remarkably good condition. Fair wear and tear, however, have taken their toll on the gates admitting water into the traditional canals (see photograph 44) all of which now need major overhaul or replacement.

Also, the earth embankments which separate the five traditional canals from one another need some rebuilding work a typical example of which is shown in photograph 45.

In all some 15 x 1.5 metre wide gates will have to be replaced, while the earthworks can be made good by a team of ten men working under supervision for one month. A generous supply of sand bags would be an advantage as would a small compacting machine.

The reconstruction works will be very straightforward as once the Zahir Shahi Bifurcation gates have been made fully operational then all activities can take place in the dry.

3.10 Manar Canal

The Manar canal is a historic canal into which flows have reduced over the years as a result of falling and shifting river bed levels. The Save the Children Fund (SCF) has financed the construction of a new offtake shown schematically in Figure 3.4. While satisfactorily addressing the problem in terms of concept, the works are incomplete and in part have been inadequately constructed. This is not a criticism of SCF as the badly constructed elements of the works have been carried out by untrained, inexperienced local people and as such represent a good effort on their part. There is nonetheless a need for an agency such as SCF or MCI to make good the construction shortcomings.

The portion of the works that has not yet been constructed is the embankment between the new intake and the beginning of the existing canal. Discussions with an official of SCF in Quetta has confirmed that SCF are intended to finance/undertake this component of the works. They have no plans, however, to strengthen or make good the suspect parts of the works. They consequently represent a good opportunity for MCI.

There are three issues to address:

(i) The rubble wall must either be grouted or protected with gabion mattresses, whichever is simplest to resource and organise, also its general shape at the inlet could be modified to provide a smoother transition thereby increasing the inlet's effectiveness for a given upstream water level;

(ii) The area upstream of the inlet needs to be cleaned out;

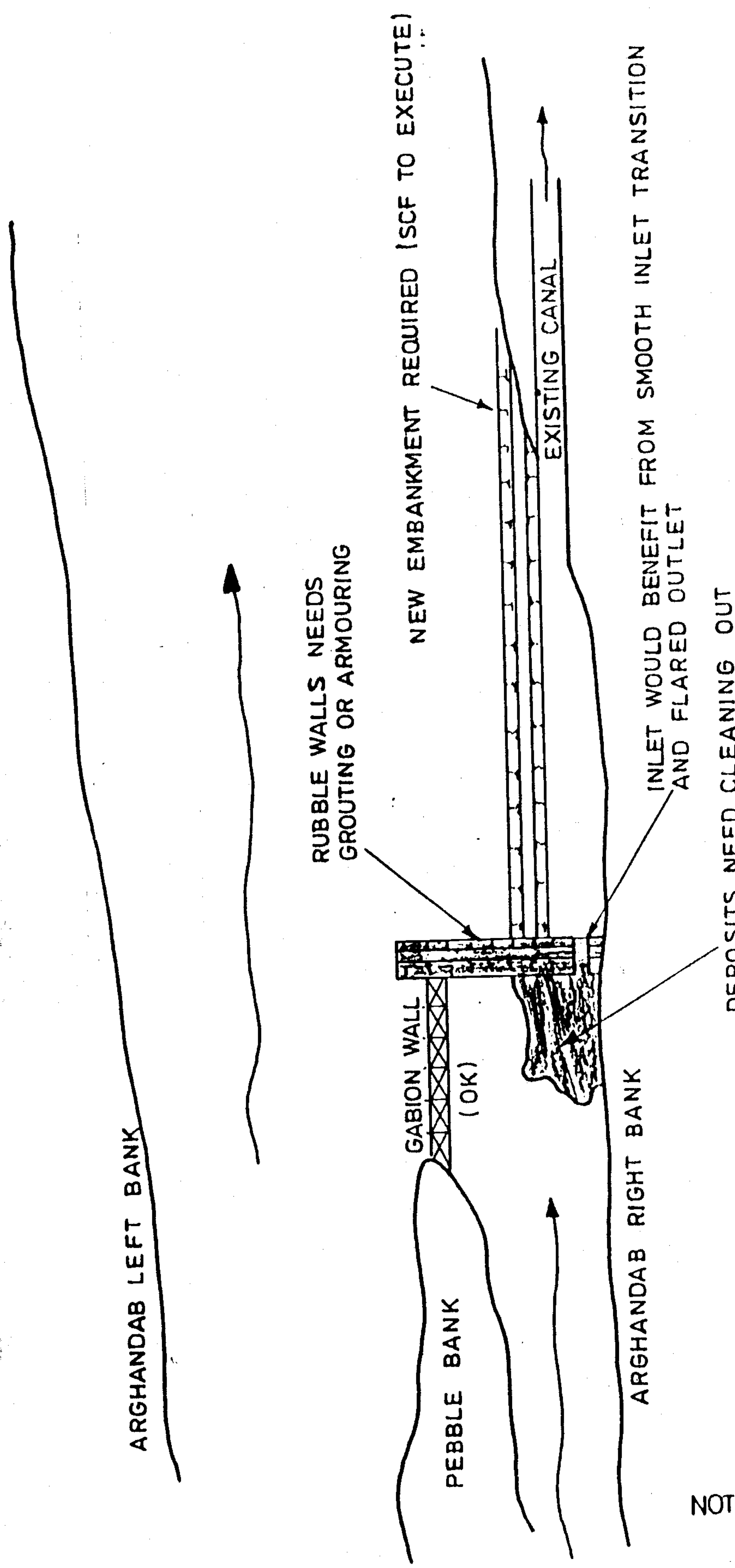
(iii) The inlet structure requires a flared outlet transition along with a better finish to the existing masonry works. No sophisticated hydraulic designs are required for the outlet transition, vertical walls flaring back into the embankments at say 30 degrees will suffice, particularly if complemented by rip rap for a few metres downstream.

The required activities could be completed in about two weeks by a team of competent masons assisted by local people as labourers.

FIGURE 3.4

SKETCH OF MANAR CANAL OFFTAKE

(Not to scale)



NOTE:

SHADED PORTION INDICATES ITEMS WHICH REQUIRE ATTENTION

4. DETAILS OF INTERVENTIONS REQUIRED FOR THE HELMAND SYSTEMS

Interventions identified as being required in the Helmand valley fall into two categories, namely programmes and projects. The terms "Programme" and "Project" as intended in this context can be defined in the following way.

A Programme comprises a series of managed activities aimed at achieving a common or all-encompassing objective. An example would be a programme intended to achieve the replacement of all flow control gates within the Darweshan system; another would be a programme aimed at training farmers in on-farm water management. A Project however refers to a discrete site specific activity such as the reinstatement of the Gurgan aqueduct or the installation of a collector drainage system at Panjwai.

It will become clear to the reader of this chapter that some of the programmes proposed in it are appropriate and replicable for the Arghandab area - in fact they are identified as such in the text. For the sake of this report however, they are discussed in respect of the Helmand Valley schemes only since they address issues which are more pressing on the large modern and centralised schemes than on the smaller traditional schemes characteristic of the Arghandab area. Even so, there is no reason why MCI should not think in terms of carrying out relevant programmes in both locations if suitable and interested donors can be found.

Thus we have:

4.1 Irrigation Water Management

The available time and prevailing security situation permitted the consultant to inspect in some detail almost all of the Darweshan Scheme, some 50 percent of the Shamalan Scheme. It was also possible to undertake a cursory inspection of the Marja Scheme.

The vast majority of all the hydraulic structures on each scheme were structurally intact and in fact in remarkably good condition. Unfortunately, however, not one of those examined had working gates due to a variety of reasons:

- (i) gates were jammed shut
- (ii) gates were jammed open
- (iii) the lifting gear had been removed
- (iv) the lifting gear was broken
- (v) gates were missing altogether
- (vi) frames were bent, etc.

It is reasonable to assume therefore that there are no operable flow control gates anywhere in the three schemes. Given the age of the schemes is would be reasonable to expect that many of the gates need replacement or major overhaul but the complete dereliction of the "moving parts" must have arisen not only from age, wear and tear, but also from wholesale cannibalisation to supply the mujahidin war effort with saleable scrap and raw materials.

Whatever the causes, however, the lack of operating gates is having a detrimental effect on the schemes. First, water is not being distributed evenly around the schemes leading to water logging in some places and undersupply in others, such variations being observable on micro as well as macro scales. Secondly, some areas where irrigation supplies are proving to be unreliable are transected by drains with plenty of water (leading from the oversupplied areas). In such areas farmers are resorting to irrigating by pumping from the drains, often using small check dams to back up the drain water (see photograph 78). This is almost always causing salinisation and often, localised waterlogging.

Given the huge food growing potential represented by the large Helmand Valley irrigation schemes and the need to attract returning refugees, there is a pressing priority to rehabilitate the schemes. Activity is needed on several fronts as will be seen throughout this chapter, the restoration of flow control facilities is one of the most urgent.

There is a need, therefore, for a programme to repair or provide, as appropriate, all irrigation flow control gates on each of the Helmand Valley irrigation schemes. Such a programme would be ideally suitable for an agency such as MCI.

First a survey of every structure must be undertaken in order to quantify actual needs. This should take no longer than one month per scheme and will require an engineer with an assistant plus a four wheel drive vehicle.

Then, either using design drawings available at the HVA headquarters or new designs, a programme of gate fabrication and repair can be planned and costed.

Much will then depend on the donor community as it is unlikely that MCI will wish or be able to finance the programme from this stage onwards. Ideally, however, gate repair/fabrication workshops can be established at each of the schemes and installation teams organised.

It is impossible at this stage to provide much more detail, save to say that the installation teams will require transportation facilities not just for themselves but also for the gates, some of which are likely to be heavy and bulky.

The duration of the actual implementation of a gate repair or replacement programme will depend on the availability of donor funding and raw materials but assuming that both are fully available from the outset it is difficult to see the programme being completed in less than one year per scheme as much of the survey and installation work will have to be undertaken between growing seasons.

If an efficient and effective modus operandus for gate repair or replacement can be established in the Helmand Valley then there will be merit in replicating it in the Arghandab irrigated areas.

Any programme of gate repair or replacement will be a waste of time and effort, however, if there are no water bailiffs to operate the new gates. It is understood that before the Russian occupation, respected members of the communities were responsible for gate operation. This system should be reinstated and appropriate training given for new bailiffs where previous ones are no longer interested or available. The training should cover the essentials of proper irrigation scheduling as well as gate operation and maintenance.

4.2 Canal Earthworks

Mention has already been made of the generally first class condition of the canal earthworks which suggests that the ability and willingness of the scheme users to maintain their infrastructure is satisfactory. Even so, there are certain locations in each scheme where repair works are required, some as a matter of some urgency.

Of particular importance are the embankments immediately downstream of certain of the stilling basins where reverse eddying has resulted in undercutting of the structures - photograph 24 show a classic example. But there are also other locations between structures where slumping has taken place (see photographs 25 and 26). Such cases are also explained in most parts by badly performing or failed structures but in these cases downstream of the problem areas.

While it is very fair to say that there are not many locations having structurally induced embankment problems (only seven were identified on the Darweshan Main canal for instance), each must be considered a priority matter if more massive consequent damage is to be avoided (see section 4.4 for an example).

What is needed is a task force assigned to each of the Helmand Valley schemes to make good the damaged portions of the canal embankments. Ideally each would comprise a junior engineer to lead them, two foremen and five labourers.

Each team would need transportation, hand tools, a means of compacting the replaced soils and a generous supply of sand bags for the temporary coffering of the works during execution.

The engineer in charge of each team should be capable of making technical judgments on a case by case basis as not all cases of erosion downstream of a drop structure or cross-regulator indicate an unstable situation. It is normal for the soil/moving water complex to interact to a state of stability. Often the resulting shape looks like a section of spring onion cut lengthwise with the round end facing the structure. This essentially stable shape in fact inspired the seminal research into so-called "onion stilling basins" carried out earlier this century by the Malayan Department of Irrigation and Drainage. Such erosion need not be corrected - an example being the situation downstream of the Darweshan stop lock.

Cases where the water is eating back at the soil beneath or around structure; where banks are being undercut or where obvious slumping has taken place are those requiring attention.

4.3 Stilling Basins

Stilling basins in the Helmand Valley schemes have been built along conventional and classic lines. They are constructed in concrete and comprise a curved chute section which discharges into a trapezoidal stilling basin containing a row of appurtenances to hold the hydraulic jump. Immediately downstream of the stilling basin's exit are more rows of appurtenances to kill any residual energy.

There are no flared outlet transitions, but the generally good condition of the downstream channels in most cases suggests that none are required.

Notwithstanding this, some structures do exhibit damaged downstream channels. Photograph 28 presents a good example (situated at chainage +9.000 on the Darweshan main canal). The damage to the left bank is clearly visible in the picture which also suggests, from the extent of the turbulent section downstream, that there may be some damage to the stilling basin appurtenances. These suspicions were confirmed by several structures lying exposed in dry sections of canals. Damage or misplacement of the downstream appurtenances was very much in evidence in several cases - see photograph 29.

While neither the symptoms nor conditions themselves do not look particularly serious at this stage such problems, like toothache, do not get better by themselves. They require expert attention while the symptoms are still mild - that is if major interventions are to be avoided later (see photograph 27).

The solution could lie with the task forces recommended in the previous section. All that is required is an inspection of all stilling basins when irrigation is not taking place - any damage can then be made good very simply.

A simple and timely programme such as this could easily be implemented by MCI with highly satisfactory results.

4.4 Cross Regulator Near Mian Pushtu - Darweshan Scheme

This is an example of a structure that did not receive the expert attention recommended in the preceding section, with obvious results. It is interesting, in fact, to note that the damaged canal embankments in photographs 25 and 26 and discussed briefly above are situated a short way upstream of the destroyed structure. The damaged was almost certainly caused by the failure of the structure, either as result of increased flow velocities or rapid drawdown in water levels.

It is not easy to explain with certainty what went wrong here. At first glance it appears that there is a drainage channel at right angles to the canal right bank, flood flows in which may have damaged the bank form the outside. But such a channel would have had to cross a tertiary canal the offtake and first twenty or so metres of which have been obliterated. More likely, however, is that the canal right bank was eroded downstream of the structure leading eventually to undercutting and collapse of the structure progressively (and possibly quite suddenly) from the right bank to the left.

Either way, a small amount of timely maintenance work could have avoided this major reconstruction job.

There is no reason why MCI should not undertake the reconstruction of this essential structure and its nearby banks. The design will be available at the HVA headquarters. Clearly, however, the work must be carried out in the dry and therefore during a non-production season.

MCI's team which is currently undertaking the reconstruction of the Darweshan intake works will be able to undertake this relatively simpler task.

The material requirements can be estimated from the design drawings and the time required will be approximately 4 - 6 weeks.

Without the structure the tertiary offtakes will remain out of command and therefore useless; velocities in the upstream canal will be too high and the stilling basin of the next structure upstream may not work properly if, according to the design, its sequent depth is dependent on the backwater created by the now collapsed structure.

4.5 River Training Works Near Mian Pushta - Darweshan Scheme

Photograph 50 was taken a few hundred metres upstream of the collapsed structure discussed above. It shows a broad meander on the Helmand River which has encroached to no more than one field's length from the main canal. Its progress towards the canal continues and the canal must now be considered as being in some danger; especially has it has been reported that recent flood peaks brought Helmand river water to within 3 metres of the canal!

Attempts to contain or even divert the river must be made with some urgency. The simplest way to do this would be to install gabion groynes as illustrated in Figure 4.1.

Initially however the physical dimensions of the meander will have to be estimated - this can be done quickly and adequately from satellite imagery and will give an idea of the number of groynes required. But of course, a river training expert will have to be involved in the detailed specification of the necessary works. (S)he will also require information concerning the river cross sections at selected points along the meander along with data concerning the particle size distribution of material comprising the river bed and banks and of material suspended in the flowing water - possibly at different discharges.

Thus if MCI wishes to undertake this exercise there will be four stages involved:

(i) identification and procurement of a river training specialist and preparation of data collection and survey specifications;

(ii) data collection and survey, perhaps including the use of satellite imagery;

(iii) design of the works;

(iv) execution of the works.

MCI is capable of undertaking the 2nd and 4th activities with its workforce which is currently deployed on the Darweshan intake works.

4.6 Access Road Grading

Sound operation and maintenance of an irrigation scheme is greatly facilitated by good access roads. The roads serving the Helmand valley irrigation schemes vary from excellent (photograph 58) through good (photograph 13) to appalling (photograph 14). Roads in the Arghandab area are consistently worse.

There is therefore a pressing need for grading of the less satisfactory sections of the roads in both areas. This can easily be undertaken by MCI. Ideally a self-propelled grader should be used. It may be possible to borrow one from HVA headquarters. If this should not prove possible, however, other options could be utilised - bulldozers or tractors equipped with blades for instance.

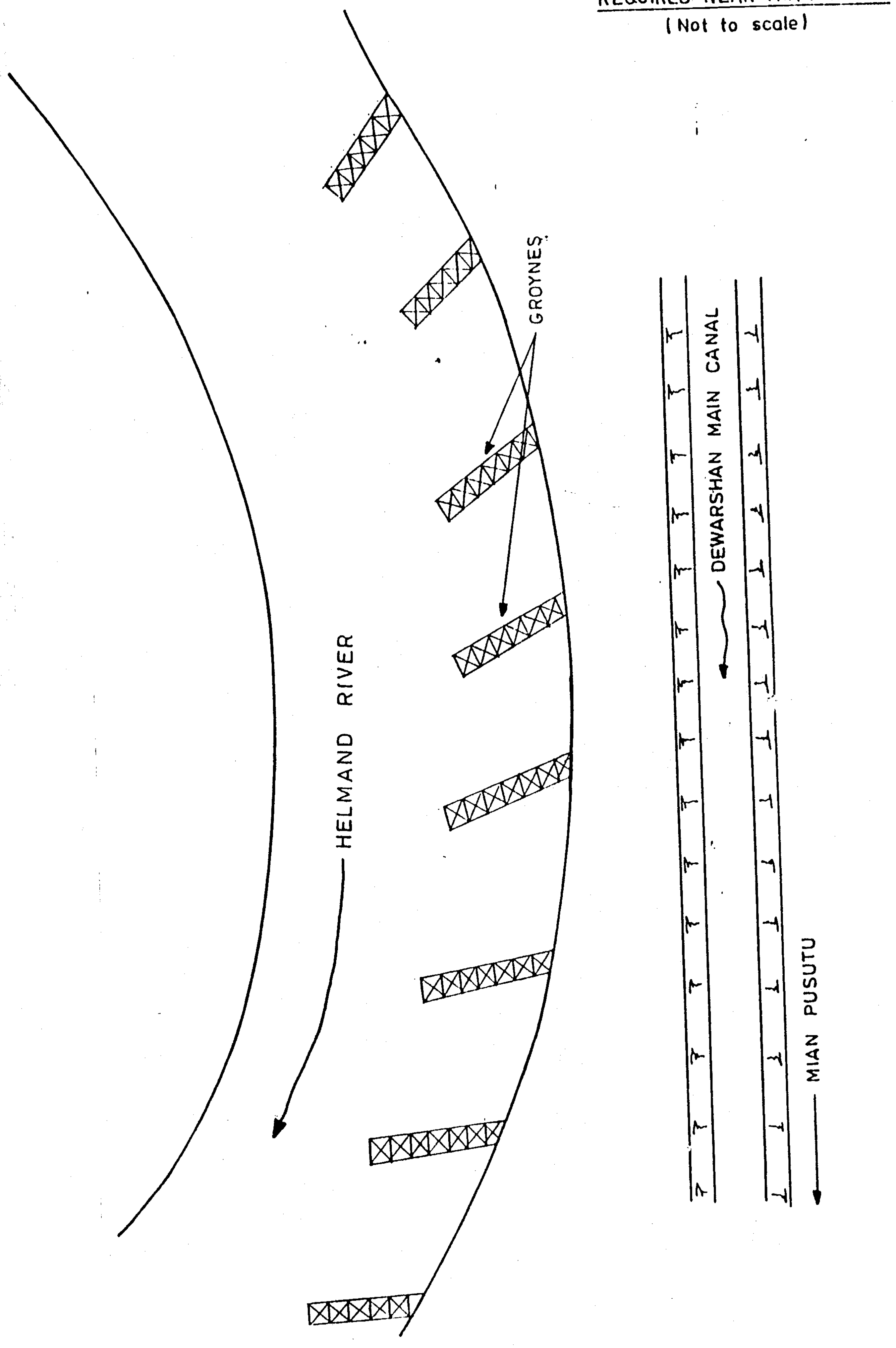
Road grading however, should not be seen as a one-off exercise. Regular inspection of all access roads is therefore strongly recommended, followed by appropriate action.

While an initial road rehabilitation exercise might be an interesting opportunity for MCI it is probably not desirable that ongoing road maintenance becomes the responsibility of an NGO ad infinitum. It is recommended therefore that before becoming involved in road rehabilitation MCI may wish to satisfy themselves as to the sustainability of the intervention - any further discussion of which is beyond the scope of this report.

FIGURE 4.1

RIVER TRAINING WORKS REQUIRED NEAR MIAN PUSHTI

(Not to scale)



4.7 Provision of Flow Measuring Facilities

Mention was made in section 4.1 of the need for a new corps of water bailiffs. Their task will be much facilitated if simple flow measuring facilities are installed downstream of each gate. In cases where sufficient head is available weirs would be the most simple to construct and use. In other cases where less is available then Parshall or similar flumes should be considered. Specifications and dimensions for standard flumes can be found in the literature.

There will, however, inevitably be locations where head is too limiting for either weirs or flumes. In such cases calibrated lined sections of canal will have to suffice. These would require calibration over a range of flows by current metre traverses.

Although there are many standard designs for flow measuring structures, the actual selection on a site by site basis will have to be carried out by an irrigation expert or hydraulic engineer. Once selected and scheduled, however, the various structures are well within MCI's capabilities for construction, again using their existing work force and in this respect it is perhaps worth noting that the opportunities for centralised construction of standardised units are considerable.

It is difficult at this stage to determine the time needed to install flow measuring facilities at all the key points in the various irrigation systems. Much depends on how many skilled staff MCI is willing or able to assign to the programme. Given the large areas involved along with the necessary conscientisation (addressed by bailiff and on-farm water management training) it would be wise to think in terms of at least three years.

Three years may seem a long time in Afghanistan's constantly changing political climate but this should not detract from the crucial significance of sound irrigation water management. Once flow control gates and measuring facilities have been installed and operators adequately trained, then irrigation water use in both the Helmand and Arghandab areas will become very much more efficient. This will go a long way towards reducing the water logging and salinity problems which currently represent a key constraint on agricultural production and indeed the social dynamics which are dominated by the refugee situation. Refugees are reported as being unwilling to leave the Pakistan camps unless their agricultural prospects are ameliorated.

4.8 On-farm Water Management

In all but a few regions of the world, uninformed farmers tend to over-irrigate. This is as true of the high-tech farmer in a developed economy as of a peasant farmer new to irrigated agriculture. But the importance of sound on-farm water management is particularly paramount in areas (i) where agriculture is entirely dependent on irrigation, and (ii) which are prone to water logging and salinity.

Both caveats apply to agricultural production in Afghanistan's Helmand and Arghandab valleys. Farmer training in on-farm water management would therefore be a most worthwhile intervention.

The training should address the following issues:

(i) The correct scheduling of irrigation to ensure that the growing plants are given the correct amount of water and no more for their various growth stages. The techniques of leaching should also be taught to the farmers, especially if a leaching requirement is found to be a requirement during irrigation. Leaching, however, will not prove beneficial without improved field drainage but this is dealt with in section 4.11 below;

(ii) The need for and physical practice of simple flow control techniques at minor canal level and below especially where rotation of supplies are necessary. The technology involved does not have to be especially advanced. At present, for instance, farmers seem simply to break the banks of canals flowing past their plots thus the amount of water flowing into their fields cannot be accurately estimated and will vary dramatically with changes of depth in the feed canal. Significant improvements (and more durable infrastructure) can be achieved by providing a pipe or a series of pipes under the canal bank. Flow into the farm, being undershot will then vary far less with changes in canal depths. Simple bungs would be used to open and close the pipe(s).

Rotation of supplies around the minor canals is presently effected by the simple expedient of using earth to close off supplies to canals not required at any particular time (see photographs 20, 21 and 23). This method is perfectly acceptable as long as there is a rationale to dictate when a canal is opened or closed - which again requires training;

(iii) The need for efficient water use at farm level - if, as a result of better flow control in the distribution systems, a farmer is no longer able to take as much as he thinks he needs, it becomes especially important that a farmer uses his water in an expert fashion. Uneven distribution of water around a farm or field was a common site during the field work. The result of this is an inadequacy of supply at one part of a field, with water logging at the bottom. This can be seen clearly in photograph 61 which shows a farm in the Shamalan system. The fields in question are rectangular in shape with the long dimension running down the slope. If the plots were rearranged such that the long dimension runs cross-slope the problem could be more easily avoided. Even more could be accomplished if the farmers were encouraged to level the individual plots more accurately;

(iv) Farmers should also be strongly discouraged from irrigating with drain water. This practise introduces two problems. First, backed up water levels in the drains (photographs 78-80) naturally causes water tables to rise in adjacent fields; secondly toxicity builds up more rapidly in the soil - the salinity problems were particularly obvious where irrigation from drains is taking place.

The above training would best be undertaken by a corps of Afghan irrigation specialists resourced and facilitated by an agency such as MCI at a rate of one per 5,000 ha of irrigated agriculture. The programme should be seen as ongoing rather than having a specific time horizon. Before proceeding, however, it should be noted that the success or otherwise of a training programme in on-farm water management will be highly dependent on the farmers' confidence in the irrigation infrastructural and institutional ability to supply the correct amount of water at the right time. Such a training programme will therefore have only limited success if the other relevant issues discussed in preceding sections are not addressed.

4.9 Remodelling of the Main Drainage Systems

While agricultural production in both the Helmand and Arghandab valleys is seriously constrained by inadequate drainage, this section deals only with the main drainage systems constructed to complement the large scale Helmand Valley irrigation schemes. The Arghandab areas are adequately served with either artificial or natural collector drains.

There are two major causes for the poor performance of the Helmand valley drainage systems:

(i) Clogged Drains

Many of the drains are clogged with silt and/or vegetation (see photographs 75, 77 and 80). This has already been addressed in respect of the Darweshan area by Eng. Wasiri of UNDP-OPS, Quetta, whose first hand survey of the problem has resulted in a very helpful quantification of the steps necessary to clean out the drains. A similar exercise is necessary in the other Helmand Valley schemes.

(ii) Constrictions

Flow in many of the large drains is severely constricted by road and canal crossings. Photograph 82 shows the downstream end of a collector drain at the point where it flows into a main drain via a small pipe under the road crossing. The outlet of the pipe is shown in photograph 81. The outlet is completely inoperable due to siltation.

Similarly, drains always pass under the canals rather than vice-versa (see photograph 73). As a general rule, however, it is always preferable to pass the known flow under the unknown. Thus the canal should pass under the drains. It is understood of course that the drainage system was added after the irrigation layouts were complete but the constrictions are nonetheless real.

Not all constrictions have resulted from design shortcomings, many have been added later, either to provide convenient crossings or to facilitate irrigation from the drains (photographs 78 and 80).

There are many such examples throughout the Helmand Valley and the lesson is clear. Drains should be allowed to run freely with no constrictions causing drains to back up with resulting water logging and salinity problems.

Two interventions are necessary.

The first is fairly straightforward and ideal for MCI. Clogged drains should be cleared out. This can be accomplished by suitably motivated and supervised local labour. The willingness of the local people to maintain their canals augurs well for a similar programme on the drains - although a degree of conscientisation may be necessary as many of the people may not understand the importance of sound drainage.

The second intervention is rather more complex - the whole main drainage system requires remodelling in order to remove the undesirable constrictions against flow. These fall into two categories, first constriction caused by canal/drain crossings and secondly, all others.

It may be considered that the canal/drain crossings will be too difficult to remodel in view of (i) the major construction works involved (canal siphons would be needed at each crossing), and (ii) the inevitable disruption to irrigation supplies. This approach is not, therefore, recommended at this stage.

It should not prove difficult to remove the other constrictions however. Access road crossings could be replaced with bridges or simple ford crossings while foot crossings could be replaced by simple wooden structures. It is suggested, therefore, that these steps are taken and the scheme allowed to operate for two or three growing seasons and the effects evaluated. After that a decision regarding the remodelling of the canal/drain crossings can be taken.

MCI is certainly able to deal with the first stage but the scale and cost of a programme to remodel the canal/drain crossings, along with the design inputs needed may require the services of a more specialist organisation.

Another problem observed in the drainage system concerns the lack of drop structures in canal overflow/wasteways. Photograph 76 shows the sort of problems that the lack of such structure is causing. Assuming that designs can be carried out by a hydraulic engineer MCI would be capable of carrying out the construction.

4.10 Field Drainage Systems

No extent of remodelling of the existing drainage systems will have much effect on the drawing down of the high water tables in both the Helmand and Arghandab valleys. A system of properly spaced field drains is required in both locations, the choice of sub-surface versus open ditches will have to be made by a suitably experienced drainage engineer. The choice, as well as being made on technical grounds, should also take into account the advantages or otherwise of mobilising local labour.

Either way, MCI is an ideal agency for executing a field drainage programme if provided with the services of a drainage design engineer.

If open ditches are selected and local labour can be mobilised, then it is simply a matter of providing supervision, which can be done with MCI's existing staff. Sub-surface drains however will require much more in the way of materials and skilled labour and possibly machinery.

4.11 Leaching

The soils which predominate in both the Helmand and Arghandab valleys do not appear to have suffered any structural breakdown as a result of the build up of salinity. They are fairly open textures with good permeability characteristics. As such they can be rehabilitated by the simple, if expensive, expedient of leaching. This of course assumes that field drains have been installed or excavated.

A leaching programme will basically require that agricultural production is ceased for a season, with predetermined amounts of water applied via the irrigation system to flush the salts out of the soil. This is clearly impractical on a large scale. A pilot project approach is therefore recommended. Ideally an entire tertiary unit served by a discrete drainage system should be used but however the pilot area is selected, it need not be greater than 100 ha.

In consultation with the communities, areas of land should be selected for leaching and the lost agricultural production made good for the families concerned. In this respect it may be considered advantageous to leach portions of farms rather than take entire farms out of production.

An irrigation specialist will be required to calculate the leaching flows necessary but the main inputs required for the leaching programme are essentially organisational in nature. MCI with its excellent community access is ideally suited to work with the communities in selecting the pilot areas, monitor progress and distribute the necessary compensation to the relevant farming families. This can be carried out with the available staff.

In association with the leaching programme, further inputs from an irrigation specialist will be required to establish the need or otherwise for a leaching requirement to be added to the normal irrigation water requirements. The results of which should be incorporated into the training programme for improved on-farm water management.

5. ACTIVITIES OF OTHER AGENCIES

Like similarly troubled areas, Afghanistan is attracting the attention of myriad relief and development agencies, both institutional and non-governmental. For this reason it is particularly important to ensure that efforts are not duplicated and that plans are developed in a strategic and co-ordinated fashion.

The consultant therefore was required to obtain an overview of what other agencies were planning for Afghanistan and to make comparisons with MCI's intended activities.

To this end it proved possible in the time available to meet or talk with representatives of the following agencies:

AFGHANAID
ARR
CARE
IRC/SRP
VITA

The information gained from the individuals concerned about their own and other agencies activities suggests that the programmes and projects proposed in this report are not about to addressed by another agency.

To be more specific:

AFGHANAID is not active at all in the Helmand and Arghandab valleys but is active in gabion based construction works in the North of the country, as such they were able to supply helpful information about gabion transportation and utilisation - this information was duly passed on to MCI in respect of their repair works at the Darweshan intake works.

ARR are involved in facilitating routine canal maintenance on a self-help basis in the Helmand valley - in fact photograph No 16 shows a portion of the Shamalan main canal which had recently been cleaned out with support from ARR.

CARE is not active in the project area but is regularly involved in gabion based works in the North and as such were also able, like AFGHANAID, to supply useful information; more interestingly they are also involved in the rehabilitation of traditional irrigation schemes. Each of their interventions are subjected to an evaluation exercise, the reports from which are in the public domain. MCI are invited to make contact with a view to learning from CARE's evaluations.

IRC/SRP are involved in training Afghan families in gabion fabrication and have in fact supplied other agencies such as CARE and AFGHANAID with gabions. Such gabions are proving to be very much cheaper than "branded" alternatives. Furthermore, those end users questioned by the consultant had no complaints whatever about the quality supplied. IRC/SRP claim that something like 1,400 families, resident in refugee camps, have now been trained in gabion weaving. Theoretically there is a capability to weave gabions of any shape or size, but the overwhelming majority of available jigs are set up for 2 x 1 x 1 baskets. IRC/SRP are able to mount cross-border training programmes lasting six weeks, thereby allowing end users to transport wire only for Afghanistan based families to weave into gabion panels (with a considerable cost saving to the agency concerned). This option is expected to be of significant interest to MCI.

VITA is very busy in several sectors all over Afghanistan. Their representative in Peshawar mentioned that typical activities include rehabilitation of small scale traditional irrigation systems; roads and bridges. It was also claimed that such activities are going on in the Arghandab and Helmand Valleys - a specific example being the Darweshan bridge which requires reconstructed and strengthened abutments. The VITA representative in Quetta, however, stressed that so far no firm plans have been made for any new activities in the area in question, although plans are being made for interventions in nearby areas such as that North of Grishk. It was noted by VITA's Quetta based staff that drainage and salinity are the most significant problems in the Helmand valley, along with the associated problem of poor on-farm water management. Finally it was stressed by VITA's staff that no plans for the "MCI" areas are expected to made until any MCI programme has been set out.

During the field trip it was possible to see first hand one of VITA's interventions which comprised the diversion of the Panjwai canal underground to cut out a damage prone portion which traversed a hard promontory close to the river bank. As well as being well executed, VITA's approach was particularly cunning as it made use of a series of ancient karez's.

The consultant was not able to identify any other agencies or activities likely to "compete" with MCI's opportunities but time did not permit a completely thorough investigation, thus before finally embarking on any programme or project MCI may wish to make special efforts to ensure for themselves that their intentions are not being duplicated by another agency.

6. THE SUITABILITY OF MERCY CORPS INTERNATIONAL AS AN IMPLEMENTING AGENCY

Mercy Corps International have been working with disadvantaged Afghan people since the early 1980's, both in Pakistan and cross border in Afghanistan itself. As a result of this they have been able to build up a sound operational capability despite the formidable challenge that operating in trouble torn Afghanistan represents.

This consultancy was addressed at two fairly discrete areas, the Arghandab and Helmand valleys. Ongoing activities mean that MCI have permanent representation in both areas in the form of clinics, tented go-downs and staff houses, etc. The consultant was accommodated in two MCI staff houses, one in each location (Panjwai and Darweshan) and was impressed with their efficient and businesslike approach. It has to be said that food at the Dewarshan centre was in very short supply but this had more to do with transportation and supply difficulties rather than any inefficiency on MCI's part.

In fact, despite the day-to-day difficulties of operating in Afghanistan (which should not be underestimated) MCI has built up a good team of competent, committed drivers and equipped them with suitable vehicles. MCI's ability to remain mobile even on the horrendous dirt roads in Afghanistan is beyond question. There was one occasion, however, when all four vehicles in the convey became seriously and repeatedly bogged down while attempting to cross two kilometres or so of heavy saturated soils. It was clear that the tyres were not suitable for such terrain - as such terrain is not usual the choice of tyres is probably correct.

MCI's communications within Afghanistan are affected by radio, there being no intact and operational telephone system. The radios in question seem to work well but are based at MCI centres. As a consequence the consultant and his party regretted the lack of vehicle based radios on several occasions, the most serious of which were the missile bombardment of Lashkagar and the crossing of the Registan desert when faulty fuel caused a series of potentially life threatening vehicle breakdowns.

Of course, all of MCI's capabilities and attributes are not enough by themselves. Equally or perhaps more important are the relationships which the organisation has with the local people, particularly those in authority. If the warm and friendly welcome offered by the various commanders encountered in the field are any indication these would seem to be excellent. Also, many of MCI's Afghan staffers are clearly well known and liked among the communities visited. But the good relationships are not limited to those people living in the rebel held areas. During the two days spent in Laskkagar meeting and discussing with officials at the Helmand Valley Authority headquarters every courtesy and cooperation was extended to the mission resulting in a successful data gathering exercise.

The Panjwai and Dewarshan centres were both occupied by generally busy teams of MCI field workers. The consultant is not qualified to address their competence in fields other than irrigation engineering, but in that field, as demonstrated by the temporary protection measured which had been undertaken at the Dewarshan offtake site, the works had been well executed. There did seem, however, to be a underlying problem in mobilising labour from within the communities for such activities as rock breaking, etc. Several factors were identified as being influential. First, there was a genuine lack of suitable equipment, which has since been addressed. Secondly, local social dynamics which required that labour is organised through local dignitaries were difficult to circumvent, and thirdly, the onset of Ramadan was expected to slow things done considerably.

Morale among the MCI field staff was generally quite high but clearly at Dewarshan the above labour based problems were undermining morale a little as were highly specific demarcation issues. The latter is of course not really part of this writer's mandate and is anyway being addressed by the site supervision engineer and MCI's agricultural project coordinator.

All in all it is reasonable to conclude, in general terms, that MCI would be an ideal choice of implementing agency for many kinds of development programmes or projects in Afghanistan - at least in the areas visited by the consultant (and most likely elsewhere). It is necessary, however, to compare this clearly demonstrated general suitability with the specific programmes and projects proposed in this report. An assessment of MCI's capabilities in respect of these is presented in Table 6.1.

The question remains as to whether it would be better to concentrate on a sectoral or area approach to agricultural rehabilitation. The former would imply that all drainage problems in the Arghandab and Helmand valleys would be solved under a single programme or basket of programmes. The latter would result in a multi-sectoral solution of all the problems in a small socio-economically or geographically discrete areas.

After much consideration of the two options this writer would favour the latter approach for the following reasons:

(i) there would be a more noticeable and rapid return on donor "investment" as the benefits of interventions in one sector would be compounded by interventions in others;

(ii) there would be more to show other donors with a view to attracting more funds for new areas;

(iii) a more comprehensive treatment of a particular area's problems would be more effective in persuading refugees to return from their camps in Pakistan and Iran.

TABLE 6.1 THE CAPABILITIES OF MCI AS IMPLEMENTING AGENCY FOR CONSTRAINTS ON IRRIGATED AGRICULTURAL PRODUCTION IN AFGHANISTAN'S ARGHANDAB AND HELMAND VALLEYS/continued

PROJECT	NATURE OF INTERVENTION	MCI's CAPABILITIES	NATURE OF ANY EXTRA RESOURCING REQUIRED (other than funding)
Zahir Shahi Bifurcation to Babawali Offtake	Project to provide and install lifting cables to 3 large radial gates	Suitable	None
Repair of Babawali Distribution Complex	Project to repair or replace offtake control gates and damaged earthworks	Suitable	None
Manar Canal Offtake	Project to make good certain construction shortcomings of a small river offtake structure	Suitable	None
Reconstruction of Cross Regulator Near Mian Pushtu on Darweshan System	Self-explanatory project	Suitable for carrying out or facilitating the construction but not suitable for the initial design work if original drawings no longer available at HVA headquarters	If original drawings no longer available at HVA headquarters then the help of an irrigation or hydraulic structures specialist will be required
River Training Works Near Mian Pushtu	Project to attempt to contain or even divert a meander on the Helmand River	Suitable	Initial guidance from a suitable specialist will be necessary in respect of the deployment of the groynes
Replacement of flow control gates	Programme to replace all irrigation flow control gates on existing schemes in the Helmand and Arghandab Valleys	Suitable	Intermittent assistance of an irrigation engineer possibly from HVA
Canal embankment repair	Programme to identify and make good damaged portions of irrigation canals in the Helmand and Arghandab Valleys	Suitable	None
Checking and repair of Cross-regulator Stilling Basins	Programme to identify and make good damaged elements of stillings basins on irrigation canals in the Helmand and Arghandab Valleys	Suitable	Assistance of an irrigation engineer possibly from HVA

TABLE 6.1 THE CAPABILITIES OF MCI AS IMPLEMENTING AGENCY FOR CONSTRAINTS ON IRRIGATED AGRICULTURAL PRODUCTION IN AFGHANISTAN'S ARGHANDAB AND HELMAND VALLEYS

PROJECT	NATURE OF INTERVENTION	MCI's CAPABILITIES	NATURE OF ANY EXTRA RESOURCING REQUIRED (other than funding)
Harambanee drainage area	Project to excavate correctly aligned field drains	Suitable	A setting out engineer will be required if none are available in-house
Reconstruction of Gurgan Aqueduct	Project to reconstruct an aqueduct spanning approximately 50 m across the Tarnak river	The nature of the technology recommended is such that MCI are probably not ideally qualified to undertake this	The new structure should be designed by suitably qualified structural engineers who should also take responsibility for construction, planning and supervision
Panjwai Irrigation Main Offtake	Project to remodel the main offtake to the Panjwai irrigation system	Suitable	A small amount of advice will be initially required from an irrigation engineer
Panjwai Drainage	Project to excavate field drains feeding into the new Panjwai main drain	Suitable	A drainage expert will be required along with a setting out engineer if none are available in-house
Malajat Drainage	Project to excavate correctly aligned field drains	Suitable	A drainage expert will be required along with a setting out engineer if none are available in-house
Repair of Rahman Wash	Project to substantially remodel a drain/canal crossing by constructing a syphon	Suitable for carrying out or facilitating the construction but not suitable for the initial design work	The crossing will have to be designed by a suitably qualified irrigation or hydraulic structures specialist
Zahir Shahi Main Offtake	Project to install 3 new radial gates at the Zahir Shahi main offtake, the gates have already been fabricated	Suitable	None

TABLE 6.1 THE CAPABILITIES OF MCI AS IMPLEMENTING AGENCY FOR CONSTRAINTS ON IRRIGATED AGRICULTURAL PRODUCTION IN AFGHANISTAN'S ARGHANDAB AND HELMAND VALLEYS

PROJECT	NATURE OF INTERVENTION	MCI's CAPABILITIES	NATURE OF ANY EXTRA RESOURCING REQUIRED (other than funding)
Harambanee drainage area	Project to excavate correctly aligned field drains	Suitable	A setting out engineer will be required if none are available in-house
Reconstruction of Gurgan Aqueduct	Project to reconstruct an aqueduct spanning approximately 50 m across the Tarnak river	The nature of the technology recommended is such that MCI are probably not ideally qualified to undertake this	The new structure should be designed by suitably qualified structural engineers who should also take responsibility for construction, planning and supervision
Panjwai Irrigation Main Offtake	Project to remodel the main offtake to the Panjwai irrigation system	Suitable	A small amount of advice will be initially required from an irrigation engineer
Panjwai Drainage	Project to excavate field drains feeding into the new Panjwai main drain	Suitable	A drainage expert will be required along with a setting out engineer if none are available in-house
Malajat Drainage	Project to excavate correctly aligned field drains	Suitable	A drainage expert will be required along with a setting out engineer if none are available in-house
Repair of Rahman Wash	Project to substantially remodel a drain/canal crossing by constructing a syphon	Suitable for carrying out or facilitating the construction but not suitable for the initial design work	The crossing will have to be designed by a suitably qualified irrigation or hydraulic structures specialist
Zahir Shahi Main Offtake	Project to install 3 new radial gates at the Zahir Shahi main offtake, the gates have already been fabricated	Suitable	None

TABLE 6.1 THE CAPABILITIES OF MCI AS IMPLEMENTING AGENCY FOR CONSTRAINTS ON IRRIGATED AGRICULTURAL PRODUCTION IN AFGHANISTAN'S ARGHANDAB AND HELMAND VALLEYS/continued

PROJECT	NATURE OF INTERVENTION	MCI's CAPABILITIES	NATURE OF ANY EXTRA RESOURCING REQUIRED (other than funding)
Rural Access Road Grading	Self-explanatory programme	Suitable	None
Installation of Flow Measuring Facilities	Self-explanatory programme	Suitable	An irrigation or hydraulic structures specialist will be required for specification and design work
Provision of Training in On-farm Water Management	Self-explanatory programme	Suitable	A full time extension worker will be required and possibly a message design expert in the initial stages
Remodelling of Existing Drainage Systems	Programme to remove flow constrictions affecting drainage systems in the Helmand and Arghandab Valleys	Suitable	Considerable inputs will be required from a drainage and/or hydraulic design specialist if canal/drain crossing are to be remodelled
Provision of Field Drainage Systems	Programme to install field drains capable of drawing down water tables and removing leaching water	Suitable	A drainage engineer will be required to undertake the specification and design work
Leaching of Saline Land	Self-explanatory programme	Suitable	None, if the on-farm water management training exercise is proving/has proved to be successful

APPENDIX A

CONSULTANT'S ITINERARY

APPENDIX A CONSULTANT'S ITINERARY

FEBRUARY	6th	Departed Nairobi for Karachi
	7th	Departed Karachi for Quetta
	8th	Briefing at MCI office, reading background documents
	9th	Departed Quetta for Islamabad attended meeting convened by WFP and UNDP, met for discussions with UNDP-OPS Quetta representative
	10th	Attended formal briefing meeting with AID-REP, US Embassy, Islamabad; held discussions with DAI, departed Islamabad for Peshawar
	11th	Meetings with IRC/SRP, VITA, CARE and AFGHANAID; departed Peshawar for Islamabad
	12th	Attempted to depart Islamabad for Quetta, but after waiting for 8.5 hours in departure lounge, flight was cancelled
	13th	Departed Islamabad for Quetta
	14th	weekend
	15th	Continued reading baseline documents and began preparations for the cross border mission
	16th	Continued reading baseline documents and finalised preparations for the cross border mission; met with VITA, Quetta.
	17th	Departed Quetta for Chaman
	18th	Departed Chaman for Panjwai via Harambani scheme location
	19th	Visited Panjwai agricultural area; Gurgan Aqueduct site and Malajat scheme location
	20th	Visited Rahman washout site; Zahir Shahi offtake and bifurcation sites; Babawali distribution structures; Jui Lahore canal offtake and Manar canal offtake
	21st	Visited Panjwai canal offtake site; departed Panjwai for Lashkagar
	22nd	Studied Archive drawings at Helmand Valley Authority Headquarters in Lashkagar
	23rd	Evacuated Lashkagar under during Mujahidin missile bombardment; proceeded to Darweshan; made a preliminary visit to Darweshan headworks

	24th	Inspected Darweshan scheme main distribution system
	25th	Technical inputs on Darweshan Headworks repair works
	26th	Technical inputs on Darweshan Headworks repair works
	27th	Visited Marja command area of Boghra scheme area; inspected those portions of Shamalan scheme's main and secondary distribution system in secure (i.e. Mujahidin controlled) areas
	28th	Inspected Darweshan secondary distribution and drainage systems
	29th	Departed Darweshan for Dalbandin
MARCH	1st	Departed Dalbandin for Quetta; preliminary debriefing at MCI office
	2nd	Prepared an aide-memoir for AID-REP, attended a meeting with UNDP-OPS in Quetta, began writing detailed technical report
	3rd	Continued with report writing; met with Save the Children
	4th	Continued with report writing; departed Quetta for Islamabad
	5th	Attended formal debriefing with AID-REP; departed Islamabad for Karachi
	6th	Departed Karachi for Nairobi
	7th	Arrived Nairobi
	23-27th	Report finalisation in Nairobi

APPENDIX B

REPAIR WORKS AT DARWESHAN INTAKE SITE

APPENDIX B REPAIR WORKS AT DARWESHAN INTAKE SITE

1. INTRODUCTION

Darweshan Irrigation Scheme supplies a large area of mixed arable agriculture with water from the Helmand river. It was constructed during the 1950's with US technical assistance and falls under the aegis of the Helmand Valley Authority (HVA) which has its headquarters in Lashkagar.

[Detailed histories and descriptions of the scheme can be found in numerous other reports and need not be repeated here.]

The scheme's river intake works are located some 60 km downstream of Lashkagar at a point marginally protected by a large outcrop of hard material on the Helmand's left bank and known locally as "Chimney Rock". Notwithstanding this, the river is nonetheless highly mobile as the flood plain on which the scheme is situated comprises loose easily eroded material.

Post construction changes in river course coupled with damaged, inoperable gates have resulted in the failure of the main canal right bank approximately 50m downstream of the inlet structure discharge box - thereby admitting the river directly and uncontrolled into the main canal. The situation was then made very much worse by an unusually severe flood event in 1990. As it stands now a large portion of the scheme's upper distribution system is highly vulnerable to more catastrophic damage during future flood events.

Rectification of the problem, while being technically quite straightforward is complicated by the ongoing security problems which still affect most of Afghanistan. Yet the importance of the Darweshan scheme as a major food producing area and its strategic potential for encouraging the return of refugees has focussed attention on the possibilities of reconstruction. Clearly an implementing agency already operating successfully in Afghanistan, especially in Mujahidin held areas, would be required.

Mercy Corps International (MCI) is such an agency. It has well established and ongoing relationships with Mujahidin commanders and groups along with a clearly demonstrated logistics capability "cross-border". MCI was therefore approached by UNDP-OPS with a view to their becoming the implementing agency for the reconstruction works. A draft design had already been prepared.

MCI accepted the challenge and proceeded to recruit:

(1) a construction engineer to expedite, co-ordinate and supervise the works, utilising funds made available by UNDP-OPS;

and

(2) an irrigation specialist to provide consultancy support utilising funds made available by USAID.

This appendix presents the consultant's conclusions and recommendations. Terms of reference as given to the consultant are listed in Chapter 1 of the main text, while the itinerary followed can be found in Appendix A.

2. ENGINEERING ISSUES

The original as built design of the headworks followed a classical approach with a cross-river structure comprising wash-out sluices, a concrete weir and sheet piling along with an undershot offtake approximately parallel to the river's line of flow at the point. This approach, which was suggested by recent site photographs and confirmed by the original as-built drawings as viewed at the HVA headquarters, would have presented no serious difficulties during construction.

Unfortunately the Helmand river is, by the time it reaches the Darweshan intake site, well into an extensive and mature flood plain and thus is highly mobile, especially given the non-cohesive nature of the soils that it has deposited. Because of this the site is now nothing like its original situation - the leading edge of the meander on which the works were located is now several hundred metres downstream with dry land appearing in its wake, i.e. in the vicinity of the headworks. In other words the river is merely demonstrating classic and predictable behaviour. The consequence of this, however, is that any attempt to restore the intake works to anything like the original concept is going to be extremely problematic and costly.

In the broadest terms such an attempt would require that what was once a "cut to spoil" approach in virgin ground would become a "fill from borrow" approach executed on unknown and doubtful foundations in a fast flowing and major river.

Listing now the difficulties in more detail:

(1) There is no clay within many kilometres of the site thus a stabilised earth embankment is impossible.

(2) An unconsolidated embankment with side slopes greater than or equal to the angle of repose of the material which is available would be excessively wide and easily eroded.

(3) A closure embankment would therefore require retaining walls on each face.

(4) The simplest approach to construction of such retaining walls would be to utilise box gabions but extensive searches have shown that there is insufficient material with which to fill the large number of gabions involved.

(5) To fill the gabions with sandbags themselves filled with lean concrete would require too much cement (approximately 1,400 tonnes!).

(6) Costly river training works would also be required, both to simplify construction and to ensure longevity of the new embankment.

(7) Even if the river training works proved successful massive siltation upstream of and around the intake would almost certainly result.

Thus as a result of the investigations and considerations made possible by the consultancy, the solution as planned has been found to be impracticable.

Even so, it has to be mentioned that the works have been planned in two phases. The first phase is now complete.

It basically comprised the protection of high risk points at the canal inlet as it currently stands, against further possible damage during the forthcoming flood season. This has been accomplished utilising gabions filled with the limited material that is available. This protection work is necessary whatever final solution is applied to the intake problem.

The consultant therefore examined the work during the site visits and found it to have been very satisfactorily executed, although spot recommendations for a little additional protection were also given. The stones sensibly available for gabion filling are not particularly ideal, comprising large well rounded pebbles. Such material does not lend itself to high gabion packing densities and shear strengths. Even so, given the fact that this material had to be used, the consultant was impressed with the great care taken to make the most of it, that is to say that great care had obviously been taken by those responsible for filling the baskets.

So, the first phase has been completed, but what of the next, i.e. main phase?

The problems as listed above were discussed at length with the UNDP-OPS representative in Quetta. As a result of the discussions it was agreed to adopt a radical new approach to solving the pressing problem of controlling inflows to the main canal. This will involve the following steps:

(1) the excavation of a temporary diversion channel from the Helmand river into a point on the main canal conveniently upstream from the stop lock structure at around chainage 3,500.00m;

(2) the damming-off and dewatering of a portion of main canal approximately 100m long at around original chainage 500m;

(3) the construction, in the dewatered section, of an inlet control structure incorporating a flow measuring flume;

(4) further armouring of the canal upstream of the new structure;

(5) closure of the temporary diversion channel.

It was further agreed that the consultant was retained to undertake the hydraulic and layout design of the new structure, while UNDP-OPS in house experts would undertake the necessary structural and other detailing. Detailed scheduling of the construction activities will remain the responsibility of the construction engineer.

Although the approach now adopted will be much easier to construct as well as being more appropriate and durable, there remains the possibility that sedimentation in the lead channel will occur. This however can be addressed as an operation and maintenance activity and is easily justified as such by the clear willingness and ability of the local people to undertake such work.

APPENDIX C

GPS CO-ORDINATES TAKEN DURING MISSION

APPENDIX C GPS CO-ORDINATES TAKEN DURING MISSION

Mssrs Development Alternatives Incorporated (DAI) very kindly made available from their Islamabad Office, a Magellan Geographical Positioning System (GPS) handset in order to facilitate the fixing of key features encountered or examined during the field trip.

Unfortunately, due to the fact that satellites were not always available at suitable times during the working day, the number of readings taken were perhaps rather limited. Even so it has to be said for the record that the unit was found to be extremely straightforward in use and ideally suited for the task in hand.

In all 13 locations were fixed using the GPS unit, of these ten were three dimensional fixings. Descriptions of each are given in the following notes which should be read in conjunction with the photograph album issued with this report.

LOCATION 1 - Near Balandai Village

31 deg 27.47 min North
65 deg 35.08 min East
891 m above mean sea level

This area comprises badly ordnance damaged wheat and raisin fields criss-crossed by run down and damaged irrigation canals. Considerable self-help effort is now underway to repair homestead compounds and agricultural infrastructure - photograph 9 refers.

LOCATION 2 - Rambasi Village

31 deg 32.37 min North
65 deg 38.36 min East
926 m above mean sea level

This area is very much the same as the above but also suffers from high water tables and waterlogging. Refugees are slowly returning and busying themselves with repairing their properties as well as installing a new drainage system. Pre-war wheat yields reached 1,250 kg/jerib, such yields along with vegetable secondary crops, exported to Pakistan, mean that the area used to be prosperous in local terms.

LOCATION 3 - Panjwai Environs

31 deg 31.89 min North
65 deg 27.71 min East
992 m above mean sea level

This was once a very successful raisin growing area. Again military activity has destroyed much of the rural infrastructure but the overriding problem is salinisation due to high water tables and poor drainage. Photographs 2, 51, 52, 63 and 64 refer.

LOCATION 4 - Confluence of Two Drains South of Kanahar

31 deg 34.37 min North
65 deg 42.13 min East
1050 m above mean sea level

Recently constructed drains have become clogged. Furthermore, damaged irrigation canal banks in Kandahar are allowing irrigation water to flow into one of the drains. This water is backing up the drainage system causing waterlogging which is not helped by the fact that in places drains are breached or pumped from for irrigation supplies. Photograph 70, shows the actual confluence, while 65 - 69, 71 and 72 show the results.

LOCATION 5 - Breach on the Sangesar Canal

31 deg 36.10 min North
65 deg 30.66 min East
1077 m above mean sea level

Here a seasonal natural drainage channel has badly damaged an important canal. Photographs 34 - 40 show the extent of the damage while illustrating the local land use. Ordnance damage to fields did not seem to be quite so extensive as elsewhere.

LOCATION 6 - Zahir Shahi Canal - Babawali Bifurcation, etc.

31 deg 39.65 min North
65 deg 40.15 min East

The structure, which is shown in photograph 41, abstracts water conveyed from the Arghandab river some 20 km away by the Zahir Shah canal, into a lead canal which itself supplies five traditional canals.

Photograph 5 indicates current land use to the North of the structure.

LOCATION 7 - Manar Canal Offtake

31 deg 44.76 min North
65 deg 42.76 min East
1006 m above mean sea level

This is the offtake of a historic canal taking water from the Arghandab River's right bank in a South Westerly direction. The canal traverses land as shown in photograph 4 (taken near to the offtake) before reaching its command area.

LOCATION 8 - Panjwai Canal Offtake

31 deg 35.14 min North
65 deg 29.58 min East
953 m above mean sea level

This is the location of the offtake to the Panjwai canal which is illustrated in photographs 46-49.

LOCATION 9 - Secondary Offtake on the Darweshan System

31 deg 06.92 min North
64 deg 11.63 min East
536 m above mean sea level

Photographs 7 and 8 indicate typical land use at this location, although some salinity based degradation of the type shown in photograph 57 is occurring as a result of poor irrigation water management.

LOCATION 10 - Mian Pushtu, Darweshan Main Canal

30 deg 56.08 min North
64 deg 08.66 min East

Here the Helmand river is meandering ever closer to the canal and is now effectively just one field away, as shown by photograph 50 which also presents a clear illustration of the salinisation affecting much of the Darweshan project.

LOCATION 11 - Chainage +52.000 on Darweshan Main Canal

30 deg 46.19 min North
64 deg 66.48 min East
735 m above mean sea level

This location marks the end of the original main canal, although the canal has since been extended. The land around here is characterised by salinity problems, photographs 53 and 54 were taken nearby.

LOCATION 12 - Shamalan System

31 deg 25.30 min North
65 deg 19.82 min East

This is a mainly wheat growing area, with some salinity and waterlogging problems exacerbated by poor irrigation water management at both system and field levels. General land use and the main canal are shown in photograph 16 while 61 shows typical fields.

LOCATION 13 - Shamalan Canal Terminal Structure

31 deg 19.27 min North
65 deg 16.60 min East
806 m above mean sea level

This location marked the original termination of the Shamalan canal which has since been extended.