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REHABILITATION AND COMPLETION OF IRRIGATION AND DRAINAGE INFRASTRUCTURE PROJECT

ENVIRONMENTAL ASSESSMENT AND MONITORING IN THE PROJECT AREAS OF THE SAMUR APSHERON CANAL AND MAIN MILL MUGAN COLLECTOR DRAIN

Final Report

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Revised

EXECUTIVE SUMMARY

The present study has been granted by the International Development Association, Grant No. TF025537. CES Consulting Engineers Salzgitter GmbH has been contracted on 11 July, 1999 by the State Amelioration and Irrigation Committee (SAIC) to conduct the "Environmental Assessment and Monitoring in the Project Areas of the Samur Apsheron Canal and the Main Mill Mugan Collector".

According to the national environmental legislation the project executing agency, SAIC, is responsible for the assessment and the monitoring of environmental impacts caused by the project. This study assesses the present and future environmental situation in both project areas and proposes an environmental monitoring programme as required by the legislation. This programme forms the basis for the regular observation and assessment of environmental key parameters in both project areas.

On 4 August, 1999 a workshop was carried out by SAIC to find a common understanding of monitoring relevant topics, the participants represented different institutions involved in environmental affairs, e.g. the State Committee on Ecology and Control on Natural Resources Utilisation (ASCE). During the workshop the environmental monitoring was discussed and key parameters were agreed upon between SAIC and the participants (Annex C).

The monitoring areas have been defined during the workshop. The MMMC monitoring area is bordered by the Araz river south west to north east, by Karabakh Canal in the south west. The collector drain K3, Ag gol and Sarisu lakes together with the Kura form the northern borders of the monitoring area. The SAC monitoring area is bordered by the upper 50 km of the SAC in the west, the Caspian Sea in the east, the international border to Russia in the north and the Velvelichay river in the south. Finally the SAC area was extended to the southeast to include also the area of the Deveci Lake which is located approximately 20 km southeast of the bottom end of the SAC reach to be rehabilitated.

Three public consultants meetings were held during December 1999 to inform local organizations and stakeholders about the proposed program, the monitoring program and the environmental management plan, and to hear their views and suggestions (see Annex D).

MILL MUGAN COLLECTOR DRAIN

The Mill Mugan Collector Drain (MMCD) is a long-term scheme to drain the right bank of the Kura River. At present the upper part of this area, irrigated by the Karabakh Canal, is drained through a siphon under the Kura River into the left Shirvan Collector Drain. In consequence, the left bank collector is over-loaded and drainage in its service area is impeded, and this also backs-up into the right bank area. Additionally, drainage water is discharged into the Kura River to relieve the over-loading in peak periods. This raises the salinity level in the Kura adversely impacting on Baku water supply, which is partly taken from this source.

The lower part of the right bank area, the Mugan-Salyan plain, has a separate collector drain already constructed to an outlet further south on the Caspian Sea.

The proposed project is to construct the 31 km missing link between this lower right bank collector and the upper part, so relieving the existing drainage congestion described above. There will be a positive impact on the right bank area drained by the lower section of the Mill-Karabatch Collector Drain, immediately above the connection with the MMCD, and the service area of the left bank Main Shirvan Collector Drain. The project will also construct all the associated structures, bridges, service road and a siphon under the Araz River. Additionally the project will provide for rehabilitation of deteriorated collector drains feeding into the new section of the MMCD, servicing some 36,500 ha.

The Project Area

The immediate project area surrounding the 31 km of missing link in the MMCD which will be constructed under the proposed project comprises (a) 36,500 ha of irrigated land which will be drained directly into the new section, and (b) about 20,000 ha of non-arable, unirrigated and undrained land, mostly rough pasture and swamps bordering the Sarisu lake, lying to the north of the new construction. This area includes some of the most saline land in Azerbaijan, resulting from a high ground water table, around 2.0 m in spring and summer which is not addressed by the current poor and impeded drainage system.

Two sensitive and protected areas are in or near the project area, these are:

- Ag-Gol Lake, a 9,173 ha protected area containing a 4,361 ha shallow lake and reed swamp located about 20km upstream of the immediate project area. This was designated a RAMSAR site in 1976 for the protection of resident and migratory birds. Ag-Gol lake receives, and is sustained, by drainage water from the Karabakh irrigation system. A regulator controls the water level in the Ag-Gol lake, and discharges through a channel to the Sarisu Lake.

- Sarisu Lake, which is a very shallow water body and reed swamp of around 6,500 ha located in the immediate project area, between the proposed MMCD and the River Kura. Although only a restricted area, the Sarisu Lake is nevertheless important for migratory and resident birds. Currently, about 10,000 ha of land south of the lake is drained by pumping into Sarisu lake, and thence through an outfall into the Kura River. This drainage water is considered responsible for the high salinity of the lake and also contributes to the salinity of the Kura River.

Impacts during Construction

Construction impacts will be negligible provided normal good working practices are observed. Contractors would be required to prevent, minimize or mitigate environmental damage. Bidding documents would have environmental precautionary clauses. An additional requirement is that de-watering operations contractors should discharge drainage water into existing drains to avoid contamination of soil and fresh water resources.

Impacts during Operation

For the agricultural land in the immediate project area, and in the wider area of influence, the effects of the proposed project are entirely positive. The seasonal drainage congestion will be relieved and consequently water logging and salinity will be correspondingly decreased. With the reduction of drainage discharge into the Kura River the salinity in this river will decrease with a positive impact on the ecology of the river as well as on Baku's water supply.

The Ag-Gol lake is outside the area of influence of the project, as the backwater effect in the Mill Karabahk Collector, originating at the siphon crossing the Kura River, does not extend to this lake. Water levels in the adjacent drains, and therefore also groundwater levels are unaffected, as is the water supply into the lake. Nevertheless, Ag Gol lake has been included in the proposed monitoring program because of its hydraulic link to Lake Sarisu. Depending on the future water supply replenishment needs of Lake Sarisu, Ag Gol may become a more important source of water for Lake Sarisu.

The Sarisu Lake is affected by the proposed project. There will be three impacts:

- The new 31 km section of the MMCD to be constructed will cut across the natural càtchment area of Sarisu Lake, reducing it by about 4,000 ha;
- The drainage water from an irrigated area of about 10,000 ha which is currently pumped into Sarisu lake will in future discharge by gravity into the new main collector;
- The new collector will lower groundwater levels along its route, and may marginally (marginally, because the new collector is 6 km from the lake at its nearest point) increase seepage losses from Sarisu Lake.

The consequence for Sarisu Lake is a reduction of inflowing water. As the lake is very shallow, and is probably perched above the groundwater level (due to the proximity of the Kura River), there is a risk that the inflow from the Ag-Gol lake is insufficient to maintain the water balance. There are no records of inflows and outflows to Sarisu Lake, so this possibility cannot be eliminated.

An additional impact is the switching of about 25 m^3/s drainage water from the left bank outfall into the Caspian Sea to the more southern right bank outfall. This is not considered to be a significant factor, but monitoring of the outfall point will be included (refer below).

SAMUR APSHERON CANAL

The Samur Apsheron Canal (SAC) has the dual function of transmission of water from the Samur River to contribute to the needs of Baku City and the Apsheron Peninsular as well meeting the irrigation requirements of 95,000 ha. The SAC, which was constructed around 1955, comprises a diversion structure on the Samur River and a 180 km concrete lined canal with associated works, siphons, aquaducts and offtakes. Pumpstations at the end lift water to a reservoir from which the Baku water supply is abstracted. The Samur River forms the northern border with Dagestan, and the SAC canal runs south along the edge of the foothills, irrigating the coastal plain, 20km from the Caspian Sea in the north, reducing to less than 5.0 km nearer Baku.

Long term neglect of maintenance, most acute in the last decade, has left the SAC in a very vulnerable condition, no longer able to guarantee an uninterrupted supply to Baku or to maintain a reliable irrigation service. In particular the mechanical components, the gates and lifting gear, at the diversion and other structures along the route, and sections of the canal lining are seriously deteriorated. The proposed project will rehabilitate the most critical components in the SAC canal, including the gates and lifting gear at the diversion, the diversion structure, sediment treatment works, damaged lining and structures over the upper 50 km of the canal.

The Government of Azerbaijan has long-term plans for development of the SAC to guarantee the Baku water supply to 2020+ and to expand irrigation. The proposed project is compatible with these plans, but is limited to maintenance, and re-establishment of the established service. It will not finance any expansion works.

The impacts of the proposed project will be: (a) to arrest the deterioration in the irrigation service; (b) to restore long-term reliability of water supply to Baku and irrigation; (c) reduce losses in the first 50km of canal; and (d) correspondingly marginally increase the supply of irrigation water in the lower reaches of the canal, where the shortages are currently most acute.

The Project Area

This coastal strip commanded by the SAC has a gross area of about 180,000 ha, and a population of around 300,000, mostly located in small towns and villages along the main road to Dagistan and Russia which runs parallel and close to the canal. In addition to the 95,000 ha irrigated by the SAC there are areas irrigated by local sources, and extensive pasture areas close to the coast. There are three protected areas in the region, comprising:

- Qusar State Protected Area of 15,000 ha located adjacent to the Samur River, and intersected at its lower corner by the SAC canal, so that only a small part is within the SAC command area. This area is dedicated to the protection of grey partridge, pheasants, roe deer, wild boar and hare from hunting;
- Yalama Liana Oak Forest of 20,000 ha close to the coast, and adjacent to the Sumar River, is a conservation area for a unique residual forest of broad leaf trees linked to "liana" type creepers.
- Deveci Lake, a 3,500 ha shallow lake in a 7,500 ha reserve close to the coast at about km 70 on the SAC canal, being an important water body for aquatic birds and fish production.

Impacts - Operation

Construction impacts will be negligible provided normal good working practices are observed. Whilst rehabilitation of the headworks and part of the main canal will be executed in the Qusar State Protected Area, no significant impact on the wild-life of this reserve is anticipated as the immediate surrounds have long been affected by the irrigation facilities and the close proximity of the main highway through to Dagestan and Russia. The other sensitive areas are not close to the proposed rehabilitation works.

Impacts - Operation

The project's effects on the area will be almost exclusively positive. The extended functional life of the diversion and canal will eliminate the immediate risk of a serious collapse of the irrigation service and the water supply to Baku. The reduction in losses and improved irrigation distribution will improve equity amongst farmers, and the beneficial effects of additional water will be felt at the lower end of the canal where the service is least reliable. In the upper areas seepage losses and over-supply of irrigation water will be reduced, with a beneficial effect for the area: a lower water table, less stagnant water ponds and a lower risk of salinity.

Operation of the system will have no significant effect on the Qusar State Protected Area, the Yalama Liana Oak Forest or the Deveci Lagune.

The Deveci Lake is currently seriously affected by irrigation, as the stream naturally feeding the lake is diverted for local minor irrigation unconnected with the SAC system. With improved management, and the reduction of losses in the SAC, the project may have an opportunity to improve the hydraulic regime of the lake by reduction of the area's dependence on the local stream for irrigation. Under the proposed project the situation will be monitored, and the possibility for improving the situation explored.

Monitoring Programme

The environmental monitoring programme is proposed to get an exact picture as possible of the situation before, during and after the implementation of the MMMC and SAC projects. This allows to define actual project impacts and to design effective mitigation measures. The programme comprises annual campaigns of data collection (statistical data and field observations), data assessment and reporting. It is proposed to start in early 2001 at least four months before construction and to last 8 to 10 years in total. At least, until the end of the project implementation it should be carried out by SAIC. The monitoring will comprise the observation and assessment of:

- Natural parks and biodiversity
- Hydrological and Hydrogeological flow regimes
- Soil degradation and land-use
- Water quality
- Health
- Socio-economy

In both project areas 15 points are proposed for hydrometric observations, 5 points for regular groundwater observation, 17 points for analysis of surface and groundwater quality and 20 points for soil sampling. Socio-economic surveys are proposed to be carried out in two representative districts. Details are found in Chapter 4.

MMMC Area

In the MMMC area the monitoring programme considers the water balance and quality of the Ag Gol and Sarisu lakes, their natural habitats and biodiversity, the water quality of the Kura and Araz rivers, as well as the water quality of the MMMC sea outlet (on-shore and off-shore), groundwater level and quality, soil degradation and land use in the Mill plain as well as the socio-economic and health conditions of the Imishli district.

Hydrometric observations, comprising water levels of the two lakes and their inflowing collectors and canals (9 locations) as well as groundwater metering (5 locations) will be carried out at short time intervals (e.g. daily, weekly or 10 days). EC, pH and temperature as standard water quality parameters will be collected at the two lakes in short intervals, e.g. weekly. Complete quality surveys of the lakes, rivers, collectors, canals and of the sea outlet will be carried out annually. Plant and bird life at the two lakes will also be observed annually at critical periods. After six years a satellite image based land use survey is proposed. For the assessment of socio-economic conditions 2-year field surveys are suggested. Health conditions are proposed also to be analysed at two year intervals on the basis of statistical information.

SAC Area

The proposed monitoring concentrates on the Deveci Lake which may benefit in the future from the rehabilitaiton of the SAC. The lake water level will be monitored at short term intervals (e.g. weekly) and water samples will be collected and analysed annually. In addition hydrometric observations are suggested for Shabranchay river that feeds the lake, and for the SAC at its upper reach. For both locations annual water quality analyses are considered.

Soil degradation and land use will be monitored as well as socio-economic and health conditions for which the Khachmaz district will serve as an indicator for the monitoring area. A satellite image based land use survey is proposed to be carried out after six years. For the assessment of socio-economic conditions 2-year field surveys are suggested. Health conditions are proposed also to be analysed at two year intervals on the basis of statistical information.

Institutional Arrangements

To steer, administer and to conduct the monitoring programme an environmental monitoring unit (REMU) is proposed to be established under the existing hierarchy of the SAIC as a sub-unit of the RIIDIA II Project Implementation Unit (PIU). The REMU will be responsible for reporting to the SAIC, which should inform ASCE. The REMU is proposed to have 2 regional data handling units in the project areas. It will co-ordinate and collaborate with the governmental organisation and institutes, such as ASCE, Committee of State Hydrometeorology, etc. It will make consultancy agreements with the third parties (e.g. private institutes and organisations) to carry out the monitoring programmes.

To set-up the REMU monitoring programmes for hydrological and geo-hydrological, soil quality, water quality, health situation and socio-economic key parameters (including Geographic Information System, GIS) would require a tentative total investment of approximately $US98,000. This amount includes the costs for a three months assignment of an international expert. The annual operational costs of REMU, including all monitoring costs would total about $US26,000. This amount includes annual operation costs and staff costs, as well as consultant costs. The investment costs would lower to approximately $US86,000 if no GIS group would be implemented at REMU. In that case the annual costs would drop slightly to about $US25,000. The above mentioned costs are tentatively as discussed with the client. They are based on 1999 cost levels and do neither consider physical and price contingencies, nor do they consider costs for international freight and tax/customs. The cost savings are considered insignificant compared to the overall budget. In view of this the Consultant recommends a GIS equipped REMU. This approach should facilitate a modern data handling and an efficient environmental monitoring.

EXECUTIVE SUMMARY

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1. INTRODUCTION

Environmental monitoring can be used as an effective tool for the sustainable management of the environment. The objective of a monitoring programme is to obtain as accurate a picture as possible of the situation prevailing within any particular time-frame in order to determine whatever action is necessary on the basis of results obtained.

In the framework of the Feasibility Study for the Rehabilitation and Improvement of Irrigation and Drainage Infrastructure in Azerbaijan Project (RIIDIA II), the construction of the new Main Mill Mugan Collector (MMMC) and the rehabilitation and reconstruction of the Samur Apsheron Canal are proposed. The MMMC project is found in the Kura - Araz plain, it deals with the construction of a section of a drainage collector which will form the missing link in the right bank drainage system of the Kura river. The SAC rehabilitation project is located in the foothill zone of the eastern Caucasus, its purpose is to improve the conveyance capacities of the canal which feeds irrigation areas and the Baku water supply system.

Between January and February 1999 an environmental impact assessment (EIA) has been carried out for RIIDIIA II Project in the MMMC and SAC project areas. The EIA study stated that environmental impacts of the RIIDIA II Project are mitigable. It also proposes monitoring of the environmental impacts of the RIIDIA II project, which is a prerequisite for project implementation according to the national legislation.

The International Development Association (IDA) granted the present study "Environmental Assessment and Monitoring in the Project Area of the Samur Apsheron Canal and the Main Mill Mugan Collector" Project with number TF025537. The Consultant, CES Consulting Engineers Salzgitter GmbH, has carried out the study, according to the contract dated 11 June 1999 and signed by the client, State Amelioration Committee (SAIC) on behalf of the Government of the Republic of Azerbaijan.

The purpose of the study is to assess the present situation of the environment in the MMMC and the SAC Project areas, to show the future impacts of the both of the projects; to assess the need for the monitoring of environmental indicators; and finally propose an institutional structure for an environmental monitoring programme and to estimate the set-up and annual operation costs for the programme.

Thus, within the framework of this study the SAC and MMMC project areas are being analysed, not only to set up a monitoring programme, but also the technical and the budget requirements as well as the institutional requirement for the monitoring system. Also a workshop has been organised on 4th of August 1999 to identify responsibilities of the relevant organisations and institutions as well as to obtain knowledge on baseline information.

The present report shows the results of the environmental assessment and the layout of the proposed monitoring system, comprising monitoring programme, institutional set-up and budget needs. Therefore the report is organised as follows:

An executive summary gives in short the main findings and outcomes of the study, it also shows the overall budget requirements for set-up of the monitoring and for its annual operation.

After this brief introduction the second section works out the assessment of the present environmental conditions for both project areas. The main fields of investigation are natural parks and biodiversity, surface and groundwater, soil degradation and land use, water quality, health situation and socio-economic aspects. For all mentioned aspects potential future project impacts are addressed.

The third section elaborates the monitoring programme for both project areas. This includes the organisational set-up of the environmental monitoring unit, the elaboration of environmental key parameters as well as their monitoring schedule, staff requirements, equipment and laboratory needs, report regulations and the respective budget requirements.

The fourth section proposes an optional Geographic Information System (GIS) for the RIIDIA II Environmental Monitoring Unit (REMU). The details of this section cover the objectives of GIS, its institutional and staff requirements and budget needs.

In the last section overall monitoring budget needs for the RIIDIA II Environmental Monitoring System (REMS) are introduced. It shows the set-up costs and the operational costs on an annual basis.

The Annexes are organised according to the main sections of the report:

Annex A corresponding to section 2. Environmental Assessment
Annex B corresponding to section 3. Monitoring Programme

The minutes of the three public consultation meetings are presented in Annex C

2. ENVIRONMENTAL ASSESSMENT

2.1 GENERAL

Environmental impacts of the construction of Main Mill-Mugan Collector (MMMC) and of the rehabilitation of the Samur Apsheron Canal (SAC) are predicted to be mitigable according to the Environmental Impact Assessment Study that was carried out during the RIIDIA II Feasibility Study in early 1999. A general assessment of the present environmental situation is performed in the following paragraphs, these also assess the expected effects of the project on the environment. For the assessment of the present situation, the previously elaborated environmental impact assessment forms the basis.

2.1.1 MMMC Monitoring Area

The MMMC project is by its character a drainage project. The section of the Mill Mugan Collector proposed for construction under the Project forms a missing link of about 31 km length. It will connect the Mill Karabakh Collector to the Mill-Mugan collector on the right bank of the Araz river. Closing of the gap will ultimately affect more area than can initially be served by existing drainage infrastructure. The surface potentially affected by drainage improvements contains ultimately about 576 000 ha, and is geographically equivalent to the Mill-Karabakh sector. In addition, the Mill-Mugan collector is a prerequisite for the successful drainage upstream of the two initial phases of the Shamkir project.

The delineation of the MMMC project area is agreed upon in the workshop held on 4 August 1999 (see Annex C) as: the Araz river from south west to north east, the Karabakh Canal on the south west and K3, Ag gol and Sarisu lakes together with the Kura form the northern borders of the project area. The MMMC area that is to be monitored covers an area of approximately 168 000 ha, its delineation is shown in Figure 2.1.

The ecologically important Sarisu lake may be affected by the cutoff of catchment area of the Sarisu lake. Another lake, Ag Gol, forms part of a strictly protected State Reserve of the same name, but is located upstream of the proposed collector drain and outside its area of influence. At present, the lakes are fed by drainage water being discharged from irrigated areas supplied by the Karabakh Canal.

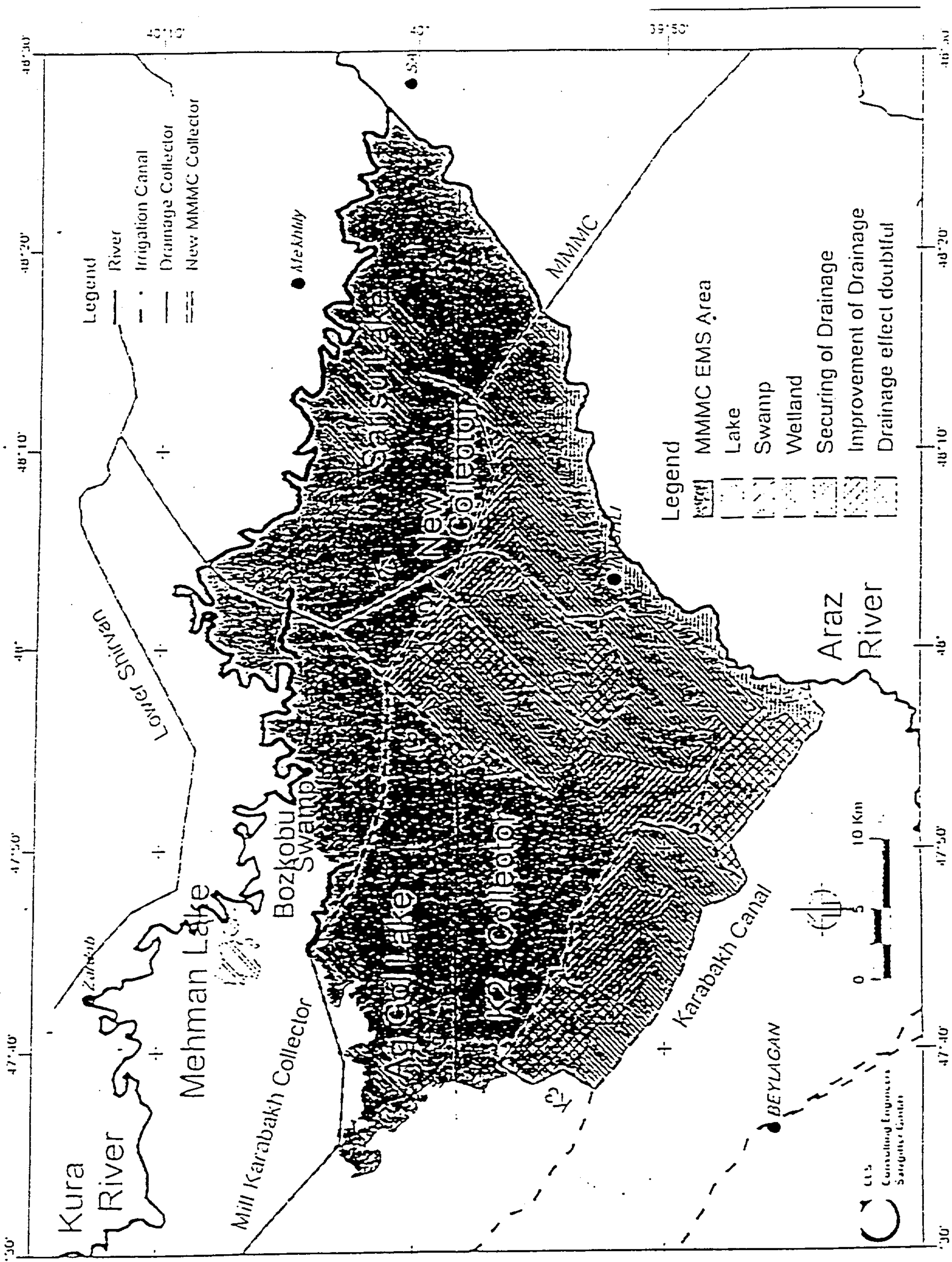

Figure 2.1: Delineation of MMMC Monitoring Area

For both lake areas the preservation of the present surface water level is essential to assure the ecological function of the lakes. At present the water levels are controlled out by hydraulic structures (weirs) at the outlets of the lakes. Although Ag Gol is not influenced by the new drain, it is included in the proposed monitoring program because of its water supply functions to Lake Sarisu.

The positive effect of the Main Mill Mugan Collector Project consists in the socio-economic benefits due to increased agricultural production. Indirect benefits are expected from the improvement of the Kura river water quality, from which the potable water supply of Baku profits, as well as the fisheries and sturgeon hatcheries in the Kura mouth near Neftchala.

For the evaluation of the above mentioned mitigation measures and for the control of their effectiveness a monitoring system with periodic observations and assessments is needed. The main elements of this system will cover natural parks and biodiversity (especially Ag gol State Protected Area), hydrological water balance of the Ag Gol and Sarisu lakes and of groundwater, soil degradation and land use, water quality of the Kura and Araz rivers and of the outfalls of the Mill-Mugan / Mugan Salyan Collector into the Caspian Sea as well as health situation and socio-economic aspects. The monitoring should be carried out on the basis of the RIIDIA II Environmental Assessment Study and on the basis of present assessment which is shown for the present and future situation starting with chapter 2.2.

2.1.2 SAC Monitoring Area

The SAC project is to be characterised as an irrigation and water supply project. The proposed infrastructural measures comprise the rehabilitation of the existing SAC on its upper reach between the Samur intake weir and the downstream crossing Velvelichay river and the rehabilitation of the secondary canals.The impact area of the present project, intending to rehabilitate the upper 50 km of the Samur-Apsheron Canal has been agreed upon in the workshop held on 4 August, 1999 as: the area that is surrounded by Samur-Apsheron Canal in the west, the coast line of the Caspian Sea in the east, the border line in the north and the Velvelichay river in the south. Additionally the area of the Deveci Lake, located 10 km southeast of the Velvelichy river is included also. According to these borders the SAC monitoring area covers approximately 126 600 ha from Samur to the Velvelichay and additonal 47 000 ha south of the Velvelichay with the 5 800 ha Deveci Lake. The delineation of the SAC monitoring area is shown in Figure 2.2.

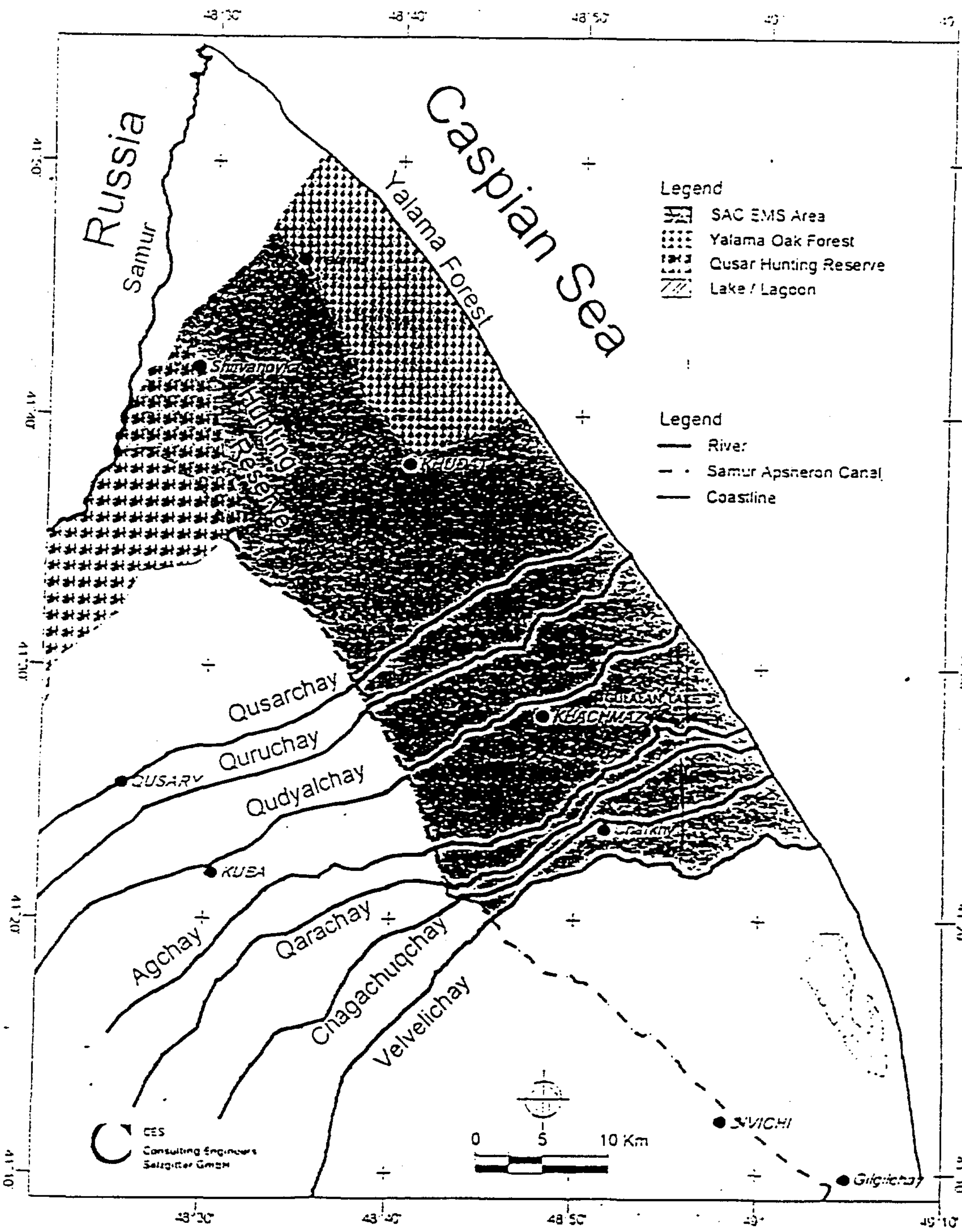

Figure 2.2: Delineation of SAC Monitoring Area

The SAC Monitoring Area comprises 3 areas of ecological importance, these are the Yalama Oak Forest, The Qusar Hunting Reserve and the Deveci Lake. Apart from these three areas, it is a major zone of irrigation dependent agricultural activity.

The unique residual forest of oaks in the coastal zone of Yalama does so far not possess any nature protection status. With the improved irrigation water supply in the future young tree plantation may be better served.

The upper 8 km reach of the SAC passes through the Qusar hunting reserve. During the project construction phase this area may be affected marginally in the vicinity of the construction site. However, after the rehabilitation of the SAC, there will not be any additional environmental stress due to the existence of this canal, compared to the present situation.

Additional irrigation water will increase the agricultural production capacities and the use of fertilisers and other agrochemical. This may effect the quality of the ground water and also the quality of the surface water.

Similar to MMMC area, a monitoring programme will be needed for evaluation of the environmental impacts of the infrastructural measures. The monitoring system will concentrate on the Deveci Lake, its inflow and water level and its water quality. In addition soil degradation, land use and health and socio-economic aspects will be observed to deliver data that can also be used for the project monitoring. The monitoring should be carried out on the basis of the environmental assessment that was carried out during the RIIDIA II Environmental Assessment Study and on the basis of the baseline data that was elaborated during the present assessment which is shown in the following chapters for the present and future situation.

2.2 NATURAL PARKS AND BIODIVERSITY

2.2.1 General

The information related to the flora and fauna characteristics of the MMMC and the SAC project areas have been collected from ASCE, the National Hunting Agency, and their respective district offices, and from the Zoological and Botanical Institutes of the Academy of Sciences.

District offices of ASCE are regularly monitoring natural parks and rare and endangered species of the natural flora and fauna. During the field trips it has been observed that the technical staff, equipment and vehicles were not sufficient to cope with the monitoring requirements, especially in the area of the Ag gol lake. The district office which is responsible for the monitoring of the Ag gol lake vigils the central protection area as well as a peripheral wildlife conservation area by three observation posts located in the south, west and east of the areas.

2.2.2 MMMC - Monitoring Area

The State Protection Area and State Reserve of Ag gol, Bozkobu swamp and Sarisu lake Hunting Reserve are located in the MMMC project area (Figure 2.1). The ASCE manages the Ag gol State Reserve, whereas the others are managed by the Hunting Agency. Some of the rare and endangered species listed in the Red Book of Azerbaijan are found in the MMMC monitoring area.

To assess the present situation of the MMMC monitoring area the scarce or endangered, endemic and non-endemic floristic and faunistic species are taken into consideration. The assessment is carried out according to the Red Book of Azerbaijan. The following three categories were taken into consideration:

- I Category: Endangered species; special measures should be taken into account to protect and sustain these species.
- II Category: Species decreasing in number; measures should be taken into account, these species may be endangered.
- III Category: Species in limited number and in limited area; if they have unfavourable conditions they may be endangered.

2.2.2.1 Present Situation

The direct zone of influence of the project encompasses the Araz river's left bank irrigation sectors of Imishli, Saatli and the lower sectors of the Beylagan rayon. A small portion of Sabirabad district is included south of the Kura river. A great part of the considered project area possesses irrigation infrastructure and is under some form of agricultural use. Natural flora and fauna established, often called weeds, are therefore the follower and ecological complement of human activities, thus it does not represent in this region species of exceptional rarity or in danger of extinction.

The state reserve area has been founded in 1964, it is situated east of Agjabedi and borders to the north on the Mill Karabakh collector. The purpose of the establishment of this 9 173 ha area as a state reserve was to protect natural habitats of migrating birds and of other birds and of mammals. However, the regulations set to protect this area were not sufficient to protect the environment required by these species. Therefore a part of that area (4 400 ha) having stricter rules has been established in 1978, as the Ag gol State Reserve Area. Further 782 ha have been added to the reserve area, in 1987.

The Ag Gol lake was considerably affected between 1985 until 1987 by the decrease of lake surface area and by the drying out of swampy areas which consequently affected the natural habitats. After that time the lake recovered. The water surface area of the lake was 8 176 ha in 1987 (satellite images). From the 1998 satellite images it can be taken that the water surface area increased to 9 281 ha. If the suggested remedial water resources management measures (chapter 0 on Water Resources) are carried out, the water quality of the lake is likely to improve. According to the ASCE district office the number of the birds and of other animals would benefit immediately from this.

The Ag gol lake possesses also potential for the breeding of commercial fish species.

Seventeen groups and more than 140 species of birds live in Ag gol and its surrounding area. Eighty-seven groups of birds are nesting. Approximately 500 000 birds are wintering in the area. (See Annex A.21)

Six groups and 15 species of mammals, 8 species of reptiles, 4 species of amphibians and 12 species of fish live at the Ag gol state protected area. From that fauna 20 species of the birds, 2 species of reptiles, 3 species of amphibians are listed in the Red Book of Azerbaijan. Greylag goose, white tealed are some of the species nesting only in that area of the country.

The vegetation around the water-swamp areas has been dominated by dense southern reed. Some water plants in the lake area are: myriophyllum spicatum and verticcaliatum, Potamogeton crispus and Potamogeton lucens. Ceratophyllum demersum, Utricularia vulgaris, Najadaceae and others are also typical for that region. In lake Ag gol 42 species of water vegetation have been observed. The reed bands within the lake border are 500 m wide, due to the shallowness of the lake. The maximum depth of the lake is 2.5 m it average depth is 0.8 m.

According to the results of observations made by the Agjabadi Local Authority of ASCE in 1998 there are 40 species of plants. Eighteen of them are the components of true swampy types, 22 of them form part of semi-desert phytocoenosis. Annual grass, perennial grass and bushes compose 50 %, 45 % and 5 % of the total plant area, respectively.

According to the 1998 information, obtained from the District Office of ASCE the ageing process of the reeds (forming 90-92 % of the flora of the Ag go)l is slow. For 1998 it is also reported that reeds dried in the central area and in the shore areas of the lake.

In a 2 ha sized Kardon named part the Bibersitein mountain tulip is found, it is in the Red Book of Azerbaijan. [ASCE, 1998, Report of the Ag gol State Protection Area, Agjabedi]

The present conditions are observed by a dedicated but underpaid staff living in difficult conditions on the site and doing a credible job of protecting the area against poachers and illegal fishing. Due to a refugee settlement north of the Mill-Karabakh collector and because of cattle and wildlife bridges which cross the collector cattle can intrude into the reserve area. However, this is tolerated by the park authorities.

Changes in the water quality of the Ag gol lake resulted in the disappearance of the following 2 fish species: sif and breams.

Ag gol discharges its water over a weir to the Bozkobu Swampy area. Bozkobu swampy area as a hunting reserve has a protected area of 10 000 ha including a sanitary protection zone of 500 m. The Bozkobu area is formed mainly by swamps with reeds. The swamp area is the nesting, feeding and resting place of wintering birds. This area is of similar ornitofaunistic importance as the Ag gol and Sarisu lakes.

The Sarisu lake belongs to the system of ecologically highly interesting lakes of the Kura-Araz lowlands, although it is not included in Azerbaijan's protected areas. The Lake area is approximately 14 000 ha of which water and swampy areas form a surface of 6 570 ha. Its maximum length is 22 km, whereas its width is about 6 km. Its average depth is 0.9 m which indicates a shallow shape.

Due to the unfavourable water quality conditions of the Sarisu lake (see chapter 0) only reeds can grow in the lake. The lake has at least the same ecological significance as Ag gol. It offers a large open water surface as well as a dense belt of reeds and swamps, with large swarms of aquatic birds. But population pressure is high on the northern shore, due to the proximity of the Kura river permitting intensive irrigation by motor pumps. Besides a number of villages exist, their population is fishing and hunting in the lake area. The lake is considered a hunting zone, hunting and fishing requires a special licence, which can easily be obtained as it is said.

Similar to the Ag gol area, the control of the water level of the Sarisu lake is of crucial importance for aquatic flora and fauna. For this purpose, a weir regulates the water level by releasing water via a short collector to the Kura.

2.2.2.2 Potential future Project Impact

The construction activities require the use of heavy machinery, heavy lorry traffic and selective pumping for groundwater evacuation. These will cause noises, vibrations and the production of exhaust gases that could cause temporary disturbances of wildlife. When the new main collector is constructed, it will pass through treeless agricultural areas and steppe with low density of wildlife. This will be of very reduced significance. The area occupied by construction activities in comparison is very small to the encountered uniform steppe area. So natural vegetation will not be harmed to a great extent.

No direct influence is expected from construction activities for all Ag gol lake and Sarisu lake, as the construction site will be more than 60 km respectively to 10 km away.

After the new main collector is constructed, it will form a new line of separation in the landscape. Wildlife trails will be cut. Due to the necessity of inspection and maintenance roads alongside the collector, traffic generated with some disturbance effect. Effects though will be minimal due to low density of wildlife and the limited traffic and also mitigated by the necessity of transit bridges for cattle and wildlife.

The lakes in the region are very sensitive to the change of the surface water level.

For the Sarisu lake, intercepting of the drainage flow will deprive the lake of a certain proportion of surface inflow needed to maintain an ecologically sustainable water level. It is not clear at the moment whether this inflow exceeds the outflow of water into the Kura river. Inflow-outflow measurements will be a main component of the monitoring program. Lowering of the groundwater table by the proposed MMMC will only occur in the near vicinity of the MMMC. Due to fine textured soils of the area and the distance of about 10 km between Sarisu Lake and the MMMC the lake is not likely to loose water by filtration to the MMMC.

For the aquatic fauna any lowering of the lake's water level would have serious effects. The extreme heating up of the lakes in summertime up to 40 °C would be affecting the deeper portions of benthic life at the sea bottom. Due to lower dissolving capacity of oxygen at higher temperature deplete oxygen reserves for the water resource. This could lead ultimately to the death of underwater flora and fauna under anaerobic conditions (the lake system collapses).

2.2.3 SAC Monitoring Area

There are three specific areas located in the SAC monitoring area. These are the Qusar State Protected Area, the Nabran-Yalama-Khachmaz Liana-oak Forest and the Deveci Lake. The present natural flora and fauna characteristics of these areas has been assessed.

Qusar State Protected Area is managed under the authority of ASCE, by means of a District Office. Deveci lake is managed by the Hunting Agency, and the above mentioned forestry area is managed by the Forestry Agency having a regional office in Yalama.

The assessment of the flora and fauna characteristics of the monitoring area is mainly based on the Red Book of Azerbaijan.

2.2.3.1 Present Situation

Eighteen animal and 12 plant species found in the SAC area listed in the Red Book of Azerbaijan. (See Annex A.22).

Most of the project area is irrigated and under intensive agricultural use. Natural flora and fauna established, often called weeds, are therefore the follower and ecological complement of human activities, thus do not represent in this region species of exceptional rarity or in danger of extinction. Most rivers carry mountain stream fish on their upper reach, the lower reach not forming a permanent habitat due to water use for irrigation or intermittent seasonal flow. For the fish resource of the Samur river facilities have not existed for 40 years to cross the weir structure.

In 1964, the Qusar State Protected Area was established between the Samur and Qusarchay rivers at the Qusar district of the Azerbaijan Republic. The purpose was to prevent and restore the number of grey partridge (perdix perdix), pheasants (phasiaunus), roe, wild boar and hare. The total area of the state protected area is 15 000 ha. It has a length of 28 km at south-west to north-east direction and a width varying from 12 to 15 km, from north-west to south-east.

Approximately 2 325 ha of this area is covered by forests. In that area there is also 2 400 ha of vineyards and orchards. Approximately 4 % of total area is occupied by pasture, and 3.1 % of this area constituted by creeks, small canals, footpath and other roads (Figures takes from RIIDIA II EIA, 1999).

All of the protected area is impacted by human activities. Approximately 70 % of this area is occupied by villages and farms. Additionally 19.4 % of it is used as pasture and 3.4 % are formed by irrigation canal roads, and etc. [Aliyev H.E., Hasanov X.N., Baku, 1993]. The protected areas are established on areas where forestry, agriculture and other practices are allowed, usually on a temporary basis. In any case, the economical activity in the protected area should not damage the protected objects. Within the Qusar State Protected Area agricultural activities, irrigated area, the Samur weir and heavy vehicle traffic on the main road to Russia could be observed during field trips.

The Qusar State Protected Area is directly affected by the Samur-Apsheron Canal, as it passes through its lower, easternmost part. The main highway with the principal traffic between Baku and Dagestan and Russia is running nearly parallel to the SAC, which may result in some disturbance and cutting of wildlife trails.

Deveci Lagune, a groundwater lake situated in a depression in the coastal plain, is a precious waterbody of importance for fish production and a habitat for many aquatic birds, endemic and migratory. This area has been protected and managed under the authority of Hunting Management. Totally protected area is 7 500 ha and 5 800 ha (Satellite data of 1998) of it has been occupied by the lake. The mean depth of the lake is around 50 cm, whereas the deepest part is 2.5 m.

At present it is fed by the Shabranchay of good water quality but insufficient quantity, and it does posses a direct outflow to the sea. In the summer season, when the irrigation water is used from Shabranchay river the water level of the lake drops down due to evaporation and unhindered outflow.

The lake has suffered in 1998 near complete drying out with a consequent impact on the fish population and impact on the wildlife feeding on them. The Fish population is now recuperating. Fortunately fish will also enter via the sea outlet. Drainwater of agricultural areas in the irrigated watershed above the lake, including the heavily contaminated waters of the Devecichay at present are intercepted by a collector drain, so that they do not enter the lake, but are led to the sea. Water quality in February was very saline EC 7.87 (about 5 g/l). At that time eutrophic conditions of the lake were observed by the consultant, which manifested itself by abundant green algae and dense, thick reed bands (~ 200 to 400 m at both sides of the lake).

Due to water scarcity, repeated attempts have been made to divert collector water to the lake, but-perhaps a mixed blessing- because of high salinity content of the drainage water. They have failed due to lack of technical means.

With improved management, and the reduction of water losses in the SAC, the project may have an opportunity to improve the hydraulic regime of the lake by reduction of the area's dependence on the local stream for irrigation.

Further sensitive areas potentially influenced by the project are the Yalama Liana Oak Forest in the north-eastern coastal plain near Nabran, Mukhtadir, Khachmaz and Yalama. This forestry area occupies 20 000 ha area, it is controlled by the Forest Management Unit that is located at Yalama under the jurisdiction of the Azerbaijan Forest Agency. This represents a unique residual forest of broad-leaved trees, mainly oaks of impressive stature covered frequently by "liana" type creepers, among them ivy. Liana-oak is widespread in Nabran region. In the past the area has been decreasing rapidly due to grounds belonging to some kolkhoz that had initiated deforestation on 5 000 ha where the soils were of good to very good agricultural potential. However, this process is being reversed now, land being partly sold back (500 ha) to the Forest Agency. Land reform has given the surrounding farmers their own ground, so there is no actual pressure on the forest, especially as they have little means of investment.

The fauna and types of trees of this forest are given at Annex A.23. This liana-oak forest contains a lot of species of trees, as well as relic and endemic ones. Each year an area of 120 ha is planted especially with young trees of oak, walnut, acacia, chestnut, etc. Irrigation water needs to be given for establishment due to the dry climate, even though the ground water table is around 1 m below surface. On the other hand, each year 2 500 m^3 of wood is allowed to be gathered and sold out. One-hundred-fifty m^3 of this timber has high quality (~$US 100 per 1 m^3) and is used as raw material for constructional works and furniture. Remaining part is sold to the villagers for their heating purpose.

According to the Plan for the Establishment of State Protected Areas and Natural Parks (1982 - 2000), establishment of the Shahdag Natural Park is also planned, including 14 400 of the Nabran Lina-Oak Forests.

Resorting and camping activities are allowed within the described areas of the forest. At the coastal area camping zones are rented at 4.700.000 Manat/ha/year. Picnic activities are free of charge but these areas are permanently controlled. Hunting within the forest area is allowed, if the necessary permission is obtained from the hunting authority.

Still cattle and pigs use the forest as pasture and illegal incursion of hunters are registered, so there is a requirement for improved vigilance equipment, personnel and facilities.

At present the surrounding agricultural lands receive water from the off-takes downstream of the Samur river canal off-take. Potentially, after canal and river off-take rehabilitation, more irrigation water might be available, which could contribute to renewed pressure on the forests.

It has been reported by the Fisheries Agency that the rivers located in the SAC Monitoring area are very important from the point of fishery economy. Especially Velvelichay, Qudyalchay, Qarachay and Qusarchay rivers distinguished from others by their ichiofauna. These rivers are very important for the local fishing. The semi-migratory fishes of Caspian Sea, such as snake-fish (Caspiomyzon Wagner) migrate into these rivers to spawn.

The utilisation of water of these rivers in the villages, for irrigation, drinking and other purposes have created the rough conditions for the river ecosystem. Therefore presently these river fisheries can not sustain their interest. Also the increase in the amount of the harvested fishes has reverse impacts on the ichiofauna of these rivers.

2.2.3.2 Potential future Project Impact

The contractors will need to establish cleared sites for camps, material dumps, access roads and site excavation itself. Wildlife may be driven away by noises, emission and by human and vehicle traffic. Drawdown of water in construction pits might affect adjacent grounds reducing water availability for sensitive vegetation. The spillage of pumped water into inadequate drains might cause on the other hand waterlogging.

The damaged concrete lining will be removed and needs to be deposited at a site different from the Qusar Hunting Area. If this is not performed, it may harm the see-see partridge (francolinus francolinus) living in that area. Francolinus francolinus is known to be one of the endangered species listed in the Red Book of Azerbaijan. If it is decided, after the preparation of the comprehensive sediment plan for the canal system cleaning of the two desilting basins, located at km 6 and km 12, this may require the development of adequate landfills to dump approximately 7 million m^3 of non-contaminated Samur sediments. These landfills would need to be designed before start of the construction works. Their locations should be selected to minimise transport distances and related traffic, the operation of the landfills should be covered by a specific management plan to ensure a regular operation and to minimise environmental disturbances. Considering the present condition of existing disturbances by heavy road traffic, no significant additional effects on what little remains of wildlife is likely.

The Samur Apsheron Canal passes through the easternmost part of the Qusar State Protected Area Conservation area for about 15 km. Construction noises, heavy construction traffic emission dusts and gases may have considerable potential disturbance and nuisance impact to wildlife. Personnel at the construction camps will be apt to take up a ready opportunity for hunting to enrich their fare. Yet considering the present condition of existing disturbances by heavy road traffic, no significant additional effects on what little remains of wildlife are likely.

For the Qusar State Protected Area no changes to the present condition are expected for the future operation of the canal.

For the Yalama Forest, sizeable negative impacts are not likely to occur.

Positive impacts are that additional irrigation water would aid in the presently ongoing re-plantation programme, about 120 ha per year being replanted in the zone. Until the young plants reach sufficient depth to groundwater, they need to be maintained during the dry summer season.

The situation of the Deveci lake and its hydraulic regime is likely to improve from increased inflow from SAC in the future as reduced water losses in the SAC and better irrigation management and practices will create an opportunity to also reduce of the area's dependence on the local stream for irrigation. However, the hydrologic regime of the Deveci lake should be considered in the monitoring programme.

2.3 WATER RESOURCES

2.3.1. General

The SAC and the MMMC projects both deal with problems of water management. In case of the SAC it is to ensure water supply for irrigation and potable water, while the MMMC deals with the drainage of agricultural lands. In both cases the natural water resource are affected. This includes surface water and groundwater as well.

According to published figures about 1,36 Mio. hectares of agricultural area are under irrigation in Azerbaijan (Shabanov A.I., 1991, Geological monitoring of Azerbaijan meliorated areas; Commission of Water Resources, Moscow). Approximately 40 % of this area is drained by a network consisting mostly of open collectors. Great efforts are undertaken to improve both the irrigation systems and the drainage systems. The presently studied SAC and MMMC project areas represent a prominent example for these efforts which will also directly affect the existing hydrographic situation, as the present hydrologic network of rivers, canals and collectors will be modified. The modifications can be outlined as follows:

1. SAC: water distribution for irrigation

2. MMMC: a new collector will be built to separate the drainage systems of the left bank and the right bank of the Kura river.

To observe the natural water resources, a nation wide hydrologic observation network has been set up by the State Hydrometeorological Institute and by the State Committee for Geology between 1979 and 1992. These network comprise 16 372 groundwater observation wells and 230 hydrometric gauges. Data from these services are used as much as possible for the present assessment.

For the MMMC project area the Kura and Araz rivers were observed by the above mentioned institute, that operates regular gauging stations on both rivers. In addition geohydrological groundwater observations were carried out in the MMMC irrigation zone by the geohydrological institute. The same institutes also carried out respective observations for the SAC area.

The following Table 2.1 shows the distribution of observation gauges and their command areas for the MMMC and the SAC areas.

Table 2.1: Distribution of hydrological and geohydrological gauges in MMMC and SAC Area

Zone	Observation area / command area (thou. ha)			No of Observation wells			No of Hydro-logical gauge	Area served by a well ha
	Total	Irrigated	Drained	Ground water	Artesian water	Special net		
MMMC zone								
Mill steppe	120,3	100,8	69,2	1172			12	102,7
SAC zone								
Samur-Apsheron region	226,5	89,8	9,7	1481	161		10	152,8
Including Area between Samur-Velvelichay rivers	90,5	55,0	2,3	320				150,0

Source: CSH and by the CGMR, 1999

Over the last decade the hydrometric and geohydrological observation network fell in unwell conditions. At present it is tried to re-organise the observation system.

2.3.2 MMMC - Monitoring Area

2.3.2.1 Climate

The MMMC monitoring area is located in the Mill plains between the Kura and Araz rivers. The climatic station of Imishli is considered to represent the conditions of the monitoring area. For this station most recent data of the last 10 years have been provided by the Hydrometeorological Institute (see Annex A.7). According to its data the climate in the MMMC area is characteristic for semi-steppe. The summer is hot and dry, the winter is relatively warm with low precipitation.

Snow can be observed rarely. The mean annual temperature is about 15 °C. The observed absolute maximum temperature is 42 ^{0}C. The hottest months are July and August, with average monthly temperatures of approximately 27 ^{0}C. During the winter months average monthly temperatures drop down to 3.6 °C for January. However, the absolute minimum was recorded as -26 °C. The number of frost free days is in the range of 240 to 260 days per year.

During the last decade the average annual precipitation for the area is almost 290 mm, with a range from 186 mm to 354 mm. The maximum daily precipitation was observed at Imishli climatic station to be 90 mm. The average annual relative humidity is 66.5 %, during the winter time it climbs up to almost 80 % in December, during the summer time it drops down to 56 % in July. The average annual wind velocity is about 1.4 m/sec. The highest average monthly wind velocities were observed during June (1.7 m/s). During the winter month it drops down to approximately 1 m/s.

2.3.2.2 Surface Water Resources

The climatic conditions of this zone have to be considered as almost semi-arid as detailed above. Intensive agricultural activity therefore crucially depends on irrigation practices. The irrigated area covers about 160 000 ha, which are supplied by the upper Karabakh irrigation Canal, which off-takes from the Araz river. A separated network collects drainage and sewage water. Among these collectors are the so called K-2 and K-3 collectors that discharge drainage water and sewage into the Ag gol lake. Water discharging into the lake is highly mineralised (2-3 gr/l), it is also reported to carry considerable concentrations of pesticides and nutrients.

The Ag gol lake has one single outlet on its northern shore. After crossing the Mill Karabakh Collector by a siphon the Ag gol discharges into the Bozkobu swamp. From here it continues as a collector to the Sarisu lake. The Sarisu lake is controlled by a weir. At times of high water levels it spills into the Kura river which then receives seriously mineralised water, that is also loaded with health affecting substances.

Regular observations on the inflow and outflow from the lakes have never been carried out before. However, during the RIIDIA II Feasibility Study the inflows into the Ag gol lake once have been measured to be approximately 8.5 m^3/sec. (Dec., 1998). The outflow from the Sarisu lake once was measured to be in the order of 15 m^3/sec. (Feb., 1999). These measurements should not be considered as more than an indication of the discharges, because of the different observation times they can not be directly compared.

2.3.2.3 Groundwater Resources

The influence zone of the proposed MMMC is insufficiently drained. Consequently irrigation water increases the groundwater level, which can be found from the analysis of ground water observations. These observations show a strong correlation between donations of irrigation water and rising of groundwater level.

Average annual precipitation is approximately 300 mm, most of it is considered to be evaporated. The hydrologically and geo-hydrologically effective portion of rainfall is therefore negligible. The lowest groundwater tables have been observed in the alluvial zones of the Mill steppe. In these areas the ground water table is found in depths of 2.8-3.5 m below soil surface. The following Table 2.2 shows for the period 1991/1998 MMMC areas for six different classes of groundwater tables. Form this it may be interpreted, that areas of high groundwater tables (< 1m) are increasing, mainly after 1997. This is considered as a direct effect of insufficient drainage.

In general the maximum ground water levels occur in April and June, while the minimum levels are found in October and November after the end of the irrigation season. The fluctuation of ground water level is about 1.0 - 2.4 m during the year. The most significant fluctuation of the ground water level is observed in the wells located in the direct vicinity of irrigated areas and near open water courses. Monthly groundwater data are shown in Annex A.8, apart from monthly fluctuations and the annual pattern no trends are obvious.

Table 2.2: Distribution of depth of groundwater table (m below surface) in the MMMC area (thousand Hectares)

Year	< 1m	1-1.5m	1.5-2.0m	2.0-3.0m	3.0-5.0m	>5m
1991	0.5	8.1	15.6	18.8	2.5	0
1992	1.4	7.7	15.3	19.5	2.9	0
1993	1.2	7.6	17.4	18.6	2.2	0
1994	1.0	11.5	20.1	18.1	5.1	0
1995	1.1	7.4	15.1	19.2	9.1	0
1996	0.9	7.2	15.0	18.6	3.8	0
1997	1.7	6.8	14.8	18.9	3.3	0
1998	1.9	6.4	15.1	19.3	3.1	0

2.3.2.4 Potential future Impacts

The flow regime of the Kura river and of the Araz river are considered not to be significantly affected by the implementation of the MMMC project. From the water resources point of view the main impacts of the MMMC project could arise from changing the water balance of the Sarisu lake. As mentioned before, the water levels of the lake crucially depend on the inflow of sufficient drainage water into Ag gol lake and from there to Sarisu lake and of excess irrigation water to Sarisu Lake. It must be assured, that the present hydrologic system is not modified in a way that endangers future water supply to Sarisu lake, which is among the country's major ecological reservations. It is noted that at this moment it is not known what the impact of the MMMC will be on Lake Sarisu. The MMMC will have no impact on Ag Gol lake and the inflow from the collector drains will continue as before. The MMMC will reduce the direct drainage zone into Lake Sarisu. It is not known how much this direct inflow now and with how much it will be reduced. It is also not known whether this reduced inflow in the future exceeds the current outflow from Lake Sarisu into the Kura river.

In order to investigate this threat, it is deemed necessary to establish an adequate network of hydrometric gauges that enable effective monitoring and assessment of the water balance of the interconnected Ag gol and Sarisu lakes. Based on the monitoring results, it may be required that water management regulations are worked out by the project that assure sufficient water level and water quality of the lakes strictly taking into consideration the monitoring results.

This may include improvements in the quality of inflows into Ag gol lake by using fresh irrigation water from the upper Kharabakh canal during the winter time (October - March). During the vegetation period the lake should be supplied by a mixture of water from K-2 / K-3 collectors and from the upper Kharabakh canal. The Sarisu lake then would also profit from the improved Ag gol lake. However, for the summer time, additional inflow from the Kura river could be suggested. The situation of the Sarisu lake could be improved directly by conveyance of more excess irrigation water through canals P-1 and P-12-1. By these actions the hydrological balance and the ecological functions of the lakes would be ensured, the water quality of the lakes would also be improved significantly. As a consequence of this the water quality of the Kura river would be improved, which is considered to have direct effects on the water supply of Baku.

2.3.3 SAC - Monitoring Area

The location of the SAC - Monitoring Area and its hydrographic network can be taken from Figure 2.2 on page 2-4.

2.3.3.1 Climate

Climatologically the SAC monitoring area has to be defined as semi-continental, it forms part of the semi-steppe zone. The climatic station of Khachmaz is considered to represent the situation of the area. For the assessment the latest ten years of data records have been applied (See annex A.7).

The average annual temperature is about 12.6 °C, with a small range of 11.4 to 13.5 °C. The absolute maximum temperature is observed to be about 42^0C, absolute minimum temperature is -28^0C. The hottest month is July with average temperatures of about 24.6 ^{0}C. During the winter time temperatures fall to about 1.6 ^{0}C. Long-term average precipitation is approximately 300 mm, the maximum daily precipitation was observed to be 100 mm.

The average relative humidity is 78%. During winter time the average monthly can go up to 86 %, in summer time it falls to 65 %.

The mean annual wind velocity is about 2.3 m^3/sec. During the hot time the average monthly wind velocity is 2.4 m/s, in winter time is approximately 2.2 m/sec.

2.3.3.2 Surface Water Resources

The RIIDIA II Feasibility Study revises the hydrological design capacities for the rehabilitation of the upper 50 km of the Samur Apsheron Canal (SAC) to cope with its tasks. The entire canal is of crucial importance to the social and economic welfare of the SAC region. It carries water from the Samur River in the north to Baku and further to the south. The SAC is the major water conveyor of the region. It connects the dry SAC project area with its vast irrigation schemes and the metropolitan area of Greater Baku to the water resources of the Samur.

The RIIDIA II design capacities for the upper 50 km reach of the SAC take into consideration additional flows that may be diverted in the future from seven local rivers crossing the SAC on the named reach. These rivers are from north to south: Qusarchay, Quruchay, Qudyalchay, Agchay, Qarachay, Chagachuqchay and the Velvelichay. All the rivers follow the same hydrological pattern, which is characterised by peak flows during the early summer months and by a crucially dryer period during the winter months, reflecting just the mountainous origin of the rivers. Their higher catchment parts receive a good portion of their annual precipitation during the winter months (40 %) in form of snow, which is stored until the warmer temperatures of the late spring cause snow smelt. Only about 20 to 30 % of the runoff is caused directly by surface runoff, while the remaining 40 % are considered as ground water recharged base flow which is of special importance in the coastal area. Principally the snow-melting mechanism is to be considered as a natural reservoir allowing for additional water supply during dry and hot summer months, when the water demand is the highest in irrigation and other consumption. The long-term monthly averages[1] of these rivers are shown in Table 2.3 and Figure 2.3.

The concerned river flows have been taken into account for the determination of the design discharge of the first 50 km of the SAC. Possible effects on the environment, especially in the river sections downstream of the SAC are not dealt with in this study as river diversion is not included in the current SAC project. The proposed rehabilitation under this project would not include any enlargements of abstraction or canal capacity.

Table 2.3 Long-term Average Monthly Natural River Runoff [m^3/s] at Calculation Points (1961-1992)

River	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
Samur u/s Weir HCP1	22.2	20.3	23.8	51.2	115.7	163.1	133.2	77.2	56.4	47.3	35.7	27.0	64.4
Qusarchay HCP3	1.8	1.8	2.0	3.6	6.9	11.2	11.7	7.3	4.8	3.4	2.5	2.0	4.9
Quruchay HCP4	0.4	0.4	0.7	1.4	1.7	1.5	0.9	0.7	0.8	0.7	0.6	0.5	0.9
Qudyalchay HCP5/6	2.8	2.8	3.4	6.4	11.8	16.0	11.6	7.6	6.0	5.6	4.6	3.4	6.8
Agchay HCP7	0.6	0.7	1.7	2.8	2.3	2.1	1.0	0.8	1.3	1.4	1.1	0.7	1.4
Qarachay HCP8	1.0	1.0	1.2	2.1	4.0	6.0	4.4	2.4	2.3	1.9	1.5	1.2	2.4
Chagachuq-chay HCP9	0.5	0.5	1.3	2.5	2.8	1.9	0.8	0.4	0.6	0.8	0.8	0.6	1.1
Velvelichay HCP11	1.5	1.6	3.1	7.1	10.0	8.3	5.1	3.3	3.1	3.1	2.5	1.9	4.2

[1] Information is taken from RIIDIA II Feasibility Study, 1999

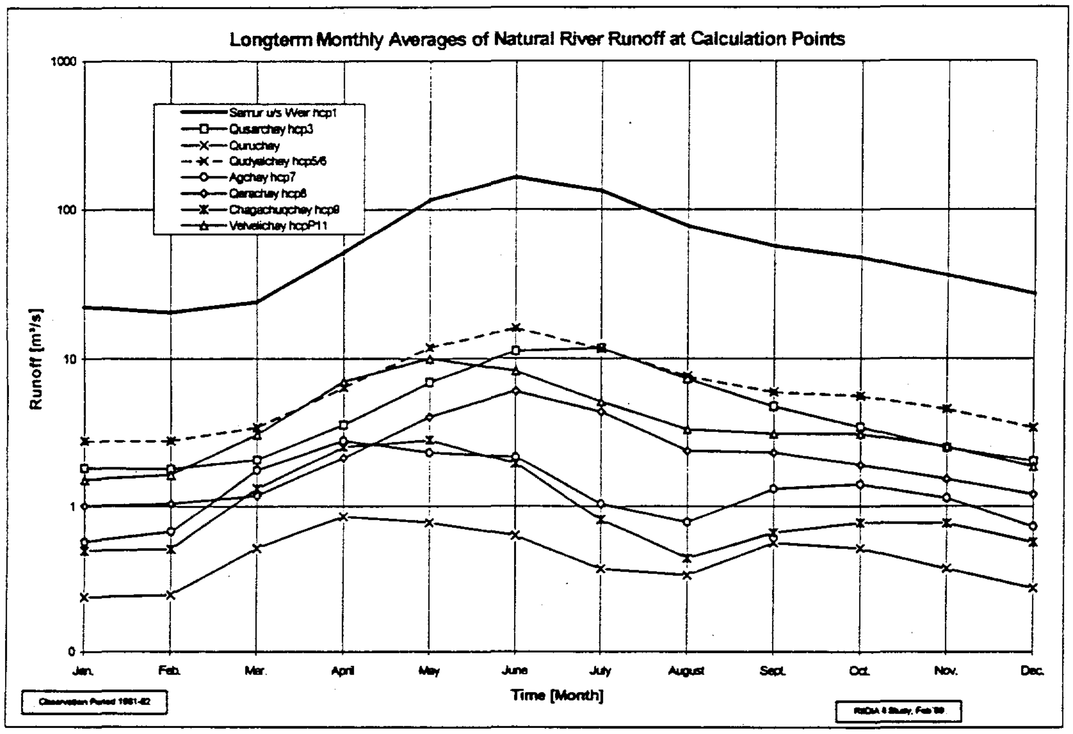

Figure 2.3 Long-term Average Monthly River Runoff at SAC Calculation Points (1961-1992)

The Deveci lake is the biggest water body in the SAC monitoring area. Its only freshwater source is the Shabranchay. This river crosses the Samur Apsheron Canal downstream of the 50 km rehabilitation reach and no abstractions from this river are planned to feed the canal. In the past the lake has suffered strongly from near drying out with the consequent difficulties of re-establishing the fish population, which is still not overcome completely. However, the future water balance of the lake may be positively affected by the project as the area's dependence on the local stream for irrigation will be reduced.

2.3.3.3 Groundwater Resources

Available data (see Table 2.4) show, that the ground water table is raising in average by about 1 m over the period 1950 until 1995. The rapid raise mainly began after 1980. The raising of the groundwater table is expected to be a consequence of increased application of irrigation water.

Table 2.4: SAC Ground Water Level (%)

Depth	< 1 m	1-2 m	2-3 m	3-5 m	>5 m	Average depth [m]
1950	0.8	4.5	10.2	5.1	79.4	4.54

1960	1.1	6.6	12.6	6.8	72.8	4.11
1970	1.9	7.9	3.1	8.4	68.7	3.95
1980	2.8	11.4	15.6	11.3	58.9	3.68
1995	5.4	15.5	18.7	19.8	40.6	3.56

Source : SAIC's Hydrogeology and Amelioration Expedition, 1999

However, the latest available groundwater information (see Table 2.5), generated from 7 wells in the SAC area, shows that the groundwater table can be considered as stable since 1991. This may correlate with the general economic situation and the reduction of agricultural activities. Annex A.8 shows monthly groundwater data for the SAC area. This demonstrate slightly monthly variations according to the annual pattern, but no obvious trends.

Table 2.5: SAC Ground Water Level (thou. ha)

Depth	< 1	1-1.5 m	1.5-2.0 m	2.0-3.0 m	3.0-5.0 m	>5.0 m
1991	3.4	6.8	6.3	10.2	7.9	18.5
1992	3.2	6.2	6.3	10.1	8.0	18.5
1993	3.3	6.1	6.2	10.1	7.9	18.5
1994	3.5	6.0	6.3	10.6	8.0	18.0
1995	3.2	6.2	6.3	10.6	8.0	18.0
1996	3.1	6.2	6.2	10.5	8.3	18.5
1997	3.2	6.3	6.3	10.4	8.0	18.4
1998	3.3	6.4	6.0	10.5	8.1	18.0

Source : SAIC's Hydrogeology and Ameloration Expedition, 1999

2.3.3.4 Potential Future Impacts

After the rehabilitation of the SAC the irrigated agriculture is likely to be intensified in the SAC area. Intensification of irrigated agriculture will increase the amount of water that is donated to the fields - consequently the micro climatic conditions will change to higher humidity. This however might moderately lower the air temperatures. Consequently the land/sea temperature gradient may smoothen which in reverse could lower wind velocities a little bit. However, these effects are not considered to have significant influence on the climatic and micro climatic conditions in the SAC area.

In future a total of seven local rivers may be partly diverted to the SAC. The potential river diversions would be located in an approximate distance of 20 to 30 kilometres upstream their mouths into the Caspian Sea. Ecological flow requirements of these rivers are shown in Table 2.6. Environmental impacts have not been assessed as river diversion is not part of the envisaged project financed by IDA, not currently by any other financier. Any future diversion would only be considered after detailed studies, which would combine technical, economic and environmental aspects of needed river diversions for increased water supply for irrigation and to Baku.

Table 2.6 Average Monthly Ecological and Fish Breeding Flow Requirements [m^3/s] above SAC as considered for the RIIDIA II Study

Samur into SAC	4.0	4.0	4.0	8.0	20.0	20.0	14.0	14.0	8.0	4.0	4.0	4.0	9.0
Qusarchay	1.1	1.1	1.1	1.5	2.5	2.5	2.5	1.5	1.5	1.1	1.1	1.1	1.5
Quruchay	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Qudvalchay	1.8	1.8	1.8	2.6	3.0	3.0	3.0	2.6	2.6	1.8	1.8	1.8	2.3
Agchay	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.2	0.2	0.1	0.1	0.1	0.2
Qarachay	0.6	0.6	0.6	0.9	1.2	1.2	1.2	0.9	0.9	0.6	0.6	0.6	0.8
Chagachuqchay	0.1	0.1	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2
Velvelichay	0.8	0.8	0.8	2.2	2.2	2.2	1.0	1.0	1.0	0.8	0.8	0.8	1.2

Source : RIIDIIA II Feasibility Study, 1999

The operation of the rehabilitated SAC will have no direct effects on the hydrological regime of any of the crossed local rivers as no river diversions are planned for this project phase. The Deveci lake is located approx. 25 km southeast of the lower end of the SAC reach to be rehabilitated. It is likely that impacts on the lake will be positive, if any. Positive effects may arise from reduced canal losses and increased irrigation efficiency. Both would reduce water abstractions from local rivers allowing more river flow reaching the lake. Anyhow, it is suggested to monitor the hydrological regime of the lake by observing and analysing its inflows and water levels.

There are no indications that groundwater levels will be affected by the rehabilitation of the canal.

2.4 SOIL DEGRADATION AND LAND USE

2.4.1 General

Agricultural crop yields are directly related to soil conditions, if soils degradate yield decrease immediately - soil conservation therefore is an important task to maintain high productivity.

The soil conditions of the MMMC and SAC monitoring areas are assessed on the basis of data obtained from the Hydrogeological and Melioration Expedition of SAIC, and Azgiprovodkhoz Institute. This baseline information includes data from the field studies and laboratory analysis of 1997. This information is completed by soil surveys carried out during the RIIDIA II Project (1998/1999) and during the present study (July 1999). The before mentioned data were completed by Landsat Satellite information of Summer 1998.

The available data were processed and analysed according to standard procedures as accepted in Azerbaijan. The MMMC monitoring area was assessed in view of the drainage conditions, focussing on salinity and soil degradation, the SAC area was assessed in view of irrigated agriculture.

2.4.2 The MMMC Monitoring Area

Approximately 27-34 % of the upper Mill-Karabakh plain is used for irrigated agriculture. In the higher parts these plains are well drained. The monitoring area is geologically formed by weak, fragmented zigzag plains. The area slopes down from north-west to south-west with an average of 0.003 m/m. The soil types in this area are various (see chapter 2.4.2.1).

Soil conditions in irrigated areas are characterised by their salinity, mechanical property, ground water level, acidity, contents of nutrients, status of degradation and by the quality of irrigation water. These aspects are considered for the assessment of the present conditions in the MMMC monitoring area.

2.4.2.1 Assessment of present Soil Conditions

The MMMC monitoring area measures approximately 168 000 ha. Both, alkaline and acidified soils are found in the area. Soil types of the Mill-Karabakh sector and their predominant spatial spreading are shown in Table 2.7.

Table 2.7: Soils of the Mill-Karabakh sector

Area	Soil Type
In the dryer, elevated parts near the mountains	Chestnut soils, bright Chestnut soils and Grey soils.
In the lower part near Kura river	Meadow grey saline and Meadow with middle and high humus
In the depressions near Araz river	Meadow bright low humus soils

Source : CES, EIA of RIIDIA II Project, 1999

Soil types for Imishli Araz left bank sector and Agjabedi districts are given in Table 2.8.

Table 2.8: Soil Types of Imishli Araz Left Bank Sector and Agjabedi Districts

Area	Soil	
	Type	Area [ha]
Imishli Araz left bank sector	Bright meadow	31 294
	Meadow grey saline	7 824
Agjabedi	Middle and highly humused soils	33 736
	Meadow and grey saline soils	14 057
	Bright meadow soils	8 464

Source : CES, EIA of RIIDIA II Project, 1999

On the 26th and 27th of July, 1999 a field trip was carried out to take 12 soil samples (see Figure 3.5 at the Chapter 3.6 on Soil Degradation and Land Use) in the MMMC monitoring area. It should be noticed that the soil samples were collected during the irrigation season. Therefore, it was not possible to assess the real situation on the salinity and mechanical properties of the soil. So, results of the analysis obtained from this field trip (see Annex A.9) has not been accepted to be reflecting the real situation. However these results are used to assess the soil conditions together with results obtained form the previous studies of RIIDIA II project. Meliorative conditions of the soils in the monitoring area are various. The monitoring area is dominated by soils that have chlorinated-sulfated type of salts or only the sulfated salts.

The soils around the new and K1 collectors are highly to moderately salined. The salinity of the soils varies between 1.21 to 2.31 % of dried residual substances. For these type of soils special meliorative measures have to be taken into consideration. At the remaining part of the MMMC monitoring area soils are composed by non-salined, less salined or moderately salined type of soils. These areas could be used for agricultural purposes without any special treatment or with simple measures. Soils in the MMMC area differ from place to place concerning their alkalinity. Total amount of nitrates varies from 3.1 to 19.3 % of total substances in soil.

Soil texture of the alluvial sediments consist mainly of silty and fine sandy loams and medium clays. In the confluence of Araz and Kura river and zone of lakes, silty clays, clays and heavy clays predominate.

In the zone near the mountains some gravels are included in lenses.

In Imishli left bank sector, areas requiring drainage amount to 15 300 ha, from a total of 39 118 ha, while in Agjabedi areas in need of rehabilitation amount to 31 000 ha from 56 257 ha. This does not include about 5 000 ha in the Araz left bank sector of Saatli. [AI, 1999]

According to the USDA soil suitability classification, soils suitable for irrigation with slight restrictions (II) are those with none or low salinity (< 0.25 g/100g soil). These cover about 230 400 ha, equivalent to 40 %. Areas with severe restrictions (III), with salinity between 0,25 and 0,5 g/100g cover 115 200 ha or 20 %. The remaining 40 % shows soils with more than 0,5g salt per 100g of soil (very severe restrictions class IV and worse) the consultant considers these areas not to be meliorable economically. [CES, EIA of RIIDIA II Project Feasibility Study, 1999]

In the left bank Araz river sector of Imishli the soil salinity is distributed as follows:

Slightly saline	8 000 ha;	20.5 %	(0,25 - 0,50	g/100 soil) class III
Moderately saline	3 600 ha;	9.2 %	(0,50 - 1,00	g/100g soil) class IV
Highly saline	27 518 ha	70.3 %	(>1,0	g/100g soil) class V - VI

In Agjabedi salinity distribution shows the following values:

Non saline	25 257 ha, class II
slightly saline	11 000 ha, class III
Highly saline	20 000 ha class V - VI

Soil degradation occurs in the MMMC areas as:

a) Salinity/Alkalinity

Salinity affects about 60 % of the Mill-Karabakh zone, equivalent to about 345 600 ha. Of these about 230 400 ha (40 %) have a salt content above 0.5 g/100 g soil, equivalent to the FAO level of electric conductivity in the saturation extract EC of approximately 10 mmohs/cm. Areas with salt contents above this are considered by the Consultant as economically not meliorable (for details of the direct project area affected, see EIA of RIIDIA II Project)

b) Relief and Erosion

No evidence of water erosion can be found in the zone except riverbank erosion and sagging of hydraulic structures. The wide open spaces are conducive to wind erosion and drying effect of the wind.

The total irrigated area in the Azerbaijan has almost doubled from 726 000 ha in 1940 to 1 450 000 ha in 1995. [Elimov E.K., Irrigation at its Impacts on Environment, Baku, 1996]. In the Mill-Karabakh Plain the increase was even higher.

With the extension of the irrigated areas the pressure on the drainage collectors increased considerably. Mainly the K-1, K-2, K-3 and the Mill-Karabakh Collector, but also the inter-farm collectors have exceeded their capacities, consequently considerable area can not be drained adequately.

Maintenance of the collectors is one of the basic elements in soil conservation. The observations form the field trip of July 99 are noted in the Annex A.9, however, it was found that most of the collectors are in bad condition. Bank erosion was observed, many collectors are blocked by vegetation (reeds) or by sediments. As a result the efficiency of the collector system drops. Leaching out of salts from the soils is decreased. In some cases, the soil salinity even increases due to the rise of the groundwater.

Annex A.10 shows a comparison of soil salinity data of Imishli district for January 1997 and January 1998. According to be data the soils having good and sufficient meliorative conditions decreased by 16.2 % and 7.5 % respectively, whereas the soils having insufficient meliorative conditions increased by 35.4 %. If the soil salinity problem goes on to increases that fast goes that fast suitable soils for agriculture may become rare in the future.

If the drainage conditions in the MMMC monitoring area do not improve than benefits from irrigation will be little in the future.

2.4.2.2 Assessment of future Soil Degradation and Land-use related Project Impact

During the construction great amounts of soil (about 350 m^3 per running meter) need to be excavated and moved during the construction of the 31 km stretch of the new main collector. As a normal procedure, excavated soil and subsoil will be deposited laterally to form a dike and a compacted roadway for inspection and maintenance. No negative impact is seen as the soils can be considered as uncontaminated, possessing a salinity comparable to the environment from which they were extracted. As the topsoil usually is saline and contains little humus, a separation from the rest of the excavation material is not considered necessary or useful. Only in wet depressions with soils of high humus contents this should be removed in the interest of embankment stability.

During the operation of the main collector and adjacent sub-collectors will accomplish the primary purpose: the leaching of salts and soil improvement for irrigation purposes for an estimated area of about 36 500 ha. Further areas will be improved in the upstream sectors of the Mill-Karabakh collector once drainage has been rehabilitated and new drainage sectors implemented.

New or reclaimed areas under agriculture will in the appreciable future be cultivated with the help of fertilisers and agro-chemicals, once production and markets have been re-established. Soils will accumulate these substances and transfer them via plants used for consumption or fodder into the food chain. In addition leached substances will be transmitted to the drainage water and harm aquatic organisms or may lead to eutrophication.

2.4.3 The SAC Monitoring Area

The SAC monitoring area is characterised by extended future irrigation activities. Therefore irrigation related soil and land use aspects are considered mainly. The assessment of the present situation is based on soil surveys carried out during the RIIIDIA II feasibility study. These data were completed by those gained from the soil survey of July 99.

2.4.3.1 Assessment of present Soil Conditions

According to the Dokuchajev soil classification [FAO,1985, Water Quality for Agriculture, FAO Irrigation and Drainage paper 29 (revision 1), Food and Agricultural Organization of the United nations, Rome] the soil types of the SAC area are closely related to their physiographic position:

- Upper reaches of the alluvial fans: Typical and carbonated grass-brown;
- Intermediate parts of alluvial fans: dark and ordinary chestnut;
- Southern plain: Grass-grey, salinated and sandy;
- Lower parts of alluvial fans and coastal plain: in dry parts washed and carbonated grass forest, and in wet parts wet alluvial grass soils.

The soil texture is defined by hard clay to medium clays, the lighter soils (clay loams) concentrating on the upper portions of the alluvial fans. In the vicinity of the principal rivers shallow soils on gravel deposits prevail. On the coastal sand bar, soils are not suitable for surface irrigation.

Drainage condition of the soil in the upper and middle part of the alluvial fans is generally good. In the coastal plain areas of soils with deficient drainage is about 57 700 ha, equivalent to 64 %.

Soil salinity occurs on presently irrigated or abandoned soils at a moderate level in the monitoring area. Total project area affected by salinity to such degrees as to make leaching necessary is 24 503 ha, equivalent to 27%.

Soils of the foothills and coastal plains area can generally be considered to have good productive capacity, but some problems due to heavy texture. This is equivalent to a suitability rating of I to II according to the USDA Classification (about 46 000 ha, see Table 2.9). Only in the areas requiring drainage, suitability can be considered III to IV. Sandy soils of the coastal sandbar are rated VII, generally unsuitable for agriculture. A special case might be made for grape or fig, but only under drip irrigation. Except for this area no restrictions to selection of crops are given except the climatic one, in effect a semi-arid climate with short frost spells in winter. Recommended crops are wheat, fodder crops, orchards, vegetables and other crop requiring intensive inputs.

According to the information obtained from Azgiprovodkhoz Institute, the soils of the Qusar and Quba districts are more unfavourable than the other soils of the monitoring area. Some part of the soils of Khachmaz district is salined. Erosion has been recorded in the higly sloped parts of the Qusar and Quba districts. Approximately 105,150 ha of the soils of the Quba-Khachmaz area is exposed to moderate and / or high erosion. (See Annex A.11)

Table 2.9: Agricultural Production Capacity and Limitations

Class	Area[ha]	Percent	Limitation
I	31 536	35%	No need for melioration, slight erosion
II	15 118	17%	Drainage
III	18 075	20%	Drainage
IV	5 287	6%	Drainage and leaching
V	10 950	12%	Drainage and leaching
VI	8 266	9%	Drainage. leaching, alkalinity
VII	808	1%	Deflation, sandy
Total	90 039	100%	

Source: SEYAS - SUIS, 1996

Agriculture usually applies agro-chemicals in the monitoring area. This affects the soil conditions and groundwater in the area. The concentration of the chlorinated pesticides in the soils of the vineyards of the Quba district varied from 1 to 10 mgeq/kg of soil during the FSU time. [Galiulin R.V. et all, 1982, Chlorinated Pesticides and Heavy Metals in the Soils of Azerbaijan, Pushino]

The amount of the fertilisers used in different districts of the SAC monitoring area is given in More recent data are not avoidable, but it is expected that fertilizer use has reduced considerably, as inputs are not available anymore at subsidized prices as during the time of the FSU.

Table 2.10. The shown data belongs to the year 1982. During this year agrochemicals are used intensively in agricultural activities. More recent data are not avoidable, but it is expected that fertilizer use has reduced considerably, as inputs are not available anymore at subsidized prices as during the time of the FSU.

Table 2.10: Fertilisers used in the Districts of SAC Monitoring Area

Districts	Total Mineral	Fertilizers Used (kg/ha)		
	Fertilesers (kg/ha)	Nitrogen based	Phosphorus Based	Potassium Based
Khachmaz	193.4	96.8	73.6	23.0
Quba	175.5	86.2	69.5	19.8
Qusar	157.5	98.0	46.8	12.7

Source : Galiulin R.V. et all, 1982, Chlorinated Pesticides and Heavy Metals in the Soils of Azerbaijan, Pushino

During the field trip of July 99 it has been observed that the drainage system is in unwell conditions at the most parts of the SAC monitoring area. Eroded collector slopes, and growth of reeds have been observed, making the collector system non-functional at many places. These deficiencies have caused rising of groundwater levels, soil salinisation and extension of swampy areas.

The soils in the irrigated areas of the SAC region are saline. The central area of the SAC which are not used for agricultural purposes are also salined soils. The soils located at the 50 km of the monitored SAC reach are good in quality. Unfortunately, the meliorative quality of the soils of the Khachmaz district that are located near to the Velvelichay decreased. (See Table 2.11) This is mainly related to the non-functioning of the collectors in that area.

The field trip into the SAC monitoring area is carried out between the dates 29th and 30th of July. (see Figure 3.6: Location of Soil Sampling Points in the SAC monitoring Area). The samples were collected from 15 points. For the results of the analysis obtained from this field trip see Annex A.13. The soil salinity varies from 0.08 to 0.18 % of the dried residual substances. These soils in the SAC area are neutral or slightly alkaline. The total amount of nitrates in the 2nd and 4th sampling points reaches to 5.1 and 10.1 % of total substances in soil, respectively. The soils can be used for agricultural purposes.

Table 2.11: Salinity of Agricultural soils (0 - 100 cm) in the Khachmaz District (1996-1998) in hectares

Years	Salined	Less Salined	Moderately Salined
1996	45 900	5 300	1 100
1997	45 630	5 300	1 400
1998	45 430	5 400	1 500

Source : AI, Salinity Maps, 1998

2.4.3.2 Assessment of future Soil Degradation and Land-use related Project Impact

Based on the results of a comprehensive sedimentation plan to be carried out during the early stages of implementation During the construction considerable volumes of sediments will need to be taken out of these sedimentation basins. The two sedimentation basins are located at 6 km and at 12 km downstream of the Samur weir. It is estimated, that sediments settled in the two sedimentation basins have a total volume of approx. 7 mio. m^3. These will either be spilled into adjacent rivers with corresponding temporary effects or will need to be excavated and transported to one or more adequate landfill site(s) at an acceptable transport distance. The site(s) and the excavation/transport methods should be defined and agreed upon before the start of the rehabilitation works. The sediments are uncontaminated, originating from the Samur river, and no special precautions need to be taken.

The damaged old canal lining and old hydraulic infrastructure made of concrete and steel need also to be deposited in an adequate space. As these are essentially uncontaminated materials, no special precautions need to be taken: e.g. abandoned quarries or rocky surfaces could be useful spots. Alternatively the material may be recycled as road-fill material or for other construction purposes.

Construction could possibly trigger soil erosion due to destruction of vegetation cover, compaction by heavy traffic and concentration of surface flow.

During operation of the project, additional irrigation in the future will affect soil resources with potential contamination hazard by agrochemicals. This could affect the quality of agricultural products, of drain-water entering into sensitive areas.

During the future operation of the rehabilitated Samur Apsheron Canal its desiltation basins will need to be regularly cleared. The sediments of an annual volume of approx. 600 000 m^3 need to be transported and stored at an adequate landfill. This site should be located at an acceptable transport distance. The sediments are originating from the Samur river, they are uncontaminated, and no special precautions need to be taken in this respect. The landfill site and the excavation/transport methods should be defined and agreed upon before the start of the canal operation. This assessment would be part of the sedimentation study.

No significant erosion hazard is expected for agriculture, as terrain slopes at the level of the canal are already of reduced inclination.

2.5 WATER QUALITY

2.5.1 General

In general, irrigated agriculture affects the quality of water. The return (drainage) flow may carry salts and may be contaminated with agro-chemicals and nutrients. By this irrigation and drainage may have effects on the ecology of water resources due to decrease in amount and / or in quality.

The MMMC and SAC monitoring areas include both drinking water resources and also environmentally important water resources.

Water quality of rivers is observed by the State Hydrometorological Institute. In the past the Azgiprovodkhoz Institute also observed the quality of water resources used for irrigation purposes. The base line information in the water quality assessment is considered to be as recent as possible. Therefore the assessment of the present conditions of the water resources in the MMMC and SAC monitoring areas is based on data obtained from the previous RIIDIA II EIA and from the field trip of present study.

Annexes A.2, A.3, A.4, A.5 and A.6 are generalised water quality standards, guidelines and recommendations for irrigation, drinking and fresh water fisheries. In addition Annex A.24 gives the national water quality standards for drinking water, fisheries, etc.. These standards have been taken into account for evaluation.

2.5.2 MMMC Monitoring Area

2.5.2.1 Present Water Quality Situation

The inadequate water quality in the MMMC area is caused by both the point and diffused type of pollution sources. Main industries are concentrated in the population centres Saatli and Imishli. Household discharges and industrial wastewater either are emitted into the Araz river or enter into collectors. The main contamination originates from leaching of salts out of irrigation areas. Further pollution comes from pesticides and nutrients from fertilisers. The harmful substances are leached by percolating drainage water and enter into collectors, lakes and rivers. Present changes in agriculture has brought the use of agrochemical down to zero, but the expected revival of agricultural markets will bring increasing use of fertilisers, herbicides, fungicides and pesticides. The quality of Kura water from the point of view of salinity, nutrients and heavy metals can still be seen as satisfactory. The July 99 field trips carried out in the MMMC monitoring areas show that Kura and Araz rivers water are suitable for drinking and irrigation purposes. (See Annex A.25 and Table 2.12)

At present drainage water discharged into the lakes carries pros and contras. On the one hand they supply the lakes with water, but this water carries leached out ions (salts) and at least in the former times residues of fertilisers and plant protection chemicals to the detriment of the precious flora and fauna. Evidence of excessive eutrophication was reported in former times.

Table 2.12: Water Quality of MMMC Water Resources

Water	Purpose of Usage		
Resource	Drinking water	Irrigation Water	Fish Life
Kura	Suitable*	Suitable	Suitable
Araz	Suitable*	Suitable	Suitable
Ag Gol Lake	Chloride is > 250 mg/l, Sodium > 200 mg/l	Will Increase the problem, ECw is between 0.75-3.0 mmhos/cm	Suitable
Sarisu lake	Chloride is > 250 mg/l, Sodium > 200 mg/l	Severe problems occurs, ECw is > 3.0 mmhos/cm	Suitable

Note: Hygienic parameters not included in the table, as they have not been measured

Ag gol

In the past the lake was affected from diffuse and direct inflows of agricultural nutrients and other agrochemicals. The measured salinity of the lake is around 2.5 g/l. See Annex

A.25) The formerly reported concentration of ammonium and phosphorus were 0.9 and 0.7 mg/l, respectively. The consultants own sampling in February '99 and in July '99 resulted in values showing a marked decrease: 0.005 and 0.007 mg/l representing an improvement of the lake water quality. Unfavourable oxygen conditions for fish existed formerly: from 2.3 to 6.9 mg /l O_2. Today, deficit of the oxygen still has been observed during warmer months. [Mansurov A, Salmanov M, 1996, Ecology of Kura River and it's Basin, Baku, Azerbaijan Republic]

Sarisu

Fed by the water from Ag Gol and water emanating from extensive swampy areas, the lake has almost double salinity of Ag Gol, due to the discharge of saline drainage water (Annex A.25) from the Imishli irrigation sectors into it. Drainage waters from K and K1 systems are presently discharged into the Sarisu Lake. Additionally irrigation excess water from P-1 and P-12-1 is reported to flow into the lake. Furthermore evaporation from the lake surface and concentration of salts are additional factors.

2.5.2.2 Potential future Impact on Water Quality

In the MMMC project area the construction activities on the missing link of the Mill-Mugan canal will involve great amount of excavation activities. Construction is done in such a way that groundwater is allowed to flow through the completed section downstream by gravity. Should pumping of groundwater become necessary for the construction of hydraulic or other structures the highly mineralised water should be discharged safely to the downstream section. In no case should any mineralised groundwater be allowed to enter some freshwater rivers or ecologically sensitive lakes.

The new main collector and the adjacent rehabilitated sub-collectors will effect the primary purpose: the intended groundwater lowering and at the same time the leaching of salts. Drainage water at present entering Sarisu lake and Kura river will be intercepted and carried away. Thus lake water will be improved considerably as input of salts will be reduced as well as contamination by fertilisers and agrochemicals. The Kura river will be protected from unwanted intake of drainage water carrying salts and contaminants, improving the water quality for the freshwater off-take for Baku water supply, and last but not least improving conditions for the fish population in the Kura river, the fish production facilities at Neftchala and the sturgeon hatcheries, once re-established.

In the future, drainage improvements can be expected for the upper sectors of the Mill-Karabakh Collector, once rehabilitation and construction of new drainage schemes have been accomplished.

Intercepting of the drainage flow on the other hand will deprive the Sarisu lake of a certain proportion of inflow needed to maintain an ecologically sustainable water level. Therefore this lake may have water quality problems due to increase in concentrations caused by the less inflow. However, at this point cross reference is made to the Water Resources chapter 2.3 where proposals are made how to ensure the water balance of the lakes.

Once the drainage conditions improve, the use of agrochemical may also increase due to intensified agricultural activities. This may lead to the contamination of groundwater and/or Ag gol and Sarisu lakes by agrochemicals. However without the new MMMC this problem would be even more severe.

2.5.3 SAC Monitoring Area

The methodology of water quality assessment of the SAC monitoring area is based on the same standards and guidelines mentioned for the MMMC monitoring area. The SAC water is used for irrigation and drinking water purposes.

2.5.3.1 Present Water Quality Situation

The sources of water contamination in the project area are mainly from the agricultural areas and the effluent from the large population centres. During the times of the former Soviet Union large amounts of fertilisers, pesticides and herbicides have been used in intensive agriculture, especially in the orchard and grape production which is of great significance for the region. Substances used have been recognised today as being harmful to the environment and consequently are banned, but residual effects such as chlorinated hydrocarbons are still to be registered. Fertilisers, especially nitrogenous have been washed out by drainage water and have contributed to the eutrophication of watercourses. With the demise of the former Soviet Union and the subsequent re-structurisation, the use of agrochemical has been drastically reduced on economic grounds, and this has contributed to the reduction of environmental contamination. Yet, in the future, with the expected economic upturn it can be envisaged that the use of fertilisers and fungicides, herbicides and pesticides will again increase, albeit not to the same levels as during the former Soviet Union period. A number of population centres are situated next to the principal rivers. These are Qusar on the Qusarchay, Quba and Khachmaz on the Qudyalchay. Their population and industries have contributed to the environmental degradation of the rivers. Due to the downturn of the industrial production, river contamination with industrial discharge containing heavy metals and hydrocarbons have decreased, but deteriorating conditions in the water supply and sanitation have contributed to an ever increasing load of sanitary hazards. This is reflected by the prevalence of intestinal and water borne diseases in the region (see section 0). Yet the contamination data on rivers, other than hygienic criteria, generally attest the rivers a good water quality (see Annex A 25). The following Table 2.13 summarises the results from water quality analyses carried out recently in February 1999 and July 1999.

Table 2.13 Water Quality of Rivers in the SAC Area

Water	Purpose of Usage		
Resource	Drinking water	Irrigation Water	Fish Life
Samur River	Suitable*	Suitable	Suitable
Qusarchay River	Suitable*	Suitable	Suitable
Qudyalchay River	Suitable*	Suitable	Suitable

Note: Hygienic parameters not measured.

The Deveci lake receives its inflow mainly from the Shabranchay river, however, as considerable flows are diverted from the river to irrigation schemes the lake is loosing its catchment. In 1998 the lake suffered near complete drying out with a consequent disaster on the fish population and impact on the wildlife feeding on them. Drainwater of agricultural areas in the irrigated watershed above the lake, including the heavily contaminated waters of the Devecichay at present are intercepted by a collector drain, so that they do not enter the lake, but are led to the sea. Water quality in February was very saline EC 7.87 (about 5 g/l). Eutrophic conditions of the lake was observed by the consultant within the Deveci lagune, which manifested itself by abundant green algae and dense, thick reed bands (~ 200 to 400 m at both sides of the lake).

Due to water scarcity, repeated attempts have been made to divert collector water to the lake, but -perhaps a mixed blessing- they have failed due to lack of technical means.

2.5.3.2 Potential future Impact on Water Quality

During the re-construction of SAC all water resources at which rehabilitation needs to be done will be affected. This includes the Samur river and all transversal rivers to the canal that are connected. Main cause will be the temporary diversion of water, stirring up and spilling of sediment and construction debris, making conditions for aquatic flora and fauna temporarily difficult.

During the 2-year construction period SAC water needs to be diverted to the Kharnakh Canal in order not to disrupt a continuous water supply to Baku and to the connected irrigation schemes. This may cause section-wise temporary cut-off of irrigation water for the immediate command area between Samur-Apsheron Canal and Kharnakh Canal, with consequent loss of production and socio-economic benefits. However, construction during the irrigation season will as much as possible on activities that would not obstruct the water flow to these irrigation schemes.

No additional water will be diverted from the Samur river, therefore the operation of the SAC will not change the Samur river flow regime. That means there will be no detriment in the water quality of Samur river.

Additional irrigation which may be expected with the recuperation of the economy in the future may affect groundwater resources with potential contamination hazard by agrochemicals. This could affect the groundwater quality extracted for Baku potable water in the well galleries installed near the railway line in the Khachmaz region. However, as explained, these threats are primarily related to the emerging economy and not to the rehabilitation of the SAC.

Water that is harvested from two crossing rivers to feed the SAC may form a source of water pollution in the future. Here serious water quality sampling may become necessary in the future at the respective diversion works. Respective monitoring requirements, however, are at this point in time not part of the present canal rehabilitation project.

So far the water quality of the SAC is considered as excellent - the proposed infrastructural measures will not change the present water quality. However, with the recovery of the economy threats may come up that need to be handled by political care and with full responsibility to ecology and water quality.

Water quality of the Deveci lake at present is poor. It may be changed to the positive in the future as reduced canal losses and increased irrigation efficiencies may reduce the farmers' dependence on Shabranchay flow. Under such conditions the lake could receive more freshwater, clearly improving its water quality and its hydrological regime.

2.6 HEALTH SITUATION

2.6.1 General

An increase of water-borne or water-related diseases (see Annex A.1) is commonly associated with the introduction or extension of irrigation. The diseases most often linked with irrigation are schistomsomiasis, malaria and onchocerciasis, whose vectors proliferate in the irrigation water. However, it is expected that the probability of the occurrence of these diseases is decreased by means of drainage measures. Sometimes the reuse of drainage water, which is usually mixed with wastewater, for irrigation has the potential of transmitting communicable diseases (mainly helminthic, and to a lesser extent bacterial and viral).

Positive effects of irrigated agriculture from the point of health might be food security and an increase in the purchasing power for drugs and health services.

The Republican Centre for Hygiene and Epidemiology is responsible for monitoring of the health situation in Azerbaijan. Their laboratory equipment and technical staff is considered suitable by the health expert to cope with the related tasks.

In general, irrigation and drainage have different effects on the health situation in the respective project areas. Unfortunately, as it will be discussed below, the present health conditions have to be considered as not satisfying for the MMMC and the SAC project areas.

Coliform organisms have long been recognised as a suitable microbial indicator of drinking water quality, largely because they are easy to detect and enumerate in water. WHO guideline states that all water intended for drinking purpose should not contain any Escherichia Coli in any 100 ml sample.

2.6.2 MMMC - Monitoring Area

2.6.2.1 Present Health Conditions

The MMMC area is governed by agricultural land use. In general the agricultural areas are under irrigation, however, their present drainage conditions are considered as poor. The non sufficient drainage capacities may form a threat to human health in the MMMC area. Drainage water is often mixed with domestic effluent, further downstream it is often reused e.g. for drinking water supply. The Kura and the Araz rivers form an important resource for the water supply of Baku. These rivers may be affected by the sanitary conditions in MMMC area, consequently they are to be considered as a threat to the water supply of Baku. The information on diseases that occurred in the MMMC area is mainly obtained from the Republican Centre for Hygiene and Epidemiology. In addition field trips carried out by the Consultant gave information on contamination sources. The findings from the previous RIIDIA II environmental impact assessment study were considered.

The summertime amount of coliform bacteria increased in Sabirabad river water from 10 000 per ml in 1974 to 24 000 per ml in 1994. The river water is used for irrigation purposes as well as for drinking water supply. The generally very direct and obvious effects unfortunately can not be proven by means of district related statistical data, however, the nation wide health statistics show a rise in nation-wide mortality between 1991 and 1994 by intestinal diseases from 27 to 31 per 100 000 capita and from 21 to 29 for infectious diseases.

During the first half of 1999 1, 8 and 67 cases of salmonella, viral hepatitis and malaria have been observed in the Imishli district. At the first half of 1998 observed Malaria cases were 377 and viral hepatitis cases were 24. This demonstrates the variability of number of cases during the years. This improvement is reached by the education of the people on health aspects and contamination. The status of further water-borne and water-related diseases is shown in Table 2.14 for different districts of the MMMC area. The percentage of people infected by the diseases has risen by 5.7% in 1998. Table 2.14 shows that water-washed diseases, Category II (See Annex A.1) are widespread in MMMC region. To protect people against that type of category II diseases the quality of water, water accessibility and hygiene conditions need to be improved.

2.6.2.2 Potential future Impacts on Health

Deteriorating sanitary facilities and population increase have led to increased amounts of sanitary wastewater to be released into the rivers, canals and collectors.

Table 2.14: Cases of Water-borne, Water-related Disease in the MMMC Area

District and Population[a]	Salmonella	Dysentery	Viral hepatites	Malaria[b]		Ascariasis	
	1997-1999	1997-1999	1997-1999	1998	1999	1995	1998
Agjabadi 101 800	23	24	8-10	47	33	235	357
Beylagan 80 000	4	20	4-5	240	-	227	614
Imishli 98 800	1	-	4-8	377	67	42	63
Saatli 81 500	-	5	18-3	206	47	235	341
Sabirabad 131 300	-	-	7-11	278	56	235	341

[a] Source for population figures is CSSAR, population statistics, Baku,1998.
[b] Figures for both of the year belongs to first half of the respective years.
Source : MoH, 1999

The future impacts of the proposed infrastructural measures are assumed to be as follows:

- During the construction phase: construction activities will create temporary noises, nuisances and road traffic emissions for any population in the vicinity of the construction sites. Fortunately the area is very sparsely populated, with the exception of the eastern end of the main collector, where the population engages in intensive irrigation by river water from Araz.

- The operation of Mill Mugan collector will improve drainage conditions on the right hand side of the Kura river. Due to this improved drainage, better conditions for health conditions will be created.

- The Kura river will be protected against unwanted inflow of drainage water carrying salts and contaminants, improving the water quality for the freshwater off-take for Baku water supply. So, the improved quality of potable water will help to avoid health hazards, especially intestinal diseases of the urban population of Baku.

From the above it can be stated that the construction of the MMMC will not harm public health in the project area, neither during construction nor during operation. In contrary, it is likely that the proposed infrastructural measures will improve the sanitary conditions, as a consequence the number of water-related health cases is considered to decrease after project implementation.

2.6.3 SAC Monitoring Area

In the SAC project area it is planned to increase the agricultural production by means of rehabilitation of the Samur Apsheron Canal. In addition this water resource is used as drinking water supply of Baku. Any potential contamination of this water resource might create health associated problems in the direct project area and in Baku. The following chapters will assess available information concerning the actual health situation and as it might be after project implementation.

For the SAC area the Consultant applied the same methodology as for the MMMC area. Therefore reference is made to the respective chapter of the MMMC assessment.

2.6.3.1 Present Health Conditions

During the period of 1997/1998, 68 cases of viral hepatitis were observed in the Khachmaz district. In 1997, 33 cases of Malaria have been recorded, in 1998 Malaria was found in 49 cases in this district. Percentage of population having diseases has reached to 3.8 in 1998. For other water-borne and water-related diseases and their spreading across the SAC area reference is made to the below Table 2.15.

Table 2.15 Water-borne Water-related Disease at the SAC Area

District and Population[a]	Salmonella	Dysentery	Viral hepatitis	Malaria[b]		Ascariasis	
	1997-1999	1997-1999	1997-1999	1997	1998	1995	1998
Khachmaz 131 900	3	26	68	33	49	433	1586
Quba 128 700	9	5	40	10	7	842	4280

[a] Source for population figures is CSSAR, population statistics, Baku,1998.
[b] Figures for both of the year belongs to first half of the represented years.

Source : MoH, 1999

It shows, that water-washed diseases, Category II (See Annex A.1) are widespread in the SAC area, especially asceriasis. The improvement of water quality and of water accessibility have to go hand in hand with better hygienic conditions to reduce the number of cases.

2.6.3.2 Potential future Impacts on Health

Construction activities will create temporary noises, nuisances and road traffic emissions for the population in the vicinity of the construction sites.

The operation of the rehabilitated canal will assure and improve flow for irrigation demands and for the water supply of Baku. The losses will be reduced considerably and more efficiency achieved in irrigation. Improvements in agricultural production will generate correspondingly more income, and improved quality of potable water will help avoid health hazards, especially intestinal and contagious diseases for all population involved, including the urban population of Baku.

Some negative effects may be expected, when additional irrigation is implemented, the microclimate turning generally more humid. Under deficient management waterlogging may increase vector breeding grounds for the transmission of diseases like malaria. But expansion of irrigated area is not intended under this project.

To combat health hazards from the increase in open water courses, environmentally non-persistent and selective insecticides should be applied to reduce the multiplication of aquatic larvae of disease vectors (malaria). As a management practice stagnant pools of water should be avoided wherever possible.

2.7 SOCIO-ECONOMIC ASPECTS

2.7.1 General

The SAC and the MMMC projects are understood to increase the agricultural production and the living conditions. Taking this into account socio-economic aspects gain major importance for the assessment of the present situation of the environment to which man is an important contributor.

This socio-economic assessment is carried to elaborate the status quo or the present situation in the two monitoring areas. It applies baseline information that is obtained from the Committee for State Statistics of Azerbaijan Republic (CSSAR) and Imishli and Khachmaz district offices of CSSAR, State Land Use Committee, State Irrigation Committee and Ministry of Agriculture.

In general the most important key indicator for the socio-economic assessment is the income situation, related to districts and different sectors. Unfortunately the Consultant could not obtain these information from the relevant authorities. Anyhow, to reflect the recent situation the Consultant briefly likes to refer to general income figures for Azerbaijan. In 1998 the average monthly income per person is $US34.6, while the expenditures per person are $US34.0. The value of the total agricultural production is $US 616 million in the plant-growing sector and $US428 million in the cattle-breeding sector [CSSAR,1998].

To asses the socio-economic aspects it is necessary to find out which areas will be effected from the project. To get the most accurate impression for the present situation and for the future monitoring certain areas have been selected to serve as so called indicator areas. The following assessment uses this approach.

2.7.2 Present Socio-Economic Situation in MMMC Monitoring Area

The MMMC monitoring area partly covers Agjabedi, Beylagan, Imishli, Saatli, Sabirabad administrative districts. The delineation of the monitoring area is described in chapter 2.1.1 and shown in Figure 2.1. From the agricultural point of view the MMMC area may be characterised by the production of cotton and cattle. However, it is also one of the major melon growing areas of the country. From a field trip carried out in July 1999 it could be seen, that the agricultural situation at present is under stress, which reflects in obviously abandoned areas.

The present situation is assessed on the basis of information collected from the organisations mentioned above. It is shown in the annexes as:

- Present population and increases in the rural and urban population of both of the project areas at Annex A.14;
- Agricultural land use at both of the monitoring areas at Annex A.15;

- The cropping pattern and crop yield of both of the monitoring areas at Annex A.16;
- Orchards and vineyards with produced amounts of fruits at both of the project areas at Annex A.17; and
- Domestic animals of the both of the monitoring areas at Annex A.18.

The data was collected for districts. The most representative district for the MMMC monitoring is Imishli which covers almost 77 % of the entire monitoring area (see Table 2.16 and Figure 2.4).

Table 2.16: Monitoring Area in Districts of MMMC Area

District		Monitored District area				Percentage
Name	Total, ha	Irrigated (ha)	Total (ha)	Total (%)	Irrigated (ha)	of the Monitoring Area
Agjabadi	140 098	56 747	3 360.8	2.4	1 361.3	2.51
Beylagan	127 543	50 956	13 814.3	10.8	5 519.1	10.33
Imishli	171 103	46 501	102 768.3	60.1	27 929.5	76.84
Saatli	76 986	48 788	8 618.0	11.2	5 461.5	6.44
Sabirabad	134 107	68 816	5 190.5	3.9	2 663.5	3.88
MMMC	649 837	271 808	133 751.9	20.6	42 934	100

Source: Calculations are based on the information obtained from the CSSAR in 1998

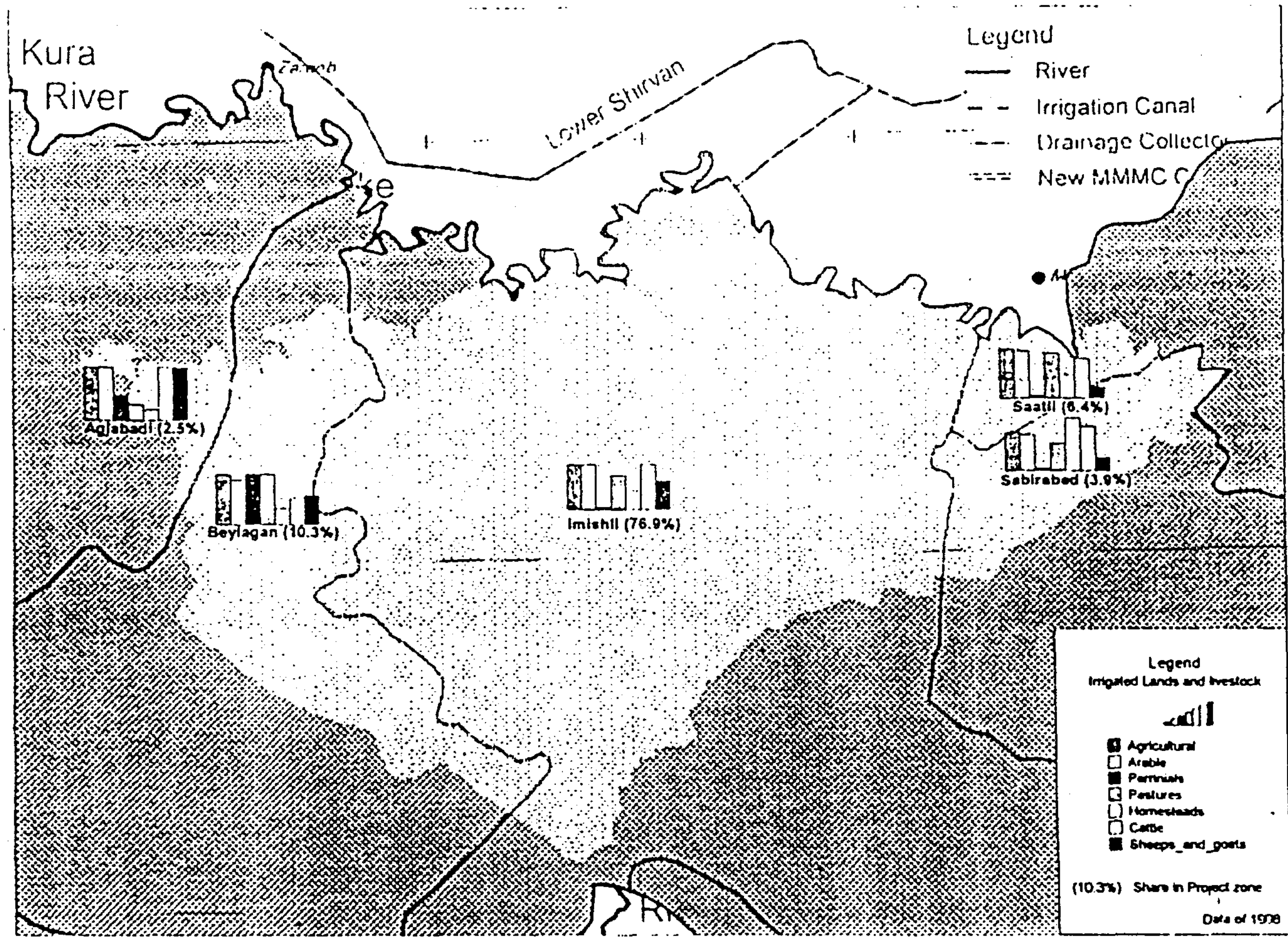

Figure 2.4 The MMMC Monitoring Area (Socio-economic Evaluation)

Concerning environmental aspects the socio-economic situation is mainly reflected by land use. Present land use in the five districts is mainly characterised by irrigated agriculture. In the past major irrigation schemes have been set up, diverting water directly from the Araz river. The Karabakh Canal on the other hand takes its water from the Mingachevir reservoir upstream Kura river and from many smaller tributaries of the Karabakh region. Irrigation is practised on suitable elevated and well drained soils near the mountainside. Near the big rivers small but intensive agriculture and horticulture is installed directly fed by river water pumps. Towards the salined and deficiently drained area in the interfluvial depressions and near the swamps and lakes agriculture gradually is replaced by a poor cattle and sheep pasture on salinity resistant grasses and herbs.

Main cultivated crops are cotton, fodder (alfalfa), and grains (mainly wheat). In the Imishli district, typical for the project area, the cropping pattern consists of about 45% cotton, 21 % Alfalfa, 21% Wheat, 5% silage maize and the balance in other forage crops and perennial cultures and 8 % for other agricultural plants. In other areas some sugarbeets were produced for delivery to Iran, but this has now been discontinued. [CES, 1999, EIA of the RIIDIA II Project]

Horticulture and fruticulture is practised on a small scale privately, where adequate water and soil resources exist, mainly next to villages and on well drained soils on the rivers.

The cotton is meanwhile delivered to five cotton ginneries installed by the Turkish firm Paksu, but still production has not reached the level of former Soviet times, where a ready market existed.

The land reform, allocating 0,75 ha per person, has led to a breakdown of the former Kolkhozes and Sovkhozes without an equivalent formation of water user associations, so that an effective irrigation management is still pending.

The monitoring area touches five districts with a total population of 493 thousand. About 378.8 thousand people are considered as rural population, including the rural population of the Imishli district which is 65.3 thousand people (Annex A.14). The population figures for the MMMC monitoring area can not be defined from the present data material. However, as the Imishli district form about 77 % of the monitoring area its figures may be taken as an indicator for its population. The density of the present population is calculated and given at the Annex A.19. Imishli district has the lowest population density with 1.54 ha/person.

Livestock per person is calculated and tabulated in the Annex A.20. The highest number is 0.87 for the Agjabadi district, whereas the lowest is 0.46 for Beylagan district. Usually all the districts have the same ratio of cattle per person, however Agjabadi district has a big difference in the ratio if small livestock (sheep, goats) is considered.

On inter-farm level management problems come together with poor conditions of irrigation and drainage infrastructure. This finally led to:

- Increased salinisation because of the conditions of the collectors as explained in the chapter (2.4)
- Intensification of the salinisation process because of the inadequate irrigation practices;
- Lack of financial means for the maintenance of the irrigation (Table 2.17) and of the collector system

Table 2.17: Irrigation Water Charges in the MMMC Monitoring Area

Districts	Price of Irrigation Water (Manats/m^3)	Total Amount of Irrigation Water paid (m^3)	Total Revenue from Irrigation Water (Manats)
Agjabadi	37.5	487 700	18 288 750
Beylagan	7.7	352 864	2 717 052.8
Imishli	5.6	328 261	1 838 261.6
Saatli	4.6	328 459	1 510 911.4
Sabirabad	17.2	507 077	8 721 724.4
MMMC (Total)	16.5	2 004 361	33 076 700.2

Source: SAIC,1997

The irrigation water charges change from one district to another. The highest charge is applied in Agjabadi district that is 0.87 US cents/100 m^3, while the highest amount of water is consumed in Sabirabad district. The indicating Imishli districts is found at the lower end of the price scale with water charges of 0.13 US cent/100 m^3. The total revenue obtained from the five districts was approximately 7 700US$ (1 $US = 4 300 Manats), for Imishli this is about 425 $US.

The information about the employment and unemployment have been obtained directly from the district offices of CSSAR and from its head office. For Imishli as the indicator district, the following information has been given by the district offices. The employable population of Imishli counts 54 500, the actual number of the working people is 38 500, the actual number of the unemployed people is 16 000 which is 33% of the employable people. These figures differ from the information given by the head office of CSSAR by a factor of 3.5 (Table 2.18).

Table 2.18: Registered Unemployment in the MMMC Monitoring Area, 1998

Districts	Number of the Unemployed Persons	Number of the Unemployed receiving Subsidies
Agjabadi	116	9
Beylagan	122	8
Imishli	4 580	222
Saatli	640	47
Sabirabad	312	16
MMMC	1536	302

Source : CSSAR, 1999

Present Socio-Economic Situation in the SAC Monitoring Area

The SAC monitoring area is described in chapter 2.1.2 it covers Khachmaz, Quba and Qusar administrative districts.

The baseline information collected from the organisations mentioned above are given together with the same annexes of the MMMC monitoring area as described in the chapter 2.7.2.

The Khachmaz district is selected as the indicator district for the SAC monitoring area. This district covers 81.68 % of the monitoring area (not considering the area southeast of the Velvelichay) as given in the Table 2.19. (see Figure 2.5).

Table 2.19: Districts of the SAC Monitoring Area

District		Area of District in Monitoring Area*				Percentage of the Monitoring Area
Name	Total Area, ha	Irrigated (ha)	Total (ha)	Total (%)	Irrigated (ha)	
Khachmaz	147 075	52 240	147 975.0	100.0	52 240	81.68
Quba	292 071	27 047	5 017.3	1.7	464.6	2.79
Qusar	187 645	29 802	27 980.6	14.9	4 443.9	15.54
SAC	802 722	130 848	180 073.0	22.4	57 148.5	100.0

Source: Calculations are based on the information obtained from the CSSAR in 1998; area southeast of Velvelichay is not considered.

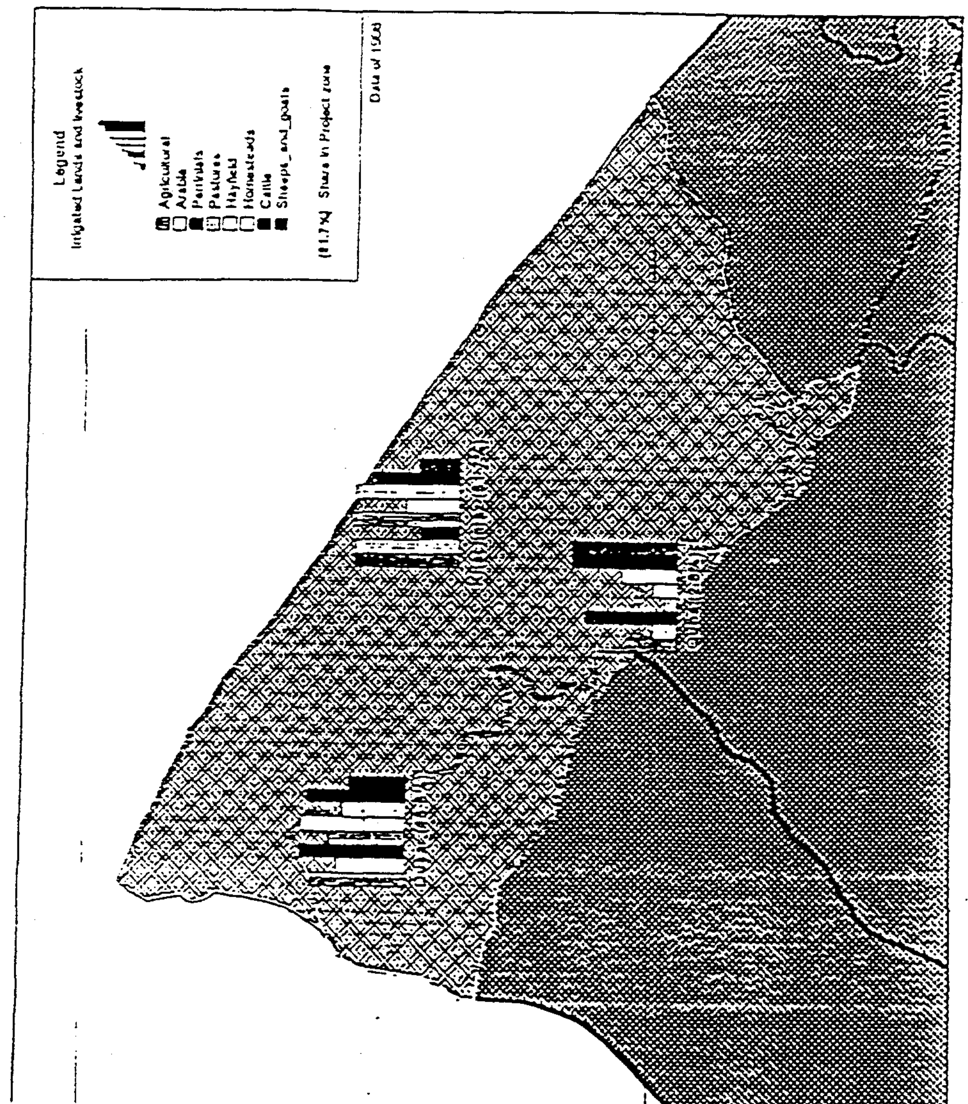

Figure 2.5 The SAC Monitoring Area (Socio-economic Evaluation)

The population of the 4 districts is 379.1 thousands thereof 269.2 thousand are considered as rural population, including the rural population of Khachmaz district which is 87.5 thousand (Annex A.14). The population of the SAC monitoring area should be represented more or less by that of the Khachmaz district.

Almost at all of the districts of the SAC Monitoring area the lands are mainly used as vineyards or orchards. In irrigated orchards, mainly apples, pomegranates, plums cherries, blackberries, vineyards, walnuts, chestnuts, hazelnuts etc. are cultivated.

In Khachmaz the ratio of the cattle per person is 0.54 and the ratio of small livestock per person is 1.01 which are the least figures within the SAC monitoring area. (Annex A.20)

The irrigation water charges are given in Table 2.20. Total revenues obtained from the SAC monitoring area are approximately $US375.0. The lowest water costs are charged in the Khachmaz district with 0.037 US cents/100 m^3. (1 $US = 4 300 Manats)

Table 2.20: Irrigation Water Charges in the SAC Monitoring Area

Districts	Price of Irrigation Water [Manats/m^3]	Total Amount of Irrigation Water paid [m^3]	Total Revenue from Irrigation Water [Manats]
Khachmaz	1.6	200 810	321 296
Quba	7.3	112 516	821 366.8
Qusar	4.8	96 348	462 470.4
SAC (Avg./Total)	3.9	409 674	1 605 133.2

Source: SAIC, 1997

The coastal plain is an important transport corridor between Baku and the states of the CIS to the north. They comprise a double tracked railway line and a main highway running alongside, leading to Dagestan. The most important population and administrative district centres touched by this line are Deveci, Khachmaz and Khudat. Present transit road traffic to Russia takes the main road branching off north of Deveci, approximately following the line of the Samur Apsheron Canal and crosses the border on the dam diverting the Samur water to Azerbaijan and Dagestan. Main road communication to the important district capitals Quba and Qusar situated at approximately 600 m elevation branch off to the west. Into the upper reaches of the Caucasus watershed only small roads of increasingly lower standard with only local significance follow up the river valleys. The combination of good soils, a more humid climate and a good supply of irrigation water contribute to an intensive agriculture: Irrigated agriculture comprises cereals, mainly wheat, and fodder, mainly alfalfa. Intensive irrigated horticulture produces tomatoes, potatoes, onions, lettuce, cabbage, peppers, egg-plants, carrots, etc.

The population density in the monitoring area is calculated for different land use practices which are 1.41 ha/person agricultural lands, 0.41 ha/person sown area, 0.12

ha/person perennial plants. (See Annex A.19). Khachmaz district is the densest populated area with 0.87 ha/person if the agricultural lands are considered.

The principal cropping pattern consists of about 39 % cereals (mainly winter wheat), fruits 25 % (mainly apples), fodder crops 25 % (mainly alfalfa), vegetables 5 % (mainly tomatoes) as well as 6 % other cultures. [CES,1999, EIA of RIIDIA II Project]

Main sectors of employment are agriculture, canning and preserving industries, silk, carpet weaving, and wine making. Local information on unemployment could not be obtained. The Table 2.20 gives the registered unemployment persons in the SAC monitoring area which are totally 951 persons, for Khachmaz these are 400.

Table 2.20: Registered Unemployment in the SAC Monitoring Area, 1998

Districts	Number of the Unemployed Person	Number of the Unemployed Receiving Subsidies
Khachmaz	400	15
Quba	165	3
Qusar	386	15
SAC	951	33

Source : CSSAR

2.7.4 Potential Impacts on future Socio-economic Situation in both Monitoring Areas

Main purpose of the SAC rehabilitation is to assure and improve flow for irrigation and the potable water supply in quantity and quality to the city of Baku. The water losses will be reduced and more efficiency achieved in irrigation. Improvements in agricultural production will generate correspondingly more income, and improved quality of potable water will help avoid health hazards, especially intestinal and contagious diseases for all population involved, including the urban population of Baku. The total farm area for which improvement is foreseen amounts to 63 900 ha. Yearly income for farm-sizes between 2.5 and 3 ha will rise by $US1000, benefiting about 20 000 families. For farm-sizes of 25 to 30 ha, increase in income reaches $US 15 000, benefiting about 200 farms. [CES, 1999, EIA of the RIIDIA II Project].

Agricultural areas in the zone situated between the SAC and the Khanarkh Canal comprising about 20 350 ha may suffer occasionally from irrigation water cut-off during a rehabilitation period of about two years. Although this will only affect short canal sectors and appurtenant outlets at a time, loss of agricultural income may occur, so far not economically assessed. [CES,1999, EIA of RIIDIA II Project]

Numerous oil pipelines, defunct or active, cross the Samur Apsheron canal in the form of pipe bridges. Special precautions need to be taken at the identified spots during rehabilitation in order not to damage the oil pipeline and cause accidental spills and economic losses.

The proposed canal rehabilitation will reduce water losses and improve water availability with potential consequences on agricultural production. This may reflect on irrigation techniques and may reduce exploitation and contamination of natural water resources. For the Deveci lake this development can only be considered as positive.

The MMMC area will profit from the proposed infrastructural measures by optimisation of the agricultural production environment. It is assumed that agricultural output will increase and that incomes will follow correspondingly. Additional benefits may be expected from the side aspect of water quality improvement. This may reduce health expenditures in the monitoring area and it may also reduce water treatment costs in Baku.

3. ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAMME

3.1 GENERAL

Within the framework of the present environmental assessment and monitoring project, numerous institutes and governmental organisations have been contacted to obtain the available baseline information. Mainly the information is obtained from the Hydrogeological Institute of SAIC, State Hydrometeorological Institute, Geological Commission, Ministry of Health, etc.

The Consultant suggests to compile the monitoring information in a digital data base, supplemented by a geographic information system (see chapter 4; Proposal of Geographic Information System (GIS) for RIIDIA Environmental Monitoring System (REMS)), which can integrate geographic and attribute information for respective analyses.

Monitoring is an activity which needs to be repeated periodically. The monitoring cycle will start by the initial basic collection or observations of the defined parameters, which signifies the compilation of existing information and the execution of supplementary observation campaigns to obtain essential but so far missing data. The result will be defined as the status quo.

Type, intricacy and quantity of data required defines the time between the repetition of the monitoring cycle. In the context of the actual RIIDIA II irrigation and drainage projects the repetition intervals are suggested by the Consultant to be between one and six years.

In the future, after the first repetition of monitoring activities, an analysis of recorded changes to the status quo can be made on developments analysed, but confirmation of reliable tendencies and statistical correlation of parameters in the condition of the environment will need at least several repetition cycles. It is therefore suggested to carry out a first monitoring campaign early on during project implementation, a second should be carried out mid-way through and a third after the implementation. The entire monitoring period should not exceed ten years for the SAC and the MMMC project area.

In parallel to the collection of basic information the institutional infrastructure for the monitoring activities need to be developed. Consequently the implementation of an environmental monitoring programme is suggested.

The obtained environmental information will be used to trigger the necessary remedial, compensation or avoidance action with the responsible executing authorities. In this context the required co-operation of SAIC and ASCE is to be mentioned. Besides this, the organisational arrangements should be established also between SAIC and other relevant governmental organisations and institutes that can deliver relevant information.

To reach consensus on all these matters, SAIC conducted a workshop, held on 4 August, 1999 in Baku, during which the involved authorities and relevant governmental organisations and institutes have been informed about the proposed monitoring programme. Major findings and issues of the programme have been discussed, e.g. delineation of project areas, key parameters, monitoring cycles, executing agency. The results from these discussions have been taken into consideration for the set-up of the monitoring programme. The protocol of the workshop is given in Annex C.

The proposed environmental monitoring programme includes key parameters and their observation requirements, monitoring schedules, budget requirements for set-up and operation and the institutional responsibility.

3.2.1. Potential Environmental Impacts

The proposed project would finance the rehabilitation of deteriorated irrigation infrastructure and the completion of a collector drain. No new irrigation canals or structures that would allow increase in the delivery capacity of water are envisaged. The proposed project does not include any investments in dams or involve resettlement. It has been classified as Category "B" for the purpose of OP 4.01 Environmental Assessment.

Potential positive environmental impacts from the implementation of the project would be: (i) in the SAC area reduction of water losses through improved infrastructure and improved operation and maintenance (O&M); and (ii) in the MMCD area reduced risk of soil salinization, waterlogging and standing water from improved drainage.

Potential negative impacts of the project would be: (i) a reduction in water inflow into Lake Sarisu and subsequent reduction in water surface and depth; (ii) increased agrochemical pollution and surface water contamination, resulting from increased use of pesticides and fertilizers, along with improved availability of irrigation water; (iii) indiscriminate dumping of excavated sediment deposits and other materials from the canals, drains and structures during construction and maintenance; and (iv) environmental damage caused by contractors during construction activities.

3.2.2 Mitigation Measures

The key mitigation measures recommended under this Environment Management Plan (EMP) are:

From the previous Chapter it is clear that there will be a reduction in drainage water flow to Lake Sarisu. Because of lack of inflow-outflow data of the Lake it is as yet unclear whether this reduced water supply will negatively affect the lake's water level and area. A comprehensive monitoring plan has been designed and costed (see next Section). Based on the results of the monitoring, Lake Sarisu may have to be connected to a new water source. A number of options have been considered: (i) increase the water supply to Ag-Gol lake through a connection with the Mill-Karabakh Main Irrigation Canal; or (ii) a connection with the Kura river. A financial allocation has been made in the project budget to implement such mitigation measure, if deemed necessary after the monitoring. The PIU would be in charge of arranging for the implementation of necessary works.

A panel of national specialists will be recruited as consultants to review the data collected in the monitoring program, and to determine the necessity for mitigation measures for Sarisu Lake. The Expert Panel will be constituted with the following members:

- ASCE (or other institute) specialists (3 persons) in fields of fisheries and aquatic wild-life, hydrology and water quality,
- ASCE field protection staff with specific site knowledge;
- Representative of the District administration;
- Representatives of district irrigation Exploitation Units;
- PIU representative.

The Sarisu Lake Panel will meet in April, 2003. The broad scope of the duties of the expert panel is set out in the following paragraphs, but the detailed terms of reference will be drawn up by the PIU staff nearer the time of mobilization with assistance from the technical assistance team.

Sarisu Lake Panel[2]: The general scope of the Expert Panel's responsibilities is to determine the requirements for mitigation measures on the basis of the data collected by the monitoring program, specifically:

- review the water level, outflow and quality data assembled during the monitoring program;

[2] The Panel will take the Ag-Gol lake into consideration (the same data is to be collected for both lakes) because they are hydraulically connected, with Sarisu receiving the outflow from Ag-Gol.

- assess the contribution to the lake of the pumped drainage water in quantity and quality terms;
- calculate and present a water balance simulation for "average" and "dry" years for the current and after MMCD construction situations;
- estimate the differences in salinity, pH and temperature in the above two scenarios;
- review the plant and wild life surveys;
- assess the impact of the changed hydrology caused by the MMCD construction on the ecology of the Lake;
- advise on the necessity for a replacement water source, and if this is deemed necessary, set out the quantity and quality requirements in "average" and "dry" years.

Increased agrochemical pollution and surface water contamination, resulting from increased use of pesticides and fertilizers, along with improved availability of irrigation water would be addressed by agricultural advisory services that are being established under the ongoing IDA supported Agricultural Development and Credit Project (ADCP). The specialists of this service would provide extension and advisory services, as well as training in proper application techniques, timing and handling of residues of fertilizers and pesticides. As inputs would not anymore be available at subsidized prices as during the time of the Former Soviet Union (FSU), the actual use of pesticides, chemicals and fertilizers would not reach the high levels as before independence. This more careful use of fertilizers and chemicals and the extension and advisory services is expected to keep the negative impact of increased input use to a minimum. However, if the condition of the drainage water would be consistently above WHO or other international norms, increased monitoring of the collecting water source would take place. If the recipient source's water is also above the allowable norms for longer periods, corrective measures would have to be implemented. These would include increased training and extension activities and possibly reduction in the use of inputs;

(iii) Indiscriminate dumping of excavated sediment deposits and other materials from the canals, drains and structures; and

(iv) environmental damage caused by contractors during construction activities would both be addressed during project design and supervision. Contractors would be required to prevent, minimize or mitigate environmental damage. Sediments and other debris would be displaced in an orderly manner in approved paths and landfill or dump sites, rather than dumped indiscriminately. There would be reuse of suitable excavated materials, limiting the need for old and new quarries. Where possible, existing quarries would be used for required additional materials. Contractors would also have to restore to quasi-original condition the landscape after completion of rehabilitation works and after use of quarries.

The bidding documents would have environmental precautionary clauses, as follows:

"The natural landscape should be preserved to the extent possible by conducting operations in a manner that will prevent unnecessary destruction or scarring of the natural surroundings. Except where required for permanent works, quarries, borrow pits, staging and processing areas, dumps and camps, all trees, saplings, and shrubbery should be protected from unnecessary damage by project related activities. After unavoidable damage, reseeding, replanting, or restoration are required promptly to prevent further damage and to restore quasi-original conditions were appropriate.

The contractor's operations should be so performed as to prevent accidental spillage of contaminants, debris, or other pollutants, especially into streams or underground water resources. Such pollutants include untreated sewage and sanitary waste, tailings, petroleum products, chemicals, biocides, mineral salts, and thermal pollution. Wastewater, including those from aggregate processing and concrete batching, must not enter streams without settling ponds, gravel filters, or other processes, so as not to impair water quality or harm aquatic life.

The contractor should ensure proper disposal of waste materials and rubbish. If disposal by burial or fire, it should not cause negative impact to either the air, soil nor ground water supplies.

The contractor should minimize air and water pollution emissions. Dust from the handling or transporting of aggregates, cement, etc., should be minimized by sprinkling or other methods. Materials, brush or trees should only be burned when the owners permits, under favorable weather conditions.

The contractor's facilities, such as warehouses, labor camps, and storage areas, should be planned in advance to decide what the area will look like upon completion of construction. These facilities should be located so as to preserve the natural environment (such as trees and other vegetation) to the maximum extent possible. After projection construction, camps and buildings should either serve as permanent residences and form future communities, if such use can be foreseen and approved, or be torn down and the area restored to its quasi-original condition in order to avoid deterioration into shanty-towns.

Borrow pits should be landscaped and planted accordingly to an ecological design to provide some substitute area for lost natural landscapes and habitats."

The Development Credit Agreement would include a covenant calling for the implementation of the Environmental Management Plan.

3.2.3 Environmental Management Arrangements

1. The Environmental Management responsibility will be divided into three categories:

the *executing agency*;

the *supervising agency*; and

the *monitoring agency*.

Three organisations will participate in the environmental monitoring and management program with the responsibilities set out below.

The *executing agency* will have to assume the responsibility for: (a) the design and assessment of the physical work options in accordance with Kyrgyz environment regulations and/or requirements; and (b) the physical implementation of the activities under the project, as well as the efforts to mitigate potential negative environmental impacts.

Design engineers and contractors are part of the executing agencies. Design engineers will be responsible for providing design options and bidding documents, taking into account environmental protection requirements. Contractors will be responsible for the implementation of the works in accordance with environmental requirements, as described in the bidding documents and instructions from supervisory and monitoring staff.

Advisory specialists are also part of the executing agencies. They will have to provide formal training and extension advice to water users.

The PIU is the *supervising agency*. It will be responsible for the timely and sound execution of works and activities under the project. It will have responsibility for procurement, management and supervision of the environmental monitoring program, and will fund the program from project funds. It has to obtain required environmental clearance from the MEP before construction activities can commence. It will also supervise the activities by contractors and consultants during the implementation of the rehabilitation works.

The PIU will establish an M&E cell which will have responsibility for management of the Environmental Management Program. The duties of this cell be to recruit and supervise the field staff, collect the data from them, check and archive it, prepare and annual report and an annual program.

The State Committee on Ecology is identified as the primary *monitoring agency* for the EMP activities. Its specialists and inspectors will be responsible for the timely monitoring of the agreed indicators. Specialist surveys will be conducted by District offices of the State Committee on Ecology or will be sub-contracted to external specialists where the study is outside their staff skills.

The routine data collection (water levels, discharges, water quality) will be conducted by staff assigned by the District Irrigation Exploitation Units under an annually renewable arrangement with the PIU.

Although mainly a *monitoring agency*, MEP will also participate in supervision of the rehabilitation works, with emphasis on the environmental parameters, such as dumping soil, alignment of roads and tree cutting.

In addition, the World Bank will review and approve the sub-projects from environmental considerations and monitor the adherence to the EMP as part of its supervision activities.

3.2.4 Costing

2. The project budget allows for the full funding of the environmental monitoring and mitigation of possible effects on Lake Sarisu. A detailed budget of the monitoring arrangements is presented in Chapter 5. An allocation of US$ 175,000 has been made in the Project's budget for mitigating the reduced water supply to Lake Sarisu, as needed.

ISSUE	IMPACT	MEASURE	EXECUTING AGENCY	SUPERVIS G AGENC
1. Reduced water supply to lake Sarisu	Possible lowering of water level and reduction of surface area, which will impact flora and fauna	Increase the water flow from Ag-Gol lake to Lake Sarisu or connect Lake Sarisu to the Kura river as a new water source.	Design Engineers and Contractor	PIU
2. Increased use of pesticides, chemicals and	Increased agro-chemical pollution and surface water	1. Advise and training of farmers in proper application	ADCP extension and advisory specialists	PIU

fertilizers	contamination	techniques, timing and handling of residues of fertilizers, chemicals and pesticides. 2. Monitoring of water quality at representative collector drains and recipient sources.	 --	 PIU
3. Dumping of excavated sediment deposits and other debris from canals, drains and structures	Damage to the landscape	Placement of sediments and debris in approved paths and landfill or dumpsites and reuse of suitable excavated materials. Landscape to be restored to quasi-original condition after completion of works. Environmental clauses to be described in detail in the bidding documents.	Design consultants and contractors	PIU

4. Environmental damage caused by contractors during construction activities	Pollution of water, air and soil	Contractors to conduct operations in a manner that avoids or minimizes environmental damage and where needed to restore natural resources to quasi-original conditions after unavoidable damage. Requirements and measures to be described in detail in the bidding documents	Contractors	PIU

3.3 RIIDIA II ENVIRONMENTAL MONITORING UNIT

3.3.1 General

It is proposed to create the RIIDIA II environmental monitoring unit (REMU), which will conduct all environmental monitoring activities.

Personnel and facilities need to be brought together in an effective institutional structure. Therefore the REMU is suggested to be established within the SAIC as one of the sub-units of the existing RIIDIA II Project Implementation Unit (PIU). REMU will monitor and assess the project related environmental problems faced in the SAC and MMMC project areas and provide decision making information for the rational use and protection of natural resources in those areas.

It can be stated that the proposed environmental monitoring programme with an organised environmental monitoring unit will be the first one for Azerbaijan. Therefore the RIDIIA II may be seen as a model for monitoring of irrigation/drainage project related environmental impacts. Thus, this project will derive benefits for the institutional capacity building in Azerbaijan. It is recommended to Transfer REMU to ASCE after the five years RIIDIA implementation period.

3.3.2 Environmental Legislation

There are more than 20 laws, regulations and standards related to the environment, water resources and irrigation sub-sector in Azerbaijan (See Annex B.1). This legislation is a combination of different acts which were accepted at different dates. However, most of the environmental acts are inadequate for market economy and transition period. The most important element of the existing environmental legislation is the part which were accepted after 1991, because this part of the legislation were prepared considering the market reforms.

The "Handbook for the Environmental Impact Assessment Process in Azerbaijan (HEIAPA)" was prepared in association with UNDP and is evidently based on procedures developed in Europe and North America. EIA is potentially a vital tool for environmental protection during construction and operation of irrigation and drainage system. However, the HEIAPA explains the EIA procedures as a complex and bureaucratic 21-step procedures for the existing environmental legislation.

According to the existing environmental legislation, in particular Environmental Law, Water Code, Irrigation and Land Reclamation Law and HEIAPA, SAIC and ASCE are the responsible authorities for the monitoring of the environmental impacts of the SAC and MMMC projects.

It was considered that the existing environmental legislation is adequate and provides an up-to-date scheme of law based on the necessary principles for creation of a good environmental monitoring in the project areas. In particular, the Articles No. 24; 39; 40 (Environmental Law), Article No. 44 (Water Code) and Article No. 16 (Irrigation and Land Reclamation Law) refer to the necessary administrative and legal power to irrigation and drainage authorities to carry out effective and project specific environmental monitoring.

The SAIC has to get an Environmental Permission from the Azerbaijan State Committee on Ecology and the Control of the Natural Resource Utilisation (ASCE) before the implementation of the projects can start. According to the existing environmental legislation, SAIC is the applicant. The application for Environmental Permission includes the previous environmental impact assessment study carried out by the Consultant in 1999 during the execution of the RIIDIA II Feasibility Study. In addition SAIC has to carry out an environmental monitoring programme. The parameters to be monitored form the part of an agreement between SAIC and ASCE; they are subject of the present study.

3.3.3 Institutions Involved

The State Amelioration and Irrigation Committee, State Environmental Committee, State Committee for Hydrometeorology, Committee for Geology and Mineral Resources of Azerbaijan, Ministry of Health, State Committee for Housing and Communal Services, Azerbaijan Fisheries Agency, State Committee for Construction and Architecture and Committee for State Statistics of Azerbaijan Republic are governmental organisations having responsibilities on the establishment and operation of the irrigation infrastructure and monitoring of different environmental and social aspects.

The State Amelioration and Irrigation Committee (SAIC) is responsible for provision of water for agricultural needs, operation, maintenance and repair of main irrigation canals, drainage collectors and pumping stations, off-farm irrigation infrastructure, regulation of surface water, flood alleviation and mud slides protection, control and monitoring of conditions of irrigated areas. There are Hydrogeological and Land Reclamation Services within the SAIC which are carrying out monitoring programmes for the control of irrigated lands. Their main emphasis is to observe the salinization process in the Kura-Araz lowland.

The State Environmental Committee (ASCE) is responsible for the protection of the atmosphere, terrestrial environment, aquatic environment, management of conservation areas and wetlands for protection of fauna and flora, monitoring of surface water, issue of licenses for water abstraction from and for discharges into surface waters, inspection of cases of accidental pollution spillages and the implementation of EIA procedures since 1992 when the Environmental act was promulgated. The procedures for the EIA have been clearly identified in the "Handbook for the EIA process in Azerbaijan" which is approved and issued by the ASCE.

The State Committee for Hydrometeorological (SCH) monitors quantity and quality and river flow as well as meteorological parameters. The observation points include 47 river gauges and 4 reservoirs, resulting in more than 1000 samples per year.

The Committee for Geology and Mineral Resources of Azerbaijan (CGMR) is responsible for control and exploitation of groundwater and of all minerals other than oil and natural gas, they issue licenses for ground water abstraction, they also control and monitor groundwater level and groundwater quality. CGMR carries out water quality analyses at 211 boreholes monitored nation-wide three times per year.

Ministry of Health (MoH) has a Center of Epidemiology and Hygiene which is responsible for monitoring the quality and safety of drinking water supplies throughout the country, including sampling and analysis, setting the quality standards for drinking water, monitoring the quality of sewage discharged to receiving waters. The center has 42 local units. The central laboratory in Baku is considered to be effective, but regional units in the project areas are not furnished to carry out laboratory analyses.

State Committee for Housing and Communal Services (SCHCS) is responsible for provision of safe drinking water in the rural areas, including monitoring of water quality from source to point of supply. SHCSC has 51 local units (Vodokanal), including 10 units in each of the districts allocated in the project areas. SHCSC is also responsible for control and supervision of wastewater management in the rural areas, provision of wastewater service, monitoring and quality control of wastewater.

Azerbaijan Fisheries Agency (AFA) is responsible for protection, promotion and regulation of fishery in rivers, lakes, reservoirs, and Azerbaijan territorial waters in Caspian Sea.

Azerbaijan Forestry Agency (AFORA) is responsible for forest management and aforestration, protection and regulation of forest resources, including forest flora and fauna, also soil conservation in the mountainous and highland areas.

State Committee for Construction and Architecture (SCCA) is the responsible organisation for development strategies, policies, norms and standards within design and construction, and for control and management that norms and standards are followed during construction.

Committee for State Statistics of Azerbaijan Republic (CSSAR) is responsible for the collecting and editing of the figures in social aspects, such as population, education etc.

Most of the Azerbaijan governmental organisations and institutes are capable of obtaining and evaluating data for their own requirements, which are listed above (See Annex B.2). To process and to adapt their data under the proposed REMU requires considerable efforts.

REMU is suggested to have co-ordination and collaboration with these governmental organisations and institutes for the monitoring of environment and assessment of results through the existing hierarchy of SAIC. In many cases, it is cost effective for REMU to carry out the environmental monitoring activities on related fields by means of consultancy agreements made with these governmental organisations and institutes.

3.3.4 Organisational Arrangements to sustain the Environmental Monitoring System

The organisational set-up of the REMU has been discussed and agreed upon with the SAIC and other related institutes. The set-up is shown in Figure 3.1. According to the present environmental legislation, SAIC has to conduct the monitoring of environmental impacts of the RIIDIA II Project within the project areas. Therefore REMU is proposed to be established under the existing hierarchy of the SAIC where it should form a sub-unit of the RIIDIA II Project Implementation Unit, PIU. The principle tasks of the REMU are outlined in the following:

1. contract and supervise the contractors, consultants and institutes
2. purchase of monitoring equipment
3. contract and supervise installation of monitoring equipment
4. co-ordinate monitoring of the environment in the project areas
5. assess the monitoring results (in co-operation with consultants)
6. handle and process data
7. identify critical conditions
8. work out proposals for remedial measures (in co-operation with consultants)
9. report about results to the SAIC, ASCE and others as needed
10. prepare and administer the monitoring budget
11. co-ordinate with other organisations
12. control and direct staff in the sub-units

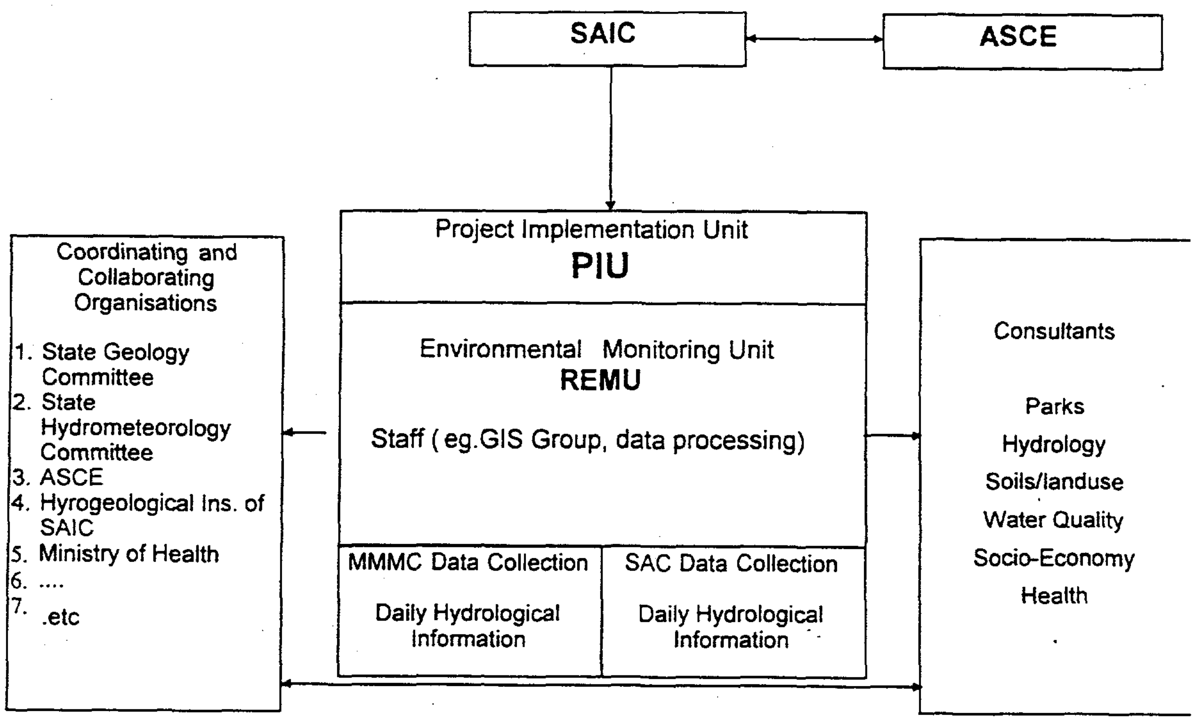

Figure 3.1: Organisational Set-up of REMU

One of the components of REMU could be a GIS group in order to effectively handle and process the data.

The Consultant considers the GIS group to be an optional entity of the REMU. The GIS group could be replaced by a stronger data processing group which does not have the GIS software facilities. However, the staff and hardware requirements would be almost the same as those for the GIS group. The international expert would be required for set-up of the data base and for support of the Head of REMU. Consequently, the cost savings from not having GIS are considered marginal.

REMU will have two different regional units within the existing regional offices of SAIC for the co-ordination and collection of continuously observed hydrological and hydrogeological data and delivering these data to the REMU.

The establishment of REMU (GIS option) calls for basic equipment, this will require a budget for investment costs of $US4,380. (see Table 3.1). In the other case the REMU (non-GIS option) its set-up cost become $US6,860 including one additional PC, one printer and one auxiliary power supply (UPS). (See

Table 3.2)

Table 3.1: Budget Requirements for REMU Office Equipment (GIS option)

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Fax machine	400	1	400
2	Photocopy machine	1000	1	1 000
3	PC Pentium III (Including software for operating system)	1700	1	1 700
	Office software	500	1	500
4	Laser Printer, A4	450	1	450
6	UPS	330	1	330
			Total	$US 4 380

Table 3.2: Budget Requirements for REMU Office Equipment (non-GIS option)

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Fax machine	400	1	400
2	Photocopy machine	1000	1	1 000
3	PC Pentium III (Including software for operating system)	1700	2	3 400
	Office software	500	1	500
4	Laser Printer, A4	450	2	900
6	UPS	330	2	660
			Total	$US 6 860

The annual operational cost including the staff and annual consumptives such as cartridges for printer and fax machine, toner for photocopy machine, and diskettes, etc. is equal to $US2,335 (see Table 3.3). This amount also includes hardware replacement costs which are considered as 25% of the hardware investment costs. For annual operation costs of the regional staffs see the chapter 3.5 (3.6 Hydrological and Hydrogeological Flow Regimes).

Table 3.3: Budget Requirements for annual Consumptives for REMU (GIS option)

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Fax machine cartridges	30	6	180
2	Photocopy toners	80	4	320
3	Diskettes	1	100	100
4	Printer toners	60	10	600
5	Paper (A4)	8	5	40
6	Annual Hardware replacement (25% of hardware costs)	1095	1	1 095
			Total	$US 2 335

3.3.4.1 Staffing

The head of the REMU will work under the PIU's head. He will be responsible for REMU's management, mobilisation of the resources and the Consultants, organisation of the laboratory works and field surveys, procurement and operation of equipment, GIS training, quality control and reporting and budget set-up . For liaison with the involved organisations the PIU head is responsible. The data processing specialist will be responsible for the operation of the data base and to conduct data inputs. The head of the unit and the data processing specialist will have a full time job.

The REMU's sub-unit staff are responsible for data collection from the local and regional organisations, checking of information, preparation of required reports for REMU. They will establish relationships with local interested organisations and individual shareholders, to assist the local Consultants for data collection and field survey on the places. The budget needs for the REMU staff are shown in Table 3.4.

Table 3.4: Annual Budget Requirements for Staff of REMU

Pos.	Expert / Task	No.of Staff a)	MM per year per Staff b)	Total MM per year c) a x b	Cost per MM [$US] d)	Annual Cost [$US] e) c x d
1	Head	1	12	12	250	3 000
2	Data processing specialist	1	12	12	200	2 400
3	Data collection specialist, SAC *	1	12	12	50	0
4	Data collection specialist, MMMC *	1	12	12	50	0

Total $US 5 400

* The costs of data collection specialists are covered at the Hydrology (Chapter 0)

3.3.4.2 Reporting Requirements

REMU's main task will be to provide decision making information for environmental management in the considered MMMC and SAC monitoring areas. With its capacity to recruit consultants and institutes it has the possibility to integrate considerable expertise in the environment related fields. REMU's primary task therefore should be to inform in detail about the environmental situation in both project areas on the basis of most actual data and corresponding expert assessment. The reporting should be carried annually about two months after the end of the monitoring campaigns. It should be addressed to the SAIC from where it is to be distributed to other involved parties.

The reports should comprise the detailed assessments of the involved experts. These will assess the present situation as found during the actual monitoring campaign as well as the situation as it developed since the start of the project implementation. The report would clearly show negative developments and detail proposals for remedial measures that were elaborated by professional experts (e.g. by PIU's TA). Further on the report should state the status of the database as well as difficulties and constraints concerning data acquisition. If certain key indicators do not show a significant response to the infrastructural measures these have to be identified in the report and it will be discussed whether their observation should be carried on. For administrative purposes the report also has to show the budget requirements for the campaign that is reported on and for the up-coming one.

The PIU should be responsible to make the REMU data available for project monitoring.

3.4 MONITORING SCHEDULE

In the following paragraphs the environmental monitoring programme will be introduced. In compliance with the presently carried out assessment the programme will be set up to monitor environmentally relevant parameters from different fields, these are:

- Natural Parks and Biodiversity
- Hydrological and Hydrogeological Flow Regimes
- Soil degradation and land use
- Water Quality
- Health

- Socio-economic situation

For each of the above topics key indicators and corresponding observation intervals will be defined. The time span after which different parameters react to the infrastructural measures is supposed to be different. While groundwater levels may respond rapidly, socio-economic indicators may need considerably more time. Because of these different reaction times the Consultant suggests a total monitoring time which will insure, that even the slowly socio-economic indicators will have a chance to respond. A monitoring time of 8 to ten years was discussed with the client and agreed upon as adequate.

The environmental monitoring should be carried out before, during and after the construction. In

Figure 3.2, a tentative monitoring schedule is proposed for the SAC and the MMMC monitoring areas.

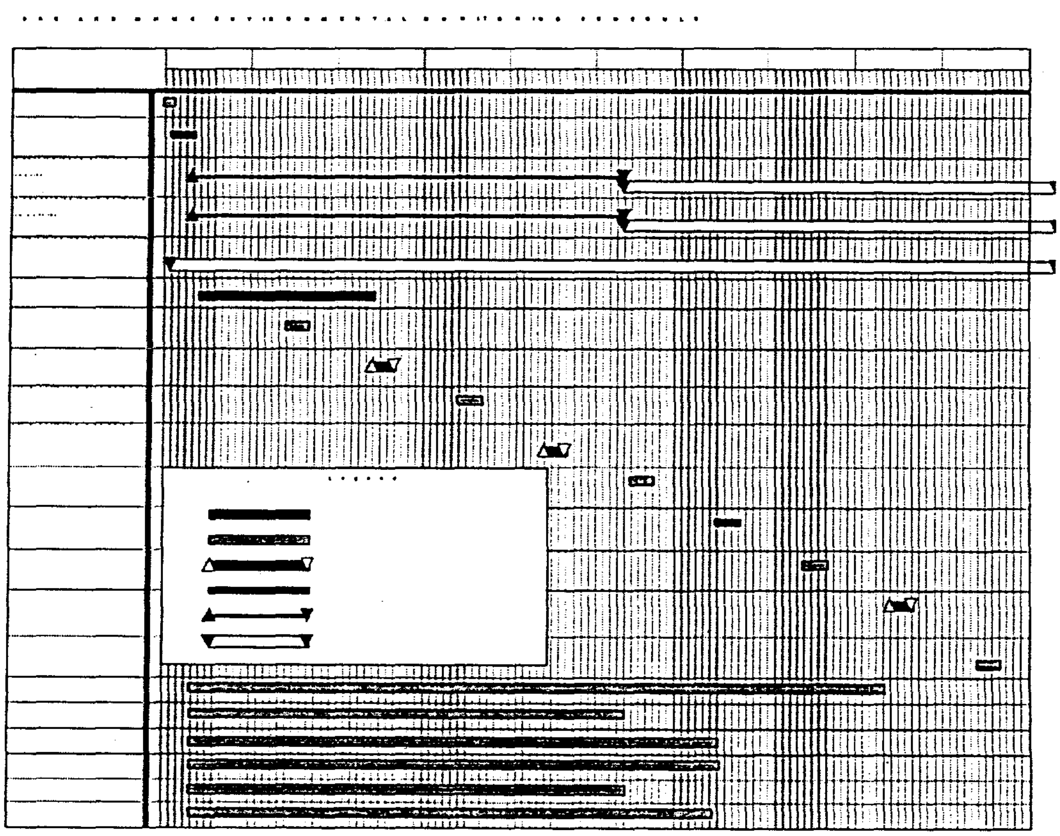

Figure 3.2: SAC and MMMC Environmental Monitoring Schedule

The schedule shows the monitoring to start with a first campaign right after the set-up of the REMU in early 2001. The first campaign should define the pre-construction status quo for all above mentioned topics. In case of the hydrological and geohydrological observation it has to be used to finally identify locations for gauging stations, to set these up and to initiate the daily and monthly observations. Further on the first campaign will set up the basis for the data processing, and data handling in the REMU. This comprises the data-base preparation and, if decided on, the implementation of the GIS. Alike all others the first monitoring campaign should have a length of 3 months during which all required surveys evaluations and assessments should be carried out. During the first campaign an international expert (e.g. project experienced GIS expert) should assist the Head of the REMU in performing his tasks. At the end of the first campaign a revised monitoring schedule should be presented to the SAIC.

According to

Figure **3.2**, monitoring related consulting and expert activities should be concentrated in periods of three months per year. This eases communication among experts and also facilities co-ordination works of the REMU. For the time being it is proposed to concentrate the required campaigns during the months of July until November.

The annual campaigns should differ from each other in relation to the topics observed. Basically three different types of campaigns are proposed. They are detailed in es since project implementation

Table 3.5. The standard campaign comprises all topics, except socio-economy, which is expected to respond slowly. Therefore it is included every second year. In the sixth year a soil survey is proposed, which also considers the change in land use since project implementation; satellite image interpretation is the adequate means for this. A detailed socio-economic study is proposed for the sixth campaign. Alike the soil monitoring it should reflect on the changes since project implementation

Table 3.5: Classification of Monitoring Campaigns

Type	Objective	Return period	Observed Topics	Remarks
Initialisation Campaign	Set-up of hydrometric stations and observation wells; Monitoring of pre-construction period, field surveys	Non	• (geo)hydrology, climate • water quality • soil/land use survey • health • parks • socio-economy	Data collection (from other institutions), processing, analysis and assessment; Set-up of data base / GIS
Standard Campaign	Regular Monitoring and Monitoring of construction period;	One year	• (geo)hydrology, climate • water quality • soil survey (salinity) • parks, health	Collection, preparation and analysis of time series data; Hydrometric measurements; water sampling, soil data, parks health survey
Two Year Campaign	Monitoring of slowly changing indicators	Two years	• socio-economy	socio economic baseline survey;
Six Year Campaign	Socio-economic Monitoring, land use monitoring	Six years	• soil/land use survey • socio-economic study	full socio-economic assessment; land use mapping on the basis of satellite imagery, full soil survey

3.5 NATURAL PARKS AND BIODIVERSITY

The objective of the monitoring is to regularly assess and control the impacts of the infrastructural project measures on the natural parks and their biodiversity. The monitoring is defined by the observed key parameters and the respective sampling locations, as well as by the schedule of the observations and their assessment. For the monitoring the following entities are discussed: Deveci lake hunting reserve in the SAC monitoring area and the the Ag gol and Sarisu lakes in the MMMC monitoring area with their rare and endangered species. The mentioned aspects are detailed in the following paragraphs.

3.5.1 Key Environmental Indicators

The environmental indicators in the **MMMC** monitoring area are proposed to be as follows:

- Plant types and the areas occupied by them in the Ag gol and Sarisu lake area, e.g. Biebersteine (TulpaBiebersteiniana Schult) plant specie at the Kardon site of the Ag gol lake
- Water quality (pH and salinity) of the Ag gol and Sarisu lakes,
- Number of birds and their nesting and feeding places

The indicators were chosen to observe and assess the effects of infrastructural measures on the water quality of the lakes as well as their effects on the fauna and flora of these areas. The observation of the spreading of plants may be correlated to water level changes which will be observed in the hydrological monitoring.

For the **SAC** monitoring area this is the water quality of the Deveci lake (pH and salinity), which is further discussed under water quality monitoring.

3.5.2 Monitoring Schedule (sample points, sample period, personnel)

Ag gol State Protected Area is regularly observed by the Agjabadi District office of ASCE. It is proposed that both of the lakes are to be monitored by this district office. Its observations should be supported by the REMS in technical (pH meter and conductivity meter) and financial terms. In return, the observation results should be handed out to the REMU.

The monitoring covers different seasons of the year to cope with the nesting and wintering periods of birds as well as with vegetation period and spawning and migration period of the fishes.

The observations are proposed to start before the construction and to carry on 5 to 8 years after the construction will have been completed.

It is planned to occupy one biological expert for 45 days per year; during the observation periods (March to end of September) he should work 30 days. Additional 15 days should be considered for assessment and report writing to the REMU. He is also responsible for controlling and data collection from the regions and to conduct laboratory analysis for fish. All data collected will be handed over to the REMU in processed form at the end of each annual monitoring campaign.

Table 3.6: Sampling Locations of Natural Parks and Biodiversity Monitoring

Sampling Location	Sampling parameter	Schedule	No. of Days
MMMC	Plant types and the area occupied by them	In March once every week	4
		April-May once every 10 days	6
		June-Sept. once every 2 weeks	10
Ag gol and Sarisu lakes	Water quality of Ag gol	pH and EC once in a week	52
	Observation of birds and their nesting and feeding places	March-May once every week	12
		June-Sept. once every 2 weeks	10

SAC	Water Quality monitoring of Deveci Lake (see water quality monitoring)		

3.5.3 Requirements for Monitoring Equipment and Laboratories

The only equipment needed for ornitological observations is a binocular, for water quality it is a pH meter and a conductivity meter. Some utensils, nets, boots, cooling boxes are required for monitoring of fishes. In addition it is expected from the consulted biological expert to analyse the roe of fishes in his own laboratory with the provided utensils. The expert's laboratory is expected to be sufficiently equipped to cope with the tasks.

3.5.4 Regulations for Data Handling, Processing and Evaluation

The observations will be carried out by field staff. The respective data will be compiled in special forms which will be explained in the following paragraphs. Additional data can also be collected from Azerbaijan Fisheries Agency and ASCE. At the end of September of each year all the data have to be collected by the biological expert who will analyse and assess them. He also is responsible for data processing and submission of information to the REMU.

3.5.5 Report Requirements

At the end of each annual monitoring campaign the biological expert will report on the monitoring results from the recent campaign. In his report he has to state on the present conditions and on changes with respect to previous campaigns. The report has to be written in a simple and understandable manner. Important findings have to be worked out in detail. Negative developments have to be fully addressed in a special chapter. In co-operation with the Head of the REMU measures have to be proposed to remedy the negative trends.

The annual report has to comprise all field observation in paper form. For field observations standard reporting forms should be applied for the plants, birds, fishes, as well as for water level and discharge readings.

The reporting forms required for the monitoring of fishes, plants and birds and water quality are provided in the Annex B.3 in Azeri language. To record the water level measurements in the lakes refer to the Chapter 3.5.

3.5.6 Monitoring Personnel and Training needs

One consulting biological expert will co-ordinate the monitoring and conduct the assessment. He will be supported by 2 local observers, who will be engaged on a part time basis. They are specialised on the botanics and ornithofauna, working in the Ag gol and Sarisu area.

3.5.7 Budget Needs

The Budget needs for the biological monitoring are detailed in the following chapters. The total figures come up with $US1,132.- for the set-up of the monitoring and $US894.- for the annual costs.

3.5.7.1 Budget Needs for Set-up of Monitoring

To set up the monitoring of natural parks and biodiversity a total cost of $US 1,132.- is required (see Table 3.7). No training is required for that part of monitoring programme. The pH meter and conductivity meter will be introduced to the user observers by the biological expert.

Table 3.7: Bio-Monitoring Budget Requirements for Equipment

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Utensils for fish	15	1	15
2	Nets for fish	20	3	60
7	Boots	15	3	45
3	Binocular for bird observation	50	1	50
4	PH meter	400	1	400
5	Thermometer	2	1	2
6	Conductivity meter	560	1	560
			Total	$US 1 132

3.5.7.1 Budget Needs for the annual Operation of the Bio-Monitoring

For annual operation of monitoring of natural parks and biodiversity staff expenditures and transport costs are to be considered. The salaries will come up at a total of $US717.-

per year (see Table 3.9). While the transport costs are estimated at $US180.-, comprising the total expenditures for 4 field trips of the expert (see Table 3.8). The total annual costs for bio-monitoring becomes $US894.-.

Table 3.8: Budget Requirements for annual Consumptives for Bio-Monitoring

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Field Transport for Expert	60	4	120
2	Transport of fish samples to the laboratory	30	2	60
			Total	$US 180

Table 3.9: Annual Staff Budget Requirements for Bio-Monitoring

Pos.	Expert / Task	No.of Staff a)	Days per year per Staff b)	Total days per year c) a x b	Cost per Day [$US] d)	Annual Cost [$US] e) c x d
1	Biological expert	1	45	45	10	450
2	Fauna and Flora, Water quality	2	44	88	3	264
6	Fishes at the discharge of rivers, especially minoga	3	29	87	3	261
					Total	$US 714

3.6 Hydrological and Hydrogeological Flow Regimes

The SAC and the MMMC project both deal with the management of water resources. The SAC project is considered to improve water supply for irrigation and to Baku. The MMMC project concentrates on the solving of drainage problems in already irrigated areas. Both projects are assumed to affect the water household of the respective areas. The regular monitoring will form the basis for a sound assessment of the impacts these projects will have on the water resources, including surface and ground water. For the MMMC monitoring area the proposed programme will take into consideration the Kura and Araz rivers, and the Ag gol and Sarisu lakes. For the SAC monitoring area the Deveci lake should be monitored. Other effects on the hydrological regime are not likely to occur in the SAC area.

3.6.1 Key Environmental Indicators

Indicators in the MMMC monitoring area are selected to allow the assessment of the impacts of the new collector on the water balances of the Ag gol and Sarisu lake as well as on the groundwater household in the MMMC monitoring area. The collectors (K2 and K3) feed the lakes. The flow regimes of the Kura and Araz rivers are not directly related to the project measures. Therefore the Kura and Araz rivers will not be monitored within the hydrological monitoring programme.

According to the previous stated, the environmental indicators in the MMMC monitoring area are proposed to be as follows:

1. Inflow and outflow of the Ag gol and Sarisu lakes; and flows in K2 and K3 collectors;
2. Water levels of the Ag gol and Sarisu lakes;
3. Ground water levels; and
4. Climatological parameters as air temperature, humidity, wind, precipitation and evaporation at Imishli district.

The rehabilitation of the upper 50 km of the SAC will neither effect the hydrological regime of the Samur river nor of any of the local rivers crossed within the respective canal reach. However, in the future lower canal losses and improved irrigation management may reflect on reduced demands for local stream flow, consequently the Deveci Lake might recover from past and present scarcity of freshwater inflows.

Accordingly the environmental indicators in the SAC monitoring area are proposed to be as follows:

1. Climatological parameters on air temperature, humidity, wind, precipitation and evaporation at Khachmaz district, and
2. Inflows to Deveci lake and its water levels

3.6.2 Monitoring Schedule

Hydrological and groundwater sampling locations in the MMMC monitoring area are shown in Figure 3.3 and in the SAC monitoring area are shown in Figure 3.4. In both of the monitoring areas a total of 15 sampling points is proposed for hydrological observation, additional 5 sampling points are proposed to enable the monitoring of the groundwater regime.

In the MMMC area the hydrological gauging points are selected to allow for the water balances of the lakes. The collectors (K3 and K2) feeding the Ag gol and Sarisu lakes should be observed by Q1 and Q6. The outflows from the lakes should be observed by Q4 and Q5. Additional inflows of irrigation excess water via P-1 and P-12-1 should be monitored at Q7 and Q8 respectively. The MMMC sea outfalls are suggested to be monitored at Q9. Flow information from two regular Kura gauges and from one regular Araz gauge should be considered also. Groundwater gauges are proposed to assess the efficiency of the new MMMC collector. Three gauges are placed along the reach of new collector (GW3, GW4 and GW5) and one is located near to the Karabakh Canal (GW1), a fifth one (GW2) is located between the K1 and K2 collectors.

In the SAC area two hydrological gauges are proposed to monitor the hydrological balance of the Deveci Lake. Therefore one station should be installed on the Shabranchay river to assess the inflows to the lake, a second station should be installed at the lake to observe the fluctuation of the its water level.

The hydrological observations are planned to be started immediately after the implementation of the gauging stations, they should go on for at least 5 years after the construction has been finished. The gauging stations should be set up during the first monitoring campaign. The monitoring schedule is detailed in Table 3.10.

It is proposed to occupy one hydrologist for 45 days for the co-ordination and the assessment of the observations. The hydrologist will be charged to conduct the site selections of the hydrometric and groundwater gauges during 4 days at the initiation of the monitoring programme. Additionally he will carry out 2 field trips (4 days in total) each year to both of the monitoring areas to control the field observations.

3.6.3 Requirements for Monitoring Equipment and Laboratories

The proposed monitoring programme requires hydrometric equipment in form of 2 current meters (1 for the SAC monitoring area and 1 for the MMMC monitoring area). For some river gauging stations (to be selected during the first campaign) a cable car should be provided to allow suspension measurements across the rivers/canals (4 in total, except the sampling points in the lake area) and a topographic point (15 in total) should be set-up. 15 staff gauges should be provided for water level readings at the gauging points.

Table 3.10: Sampling Locations of Hydrological and Hydrogeological Monitoring

Sampling Location	Sampling Parameter	Schedule	Days per year
MMMC Ag gol, Q1, Q3 K2 Collector, Q2 K3 Collector Q4 Sarisu Q5, Q6	Water level	Daily	365
K2 Collector, Q2 Ag gol, Q3		Once per month and when the water level reached to	15

K3 Collector Q4 Sarisu Q5 P-1, Q7 P-12-1, Q8 MMMC sea outfall Q9 Kura, two gauges Araz, one gauge	Flow (water level)	maximum	
Near to K2 collector, GW1 Near to K2/K1 collector GW2, Near to the new collector GW3, GW4 and GW5	Groundwater table	Once every 10 days	36
SAC , Q5 Deveci Lake, Q4, Q5	water level	Twice daily	365
Near Deveci Lake	Groundwater table	Once 10 days	0

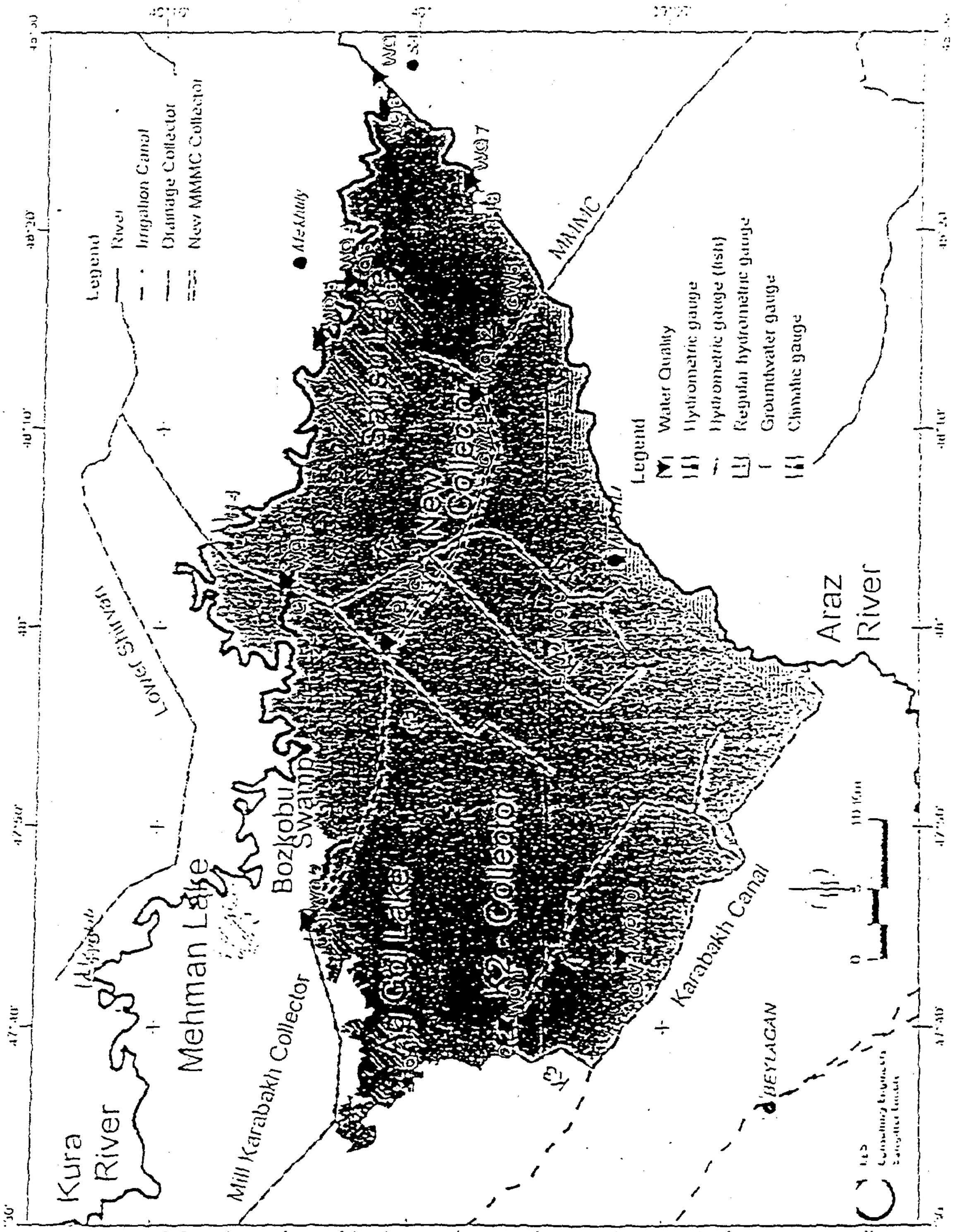

Figure 3.3: Location of hydrometric gauging stations and of water sampling points in MMMC monitoring Area

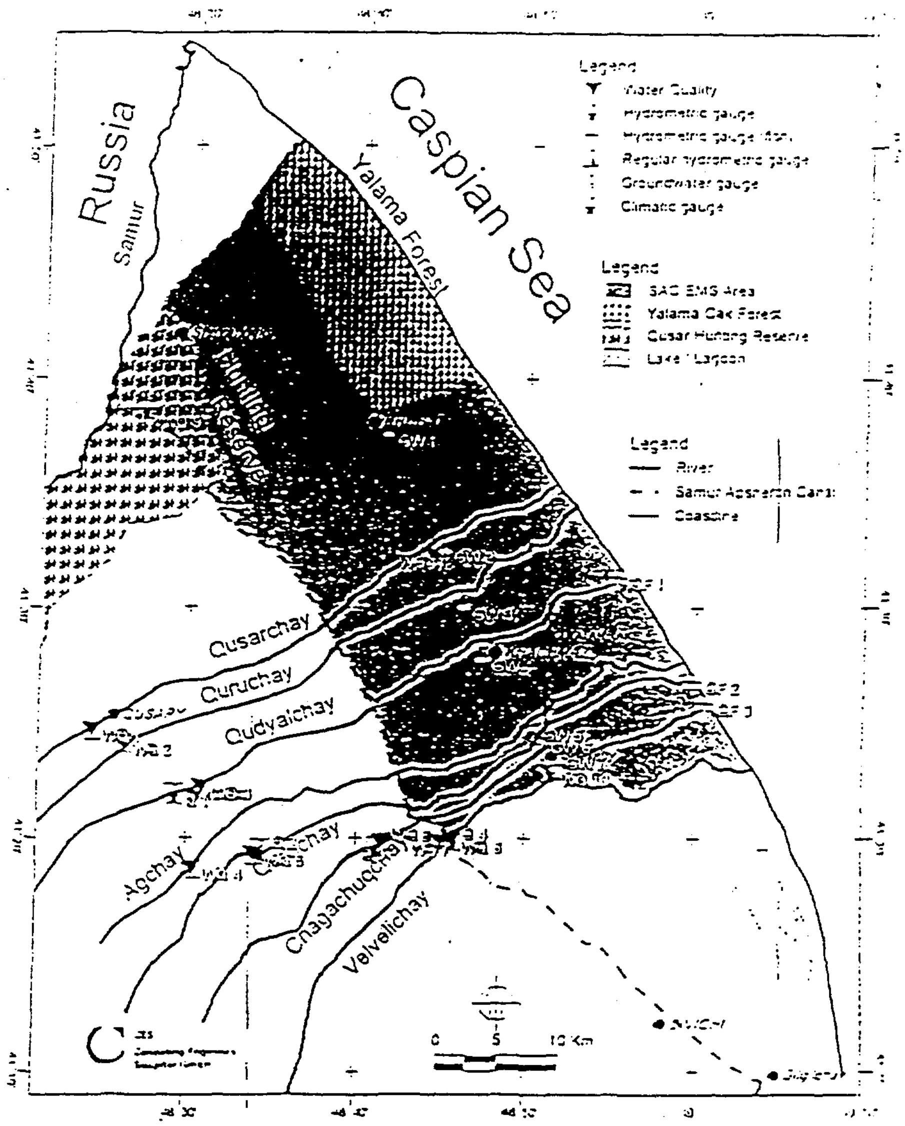

Figure 3.4: Location of hydrometric Gauging Stations and of Water Sampling Points in SAC monitoring Area

For groundwater monitoring in the MMMC area the drilling of 5 new wells should be considered. In the SAC area groundwater should be observed sporadically in the vicinity of the Deveci lake at an existing observation well. To measure the ground water levels 5 well depth meters are proposed.

3.6.4 Regulations for Data Handling, Processing and Evaluation

The observation results obtained both from daily and monthly measurements at the hydrological and hydrogeological sampling points will be recorded by the field observers. The field observers will deliver monthly the observation results to the regional data handling unit that are proposed to be functioning at the regional offices of SAIC in the SAC and MMMC monitoring areas. The staff in these units will collect, assure and control the data and then send them to the REMU which will be in contact with the hydrological expert. The hydrological expert will start to assess the data in November. At the end of first year of the monitoring, the hydrologist is expected to prepare graphics of the flow versus depth curves for all of the hydrological sampling points. He will share the water level information on Ag gol and Sarisu and Deveci lakes with the biological expert. All the data he has collected need to be installed into a data base which will enable him to compare and assess the hydrological regime in time sequences. This data base will also be installed at the REMU.

Each year at the end of September climatological data on monthly average air temperature, humidity, precipitation, wind, evaporation for Khachmaz and Imishli districts will be obtained by the SAIC from the State Hydrometeorological Committee and delivered through REMU to the hydrological expert.

3.6.5 Report Requirements

At the end of each annual monitoring campaign the water resources expert will work out a detailed assessment of the present situation based on the actual information of the ending campaign. This report will comprise hydrology, hydrogeology and climatology. The assessment includes the Ag gol and Sarisu lakes, and the Deveci lake as well as ground water levels in the two monitoring areas. The assessment will also address the relevant climatological data from Kachmaz and Imishli station.

To allow for an assessment of the development of the water resources the report will relate the present results to those from previous monitoring campaigns. Any negative trends will be clearly identified in a separate chapter. This chapter would be followed by recommendations to remedy these negative developments. The respective remedial measures will have been co-ordinated with the Head of the REMU and with other experts, if required.

Each annual report will state on the requirements for gauging stations and equipment. The necessity for each gauging station will be assessed annually. This will help REMU to set-up an realistic budget for the coming campaign.

The report will be submitted to the REMU on request of REMU head. The document will contain the assessment and all measured and calculated data of the ending year. The data will be provided to REMU in form of listings and in digital format.

3.5.6 Standardised Report Forms

The reporting forms from surface and ground water levels and flow measurements are provided in the Annex B.4 in Azeri language. These forms are set up to be used by the field observers.

3.5.7 Monitoring Personnel and Training Needs

The monitoring will be co-ordinated by one consulted water resources expert. He is also responsible for data management, the assessments and the reporting as well as for training of field personnel. Hydrometric and groundwater measurements will be carried out by 14 field observers. For each of the sampling points an unskilled field observer is suggested to measure water level in the wells and at the hydrometric gauges. Surface water level and flow measurements at the outlet of Ag gol will be conducted by one single field observer. It will be the same for Sarisu lake and for the Deveci lake. Field observers will be selected from the nearest by locations, they should be reliable and have a good reputation. For the Ag gol lake (Q1 and Q3) water level reading is proposed to be performed by the local staff of ASCE. The observed data will be reported monthly by the field observers to the SAIC's regional offices. The regional offices will be responsible to collect the data and control the field observations, as well as to deliver the achieved data to REMU.

3.6.8 Budget needs

For the set up of the water resources monitoring a budget of $US 2,965 is assumed. This amount includes hydrometric equipment and training as well as site selection and infiltration measurements (see Table 3.11).

The annual operation costs for monitoring hydrological and hydrogeological costs including the staff costs and transport cost of the hydrologist to control the monitoring is equal to $US4,643.5 (see 3.12 and Table 3.13)

Table 3.11: Budget Requirements for Equipment of Water Resources Monitoring

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Installation of Cable car (complete)	300	4	1,200
2	Current meters	100	2	200
3	Staff gauges, incl. Installation	20	15	300
4	Topographic points, incl. installation	5	15	75
6	Well drilling (10m deep)	125	5	625
7	Well depth meters	5	5	25
8	Training including travel and expert	150	2	300
9	Site selection including travel and expert	60	4	240
			Total	$US 2,965

3.12: Annual Budget Requirements for Staff for Water Resources Monitoring

Pos.	Expert / Task	No.of Staff a)	Days per year per Staff b)	Total Days per year c) a x b	Cost per Day [$US] d)	Annual Cost [$US] e) c x d
1	Hydrologist	1	60	60	10	600
2	Regional Data Handling staff at MMMC and SAC	2	365	730	1.65	1,204.5
3	Field workers for water level reading	9	365	3,650	0.75	2,464
4	Field workers for groundwater level reading	5	36	432	0.75	135
						Total $US 4,403.5

Table 3.13: Budget Requirements for annual Consumptives for Water Resource Monitoring

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b

1	Transportation (including driver)	60	4	240
			Total	$US 240

3.7 SOIL DEGRADATION AND LAND USE

The SAC rehabilitation project offers the possibilities for an intensification of irrigation in the SAC monitoring area. The irrigation of land may lead to the reduction in soil fertility, water logging in areas of shallow groundwater tables or to introduction of toxic elements into the soil by intensive agrochemical usage. Furthermore, a probable change in land usage due to irrigation activities has to be taken into account. The MMMC project deals with the improvement of the soil conditions by means of developing the drainage infrastructure.

Both projects are expected to effect the soil conditions. An adequate tool to investigate the impacts on the soil is a regular monitoring. In both surveying areas the main objectives of the monitoring programme will be to evaluate the changes in the meliorative conditions of the soil in relation to the implementation of the irrigation and drainage schemes. To achieve these aims any change in soil quality or land use has to be detected and assessed. On this basis preventive measures can be proposed by the REMU.

To achieve the maximum information it is essential to define key environmental indicators, the sampling points and the monitoring schedule. At last the budget has to be proposed for set-up and operation of the soil monitoring.

3.7.1 Key Environmental Indicators

Main environmental indicators concerning the meliorative conditions of irrigated soils are as follows:

- Salinity of the irrigated soils defined by type and area;
- Microelements in the soil (nutrients and pesticides),
- Conditions of the irrigation canals and collectors;
- Crop pattern and land usage
- Groundwater regime and salinity conditions

The construction of the new collector in the MMMC area is expected to have a positive impact on the soil quality, especially on its salinity. Agricultural land usage will also change due to improved land conditions. The reconstruction and rehabilitation of SAC takes into consideration intensified irrigation water usage which may lead to the reverse case, e.g. the rise in groundwater level within the areas near to the coastal zone.

3.7.2 Monitoring Schedule (sampling locations, sampling period, personnel)

Soil sampling locations in the MMMC and the SAC monitoring area are shown in Figure 3.5 and Figure 3.6, respectively. To get an accurate idea of the soil quality at each monitoring area 10 sampling points are proposed. In Annex A.12 both the present and proposed sampling points are shown with their co-ordinates.

The consultant proposes two different soil sampling campaigns. The aims of the first campaign, which will be carried out twice per year, is to investigate the chemical properties of the soil, with main focus on salinity. The first group of samples will be collected between March and April. The second group of samples will be collected between September and October. Additional to the sample collection the conditions of the collectors will be visually observed. The second campaign is proposed to investigate the changes of the mechanical properties of soil and will be conducted in the first year and after 6 years. The second campaign will be conducted at 4 sampling points of each monitoring area (see Annex A.12).

Within the second campaign a satellite image- or air photographs- processing will be carried out to assess the change in land use. The Yalama-Khachmaz forest area will be included in this survey.

The soil expert will be responsible for the sampling and the assessment of the soil degradation and / or improvement. It is proposed to occupy him for 40 days during which he is expected to carry out 4 field trips (8 days in total) each year to both of the monitoring areas in order to perform the sampling.

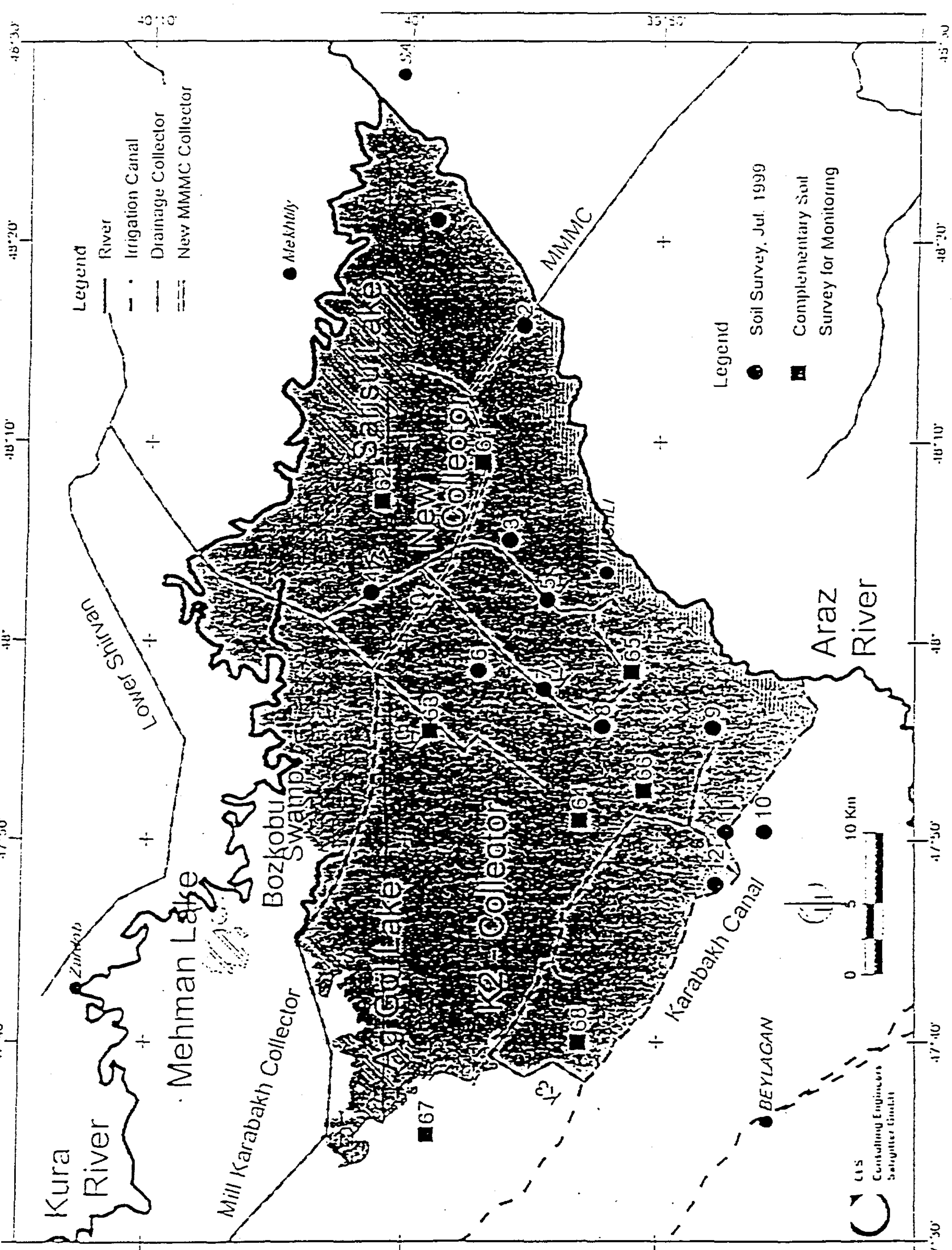

Figure 3.5: Location of Soil Sampling Points in the MMMC Monitoring Area

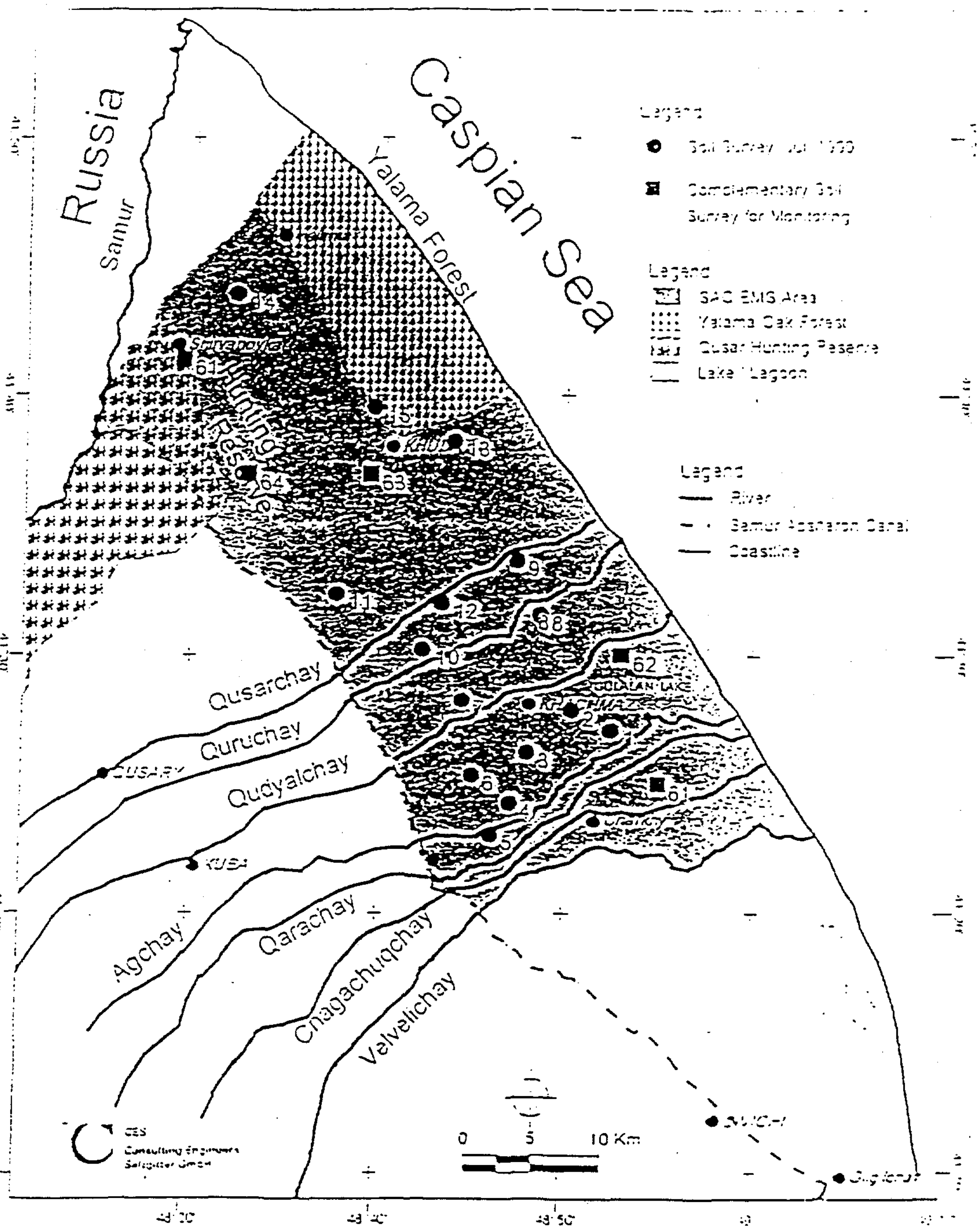

Figure 3.6: Location of Soil Sampling Points in the SAC Monitoring Area

3.7.3 Requirements for Monitoring Equipment and Laboratories

The proposed monitoring programme requires:

- Hand held Global Positioning System (GPS) to locate sampling points;
- Hand auger (sampling pipe) for undisturbed soil samples
- Field set for measurement mechanical soil properties
- Landsat satellite imagery

The chemical and other remaining mechanical analysis of soil will be carried out at a fully equipped soil laboratory. The use of satellite imagery is the most effective method to investigate the land use changes in project areas as great as the SAC and the MMMC. These images are thought to be processed by the proposed REMU GIS group. Without the GIS-system the land use has to be carried out by air photographs which would take additional 4 expert months.

3.7.4 Regulations for Data Handling

The soil expert is advised to take the samples from a location at least 100 metres away from collector and/or inter-farm collectors to get a reasonable sample. Three samples will be collected from each sampling point at depth of 0 to 25 cm; 25 to 50 cm and 50 to 100 cm. This is the minimum required number of samples that can be collected from one point to identify the chemical and mechanical properties. Together with the field assistant the soil expert will collect these samples from each depth represented above and put them into previously labelled bags. Additional, three samples obtained from each sampling point will be put into a single pouch which label includes the number of sampling point and the date. The pre-defined sampling points should not be moved.

The report of the field trip should also include an evaluation of the condition of the collectors.

An appropriated satellite image for the land use assessment needs to be obtained from the relevant agency representing the present state of the usage on June or July (vegetation period) of the second campaign.

The soil expert will start to assess the data in November, sharing the land use information with the biological expert.

3.7.5 Report Requirements

At the end of each annual monitoring campaign the soil expert will work out a detailed assessment of the present situation based on the actual information. This report will comprise chemical and mechanical properties, conditions of collectors and land use.

The comparison of present and previous soil analyses allows to identify trends of soil improvement or degradation. In case of the latter one. This chapter shall be followed by recommendations to remedy degradative changes that will be worked out and detailed in a special chapter. The respective remedial measures will have to be co-ordinated with the Head of the REMU and with other experts, if required.

After six years a detailed analysis of land use changes will be worked out on the basis of change detection methods, applied to the 1998 satellite images and the latest available at that time (e.g. those of summer 2005).

Each annual report will state on the requirements of sampling points and equipment as well as on maintenance requirements of the collectors. The necessity for each sampling point will be assessed annually which will help REMU to set-up a realistic budget for the coming campaign.

The report will be submitted to the REMU on request of REMU head. The document will contain the assessment and all measured and evaluated data of the ending year. The data will be provided to REMU in form of listings and in digital format.

3.7.6 Standard Reporting Requirements

The results from the soil analyses will be processed in a standardised form. For this purpose a field analysis form is shown in the Annex B.5 in Azeri. This forms will be used for field work and to report the laboratory analysis.

3.7.7 Monitoring Personnel and Training Needs

The monitoring will be co-ordinated by one consulted soil expert. He also will be responsible for the sampling, data management and the assessment as well as for reporting. The other members of the monitoring team are formed by one technical assistant for each of the monitoring areas. The two field assistants will be trained by the expert in the field. During the field work field assistants are expected to manage sampling and recording.

3.7.8 Budget Needs

The costs for soil degradation and land use monitoring need to be distinguished in set-up costs and annual costs. This is considered in the tables listed below.

For the required equipment already mentioned a budget of $US13,835 is assumed. This sum also comprises the expenditures for 3 Landsat images to be purchased after six years.

The annual costs to conduct the first campaign (type a) for chemical properties of the soil are $US1,999. Those for the second campaign (type b) (mechanical soil properties) are $US1,274. Type b is carried out during the first year and after six years, type a is carried out during all other campaigns. Consequently the average annual costs are $US4,485. Without GIS support the type b campaign would require addition budget of $US1,200. This would increase the average annual cost to the $US4,785.

Table 3.14: Budget Requirements for Equipment and Training of Set-up of Soil and Land-use Monitoring

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Hand held GPS	250	1	250
2	Soil Sampling pipe	10	1	10
3	Landsat satellite imagery	4500	3	13,500
4	Field equipment for the analysis of mechanical properties of soil	75	1	75

Total $US13,835

Table 3.15: Budget Requirements for Annual Consumptives for First Campaign of Soil Degradation and Land Use Monitoring in SAC and MMMC Area

Pos.	Item	Unit Price [$US] a)	Pieces b)	Total Price [$US] c) a x b
1	Transportation (including driver)	60	4	240
2	Sampling bags	0.024	120	2.88
3	Sampling pouches	0.4	40	16
4	Chemical analysis of the soil	14.5	120	1,740

Total $US 1,999

Table 3.16: Annual Budget Requirements for Staff for First Campaign of Soil Degradation and Land Usage Monitoring (costs of 1999)

Pos.	Expert / Task	No.of Staff a)	Days per year per Staff b)	Total days per year c) a x b	Cost per day [$US] d)	Annual Cost [$US] e) c x d
1	Soil expert	1	40	40	10	400
2	Field assistants	2	8	16	5	80

Total $US 480

Table 3.17: Additional Budget Requirements for annual Consumptives for Second Campaign of Soil Degradation and Land Usage Monitoring

Pos.	Item	Unit Price [$US] a)	Pieces b)	Total Price [$US] c) a x b
1	Sampling bags	0.024	12	0.288
2	Sampling pouches	0.4	4	1.6
3	Mechanical analysis of the soil	106	12	1,272
			Total	$US 1,274

Table 3.18: Additional Annual Budget Requirements for Staff if GIS is not available for second Campaign of Soil Degradation and Land Usage Monitoring in SAC and MMMC Area (costs of 1999)

Pos.	Expert / Task	No.of Staff a)	MM per year per Staff b)	Total MM per year c) a x b	Cost per MM [$US] d)	Annual Cost [$US] e) c x d
1	Soil expert	1	4	4	30	1,200
					Total	$US 1,200

3.8 WATER QUALITY

According to the previous water quality assessment some effects on the future water quality may be expected from the implementation of the proposed infrastructural measures. The verification of this assumption requires a systematic monitoring. This should be carried out before, during and after the construction.

The water quality monitoring will be carried out in the MMMC and in the SAC monitoring area. It will concentrate on physical, hydrochemical and microbiological parameters to assess the suitability of water for irrigation purposes; for potable water purposes also bacteriological criteria is considered.

For the MMMC monitoring area the monitoring program will consider water quality assessments for the K2 and K3 collectors and of P-1 and P-12-1 irrigation canals as well as for the Ag gol and the Sarisu lakes. Water quality of the lakes will be based on the criteria for fish life. (Annex A.6) The Kura river and the Araz river will be surveyed as they form important resources for Baku water supply. At the bottom end of the MMMC water quality will be monitored in the sea outfall and offshore. Last but not least quality of groundwater will be considered also. In the MMMC area water quality may be affected by the improved drainage conditions. This may mainly be the case for Kura and Araz rivers. However, negative developments could arise if for example the water balance of the lakes would be changed negatively or if increased agricultural activities would lead to an intensified use of agrochemical.

In the SAC monitoring area water quality of the Deveci lake and its inflow will be monitored.

3.8.1 Key Indicators

The above mentioned water courses are used for drinking water supply, irrigation water supply, and for drainage of irrigated areas. In addition Ag gol, Sarisu and Deveci lakes are considered to have ecological importance.

It is found that the required water quality information cannot necessarily be obtained from existing observation networks that are operated by the State Hydrometeorological Agency.

Water quality will be assessed according to its physical, chemical and microbiological characteristics. The parameters listed at the Table 3.19 are selected to monitor the water quality in both of the areas.

3.8.2 Monitoring Schedule

The annual water quality monitoring of the MMMC and SAC monitoring areas is suggested to be carried out at different sampling intervals. In the MMMC monitoring area sampling points of the Kura and Araz rivers should be monitored twice per year; once at the maximum flow period (March-April) the second sample should be taken during the low flow period (August-September). From collectors, canals and the Ag gol, Sarisu and Deveci lakes two samples should be taken, one before and one at the end of the vegetation period. The offshore sampling at the mouth of the MMMC should be carried out at least once a year in September. PH, EC and temperature should be monitored at the lakes at weekly intervals. The groundwater sampling at both of the monitoring areas will be carried out twice per year; once in April and once in September.

Table 3.19: Water Quality Monitoring Parameters in both of the Project Areas

Parameters	River & DW Resource	Collector Water	Ag gol Sarisu lake	GW Resource
Physical Parameters				
Temperature	+	+	+	
PH	+	+	+	+
Electrical Conductivity	+	+	+	+
Suspended Solids	+	+	+	
Dissolved Oxygen	+		+	
Chemical Parameters				
Total iron	+	+	+	+
Biological Oxygen Demand	+		+	
Oil, grease, petroleum	+	+	+	+
Salinity (HCO_3, SO_4, Cl, Mg, Ca, Na, K)	+	+	+	+
$N0_3$, NO_2, NH_4	+	+	+	+
Total Phosphorus	+	+	+	+
Pesticides	+	+	+	+
Phenols	+	+	+	+
Zinc	+			+
Copper	+	+	+	+
Microbiological Parameters				
Escherichia coli	+			+

Note: +; indicates that monitoring is needed for the relevant parameter, DW: drinking water, GW: groundwater.

For the MMMC monitoring area 16 water quality sampling points should be installed at:

1. Inflow to Ag gol lake (WQ 1)
2. Outflow of Ag-gol lake (WQ 2)
3. Inflow to Sarisu lake (WQ 3)
4. Outflow of Sarisu lake (WQ 4)
5. Kura river u/s of Sarisu lake inflow (WQ 5)
6. Kura river u/s of Araz inflow (WQ 6)
7. Araz river u/s of Kura confluence (WQ 7)
8. Kura river d/s of Araz inflow (WQ 8)
9. At the beginning of the MMMC collector (WQ 11)
10. At the end of the 32 km MMMC collector (WQ 12)
11. Irrigation canal P-1 (WQ 13)
12. Irrigation canal P-12-1 (WQ 14)
13. MMMC sea outfall (WQ 15)
14. MMMC offshore (WQ 16)

In addition samples from groundwater should be taken at two sites (WQ 9 and WQ 10) to enable the assessment of groundwater quality in relation to the implemented drainage measures. The location of water quality sampling points of MMMC monitoring area is shown at Figure 2.1 on page 3-22.

The water quality monitoring program is proposed to last for 5 to 6 years.

One water quality expert will be responsible for the collection of the samples and for the assessment of analysis. He will be charged for 6 days for the collection of samples from both of the project areas (2 days in the MMMC monitoring area and 4 days in the SAC monitoring area) and additionally for 54 days for the assessment of the laboratory analysis and preparing a report to the REMU. He should be employed for 60 days in total.

3.8.3 Requirements for Monitoring Equipment and Laboratories

The physical parameters (water temperature, pH, turbidity, colour and dissolved oxygen) will be observed under natural conditions directly in the field.

All other water analyses will be carried in a hydrochemical laboratory. For bacteriological and hydrochemical analyses samples will be carried in sterile conditions in a portable refrigerator. The bacteriological measurements will be conducted in the existing local laboratories at both of the monitoring area. The transportation time for the bacteriological samples should not be more than 6 hours.

3.8.4 Regulations for Data Handling, Processing and Evaluation

The water samples will be analysed in the field and in an adequate laboratory according to standard procedures which are supervised by the water quality expert. The results from the analyses will be processed in a standardised form. For this purpose a field analysis form is shown in the Annex B.6. For the laboratory results other corresponding forms will be used.

The results from the annual water quality campaign will be processed and evaluated by the water quality expert. The data will be stored by the expert in digital form in an appropriate data base. The evaluation will comprise the revision of the recent laboratory analyses, checks on plausibility and the assessment of the current situation and how it has to be seen in relation to the situation in previous years. The processed data and the raw data will be handed out to the REMU where they are integrated into the REMU database. The outcomes of the evaluation will be handed out to REMU in form of an appropriate report.

3.8.5 Report Requirements

At the end of each annual monitoring campaign the water quality expert will report on the monitoring results from the recent campaign to the REMU. The report assesses the present conditions and details the changes with respect to previous campaigns. It should also contain an assessment of the physical water quality parameters that are measured in the context of the bio-monitoring for Ag gol and Sarisu lakes. The report has to be written in a simple and understandable manner. Important findings have to be worked out in detail. Negative developments have to be fully addressed in a special chapter. In co-operation with the Head of the REMU measures have to be proposed to remedy the negative trends.

The report will clearly work out the suitability of water for irrigation purposes and for drinking water purposes. All relevant parameters will be addressed and assessed according to national norms (SanPIN 4630-88, Moscow, 1988, Law of protection of superficial waters from pollution by waste water, Baku, 1994) and international standards (WHO, 1993; Guidelines for drinking-water quality, Vol. 1) (see Annex A5)

The report also states on the necessities how to carry on with the monitoring in the future. This for example includes the identification of no longer needed sample taking or the need for additional analyses and sampling. On the basis of this information REMU will be enabled to propose update budget requirements for the next monitoring campaign.

3.8.6 Monitoring Personnel and Training Needs

The monitoring team comprises 3 members, one water quality expert and one field assistant for the SAC and one for the MMMC area. The two field assistants will be trained by the expert in the field. During this field work field assistants are expected to manage sampling, e.g. preparation of sampling, sampling, fixing of samples and their transportation.

3.8.7 Budget Needs

The costs for water quality monitoring need to be distinguished in set-up costs and annual costs. This is carried out in the following paragraphs.

3.8.7.1 Budget Needs for Set-up of Monitoring

All required laboratory equipment is expected to be available in the laboratory of the consulted water quality expert. However, for the necessary field sampling appropriate equipment is required. This includes laboratory glass container of capacity 1 litre, pH-meter, EC-meter, thermometer and a portable refrigerator. The respective costs are detailed in Table 3.20. The total cost for set-up of monitoring is $US3,872.

Table 3.20: Budget Requirements for Water-Quality Monitoring Equipment

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Laboratory tight glass wares, capacity: 1 litre	0.07	200	14
2	pH meter	400	3	1,200
3	EC-meter	560	3	1,680
4	Sampling device for groundwater	20	1	20
5	Thermometer	2	3	6
6	Portable refrigerator	100	1	100
7	Oxygen meter	850	1	850
			Total	$US 3,872

3.8.7.2 Budget Needs for annual Operation of Water Quality Monitoring

The annual costs for the water quality monitoring consider consumptives and staff costs. The costs for consumptives are detailed in

Table 3.21; they end up at $US 2,396 per year. In Table 3.22 the staff costs are given. The staff set-up considers one water quality expert and two local staffs are required for taking water samples in the respective project areas. The annual operation costs for water quality monitoring becomes $US 3,026.

Table 3.21: Budget Requirements for annual Consumptives for Water Quality Monitoring

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Water Quality Analysis at MMMC in the Kura and Araz rivers	68.35	8	546.80
2	Water Quality Analysis at MMMC in collectors	34.46	4	137.84
3	Water Quality Analysis at MMMC in Ag gol and Sarisu lakes	37.60	8	300.80
4	Groundwater Analysis, in MMMC region	65.16	4	260.64
5	Water Quality in canals P-1 and P-12-1	37.60	4	150.
6	Water Quality of MMMC sea outfall and offshore	1;000	1	1,000
7	SAC, Water quality of Deveci lake and ist inflow (pH, EC, temp. by field equipment, no extra costs)			0
10	Field Transport (including driver)	60	6	360
			Total	$US 2396.04

Table 3.22: Annual Staff Budget Requirements for Water-Quality

Pos.	Expert / Task	No.of Staff a)	Days per year per Staff b)	Total days per year c) a x b	Cost per Day [$US] d)	Annual Cost [$US] e) c x d
1	Water Quality Expert	1	60	60	10	600
2	Assistant, SAC	1	4	4	5	20
3	Assistant, MMMC	1	2	2	5	10
					Total	$US 630

3.9 HEALTH SITUATION

The SAC and the MMMC projects both deal with the management of water and land resources. People use water for drinking, cooking and irrigation, they use the soil to grow crops and to feed their domestic animals. The hygienic quality of water and food depends on the sanitary and hygienic conditions of these resources. Changes in the hygienic conditions of these resources are reflected in the health statistics. The SAC project is considered as an irrigation project; this project may cause water logging problems and increase number of malaria cases. Besides, the SAC project provides additional water supply to Baku. The MMMC project concentrates on solving of drainage problems in already irrigated areas. This project is assumed to improve the health conditions in the region, as much as the reuse of the collector water is avoided. This also includes the consideration of the Kura river which is used downstream as drinking water resource.

The regular monitoring will form the basis for a sound assessment of the impacts that the projects will have on the health conditions. For the MMMC monitoring area the proposed programme will take into consideration health statistics of Imishli district and Kura river data for drinking water. For the SAC monitoring area the monitoring will consider SAC water as drinking water resource and health statistics of the Khachmaz district. The key environmental indicators, the sampling points and the monitoring schedule are selected to achieve the maximum information to assess the status of the health situation. Finally the budget needs for setting up and operation of the monitoring programme are detailed.

The health statistic are regularly recorded by the district offices of the Ministry of Health (MoH).

3.9.1 Key Environmental Indicators

Indicators in the MMMC and SAC monitoring areas are selected to allow the assessment of the health impacts of the new collector and of the rehabilitated canal.

The environmental indicators in the MMMC and SAC monitoring areas are proposed to be as following:

1. Main infective diseases in relation to water supplies at Imishli district in the MMMC monitoring area and at Khachmaz district in the SAC monitoring area; and
2. Microbiological water quality of the Kura river in the MMMC monitoring area and of the SAC water in the SAC monitoring area.

The health indicators in both of the areas will deal with the health statistics. Imishli district is proposed to be the hygienic monitoring zone of the MMMC monitoring area and Khachmaz district is proposed to be the respective zone of the SAC monitoring area, both proposals were discussed and agreed upon during the workshop of 4 August, 1999. Imishli district health statistics on water borne and water related diseases will show the efficiency of the new collector and its management. Health statistics of Khachmaz district is expected to be a good indicator for the impact of irrigation on the health situation in the SAC monitoring area.

3.9.2 Monitoring Schedule

The Imishli district in the MMMC monitoring area and Khachmaz district in the SAC area will be regularly monitored to obtain the information on health situation. Health statistic of these districts will be recorded monthly by the epidemiologist.

The microbiological quality of the Kura river and the SAC water will be monitored within the water quality monitoring programme as explained in the chapter 3.7 3.8 Water Quality.

The health monitoring programme is planned to be started during the early stage of the project and carried out during the construction and at least to be continued for 5 years after the project is completed.

It is proposed to consult one health expert and 2 epidemiologists for 30 days per year, each will work 12 days per year for the collection and the assessment statistical data.

3.9.3 Requirements for Monitoring Equipment and Laboratories

The proposed health monitoring programme does not require any additional equipment and laboratory facilities as all relevant analyses are carried out by MoH.

3.9.4 Regulations for Data Handling, Processing and Evaluation

The health statistics will be obtained from monthly records. The epidemiologist in the Imishli and Khachmaz district offices of the MoH will collect and appraise the district health statistics and then send them to the health expert. The health expert will start to assess the data in November. He will obtain the information on the microbiological water quality of the Kura river and the SAC water from REMU's water quality monitoring. All the health data need to be implemented in a data base which will ease the assessment of the time variant health situation. The data base will be installed at the REMU.

3.9.5 Report Requirements

At the end of each annual monitoring campaign the health expert will work out a detailed assessment of the present situation based on the actual information of the ending campaign. This report will comprise an assessment of the water-borne, water related health situation in the 2 monitoring areas and an assessment of the microbiological quality of the Kura river and the SAC water.

To allow for an assessment of the development of the health situation, the report will relate the present results to those from previous monitoring campaigns. Any negative trends will be clearly identified in a separate chapter. This chapter would be followed by recommendations to remedy these negative developments. The respective remedial measures will have been co-ordinated with the Head of the REMU and with other experts, if required.

Each annual report will state on the requirements for monitoring programme. The necessity for the monitoring programme will be assessed annually. This will help REMU to set-up a realistic budget for the coming campaign.

The report will be submitted to the REMU on request of REMU head. The document will contain the assessment and all health data of the ending year. The data will be provided to REMU in form of listings and in digital format.

3.9.6 Standardised Report Forms

The reporting forms about the health situation for the epidemiologists are provided in the Annex B.7 in Azeri language.

3.9.7 Monitoring Personnel and Training Needs

The monitoring will be co-ordinated by one consulted health expert. He is also responsible for data management, the assessments and the reporting. The collection of health statistics will be carried out by 2 epidemiologists who are working the local offices of the Ministry of Health. They will deliver the data monthly o the health expert through REMU.

3.9.8 Budget Needs

For the set up of the health situation monitoring there will be no need for a budget.

The annual operation costs for the health monitoring only includes the staff costs. It sums up at $US420. (see Table 3.23)

Table 3.23: Annual Budget Requirements for Staff for Health Situation Monitoring

Pos.	Expert / Task	No.of Staff a)	Days per year per Staff b)	Total Days per year c) a x b	Cost per Day [$US] d)	Annual Cost [$US] e) c x d
1	Health expert	1	30	30	10	300
2	Epidemiologists (MMMC / SAC)	2	12	24	5	120
					Total	$US 420

3.10 Socio-Economic Aspects

The SAC and the MMMC projects both are expected to improve the existing agricultural infrastructure of Azerbaijan. The SAC project is considered as an irrigation project, which will improve the agricultural production and consequently improve the economic and social well-being of the area of the project. Also the SAC project will provide additional drinking water for Baku improving the social-welfare in the city. The MMMC project is considered as a drainage project which will improve the melorative conditions of the land. Consequently, the rising usage of agricultural areas will increase in productivity. Therefore, also the MMMC project is expected to contribute to the income level of the people and social-welfare. Both projects are assumed to affect the socio-economic level in their implementation areas. The regular monitoring will form the basis for a sound assessment of the project impacts to the human environment. For the MMMC and SAC monitoring areas the proposed programs will take into consideration the Imishli and Khachmaz districts respectively. The key indicators, the sampling points and the monitoring schedule are arranged to achieve the maximum information to assess the status of socio-economic situation in relation to the agricultural sector. Finally, the budget is set up and operation-costs of the monitoring programme are detailed.

State Statistical Committee regularly issues statistics on population, migration, etc. Additional, there is some statistical information available from the district office of the State Statistical Committee.

3.10.1 Key Environmental Indicators

Indicators in the MMMC and SAC monitoring areas are selected to allow the assessment of the impacts of the new collector and rehabilitated irrigation canal on the socio-economic conditions.

The proposed indicators in both monitoring areas are listed below:

1. Demographic factors
2. Crop productivity;
3. Livestock productivity;
4. Fraction of the incomes per capita; and
5. Fraction of the expenditures per capita.

These indicator parameters will indicate the socio-economic situation in the project areas. Economical investments may positively and negatively effect the physical environment but usually they influence human environment by economical means. This contribution is need to be monitored in order to evaluate the achievements. In case of these projects the contribution of agricultural activity to socio-economy will be carried out according to the indicators mentioned above.

3.10.2 Monitoring Schedule

The socio-economic situation will be monitored in the Imishli district of the MMMC monitoring area and in the Khachmaz district of the SAC monitoring area. Surveys within the complete monitoring areas would be very inefficient and therefore sampling indicator areas are chosen to represent the socio-economic condition in the whole monitoring areas. (See also Chapter 2.7 2.7 Socio-Economic Aspects).

The socio-economic monitoring will be carried out in a two years interval. The actual surveys will be carried out in both project areas during a time span of 15 days, one week of field survey is supposed to be sufficient for each monitoring area. The surveys will start at mid November. The monitoring programme for the socio-economy is proposed to last at least 6 years.

It is proposed to employ one socio-economist for 30 days for the co-ordination and the assessment of the observations. The socio-economist will be charged for 15 days to co-ordinate the monitoring studies and another 15 days for the assessment of the surveys. During the co-ordination period the socio-economist will conduct one day field trips to each monitoring areas (total 2 days).

3.10.3 Requirements for Monitoring Equipment and Laboratories

It is assumed that the socio-economist will work out his report on his own computer equipment. Therefore no additional equipment is required.

3.10.4 Regulations for Data Handling, Processing and Evaluation

Before the survey starts, specific standardised questionnaires will be prepared by the socio-economist. The surveys will be carried out at 7 different locations of the Imishli and Khachmaz districts. At each location 6 specialists will conduct surveys using the standardised questionnaires. The socio-economist will assess the MMMC and SAC data and report on the results. Thereafter he takes care that all collected data can be installed at the REMU data base.

In addition to the project-own surveys the socio-economist will collect every two years statistical information from State Statistical Committee and its district offices. This information will also be integrated into the REMU data base.

3.10.5 Report Requirements

At the end of each monitoring campaign the socio-economist will work out a detailed assessment of the present situation based on the actual information.

To allow an assessment of the improvement of agricultural production and of the economic and social situation the actual results will be related to those from previous monitoring periods. All trends will be clearly identified in a separate chapter. If negative developments can be identified remedial measures should be outlined. These measures will have to be co-ordinated with the Head of the REMU and with other experts, if deemed necessary.

Each report will state on the requirements of the socio-economic monitoring programme. This will help REMU to set-up a realistic budget for the coming Campaign.

The report will be submitted to the REMU on request of REMU head. The document will contain the assessment and all surveyed and calculated data of the ending period. The data will be provided to REMU in form of listings and in digital format.

3.10.6 Standardised Report Forms

The reporting forms for the socio-economic aspects will be similar to the ones listed at the Appendix (see A.14 to A.20). These forms will be completed by the socio-economist according to the actual survey requirements.

3.10.7 Monitoring personnel and training needs

The monitoring will be co-ordinated by the socio-economist. He is also responsible for data management, the assessments and the reporting as well as for co-ordination of the local field surveyors, 6 for each district.

3.10.8 Budget needs

The socio-economic monitoring programme does not require a special set-up budget.

In Table 3.24 and Table 3.25 the total operational costs for the two-yearly surveys are shown to be $US1,260, the average annual costs are $US 630 consequently. These amounts include the staff costs and transportation costs for the socio-economist.

Table 3.24: Budget Requirements for two yearly Consumptives for Socio-Economic Monitoring

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	Transport (including driver)	60	2	120
			Total	$US 120

Table 3.25: Two yearly Budget Requirements for Staff for Socio-economic Monitoring

Pos.	Expert / Task	No.of Staff a)	Days per year per Staff b)	Total days per year c) a x b	Cost per day [$US] d)	Annual Cost [$US] e) c x d
1	Socio-economist	1	30	30	10	300
2	Specialists (including local transportation)	12	7	84	10	840

Total $US 1,140

4. PROPOSAL OF GEOGRAPHIC INFORMATION SYSTEM (GIS) FOR REMU

4.1 GENERAL

The present chapter focuses on the application of GIS methods to support the execution of the RIIDIA II monitoring programme. The implementation of the GIS should be considered as optional. GIS is internationally considered as one of the main data integration and assessment tools in environmental monitoring. As detailed below the main investment costs will be related to training by an international expert. This expert has a twofold function, a) to train GIS and b) to support the head of the REMU as monitoring expert. Although considered as optional the Consultant strongly recommends the implementation of a monitoring specific GIS. The absence of GIS does not necessarily hinder successful monitoring, but it may provoke persistent problems in handling and analysis of time and space relevant monitoring data.

Environmental monitoring as it is to be carried out in the framework of the RIIDIA II project focuses on the spatial and on the temporal development of environmental parameters. In this framework it is of interest to find out at what distance to the infrastructural measures specific environmental parameters are affected by the project. It is also of interest to define the delay in time between completion of infrastructural measures and distance related change of key parameters.

To be able to answer the above indicated questions the monitoring is to be carried out periodically for different parameters at different locations. The gained data need to be collected and processed and evaluated to achieve space-time related information which then can be used for environmental decision making. With the increasing of the data stock its processing and evaluation gains crucial importance. The application of computerised databases therefore forms the state of the art technique to comply with that task.

The set-up of the monitoring programme takes into consideration the existence of two different monitoring areas. In these areas a number of different topics is to be monitored and assessed. Each of the topics is defined by a different number of key parameters. In general the sampling points of these key parameters can be directly related to a specific geographic location, e.g. the place of a soil sample, or of a water sample, etc. In addition, each of the samples taken for a key parameter can be related also to a date. By this an exact space-time definition is possible for each monitoring event.

For the processing, evaluation and presentation of space-related information a specific type of computerised database is accepted world-wide. It is the Geographic Information System (GIS) which integrates different geographic information and allows topic related analysis and representation by means of specific GIS-methods and subsequently by the generation of data-tables or by means of thematic maps.

4.2 TASKS OF GIS

In the framework of the monitoring programme a Geographic Information System will be formed and set-up to enable an appropriate integration of attributive and geographic data related to the different project specific monitoring parameters. The GIS will assist the REMU to process and analyse the monitoring data and results that are to be collected and delivered by the external Consultants as attributive data and maps, in digital form and on paper (maps). The GIS should be installed at the REMU within the SAIC. All data collected by the external Consultants will be processed and stored by the REMU in the GIS as far as applicable. Other data, e.g. hydrological time series data will be stored in their own appropriate manner. The GIS will also assist the external Consultants in their evaluation and assessment of the data. In accordance with the actual monitoring needs the GIS tasks may also include the following:

System set-up

- Identification of information needs
- Definition of data models
- Elaboration of database structure
- Purchase and set-up of software and hardware

Data acquisition

- Capturing of attribute data from external digital sources
- Capturing of graphical data from external digital sources
- Digitising of maps
- Generation and validation of vector information
- Geo-referencing of vector information
- Import of Raster data (e.g. satellite images or scanned map data)
- Geo-referencing of raster information
- Integration of attributive and geographic data
- Topological revision of vector information
- Attaching of attribute information to vector objects

Image processing

- Contrast enhancement of satellite images
- Classification of satellite data
- Support of land use classification
- Support of physiographic and morphological classification

Data exchange

- Identification of external GIS resources and their import to the REMS-GIS
- Export of GIS-information for use in other systems

Mapping / reporting

- Definition of map layouts for different thematic maps
- Preparation of maps
- Preparation of database reports

The sustainable operation of an environmental GIS requires personnel with special expertise and training. Therefore it is suggested to form a GIS group within the REMU. This group should provide the required expertise. The personal set-up and the general outline of the tasks of the mentioned GIS group is outlined in the following paragraph.

4.3 Composition and Tasks of GIS-Group

It is supposed to form a GIS working group within the REMU to carry out the previously defined GIS tasks. This REMU-GIS group should be responsible to the head of the Unit. The group should be formed of at least three members, comprising one GIS- and database expert and two operators, assisting him in data capturing, database work and map-making.

The obligation of the GIS group is to support the REMU in performing its duties concerning data acquisition, data integration and processing and data evaluation. In addition the group members are responsible for the generation of database related data reports and of GIS based cartographic materials. The above mentioned GIS tasks will also be carried out by them as required by the Head of the REMU.

The REMU-GIS group should be operational only during those periods, when the REMU is operational also. In order not to loose their skills it is suggested, that the REMU-GIS group and their equipment is assigned to other SAIC projects during the rest of the year. For these times of the year extra budget resources need to be identified by SAIC for the operation of the REMU-GIS. For the REMU-GIS related budget finding it was assumed that the GIS group would be occupied with REMS work approximately 3 months per year.

The training requirement for the REMU-GIS is presented in the following paragraph.

4.4 GIS Training Requirements

Environmental GIS is considered to comprise ambitious methods of database organisation and analysis. It is set up to integrate different types of graphical (geographic) and attribute information from environmental parameters. The handling of such systems requires certain skills that differ considerably from standard office applications as they are applied in modern data processing.

The skills required to operate the envisaged environmental GIS comprise basic knowledge from the fields of geomatics, database organisation, geography and cartography. However, it also requires special skills in the practical operation of the project specific system, comprising its set-up, its modification and its useful application.

From the above mentioned it is deemed necessary to provide special training to the suggested GIS-group. From previous experience of the Consultant a training on the job is offering the most promising approach to successful staff training. Therefore it is suggested to run a respective training for the duration of one full monitoring campaign, i.e. of three month. During this time an international GIS expert shall set-up the GIS-Group together with the Head of the REMU. After that the group shall be enabled to carry out all tasks required for the successful operation of the environmental GIS. These works will be defined together with the Head of the REMU.

The REMU GIS specialist should offer professional background (e.g. from the fields of agriculture/irrigation engineering or geography) and sound experience in database management and mapping/cartography. This expert should also have good working knowledge of English language. The two operators/draftsmen should be familiar with cartographic work, in addition they should be capable to carry out computer assisted data capturing, e.g. digitising works and data typing. If time allows the international GIS-specialist will also assist the Head of the REMU in carrying out the first monitoring campaign.

The following Table 4.1 details the budget requirements for a 3 months training on the job carried out by one international expert for 3 national experts.

4.5 GIS Hardware Requirements

The REMU GIS-group should be fully furnished with its own hardware and software to accomplish with the above outlined tasks. The hardware should principally comprise PC-suitable standard equipment. This hardware is considered to carry the GIS software and the related databases.

It is recommended to consider a commercially available open GIS system that offers high performance for vector and raster processes including image processing, at an economic price. The GIS software should generally be platform independent and run on a Standard PC-platform like WINDOWS 95/98. The proposed GIS should offer the possibility of regular software updates. It is not recommended to install any system, that requires important features to be additionally programmed or acquired during the course of the project.

Table 4.1: Budget Requirements for GIS Training

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	GIS Training (int. Expert)	15,500	3 MM	46,500
2	GIS Training (local Expert)	185	9 MM	1,665
3	International Flight (Europe- Baku-Europe)	1,500	1 return ticket	1,500
4	Miscellaneous Travel Expenses	1	150	0,150
4	Accommodation (for int. Expert)	750	3 months	2,250
5	Hotel	130	4 nights	0,520
6	Interpreter and Translator Services	1,000	3 months	3,000
7	Local transport (for int. Expert)	800	3 months	2,400
			Total	$US 57,985.0

During the preparation of the project the Consultant worked with the GIS software TNTMIPS of MicroImages, Nebraska, USA. This package easily allows the integration and classification of LANDSAT TM data and it provides full CAD and VECTOR capabilities, fully relational database facilities and numerous import/export tools for VECTOR, CAD and RASTER objects. A so call viewer version of TNTMips was installed on a PC-Computer at the AZGHIPROVDKHOZ Institute, Baku. This installation offers access to the 1987 and 1998 satellite images.

All hardware components should be purchased on the national market as far as available at international prices. The GIS software is suggested to be purchased on the international market. For printing an A3-colour printer is considered suitable. However if additional demand for E-format colour printing should arise, the hardware budget needs to be increased by additional $US3,000.- to purchase e.g. a HP-DesignJet 450C including stand, etc.

The budget requirement for the set-up of the GIS equipment are detailed in Table 4.2. The shown hardware prices are understood as actual net prices as surveyed in Germany in August 1999. The German prices are considered to well represent the international level.

4.6 ANNUAL BUDGET REQUIREMENTS FOR GIS STAFF

According to the previous outlines the GIS-Group should comprise 3 members, one professional GIS expert and two draftsmen/operators. The group would be operative for the REMU for a period of 3 month per year. The respective staff budget requirements for that group are detailed in

Table 4.3. During the first year of monitoring the annual staff budget requirements would be included in the budget for the GIS training. The shown monthly rates are understood as tentative gross-rates. They were discussed and agreed upon with the SAIC.

Table 4.2: Budget Requirements for GIS Equipment

Pos.	Item	Unit Price [$US] a)	Quantity b)	Total Price [$US] c) a x b
1	GIS Software package (e.g.TNTMips)	7,000	1	7,000
2	MS-Office Professional Software	500	1	500
3	Digitiser (A2) (Summagraphics)	2,100	1	2,000
4	Pentium III, 128 MB-RAM, CD-ROM, 9 GB HDD	1,700	1	1,700
5	Screen, 21"	900	1	900
6	Auxiliary Power Unit (APU)	300	1	300
7	Streamer, 2GB	1,000	1	1,000
8	Colour-Printer, A3, Epson	350	1	350
			Total	$US 13,750.0

Table 4.3: Annual Budget Requirements for GIS Staff

Pos.	Expert	No.of Staff a)	MM per year per Staff b)	Total MM per year c) a x b	Cost per MM [$US] (gross) d)	Annual Cost [$US] (gross) e) c x d
1	EMS GIS Expert	1	3	3	350	1,050
2	Operator / Draftsman	2	3	6	100	600
					Total	$US 1,650.0

4.7 ANNUAL CONSUMPTIVES FOR GIS

For the time being it is assumed that the REMU will be operative for a continuous period of three months per year. During this period the respective sampling, data evaluation and assessment needs to be carried out by the respective consultants. During that time the REMU GIS group is operative also. The annual consumptives for GIS operation (3 months periods) are detailed in Table 4.4. These consumptives also include hardware replacement costs and annual costs for the update of the GIS software. The prices are understood as net, they represent German price levels of August 1999.

Table 4.4: Budget Requirements for Annual GIS Consumptives

Pos.	Item	Unit Price [$US] a)	Pieces b)	Total Price [$US] c) a x b
1	Printer Colour Cartridges (Epson)	20	3	60
2	Diskettes	1	50	50
3	Steamer Tapes	15	10	150
4	Colour Printer Paper (A3)	1.5	100	150
5	Annual GIS update costs	1	1,000	1,000
6	Annual hardware replacement cost	1	1,500	1,500
			Total	$US 2,910.0

4.8 OVERALL GIS BUDGET REQUIREMENTS

Form the previously elaborated cost tables investment/training and operation items of the REMU GIS-group can be distinguished and summarised. Accordingly Table 4.5 shows for set-up needs (Pos. 1 and Pos. 2) and for the operational needs (Pos. 3. and Pos. 4) the total budget requirements.

Table 4.5: Summary of GIS Budget Requirements

Pos.	Item	Cost [$US]
1	GIS Training Requirements	57,985
2	GIS Hardware and Software Requirements	13,750
1+2	**Total set-up costs**	**$US71,735.0**
3	Annual Budget Requirements for GIS Staff	1,650
4	Annual GIS Consumptives	2,910
3+4	**Total annual operation costs**	**$US4,560**

5. OVERALL MONITORING BUDGET NEEDS

To set-up and initiate the REMU an overall cost estimation is carried out tentatively in the following chapter. The figures used in this chapter have been elaborated previously in the relevant chapters. All costings take into consideration staff costs (gross) that were discussed and agreed upon with the SAIC. However, it should be noted that changes in the staff budgets may have considerable consequences on the overall budget.

The cost calculation covers two different alternatives for set-up and operation of the REMU. The first alternative includes a GIS Group, incl. equipment and its operation costs whereas the second does not consider GIS. In case of the first alternative the set-up costs and average annual operation costs are $US97,919 and $US26,393, respectively. In the second case the set-up costs are $US86,084, the average annual operation costs are $US25,393. In comparison to the GIS solution the non-GIS alternative is only $US11,835 cheaper in set-up and $US1,000 in operation. With respect to these insignificant cost savings the Consultant recommends to include an equipped GIS Group into the REMU. Hereby REMU and SAIC will have the chance to introduce a modern monitoring system with efficient database and data handling techniques.

All staff budgets are understood as gross costs. The monthly rates for consulted experts were discussed intensively with the client. Accordingly basic monthly rates of $US300,- were applied. The rate for proposed REMU staff were also agreed upon with the client, consequently $US250,- were applied for the head, $US200,- for data processing specialists and $US50,- for regional sub-unit representatives. All equipment is understood as net, not including taxes, transport or customs.

5.1 OVERALL BUDGET NEEDS FOR SET-UP

To set-up REMU (GIS option) a budget of $US97,919 is estimated, this would include monitoring investment costs for hydrology, geohydrology, climate; for soil and land use survey monitoring programme; for water quality monitoring programme; for natural parks and biodiversity monitoring programme and for the optional REMU-GIS. (See Table 5.1).

Table 5.1: Overall Budget Needs for the Set-up (GIS option)

Pos	Item	Set-up Costs [$US]
1	Hydrology, Geohydrology, Climate	2,965
2	Soil and Land use Survey, incl. 3 Landsat images after 6	13,835

	years) Landsat images=$US13500	
3	Water quality	3,872
4	Health	0
5	Parks, Biodiversity	1,132
6	Socio-Economy	0
7	Set-up of REMU (non-GIS option)	4,380
8	Set-up of REMU GIS Group (Including 3 months training, hardware and software)	71,735
	TOTAL	$US 97,919

Without GIS the budget requirements of REMU (non-GIS option) would be slightly lower at $US86,084. In the latter case 3 months of international expert is proposed to be occupied for the initiation of the monitoring programme with a monthly rate of $US 15,500, plus travel expenditures, etc. (See Table 5.2) The high investment costs for the soil and land use monitoring are related to the purchase of 3 Landsat satellite images. The purchase of these images is expected to be carried out during year 6 of the monitoring programme.

Table 5.2: Overall Budget Needs for the Set-up (non-GIS option)

Pos	Item	Set-up Costs [$US]
1	Hydrology, Geohydrology, Climate	2,965
2	Soil and Land use Survey, incl. 3 Landsat images after 6 years) Images = $US13.500	13,835
3	Water quality	3,872
4	Health	0
5	Parks, Biodiversity	1,132
6	Socio-Economy	0
7	Set-up of REMU (non-GIS option)	6,860
8	International expert for 3 months (1 assignment incl. expenditures for intern. and local travel/transport, accommodation and interpreter services)	57,420
	TOTAL	$US 86,084

5.2 Annual Budget Needs for Operation of Monitoring System

The annual operation costs used in chapter 3 are annual averages. The total average annual costs of the monitoring, in the first case REMU (GIS option) would be $US 26,393 (See Table 5.3). In the second case total annual costs of REMU (non-GIS option) become $US 25,393 (see Table 5.4).

For the non-GIS option Table 5.4 shows REMU operation costs that are almost 30% higher than those of the with-GIS version. This is caused by the additional data base expert (3x350$US/mm), one additional operator (3x100$US/mm), one additional soil expert (see chapter 3.6.8), and additional hardware replacement costs ($US1,910). These additionally required experts are already included in the with-GIS budget.

Table 5.3: **Annual Budget Needs for the Operation (GIS option)**

Pos	Item	Operation Costs [$US]
1	Hydrology, Geohydrology, Climate	4,643.5
2	Soil and Land use Survey (average)	4,485
3	Water quality	3026.04
4	Health	420
5	Parks, Biodiversity	894
6	Socio-Economy (average)	630
7	REMU (non-GIS option)	7,735
8	REMU GIS Group (Including hardware replacement)	4,560
	TOTAL	$US 26,393.54

Table 5.4: Annual Budget Needs for the Operation (non-GIS option)

Pos	Item	Set-up Costs [$US]
1	Hydrology, Geohydrology, Climate	4,643.5
2	Soil and Land use Survey (average)	4,785
3	Water quality	3,026.04
4	Health (every second year)	420
5	Parks, Biodiversity	894
6	Socio-Economy (average)	630
7	REMU (non-GIS option)	10,995
	TOTAL	$US 25,393.54

FINANCING OF ENVIRONMENTAL MONITORING

The REMU cost for a five year implementation period including the GIS components are indicated in Table 5.5

Year	**Equipment** [$US]	**Operational Costs** [$US]	**Total** [$US]
1	97,919	26,393	124,4312

2		26,393	26,393
3		26,393	26,393
4		26,393	26,393
5		26,393	26,393
	97,919	131,965	229,884

During the following years only $US26,393 are necessary for operation per year. All costs should be financed by GoA and IDA. Respective cost sharing should be negotiated among the parties, taking into account that GoA funds are very scare.

Further funds for the period after RIIDIA implementation may be financed partially by IDA under an Irrigation II – Project. It is recommended to Transfer REMU and its obligations to MoE (ASCE) after the five years RIIDIA implementation period.

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LIST OF ABBREVIATIONS

$US	US Dollar
AFA	Azerbaijan Fisheries Agency
AFORA	Azerbaijan Forestry Agency
AI	Azgiprovodkhoz Institute
ASCE	Azerbaijan State Committee on Ecology and the Control of the Natural Resource Utilisation
CGMR	Committee for Geology and Mineral Resources of Azerbaijan Republic
cm^2	Square centimetre
CSH	Committee of State Hydrometorology
CSSAR	Committee for State Statistics of Azerbaijan Republic
d/s	Downstream
EA	Environmental assessment
EAM	Environmental Assessment and Monitoring
EC	Electrical conductivity
eff_p	Project efficiency [%]
EIA	Environmental impact assessment
EMS	Environmental Monitoring System
FAO	Food and Agricultural Organisation of the United Nations
GIS	Geographic Information System
GoA	Government of Azerbaijan
GPS	Global Positioning System
GWM	Ground water mineralization (normally shallow or 'drainage' ground water)
ha	Hectare
hcp	River flow calculation point
HEC	Hydrologic Engineering Center, U.S. Army Corps of Engineers
HEIAPA	Handbook for the Environmental Impact Assessment Process in Azerbaijan
kg/s	Kilogram per second
km	Kilometre
km^2	Square kilometre
ls/ha	Litre(s) per second per hectare
m.s.l	Metres above sea level
m^3/s	Cubic metres per second
MCM	Million cubic metres
MKC	Main Karabakh Collector
mm	Millimetre
MMC	Mill Mugan Collector
MMMC	Main Mill Mugan Collector
MoH	Ministry of Health of Azerbaijan Republic
MOM	Management operation and maintenance

MM	man/month
n.a	not available
NEAP	National Environmental Action Plan
O&M	Operation and Maintenance
PC	Personal Computer
REMS	RIIDIA II Environmental Monitoring System
REMU	RIIDIA II Environmental Monitoring Unit
SAC	Samur Apsheron Canal
SAIC	State Amelioration and Irrigation Committee
SCCA	State Committee for Construction and Architecture
SCHCS	State Committee for Housing and Communal Services
SRA	State Railway Administration
TDS	Total dissolved solids
thou tons	1 000 metric tons
ToR	Terms of Reference
u/s	Upstream
UNDP	United Nations Development Programme
USBR	United State Bureau of Reclamation
USDA	United States Department of Agriculture
WB	World Bank
WHO	World Health Organisation of the United Nations
WMO	World Meteorological Organisation
WUA	Water users' association
HCO_3	Bicarbonate
SO_4	Sulphate
Cl	Chloride
Mg	Magnesium
Ca	Calcium
Na	Sodium
K	Potassium
NO_3	Nitrite
NO_2	Nitrate
NH_4	Ammonia

ANNEXES

ANNEX A

Main Infective Diseases In Relation to Water Supplies

Category	Disease	Frequency	Severity	Chronicity	% suggested reduction by water improvements
I	Cholera	+	+++		90
I	Typhoid	++	+++		80
I	Leptospirosis	+	++		80
I	Tularaemia	+	++		40?
I	Paratyphoid	+	++		40
I	Infective hepatitis	++	+++	+	10?
I	Some enteroviruses	++	+		10?
I, II	Bacillary dysentery	++	+++		50
I, II	Amoebic dysentery	+	++	++	50
I, II	Gastroenteritis	+++	+++		50
II	Skin sepsis and ulcers	+++	+	+	50
II	Trachoma	+++	++	++	60
II	Conjunctivitis	++	+	+	70
II	Scabies	++	+	+	80
II	Yaws	+	++	+	70
II	Leprosy	++	++	++	50
II	Tinea	+	+		50
II	Louse-borne fevers		+++		40
II	Diarrhoeal diseases	+++	+++		50
II	Ascariasis	+++	+	+	40
III a	Schistosomiasis	++	++	++	60
III b	Guinea worm	++	++	+	100
IV	Gambian sleeping sickness	+	+++	+	80
IV	Onchocerciasis	++	++	++	20?
IV	Yellow fewer	+	+++		10?

Category	Preventive Strategy
I Faecal-oral	Improve water quality. Prevent casual use of improved sources
II Water-washed	Improve water quality. Improve hygiene Improve water accessibility
III Water-based a. Penetrating skin b. Ingested	Decrease water contact. Control snails. Improve water quality
IV Water-related insect vectors	Improve surface water management. Destroy breeding sites. Decrease human insect contacts.

Source : HR. Wallingford, Report OD 131, March 1995

Guidelines for Interpretation of Water Quality for Irrigation

IRRIGATION PROBLEM	DEGREE OF PROBLEM		
	No Problem	Increasing Problem	Severe Problem
SALINITY (Affects crop water availabilty)			
ECw (mmhos/cm)	< 0.75	0.75-3.0	> 3.0
PERMEABILITY			
ECw (mmhos/cm)	> 0.5	0.5-0.2	< 0.2
adj. SAR [1/2/]			
Montmorillonite (2:1 crystal lattice)	< 6	6-9 [3/]	> 9
Illite-Vermicullite (2:1 crystal lattice)	< 8	8-16 [3/]	> 16
Kaolinite-sesquioxides (1:1 crsytal lattice)	<16	16-24 [3/]	> 24
SPECIFIC TOXICITY (Affects sensitive crops)			
Sodium [4/5/] (adj. SAR)	< 3	3-9	> 9
Chloride [4/5/] (meq/l))	< 4	4-10	> 10
Boron (mg/l))	< 0.75	0.75-2.0	> 2.0
MISCELLANAEOUS EFFECTS			
NO_3-N (or) NH_4 (mg-l)	< 5	5-30	> 30
HCO_3 (meq/l) [overhead Sprinkling]	< 1.5	1.5-8.5	> 8.5
pH	[Normal Range 6.5 to 8.4]		

1/ adj. SAR means adjusted Sodium Adsorption Ratio can be calculated using the procedure given in Table.3

2/ Values presented are for the dominant type clay mineral in the soil since structural stability varies between the various clay types (Rallings, 1996, and RHoades, 1975). Problems are less likely to develop if water salinity is high: more likely to develop if water salinity is low.

3/ Use the lower range if ECw < 0.4 mmhos/cm:
Use the intermediate range if ECw = 0.4-1.6 mmhos/cm:
Use the upper limit if ECw > 1.6 mmhos/cm:

4/ Most tree crops and woody ornamentals are sensitive to sodium and chloride (use values shown). Most annual crops are not sensitive (use the salinity toleranse tables [Table 5])

5/ With sprinkler irrigation on sensitive crops, sodium or chloride in excess of 3 meq/l under certain conditions has resulted in excessive leaf absorbtion and crop damage.
< means less than
> means more than

Source : FAO,1985 Water Quality for Agriculture, FAO Irrigation and Drainage paper 29 (revision 1), Food and Agricultural Organization of the United nations, Rome.

Recommended Maximum Concentrations of Trace Elements in Irrigation Waters

Element	Symbol	For Water Used Continuously on all soils mg/l	For Use up to 20 Years on Fine Textured Soils of pH 6.0 to 8.5 mg/l
Aluminium	Al	5.00	20.00
Arsenic	As	0.10	2.00
Beryllium	Be	0.10	0.50
Boron	B	1/	2.00
Cadmium	Cd	0.01	0.05
Chromium	Cr	0.10	1.00
Cobalt	Co	0.05	5.00
Copper	Cu	0.20	5.00
Fluoride	F	1.00	15.00
Iron	Fe	5.00	20.00
Lead	Pb	5.00	10.00
Lithium	Li[2/]	2.50	2.50
Manganese	Mn	0.20	10.00
Molybdenum	Mo	0.01	0.05[3/]
Nickel	Ni	0.20	2.00
Selenium	Se	0.02	0.02
Vanadium	V	0.10	1.00
Zinc	Zn	2.00	10.00

These levels will normally not adversely affect plants or soils. No data available for Mercury (Hg), Silver (Ag), Tin (Ti), Tungsten (W).

[1/] See Table 1.

[2/] Recomended maximum concentration for irrigating citrus is 0.075 mg/l

[3/] For only acid fine textured soils or acid soils with relatively high iron oxide contents.

Source: Environmental Studies Board, Nat. Acad. of Sci. Nat. Acad. of Eng. Water Quality Criteria 1972.

Recommendations for Level of Toxic Substances in Drinking Water for Livestock

Constituent	Symbol	Upper Limit mg/l
Aluminium	Al	5
Arsenic	As	0.2
Beryllium	Be	no data
Boron	B	5
Cadmium	Cd	0.05
Chromium	Cr	1
Cobalt	Co	1
Copper	Cu	0.5
Fluoride	F	2
Iron	Fe	no data
Lead	Pb	0.1[1/]
Manganese	Li[2/]	no data
Mercury	Hg	0.01
Molybdenum	Mo	no data
Nitrate + Nitrite	NO_2-N	100.0
Nitrite	NO_3-N + NO_2-N	10.0
Selenium	Se	0.1
Vanadium	V	0.1
Zinc	Zn	24.0
Total Dissolved Solids	TDS	10 000[2/]

[1/] Lead is accumulative and problems may begin at treshhold value=.05 mg/l

[2/] See Table 12.

Source: Environmental Studies Board, Nat. Acad. of Sci. Nat. Acad. of Eng. Water Quality Criteria 1972.

Inorganic Constituents for Drinking Water Quality

Characteristics	Unit	Health-based guideline
Antimony	mg/l	0.005
Arsenic	mg/l	0.01
Barium	mg/l	0.7
Boron	mg/l	0.3
Cadmium	mg/l	0.003
Chromium	mg/l	0.05
Copper	mg/l	2
Cyanide	mg/l	0.07
Fluoride	mg/l	1.5
Lead	mg/l	0.01
Manganese	mg/l	0.5
Mercury	mg/l	0.001
Molybdenum	mg/l	0.07
Nickel	mg/l	0.02
Nitrate	mg/l	50
Nitrite	mg/l	3
Selenium	mg/l	0.01
Uranium	µg/l	140
		Consumer Acceptability Level
Aluminum	mg/l	0.2
Chloride	mg/l	250
Hardness as CaCO3	mg/l	500
Hydrogen Sulphide	mg/l	0.05
Iron	mg/l	0.3
Manganese	mg/l	0.1
pH		6.5-9.5
Sodium	mg/l	200
Sulphate	mg/l	250
Total Dissolved solids	mg/l	1200
Zinc	mg/l	4

Source: WHO, 1993

Water Quality for Freshwater Fish (temperate zone excluding salmonids)

Characteristic	Level at which no stress is shown
Dissolved Oxygen	50 % of the time ^{3} 7 mg/l O_2
Non-ionised Ammonia	£ 0.025 mg/l NH3

Notes:

1 The two parameters to which fish are more sensitive are temperature and dissolved oxygen Oxygen is less soluble in water at hihger temperatures. Also more non-ionised ammonia, which is toxic to fish, moves into solution from NH_4^{1+} as the temperature rises as well as an increase in pH. the higher the ambient temperature, the closer fish are living to their upper tolerance limit and the less able they are to tolerate changes to their environment. Organic pollution will reduce the dissolved oxygen content of the water.

2 A wide range of heavy metals, industrial pollutants and agrochemicals are toxic to fish.

3 More information may be obtained from FAO Fisheries Technical Papers.

Source : EC Council Directive (78/659/EEC) on the quality of fresh water needing protection or improvements in order to support fish life.

Imishli Climate Station

Relative Humidity [%]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	77	74	71	63	68	59	63	66	67	72	78	74	69,3
1989	67	67	64	62	60	58	53	59	66	68	72	75	64,3
1990	77	79	66	75	66	60	58	61	62	74	75	77	69,2
1991	76	74	74	68	66	54	57	56	64	68	75	77	67,4
1992	63	70	68	67	61	57	58	58	64	61	73	83	65,3
1993	71	76	61	66	64	60	56	58	58	66	82	78	66,3
1994	78	75	67	66	66	60	56	52	58	56	78	71	65,3
1995	72	69	65	64	61	56	55	52	61	66	70	65	63,0
1996	74	71	78	73	62	55	55	56	63	70	78	81	68,0
1997	79	80	73	61	61	59	51	49	66	67	72	81	66,6
Avg	73,4	73,5	68,7	66,5	63,5	57,8	56,2	56,7	62,9	66,8	75,3	76,2	66,5

Wind velocity [m/s]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	0,6	0,8	1,2	1,3	1,4	1,2	1,2	1,5	1,5	1,2	1,2	1,3	1,2
1989	1,6	1,2	1,4	2,0	2,0	1,7	1,4	1,5	1,0	1,2	1,4	1,2	1,5
1990	1,1	1,2	1,9	1,7	1,9	1,5	1,5	1,6	1,5	1,2	1,2	1,3	1,5
1991	1,3	1,2	1,4	1,5	1,9	1,4	1,1	1,1	1,6	1,0	0,9	0,9	1,3
1992	1,2	1,4	1,5	2,0	1,5	1,7	1,5	1,4	1,4	1,7	1,1	0,8	1,4
1993	1,2	1,4	1,8	1,8	1,8	1,6	1,7	1,3	0,1	1,3	1,3	1,1	1,4
1994	1,0	1,7	1,9	1,6	1,7	1,5	1,5	1,4	1,3	0,1	1,1	0,8	1,3
1995	0,9	0,8	1,1	1,3	1,3	1,4	1,4	1,0	1,0	1,0	1,1	0,8	1,1
1996	0,8	1,4	1,5	1,6	1,4	1,7	1,4	1,7	0,9	1,2	0,8	1,1	1,3
1997	1,3	1,0	1,2	2,2	1,7	1,5	1,6	1,6	1,3	9,2	0,9	0,8	2,0
Avg	1,1	1,21	1,49	1,7	1,66	1,52	1,43	1,41	1,16	1,91	1,1	1,01	1,4

Air Temperature [°C]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	3,2	3,6	7,9	14,5	18,1	25,1	26,7	25,6	22,1	16,8	9,4	7,0	15,0
1989	3,0	3,3	10,8	15,1	20,0	24,8	28,2	27,8	22,7	16,7	10,9	5,6	15,7
1990	3,0	4,6	9,3	13,0	18,1	24,8	27,5	26,0	23,7	16,3	12,0	6,8	15,4
1991	3,3	3,6	7,1	14,4	18,2	24,0	28,1	27,2	23,0	18,9	10,5	4,6	15,2
1992	3,2	4,0	7,8	13,4	17,6	23,9	26,3	25,1	21,6	15,6	9,4	5,0	14,4
1993	3,0	2,7	8,2	13,6	19,3	23,6	26,1	26,8	25,3	15,4	5,2	4,3	14,5
1994	4,6	2,9	8,6	14,8	19,3	22,7	26,4	27,0	22,9	22,2	10,0	3,4	15,4
1995	5,2	7,0	8,9	15,7	20,8	25,3	27,9	27,4	23,2	15,4	11,6	4,9	16,1
1996	3,5	5,3	6,6	11,6	20,9	23,7	27,8	27,2	23,5	17,2	10,3	8,6	15,5
1997	4,6	3,6	7,1	15,1	20,7	25,0	27,3	27,7	19,1	16,7	9,7	4,3	15,1
Avg	3,66	4,06	8,23	14,1	19,3	24,3	27,2	26,8	22,7	17,1	9,9	5,45	15,2

Precipitation [mm]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	3,5	12,1	22,9	32,9	59,4	50,8	19,9	17,7	19,8	23,8	37,9	31,0	331,7
1989	5,8	13,3	10,5	10,9	14,2	1,2	4,4	8,9	82,3	91,4	55,6	23,1	321,6
1990	36,0	22,3	5,3	71,7	28,1	27,9	0,4	3,8	0,7	42,2	11,5	16,2	266,1
1991	28,4	30,2	76,8	20,2	54,4	5,3	17,2	4,2	0,0	16,7	62,0	18,8	334,2
1992	4,6	22,6	16,8	39,1	20,6	44,9	16,3	10,1	41,5	28,6	52,6	55,9	353,6
1993	22,0	13,1	9,1	22,8	54,8	45,6	4,1	0,6	0,0	0,7	96,9	9,0	278,7
1994	12,8	18,9	29,4	27,1	37,2	37,5	0,0	0,0	0,0	0,0	55,9	43,4	262,2
1995	20,2	13,9	40,1	27,9	8,5	19,1	2,3	0,0	111,6	5,0	14,1	3,5	266,2
1996	17,6	3,8	50,8	28,2	16,9	14,8	1,1	0,4	8,3	19,1	10,0	15,5	186,5
1997	13,1	33,6	33,2	3,5	24,9	52,2	16,9	0,0	61,7	8,6	0,0	18,9	266,6
Avg	16,4	18,4	29,5	28,4	31,9	29,9	8,3	4,6	32,6	23,6	39,7	23,5	286,7

Khachmaz Climate Station

Relative Humidity [%]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	87	86	86	75	78	73	66	68	76	80	87	86	79,0
1989	81	80	84	77	70	68	68	67	73	81	83	86	76,5
1990	85	83	74	78	76	66	63	69	73	83	85	88	76,9
1991	85	85	84	77	76	66	61	68	74	77	86	81	76,7
1992	78	85	78	75	71	68	68	69	79	82	85	89	77,3
1993	80	81	80	80	77	72	66	69	75	81	86	84	77,6
1994	85	81	83	78	78	70	64	68	72	80	86	84	77,4
1995	86	85	84	80	77	73	61	70	75	81	85	88	78,8
1996	89	86	85	82	70	64	62	69	76	84	83	87	78,1
1997	87	84	77	79	71	69	69	72	80	86	85	86	78,8
Avg	84,3	83,6	81,5	78,1	74,4	68,9	64,8	68,9	75,3	81,5	85,1	85,9	77,7

Wind velocity [m/s]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	2,1	2,2	2,4	2,8	2,0	2,1	2,3	2,0	2,4	2,2	2,4	2,2	2,3
1989	2,2	1,9	2,3	2,4	2,6	3,0	3,0	3,1	3,4	2,0	2,0	2,4	2,5
1990	2,3	2,2	2,6	2,3	2,1	2,3	2,3	2,1	2,0	2,0	1,8	2,1	2,2
1991	2,3	3,0	2,4	3,0	3,0	2,5	2,9	3,4	2,8	2,2	2,3	2,6	2,7
1992	2,7	2,9	2,7	2,7	1,8	1,8	2,5	1,8	2,1	1,5	2,3	2,1	2,2
1993	2,4	3,0	2,4	2,0	2,0	1,7	1,9	1,6	1,9	1,2	2,7	1,3	2,0
1994	1,9	2,6	2,8	1,9	1,8	2,7	1,9	2,6	2,1	2,0	2,3	2,1	2,2
1995	1,7	1,9	2,3	2,5	2,1	2,3	2,9	2,2	2,9	2,1	2,2	2,1	2,3
1996	1,8	2,8	2,3	2,6	2,3	3,1	2,1	2,4	2,3	2,2	1,5	2,1	2,3
1997	2,0	2,4	2,1	2,2	1,4	2,3	2,1	2,6	2,5	2,2	1,9	2,6	2,2
Avg	2,14	2,49	2,43	2,44	2,11	2,38	2,39	2,38	2,44	1,96	2,14	2,16	2,3

Air temperature [°C]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	2,4	0,4	5,0	11,1	14,4	22,2	25,2	23,9	19,2	14,5	7,2	5,4	12,6
1989	1,2	1,5	6,7	10,6	16,3	21,2	25,2	25,2	20,6	14,1	9,1	4,1	13,0
1990	2,4	2,7	6,3	10,6	14,8	22,1	24,9	23,1	21,1	14,0	10,7	4,8	13,1
1991	2,3	0,2	4,4	11,4	15,1	21,3	25,4	24,7	19,9	16,3	8,8	4,3	12,8
1992	1,5	1,8	4,4	9,8	14,8	20,9	23,3	22,8	18,5	13,2	7,9	3,3	11,9
1993	1,7	0,6	4,9	9,4	15,8	20,9	23,2	24,1	18,6	12,3	3,2	2,3	11,4
1994	3,5	0,3	4,3	11,1	15,6	19,8	23,5	23,6	20,0	15,2	8,2	2,0	12,3
1995	3,1	4,8	6,1	11,2	17,4	23,8	25,2	23,9	20,6	13,4	9,7	2,4	13,5
1996	2,3	2,0	3,9	8,2	17,3	21,2	25,3	24,1	19,9	13,8	9,1	6,3	12,8
1997	2,0	1,3	4,1	9,9	17,5	22,3	24,6	24,2	16,9	14,6	8,1	4,0	12,5
Avg	2,24	1,56	5,01	10,3	15,9	21,6	24,6	24	19,5	14,1	8,2	3,89	12,6

Precipitation [mm]

Year	Months												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1988	26,9	11,6	53,8	28,7	14,8	16,5	9,2	2,8	55,7	12,9	48,9	44,6	326,4
1989	29,2	52,3	3,2	9,1	5,3	1,9	4,2	13,9	24,5	21,0	12,9	35,2	212,7
1990	58,9	31,5	12,9	37,2	23,1	3,3	2,0	9,1	5,8	93,2	28,3	48,5	353,8
1991	35,7	25,7	29,0	3,2	37,8	6,2	8,2	14,5	13,3	5,9	47,9	10,8	238,2
1992	15,6	40,8	1,5	18,8	12,8	13,9	30,4	31,1	55,2	18,9	60,8	53,0	352,8
1993	42,6	41,0	8,7	20,9	6,6	35,4	8,8	17,5	34,3	25,1	78,0	3,8	322,7
1994	11,4	20,1	30,6	23,8	24,0	9,1	11,8	3,6	10,9	42,3	44,7	52,0	284,3
1995	16,5	7,6	53,4	5,9	3,4	19,4	1,9	8,6	119,2	80,6	21,4	33,0	370,9
1996	25,4	15,4	19,1	23,3	10,4	12,6	0,0	20,5	34,8	37,2	49,0	13,8	261,5
1997	33,3	41,7	3,2	11,1	3,1	18,7	17,4	12,5	74,8	12,4	8,4	25,0	261,6
Avg	29,6	28,8	21,5	18,2	14,1	13,7	9,39	13,4	42,9	35	40	32	298,5

SAC Groundwater Data
Depth of Groundwater Table [m below surface]

	Well N 458, SAC, GW-1	Well N 393, SAC, GW-2	Well N 387, SAC-GW-3	Well N 191, SAC, GW-4	Well N 164, SAC, GW-5	Well N 110, SAC, GW-6	Well N 83, SAC, GW-7
01 94	1,13	5,32	1,75	1,48	2,73	0,69	2,26
02 94	1,15	5,38	1,71	1,41	2,75	0,68	2,19
03 94	1,17	5,41	1,76	1,31	2,78	0,63	2,30
04 94	1,16	5,42	1,82	1,28	2,71	0,60	2,32
05 94	1,30	5,40	1,87	1,27	2,68	0,63	2,29
06 94	1,27	5,35	1,95	1,25	2,57	0,65	2,13
07 94	1,20	5,31	1,99	1,22	2,53	0,69	2,07
08 94	1,15	5,26	2,12	1,27	2,49	0,71	2,03
09 94	1,17	5,18	2,06	1,39	2,46	0,75	2,12
10 94	1,10	5,20	2,13	1,41	2,45	0,74	2,14
11 94	1,21	5,26	2,13	1,47	2,51	0,73	2,16
12 94	1,26	5,29	2,02	1,42	2,60	0,72	2,09
01 95	1,21	5,36	2,06	1,40	2,65	0,75	2,17
02 95	1,26	5,37	2,10	1,38	2,68	0,73	2,18
03 95	1,28	5,42	2,13	1,37	2,71	0,78	2,22
04 95	1,21	5,40	2,17	1,36	2,91	0,76	2,26
05 95	1,36	5,35	2,21	1,32	2,85	0,73	2,23
06 95	1,33	5,31	2,22	1,30	2,70	0,68	2,26
07 95	1,32	5,27	2,21	1,33	2,68	0,67	2,23
08 95	1,30	5,19	2,18	1,31	2,63	0,70	2,09
09 95	1,35	5,12	2,03	1,40	2,62	0,72	2,12
10 95	1,31	5,17	2,10	1,43	2,60	0,76	2,06
11 95	1,22	5,18	2,06	1,47	2,65	0,73	2,13
12 95	1,15	5,22	1,97	1,46	2,68	0,74	2,16
01 96	1,03	5,21	1,81	1,55	2,85	0,75	2,12
02 96	1,10	5,30	1,60	1,35	2,90	0,72	2,25
03 96	1,20	5,32	1,72	1,32	2,95	0,65	2,43
04 96	1,02	5,37	1,80	1,26	2,92	0,62	2,44
05 96	1,35	5,30	1,85	1,20	2,87	0,65	2,48
06 96	1,20	5,27	1,90	1,17	2,75	0,67	2,02
07 96	1,03	5,20	1,97	1,19	2,63	0,68	2,03
08 96	0,95	5,18	2,05	1,00	2,58	0,67	1,94
09 96	2,98	5,10	2,10	1,70	2,60	0,75	1,95
10 96	0,95	5,15	2,15	1,66	2,67	0,72	1,98
11 96	1,04	5,21	2,10	1,71	2,72	0,71	1,98
12 96	1,07	5,26	1,95	4,62	2,80	0,70	2,05
01 97	1,15	5,27	1,98	1,43	2,77	0,72	2,09
02 97	1,17	5,28	1,91	1,41	2,79	0,73	2,13
03 97	1,18	5,31	1,93	1,13	2,83	0,74	2,42
04 97	1,20	5,32	1,97	1,40	2,85	0,68	2,40
05 97	1,31	5,27	1,99	1,41	2,83	0,63	2,41
06 97	1,38	5,23	1,98	1,35	2,79	0,68	2,38
07 97	1,33	5,19	2,02	1,36	2,73	0,71	2,32
08 97	1,19	5,16	2,10	1,33	2,70	0,72	2,19
09 97	1,22	5,19	2,13	1,40	2,73	0,76	2,13
10 97	1,18	5,21	2,17	1,47	2,77	0,73	2,16
11 97	1,17	5,26	2,13	1,48	2,79	0,77	2,19
12 97	1,09	5,23	2,00	1,38	2,84	0,75	2,09
01 98	1,06	5,31	2,06	1,39	2,86	0,76	2,13
02 98	1,12	5,36	2,13	1,33	2,87	0,75	2,26
03 98	1,13	5,38	2,17	1,31	2,91	0,77	2,49
04 98	1,14	5,41	2,26	1,36	2,97	0,79	2,45
05 98	1,28	5,42	2,31	1,38	2,94	0,80	2,49
06 98	1,32	5,38	2,33	1,32	2,92	0,77	2,51
07 98	1,36	5,36	2,31	1,43	2,88	0,73	2,46
08 98	1,32	5,31	2,33	1,46	2,84	0,76	2,41
09 98	1,33	5,36	2,30	1,51	2,86	0,78	2,35
10 98	1,30	5,42	2,32	1,52	2,89	0,79	2,35
11 98	1,26	5,36	2,12	1,62	2,93	0,81	2,30
12 98	1,20	5,32	2,08	1,73	2,88	0,83	2,16

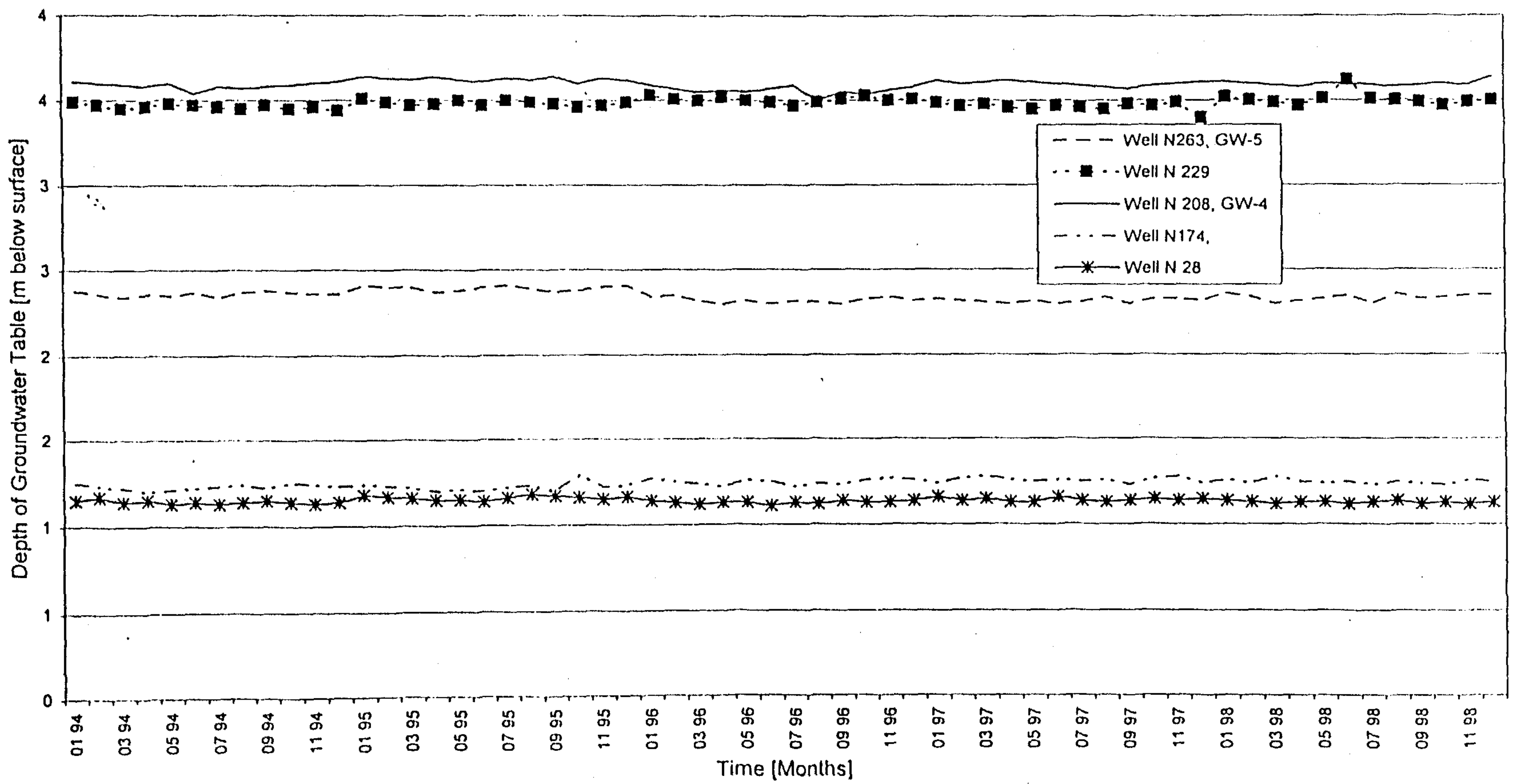
MMMC Groundwater Data

Depth of Groundwater Table (m below surface)

	Well N263, GW-5	Well N 229	Well N 208, GW-4	Well N174,	Well N 28
01 94	2,38	3,49	3,61	1,25	1,15
02 94	2,36	3,47	3,60	1,23	1,17
03 94	2,34	3,45	3,59	1,22	1,14
04 94	2,36	3,46	3,58	1,20	1,15
05 94	2,35	3,48	3,60	1,21	1,13
06 94	2,37	3,47	3,54	1,22	1,14
07 94	2,34	3,46	3,58	1,23	1,13
08 94	2,37	3,45	3,57	1,24	1,14
09 94	2,38	3,47	3,58	1,22	1,15
10 94	2,37	3,45	3,59	1,25	1,14
11 94	2,36	3,46	3,60	1,24	1,13
12 94	2,36	3,44	3,61	1,23	1,14
01 95	2,41	3,51	3,64	1,24	1,18
02 95	2,40	3,49	3,63	1,23	1,17
03 95	2,40	3,47	3,62	1,22	1,16
04 95	2,37	3,48	3,64	1,20	1,15
05 95	2,38	3,50	3,62	1,21	1,15
06 95	2,40	3,47	3,61	1,20	1,14
07 95	2,41	3,50	3,63	1,22	1,16
08 95	2,39	3,49	3,62	1,23	1,18
09 95	2,37	3,48	3,64	1,20	1,17
10 95	2,38	3,46	3,60	1,29	1,16
11 95	2,40	3,47	3,63	1,22	1,15
12 95	2,41	3,49	3,62	1,23	1,17
01 96	2,34	3,53	3,59	1,27	1,14
02 96	2,35	3,51	3,57	1,25	1,13
03 96	2,32	3,50	3,55	1,24	1,12
04 96	2,30	3,52	3,56	1,22	1,13
05 96	2,32	3,50	3,55	1,26	1,13
06 96	2,30	3,49	3,57	1,25	1,11
07 96	2,32	3,47	3,59	1,22	1,13
08 96	2,31	3,49	3,50	1,24	1,12
09 96	2,30	3,51	3,55	1,23	1,14
10 96	2,33	3,53	3,54	1,26	1,13
11 96	2,34	3,50	3,56	1,27	1,13
12 96	2,32	3,51	3,58	1,26	1,14
01 97	2,33	3,49	3,62	1,24	1,16
02 97	2,32	3,47	3,60	1,27	1,14
03 97	2,31	3,48	3,61	1,28	1,15
04 97	2,30	3,46	3,62	1,25	1,13
05 97	2,32	3,45	3,61	1,25	1,13
06 97	2,30	3,47	3,60	1,26	1,16
07 97	2,31	3,46	3,59	1,25	1,14
08 97	2,34	3,45	3,58	1,26	1,13
09 97	2,30	3,48	3,57	1,23	1,14
10 97	2,33	3,47	3,59	1,27	1,15
11 97	2,33	3,49	3,60	1,28	1,14
12 97	2,32	3,40	3,61	1,24	1,15
01 98	2,36	3,52	3,61	1,26	1,14
02 98	2,34	3,50	3,60	1,24	1,13
03 98	2,30	3,49	3,59	1,28	1,12
04 98	2,32	3,47	3,58	1,25	1,13
05 98	2,33	3,51	3,60	1,24	1,13
06 98	2,35	3,62	3,60	1,25	1,12
07 98	2,30	3,51	3,59	1,23	1,13
08 98	2,36	3,50	3,58	1,25	1,14
09 98	2,33	3,49	3,59	1,24	1,12
10 98	2,34	3,47	3,60	1,23	1,13
11 98	2,35	3,49	3,59	1,26	1,12
12 98	2,35	3,50	3,64	1,25	1,13

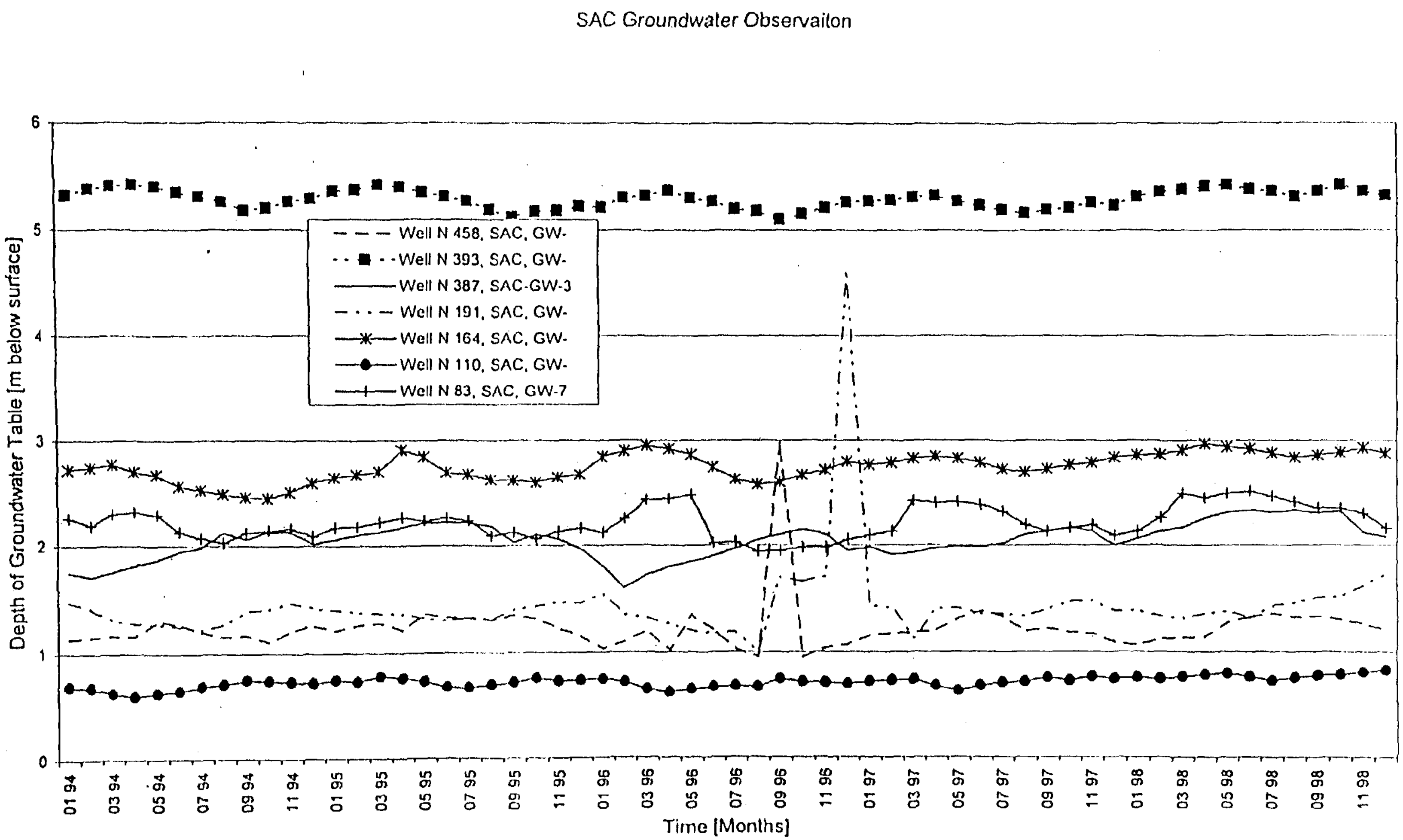
MMMC Groundwater Data

MMMC Groundwater Observaiton



Annex A8

SAC Groundwater Data



Annex A8

Mechanical Soil Analysis of the Field Trips in MMMC Area dated 26-27 July 1999

Sampling Point	Depth cm	Hydrioscopic Humidity %	Fractions, mm						
			1.0-0.25	0.01-0.05	0.05-0.01	0.01-0.005	0.005-0.001	0.001	<0.01
2	0-20	5,00	1,04	41,68	31,12	9,40	6,12	10,64	26,16
	20-40	6,62	0,86	68,22	11,48	6,68	8,92	3,84	19,44
	40-60	4,81	1,01	47,67	27,76	12,52	8,52	2,52	23,56
4	0-20	4,76	0,60	18,72	24,28	20,00	11,28	25,12	56,40
	20-40	4,76	4,50	19,34	17,68	10,20	17,88	30,40	58,48
	40-60	5,71	3,91	20,45	11,00	8,08	18,64	37,92	64,64
8	0-20	5,71	1,34	19,34	16,80	6,16	20,20	36,16	62,52
	20-40	4,69	1,29	11,39	26,16	8,32	16,48	36,36	61,16
	40-60	5,45	6,08	16,84	14,52	15,84	12,00	34,72	62,56
11	0-20	5,05	0,07	21,37	17,88	10,32	21,92	28,44	60,58
	20-40	5,00	0,25	18,95	20,76	7,00	15,60	37,44	60,04
	40-60	4,88	0,47	16,73	14,40	15,44	23,00	29,96	68,40

Soil Survey Results in the SAC Area (26-27 July 1999)

No	Sampling Points	Depth cm	%								meq/l							
			NSO_3	Cl	SO_4	Ca	Mg	Na+K	Total Ions	Driod Subs.	NSO_3	Cl	SO4	Ca	Mg	Na+K	Total Ions	Ca+Mg
1		0-20	0.024	0.009	0.178	0,036	0,023	0,015	0,285	0,300	0,40	0,25	3,71	1,86	1,90	0,66	4,36	3,70
2	1	20-40	0.034	0.013	0,048	0,010	0,013	0,008	0,126	0,140	0,55	0,38	1,00	0,50	1,10	0,33	1,93	1,60
3		40-60	0.027	0.009	0,101	0,020	0,016	0,012	0,185	0,202	0,45	0,25	2,10	1,00	1,30	0,50	2,80	2,30
4		0-20	0.031	0.009	0,048	0,008	0,011	0,010	0,117	0,120	0,50	0,25	1,00	0,40	0,90	0,45	1,75	1,30
5	2	20-40	0.057	0.013	0,048	0,008	0,011	0,017	0,134	0,150	0,60	0,38	1,00	0,40	0,90	0,68	1,98	1,30
6		40-60	0.058	0.013	0,043	0,008	0,007	0,028	0,157	0,164	0,95	0,38	0,90	0,40	0,60	1,23	2,23	1,00
7		0-20	0.058	0,009	0,043	0,008	0,011	0,018	0,147	0,160	0,95	0,25	0,90	0,40	0,90	0,80	2,10	1,30
8	3	20-40	0.07	0.009	0,067	0,010	0,010	0,035	0,201	0,218	1,15	0,25	1,40	0,50	0,80	1,50	2,80	1,30
9		40-60	0.073	0.026	0,096	0,010	0,010	0,061	0,276	0,290	1,20	0,75	2,00	0,50	0,80	2,65	3,95	1,30
10		0-20	0.042	0.670	0,711	0,180	0,066	0,449	2,142	2,308	0,70	18,87	14,81	9,50	5,50	19,88	34,38	14,50
11	4	20-40	0.056	0.387	0,720	0,130	0,046	0,377	1,716	1,789	0,92	10,88	15,00	6,50	3,87	16,43	26,80	10,37
12		40-60	0.049	0.408	0,672	0,140	0,058	0,332	1,659	1,801	0,80	11,50	14,00	7,00	4,87	14,43	26,30	11,87
13		0-20	0.042	0.237	0,647	0,112	0,042	0,270	1,350	1,400	0,70	6,69	13,50	5,62	3,50	11,77	20,89	9,12
14	5	20-40	0.04	0.220	0,696	0,127	0,046	0,255	1,384	1,501	0,65	6,19	14,50	6,37	3,87	11,10	21,34	10,24
15		40-60	0.042	0.240	0,504	1,11	0,034	0,220	1,150	1,210	0,70	6,75	10,50	5,50	2,87	9,58	17,95	8,37
16		0-20	0.046	0.013	0,048	0,008	0,008	0,024	0,147	0,660	0,75	0,38	1,00	0,40	0,70	1,03	2,13	1,10
17	6	20-40	0.043	0.009	0,053	0,014	0,010	0,013	0,142	0,150	0,70	0,25	1,10	0,70	0,80	0,55	2,05	1,50
18		40-60	0.04	0.018	0,038	0,012	0,005	0,022	0,135	0,148	0,65	0,50	0,79	0,60	0,40	0,94	1,94	1,00
19		0-20	0.052	0.009	0,053	0,010	0,002	0,035	0,161	0,174	0,85	0,25	1,10	0,50	0,20	1,50	2,20	0,70
20	7	20-40	0.04	0.022	0,038	0,008	0,004	0,032	0,144	0,152	0,65	0,63	0,79	0,40	0,30	1,37	2,07	0,70
21		40-60	0.049	0.009	0,034	0,008	0,005	0,022	0,127	0,134	0,80	0,25	0,71	0,40	0,40	0,96	1,76	0,80
22		0-20	0.058	0,013	0,053	0,006	0,002	0,044	0,176	0,186	0,95	0,38	1,10	0,30	0,20	1,93	2,43	0,50
23	8	20-40	0.073	0.013	0,072	0,006	0,002	0,059	0,225	0,244	1,20	0,38	1,50	0,30	0,20	2,58	3,08	0,50
24		40-60	0.034	0.018	0,062	0,010	0,006	0,031	0,161	0,170	0,55	0,50	1,29	0,50	0,50	1,34	2,34	1,00
25		0-20	0.043	0.009	0,058	0,010	0,002	0,034	0,156	0,168	0,70	0,25	1,21	0,50	0,20	1,46	2,16	0,70
26	9	20-40	0.037	0,013	0,048	0,006	0,005	0,029	0,138	0,146	0,60	0,38	1,00	0,30	0,40	1,28	1,98	0,70
27		40-60	0.043	0.009	0,067	0,006	0,004	0,040	0,169	0,180	0,70	0,25	1,40	0,30	0,30	1,75	2,35	0,60
28		0-20	0.052	0.013	0,053	0,006	0,002	0,042	0,168	0,176	0,85	0,38	1,10	0,30	0,20	1,83	2,33	0,50
29	10	20-40	0.055	0.018	0,062	0,008	0,004	0,046	0,193	0,208	0,90	0,50	1,29	0,40	0,30	1,99	2,69	0,70
30		40-60	0.043	0,009	0,048	0,008	0,005	0,026	0,139	0,150	0,70	0,25	1,00	0,40	0,40	1,15	1,95	0,80
31		0-20	0.064	0.018	0,072	0,006	0,004	0,056	0,220	0,236	1,05	0,50	1,50	0,30	0,30	2,45	3,05	0,60
32	11	20-40	0.046	0.013	0,058	0,006	0,002	0,042	0,167	0,180	0,75	0,38	1,21	0,30	0,20	1,84	2,34	0,50
33		40-60	0.04	0.013	0,043	0,006	0,004	0,031	0,137	0,138	0,65	0,38	0,90	0,30	0,30	1,33	1,93	0,60
34		0-20	0.043	0.018	0,048	0,018	0,012	0,007	0,146	0,154	0,70	0,50	1,00	0,90	1,00	0,30	2,20	1,90
35	12	20-40	0.049	0.013	0,043	0,010	0,007	0,023	0,145	0,158	0,80	0,38	0,90	0,50	0,60	0,98	2,08	1,10

Annex A. 10 Meliorative Conditions of Irigated Soils of the MMMC and SAC Monitoring Areas

Districts	Irrigated Area (ha)	Drained Area of the Irrigated Area (ha)	Salinity of Irrigation Water (g/l)			Salinity Classication of Irrigated Soils (ha) (0-100 cm depth)				Alkalinity Classification of Irrigated Soils (ha)			Classification of Irrigated Soils According to the Groundwater depth and Salinization (ha)		
			< 1.0	1.0 - 2.0	> 2.0	Unsalined	Slightly Salined	Moderately Salined	Highly Salined	Neutral	Slightly Alkaline	Moderately and Highly Alkaline	Good	Enough	Not Enough
MMMC Area															
Imishli	45856	20502	-	45856	-	22541	18410	3570	1335	11980	23540	10336	15947	20042	9869
Saatli	54096	54096	-	54096	-	13533	31557	8625	381	-	-	-	90	44335	9671
Sabirabad	65267	65267	-	65267	-	36878	21543	4438	2408	-	-	-	333	56134	8800
Beylagan	52801	37726	51851	950	-	33474	16810	2218	299	52801	-	-	27905	20109	5597
SAC Area															
Qusar	30100	-	30100	-	-	30100	-	-	-	30100	-	-	18500	3300	8300
Quba	26600	-	26600	-	-	26600	-	-	-	26600	-	-	17800	5400	3400
Khachmaz	52300	10800	52300	-	-	45900	5300	1100	-	37000	15300	-	24000	24400	3900

Source : SAIC's Hydrogeological and Meliorative Expedition, Meliorative Conditions of Irrigated Soils of Azerbaijan in 01.01.1997, Baku

Annex A.11 Erosion Assessment of the Irrigated Soils by Means of Gravity In the SAC Area (Total Irrigated Area Is 105, 150 ha)

Bottom FlashingSpeed in m/s	Absorbtion Speed (mm/minutes)	Soil Washing (t/ha)	% from the Irrigated Areas	Assessment of Evaluation Of Soil Erosion
4×10^{-2}	0.08	23.91	11	Highly erosive
6×10^{-2}	0.17	20.98	9	Highly erosive
5×10^{-2}	0.005	98.71	41	Highly erosive
5×10^{-2}	0.009	87.8	39	Highly erosive

Source : AI, 1986, Complex Environmental Protection Scheme of Azerbaijan Republic up to the year 2010

Sampling Points of SAC

No	N	E
1	41°27'06	48°52'29
2[b]	41°27'52	48°50'26
3	41°26'13	48°48'04
4[b]	41°24'16	48°47'10
5	41°23'02	48°46'09
6	41°25'19	48°45'06
7	41°28'15	48°44'32
8	41°31'35	48°48'44
9	41°33'48	48°47'26
10[b]	41°30'14	48°42'23
11	41°32'23	48°37'47
12	41°33'01	48°43'23
13	41°38'15	48°43'55
14	41°43'52	48°32'18
15[b]	41°39'32	48°39'38
16[a]	41°25'00	48°55'00
17[a]	41°30'00	48°53'00
18[a]	41°37'00	48°39'30
19[a]	41°37'00	48°33'00
20[a]	41°41'20	48°29'30

Sampling Points of MMMC

No	N	E
1	39°58'56	48°21'03
2[b]	39°55'26	48°15'03
3	39°55'55	48°05'03
4	39°01'25	48°02'26
5[b]	39°54'22	48°02'04
6	39°57'06	48°58'32
7	39°54'30	48°57'35
8[b]	39°52'07	48°55'45
9	39°47'51	48°55'41
10	39°45'52	48°53'14
11[b]	39°47'20	48°50'25
12	39°47'43	48°47'49
13[a]	39°57'00	48°09'30
14[a]	40°01'00	48°07'00
15[a]	39°59'00	47°33'30
16[a]	39°53'00	47°51'00
17[a]	39°51'00	47°58'30
18[a]	39°50'30	47°52'30
19[a]	39°59'00	47°35'20
20[a]	39°53'00	47°40'00

a denotes: proposed soil sampling points for future monitoring campaigns;
b denotes: sampling points for mechanical properties of soil

Soil Survey Results in the SAC Area (29-30 July 1999)

No	Sampling Points	Depth cm	% NSO₃	% Cl	% SO₄	% Ca	% Mg	% Na+K	% Total ions	% Dried Subs.	meq/l NSO₃	meq/l Cl	meq/l SO4	meq/l Ca	meq/l Mg	meq/l Na+K	meq/l Total ions	meq/l Ca+Mg
1	1	0-20	0,046	0,005	0,029	0,018	0,005	0,004	0,107	0,108	0,75	0,13	0,60	0,90	0,40	0,18	1,48	1,30
2		20-40	0,055	0,005	0,010	0,016	0,004	0,003	0,093	0,100	0,90	0,13	0,21	0,80	0,30	0,14	1,24	1,10
3		40-60	0,043	0,005	0,013	0,014	0,005	0,003	0,089	0,090	0,70	0,13	0,40	0,70	0,40	0,13	1,23	1,10
4	2	0-20	0,052	0,005	0,014	0,016	0,004	0,004	0,095	0,100	0,85	0,13	0,29	0,80	0,30	0,17	1,27	1,10
5		20-40	0,049	0,005	0,010	0,014	0,004	0,003	0,085	0,090	0,80	0,13	0,21	0,70	0,30	0,14	1,14	1,00
6		40-60	0,036	0,009	0,027	0,012	0,001	0,016	0,101	0,104	0,60	0,25	0,56	0,60	0,10	0,71	1,41	0,70
7	3	0-20	0,030	0,009	0,028	0,010	0,003	0,012	0,092	0,094	0,50	0,25	0,58	0,50	0,30	0,53	1,33	0,80
8		20-40	0,030	0,009	0,042	0,020	0,002	0,010	0,113	0,114	0,50	0,25	0,87	1,00	0,20	0,42	1,62	1,20
9		40-60	0,033	0,009	0,070	0,018	0,008	0,015	0,153	0,116	0,55	0,25	1,46	0,90	0,70	0,66	2,26	1,60
10	4	0-20	0,027	0,009	0,094	0,022	0,013	0,013	0,178	0,180	0,45	0,25	1,96	1,10	1,10	0,56	2,66	2,10
11		20-40	0,027	0,013	0,042	0,026	0,001	0,007	0,116	0,120	0,45	0,37	0,87	1,30	0,10	0,29	1,69	1,40
12		40-60	0,024	0,004	0,074	0,030	0,005	0,004	0,141	0,146	0,40	0,12	1,54	1,50	0,40	0,16	2,06	1,90
13	5	0-20	0,021	0,004	0,051	0,020	0,003	0,005	0,104	0,114	0,35	0,12	1,06	1,00	0,30	0,23	1,53	1,30
14		20-40	0,027	0,004	0,057	0,020	0,005	0,008	0,121	0,126	0,45	0,12	1,19	1,00	0,40	0,36	1,76	1,40
15		40-60	0,027	0,004	0,039	0,014	0,005	0,006	0,095	0,096	0,45	0,12	0,81	0,70	0,40	0,28	1,38	1,10
16	6	0-20	0,036	0,004	0,021	0,010	0,002	0,010	0,083	0,084	0,60	0,12	0,44	0,50	0,20	0,46	1,16	0,70
17		20-40	0,036	0,004	0,029	0,008	0,001	0,019	0,097	0,098	0,60	0,12	0,60	0,40	0,10	0,82	1,32	0,50
18		40-60	0,039	0,004	0,012	0,010	0,002	0,010	0,083	0,084	0,65	0,12	0,37	0,50	0,20	0,44	1,14	0,70
19	7	0-20	0,036	0,004	0,022	0,010	0,002	0,011	0,085	0,086	0,60	0,12	0,46	0,50	0,20	0,48	1,18	0,70
20		20-40	0,036	0,004	0,029	0,010	0,001	0,016	0,096	0,098	0,60	0,12	0,60	0,50	0,10	0,72	1,32	0,60
21		40-60	0,027	0,009	0,038	0,014	0,006	0,006	0,100	0,108	0,45	0,25	0,79	0,70	0,50	0,20	1,49	1,20
22	8	0-20	0,024	0,004	0,46	0,018	0,005	0,004	0,101	0,106	0,40	0,12	0,96	0,90	0,40	0,18	1,48	1,30
23		20-40	0,024	0,009	0,048	0,018	0,005	0,008	0,112	0,122	0,40	0,25	1,00	0,90	0,40	0,35	1,65	1,30
24		40-60	0,027	0,004	0,047	0,016	0,006	0,006	0,106	0,122	0,45	0,12	0,98	0,80	0,50	0,25	1,55	1,30
25	9	0-20	0,033	0,004	0,045	0,014	0,003	0,014	0,113	0,114	0,55	0,12	0,94	0,70	0,30	0,61	1,61	1,00
26		20-40	0,027	0,013	0,050	0,024	0,003	0,008	0,125	0,132	0,45	0,37	1,04	1,20	0,30	0,36	1,86	1,50
27		40-60	0,030	0,004	0,045	0,014	0,005	0,010	0,108	0,110	0,50	0,12	0,94	0,70	0,40	0,46	1,56	1,10
28	10	0-20	0,033	0,004	0,030	0,012	0,002	0,011	0,092	0,094	0,55	0,12	0,62	0,60	0,20	0,49	1,29	0,80
29		20-40	0,030	0,004	0,032	0,012	0,002	0,011	0,091	0,092	0,50	0,12	0,66	0,60	0,20	0,48	1,28	0,80
30		40-60	0,033	0,004	0,017	0,010	0,002	0,007	0,073	0,074	0,55	0,12	0,35	0,50	0,20	0,32	1,02	0,70
31	11	0-20	0,027	0,004	0,051	0,018	0,006	0,005	0,111	0,112	0,45	0,12	1,06	0,90	0,50	0,23	1,63	1,40
32		20-40	0,030	0,004	0,031	0,014	0,003	0,006	0,088	0,092	0,50	0,12	0,64	0,70	0,30	0,26	1,26	1,00
33		40-60	0,036	0,004	0,035	0,010	0,006	0,010	0,101	0,104	0,60	0,12	0,73	0,50	0,50	0,45	1,45	1,00
34	12	0-20	0,030	0,004	0,024	0,010	0,004	0,005	0,077	0,078	0,50	0,12	0,50	0,50	0,40	0,22	1,12	0,90
35		20-40	0,033	0,004	0,018	0,008	0,004	0,005	0,072	0,074	0,55	0,12	0,37	0,40	0,40	0,24	1,04	0,80
36		40-60	0,036	0,004	0,066	0,018	0,008	0,011	0,143	0,146	0,60	0,12	1,37	0,90	0,70	0,49	2,09	1,60
37	13	0-20	0,036	0,004	0,033	0,016	0,003	0,010	0,107	0,108	0,60	0,25	0,69	0,80	0,30	0,44	1,54	1,10
38		20-40	0,024	0,022	0,101	0,035	0,008	0,016	0,206	0,210	0,40	0,12	2,10	1,75	0,65	0,72	3,12	2,40
39		40-60	0,033	0,009	0,058	0,028	0,003	0,007	0,138	0,146	0,55	0,25	1,21	1,40	0,30	0,31	2,01	1,70
40	14	0-20	0,033	0,009	0,041	0,022	0,003	0,006	0,114	0,118	0,55	0,25	0,25	1,10	0,30	0,25	1,65	1,40
41		20-40	0,036	0,004	0,045	0,016	0,005	0,010	0,116	0,118	0,60	0,12	0,94	0,80	0,40	0,46	1,66	1,20
42		40-60	0,030	0,004	0,056	0,022	0,006	0,004	0,122	0,128	0,50	0,12	1,17	1,10	0,50	0,19	1,79	1,60
43	15	0-20	0,030	0,004	0,079	0,020	0,003	0,022	0,158	0,162	0,50	0,12	0,164	1,00	0,30	0,96	2,26	1,30
44		20-40	0,033	0,009	0,047	0,014	0,006	0,013	0,122	0,124	0,55	0,25	0,98	0,70	0,50	0,58	1,78	1,20
45		40-60	0,036	0,004	0,060	0,016	0,005	0,018	0,139	0,444	0,60	0,12	1,25	0,80	0,40	0,77	1,97	1,20

Mechanical Soil Analysis of the Field Trips in SAC Area dated 29-30 July 1999

Sampling Point	Depth cm	Hydrioscopic Humidity %	Fractions, mm						
			1.0-0.25	0.01-0.05	0.05-0.01	0.01-0.005	0.005-0.001	0.001	<0.01
2	0-20	2,3	0,5	2,0	31,2	16,4	25,0	24,9	66,3
	20-40	2,2	0,6	7,7	28,8	15,0	27,1	20,8	62,9
	40-60	2,5	1,3	6,8	28,3	13,1	29,1	21,4	63,6
4	0-20	1,8	1,4	7,0	31,3	10,6	29,4	20,3	60,3
	20-40	1,7	1,0	4,0	29,5	17,1	26,4	22,0	65,5
	40-60	2,8	0,3	2,6	32,1	14,5	29,1	21,4	66,0
10	0-20	2,5	0,3	11,7	33,7	10,5	26,3	17,5	54,3
	20-40	2,4	0,7	7,4	34,2	11,7	27,3	18,7	57,7
	40-60	3,6	0,4	4,7	27,6	15,0	28,4	23,9	67,3
13	0-20	2,8	0,4	8,3	28,0	13,7	27,0	22,6	63,3
	20-40	2,6	0,6	0,5	30,3	11,2	29,3	28,1	68,6
	40-60	2,3	1,2	1,6	35,2	10,4	27,2	24,4	62,0
15	0-20	2,8	1,3	2,9	27,4	12,7	29,0	26,7	68,4
	20-40	2,1	1,2	0,8	32,3	13,1	27,3	25,3	65,7
	40-60	2,0	1,5	8,8	32,2	11,4	26,4	19,7	57,5

Existing and the permanently living population in 1998

Districts	Existing population			Permanently living population			Increase of population		
	Total	Including		Total	Including		Total	Including	
		Urban	Rural		Urban	Rural		Natural	Migration
Khachmaz	131.9	44.4	87.5	130.1	43.7	86.4	1.4	1.7	-0.3
Quba	128.7	27.5	101.2	131.9	27.4	104.5	1.6	1.8	-0.2
Qusar	73.1	16.9	56.2	73.1	16.7	56.4	0.8	0.8	0
SAC	**333.7**	**88.8**	**244.9**	**335.1**	**87.8**	**247.3**	**3.8**	**4.3**	**-0.5**
Agjabadi	101.8	27.9	73.9	97	27.7	69.3	1.3	1.4	-0.1
Beylagan	80	16	64	78.7	15.8	62.9	1.2	1.2	0
Imishli	**98.8**	**33.5**	**65.3**	**98.2**	**33.4**	**64.8**	**1**	**1.5**	**-0.5**
Saatli	81.5	16.4	65.1	80.6	16.3	64.3	1.1	1.3	-0.2
Sabirabad	131.3	20.8	110.5	130.7	20.6	110.1	1.8	2.2	-0.4
MMMC	**493.4**	**114.6**	**378.8**	485.2	**113.8**	371.4	6.4	7.6	-1.2

Source: State Statistical Committee

Use all categories of agriculture and Irigated lands (ha), 1998

Districts	Total area	Including irrigated	Including agriculture lands																				Homesteads				Forest and woodland	Including irrigated	Not suitable for agriculture use
							Including perrinials																						
			Total	Including irrigated	Arable	Including irrigated	Total	Including irrigated	Orchards and Gardens	Including irrigated	Vineyards	Including irrigated	Yung trees	Including irrigated	Other	Including irrigated	Fallow land	Including irrigated	Hayfield	Including irrigated	Pastures	Including irrigated	Total	Including irrigated	Including suitable for agriculture use	Including irrigated			
Khachmaz	147075	52240	76452	49489	39488	39225	5051	5017	3413	3381	1638	1636							1443	1443	30470	3804	4040	2727	3227	2723	23125	24	43458
Quba	294071	27047	148563	25405	19437	10565	14681	13445	14681	13445							191	144	19182	708	95072	543	3602	1642	3069	1642	52371		89535
Qusar	187645	29802	86799	28743	31586	18551	9061	8040	9029	8640	832								10091	1727	35461	1825	2953	1059	2535	1059	18600		79293
SAC	628791	109089	311814	103637	90511	66341	29393	27102	27123	25466	2270	1636					191	144	30716	3878	161003	6172	10595	6428	8831	6424	94096	24	212286
Agjabadi	140098	58747	84936	65328	52031	52031	1238	1238	80	80	572	572	582	582	4	4					31667	2059	2104	1375	1812	1375	4787	44	48201
Beylagan	127543	50950	88146	48905	40829	40829	2488	2374	214	100	2274	2274					617	425			44212	5277	1998	1504	1795	1504	2522	547	34877
Imishli	171103	46501	100320	44581	40403	40247	98	98	13	13	8	8	77	77			444	416			69375	3820	2344	1920	1920	1920	689		67760
Saatli	76986	48788	65550	48717	40595	40461	84	84					84	84			3482	1522			21389	4850	2500	2071	2323	2071	497		8430
Sabirabad	134107	68618	88488	60081	55224	#NAME?	168	168	168	168											33096	4689	11061	8735	.8735	8735	3085		31473
MMMC	649837	271808	427440	255612	229082	#NAME?	4076	3962	475	361	2854	2854	743	743	4	4	4543	2383			189739	20495	20007	15605	16585	15605	11560	591	190830

Source: Land Use Committee

Plantgrowing, 1998

Districts	Grain and green forage										Technical crops							Potato, vegetable, melons					
	Total		Grain and Grain-beans																Including				
			Total		Including													Total					
					Winter wheat		Summer barley					Cotton		Sugar beet		Tobacco			Potato		Vegetable		
	Area, ha	Productivity, ct/ha	Area, ha	Productivity, ct/ha	Area, ha	Productivity, ct/ha	Area, ha	Productivity, ct/ha	Other, ha	Grain forage, ha	Total, ha	Area, ha	Productivity, ct/ha	Area, ha	Productivity, ct/ha	Area, ha	Productivity, ct/ha		Area, ha	Productivity, ct/ha	Area, ha	Productivity, ct/ha	Other melons, ha
Khachmaz	16173	11.4	16173	11.6	12671	11.5	2532	11.1	970									2726	600	109	1959	237.1	167
Quba	8707	13.2	8707	13.5	7793	13.2	708	13.2	206									1414	768	52.3	643	106.1	3
Qusar	13551	7.9	13179	7.9	10970	7.9	1641	7.8	568	372	13					2	3	2067	1396	68.2	667	150.5	4
SAC	38431		38059		31434		4881		1744		13					2		6207	2764		3269		174
Agjabadi	16226	15.4	16069	15.4	15642	15.4	418	15.6	9	157	14014	14011	6.3	2		1		935	72	95.3	607	73.9	256
Beylagan	15751	15.8	14826	15.8	14478	15.8	310	14.6	38	925	11145	11100	7.6	45	15.9			417	94	53.9	198	129.9	125
Imishli	19075	20.2	17720	20.4	16807	20.2	718	19.7	195	1355	13184	13021	6.2	138	161.4	10	5	1300	216	86.9	382	117.9	702
Saatli	18346	26.1	18173	26	17375	26.1	661	25.8	137	173	13899	13870	12.6					1966	384	69.5	312	131.6	1270
Sabirabad	24106	25.4	20160	25.3	19288	24.8	712	39.6	160	3946	17287	17281	4.6					1954	270	93	447	163.9	1237
MMMC	93504		86948		83590		2819		539		69529	69283		185		11		6572	1036		1946		3590

Source: State Statistical Committee

Gardening 1998

Districts	Gardens and barryes		Grapes		Trellis grape		(Morus) Mulberry (for berry)	
	Total, ha	Productivity, ct/ha	Total, ha	Productivity, ct/ha	Total, ha	Productivity, ct/ha	Total, ha	Productivity, ct/ha
Khachmaz	5601	61.6	1812	35	22089	2.3	6369	0.5
Quba	14617	49.6			4873	0.1	8204	0.2
Qusar	3102	32	1		822	0.1	5300	0.7
SAC	23320		1813		27784		19873	
Agjabadi	976	68.5	306	25	11690	1.2	6478	0.6
Beylagan	309	74.9	30	383.3	46822	0.4	13647	0.3
Imishli	851	123.2			25230	0.1	5730	0.4
Saatli	113	165.2			500	0.4		
Sabirabad	1578	108.6	1	134	62106	0.4	6161	0.1
MMMC	3827		337		146348		32016	

Source: State Statistical Committee

Livestock (heads)

Districts	Cattle			Sheeps and goats		
	Total	Including		Total	Including	
		cows	Buffalo (female)		wether	goat
Khachmaz	**47560**	**18544**	**2474**	**88738**	**85561**	**3177**
Quba	67264	24792	1045	261110	233638	27472
Qusar	35185	16344	320	81678	76715	4963
SAC	**150009**	**59680**	**3839**	**431526**	**395914**	**35612**
Agjabadi	64116	24802	5263	283528	282433	1095
Beylagan	29393	12442	1954	144396	141811	2585
Imishli	**49427**	**17785**	**5986**	**142327**	**140624**	**1703**
Saatli	42311	17121	2694	46298	45601	697
Sabirabad	79865	30861	6964	104609	99527	5082
MMMC	**265112**	**103011**	**22861**	**721158**	**709996**	**11162**

Source: State Statistical Committee

Density of population (ha/person)

Districts	Agricultural area	Including irrigated	Including								Homesteads	Including irrigated
			Arable	Including irrigated	Perrinials	Including irrigated	Pastures	Including irrigated	Hayfield	Including irrigated		
Khachmaz	**0.87**	**0.57**	**0.45**	**0.45**	**0.058**	**0.057**	**0.35**	**0.04**	**0.02**	**0.02**	**0.05**	**0.03**
Quba	1.47	0.25	0.19	0.10	0.145	0.133	0.94	0.01	0.19	0.01	0.04	0.02
Qusar	1.54	0.51	0.56	0.29	0.172	0.154	0.63	0.03	0.18	0.03	0.05	0.02
SAC	**1.41**	**0.44**	**0.41**	**0.29**	**0.118**	**0.102**	**0.74**	**0.03**	**0.14**	**0.02**	**0.05**	**0.02**
Agjabadi	1.15	0.75	0.70	0.70	0.017	0.017	0.43	0.03	0.00	0.00	0.03	0.02
Beylagan	1.38	0.76	0.64	0.64	0.039	0.037	0.69	0.08	0.00	0.00	0.03	0.02
Imishli	1.54	0.68	0.62	0.62	0.002	0.002	0.91	0.06	0.00	0.00	0.04	0.03
Saatli	1.01	0.72	0.62	0.62	0.001	0.001	0.33	0.07	0.00	0.00	0.04	0.03
Sabirabad	0.80	0.54	0.50	0.50	0.002	0.002	0.30	0.04	0.00	0.00	0.10	0.08
MMMC	**1.13**	**0.67**	**0.60**	**0.60**	**0.011**	**0.010**	**0.50**	**0.05**	**0.00**	**0.00**	**0.05**	**0.04**

Quantity of livestock per capita, heads/person

Districts	cattle			Sheeps and goats		
	Total	Including		Total	Including	
		cows	Buffalo (female)		wether	goat
Khachmaz	0.54	0.21	0.03	1.01	0.98	0.04
Quba	0.66	0.24	0.01	2.58	2.31	0.27
Qusar	0.63	0.29	0.01	1.45	1.37	0.09
SAC	0.63	0.26	0.02	1.74	1.59	0.15
Agjabadi	0.87	0.34	0.07	3.84	3.82	0.01
Beylagan	0.46	0.19	0.03	2.26	2.22	0.04
Imishli	0.76	0.27	0.09	2.18	2.15	0.03
Saatli	0.65	0.26	0.04	0.71	0.70	0.01
Sabirabad	0.72	0.28	0.06	0.95	0.90	0.05
MMMC	0.70	0.27	0.06	1.90	1.87	0.03

Winter Account of Birds in Ag gol Lake, January, 1999

I. River ducks (total)	29820	*III. Geese (total)*	8000
1. Drake duck	13000	1. Gray goose	3300
2. Gray duck	1800	2. White-foreheaded goose	4700
3. Wide-bill duck	2400	*IV. Swans (total)*	840
4. Sharp-tailed duck	1300	1. Shouting swan	610
5. Marek duck	750	2. Hissing swan	230
6. Whistling duck	7600	*V. Other species (total)*	43850
7. Creaking duck	470	1. Sultan hen	12000
8. Motley duck	600	2. Flamingo	130
9. Wild duck (red duck)	1300	3. Curly-feather pelican	220
10. Other species	600	4. Bazgak	5000
II. Diving ducks (total)	7240	5. Gashgaldag	26500
1. Tufted black duck	1400	TOTAL	89750
2. Black Sea duck	470		
3. Red-headed diver	1200		
4. White-eyed diver	520		
5. Red-nosed diver	2400		
6. Blue billed duck	50		
7. Other species	1200		

Source : Agjabadi Local Authority of ASCE, 1998

Wild animals and Birds in Ag gol Reserve Area

Wild cat	3360
Badger	180
Wolf	35
Fox	780
Hare	1650
Porcupine	12
Wild boar	352
Jackal	450
Beaver(coypu)	9500
Water sable	22
Total Wild Animals	16341
Turaj	820
Pigeon	9500
Total Birds	10320

Source : Agjabadi Local Authority of ASCE, 1998

Fishes in Ag gol Lake

1. Esox lucius, Linna
2. Rutilus rutilus Berg Kurensis
3. Scradinius erythrophthatmus
4. Aspinus aspinus tacniatus, Eichwolg
5. Lencaspins delieneatus delieneatus caucasaus, Berg
6. Tinea tinen, L.
7. Alhurmus charusini hohenackeri (Kessler)
8. Alburnus tilippi, Kessler
9. Alicca bjoerkna transcaucassia, Berg
10. Abramis brama orientalis, Berg
11. Perecus cultratus, L.
12. Cyprinus carpio L.
13. Cobitis tachnia satumini, Gladkov
14. Cobit is caspia, Eichwald
15. Sillurus glanis, L.
16. Pungitius platygaster, Kessler
17. Cambusia attinis attinis (Bairdet Girard)
18. Lucioperca lucioperca, L.
19. Perca tluriatilis, L.
20. Pomatoschistus caucasicus
21. Proterochinus mermoratuss pallas

Source : Agjabadi Local Authority of ASCE, 1998

Amphibians Ag gol Reserve Area

1. Hertensiealla Caucassia
2. Turandinolge vulgaris
3. Pelobates syriacus
4. Rana ridibunda
5. Rana temporaria

Source : Agjabadi Local Authority of ASCE, 1998

Reptiles Ag gol Reserve Area

1. Emus orbicularis
2. Agrionemys
3. Natrix natrix
4. Xipera erivanensis
5. Xipera renardi

Source : Agjabadi Local Authority of ASCE, 1998

Rare and Disappearing Wild Animals, Birds and Plants in the Area of Ag gol State Reserve in 1999

I. Mammals		
I.1 Southern Mulburn, Rhirolophus Cural Blasius, 1853	Unknown	Remarks
I.2 Wild steppe cat, Felis Libyyca caudata, Cirey, 1874	> 3000	
II. Birds		
II.1. White Pelican, Pelicanus onocrotalus, L. 1758	Unknown	In winter
II.2. Curly-feather Pelican, P.crispus, Bruch. 1832	~ 400	In winter
II.3. Scraper-billed, Platalea leucorodia, L.1758	~ 3000	Makes nest in camp form
II.4. Ordinary Flamingo, Phonicopterus ruber, L. 1758	260	In winter
II.5. Hissing swan, Cygnusolor, Gm. 1789	~ 500	In winter
II.6. River Blackbird (eagle), Pandion haliactus, L. 1758	> 20	In winter
II.7. White-tailed sea eagle, Haliacctus albicilla, L. 1758	8 - 10	
II.8. Steppe eagle, Aguila rapax, Temm. 1828	Unknown	At the lake side
II.9. Turaj, Francolinius Francolinus, L,1766	> 700	At the lake side
II.10. Sultan hen, Porphyrio porphyrio, L. 1758	> 10000	Wader bird, makes a nest.
II.11. Bazgak, Otis tetrax, L.1758	~ 5000	In the grassy area of the lake side
II.12. White-tailed sunken-nosed sandpiper, Vanellochettusia Leucura, Licht, 1823	20 - 25 families	Makes nest in camp form
II.13. Steppe forked-tail sandpiper, Glareola nordmanni Nordm. 1842	~ 500	Makes nest in mixed camp form met during nesting period at the lake sides
II.14. Marble teal, Anas angustriostris, Menetz, 1832	> 500	Met during nesting period
III.Reptiles		
III.1. Transcaucassian adder	Unknown	
III.2. Round headed wormwood grove lizard	Unknown	
IV. Amphibians		
IV.1. Ordinary land frog	Unknown	
IV.2. Ordinary triton	Unknown	
IV.3. Syrian garlic-fragrant frog	Unknown	
V.Plants		
V.I.Bibershtain mountain poppy	-	In Spring, met in the plain areas of the lake, stocks are not rich

Source : Agjabadi Local Authority of ASCE, 1998
Denotes : >: more than; ~: approximately

Fauna of Sarisu Lake

I. Birds

1. Turaj, Francolinius Francolinus, L,1766*
2. Sultan hen, Porhyrio porhyrio, L. 1758*
3. Swan
4. Pelican
5. Flamingo
6. Partridge
7. Pheasant
8. Mugulu
9. Bali
10. Cane-cock
11. Cormorant

II. Ducks

1. Mallard
2. Hasalan
3. Firigih
4. Parti-coloured duck
5. Apple headed

III. Fishes

1. Carp
2. Salmon
3. Crane fish
4. Belamor
5. Talastolop
6. Bobla
7. Sudak

IV. Reptiles

1. Adder
2. Talmar
3. Talha
4. Gelden snake
5. Grass snake
6. water snake
7. Lizard

V. Mammals

1. Wild pig
2. Desert pig
3. Rabbit
4. Fox
5. Jackal
6. Wolf
7. Desert cat
8. Nutri

Source : CES, 1999, EIA of RIIDIA II Project

* Rare or endangered species

Rare and Endangered Species in Samur Apsheron Monitoring Area

Mammals	
1. Felis Silbestris	
Birds	
1. Pelecanus crispus	7. Circus macrourus
2. Pelecanus onocrotalus	8. Lyrurus tetrix
3. Porphyrio porhyrio	9. Otis tarda
4. Anser albifrons	10. Chettusia gregaria
5. Agulia heliaca	11. Gladeola nordmanni
6. Agulia nipalensis	12. Francolinus francolinus
Reptiles	
1. Testudo craeca iberia	
Amphibians	
1. Bufo bufo	
Fishes	
1. Salmo fario	3. Abramis sapa
2. Caspiomyzow wagneru	4. Lucioperca marine

Source: Azerbaijan Ansiclopedia Reduc.,1989, Red Book of Azerbaijan, Baku

Plant Types in the Qusar State Reserve Area

Tugay Trees	
1. White-poplar	4. Oak
2. Trembling-poplar	5. Willow
3. Red-tree	
Mixed Trees	
1. Peanut	4. Goyrush
2. Hornbeam	5. Apple
3. White-beech	6. Pear
Other Plants	
1. Hawthorn	5. Dog rose
2. Cornel tree	6. Blackberry
3. Plump	7. Black-prickle
4. Lian	

Source : H.A. Aliyev, X.N. Hasanov, 1993, In the Cradle of nature, Baku

Animal Species in the Qusar State Reserve Area

Birds	
1. Kirkovul	5. Rock dove
2. Partdridge (2000 in number)	6. Mallard
3. Black Francolin (1200 in number) listed in Red Book of Azerbaijan	7. Firchi cure
	8. Common scotter
4. Quail	9. Pochard
Mammals	
1. Wild pig (180 in number)	7. Forest dog
2. Cuyur (60 in number, rare specie)	8. Reed cat
3. Wolf (85 in number)	9. Badger
4. Fox (80 in number)	10. Sable
5. Jackal (140 in number)	11. Yenot
6. Forest cat (40 in number)	12. Rabbit

Source : H.A. Aliyev, X.N. Hasanov, 1993, In the Cradle of nature, Baku

Some Species of Fauna of Liana-Oak Forests

Birds
1. Pheasants (Phasianus)

Fishes
1. Farel Fish
2. Red Fish

Mammals
1. Wild boar
2. Rabbit
3. Fox
4. Wolf
5. Gazelle

Source : CES, 1999, EIA of RIIDIA II Project

Tree Types at Liana-oak Forests

1. Liana-Oak
2. Oak, Fagaceae Quercus, pubecens Willd
3. Hornbeam
4. Redtree
5. Poplar
6. Acacia
7. Walnut, Jolandaceae Juglans regia
8. Chestnut, Fageceae Cestanea Sativa Miller
9. Dende
10. River prickle

'Source : CES, 1999, EIA of RIIDIA II Project

Practical Evaluation Criteria of Water Pollution*

Substances or Indicator		Maximum Permissible Concentration mg/l	Field of Importance
Dissolved Oxygen[1]		4.0 6.0	GD
Ultimate Biological Oxygen Demand (BOD_U)		3.0	GD
Amonium Salt	NH_4^+	0.5 N(NH4+)=0.39	T
Nitrate ion	NO_3^-	40 N(NO3-)=9.0	S,T
Nitrite ion	$N0_2^-$	0.08 N(N02-)=0.02	T
Oil and oil products		0.05	F
Phenols		0.001	F
Surface Active Substances		0.1	F
Iron	Fe_3^+	0.5	O
Copper	Cu_2^+	0.001	T
Zinc	Zn_2^+	0.01	T
Chromium	Cr_3^+	0.5	O
Chromium	Cr_6^+	0.001	S,T
Nickel	Ni_2^+	0.01	T
Cobalt	Co_2^+	0.01	T
Lead	Pb_2^+	0.03	S,T
Calcium (cation)		180.0	S,T
Magnesium (cation)		40.0	S,T
Natrium (cation)		120.0	S,T
Sulphates (anion)		100.0	S,T
Chlorides (anion)		300.0	S,T
Minerilization		1000.0	GD

Source : State Hydrology Institute, 1987, Annual Statitistic of Kura River Basin · Leningrard

* Based on Former Sovviet Union Criteria

[1] During winter (under ice the) period must not be less than 4.0, during summer not less than 6.0.

Denotes : GD: General Demand; T:Toxicological, S:Sanitary,
FE: Fishing Economy,

Water Analysis Conducted at the Site during the Field Trips at MMMC dated 26-27 July 1999

No	Sampling Point	Sampling		Site Measurements		
		Date	Time	pH	t °C	EC mmhos/cm
1	K-3	26.07.99	17 : 30	8,2	22	5,43
2	K-2	26.07.99	18 : 35	8,19	26	5,33
3	Ag gol	26.07.99	18 : 20			
4	Sherbetkobu	27.07.99	9 : 29	6,60	23	9,56
5	MMMC	27.07.99	10 : 03	8,60	26	4,47
6	Kura river	27.07.99	10 : 15	8,55	28	7,78
7	Sarisu Regulator	27.07.99	12 : 30	8,15	30	0,04
8	Sarisu lake	27.07.99	12 : 45	7,70	34	0,06
9	Araz River	27.07.99	13 : 10	7,90	28	16,74
10	Kura river at Alibayramli	27.07.99	18 : 50	8,22	28	9,22

Water Analysis Results of the Field Trips at MMMC dated 26-27 July 1999 obtained at the Laboratory

No	Sampling Point	pH	SO_3^-	NSO_3^-	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	$Na^+ + K^+$	Total Ions	Total Phosphorus	Nitrate	Ammonium
			g/l / meq/l							g/l	g/l	g/l	g/l
1	Kura river at Siphon	-	0,012 0,40	0,134 2,20	0,071 2,00	0,456 9,50	0,080 4,00	0,042 3,50	0,151 6,60	0,946	0,07	0,27	2,26
2	*Kura river at Alibayramli*	-	0,012 0,40	0,183 3,00	0,044 1,25	0,384 8,00	0,060 3,00	0,060 5,00	0,106 4,65	0).849	0,07	0,27	2,26
3	*Araz river at Saatli*	-	0,018 0,60	0,171 2,80	0,142 4,00	0,336 7,00	0,080 4,00	0,066 5,50	0,112 4,90	0,925	0,07	0,27	2,26
4	*Mill Karabakh Col. at Siphon*	8,4	0,018 0,60	0,293 4,80	0,426 12,00	1,680 35,00	0,120 6,00	0,150 12,50	0,779 33,90	3,466	0,04	0,27	3,29
5	*Ag gol at K-3*	8,4	0,012 0,40	0,305 5,00	0,248 7,00	5,520 115,0	0,090 4,50	0,258 21,50	2,355 102,4	8,788	0,07	0,27	2,26
6	*Ag gol at K-2*	8,5	0,018 0,60	0,220 3,60	0,515 14,50	1,440 30,00	0,120 6,00	0,174 14,50	0,648 28,20	3,135	0,07	0,44	2,26
7	*Ag gol*	8,4	0,012 0,40	0,171 2,80	0,763 21,50	1,725 36,00	0,150 7,50	0,222 18,50	0,798 34,70	3,841	0,07	0,27	2,26
8	*Sarisu at Sherbetkobu*	8,4	0,018 0,60	0,232 3,80	1,029 29,0	2,216 46,0	0,190 9,5	0,258 21,5	1,113 48,4	5,056	0,11	0,27	2,58
9	*At outlet of Sarisu*	8,5	0,012 0,40	0,122 2,0	0,834 23,5	2,060 43,0	0,100 5,0	0,246 20,5	0,998 43,4	4,372	0,15	0,33	1,17

Water Analysis Results of the Field Trips at SAC dated 29-30 July 1999 obtained at the Laboratory

No	Sampling Point	pH	SO_3^-	NSO_3^-	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}	$Na^+ + K^+$	Total Ions	Total Phosphorus	Nitrate	Ammonium
			g/l / meq/l							g/l	g/l	g/l	g/l
1	Qusarchay at Qusar city	8,7	0,012 0,40	0,073 1,20	0,009 0,25	0,048 1,00	0,030 1,50	0,006 0,50	0,019 0,85	0,197	0,11	1,64	0,64
2	Qudyalchay at Kuchal city	8,6	0,012 0,40	0,122 2,00	0,018 0,50	0,072 1,50	0,030 1,50	0,008 0,70	0,050 2,20	0,312	0,08	0,96	0,76
3	Qudyalchay at Quba city	8,5	0,012 0,40	0,122 2,00	0,018 0,50	0,072 1,50	0,020 1,00	0,006 0,50	0,066 2,90	0,316	0,08	0,96	0,88
4	Qarachay at Nugedi village	8,6	0,012 0,40	0,098 1,60	0,018 0,50	0,072 1,50	0,040 2,00	0,004 0,30	0,039 1,70	0,283	0,07	1,64	0,64
5	Chagachugchay at Hydromet. Me.	8,6	0,024 0,80	0,159 2,60	0,027 0,75	0,144 3,00	0,010 0,50	0,013 1,10	0,127 5,55	0,504	0,11	1,29	0,96
6	Velvelichay at Tekkealti village	8,6	0,012 0,40	0,122 2,00	0,018 0,50	0,072 1,50	0,020 1,00	0,010 0,80	0,059 2,60	0,313	0,11	1,29	0,96
7	SAC at 8 km	8,7	0,012 0,40	0,024 0,40	0,009 0,25	0,072 1,50	0,020 1,00	0,002 0,20	0,031 1,35	0,170	0,11	1,64	0,96
8	SAC at Gandobu	8,7	0,006 0,20	0,159 2,60	0,009 0,25	0,048 1,00	0,020 1,00	0,002 0,20	0,065 2,85	0,309	0,11	1,64	0,96
9	Qusarchay at origin	8,7	0,012 0,40	0,037 0,60	0,009 0,25	0,072 1,50	0,020 1,00	0,008 0,70	0,024 1,05	0,182	0,11	1,64	0,96
10	Qudyalchay at origin	8,6	0,012 0,40	0,159 2,60	0,018 0,50	0,144 3,00	0,040 2,00	0,011 0,90	0,082 3,60	0,466	0,07	1,64	0,64
11	Velvelichay at origin	8,6	0,012 0,40	0,159 2,60	0,018 0,50	0,144 3,00	0,020 1,00	0,010 0,80	0,108 4,70	0,471	0,08	1,29	0,88

ANNEX B

Environmental Legislation in Azerbaijan

Name of the Regulation od Decree	Date	Number
The Law of the Protection of the Environment and Utilization of Nature	25.02.1992	79
Decree on Establishment of Azerbaycan State Committee on Ecology and the Control of the Natural Resource Utilization	21.05.1992	130
Regulation on State Committee on Ecology and the Control of the Natural Resource Utilization	07.09.1992	170
Regulation on the responsibilities on the Nature, Collection of Payments of Waste Discharged into the Environment and Use of this Payments.	03.03.1992	122
Regulation on the Payments for the Utilization of Widespread Mining Activities which are Useful for Azerbaijan	08.06.1992	319
Statute on State Hydrometeorological Committee	1994	
Regulation on the State Reserves of the Republic of the Azerbaijan	28.06.1995	105
Irrigation and Land Reclamation Law	1996	
Water Code	1997	
The Law on the Management of Forests of Azerbaijan Republic	30.12.1997	
Statute on State Irrigation Committee	1997	
Entrails Law	1998	
Regulation on Control of Utilization and Protection of Water Resources	25.09.1998	195
Regulation on the Generalization of Investment Places of Facilities Having Impact on Water Quality, Agreement on their Building Project and State Expertise and Arrangement of Usage	28.09.1998	197
Standardization on Use and Protection of Water Resources	15.10.1998	206
Statute on Land Reclamation and Hydrogeological Services	1998	
Land Code	1999	-

Some of the Monitoring Activities Carried out by Government Organizations and Institutes in Azerbaijan

Authority	Monitoring Activities
State Amelioration and Irrigation Committee Hydrogeology and Melioration Expedition	Groundwater Hydrology
State Hydrometorological Institute	Climate and hydrology of rivers
Republican Center for Hygiene and Epidemiology	Health aspects
Committee for Geology and Mineral Resources	Geology
Committee for State Statistics of Azerbaijan Republic	Social Aspects
Azerbaijan State Committee of Ecology and Natural Resources Utilization	Biodiversity, water, wastewater
Committee for State Soil	Soil
Azgiprovodkohoz Institute	Soil, hydrology, water
Azerbaijan Fisheries Agency	Fish

Чәдвәл 1. Мониторинг нөгтәләриндә биткиләрин феноложи мүшаһидәси

Монито-ринг нөг-тәсинин јери	Мүшаһидә објектинин ады	Мүшаһидә саһәсинин өлчүсү	Феноложи мүшаһидә			
			март	апрел	мај	ијун

Мүшаһидәчи ________________________

Чәдвәл 2. Мониторинг нөгтәләриндә су гушларынын јашамасы вә чохалмасы

Мониторинг нөгтәсинин јери	Мүшаһидә саһәсинин өлчүсү	Мүшаһидә вахты	Јуванын сајы	Јува гуран гушун нөвү	Гејд

Мүшаһидәчи ________________________

Чәдвәл 3. Кичик чајларын ашағы саһәсиндә јашајан вә күрүләјән балыгларын мүшаһидәси

Мони-торинг нөгтә-синин јери	Балыг-ларын чаја да-хил олма вахты	Балыгларын		Күтләви дахил олма вахты		Күрү-ләмә вахты	Гејд
		нөвү	сајы	башлан-ғычы	сону		

Мүшаһидәчи ______________________

Чәдвәл 4. Сујун кејфијјәтинин мүшаһидәси

Мониторинг нөгтәсинин ады	Мүшаһидә вахты	Температур t °C	pH	EC ммhос/см

Мүшаһидәчи __________________

Чәдвәл 1 Јералты суларын сәвијјәси, метр.

ај __________ ил_______

Мүшаһидә вәрәгәси

Гују №	5	10	15	20	25	30	Орта	Гујунун үзә чыхан узунлуғу

Мүшаһидәчи____________________

Имза

Чәдвәл 2 Су сәвијјәси өлчмә вәрәгәси, см

Чај, мәнтәгә ____

Мүшаһидәчи ____

Мүшаһидә ___________________________________ ајы 19 ил

Тарих	Сәвијјә		Орта	Тарих	Сәвијјә		Орта
	саат 8-дә	саат 20-дә			саат 8-дә	саат 20-дә	
1				16			
2				17			
3				18			
4				19			
5				20			
6				21			
7				22			
8				23			
9				24			
10				25			
11				26			
12				27			
13				28			
14				29			
15				30			
				31			

Мүшаһидәчинин имзасы

____

Чәдвәл 3.   Су сәрфи вәрәгәси

Саһәнин һесабланмасы

Дәринлик өлчмә нөгтәләри	Даими нөгтәдә олан мәсафә, м	Дәринлик, м			Өлчмәләр арасы мәсафә, м	Өлчмә арасында кы орта дәринлик м	Өлчмәләр арасы саһә	Интервал арасында саһә $м^2$
		1	2	Ор-та...				

Саһә ____________________ $м^2$

Су сәрфи вәрәгәси

Чај______________________________

Мәнтәгә_________________________

Фырланғыч системи________________________

№_____________________

Контакт һәр__________________дөврдән__________________

Сәвијјә (см) башланғычда____гуртаранда_______ орта_____

Һаванын вәзијјәти___________________________________

Өлчмә башланды(саат)_____ гуртарды (саат)______________

Су сәрфи ($м^3$/сан)________________________________

Саһә ($м^2$)_______________________________________

Орта сүрәт (м/сан)__________________________________

Чајын ени (м)______________________________________

Орта дәринлик (м)___________________________________

Мејиллик (%)_______________________________________

Сәрфи өлчдү____

Һесаблады____

Јохлады____

Чәдвәл 3 (давамы)

Сур'әт м/сан															
	Фырлан-ғачын бура-хылма дәрин-лији		саниjә						Доврләрин чәми	Бир саниjәдә довр	Сурәт м/сан	Орта сурәт м/сан	Сурәтин jарысы м/сан	Саһә м²	Су сәрфи м³/сан
			1	2	3	4	5	6							
N E h П	C 0,2 0,6 0,8 Д														
N E h П	C 0,2 0,6 0,8 Д														
N E h П	C 0,2 0,6 0,8 Д														
N E h П	C 0,2 0,6 0,8 Д														
N E h П	C 0,2 0,6 0,8 Д														
N E h П	C 0,2 0,6 0,8 Д														
N E h П	C 0,2 0,6 0,8 Д														
N E h П	C 0,2 0,6 0,8 Д														

Чәдвәл 1. Торпаг профилинин тәсвири

Торпаг профилинин гурулуш схеми	Кенетик һоризонтлар вә онун јер сәтһиндән дәринлији, см	Һоризонтларын тәсвири: рәнки, чәмлији, механики тәркиби, сыхлығы, структуру, батағлашма, шорлашма вә шоракәтләшмә вә с.

Чәдвәл 2 Торпаг хәритәсинә шәрти ишарәләр

Чөл торпаг хәритәсиндә индекс	Сыра № вә рәнки	Торпағын ады	Механики тәркиби	Торпаг әмәлә кәтирән сүхур	Релјефә көрә јерләшмә шәраити	Саһә ha	Тәсәррүфатын үмуми саһәсиндән фаизлә
1	2	3	4	5	6	7	8

Чәдвәл 3 Торпағын механики тәркиби

Тәсәррүфатын ады, рајон, өлкә											
Сыра нөмрәси	Кәсијин нөмрәси	Кенетик гатлар	Нүмунәнин көтүрмә дәринлији	Һигроскопик нәмлик %	Фраксијаларын мигдары ,%						0,01 мм-дән фрак-сијала-рын чәми
					1-0,25 мм	0,25-0,05 мм	0,05-0,01 мм	0,01-0,005 мм	0,005-0,001 мм	<0,001 мм	

Чәдвәл 4 Торпағын кимјәви анализинин нәтичәләри

Сыра №	Торпаг кәсијин-нин нөмрәси	Торпағын ады	Кенетик гатлар	Нүмунә-нин көтү-рулмә дәринлији (см)	Метод көстәрилмәклә анализ нөвләри														
1	-2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Чәдвәл 1. Чәл тәдгигат журналы

Сыра №-си	Су објект-ләри-нин ады	Нүмунәләрин көтүрүлмә мәнтәгәси вә №-си	Нүмунәләрин көтүрүлмә тарихи	Физики көстәричиләр					
				Сујун температуру, дәр.	pH	EC мОмhос/см	Шәффафлығы	рәнки	Һәлл олунмуш оксикен

Мониторинг нөгтәси ________________

Мә'луматлар һарадан алыныб, ____________

нә вахт

Чәдвәл 1: Су илә кечән вә судан төрәјән хәстәликләр һаггында һесабат

N	Хәстәлијин ады	Гејдијјатдан кечән хәстәләрин чәми	о чүмләдән				Гејд
			гадын-ларда	14 јаш дахил олмагла ушаглар да	кәнд әһалисиндә		
					чәми	онлардан 14 јаш дахил олмагла ушагларда	
1	Гарын јаталағы						
2	Паратиф						
3	Салманеллоз						
4	Дизентерија						
5	Төрәдичиси мә'лум ентеридләр						
6	Төрәдичиси мә'лум олмајан ентеридләр						
7	Вируслу һепатит						
8	Малјарија						

Чәдвәл 2: Су илә кечән вә судан төрәјән хәстәликләрки анализи

N	Хәстәлијин ады	Гејдијјатдан кечмиш хәстәләрин чәми	10 мин әһалијә көрә көстәричи	Әввәлки иллә мүгајисә, артһи (азалма) %	Республика үзрә гејдә алынмыш хәстәләрә көрә, % илә
1	Гарын јаталағы				
2	Паратиф				
3	Салманеллоз				
4	Дизентерија				
5	Төрәдичиси мә'лум ентеридләр				
6	Төрәдичиси мә'лум олмајан ентеридләр				
7	Вируслу һепатит				
8	Малјарија				

ANNEX C

Workshop Agenda

ENVIRONMETAL ASSESSMENT AND MONITORING
IN THE PROJECT AREAS OF THE SAMUR APSHERON CANAL AND MAIN MILL MUGAN COLLECTOR

IRRIGATION AND DRAINAGE REHABILITATION AND IMPROVEMENT PROJECT, AZERBAIJAN

04.AUGUST.1999

STATE COMMITTEE FOR LAND IMPROVEMENT AND WATER MANAGEMENT, BAKU

Time Schedule

1.	Opening speech by Mr. Kazibekov	10:00 - 10:10
2.	Selection or announcement of Moderator and Secretary for reporting	10:10 - 10:15
3.	Scope and expectations from the project	10:15 - 10:30
4.	Monitoring Objectives, Indicators, Schedule, Requirements and Needs for Rare Species by Mr. Ismailov	10:30 - 10:45
5.	Monitoring Objectives, Indicators, Schedule, Requirements and Needs for Hydrological and Hydrogeological Flow Regimes by Mr. Aliyev	10:45 - 11:00
6.	Monitoring Objectives, Indicators, Schedule, Requirements and Needs for Soil Degradation and Land Use by Mr. Gaziev	11:10 - 11:15
7.	Monitoring Objectives, Indicators, Schedule, Requirements and Needs for Protected Areas by Mr. Asadov	11:15 - 11:30
8.	Monitoring Objectives, Indicators, Schedule, Requirements and Needs for Water Quality by Mr. Akhmedov	11.30 - 11:45
9.	Monitoring Objectives, Indicators, Schedule, Requirements and Needs for Health Situation by Mr. Akhundov	11:45 - 12:00
10.	Monitoring Objectives, Indicators, Schedule, Requirements and Needs for Income Situation by Mr. Ismailov	12:00 - 12:15
11.	Institutional Building by Mr. Mamedzadeh	12:15 - 12:30
12.	Lunch Break	13:00 - 14:00

13. Discussions on the Monitoring Programme of MMMC 14.00 - 15:30
13.1. Discussion on the Monitoring Parameters Needed for Environmental Assessment for MMMC
13.2. Evaluation of the Available Information for MMMC
13.3. Expected Inputs from and Requirements of the Institutes
13.4. Expected outputs and public access of them
14. Discussions on the Monitoring Programme of SAC 15:30 - 17:00
14.1. Discussion on the Monitoring Parameters Needed for Environmental Assessment for SAC
14.2. Evaluation of the Available Information for SAC
14.3. Expected Inputs from and Requirements of the Institutes
14.4. Expected outputs and public access of them
15. Expected Inputs from and Requirements of the Institutes
16. Discussions on the Monitoring Structure of both Projects 17:00 - 18:00
17. Greetings and closure

List of Participants

N. Kazibekov	- First Deputy Chairman of State Amelioration and Irrigation Committee (SAIC)
M. Kuliyev	- Moderator SAIC, PIU
B. Paus	- Team Leader, CES
S. Cimen	- Deputy Team Leader, CES
R Akhmedov	- Azerbaijan State Committee of Ecology (ASEC), expert
R Samedov	- Institute of Melioration and Scientific Research
I. Huseynov	- State Committee of Forest Usage
F. Hashimzadeh	- Head Engineer, Water Usage Control Centre
T. Osmanov	- Chief of Laboratory, AzNIIGM
N. Kerimov	- AzNIIGM
H. Mailov	- Committee for Geology and Mineral Resources
L. Tagizadeh	- Republican Centre for Hygiene and Epidemiology
G. Hajeyev	- State Hydro-meteorological Institute
F. Aliev	- expert, IRRIGATOR
A Gaziev	- expert, IRRIGATOR
M. Asadov	- expert, IRRIGATOR
R Ismailov	- expert, IRRIGATOR
Prof. K. Akhundov	- expert, ETI
M. Ismailov	- expert, ASPI
1. Mammedzadeh	- expert ASPI

MINUTES OF THE WORKSHOP ON THE ENVIRONMENTAL ASSESSMENT AND MONITORING

Baku, 4 August 1999

Inviting: Mr. N. Kazibekov, Deputy Chairman of SAIC Moderator: Mr. Kuliyev, SAIC, PIU Consultant: Mr. B. Paus, CES Location: Azgiprovodkhoz Institute

- Starting: 10:00

1. Mr. Kazibekov opens the workshop, welcomes the participants and gives a brief outline on the objectives of the project and of the workshop.
2. Mr. Kuliyev takes over to moderate the workshop together with Mr. Paus. He sets the rules of workshop. The working languages of the workshop to be either English or Azeri.
3. Mr. Paus details the purpose of the workshop and proposes the delineation of the project areas of the SAC and the MMMC to be for the present study as follows:
4. SAC Project Area: The area is bordered by the Samur-Apsheron Canal in the west, the Caspian Sea coast line in the east, the international border line in the north and the Velvelichay river in the south.
5. MMC Project Area: The area is bordered by the Araz river from south west to north east, the Karabakh Canal on the south west and K3, Ag-Gol and Sarisu lakes together with the Kura form the northern borders of the project area.
6. Maps showing both of the project areas are distributed in the workshop.
7. The project areas have been discussed and accepted by the participants on question.
8. Mr. Aliyev (hydrology expert), explains the methodology for (geo-)hydro-climatological monitoring. He proposes sampling points for both of the project areas that are generally accepted by the participants.
9. Mr. R Ismailov (rare species expert) explains his findings on rare species of flora and fauna. He proposes monitoring methodology together with indicators of rare species and sampling locations.
10. Mr. AJ. Gaziyev (soil and land use expert) outlines the methodology for soil and land use monitoring. He proposes sampling points for both of the project areas that are generally agreed upon by the participants.
11. Mr. Asadov (natural parks expert) defines his findings on natural parks of both of the project areas. He proposes sampling locations for both of the project areas that are generally agreed upon by the participants. He asks for data on state reserves from the Azerbaijan State Committee on Ecology and the Control of the Natural Resource Utilisation.
12. Mr. Prof. Akhundov (health expert) explains the methodology of the monitoring of health aspects. He proposes 4 regions for monitoring of health indicators. Two of them are offered to be in Salyan and in Imishli for the MMMC area and another two in Khachmaz and in Baku.

13. Mr. Kuliyev (moderator) reminds Mr. Akhundov about the project areas. He recommends to exclude Salyan and Baku from the proposed monitoring regions. His recommendation on this subject is agreed upon by all of the participants.
14. Mr. Ahmadov (the water quality expert), explains the methodology for water quality monitoring. He proposes sampling points for both of the project areas that are generally accepted by the participants.
15. Mr. Ismailov (socio-economical expert) explains the methodology of the monitoring of socio-economical aspects. He proposes the key parameters for monitoring of these aspects that are agreed generally by all of the participants.
16. Mr. Mamedzadeh (institutional expert) explains the methodology used for setting up the environmental monitoring unit. He also explains his findings on the institutional analysis.
17. Mr. Paus (team leader) asks if any legislative obstacles are known ruling against the set up of an environmental monitoring unit within the SAIC.
18. Mr. Mamedzadeh replies that there is not any legislative obstacle to set up this environmental monitoring unit in the SAIC. All of the participants generally agree upon on this subject
19. Mr. Kuliyev (moderator) opens discussions.
20. Mr. Samedov (representative of the Water Affairs of Azerbaijan) asks for the monitoring area and timing of monitoring programme.
21. Mr. Paus explains again the borders of the project areas. He informs that the monitoring programme should be carried out before, after and during the project construction periods.
22. Mr. Samedov (Water Affairs of Azerbaijan) asks for the duration of the monitoring programme.
23. Mr. Paus explains that monitoring should be carried out up to 10 years depending on the parameter to be observed.
24. Mr. Samedov (Water Affairs of Azerbaijan) recommends the monitoring of the SAC area should be extended up to the Jeyranbatan reservoir.
25. Mr. Kuliyev rejects Mr. Samedov's recommendation.
26. Mr. Mailov (representative of the Committee for Geology and the Mineral Resources of the Republic of Azerbaijan (CGHMR) claims that after the rehabilitation of the Samur Apsheron Canal groundwater level in the SAC project area will increase. He says that the monitoring programme should also cover monitoring of the groundwater level within this area. He explains that the CGHMR is ready to share data in both of the project areas.
27. Mr. Paus shares the opinion and declares that groundwater is one of the key parameters, he asks Mr. Aliyev (hydrology expert) to contact with Mr. Mailov to obtain the data.
28. Mr. N. Kerimov (representative of the Scientific Hydrotechnical and Meloration Institute of Azerbaijan) explains that his institute is also ready to share their existing data on hydrology.
29. Mr. Huseynov (Forestry Agency) explains that irrigation implied extension of agriculture will have an impact on the forestry area in Yalama and Khachmaz region.

30. Mr. Paus agrees with his explanations. He explains therefore a land-use monitoring in the SAC area will be part of the monitoring programme.

31. No more questions

Mr. Kuliyev thanks all the participants for their valuable contribution. Mr. Paus also expresses his gratitudes to all participants for their contributions.

Ending at 14:00

Minutes

of workshop devoted to environmental impacts of "Rehabilitation and Completion of Irrigation and Drainage Infrastructure Project" and project areas environment monitoring programme

Khachmaz **December 07, 1999**

Participants: The announcement about realization of seminar - conference was before-hand given in one of the central republican newspapers ("Khalg Gazeti" December 02, 1999). On a seminar were invited the representatives of hydroeconomic, agricultural and ecological organizations, farmers, public organizations and everyone, who interested by this project.

At a seminar there were representatives of the local executive authority, hydroeconomic and ecological organizations' workers, farmers from Gusar, Khachmaz and Guba regions, water users associations (29 persons).

The director of PIU Mr. M.Guliyev opened the workshop, informed participants purposes and tasks of workshop and brief description of Reconstruction of Headworks and first 50 km part of Samur Apsheron Canal.

The Deputy Project manager Mr. A.Gafarli gave wide report of specification of project.

The representative of "Azgiprovodkhoz" Mr.M.Asadov indicated environmental aspects, possible environmental impacts of the said project. He also pointed out that, it was prepared monitoring programme to be implemented on influence zone of SAC project areas.

After information a lot of questions raised mainly subject to engineering aspects of the project.

After that the discussion of the project began. The discussion has shown, that collected, basically, are familiar with this project under the different publications in a press and television reports.

Many problems, essence which one, basically preset to the participants of a seminar, was reduced to following:

- The poor activity of a collector-drainage system in Khachmaz region is negatively mirrored in a condition of dabbled grounds. Whether the renovation of an intraeconomic drainage system is stipulated by the project?
- How much water will move in cities of Baku and Sumgait on the potable purposes from Jeyranbatan reservoir after rehabilitation of SAC.
- There are large losses of water on a filtration from earthen channels. Whether the concreting of these channels is stipulated by the project?
- How the clearing of water of detrital deposits is envisioned?
- How will be solved the problem water deliverys for a spraying during renovation SAC?

- Quite often in SAC fall and the people and livestock perish. Whether any measures for an avoidance it are envisioned?
- How will be solved the problem compensation of grounds falling under a line of building of a Khanarkh channel?

On all problems the in-depth answers and explanations were given.

Essentially the resume of comments are the followings:

Taking into account that SAC is existing canal system and construction-repairing works will be carried out of Headwork and 50 km canal part, the environmental impacts said activities should be minimized as possible. It was suggested to install fish screen structures in the rivers intended water intake for SAC in future. It was also pointed out importance of river water from sediment.

Generally participants indicated importance of project implementation which will improve water supply of irrigated land on project zone.

Participants also expressed their satisfaction that this project takes into account the environmental points in wide scale.

Minutes kept by

Representative of "Azgiprovodkhoz"
M. Asadov

Minutes

of workshop devoted to environmental impacts of "Rehabilitation and Completion of Irrigation and Drainage Infrastructure Project" and project areas environment monitoring programme

Saatly **December 09, 1999**

Participants: The announcement about realization of seminar - conference was before-hand given in one of the central republican newspapers ("Khalg Gazeti" December 02, 1999). On a seminar were invited the representatives of hydroeconomic, agricultural and ecological organizations, farmers, public organizations and everyone, who interested by this project.

At a seminar there were representatives of the local executive authority, hydroeconomic and ecological organizations' workers, farmers from Imishli, Saatly and Sabirabad regions (18 persons).

The director of PIU Mr. M.Guliyev opened the workshop, informed the participants purposes and tasks of workshop and brief description of construction of Main Mill Mugan Collector Canal 31 km long.

The deputy Project manager Mr. A.Gafarli gave information about the project and engineering aspects. The representative of "Azgiprovodkhoz" Mr. M.Asadov pointed out environmental aspects, possible environmental impacts of the said project. He gave information that special monitoring programme had been prepared and would be carried out on Main Mill Mugan Collector project.

Discussions and questions, raised during meeting mainly regarded to the engineering aspects of the project. The questions were covered not only designed project but the already constructed part.

Basically problems and proposals was applied to following:

- What way and what gears envisions clearing of MMMC after completion of building?
- How is solved the water supply problem of the Ag-gol and Sarycu lakes?
- Whether there is a waterlogger threat for Boz-kobu?
- How will the junction of MMMC with MMKK affect on lands to be improved in Saatly region?
- What water line will be in a collector and how lower it will be than a level of a surface of the ground?
- The intereconomic collectors are in bad condition. Whether their renovation is envisioned by the project?
- Whether the creation of forest belt along of MMMK is planned?

Generally, all participants indicated importance of Project implementation, which would improve irrigated lands, raise their productivity and make possible achieve protection of environment. It was also expressed approval of intended monitoring programme for the said project.

Minutes kept by **Representative of "Azgiprovodkhoz"**
M. Asadov

Minutes

of workshop devoted to environmental impacts of "Rehabilitation and Completion of Irrigation and Drainage Infrastructure Project" and project areas environment monitoring programme

Baku city **December 10, 1999**

Taking in account, that the representatives of non-governmental public and ecological organizations have not accepted participation in seminars spent for regions of republic, for them the seminar in city of Baku was conducted follow-up.

At a seminar were present:

S. Israfilov	- Chairman of Nature Protection Society of Azerbaijan
A. Eyvazov	- Chairman of Local Lore Study Society of Azerbaijan
R. Garayev	- Representative of "Eco-Energetika" Public Academy
O. Mamedov	- Representative of "Eco-Energetika" Public Academy
T. Karagezov	- First Deputy Chairman of Akademician G. Aliyev Fund
A. Islamzade	- Chairman of Ecological Rehabilitation Center of Sumgait city
R. Akhmedov	- Representative of Committee on Ecology and Nature Utilization Control of Azerbaijan

and also representatives of Irrigation and Water Use Committee, Project Implementation Unit and "Azgyprovodkhoz" Project Institute (13 persons).

The First Deputy Chairman of Committee of Amelioration and Water Facility Mr. N.Kazibekov opened the workshop indicating purposes and tasks of the meeting and gave brief information rehabilitation of first 50 km long Samur Apsheron Canal and completion of Main Mill Mugan Collector projects.

The deputy Project manager Mr. A.Gafarli told about project and its technical details.

The representative of "Azgiprovodkhoz" Mr. M.Asadov in his information indicated environmental aspects of project, its possible environmental aspects of project, its possible environmental impacts. He pointed out the Project Environment monitoring programme had already prepared for each projects.

After information a lot of questions raised by participants mainly not regarding to those projects.

Basically problems and proposals was applied to following:

- Is it possible to use the detrital deposits defended in SAC's settlings?
- Whether there are data on a structure of detrital and whether they are suitable for usage in an agriculture?
- Whether the conservation zone for SAC is stipulated in the project?
- How much will be increased a volume of Jeyranbatan reservoir?
- Whether the economic efficiency of the given project was studied?
- How can influence the implementation of the project an ecological condition of lake a Ag-gol? Whether the problem of lake's water supply is esteemed in the project? Allowing its large significance, as reservation, it is necessary to approach to this problem closely.
- It is necessary to solve, where the detrital deposits from SAC's settlings will be stored? The analysis of an elemental composition of the rivers to a zone SAC is necessary.
- In some places SAC it is necessary to construct covered for an avoidance of its pollutions.

All questions raised in the meeting were answered in detail.

Minutes kept by

Representative of "Azgiprovodkhoz
M. Asadov