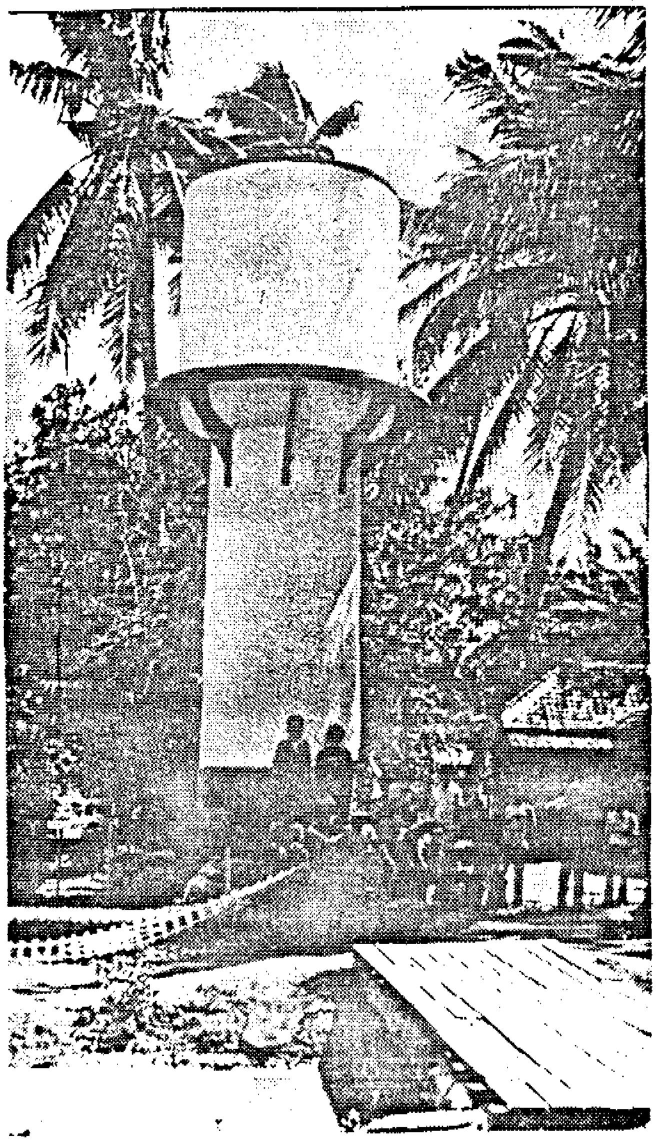
Government of Indonesia
Ministry of Public Health
Directorate General of
Communicable Disease Control
and Environmental Health

Government of The Netherlands
Ministry of Foreign Affairs
Directorate General of
International Cooperation

Consultancy for the development of the rural water supply sector of the Kabupaten Indramayu, Province of West Java, Republic of Indonesia.

FINAL REPORT.



West Java Rural Water Supply Project

IWACO
Consultants for Water & Environment

Head Office:
P.O. Box 183
3000 AD Rotterdam
The Netherlands

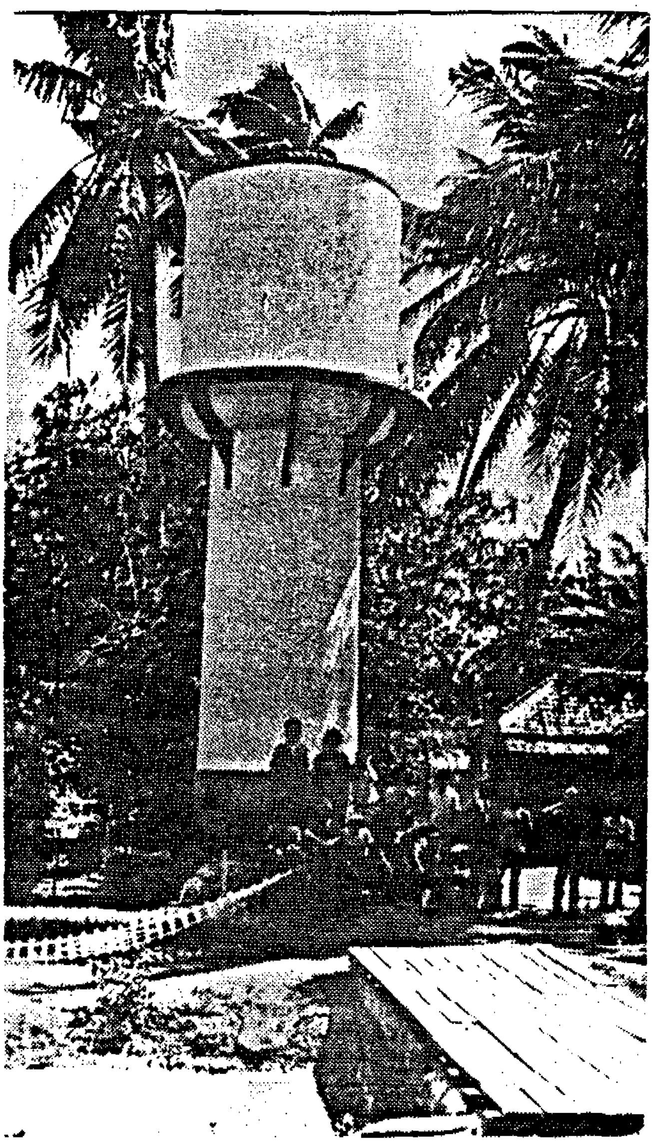
Rotterdam july 1985.

Government of Indonesia
Ministry of Public Health
Directorate General of
Communicable Disease Control
and Environmental Health

Government of The Netherlands
Ministry of Foreign Affairs
Directorate General of
International Cooperation

Consultancy for the development of the rural water supply sector of the Kabupaten Indramayu, Province of West Java, Republic of Indonesia.

FINAL REPORT.



West Java Rural Water Supply Project

IWACO
Consultants for Water & Environment

Head Office:
P.O. Box 183
3000 AD Rotterdam
The Netherlands

Rotterdam july 1985.

CONSULTANCY FOR THE DEVELOPMENT OF THE RURAL WATER SUPPLY SECTOR OF THE KABUPATEN INDRAMAYU, PROVINCE OF WEST JAVA, REPUBLIC OF INDONESIA.

FINAL REPORT

Acknowledgements.

This report is the result of the effort of a lot of people, related to the RWS&S Sector Development Programme in Indramayu, West Java, and its mother project, the West Java Rural Water Supply Project (OTA-33).

The Sector Development Programme in the Kabupaten of Indramayu (SDKI Programme) is the consequence of the visit paid by the Dutch Ambassador, Mr. L.B.J. van Gorkom, to Indramayu to the site of the first "MCKS" - an integral water supply and sanitation scheme - in the village of Cilandak. The Bupati of Indramayu, Mr. H.A. Djahari, SH., suggested to the Ambassador that this system could be the pivot around which to set-up the Village Water Supply Organization. His main argument was the appropriateness of the system; staff of his own services at Kabupaten level, together with people from the village constructed this plant.

A project proposal for the development of the RWS&S sector was formulated and approved by the Dutch Directorate General of International Cooperation and the Indonesian Directorate General of Communicable Diseases Control and Environmental Health (CDC&EH).

We would like to express our thanks to Dr. Adhyatma, Director General of CDC&EH, who has always been very interested in the developments in Indramayu. We would like to thank both Mr. van Gorkom and Mr. Djahari for the opportunity to further develop this kind of technology. Through this project we had the possibility to test innovative methods for village development. The Ambassador fully backed the SDKI-programme, and the Bupati pushed actively to make the programme a success.

Drs. M.H. Dol from the Dutch Embassy and Ir. B. van Bronckhorst, then projectleader of the West Java Rural Water Supply Project "OTA-33" have done a lot for the promotion of the approach of the SDKI Programme, as well as Ir. A.R. Bergen, project supervisor of "OTA".

Indeed many people have worked hard to make this project a success. Not only the project office of OTA in Bandung - led by Ing. W.R. van Kerkvoorden and Drs. A.Santoso- but also the OAMP office in Indramayu- led by Mr. Baitha Nusantara, BA.
A special word of thanks to Mr. Agus Ruchimat, SH and Adil Finoraldy, BSc, who solved many Indramayunese problems, and of course Hari Siswoyo Aji, BSc and Dr. Maria Ulfah Asmuni, who introduced us to the Village Head of Cilandak, the village where it all started.

Finally a word of thanks to IWACO B.V., Consultants for Water and Environment, Rotterdam, who took care that funds where always available for project implementation and provided technical backstopping. IWACO, together with the Indonesian firm Unisystem Utama Ltd., is the consultant for the West Java Rural Water Supply Project OTA-33.

Caspar L.P.M. Pompe
Projectleader Sector Development
Programme Kabupaten Indramayu.

S U M M A R Y

The Sector Development Programme in the Kabupaten of Indramayu (SDKI) is a sub-project of the West Java Rural Water Supply Project OTA 33 in the Republic of Indonesia. Within the framework of the cooperation between the Dutch and the Indonesian Governments, the counterpart agencies are the dutch Directorate General of International Cooperation (DGIS) and the indonesian Directorate General of Communicable Diseases Control and Environmental Health (CDC&EH). The consultants are PT UNISYSTEM UTAMA, Jakarta and IWACO BV, Rotterdam. The SDKI Programme started in Januari 1982 and terminated in May 1984.

Kabupaten Indramayu is one of the Kabupatens in the northern coastal plain of West Java. In 1982 average income is about US$ 250.-. The area has a high occurrance of communicable diseases. This is why Indramayu is chosen as one of the areas assigned to the OTA Project.

The general objective of the SDKI Programme is the development of the Sector of Rural Water Supply (and Sanitation) at Kabupaten level. The activities of the SDKI Programme are concentrated on the Village Water Supply Organization of the Kabupaten of Indramayu; the OAMP. The set-up of the OAMP aimes at decentralization of RWS activities. In order to develop the OAMP, a "Learning by Doing" approach is adopted. Complexity of management of the OAMP is gradually increased in several steps. The vehicle for organization development is the actual construction of village water supply schemes.

The OAMP is now able to survey, design, and construct simple piped systems. However, operation and maintenance (O&M) is not yet taken care of at a regular basis, due to lack of funds and personnel. Regulations, that are required for a regular and functional water quality control (WQC), are not yet issued. Skills are mostly available, while little additional investments are needed for the set-up of a decentralized WQC. Additional consultancy is urgently requested, especially in order to set-up systems for both O&M and WQC.

A pragmatic method of community participation is developed. For this purpose a mapping team produces a map of the village in close cooperation with the village administration and members of the community. During the process a baseline survey is conducted. Village meetings and interviews make that villagers are involved almost individually in the project taking place in their village. During all stages of the project, labour from the village is paid normal wages. A village water team is established in the village to run the scheme. The process of community participation is illustrated with the case of the village of Sukareja.

In this case, the Kabupaten Administration used the services of the SDKI Programme (mapping team and water supply scheme) in the implementation of their integrated village development project. The project was fully initiated and coordinated by the Kabupaten Administration of Indramayu.

It is recommended that the method of survey annex community participation be further consolidated, and possibly integrated with the newly deviced programme on primary health care of the Health Ministry. A mapping team that takes care of storage of data and updating may be established. These activities may be coordinated by Bappeda II. Production of a map of a village of about 3000 people takes about a month at a cost of about US$ 1,000.-, including the baseline survey. The making of such maps may be contracted to local consultants.

The Dutch and Indonesian Governments have committed themselves to go on with their cooperation in the field of RWS&S in West Java. For this purpose, several elements of a programme for RWS&S are discussed. In a multi-kabupaten programme, still the turning point will lay at kabupaten level. Now, several Kabupaten Programmes are coordinated by a RWS&S Organization at Provincial Level. Each new RWS&S Organization at Kabupaten Level will start small, but will evolve into a full fledged Service for RWS&S eventually.

It is recommended strongly to finance the Programme with T.A. funds mainly, since procedures that are required for Project Aid may hamper proper implementation seriously.

Details on the several technical units that have been realized during the SDKI Programme are provided in Annexes, as well as a financial evaluation. Per Capita Investments (PCI) are used for the evaluation. The average PCI for hardware of the SDKI Programme is US$ 9.38, but this figure is misleading and should not be compared with figures of other programmes. PCI figures are influenced by the elements that make-up the systems. The PCI figures are also a function of the way of implementation and whether overhead is included or not. PCI of a typical surface water treatment scheme of the SDKI Programme, as budgetted by standards of Public Works, built by a local contractor and including overhead of the principle, would amount to about US$ 25.- (MCKS 3000, 1985). The OAMP realizes such a system by themselves at a PCI of US$ 14.50 (1985), excluding overhead.

The total budget of the SDKI is Dfl 568,000.- excluding consultancy. (US$ 172,000.- at 1 US$ = Dfl 3.40)

G L O S S A R Y

APBD I	Regional Budget, provincial level
APBD II	Regional Budget, kabupaten level
APK	Academy of Sanitary Engineering (Ministry of Health)
ATPU	Academy of Sanitary Engineering (Ministry of Public Works)
BANGDES	Village Development Organization
BAPPEDA I	Provincial Planning Board
BAPPEDA II	Kabupaten Plannning Board
BAPPENAS	National Planning Board
BPAM	Kabupaten branch of Provincial Water Supply Project of PU
Bupati	Administrator of Kabupaten
CDC&EH	(Directorate General) of Communicable Diseases Control and Environmental Health
Camat	Administrator of Kecamatan
DAGRI	(Ministry) of Home Affairs
DEPKES	Department of Health (National Level)
DINKES	Health Service (Provincial and Kabupaten Level)
Desa	Village (5th administrative level)
IKK	Small Cities Water Supply Project
IWACO	Consultants for Water and Environment, Rotterdam, Holland
Kabupaten	Regency (3rd administrative level)
Kecamatan	Sub-district (4th administrative level)
LKMD	Village Resilliance Organisation
MCKS	Integrated Rural Water Supply and Sanitation Scheme
OAMP	Village Water Supply Organization of Kabupaten Indramayu
OPAMDES	Village Water Supply Organization of Kabupaten Karawng
OTA 33	West Java Rural Water Supply Project OTA 33
PCI	Per Capita Investments
PDAM	Kabupaten Water Supply Company
PU	Publics Works (Department or Ministry)
PU-CK	PU-Cipta Karya; Department of PU responsable for WS&S
PU-K	Public Works Service of Kabupaten Administration
RWS	Rural Water Supply
RWS&S	Rural Water Supply and Sanitation
SDKI	RWS&S Sector Development Programme of Kabupaten Indramayu
SPPH	Highschool of Sanitary Engineering (Ministry of Health)
UNISYSTEM	Engineering and Management Consultants, Jakarta, Indonesia
Wayang	Traditional Puppet Play

1. INTRODUCTION.

From Januari 1982 until May 1984, the West Java Rural Water Supply Project OTA 33 provided services to the Administration of Kabupaten Indramayu in the form of a sub-project, entitled:

> Consultancy for the development of the Rural Water Supply Sector of the Kabupaten Indramayu, Province of West Java.

This sub-project, the **Sector Development** Programme Kabupaten Indramayu (SDKI Programme), had its office in the capital city of the Kabupaten Indramayu. The main actor, at Kabupaten level, was the Village Water Supply Organization; the OAMP.

Pivot of the SDKI Programme is an integrated village water supply scheme with a capacity of about 3 l/sec.; the "MCKS 3000". The scheme is operated by the Water Supply Team of the village where the system is located. Expenditures for daily operation is covered from consumer fees of House Connections and Public Stand Posts. No subsidies are given for this purpose. Besides this scheme, that uses surface water as water source, other types of schemes are provided as well. A common characteristic of these schemes is that sanitary facilities are always included. During implementation, the village community is involved closely, from survey until monitoring. As much as possible goods and services from inside the Kabupaten are purchased.

At the time this report is written, about a year after the programme terminated, most of the schemes, that are realized under the programme, are still functioning. In particular the schemes, that cover a whole village, are still in use, because the Village Head is motivated to monitor the functioning of the Water Supply Team. The higher level of service, through the provision of House Connections, is important to make the schemes functions well. In this way a continuous water supply to Public Stand Posts is ensured as well. Annex 1 provides insight into the status quo of the systems as per April 1985. Although many systems still function, proper maintenance is not yet taken care of due to lack of funds and personnel.
Last year little activity is undertaken by the OAMP, besides irregular maintenance of the systems. However, for fiscal year 86-87, the OAMP plans construction of about 11 new schemes.

Village Water Supply Organization of Kabupaten Indramayu

Hopefully, this report may initiate further assistance to the OAMP. The Bupati states that two more years of assistance would be needed to make the OAMP strong enough. Most important in this assistance is know-how transfer, and consultancy to the further development of the OAMP. Funds may already be available through the regional budget (APBD II).(see annex 2) Funds, however should not be allocated for construction only, but maintenance should also get a regular funding. The SDKI Programme did not have the possibility to set-up a well functioning maintenance section within the OAMP. Obviously this should be a major field of attention in the future.

The first chapter is devided into four sections. The first and second sections deal with the geographical setting of the project, the Regency of Indramayu in the Province of West Java, as well as the water supply problems in this area. A short history is given in section three. The fourth section provides insight into the set-up of the programme.

Chapter two deals with organization development of the OAMP. Aspects such as Man Power Development, Know How Transfer and Management are discussed in this chapter. Chapter three is conceptional and deals with community participation and rural development. In chapter four recommendations for further activities are given.

All technical and factual information is given in Annexes, of which Annex 3 and 4 are of special interest. Annex 3 is a listing of all the systems that have been build by the OAMP during the SDKI Program. Each system is explained technically and some interesting points related with each system are discussed. Annex 4 is a financial evaluation of the SDKI programme. Performance of the OAMP is illustrated with figures. A break-even analysis of the water supply scheme of the village of Lobener is included in this annex.

1.1. THE REPUBLIC OF INDONESIA, WEST JAVA PROVINCE.

The archipelago of the Republic of Indonesia consists of more than 13 thousand islands over an area as large as the United States.

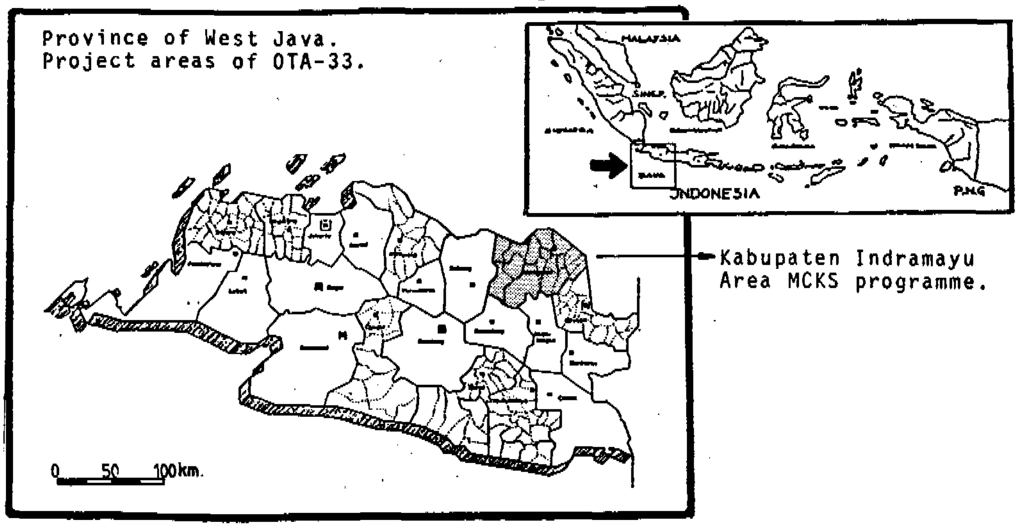
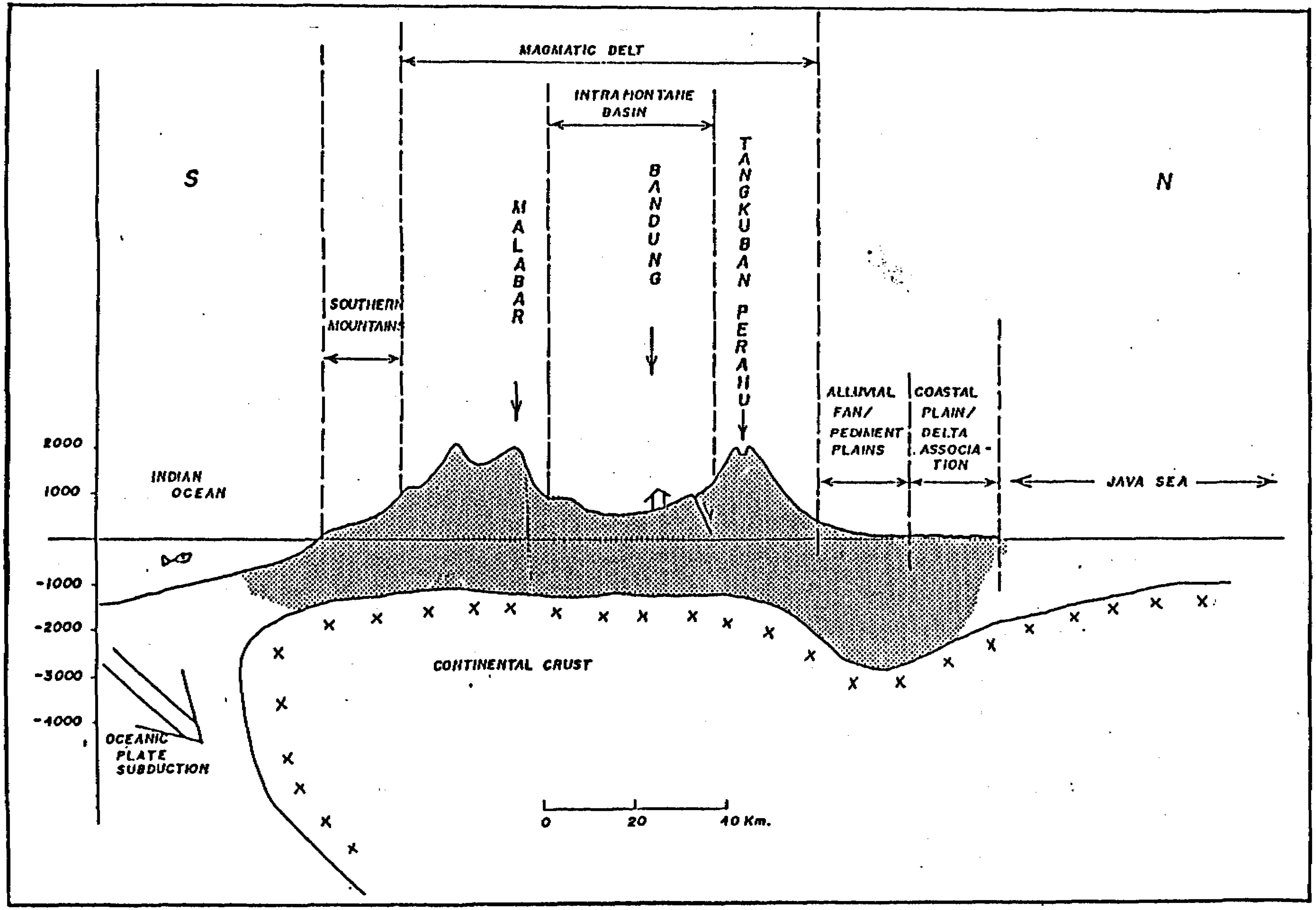


Figure 1.: Location of the programme.

More than 145 million people live on this "ribbon of emeral" as Indonesia is called because of its evergreen tropical islands. However, about 60% (85 million) of its people live on the island of Java, which has a land surface of only 6,9% of the total Indonesian land surface. The Province of West Java has 33 million inhabitants with a concentration in the metropolitan area of Jakarta with 7 million inhabitants.

Driving along Javanese roads one sees on both sides an endless sequence of houses, people, mosques, markets, etc. From a "bird's-eye" view you would distinguish the dark green string of settlements along roads and bordering water arteris, former river basins and beach levies. In between, light green rice paddies glimmer and glitter in the sun.
On the northern coastal plains the population density has an average of about 650 inhabitants per square kilometer.

The coastal plains of Java are of (geologically) recent date. Birdfoot shaped river deltas are constantly extending their flood plains into the Java Sea, with material eroded from the volcanic mountain ridge which forms the spine of the Indonesian archipelago. After drainage this highly fertile flood plain is made into irrigated rice paddies.


MAGMATIC BELT
INTRAMONTANE BASIN
S
N
MALABAR
BANDUNG
TANGKUBAN PERAHU
SOUTHERN MOUNTAINS
ALLUVIAL FAN/ PEDIMENT PLAINS
COASTAL PLAIN/ DELTA ASSOCIATION
JAVA SEA
INDIAN OCEAN
2000
1000
-1000
-2000
-3000
-4000
CONTINENTAL CRUST
OCEANIC PLATE SUBDUCTION
0
20
40 Km.

Originally settlements were mostly found along the rivers. Of the 40 thousand people living in the Indramayu part of the Cimanuk water shed in the beginning of the 18th century, only 7 thousand people lived on the coast or in the hills. With the extension of the irrigation system, settlements were also set-up along its channels. However, the major part of the population stayed near the river. The effective population density in the residential areas in the villages increased enormously, since the farmers, with mostly small landholdings, do not want to sacrifice rice paddies to settlements. The type of growth encountered here may be called Density Growth. The existing environment will eventually get overloaded and damaged. To cope with these changes the Javanese community will have to improve the quality and quantity of infrastructure and facilities in their villages and cities.

WEST JAVA, WATER RESOURCES.

West Java has a tropical monsoon climate; in the wet season heavy rains sweep over the plains and soak the mountains, whereas in the dry season the sun evaporates water from the ponds and wells and cracks the fertile land. In the rainy season man may be drowned in floods, in the dry season he may have to pay a high price for water since it becomes scarce.

The picture of water resources in West Java is broadly divided into two: one of the mountain areas and one of the (coastal) plains.

The hills around the volcanoes are being terraced up to a reasonable height for rice paddies and for spice- and vegetable cultivation. The highest areas are occupied by human settlements. People of these mountain settlements fetch water from deep dug wells (to 80 m deep) or use seeping water which is part of the hydrological cycle; irrigation ditches, fish ponds with mounted toilet, rice paddies, wells, etc. It is not this part of West Java where the water problem is most severe.

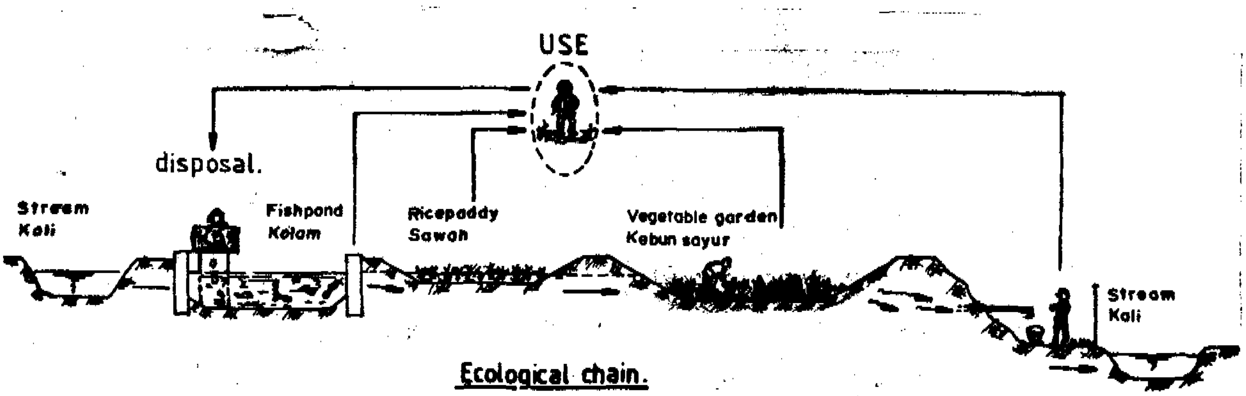


Figure 2.: Ecological Chain in Mountainous Villages.

In the coastal plains access to (safe) water forms a big problem. Utilization of deep groundwater is only possible after a considerable investment, sometimes deep groundwater is salty. Shallow groundwater is often brackish in the dry season. Irrigation water and river water is available during most months of the year, however, it is not only a source of water but also a source of diseases. The channel is used for all purposes of water usage, including excreta disposal. Still it is the water resource most people in the coastal plain are dependent upon. This is also the reason people settle as near as possible to these water arteries.

However, in both regions, hilly and flat, most surface water that is used is contaminated bacteriologically, a problem that is growing more and more acute as population density increases the contamination load. For West Java it may be stated that 84% of its rural population has no access to safe drinking water (Department of Health, 198..).

1.2. INDRAMAYU.

As part of the northern coastal plain, Indramayu mainly consists of flood plains. Eroded material is carried by the Cimanuk river and settles in the birdfood shaped delta. Every year ca. 1 ha. (10.000 m^2) of new land is built out into sea.

In the Western part of Indramayu water may be taken from deep wells.

In the eastern part shallow groundwater is predominantly brackish. In that area people are mainly dependent up on channels, rivers and some shallow groundwater from former riverbeds and beach levies. These groundwater sources however are very limited.

One problem is that the irrigation system fed by water from the Cimanuk water shed has only a partial water supply. For a period of two months a year distribution is intermittent and for up to two months a year the canals are dry. In these periods water scarcety is a reality and people have to walk kilometers for good water, or buy water from carriers with at a price of ca. US $ 0.15 per 40 liters (US $ 3.75/ m^3).

The hydro-geological conditions also explain why the water-artery related settlements are densely populated along the Cimanuk river. Along the road from Indramayu to Kertasemaya, following the course of the river, a belt of villages stretches that has "urban - rural" characteristics. In these densely populated areas infrastructural systems are very much interwoven. Water supply with no adequate relation to a discharge system will immediately cause health-hazardous situations, such as cesspools and flooded areas. Especially in the villages, the only way to fight waterborne diseases is by emphasizing the complete chain of water supply--water usage--water (and waste) disposal.

The techniques and technologies, however, should fit the socio-economic environment of the villages. At least operation and minor maintenance should be covered from consumer fees. As much as possible local labour and materials should be utilized during construction. Operators are to be recruited from the village, therefore the system should be as simple as possible. Another condition may be that the schemes must be constructed under guidance of staff of regional organizations by local contractors or the like.

Decentralization of implementation of water supply programmes is a consequence of sheer numbers. The total population of Indramayu amounts to about 1.200.000 people. They live in 350 villages and 20 Kecamatans. Only a small number of people live in the city of Indramayu (40.000). The economy is mainly agricultural. Indramayu is the Kabupaten with the highest rice production of West Java. Average income is about US $ 250 per capita in 1982. Indramayu still has a high occurrence of water related diseases such as cholera.

1.3. HISTORY OF THE OTA PROJECT AND ITS SUB-PROJECT; THE SDKI PROGRAMME.

The SDKI programme is a sub-project of the West Java Rural Water Supply Project "OTA-33". OTA started in 1976. The Dutch Ministry of Development Cooperation and the Indonesian Ministry of Health were the counterparts at governmental level. The Directorate General of Communicable Diseases Control of Indonesia and the Dutch Directorate General of International Cooperation were the executing agencies. They were represented by the Health Service (Dinkes) of the Department of Health at provincial level. The Consultancy firms IWACO B.V., Rotterdam, and P.T. Unisystem Utama, Jakarta, were charged with execution of the project. In short terms, OTA-33 was run by IWACO/Unisystem and Dinkes, with a project office in Bandung, the capital city of the Province of West Java.

OTA first started developing techniques (1976-1980), the Bandung Pump, and ferrocement rainwater tanks. Both are now widely adopted through, amongst others, the "INPRES" programme, a programme for village development on special presidential instruction. More details on the results of OTA are provided in its Final Report, dated May 1985.

The next step, set by OTA, was the development of technologies, in the sense that technology is the implementation of techniques in a certain environment. Two surface-water-treatment plants were designed, both using ferrocement and Bandung Pumps as important ingredients (1980, 1981), built together with people from the regency. One of those systems was the water treatment scheme that was built around an ancient (holy) water pond in the village of Cilandak, Kabupaten Indramayu. The system was baptized "MCKS-2000". It was totally constructed with locally available materials and labour from the village. This first MCKS was financed by a combination of Dutch T.A. funds and local funds from the Kabupaten and the Village.

The third step was Organization Development and Sector Development. OTA assisted in the set-up of RWS-organizations in two Kabupatens, Karawang and Indramayu. These organizations were set-up and staffed with part-timer staff from several relevant agencies. A concept that proved not to be very successful, because of its complicated structure of decision making.

Then the Dutch Ambassador visited the MCKS-scheme as a guest of the Bupati (Head) of the Regency of Indramayu in October 1981. During this visit, it was considered that the innovative concept of the MCKS could be the pivot around which the Village Water Supply Organization (OAMP) in Indramayu could be revitalized.

Since a new project would need too many procedures, the project was formulated as a sub-project of "OTA-33", although the counterpart organization was the Regency Administration. Thanks to the flexibility of the Director General of Communicable Diseases Control, the backing of the Ambassador and the Bupati, the project started very soon after its inception.

OTA tried as well to implement several systems at once. They learned that the process of tendering was a very trouble some. The first reason was that the Departement of Health was not experienced with tendering procedures of civil works. A second reason being the lack of skilled local contractors at Kabupaten level. One may draw the conclusion that the infrastructure for effective mass implementation by tendering to local contractors is not yet refined enough. Tendering, however, is one of the conditions of (tied) loans.

The SDKI programme, that was financed from Dutch T.A.-funds, meant to indicate an alternative way for implementation of programmes that consist of a large number of small scale units. For these programmes the process of tendering at Provincial Level would be too much of a burden. The SDKI programme would follow the required procedures at Kabupaten Level.

New techniques and technologies should be further developed together with the development of institutional concepts. Possibly in 1985 the fourth step may be taken, namely to built-out the organizational structure of rural water supply at provincial level and to extend the activities to other Kabupatens. It may be advisable to see whether the extended new project for RWS&S for West Java can ressort under the Ministry of Health. Such a set-up may very well be in-line with the Directives of the three Ministries involved in this matter (Bali, 1982)

1.4. THE SET-UP OF THE SDKI PROGRAMME.

The official title of the SDKI programme was:
"Consultancy for the development of village water supply sector in the Kabupaten of Indramayu". This broad title was necessary to allow enough flexibility. In the beginning of the programme it was not clear whether the original set-up would prove to be workable. Indeed, changes had to be made in the organization and more agencies at Kabupaten level got involved towards the end.

The main objective of the programme was the further development of the OAMP. More specifically; development that was required for building, operating and maintaining water supply systems within the framework of existing agencies. The programme consisted of three activities:

1. Applied research in which several items are tried-out in field conditions:

   a. Up Flow Filtration;
   b. Village-Map and Masterplan;
   c. More active involvement of Village Leadership in very small scale schemes.

   Instead of the development of solar stills, as was planned, an array of other small scale systems was designed and constructed, in close cooperation with the village communities (see Annex 3).

   This part of the programme was fully financed from Dutch funds.

2. The second activity, and most visible one, is the construction of water supply systems, executed by the Village Water Supply Organization. The main motivation for implementation of "hardware" was a "Learning by Doing" approach. Sometimes, applied methods failed or had to be improved. The question was whether agencies at Kabupaten level and below could implement a village water supply programme effectively.

   Starting with only one small system, staff of the organization learned the principles of the construction, the functioning and maintenance of such a system. After this first system three more small systems were planned. Administration of construction activities had to be set-up. Designs had to be made. Logistics management became more important.

   After the small systems were realized, the design and construction of six large MCKS systems was planned. Important during this phase was that it demanded full scale logistics management, financial management, increased the workload both in design and in the field. A good coordination between office, design section and field section, and later the section for operation and maintenance was needed. The "hardware" of the SDKI Programme was partly funded by Indonesia and partly by The Netherlands. Not all planned hardware was realized. Only five out of the six larger MCKS systems that were planned, were built. (see Annex 1)

   The water supply schemes are completed with sanitary facilities because, for improvement of health conditions in rural villages the whole chain of supply--use--disposal should be considered. This is "translated" into the "MCK-X" concept. The "MCK" is a sanitary unit consisting of a handpump, with a washing floor, one or two bathrooms, one or two toilets, a septic tank and a discharge gutter. The "X" may be any type of water supply, groundwater or treated surface water.(see Annex 3)

3. The third activity of the programme was the organizational development of the OAMP. The OAMP started in 1980 as a multi-sectoral work group. This, however, was not a workable set-up, because part-time staff could not be relied upon. Soon the Bupati put the organization under his direct command (May 1982). The OAMP was not the only actor at play in the field of RWS&S in the Kabupaten. Other agencies had programmmes as well. Consequently, the Consultant was asked to provide services to those agencies as well. Organization development is discussed under chapter 2.

Two aspects of RWS made up the back ground of the SDKI Programme; involvement of the village communities in the implementation of the programme, and the relation of the programme with other development activities in the area. The Sukareja case was an example of the role of RWS in more integrated village development activities. These two aspects are dealt with under chapter 3.

Consultancy was provided by a lawyer and a civil engineer, assisted by two sanitary engineers (BSc) and a technician in the field.

2. ORGANIZATION, MANPOWER DEVELOPMENT AND MANAGEMENT

The main objective of the programme was to further develop the Village Water Supply Organization. For this purpose a "Learning by Doing" approach was adopted.

Initially (Jan. 1982) the organization consisted of the staff from other agencies. However, when the staff had to do something for their own agencies, they were gone. The managing board consisted of the heads of these agencies. The consequence of this set-up was that the purchase of "every screw" had to be approved by all members of the board. This is why the Bupati, soon after the first system had been completed, (May 1982) reformed the organization into a workable unit.

In the beginning of 1982 the Organization was headed by a manager, and two technicians . Medio 1984 the Organization had about 15 staff members. The consultant was represented at that time by a BSc-sanitary engineer and a BSc accountant, both Indonesian.
In the first section of this chapter the development of the OAMP is discussed in a historical way. Then, in section 2.2, the "Learning by Doing" approach is illustrated with the aspect of manpower development. Know-how transfer is another aspect in organization development, which is dealt with in section 2.3. Finally, a short remark will be made on the management approach that was applied for implementation of the SDKI Programme.

2.1. THE VILLAGE WATER SUPPLY ORGANIZATION OF THE KABUPATEN INDRAMAYU.

The OAMP was established in the beginning of 1980 by the Bupati, conform the set-up as designed by OTA. It was an extra structural, multi-sectoral organization directly resorting under the Bupati. The OAMP was supervised by a Managing Board, consisting of the representatives of all agencies at Kabupaten level related with RWS&S. Staff of the OAMP consisted of a secretary and an office boy. Most activities consisted of the construction of ferrocement rainwater tanks as promoted by OTA. The agency most involved in the OAMP was the Health Service. The Head of the Division of Hygiene and Sanitation was also the main motor of the OAMP at that time. However, the OAMP in the original set-up never developed into a very active organization.

Most important reason for the low level of activity of the OAMP was its multisectoral set-up. This hampered flexibility of the organization and the ability to take decisions. Of course, most agencies, having their own interests, were not very motivated to push its development. Also, funds available for this new organization were not abundant.

Construction of the first MCKS systems, in Cilandak (1981) and Pawidean (1982), learned that a more accurate organization was required. The Managing Board was given the status of Council, and a full time manager and technician were added to the OAMP (may 1982).

The structure of the Village Water Supply Organization of the Kabupaten of Indramayu per December 1983 is depicted in underneath graph.

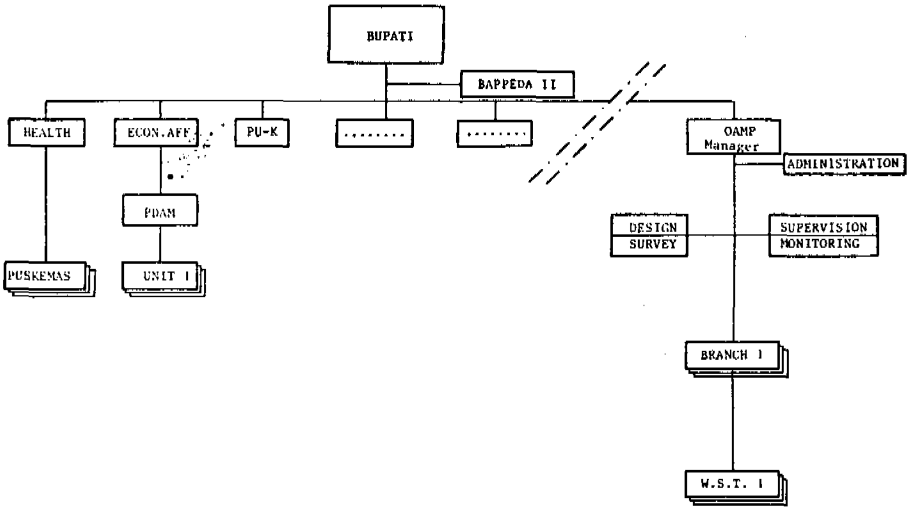


Figure 3: Organization Scheme of Village Water Supply Organization (OAMP).

At long term, the intention of the National Government is to establish services for both Urban and Rural Water Supply and Sanitation at Kabupaten level. In the beginning however, RWS&S is dealt with by a separate organization that starts small and grows gradually. Three alternatives for the initial organizational set-up may be possible at Kabupaten level:

1. Working Unit directly under command of the Bupati, that will be changed into a Service for RWS&S. The Working Unit is extra structural.
   (OAMP, Indramayu, OPAMDES-1980, Karawang)
2. Section for RWS&S under PU-K.
3. Devision for RWS&S under BPAM or PDAM (Karawang and Tasikmalaya 1985).

Mr. A.Koesman, Vice-governor in charge of RWS&S, stated that it is up to the Bupati's to choose one of the options. After some time a final decision will be taken by the Provincial Government.

At the end of 1983 the OAMP was still an "extra structural" Organization. The Provincial Administration was asked for permission to give the OAMP the status of a service, that is part of the Kabupaten Administration. So far, this request was not yet granted. The Bupati preferred this set-up over the status of a section of the PU-K, because the status of service provided staff of the Organization, and, especially it's head, a higher status.

In the discussion on the appropriate structure for the initial organization of RWS&S at Kabupaten level, it is also suggested to extend the BPAM for this purpose. The Bupati of Indramayu choose the OAMP option due to the existing regulations for the BPAM. The regulations dictate that after some years the BPAM has to become a "PDAM", which is a self-sufficient company. That is why Village Water Supply Schemes are not very attractive for this PDAM, because not all Village Schemes are self-sufficient. The PDAM of Indramayu currently runs two urban water supplies in the Kabupaten.

The OAMP should be able to implement RWS&S programmes, especially those concerning villages of 500 to 3000 people. Planning of activities of all implementing agencies for RWS should be coordinated by Bappeda II. After completion, Operation and Maintenance of all implemented schemes should be coordinated by the OAMP.

Background of the new set-up of the OAMP (May 1982), was the "Top down / Bottom-up" approach as promoted by the Bupati. Programmes that are parachuted Top-down proved to have a high failure rate. However, programmes that are pure Bottom-up lacked implementing power and planning. The 'Top-down / Bottom-up" approach of the Bupati gave the Kabupaten a bridge function between both approaches.

Level	Planning	Top Down Bottom Up	Management	Agencies
National	Development plan Budgets	Top Down	Policy	Bappenas 3 Ministries
Provincial	Programming		Directives, Instructions	Bappeda-I 3 Department
Kabupaten	Physical Planning	Coordination	Control	Bappeda-II PDAM/OAMP
Kecamatan	Preparation		Supervision	Branch office
Village	Plan/Proposal	Bottom Up	Execution.	Water Supply Team LKMD.

figure 4. Top-down/Bottom-up approach.

Apart from the practical motivation for a decentralized approach, there was a strong managerial motivation as well, because of time constraints. For the coming period of five years, the Indonesian Government plannned to provide 60% of the rural population with safe water supplies and 40% with improved sanitation facilities.

The Bottom-up/Top-down approach meant that the organization at Kabupaten level dealing with rural water supply and sanitation had to fulfill three functions:

a. policy as formulated by the National Government should be applied at lower levels of Administration;
b. needs as seen at village level should be assessed and;
c. detailed programmes in which both Policy and Needs are considered should be formulated. (Bappeda II);
d. implementation by several agencies. (technical approval PU-K)
e. Operation and Maintenance by the OAMP.

Kabupaten level had an intermediary function, in between Top and Bottom.

The process of implementation of RWS&S programmes at Kabupaten level may consist of the following steps:

1. Needs assessment- coordinated by Bappeda II, by extension workers of several relevant agencies;
2. Indication of the technical options for the villages;
3. Devision of tasks for implementation:
   a. Larger piped systems (IKK's) by PU-CK;
   b. Hand pump programme by Health;
   d. Rehabilitation of small traditional systems by BANGDES;
   e. Small piped systems by OAMP.
4. Yearly planning by relevant agencies, conform specific regulations.
5. Approval of yearly plans by Bappeda II;
6. Approval of technical designs by PU-K;
7. Implementation by relevant agencies, conform specific regulations;
8. Training and set-up of Water Supply Committees in the villages, ressorting under the OAMP.

The SDKI Programme worked together with the agencies playing a role in the implementation process. Designs were approved by PU-K. Sector plans for RWS for three Kecamatans were prepared in cooperation with Bappeda II, and a good contact was established with the Health Service. Cooperation with PU Cipta Karya resulted in the construction of the MCKS system in the village of Plumbon, that was connected to the raw water main of the water treatment plant of the city of Indramayu.

At the time this report is finalized, the OAMP plans two programmes for 1986-1987.

a. A regular programme for maintenance, extension, and construction. (Rp 309.000.000.-)
b. A special programme in cooperation with PU-K, PU-CK, Health and Bangdes for water supply of some villages around a beach resort. (Rp 260.000,000.-)

It is not probable that the whole budget will be approved, nevertheless only 30 % will already provide the OAMP with enough opportunities for further development. The Bupati stresses however, that assistance of a consultant is needed for two more years. Bappeda II of Indramayu is currently executing a needs assessment survey with the aid of the methods of the SDKI Programme.

This is an interesting development, since the budget is requested at Kabupaten level (APBD II). The establishment of a capable organization at Kabupaten level initiated -unthought-of- sources of funding for RWS activities.

However, last year almost no budgets were available to the OAMP, with the result that operation and maintenance was ill monitored. Many schemes are in an ailing state of operation. This may be a signal that continued monitoring of the OAMP is urgently required. (Because this problem was anticipated, slow sand filters are applied for surface water treatment. This type of filters is relatively easy to recuperate after ill treatment.

2.2 "Learning by Doing";

It was the task of the SDKI Programme to assist the Bupati and his administration to translate the Top-down / Bottom-up approach into reality. The OAMP had to be developed into an efficient tool in the hands of the Kabupaten administration. Planning methods had to be designed in order to enable Bappeda II to coordinate the RWS&S activities of the several agencies more effectively.

However, development of the RWS&S sector at Kabupaten level was a learning process. The SDKI Programme started slowly and at a small scale and gradually gained more momentum. The following steps were taken subsequently:

1. Through the construction of a small water supply system technical know how was transferred to two part-timers of two agencies related with the OAMP-old version. (MCKS 500, Pawidean, Jan.-May 1982). This water supply system for 500 people was designed by the consultant. Construction was also very closely supervised by the consultant.

2. Three small scale systems were constructed at the same time; the MCKS 500 in Kali Mati and two MCKP 500's in Pekandangan (medio 1982). By the time the OAMP was made into a working unit, resorting directly under the Bupati. The new OAMP got full-time staff members. They gained experience in survey, design, planning, community involvement and budgetting. During this period, the new staff - three people- of the OAMP learned to work with a foreign consultant. The consultant on his turn, had to learn about the area, the villages, the way in which staff at Kabupaten level behave -and not behave. One could say that this second step was a period of mutual learning.

3. During the third step the OAMP was given full responsibility for the technical implementation of a large MCKS 3000 system (Lobener). All technical aspects came into picture; providing information to the community, mapping, survey, design, approval by Public Works of the Kabupaten (PU-K), construction in an agricultural setting and in a monsoon climate, training of an operator and an administrator. "Doing" was completed with "Learning" through evaluation meetings and "classes" on theoretical background of practical problems encountered in the field or in the office.

4. Around February 1983 the fourth step was started. More and more tables were placed in the office of the OAMP. The organization had about ten staff members at that time. The first head of the OAMP was replaced by a manager, who knew very well the rules of the game at Kabupaten level. Full responsibility was given to the OAMP for financial management. Every month budgets had to be requested, financial statements had to be issued. A financial reporting system was developed for use by the field workers. For the purpose of cash management the "Permanent Balancing Tabular Method" was applied. This PBT method enabled the manager to control whether booked expenses matched with the amount of money in cash. The PBT method proved to be an essential tool for project management within the SDKI Programme.

5. During the fifth period, attention was paid to a more systematic approach of the community. A method for base-line survey and mapping was developed through which the village community was involved in the activities as from scratch on. The Sukareja case is an example of how this method was adopted by the Kabupaten administration for a more integrated implementation of their development programmes.

Continued efforts were put into improvement of the performance of the OAMP. A good working relation had to be established between the office and the field. Emphasis was given to work planning, both theoretically by the planning devision, and practically during construction of the systems. Attention was paid to proper workmanship and a tidy worksite.

6. Towards the end of 1983 assistance was asked for by Bappeda II and Bangdes, to formulate a sector plan for RWS. Staff from district level, sub-district level and village level executed a needs assessment survey first. Data from this survey was utilized for sector plans for RWS for three Kecamatans. Based on this assessment, programmes may be formulated that can, wholy or partially, be implemented with funds from several governmental programmes of provincial and national level.

Evaluation of the investments per capita through the SDKI Programme shows the development of the performance of the OAMP. After a period of learning, the OAMP worked efficiently. An evaluation based on the Per Capita Investments of the SDKI programme is included in Annex 4 of this report.

It should be stressed that all above mentioned steps were only the beginning of a long way to go. Continued assistance is urgently required in order to further strengthen the frail result of the Programme.

So far the Programme failed to set-up a well functioning O&M section within the OAMP. Funds and personnel were not made available sufficiently for this purpose. Water Supply Teams in the villages had to be monitored systematically and logistics for maintenance had to be set-up. Also it is advisable to set-up a special section within the OAMP to take care of marketing of house connections, because of their vital role in maintaining RWS schemes. This has been tried by the Programme, but the efforts failed under the pressure to finalize the planning of construction activities.

2.3. KNOW HOW TRANSFER.

An important aspect of the development of the OAMP and other related agencies at Kabupaten level, was the transfer of knowledge to the staff of these agencies. Not only at Kabupaten level, people had to be trained, also at Kecamatan and village level this was required. An enormous amount of time was devoted to this aspect. Besides, it was stressed as an element of programme management to create a pool of people possessing the skills required for effective programme implementation.

In the end local staff could build a water supply system of ferrocement in a planned way. That is the result of a lot of in-the-field training. The design section of the O&MD is currently making the design of some new MCKS-systems, being the result of two years in-the-office training. No manuals on the design of the system were available in the beginning. Now a design manual is written by a graduate of the Academy for Sanitary Engineering in Jakarta. After participating in the project he wrote the manual. In this way some other manuals are written by staff members themselves. The following subsections will report on the manpower development activities of the project at several levels.

2.3.1. Village Level.

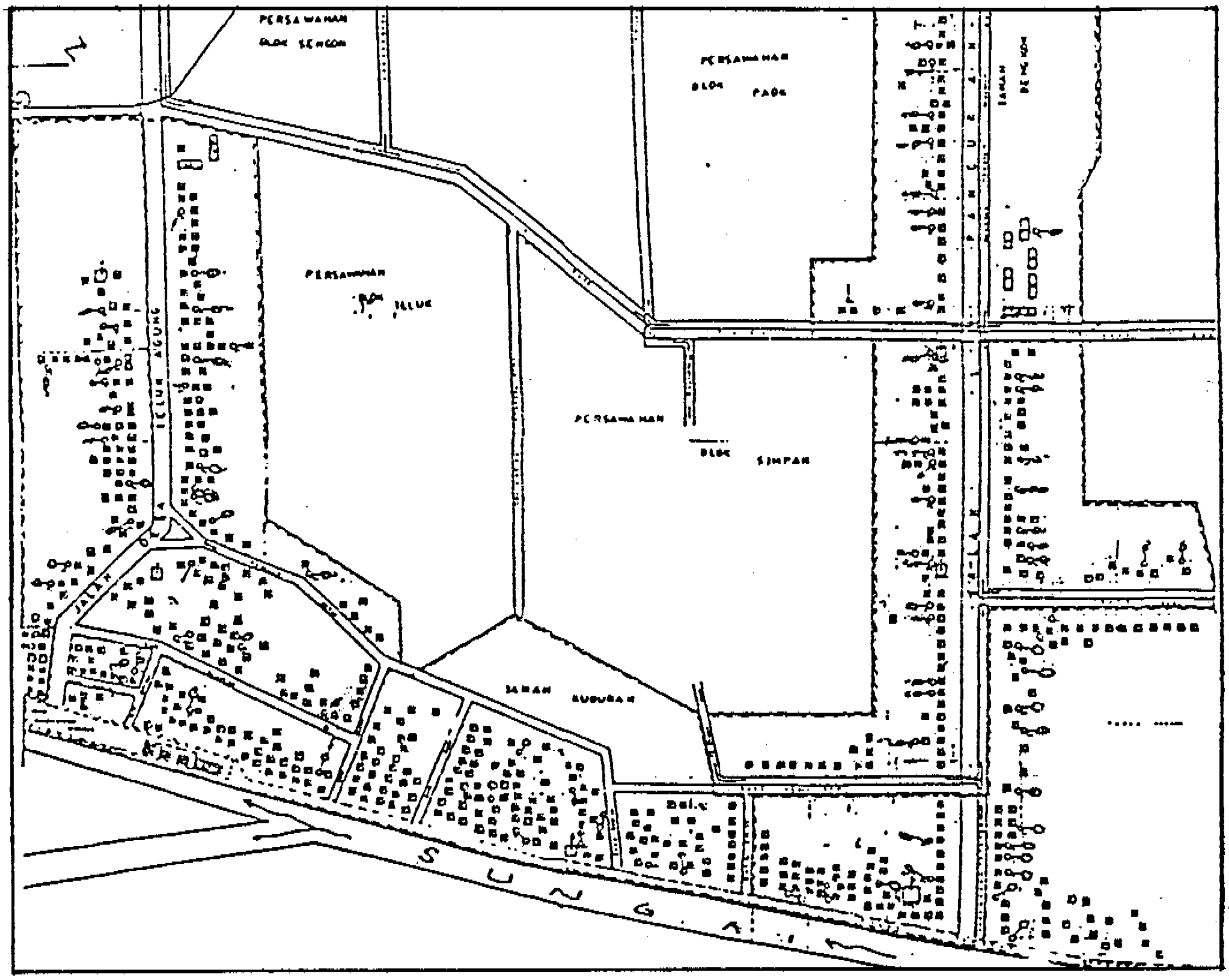
The applied technology is a combination of technology already available in the village and "imported" technology. Water Supply Technology is adapted to village technologies, such as: earth moving work, plastering, brickworking, knowledge of diesel engines and simple administration methods. Know-how on pipe-fitting- and laying, ferrocement technology and water treatment is added to existing knowledge.

* Kartubi and Kodir from the village of Pawidean learned how to weave chicken wire mesh for the construction of a ferrocement tank. They learned the moulding technique and the way of plastering of ferrocement. They on their turn taught these techniques to many others.

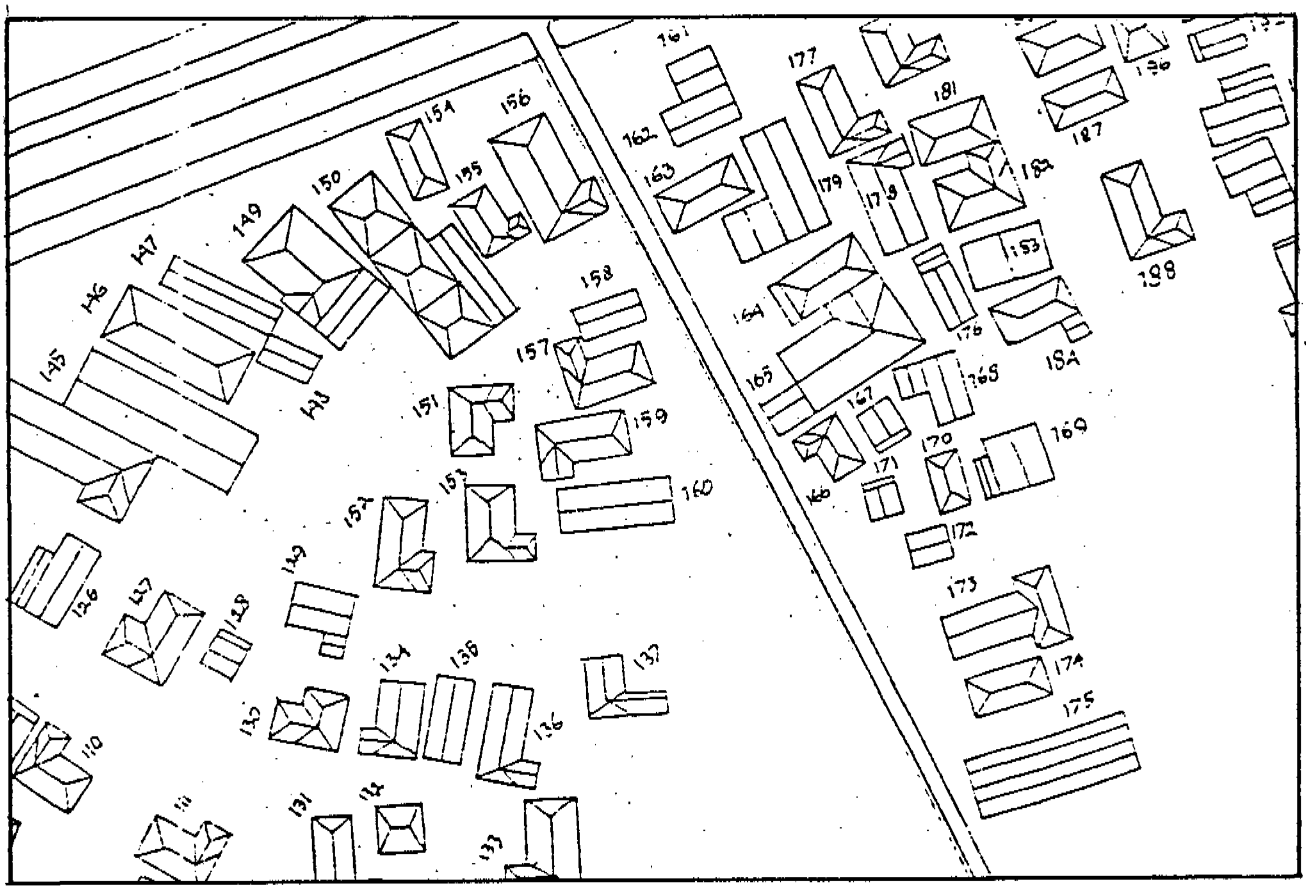
* D'hul learned the technique of pipefitting from the technician of the consultant. Now he is often asked to transfer his knowledge to others while actually making small pipe systems.

* Agus Hitam and Sanuri added knowledge on the functioning of a slow sand filter to their know-how of diesel engines.
  This latter knowledge was upgraded by Hassan from the dealer of this type of pump in the district capital town. He was given a maintenance contract during some months.

* Nurzamal had worked first with an international contractor that made a dam next to his village. After that he taught staff of the CAMP how to built the bamboo scaffolding for the watertower. His experiences were very useful.



Development; method of map making, above 1982, below 1984.



* The method for administering revenues and expenditures of the Water Supply Scheme as used in Lobener was taken over by other villages. The Village Administration developed this method by themselves.

* A network of handy men has grown that learned new techniques and passed on this knowledge to yet others.

2.3.2. Kabupaten and Kecamatan Level.

At Kabupaten level new knowledge was added to the skills of the staff of several services. The Village Water Supply Organization learned:

* management of in house implementation, staff of the office learned how to interact efficiently with field staff. How to impose the design and planning into fieldstaff, but of course, also how to make design and planning realistic.

* a bookkeeping method was devised in a way that the flow of funds and materials could be controlled. The several journal books in the field had to comply with the central book. especially to facilitate an immediate control of available funds the bookkeeping system was adapted to the practices in the field and at a Kabupaten office. (The PBT method)

  Every month a financial report was produced conform the rules of the funding agency, the Directorate General for International Cooperation (DGIS).
  It is obvious that a lot of learning was involved to get on grips with this financial management system.

* Technical skills of both field- and office staff were improved. The survey and design section learned to design water supply systems themselves, they learned to make a detailed budget and barchart planning. They learned mapping villages and how to use them to involve village community during planning and design.

  They also learned the several steps of implementation: survey, design, construction and O & M. The designs had to be approved by Public Works of the Kabupaten. They learned how to interact with the villages to get a well accepted design.

* The assistant to the consultant learned how to coordinate staff of several services, and the village leadership to produce a Village Masterplan.

* Staff of those services learned that planning was very useful for a more efficient implementation of their programmes. In particular staff of the Regency Planning Board was very eager to learn of those new planning tools.

* Extension workers of the services for Health Care, for Village Development and for Planning were involved in the production of Masterplans for water supply of several Kecamatans. This activity was fully funded from the budget of the Kabupaten. The Consultant only provided some coaching and technical inputs.

2.3.3. National and Provincial Level.

Although the SDKI Programme was oriented towards Kabupaten and lower levels, also exchange of knowledge took place at National and Provincial level.
The assistants to the consultant were recruited from freshly graduated Bachelors of Science of both the Academy of Public Works (ATPU) and the Academy for Sanitary Engineering (APK). These academies have a national scope. Because the graduates still had good relations with the academy an exchange of experiences took place.

A group of the APK visited Indramayu and studied the programme. The results were exhibited during the exhibition in honor of the university of the APK in Jakarta. Scale models of the various systems were shown, including suggested improvements.

In this section on know how transfer, the High School for Sanitary Engineering (SPPH) should also be mentioned. This highschool, organized by the Provincial Health Department, trained the extension workers of the Puskesmas. Through guestlectures experiences were discussed with future extension workers. Excursions to Indramayu were organized. A maquette of an improved MCKS system was displayed at an exhibition of the school.

It should be noted that skills for maintenance of the systems were not yet very developed. This will require a major effort of an eventual extension of the consultancy to the OAMP.

2.4. MANAGEMENT

The OAMP was -and is- an organization in development. To start-up such an organization at Kabupaten level, a lot of human energy was required. It proved to be important that the team of consultants rented a guest house in the city of Indramayu. After office hours the activities could go on. People from several villages and from other agencies was given technical advise. A good atmosphere was stimulated through the availability of a meeting place for all people involved in the programme. It was felt that the daily presence of the consultant in the Kabupaten played a vital role in getting things started.

Five aspects of development of the organization were stressed in the management of the programme;

1. Development of (technical) skills (see Manpower Development).

2. Development of organizational structure. Together with the Bupati and the OTA office in Bandung, this aspect of the OAMP was discussed with the Provincial Government. The structure of the organization was extended gradually, each time the need for reorganization was felt. In the end the OAMP consisted of three sections, 1) survey and design, 2) implementation and 3) organization. It was the intention that this last section would supervise Water Supply Teams at village level. Unfortunately the assistancy terminated before a good set-up was developed.

3. Development of management and its tools. With the increase of tasks to the OAMP, the complexity of the management increased as well. When required, new management tools were added to the existing ones. Often the conventional tools had to be adapted to the situation at Kabupaten level.

4. Development of the process of programme implementation. It was esteemed important to establish a fixed process for project implementation at Kabupaten level. Funds were made available to the OAMP, only when certain conditions were fulfilled. For example, designs had to be approved by PU-K, before the work could start. However, all steps of the procedure took place at Kabupaten level.

5. Development of the market. In many formal and informal ways the market for Village Water Supply was developed. The most important way of market development was by setting examples. People and authorities of several villages were stimulated to see the plant in Lobener.

While initially it was hard to find customers for house connections, in the end people came to ask for them. Also at the supply side of the market efforts were undertaken. As a result APBD II funds for the construction of new systems were requested by the Bupati from the Kabupaten Council. It is probable that this request will be awarded partly, which means that a new source of funding RWS is found. At both supply and demand side of the market people wanted to know what they get for their money, before spending it. The Council could only spend local funds, when a local organization was available.

Every first week of the month a staff meeting was organized during which the several aspects were evaluated. In this way the staff of the OAMP were made conscious of the developments that were going on.

At the end of 1982 the Bupati named a new head of the OAMP, who was a manager of profession. That was felt as an important step forward. The personal attention the new head paid to the staff of the organization was in line with the approach of the consultants team. A good atmosphere was the result.

The fact that the consultants' team consisted of 'outsiders', influenced the programme in a positive way. This was useful to start up activities and processes. Towards the end, however, foreign consultancy was more and more deminished. The personal push of the consultant was then replaced by motivation of the staff of the OAMP, and by a set of clear procedures.

Further consultancy is urgently required in order to set-up a proper organisation that will monitor Operation and Maintenance, both physically and financially.

Water Quality Control should complement such an O&M scheme. For this purpose, a duth student in sanitary engineering looked at the possibilities of the execution of WQC at Kabupaten Level. She worked together with the Laboratory of the Kabupaten. This laboratory, that ressorts under the Kabupaten Health Service, already executed water quality tests. Staff of the Laboratory was even given training at the Borromeus Hospital. It turned out as well, that very simple tests could even be executed at the Primary Health Centers at Kecamatan Level. Sanitarians of these centers could do the indicative tests, which would be attractive, since testing should be done as soon as possible after the samples are taken. The indicative testing at the Health Centers could tell whether further testing at Kabupaten Level would be required.

In order to set-up a WQC system it was experienced that a set of regulations, issued by the Kabupaten Administration, concerning water quality control in the area, are a prime condition for starting-up a WQC system. Every producer of potable water in the Kabupaten should be checked regularly. WQC would not require much funding, since potable water producers could be charged to cover the costs, while investments in equipment would not be excessive.

The issue of these regulations were a condition for initial funding of a WQC system in Indramayu by the SDKI Programme. Unfortunately, the Programme terminated, before the proposed regulations were approved by the Administration.

3. COMMUNITY PARTICIPATION.

In order to reach the community, it is important to act through the village authorities. For implementation of development programmes, the village authorities (Village Head and his staff) and the Village Resilliance Organization(LKMD) are assisted by several extension workers at District level. Consequently, following the official lines down to the 'target group' is not only a matter of following the rules of the administration. It also is a matter of providing learning-by-doing opportunities to extension workers and village authorities.

Another aspect of activities for participation of the village communities, is that the number of staff of the several sections of the services at Kabupaten level is very limited. Personal relations play an important role in inter - service relations. The feeling of togetherness is strong amongst the staff of the administration. Activities can only become a success if this aspect is well envisaged.

This chapter on Community Participation discusses the activities of the SDKI programme in this field. Although this aspect of RWS was not the main objective of the programme, due attention is paid to an active involvement of the village community. This did not always happen in a professional way, because staff of the OAMP were not trained on this issue. Although they could deal very well with the village heads and their staff, initially, they tended to make quick deals, without proper information to the villagers. As a result the intended short cuts turned out to be labyrinths. However, after the OAMP had some experiences with project implementation, they established a -more or less- standard approach to involve the community. The assistent to the consultant, had had a good training in community participation and provided the necessary inputs to the OAMP. The OAMP also learned from experiences of the kabupaten-branch of the Village Development Organization (BANGDES).

The method as applied by the OAMP is described in section 3.1 of this chapter. Section 3.2 is a short note on the hidden objectives of the SDKI programme. The case of the village of Sukareja is an example of the 'Master Plan' method in which the activities of the OAMP were integrated with the development activities of other agencies at Kabupaten level. This case is described in section 3.3.

3.1. METHOD OF COMMUNITY PARTICIPATION.

For each village, supplied with water, the community was given the opportunity to participate actively in the project. In the beginning of the Programme, community participation happened quite haphazardly. In the end, however, kind of a process was evolved. Although not always strictly followed, several steps in the process of project implementation could be distinguished at which villagers were involved;

1. Mushawarah Desa; First information to the village;
2. Base-line survey and Mapping; individual involvement;
3. Mushawarah Desa; presentation of the results of mapping and survey/ suggestions for improvements of the village;
4. Design for the water supply system;
5. Mushawarah Desa; presentation of the preliminary design;
6. Construction of the scheme with employment of village labour and subcontracting of the construction of sanitary units and public stand posts to "tukangs" from the village. (a "tukang" is a handy man with many skills.);
7. Promotion of house connection in cooperation with the LKMD and the Village Administration;
8. Installation of a Water Supply Team by Village Administration;
9. Training of Water Supply Team on operation, maintenance and administration;
10. Information to the consumers, hygiene education;
11. Mushawarah Desa; official opening of the system;
12. Monitoring of Water Supply Team and consumers.

When a village was selected to get a water supply system, the first step was to inform the village community on the planned activities. During a Mushawarah Desa, a Village Meeting, the process of project implementation was explained. All the family heads (KK's) were gathered, as well as the members of the LKMD, the Village Resilliance Organization. The meeting was presided by the Village Head. Not only men participated in the meeting, also women from the PKK, the women programme within the LKMD, attended the mushawarah. Staff of the OAMP were invited to explain the plans and the expected inputs and possible actions to be undertaken by the village community. The Village Head put forward some wishes and questions from the village. The president of the LKMD explained the activities undertaken by this organization, that might be of interest to the OAMP. Frequently, during this first meeting, ideas on the development of the village were already exchanged. In some cases, the extension worker of the Health Service was invited as well, in order to be informed on the activities in one of his villages.

The Mushawarah Desa was always a very lively happening, taking place in the "pendopo" of the Village House. It started after sunset, after all people had taken their daily bath, prayed, and had their meal. Only after such a mushawarah, the activities might eventually become a success. Only after the community was duly informed during such a meeting, the survey started.

Mapping was the vehicle of the survey. The method of mapping is explained step by step under Annex 3. of this report. During the mapping process, the people from the village got the opportunity to present their ideas individually. Especially the women, who happened to be at home when the survey was executed. One of the surveyors, recruited from the village, explained the meaning of the activities taking place around her house. She was also interviewed personally. Her suggestions for improvement of the neighbourhood, and often other issues on her mind, were taken note of, especially those in relation with health and water related problems. This kind of approach proved to be very informative to get an impression of the possibility of cooperation with the village community. How much is a mother of five children, living in a bamboohouse, willing to pay for water. And in what form? In a lot of villages the "prelek" system of payment was applied for communal services. With this system, every day a spoonful of rice was put apart. This amounts to a kilo a month, representing about US$ 0.25.

When the survey was finalized and the map was copied on blueprint paper, another mushawarah desa was organized. During this second meeting, often representatives of other agencies were invited. Results and suggestions from the (anonimous) villagers were discussed. A possible set-up of the water supply system was forwarded. Again, the inputs and activities by the village were dealt with.

The next step consisted in making of the technical design by the OAMP, sometimes some extra contact was required with the village administration during this process.

During a final mushawarah, the design was discussed again with the community. The financial consequences were made clear. The village had to make a final decision. Often this final decision was not taken during the meeting together with the representatives of the OAMP. In Indonesia, all decisions with financial consequences for the village have to be approved by the LMD, the Village Councel.

The village community was involved directly in the process of construction. As much as possible, village labour was employed. During harvest time, this approach caused delays of some weeks, because all hands were needed to get the rice off the sawahs. This was most critical with earth moving work. Small parts of the system were subcontracted to tukangs from the village. For example the sanitary units were built by tukangs and friends from their neighbourhood. After a first unit was constructed by the OAMP, the tukang just copied it. In this way, the project of the OAMP was also income generating for the village

Together with the LKMD, the OAMP promoted the application of house connections. This was not always very easy, because the original price of US$ 30 was considered as expensive in the village. A house connection was made that was as simple as possible. The type of HC as applied in Indramayu was constructed with local bricks. The price of the first HC's in Indramayu was brought down to US$ 15, that could be paid at once, or in three times US$ 5.50. In this set-up, the OAMP only fixed the piping and valves, when the consumer had constructed the brickwork basin at own cost. In this way, the consumers felt they were not charged too much for their connection. Back draw of this approach was, that the number of HC's did not grow very fast. Also the OAMP was not yet well organized for a proper marketing of HC's.

A Water Supply Team was established by the Village Head. Supervisor of the team was the president of the LKMD. The operator was choosen among young villagers, who had already worked with diesel engines, for example in rice hullers.The administrator was either the administrator of the village administration or the LKMD. Not only this Water Supply Team was trained for their new tasks, but also the care takers of the sanitary units were trained. The village administration was instructed on their role in the whole set-up.

In some cases, cooperation was sought with the extension worker of the regional health centre, in order to organize kind of hygiene education. Anyhow, the OAMP instructed the future consumers on the background of clear water supply, during construction of the sanitary units. Construction of those units took about a week, in which every occasion was used to inform bystanders on the benefits of clear water supply. The villagers were also instructed how to clean the toilet etc., being part of the unit. One of the operators told the people, that clean water would wash their brains. In a certain sense, he was very true.

The one but last activity in which the village community was closely involved, was the ceremony in which the system was handed over to the village administration. A "selamatan" was organized. Everybody shared food with everybody. A "wayang" show evaluated the process of how the project came into reality.... but also informed the future consumers on their duties and their rights. The water supply System was officially started up by the Camat, head of the sub-district.

Monitoring was regarded as one of the activities, also in the process of community participation. The OAMP monitored, whether the Water Supply Team executed their task well. It was stressed, that the team looked after a proper maintenance of the sanitary units. This was a cumbersome activity, because the OAMP, nor the Water Supply Team were not yet very service oriented. Also, the people in the village did not always treat the sanitary units in a proper way. Maybe a regularly reporting system would help to make the new organizations more service oriented.

3.2. DEVELOPMENT AND INNOVATION.

The red thread through the SDKI Programme was Innovation of the methods of programme implementation, in order to get endogenous development. Innovations made products, e.g. maps, surveys and water supply systems, cheaper, and thus more affordable.

The MCKS 3000 of the village of Lobener was a sample of such innovations. The total investments in 1985 prices was about 52,000 US $. Expenditures for operation and minor maintenance is covered by revenues from the 22 house connections and the 8 public stand posts. Families with a house connection pay a flat rate of two and a half dollar per month. Consumers from public stand posts are expected to pay 35 cents, but in practice only part of these consumers pay their bill. Nevertheless the scheme is still in operation. O & M costs are brought down to a level at which villagers are willing to pay. Consequently the service is provided continuously. Demand has increased and now meets supply.
The decreased level of required investments has set in motion something that may become a new trend; the Kabupaten Administration has applied for local budgets (APBD II) for RWS, to be implemented by their own agency, the OAMP.

Technical information on the MCKS 3000 can be found in Annex 3, while a financial evaluation is given in Annex 4.

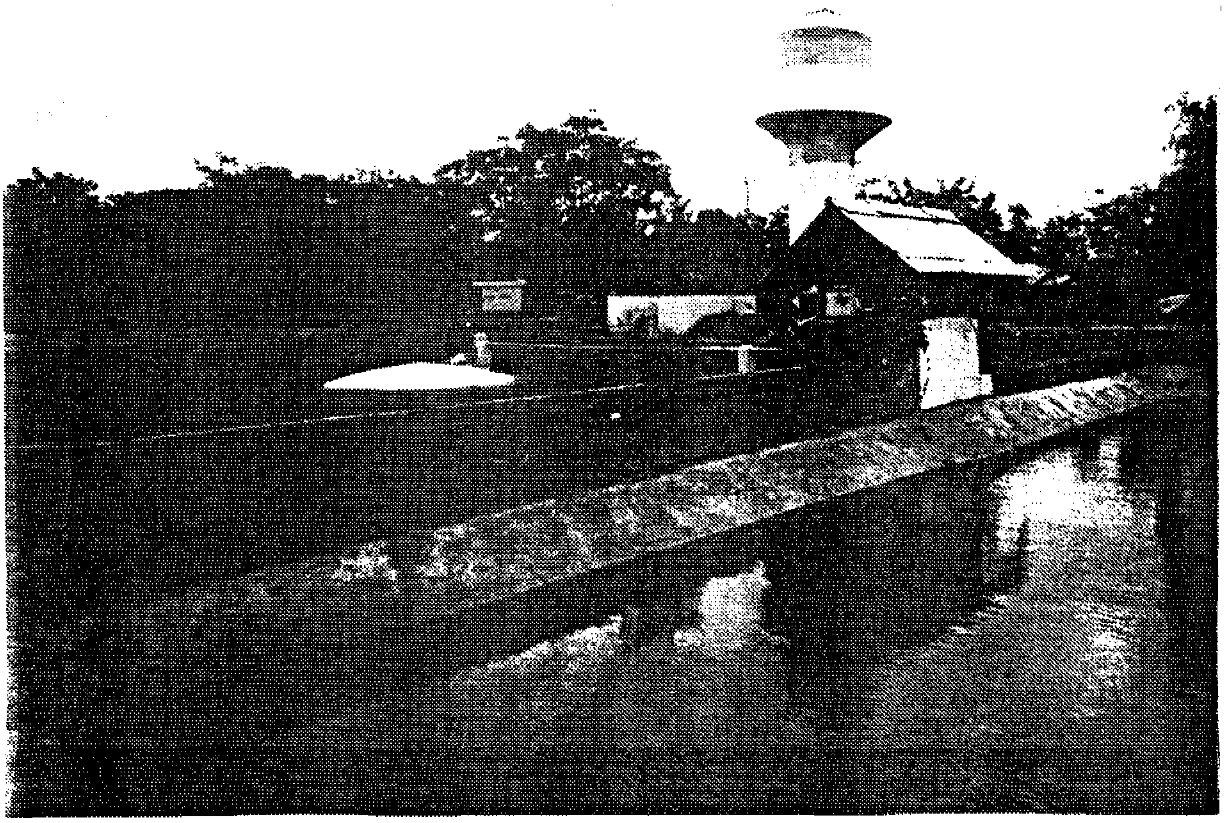


fig. 5. MCKS 3000 in the village of Lobener;
innovation in RWS.

In the second project year the Bupati ordered Bappeda II to execute an Integrated Village Development Project in the village of Sukareja. Experiences, with mapping and in formulating a masterplan for a village,gained by OAMP, proved a usefull vehicle for this integrated project. This case is an example of an approach in which innovations resulting from the SDKI Program are used by the Bupati and his Administration. These innovations helped to set in motion new developments at village level.

It should be stressed that the Sukareja project was not officially part of the SDKI Programme. It was an activity of the Kabupaten Administration in which the SDKI team, as advisors to the OAMP, also participated. Indonesian staff of the team was very much involved in the process of community participation.

3.3. THE SUKAREJA CASE.

A Village Masterplan as a frame for an Integrated Village Development Project.

The regency of Indramayu on the north coast of West Java is devided into 20 districts.
The village of Sukareja, in the district that bears the same name as the regency, is a fishermen village. Only tertiary irrigation canals reach the village. In the rainy season rainwater shallow wells and irrigation water are used for daily consumption. In the dry season, however, the only source of water is the big pond of the State Oil Company PERTAMINA, located at about half a mile from the village.

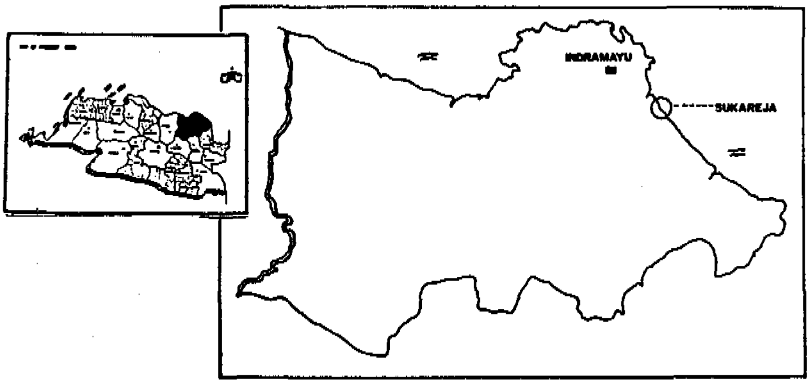


fig. 6. Location of Sukareja.

People in the village are poor, living in shabby houses and under poor sanitary conditions. Most are nourished; only salted fish and rice for their daily meal, amounting to less than 2000 calories.

H.A. Djahari, SH., Bupati (Head) of the regency, selected the village of Sukareja to run for the championship of the village development competition in 1983. The competition is organized yearly by a department of the Ministry of Home Affairs, that deals especially with village development. The Bupati choose Sukareja because the village is situated in one of the depressed districts of Indramayu, but also because the Camat, Head of the district (Kecamatan), is very active and able to motivate his people.

All agencies and services of the Regency were asked to participate. Among them the Village Water Supply Organization, a new organization established by the Bupati. The Masterplan for Rural Water Supply of the District, that was compiled by the new organization, showed that the cost of a water supply scheme for Sukareja would be about US $ 19.000,-. That amount fitted well into the budget available to the Organization.

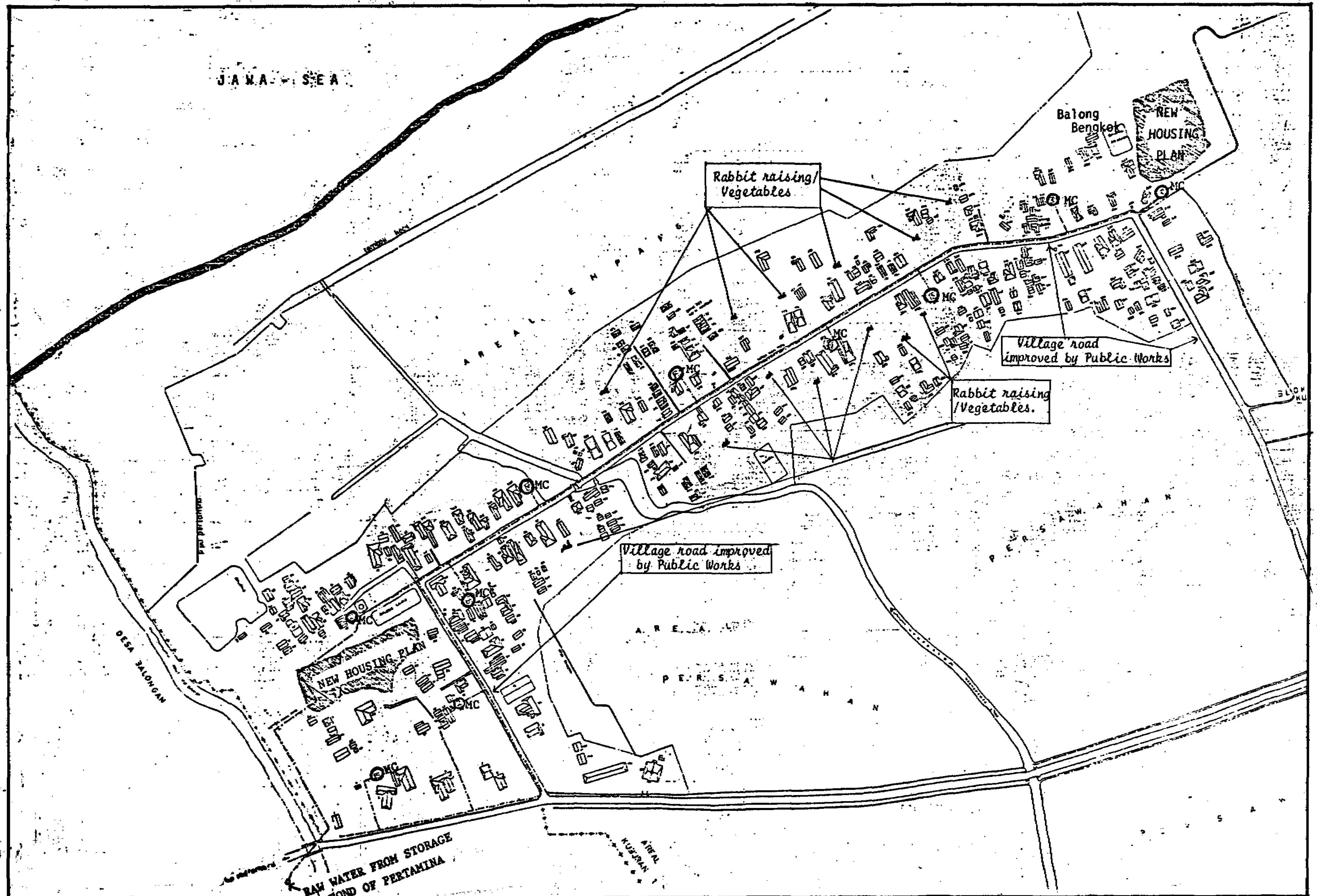
How did Sukareja become champion for 1983?

The first step in this integrated village development project was data collection. But up to date maps were not available. Making aerial photographs c.q. maps would be too expensive. The only possible way was to make a map with a terrestrial method. Staff of the Water Supply Organization, together with three members of the village administration, made a map of the village. The method of map making, as described in Annex 3, is adapted to the skills of the staff at regency level, available for this job.

At first they went from house to house to project them on the map. Everybody around was interested in what was going on. The discussion started and people gave their opinion of what the problems in the village were, and what they suggested to be done. Staff of the village administration, that assisted in making the map, discovered their village. A lot of useful ideas were put forward by the villagers. Besides detailed information about physical features of the village, such as the direction of the waterflow through the quarternary canals, also information was gathered on the people. A list of the houses was made, with the number of the house that was also put on the map. The name of the main occupant was noted, the number of people living in the house and whether the family was engaged in family planning and other useful data.

When all the information in the field was gathered and the raw map was ready, the work was copied to drawing paper from which a blueprint copy could be made. On the next page an example of a section of such a map is depicted.

Copies were distributed to the several agencies that were involved in the project of Sukareja. The village administration also got a map, with the request to discuss possible improvements with the people in the village. Shortly afterwards a meeting was organized with representatives of the people in the village (in which also a representative of the Women Cooperative) and the participating staff of the involved agencies from Kabupaten level. The assistant to the consultant, presided the meeting and noted every suggested activity. Of course in one meeting it was not possible to get a sound plan, but the consultant had an idea of the possibilities and the wishes living amongst both villagers and staff of the agencies. Based on this information the consultant made a kind of a multisectoral plan that was named "Masterplan Desa" (desa is Indonesian for village).



JAWA SEA
Balong Bengkel
NEW HOUSING PLAN
Rabbit raising/ Vegetables
MC
AREAL EMPANG
Village road improved by Public Works
Rabbit raising /Vegetables.
AREAL PERSAWAHAN
Village road improved by Public Works
DESA BALONGAN
MCK
NEW HOUSING PLAN
AREAL PERSAWAHAN
RAW WATER FROM STORAGE POND OF PERTAMINA
AREAL KUBURAN

Obviously not the entire plan could be implemented, but based on the plan, part of it was adopted by the several agencies. Every agency had projects allocated in the village.

i. The regional branch of the **Department of Public Works** improved the main village road, about 1 mile, with labour inputs from the village.

ii. The **Village Development Organization (Bangdes)**, under the provincial **Department of Home Affairs**, had a programme for upgrading houses in the village. The selected houses, indicated on the map, were improved. For better ventilation at least one window was installed, the bamboo matting partly replaced by new matting or brickwork, chaulked and painted in fresh colors.

iii. The regional branch of the provincial **Department of Health Care**, together with the sanitary extension workers of the **Health Service** of the Regency and the District had a score of projects:

- a rabbit-raising project aimed at increasing proteine in the diet of the people; some people received credit in the form of a couple of rabbits. From the offspring that was produced pretty soon, they had to pass on two rabbits to other people in the village (the system is part of a programme that is backed by President Suharto personally, who himself raises rabbits in his backyard);

- staff of the district health centre together with its doctor, Maria Ulfah, organized a campaign amongst the women of the village to participate in the family planning programme. They yielded a lot of new subscribers;

- there was also a programme that provided pit latrines to a number of families (around 50);

- women were given training how to cook the newly introduced food stuffs such as the rabbit meat and vegetables, because: other extension workers of this health centre promoted the cultivation of vegetables. This programme is called "apotik hidup" or, "drugstore for life".

iv. Actually, this last activity coincided with the project to fence the plots, 'pagarisasi, of the **Village Administration**, that suddenly made the village into kind of a bungalow park.

v. The **Village Water Supply Organization** supplied the village with water. For this purpose the Bupati arranged that permission was given by Pertamina to use the water from the big rainwater pond that is the only reliable source of water in the vicinity. With the aid of a diesel driven pump water is transmitted to a slow sand filter, located in the village. People can take the water from the system with a handpump that is connected to the pipe line running through the village. This central pipe is connected with the clear water reservoir of the sand filter.

vi. The **Service for Administration of the Regency** strengthened the leadership of the village;

vii. Camat Mulyono, **Head of the District**, motivated and pushed the implementation of the several projects.

viii. **Economic Affairs- of the Regency** helped to set-up a women cooperative that opened a shop selling the better foodstuffs that are produced in the village;

ix. From the **"INPRES" Programme for schooling**, implemented through the **Regency Administration**, the building of the primary school was improved.

This whole array of activities was implemented in one year. This is an important fact, since all people involved were continuously motivated, especially the villagers themselves.
As a result the people were very much willing to cooperate in the projects of the regional governmental agencies. This on its turn had an encouraging effect on the staff of the agencies. Pak Toro, head of the Water Supply Organization, paid a visit to the village every day to see the progress of the construction of the water supply plant. Another important aspect is that the staff of the agencies know each other well, it is one big family (this is a special characteristic of a regency administration, but will not be eluded further, although this aspect of administration deserves more attention).

At village level a close cooperation existed between the two key leaders; the head of the village and the president of the "LKMD". The "LKMD" is an official village community organization. "LKMD" stands for "Lembaga Ketahanan Masyrakat Desa" that is formally translated into "Village Resilliance Organization". Since 1978 this body is an important force in village development, through which a lot of village development programmes are implemented, especially kind of grass-roots level programmes. Food cooperatives, family planning, women organizations etcetera.

The head of the village is elected by the villagers and is a government official of Home Affairs. He presides over the village administration,taking care of the regular services, such as irrigation water distribution, within the village administration and, most important, administration of the budget of the village. To the committee that evaluated the development of the villages that participated in the Village Development Competition this close cooperation between the two leaders of Sukareja was an important factor to elect our village as number one. Another point that added much to the championship of Sukareja was the improved water supply and sanitation, that raised the quality of life in the village.

Figures 8, 9 and 10 show the slow sand filter of Sukareja, forming the main part of the water supply scheme, constructed by the villagers themselves. The OAMP provided the design and the supervision. Labour was recruited from the village and paid normal wages. The basin of the filter is designed in brickwork, in order to facilitate construction by unskilled village labour.

Note.

This description of the Sukareja case is a bit too optimistic, a bit more shiny than it was in reality. However, reality is not too far from what is written. Indeed, the Bupati and his Administration did a very good thing in Sukareja. The Programme only provided some tools and their cooperation. The staff of the Kabupaten Agencies and the people in the village skillfully made use of these services. The result is, concerning water supply, that the scheme still is functioning well and the Water Supply Team is active, although not yet monitored as it should be. It is fun to look at children playing with clear water at a sanitary unit. People enjoy the improvements in the village and as a consequence continue to pay their water bill.

It is not the intention of this case history to "sell" this integrated approach as a well consolidated one. The method may be tried out in other villages, before the approach is mature enough for wider implementation. Therefor it is proposed to apply this approach during the new RWS/S programme of the Dutch and the Indonesian Governments. In every Kabupaten one village may be covered in this way. Only then the method can be analyzed systematically and be improved for further implementation. The Health Department of the Province of West Java expressed its interest in the approach, since it may reinforce the integrated approach they have recently adopted for their primary health care programs.

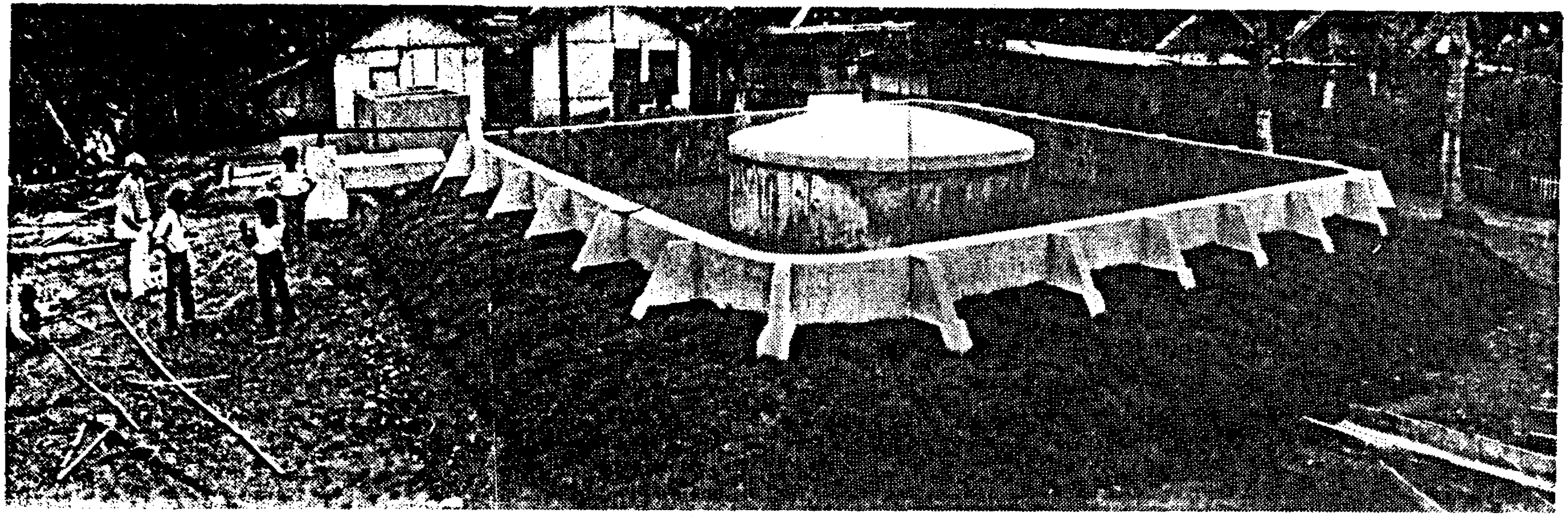


Fig. 8 Slow Sand Filter of Sukareja, a brickwork construction combined with ferrocement.

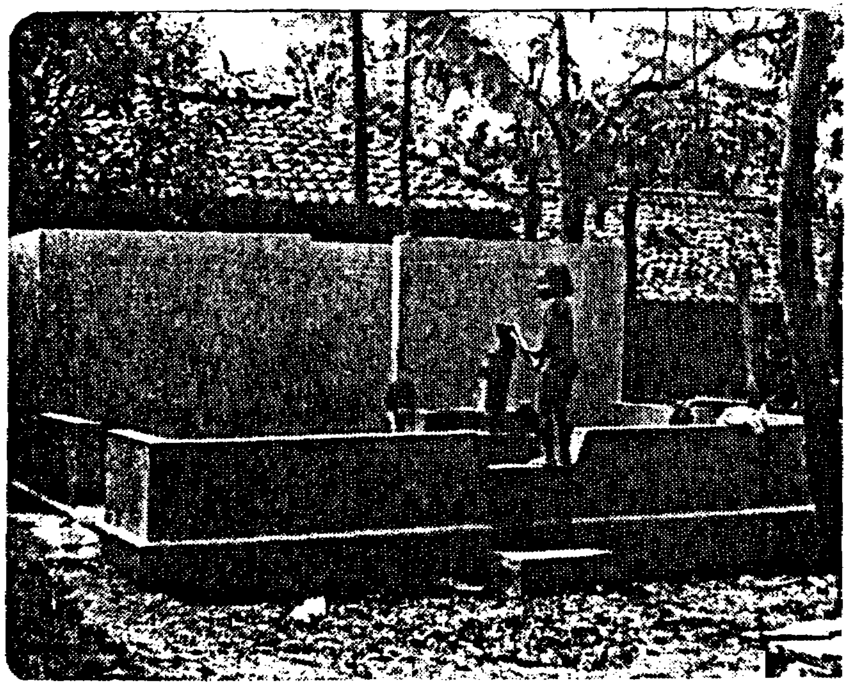


Fig. 9 Sanitary Unit.

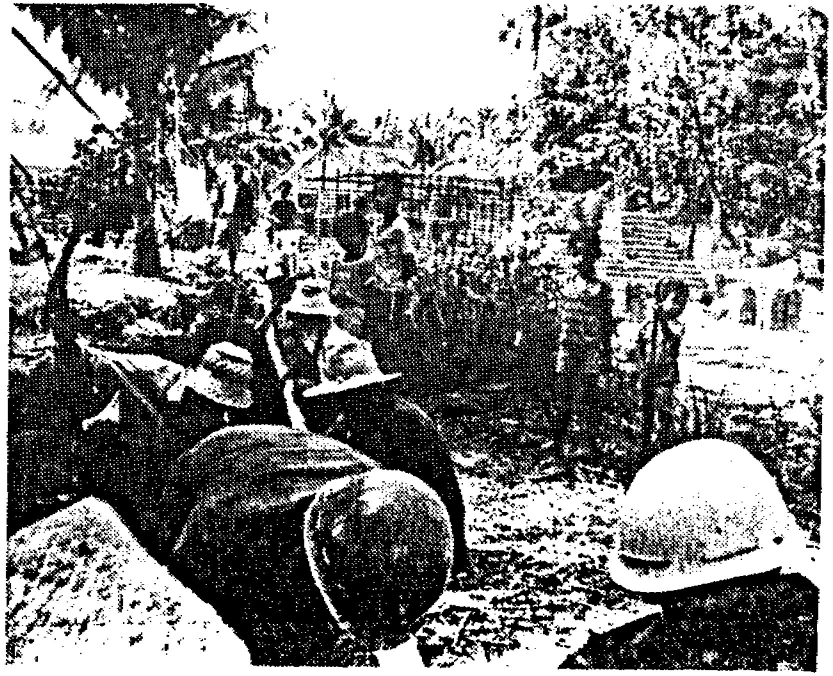


Fig. 10 Pipe-laying with local labour.

4. RECOMMENDATIONS.

4.1. INTRODUCTION.

The Dutch and the Indonesian Government will continue their cooperation in the field of rural water supply and sanitation. Currently activities are still going on, but in April 1986, a new programme will be started. The cooperation will concentrate on organization development and institution building. For this purpose, a coordinating team in the provincial capital, Bandung, will supervise several sub-programmes at Kabupaten level.

The SDKI-programme was a first step in this direction, through which the OTA-team has gained a lot of experiences. Based on these experiences, some recommendations will be put forward that may be useful for the future GON-GOI cooperation in the field of RWS.

This chapter will, however, not give a full outline of a future programme, but deal with several elements that make-up a programme. The word "programme" is used here, since it is recommended that the cooperation is based on a multi-year commitment in which several activities are executed coherently.

Recently a proposal is submitted for consultancy services for the development of the RWS sector of the Province of West Java. Concerning the speed of implementation the proposal is less far-reaching than the recommendations of this report. The amount of funds that can be expected from the Dutch and Indonesian Governments has been the limiting factor in writing the proposal.

4.2. ELEMENTS OF A PROGRAMME FOR WATER SUPPLY AND SANITATION.

A programme for water supply and sanitation for rural areas should aim at the development of both public and private sectors in the field. To do so, the programme should contain the following elements:

1. **Funding.**

The way in which funds are made available for programme implementation should be in accordance with the scale of the activities and the level at which the activities take place. It is advisable to apply T.A. funds for the process of development of organizations, while P.A. funds may be used to promote funding by lower level agencies. In section 4.3 a suggestion is put forward on how funding may be arranged.

2. **Organizational development.**

At all administrative levels organizations are to be set-up. The functions of these organizations are outlined in table 4.1. These organizations may start as working groups under existing agencies, or as non-structural units. In the end it could be advisable to create one service for both urban- and rural water supply and sanitation (see section 4.4.).

3. **Hardware implementation.**

No organization can be set-up without the realization of hardware, c.q. water supply and sanitation schemes. The volume of work has to be attractive and should be a stimulus of the development of the organization. Hardware and software are interdependent, because a sufficient speed of implementation cannot be reached with a weak structure of organization. A certain speed of implementation is required, in order to fulfill the targets of the Indonesian Government concerning RWS/S. Because many small schemes have to be build, procedures for funding have to be kept as simple as possible. When procedures consume too much time, implementation will not gain sufficient momentum. (section 4.4.).

4. **Planning.**

The activities of the several agencies currently at work in the field (P.U.; Health, Dagri) should be planned and coordinated by Bappeda I and II. Sector plans should be formulated, in which tasks are assigned to the several agencies that have programmes in RWS/S. (see section 4.4.).

5. **Manpower Development.**

Indonesia has already a wide range of educational institutes in the field of RWS/S. They range from the ITB department for sanitary engineering, application courses by P.U., Health and Dagri, to the technical highschools. The curriculae of the institutes at national and provincial level could be updated with new experiences. Students could be given the facility of practical experience. A lot of specific training is required for the formation of staff at kabupaten, kecamatan and desa level, which at the moment is almost non-existant.
On the other hand local consultants and contractors should be trained in order to involve them in the programme (see section 4.5.).
Resuming, four ways of Man Power Development may be considered; 1) Adaptation of existing curiculae; 2) Special Training Packages; 3) Practical Training; 4) Fellowships.

6. **Community Participation.**

The community, or the consumers, are the most important element of the programme. Wellbeing is the main motive behind RWS/S programmes. Care should be taken that women, children, and men participate in the process of improving their environment. The way in which this can be achieved is described under chapter 2 of this report. In order to reach the individual people, that make-up the -anonymus - community, the method as described was very effective. The provision of house connections was a step forward in 'public relations', but also made village water supplies cash break-even. (see annex 4)

7. **Technological Development / Research.**

In both soft- and hardware still a lot of research is needed. Many technological solutions in RWS/S are to be adapted to the circumstances in West Javanese villages. For this purpose applied research is required. (see sections 4.6,4.7, and 4.8.).

8. **Management and control systems.**

Control of programme performance is needed for a proper way of programme management. Several types of control systems are required, that may be executed by several agencies. Section 8 considers:

1. Water quality control.
2. Logistics control.
3. Financial control (accounting system).
4. Data base management.
5. Programme monitoring.

It is obvious that control systems are very much related with organization development. Introduction of personal computers, also at Kabupaten level, may prove to be an important innovation in programme implementation.

In the next sections the above mentioned elements are dealt with in more detail.

4.3. FUNDING.

The way of funding of a programme is of prime importance to success or failure. The level of funding is important as well, especially to obtain local funds. OTA has had problems to realize the hardware it had planned. Although seemingly abundant, P.A. funds (loans) require lengthy procedures of tendering to classified contractors. The lengthy procedures hampered implementation enormously. In contrast, the SDKI-programme had "quick" T.A. funds in a limited amount. It succeeded, therefore, to realize quite a number of RWS systems, and concluded with some interesting results from applied research. The use of T.A. funds was also catalyzing organization development.

In order to facilitate a smoother implementation of the second phase of the RWS-cooperation in West Java, the recommendations from the SDKI experience are:

Alternative 1.
Full T.A. funding of programme with a limited number of schemes e.g. 5 schemes per Kabupaten per year. In Indramayu, the local administration requested a considerable amount of local funds (APBD II), after the OAMP had proved its capacities. In case this trend is followed by the other Kabupatens, it will ease the burden on the national budget and increase the speed of implementation. As a stimulus towards local funding, a suppletion rule is recommended; for each scheme realized from APBD II funds, a scheme of equal size may be funded from T.A.- or P.A. funds with prefinancing.

Alternative 1 is worked out in the next section, in which - amongst others - the speed of implementation is discussed and illustrated. (see fig. 13., planning of implementation).

Alternative 2.
T.A. funding per Kabupaten on lump sum basis of e.g. 1,5 million DFL once for hardware. Additional schemes to be financed from P.A. funds with prefinancing by local funds.

With both alternatives a certain amount of T.A. funds should be reserved for research and know how transfer. Consultancy during the first two years may include 1 expatriate per Kabupaten, afterwards expatriate staff (T.A. funds) will decrease.

4.4. GENERAL APPROACH FOR KABUPATEN PROJECTS.

The general approach in each Kabupaten consists of three phases. The first phase is a period of learning technology and basic management tools. During this first phase, several pilot systems are constructed. The very first system may be built by the agency itself, in order to teach the staff ins and outs of construction practice of water supply schemes.
For construction of the next two schemes, one may be tendered to a local contractor, while another will be built by the agency itself again. In this way, an evaluation can be made concerning both ways of implementation in that specific kabupaten.

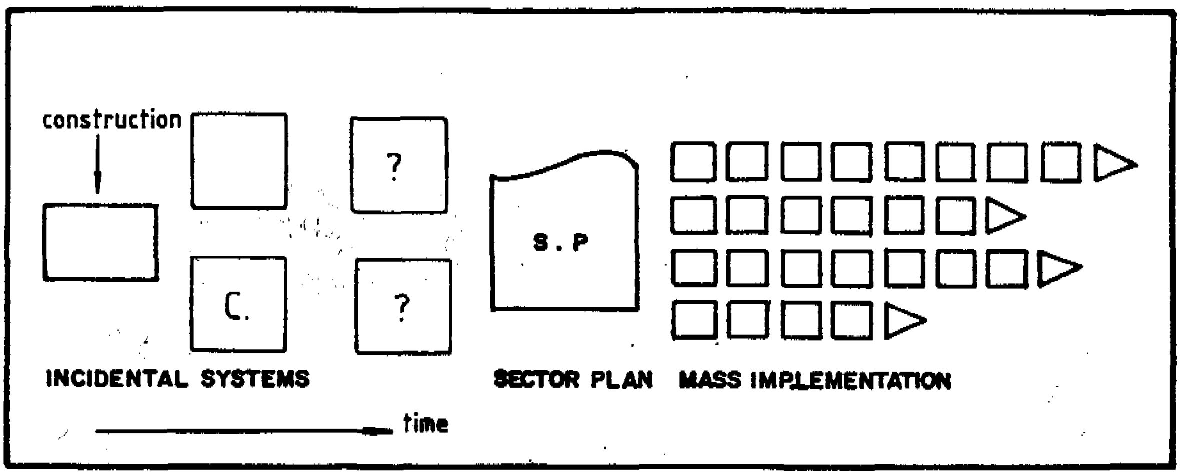


Figure 11.: General Approach per Kabupaten.

About 5 villages per year in each kabupaten may be supplied by surface water treatment schemes or gravity systems, and 5 villages by means of hand pumps (drilling task force). For this purpose each year 10 villages must be mapped and surveyed, in the frame of the RWS/S programme.
Not all Kabupatens can be started at once, because of mobilization of required personnel. Every half year two Kabupatens could be started-up. The global barchart for this is shown with figure 12.:

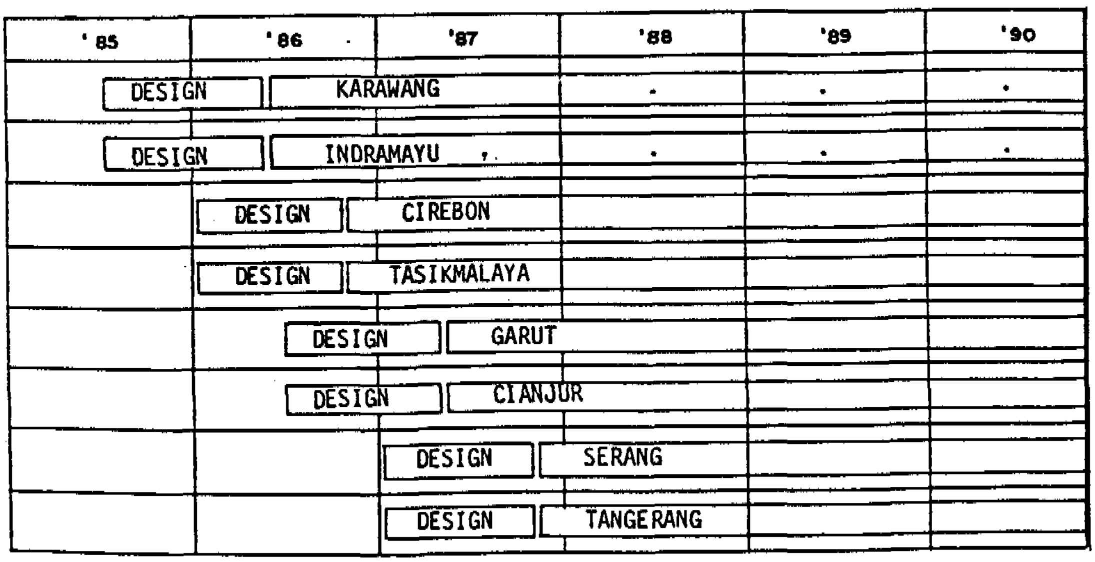


Figure 12.: Global barchart of Kabupaten projects.

In order to increase the speed of implementation, local funds from Kabupaten level (APBD II) may be allocated (as in Indramayu, see Annex 2). Funding from local funds will only happen, when a capable organization is set-up at Kabupaten level. With the use of P.A. funds, local funding may be encouraged. One can imagine that for each village scheme that is funded from APBD II, an additional village scheme will be funded from a foreign (Dutch) loan (50% - 50%). When "mass implementation" has gained its full momentum, the theoretical picture of rural water supply for one Kabupaten, looks as in figure 13.

Kabupaten X		(Rural) Water Supply Implementation					
	year	I	II	III	IV	V	T
IKK programme	system	2	2	2	2	2	10
	villages	6	6	6	6	6	30
RWS & S programme (TA)							
•Surface-water treatment		5	5	5	5	5	25
•Groundwater		5	5	5	5	5	25
APBD II							
•Surface-water treatment		3	3	3	3	3	15
•Groundwater		3	3	3	3	3	15
Stimulus programme (PA)							
•Surface-water treatment		3	3	3	3	3	15
•Groundwater		3	3	3	3	3	15
Total number of villages covered		28	28	28	28	28	140

Figure 13.: Theoretical planning of implementation of a RWS/S programme for one Kabupaten.

Conform this theoretical planning it is possible to cover 140 villages in five years. Two points should be considered. Already a certain number of villages is covered, about 30%, while the target for 1990 is to supply 60% of the rural population with water. Kabupaten X, for this theoretical picture, has about 20 * 19 = 360 villages, a realistic figure for West Java.

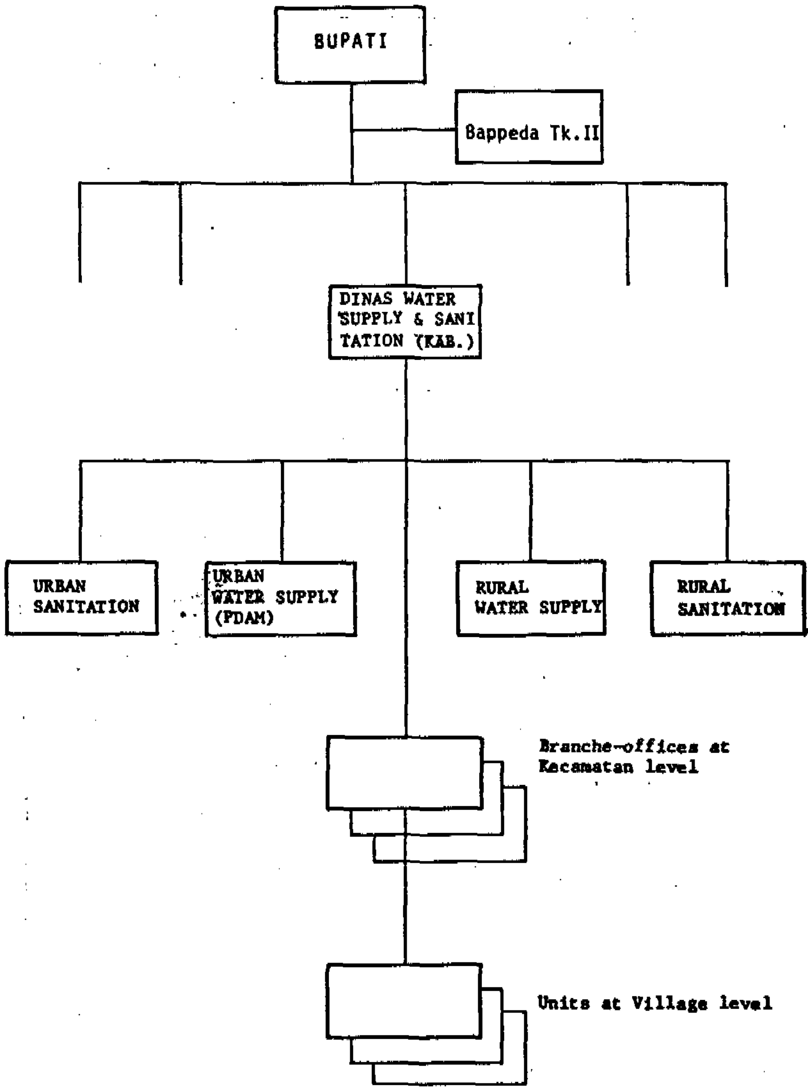


Figure 14.: Possible Future set-up of a "Dinas" for Water Supply and Sanitation at Kabupaten level.

At the moment several agencies deal with RWS/S at Kabupaten level. Even new agencies are set-up, such as the OAMP in Indramayu. Other kabupatens prefer to start the RWS/S organization as a working unit under PU-K, while others choose the PDAM for this purpose. In the end, however, it is the intention of the Indonesian Government to create a seperate Dinas for RWS/S. Such a Dinas may have a set-up as depicted in fig. 14., in which both urban and rural water supply and sanitation are taken care of.

4.5. DEVELOPMENT OF KNOW HOW.

Although the pivot of the programme should lay at Kabupaten level, at all levels of administration activities are required. Consequently, know-how concerning RWS has to be developed at all levels. For this purpose Indonesia has already a wide scope of institutes and courses. It is recommended to provide apprenticeships to students of these institutes at the Kabupaten programmes. Through such an exchange of knowledge both the programme and the institutes will benefit.
In order to get an appropriate programme for the development of know how a more detailed set-up should be formulated. The steps to reach this goal are:

1. Breakdown of functions at various administrative levels in relation with rural water supply and sanitation.

2. Tasks, as derived from these functions, to be executed by personnel at various levels.

3. Specification of required training c.q. education to fullfill these tasks.

4. Estimate of required number of peoples and skills to be delivered at a certain speed of programme implementation per year.

5. Evaluation of curricula and capacities of existing educational institutes.

6. Specification of required additional training c.q. education packages.

7. Formulation of proposal for cooperation of the programme with the existing institutes and formulation of proposal for additional training c.q. education activities.

This set-up may be formulated by a Dutch and an Indonesian consultant on training c.q. education. Before the programme starts preliminary appointments will have to be made with APK and ATPU concerning employment of graduates from their agencies in the Kabupatens.

Fellowships.

Sometimes it is useful to give fellowships to involved programme staff to upgrade their skills. One may think for example of fellowships to one of the institutes in The Netherlands giving courses on integrated regional development planning.

Fellowships to courses in Indonesia may also be envisaged. One could think of fellowships for Kabupaten staff to learn computerized data base management.

Staff that is involved in managing Kabupaten projects may be sent to courses as organized by the HRDP-project in Jakarta. Staff of the agencies at Provincial level may be trained in management and programming at courses at National level.

4.6. MAPPING.

The simplified method of mapping villages for the purpose of design of RWS&S schemes, or possibly for the formulation of Village Master Plans, has been very useful in Indramayu. It proved to be less expensive than aereal photography - when concerning villages - and it provides work at Kabupaten level. When the programme has gained full momentum, about 30 villages per Kabupaten have to be mapped.

After the maps are ready, they have to be stored safely, and a system for regular updating should be established. It is recommended that Bappeda II will institute a separate mapping division, with contracted labour for the actual map making. This map making may also be done by a local consultant, or a special foundation for this purpose. Maps are required, not only for the RWS&S programme, but also for the Kabupaten programme and programme of other sectors. The making of Village Master Plans may be handed over to a local consultant, or a special foundation for this purpose.

Initially the consultants' team of the programme may produce the maps, but this activity is typically toned to the skills of small local consultants. It is recommended to fund from T.A. the production of maps during the first years of the programme in a Kabupaten. It is recommended as well to include a Masterplan Desa for each fifth village that is supplied with water.

A dutch expert in village planning could coach the Consultant Teams at Kabupaten level to improve the Masterplan method. A training in data base management could be organized.

4.7. VILLAGE CREDIT SCHEME.

The Village Credit Scheme is mentioned in the first concept of the proposal for RWS&S as written by PEMDA I West Java. The objective of the village credit scheme is to improve living conditions in the village from within the village economy. However, to develop a credit scheme that can be implemented through the Regional Development Bank, foreign funding is asked for. Especially to evaluate experiences in this field and to assist in devising the scheme. The question is whether a village can be improved from within, without investments from central governmental programmes, or at least with a minimum amount of external inputs. In that case, villages do not have to wait until it is their turn in a governmental programme and, it will ease the burden on the development budget.

The village will pay its water supply and sewerage system through a sites and services project. The main factor of the concept is the price difference between land in the residential area of the village and the surrounding agricultural land.

Basis for a Village Credit Scheme should be a Village Master Plan. The main objective of the Scheme, in the frame of this programme, is improvement of sanitary conditions in a village and primarily water supply.

Experiences from other projects of this nature should be evaluated, before embarking into this set-up. The scheme should be based as much as possible on exchange of land to minimize risks of failure. Maybe the concept of land readjustment is useful for this project. Taxation on land transactions involved may be released for such projects to make the set-up attractive and more feasible. It may be useful to give incentives to villages that engage in the Credit Scheme, such as a certain mileage of paved road, a certain percentage of subsidy, a school or a market place may be guaranteed by the Central Government. Private enterprises may be interested to locate activities in the new set-up, where clear water is available and a road leads to all plots. The Regional Development Bank may administer savings of villagers for this purpose.

The set-up may be to finance the project from a revolving fund. If the programme is to be adopted or approved by the Regency Administration, it may be hooked on to some of their programmes. For example a Village Development Competition may adopt a category for villages that engage in this kind of development-from-within.
A sound procedure for all steps of the method may be developed in, for example, three villages. When the conditions are well known, the set-up may be adopted by the Indonesian Government through the Regional Development Bank.

It is recommended to execute a prefeasibility study of this set-up by a Dutch expert in cooperation with an expert from Bappeda I or Bangdes. The expert from Bappeda or Bangdes may go on short mission to The Netherlands to study available information at Bouw Centrum, International Training Centre and/or Institute of Social Studies. The Dutch expert may assist the Indonesian expert in the literature research.

4.8. TECHNOLOGICAL DEVELOPMENT / RESEARCH.

RWS&S development is still in motion, internationally as well as in Indonesia. A programme should allow for technology development, which is specially adapted to Javanese circumstances. Developments as started under the SDKI programme may be continued, such as:

1. **Application of Upflow Filters.**
   Not only Upflow Filters may be developed for small scale applications in hilly areas. Also their applicability for larger systems may be looked at.

2. **Application of ferrocement.**
   The application of ferrocement as a construction material in RWS schemes should be promoted. For this purpose measures for quality control and standardization of ferrocement are to be devised.

3. **Slow Sand Filtration.**
   Research may be done in cooperation with students of existing institutes, to find an alternative for conventional slow sand filters (SSF's). Drawback for SSF's is the storage of scraped-off sand. Replacement of the upper layer of sand, which bears the active bio-mass, by a washable (artificial) layer, could ease the operation of SSF.

4. **Village Credit Schemes.**
   See under 4.7.

5. **Hand pumps.**
   In the field of hand pumps, still further research is required. Development and marketing of the Banung pump requires continuous attention. OTA started also some research in Indramayu with a PVC version of the Blair pump. It is recommended to improve this pump, because of its simplicity.

6. **Sanitation.**
   It is recommended to start thinking of village sanitary systems, based on the specific conditions of West Javanese villages. Some options: leaching pits, upflow reactors, maturation ponds, water hyacinths.

This listing is far from complete. Undoubtly there are more fields of research to be done. The points, quoted here, are the questionmarks left open by the SDKI-programme. Sanitation in villages does not have to be very costly, because of the space that is still available and the natural absorbtion capacity in the villages.

4.9. MANAGEMENT AND CONTROL SYSTEMS

During this programme management and control systems should be developed. When the systems work out well, they can be used by the several implementing agencies. An important condition for the design of those systems is that they have to be used by staff at Kabupaten level. Although the programme covers only 8 Kabupatens in 5 years, the Provincial Government is responsible for all Kabupatens in the Province in the long run. Therefor the interest of the management systems surpasses the borders of the Programme.

Four types of control and management are considered;
1. Water quality control;
2. Logistics control;
3. Financial control;
4. Data base management;
5. Programme monitoring.

Ad.1. Water quality control.

Functioning of the water treatment systems has to be controlled regularly. For this purpose water samples have to be taken to check the quality of the water. Bacteriological testing should be done as soon as possible after the samples are taken. The existing laboratories at Kecamatan, Kabupaten and Provincial levels may be used for this purpose. A proper way of recording data and processing them forward and backward is required. An inventory of available equipment and skills at the various levels should be made.

Then a program may be formulated for water quality control; what kind of samples are to be tested at what levels, how the cost for a regular control are covered, how data are processed and used and how the organization for water quality control is set-up in rural areas. A set of regulations, issued by the Kabupaten Administration and the Provincial Government, concerning WQC is of vital importance is of vital importance to a long term functioning of a WQC Organization.

Ad 2. Logistics control.

In order to facilitate a smooth implementation, a logistics control system is to be set-up. A warehouse and a procedure on how to get materials out of it, are elements of this system. Also the flows of materials, equipment and labour has to be matched with the budgets and the plans. This is especially the case with in-house implementation.

Ad 3. Financial control.

Several control systems are required under this item;

1a. daily reporting of expenditures in the field and in the office at Kabupaten level.
1b. daily checking of these expenditures against the weekly budget.
2a. weekly budgetting from the field.
2b. checking of the weekly budgets against monthly and project budgets.
2c. weekly reporting on the field activities.
3a. monthly budgetting of Kabupaten offices.
3b. monthly checking of budgets by the provincial office against monthly and overall budgets.
3c. monthly checking of expenditures against budgets.

4a. quarterly budgetting by provincial offices.
4b. quarterly reporting from provincial office.
5a. yearly reporting by provincial office.
5b. yearly budgetting by provincial office.

It is obvious that the control of more Kabupaten Projects can only be done effectively with the use of (personal) computers.

Ad 4. Data Base Management.

The programme will generate a lot of usefull data, being of interest for later use. Maps are made and have to be stored, used and updated. Baseline surveys are executed, whose data must be processed statistically. Occurrence of pollution of surface water and ground water, sampling of effluent water from schemes, all that kind of information has to be stored and to be available for use.

Also technical parameters and characteristics of supply schemes must be stored, as well as information on the financial management of the individual schemes.

Ad 5. Programme monitoring.

With a number of 250 to 300 villages per Kabupaten, it is necessary for effective management and use of data from the programme, to set up a computerized control system. Introduction of (personal) computers at Kabupaten and Provincial level may also enable the agencies to implement the policies of decentralization more effectively. Programme monitoring at Provincial level can only be executed efficiently and with enough "speed" with the use of modern data processing.

Not only implementation activities are to be controlled and monitored, but, even more important, also operation and maintenance of the water supply schemes. Computerized control may be very usefull for the purpose of a O & M - System. Execution of regular maintenance can be managed more easily.

A N N E X 1

Status quo of realized systems in Indramayu

ANNEX 1

STATUS QUO OF REALIZED SYSTEMS OF SDKI PROGRAMME AS PER APRIL 1985.

A. MCKP - 200 system: - functioning 88 % of 1 until 9.

1. Patrol - functioning (SDKI)
2. Limpas Blok I - functioning (SDKI)
3. Limpas Blok II - functioning (SDKI)
4. Limpas Blok III - functioning (SDKI)
5. Limpas Blok IV - functioning (SDKI)
6. Limpas Blok Kedokan Wungu - not functioning (SDKI)
7. Limpas Blok Masjid - functioning (SDKI)
8. Anjatan (six) - functioning (SDKI-self-help)
10. Panyindangan Wetan (10) - no information (SDKI)

B. MCK - dugwell 500 system: - functioning 100 %

1. a. Sumur Adem I - functioning (SDKI) 100% funct.
   b. Sumur Adem II - functioning (SDKI- APBD TK II)
2. a. Pekandangan I - functioning (SDKI- APBD TK II)
   b. Pekandangan II - functioning (SDKI- APBD TK II)

C. MCKS - 200 system Wadjul (SDKI):functioning 50 %

1. Cilandak - functioning well
2. Limpas Blok Sabrang Wetan - not funtioning

D. MCKS - 500 system: - functioning 33 %

1. Pawidean - functioning (SDKI)in dry season.
2. Kalimati - not functioning (SDKI)

E. MCKS - 2000 system: - functioning 100 %

1. Cilandak - functioning (SDKI)
2. Sukareja - functioning (SDKI)

F. MCKS - 3000 system: - functioning 80 %

1. MCKS - 3000 Sukamulya - functioning (SDKI)
2. MCKS - 3000 Lobener - functioning well
3. MCKS - 3000 Kalianyar - functioning (SDKI)
4. MCKS - 3000 Sukareja - functioning (SDKI)
5. MCKS - 3000 Plumbon - not yet functioning

G. MCK - dugwell piping 500 system (SDKI) - 100% functioning
   Krasak A - functioning
   Krasak B - functioning

H. MCKS Up Flow Filtration - functioning 0 %
   Limpas - not functioning (SDKI)
   Singakerta - not functioning (SDKI)

Although the systems are reported to be functioning by april 1985, it is reported as well that maintenance has been insufficient for most systems. No funds are made available for this purpose. Often it is seen that the sanitary units are not cleaned regularly. Water Supply Teams of the villages, although officially instituted, do not function satisfactory. Continuation of the consultancy services is required urgently. But most important is a special O&M section within the OAMP that has sufficient funds to execute a proper maintenance scheme. Extension of the number of house connections in the larger systems has to be pushed actively, in order to provide a stronger financial base for the O&M activities at Village Level.

ANNEX 2

Regional Budget (APBD II) for RWS of the Kabupaten Indramayu

KABUPATEN DT.II INDRAMAYU

DAFTAR : USULAN RENCANA PROYEK (DURP) PRA. RAPBD. TINGKAT II-INDRAMAYU (BELANJA PEMBANGUNAN) UNTUK DINAS ANGGARAN TAHUN 1985/1986.-

NO.	Uraian tentang Sektor/Sub - Sektor/Program/Proyek.	Sifat Proyek	Volume Proyek	Lokasi Proyek	Jumlah Proyek yang diusulkan	Anggaran Tahun yang lalu (1984/1985).	Besarnya Anggaran yang diusulkan untuk PRA. RAPBD. Tingkat II Tahun 1985/1986.	Dinas/Unit	Keterangan : Alasan/Dasar Pertimbangan.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
I.	Perluasan Jaringan/Perbaikan MCKS 500 Desa Pawidean.								
	1. Pemagaran lokasi Sistim.	Pembuatan baru	144 m'	Desa Pawidean.		Rp.	Rp. 720.000,-	CAMP/KESRA	Pengamanan Sistim.
	2. Normalisasi saluran ke intake.	Pembuatan baru	400 m'	- " -			Rp. 8.500.000,-	- " -	- " -
	3. Pembuatan Kran Umum.	Pembuatan baru	2 buah.	- " -	1 (satu) Unit		Rp. 1.450.000,-	- " -	Perluasan pelayanan.
	4. Perpanjangan pipa ø 1¼"	Pembuatan baru	200 m'	- " -			Rp. 1.500.000,-	- " -	- " -
	5. Pembuatan MCK-SG dan pemasangan pipa 100 m	Pembuatan baru	1 buah.	- " -			Rp. 1.100.000,-	- " -	- " -
							Rp.13.270.000,-		
II.	Perluasan Jaringan/Perbaikan MCKS 3000 Desa Lobener.								
	1. Pemagaran lokasi Sistim	Pembuatan baru	400 m'	Desa Lobener.			Rp. 2.000.000,-	- " -	Pengamanan Sistim.
	2. Normalisasi saluran ke intake.	Pembuatan baru	150 m'	- " -			Rp. 3.750.000,-	- " -	- " -
	3. Perluasan Jaringan pipa induk ø 2"	Pembuatan baru	1.000 m'	- " -			Rp. 3.850.000,-	- " -	Perluasan pelayanan.
	4. Pembuatan Kantor & Gudang	Pembuatan baru	36 m2	- " -	1 (satu) Unit		Rp. 3.600.000,-	- " -	Fasilitas pelayanan.
	5. Pembelian Diesel untuk pengurasan 10 PK.	Pembelian baru	1 buah.	- " -			Rp. 1.500.000,-	- " -	Fasilitas pemeliharaan.
	6. Perbaikan kecil pada bagian kolam.	Rehabilitasi.	3 buah.	- " -			Rp. 500.000,-	- " -	Pemeliharaan fisik.
							Rp.15.200.000,-		
III.	Perluasan Jaringan/Perbaikan MCKS 500 Desa Kalimati.								
	1. Perluasan Jaringan distribusi dan 4 buah MCK.								
	- Pompa Diesel 6 PK.	Pembelian baru	1 buah.	Desa Kalimati.			Rp. 1.000.000,-	- " -	Fas. pemelihar.
	- Perpipaan PVC ø 2".	Pemasangan baru	1.500 m'	- " -			Rp. 5.775.000,-	- " -	Perluasan Jar.
	- MCK 4 buah.	Pembuatan baru	4 buah.	- " -	1 (satu) Unit		Rp. 1.200.000,-	- " -	Perluasan pel.
	2. Perbaikan saringan pasir lambat.	Rehabilitasi	1 buah	- " -			Rp. 350.000,-	- " -	Pemel. Fisik.
	3. Perbaikan dan normalisasi saluran ke in take.	Pembuatan baru	300 m'	- " -			Rp. 4.500.000,-	- " -	Pemel. Fisik.
							Rp.12.825.000,-		

1	2	3	4	5	6	7	8	9	10
IV.	Perluasan Jaringan / Perbaikan MCKS 500 Desa Krasak.								
	1. Pembuatan baru MCKS 500 di Blok Sukaselang.	Pembuatan baru	1 (satu) Unit	Desa Krasak.	1 (satu) Unit		Rp. 7.500.000,-	OAMP/KESRA	Perluasan pelayanan.
	2. Urugan tanah lokasi sumur dan pembuatan tempat/kolam air limbah.	Rehabilitir.	2 lokasi.	- " -			Rp. 800.000,-	- " -	Pemeliharaan - fisik.
							Rp. 8.300.000,-		
V.	Perluasan Jaringan / Perbaikan MCKS 2000 Desa Sukamulya.								
	1. Pemagaran lokasi Sistim.	Pembuatan baru	400 m²	Desa Sukamulya.	1 (satu) Unit		Rp. 2.000.000,-	OAMP/KESRA	Pengamanan sistim.
	2. Stimulan untuk penyambungan House Conection (HC) pembelian alat2 & perpipaan.	Pembuatan baru	100 sambungan	- " -			Rp. 2.000.000,p	"	Pelayanan kepada masyarakat.
	3. Pembuatan lantai kolam penampungan.	Pembuatan baru	1.000 m²	- " -			Rp. 2.850.000,-	"	Perbaikan fisik
	4. Pemagaran bambu dan pembuatan sistim pembuangan air limbah 4 buah MCK lama.	Pembuatan baru	4 buah.	- " -			Rp. 400.000,-	"	Pengamanan fisik.
							Rp. 7.250.000,-		
VI.	Penyempurnaan Sistim MCKS 2000 Desa Sukareja.								
	1. Penyempurnaan sistim dengan penambahan saringan pasir cepat	Pembuatan baru	1 (satu) Unit	Desa Sukareja.	1 (satu) Unit		Rp. 1.500.000,-	"	Penyempurnaan sistim.
	2. Pembuatan Menara Air.	Pembuatan baru	1 (satu) Unit	- " -			Rp. 3.000.000,-	"	- " -
	3. Pembelian pompa 6 PK.	Pembelian baru	1 (satu) Unit	- " -			Rp. 1.000.000,-	"	- " -
	4. Pemeliharaan 9 buah MCK.	Rehabilitasi.	9 (sembilan) unit	- " -			Rp. 900.000,-	"	- " -
							Rp. 6.400.000,-		
VII.	Penyempurnaan/Perluasan MCKS 2000 Desa Plumbon.								
	1. Pembuatan Kran Umum.	Pembuatan baru	3 (tiga) buah.	Desa Plumbon.	1 (satu) Unit		Rp. 1.200.000,-	"	Fasilitas pel.
	2. Pemagaran lokasi sistim.	Pembuatan baru	70 m²	- " -			Rp. 3.500.000,-	"	Pengamanan sist
	3. Stimulan pemasangan H.C.	Pembuatan baru	100 orang	- " -			Rp. 2.000.000,-	"	Fasilitas pel.
							Rp. 6.700.000,-		
VIII.	Penyempurnaan/Perluasan MCKS 2000 Desa Kalianyar.								
	1. Pemagaran lokasi sistim.	Pembuatan baru	200 m²	Desa Kalianyar.	1 (satu) Unit		Rp.10.000.000,-	"	Pengamanan sist:
	2. Stimulan untuk pemasangan House Connection (HC).	Pembuatan baru	100 Orang.	- " -			Rp. 2.000.000,-	"	Fasilitas pelayanan.
	3. Pemeliharaan M.C.K.	Rehabilitasi	9 buah.	- " -			Rp. 450.000,-	"	Pemeliharaan sistim.
							Rp.12.450.000,-		

2	3	4	5	6	7	8	9	10
Penyempurnaan/Perbaikan								
MCKS/MCK Desa Cilandak.								
1.Rehab berat MCKS 2000.								
a.Perbaikan pasir lambat.	Rehabilitasi	1 (satu) unit	Desa Cilandak.			Rp. 750.000,-	OAMP/KESRA	Penyelamatan fisik.
b.Pembuatan senderan kolam penampung.	Pembuatan baru	500 m2	- " -			Rp. 2.250.000,-	"	- " -
c.Pergantian pompa & lantai cuci	Rehabilitasi.	1 (satu) buah.	- " -			Rp. 200.000,-	"	- " -
d.Pembuatan Menara Air.	Pembuatan baru.	1 (satu) buah.	- " -			Rp. 4.000.000,-	"	Peningkatan sarana.
e.Pembelian pompa 6 PK.	Pembelian baru.	1 (satu) buah.	- " -			Rp. 1.000.000,-	"	- " -
f.Pemasangan pipa distribusi pipa WAVIN.	Pemasangan baru.	3.000 m'	- " -	1 (satu) unit.		Rp. 7.500.000,-	"	- " -
g.Pemagaran lokasi sintim.	Pembuatan baru.	300 m'	- " -			Rp. 1.500.000,-	"	Pengamanan lokasi.
2.Rehab berat MCK 200.								
a.Perbaikan bak penampung air dan gentongan.	Rehabilitasi.	1 (satu) unit	- " -			Rp. 2.000.000,-	"	Penyelamatan fisik.
b.Perbaikan MCK dan pompa.	Rehabilitasi.	1 (satu) unit	- " -			Rp. 1.500.000,-	"	- " -
						Rp.20.700.000,-		
Perbaikan ringan MCK-MCK 200. di Desa Patrol dan Limpas.								
1.Perbaikan lantai MCK, pemeliharaan pompa tangan dan perbaikan septick tank.	Rehabilitasi.	8 (delapan) unit	Desa Patrol & Limpas	8 (delapan) unit		Rp. 1.200.000,-	"	Pemeliharaan fisik.
						Rp. 1.200.000,-		
I. Perbaikan ringan MCK. 200.								
di Desa Sumuradem.								
1.Perbaikan lantai, pemeliharaan pompa & perbaikan septick tank.	Rehabilitasi	1 (satu) unit	Desa Sumuradem.	1 (satu) unit.		Rp. 150.000,-	"	Pemeliharaan fisik.
						Rp. 150.000,-		

	2	3.	4	5	6	7	8	9	10
II.	MCKS 2000 Luwunggesik.								
	1. Sistim penjernihan air.	Pembuatan baru	5000 m2	Desa Luwunggesik			Rp.10.000.000,-	OAMP/KESRA	
	2. Menara Air.	- " -	1 buah	- " -			Rp. 3.500.000,-	"	
	3. Pompa Diesel & R. Pompa.	- " -	1 buah	- " -	1 (satu) unit		Rp. 1.500.000,-	"	
	4. Pipa distribusi.	- " -	2000 m.	- " -			Rp. 8.500.000,-	"	
	5. Lantai Cuci.	- " -	6 buah	- " -			Rp. 1.500.000,-	"	
							Rp.25.000.000,-		
II.	MCK-SG 2000 Desa Benda.								
	1. Pembuatan sumur.	Pembuatan baru	25 sumur	Desa Benda.			Rp. 8.500.000,-	"	Masing-masing sumur diharapkan menam - pung 5 m3.
	2. Menara Air.	- " -	1 buah	- " -			Rp. 3.500.000,-	"	
	3. Pompa Diesel & R. Pompa.	- " -	1 buah	- " -	1 (satu) unit		Rp. 1.500.000,-	"	
	4. Pipa distribusi.	- " -	2.500 m.	- " -			Rp.10.500.000,-	"	
	5. Lantai cuci.	- " -	4 buah	- " -			Rp. 1.000.000,-	"	
							Rp.25.000.000,-		
IV.	MCKS. 2000 Desa Telukagung.								
	1. Sistim penjernihan air.	Pembuatan baru	5.000 m2.	Desa Telukagung.			Rp.10.000.000,-	OAMP/KESRA	
	2. Menara Air.	- " -	1 buah	- " -			Rp. 3.500.000,-	"	
	3. Pompa Diesel & R. Pompa.	- " -	1 buah	- " -	1 (satu) unit		Rp. 1.500.000,-	"	
	4. Pipa Distribusi.	- " -	2.000 m.	- " -			Rp. 8.500.000,-	"	
	5. Lantai cuci.	- " -	6 buah	- " -			Rp. 1.500.000,-	"	
							Rp.25.000.000,-		
V.	MCK-SG. 1000 Desa Kebulen.								
	1. Pembuatan sumur.	Pembuatan baru.	10 x 2 buah	Desa Kebulen.			Rp. 6.500.000,-	OAMP/KESRA	
	2. Pemasangan pipa GI. 2".	- " -	350 x 2 m.	- " -	2 (dua) unit		Rp. 3.000.000,-	"	
	3. M.C.K.	- " -	2 x 2 buah	- " -			Rp. 3.000.000,-	"	
							Rp.12.500.000,-		
VI.	MCK - SG. Desa Pawidean.								
	1. Pembuatan sumur.	Pembuatan baru.	10 buah	Desa Pawidean.			Rp. 3.250.000,-	OAMP/KESRA	
	2. Pemasangan pipa GI. ∅ 2".	- " -	350 m.	- " -	1 (satu) unit		Rp. 2.000.000,-	"	
	3. M.C.K.	- " -	3 buah	- " -			Rp. 2.250.000,-	"	
							Rp. 7.500.000,-		
III	MCKS. 2000 Desa Pawidean.								
	1. Sistim penjernihan air.	Pembuatan baru.	5.000 m.	Desa Pawidean.			Rp.10.000.000,-	OAMP / KESRA	
	2. Menara Air.	- " -	1 buah	- " -			Rp. 3.500.000,-	- " -	
	3. Pompa Diesel & R. Pompa.	- " -	1 buah	- " -	1 (satu) unit		Rp. 1.500.000,-	- " -	
	4. Pipa distribusi.	- " -	2.000 m.	- " -			Rp. 8.500.000,-	- " -	
	5. M.C.K.	- " -	6 buah	- " -			Rp. 1.500.000,-	- " -	
							Rp.25.000.000,-		
III.	MCK - SG. Desa Kraksak.								
	1. Pembuatan sumur.	Pembuatan baru.	12 sumur	Desa Kraksak.			Rp. 4.000.000,-	OAMP / KESRA	
	2. Distribusi.	- " -	500 m	- " -	1 (satu) unit		Rp. 3.000.000,-	- " -	
	3. M.C.K.	- " -	4 MCK.	- " -			Rp. 3.000.000,-	- " -	
							Rp.10.000.000,-		
X.	MCKS. 500 Desa Terusan.								
	1. Sistim penjernihan air	Pembuatan baru	500 m.	Desa Terusan.			Rp. 4.500.000,-	OAMP / KESRA	
	2. Distribusi.	- " -	100 m.	- " -	1 (satu) unit		Rp. 750.000,-	- " -	
	3. M.C.K.	- " -	3 MCK.	- " -			Rp. 2.250.000,-	- " -	
							Rp. 7.500.000,-		

1	2	3	4	5	6	7	8		10
	MCKS-SG. 1000 Desa Terusan.								
	1. Pembuatan sistim.	Pembuatan baru	1.500 m2	Desa Terusan.			Rp. 7.500.000,-	OAMP/KESRA	
	2. Menara Air.	- " -	1 buah	- " -			Rp. 4.000.000,-	- " -	
	3. Pompa / R. Pompa.	- " -	1 buah	- " -	1 (satu) unit		Rp. 1.500.000,-	- " -	
	4. Pipa distribusi.	- " -	1.500 m2.	- " -			Rp. 3.900.000,-	- " -	
	5. Public Pump.	- " -	4 buah	- " -			Rp. 600.000,-	- " -	
							Rp.17.500.000,-		
XX.	Pembangunan MCK - SG. 2000. Desa Panyindangan Kulon.								
	1. Pembuatan sumur.	Pembuatan baru	25 sumur	Desa Panyindangan Kulon			Rp. 8.500.000,-	OAMP/KESRA	
	2. Menara Air.	- " -	1 buah	- " -			Rp. 3.500.000,-	- " -	
	3. Pompa Diesel & R. Pompa.	- " -	1 buah	- " -	1 (satu) unit		Rp. 1.500.000,-	- " -	
	4. Pipa distribusi.	- " -	2.500 m.	- " -			Rp.10.500.000,-	- " -	
	5. Lantai cuci.	- " -	4 buah	- " -			Rp. 1.000.000,-	- " -	
							Rp.25.000.000,-		
XXI.	Pembangunan MCK. 2000. Desa Ujungaris.								
	1. Sistim penjernihan air.	Pembuatan baru.	5.000 m2.	Desa Ujungaris.			Rp.10.000.000,-	OAMP/KESRA	
	2. Menara Air.	- " -	1 buah	- " -			Rp. 3.500.000,-	- " -	
	3. Pompa Diesel & R. Pompa.	- " -	1 buah	- " -	1 (satu) unit		Rp. 1.500.000,-	- " -	
	4. Pipa Distribusi.	- " -	2.000 m2.	- " -			Rp. 8.500.000,-	- " -	
	5. Lantai cuci.	- " -	6 buah	- " -			Rp. 1.500.000,-	- " -	
							Rp.25.000.000,-		
					T O T A L		Rp.309.445.000,-		

Indramayu, 19 Nopember 1984.
Organisasi Air Minum Pedesaan
Kabupaten Dt.II Indramayu
K e p a l a,

= MA. RACHMAT PARTASASMITA BA. =
NIP : 010072606.

A N N E X 3

Concrete (technical) Results
and Evaluation

A3. TECHNICAL ASPECTS AND EVALUATION.

In this annex the concrete results of this programme are dealt with. The sections on technicaly results (A3.1, A3.2 and A3.3) consist of:

a. Technical information.

b. Discussion about experiences with this specific system.

Section A3.4 describes the planning methods as developed by the SDKI-programme.

A3.1. WATER USE AND DISPOSAL.

1. MCK- Sanitary Unit.

2. PSP- Public Standpost.

3. HC - House Connection.

****

A3.1.1. UNIT; "MCK"- Sanitary Unit PRICE INDICATION; $650

ELEMENTS; 1 Any type of water source;
2 Shallow well hand pump (Bandung Pump);
3 Collection Basin;
4 Spill-over to buckets and jerrycans;
5 Spill-over to washing tub;
6 Underground pipe to basin in bath room;
7 Washing floor;
8 Bath room annex toilet;
9 Septic tank;
10 Discharge gutter.

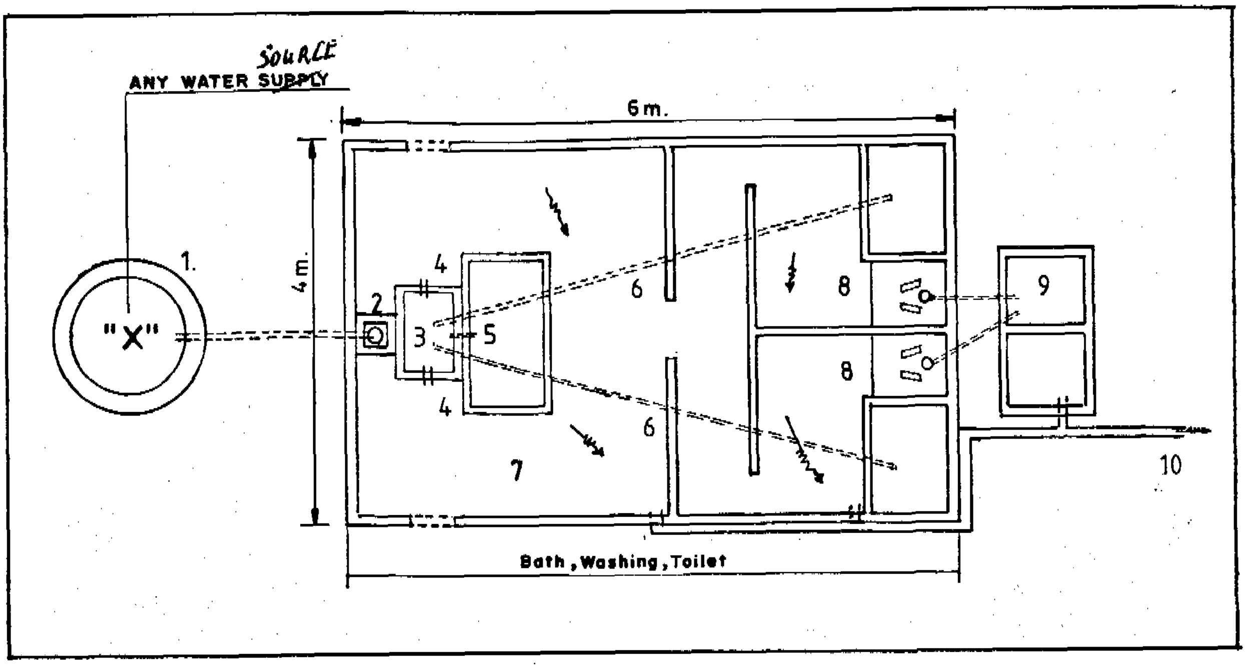
DESCRIPTION;

a) Water is drawn by a hand pump into the collection basin.
b) From this basin, with a higher elevation, water flows side-way into buckets and jerricans,
c) and it can flow into a washing tub. With wooden plugs people can regulate the flow.
d) Two underground pipes lead to the basins in the bathrooms. A horizontally perforated diaphragm prevents durt to enter the pipes
e) With the use of a "gayung" people can take water from the basin in the bathroom to take a shower.
f) Porcelaine toilet buckets are applied, because these can be cleane more easily than earthen ware buckets.
g) Effluents from washing and bathing delutes the effluent of the septic tanks, before running into the agricultural drainage grid.

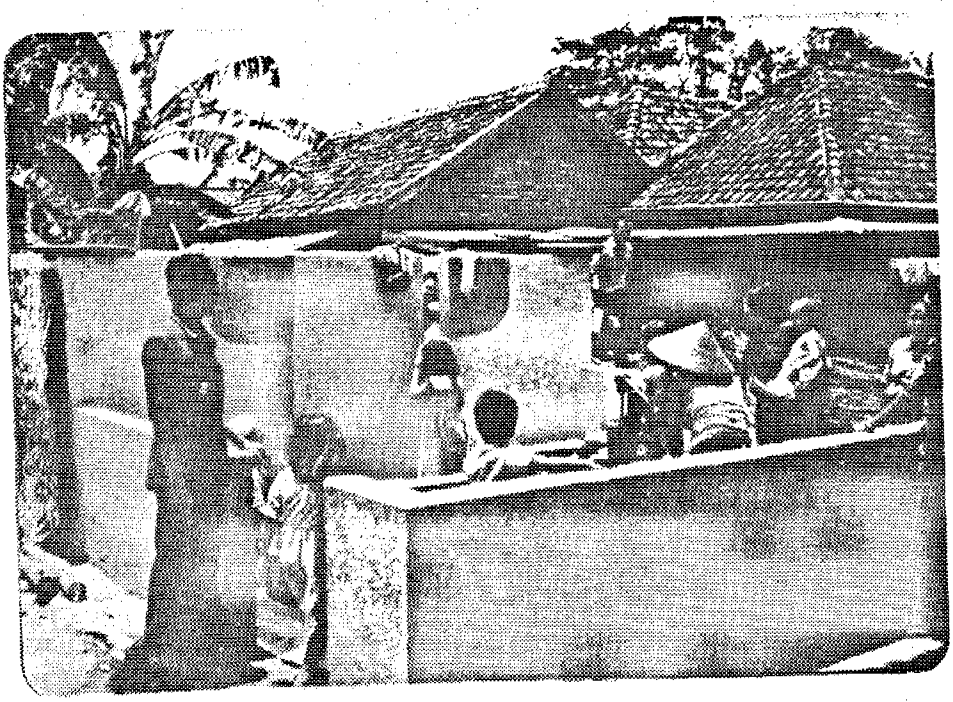
DETAILS
DISCUSSION;

The toilets are porcelaine toilets, easy to clean with some splashes of readily available water. Another advantage over earthen ware toilets is, that porcelaine toiles look fancier, so people like to use them. Besides, they cost only US $ 3 on a total price of US $ 650 per MCK. The construction of both MCK and public standposts are handed over in contract to handymen in the village, often coordinated by either the Village Head or the President of the Village Resilliance Organization (LKMD).

****


SOURCE
ANY WATER SUPPLY
6 m.
4 m.
1.
"X"
2
3
4
4
5
6
6
7
8
8
9
10
Bath, Washing, Toilet

MCK-UNIT



****

A3.1.2. UNIT; Public Stand Post (PSP) PRICE INDICATION; $260

ELEMENTS: 1 Connection to distribution grid of water supply scheme;
2 Floating valve;
3 Reservoir (1.5 m3) with floor at minus .5 meter;
4 Shallow well hand pump (type: Bandung Pump);
5 Brickwork slab;
6 Discharge gutter to agricultural drainage grid.

DESCRIPTION;

a) Water from a Water Supply Scheme flows into a 1.5 m3 reservoir;
b) A floating valve prevents the water from spilling over the rim;
c) Because the spout of the pump has an elevation of .5 m, it was necessary to lower the floor of the basin with .5 m.
d) With a shallow well hand pump the water is drawn from the reservoir.
e) Spilling water is discharged into the agricultural (drainage) grid

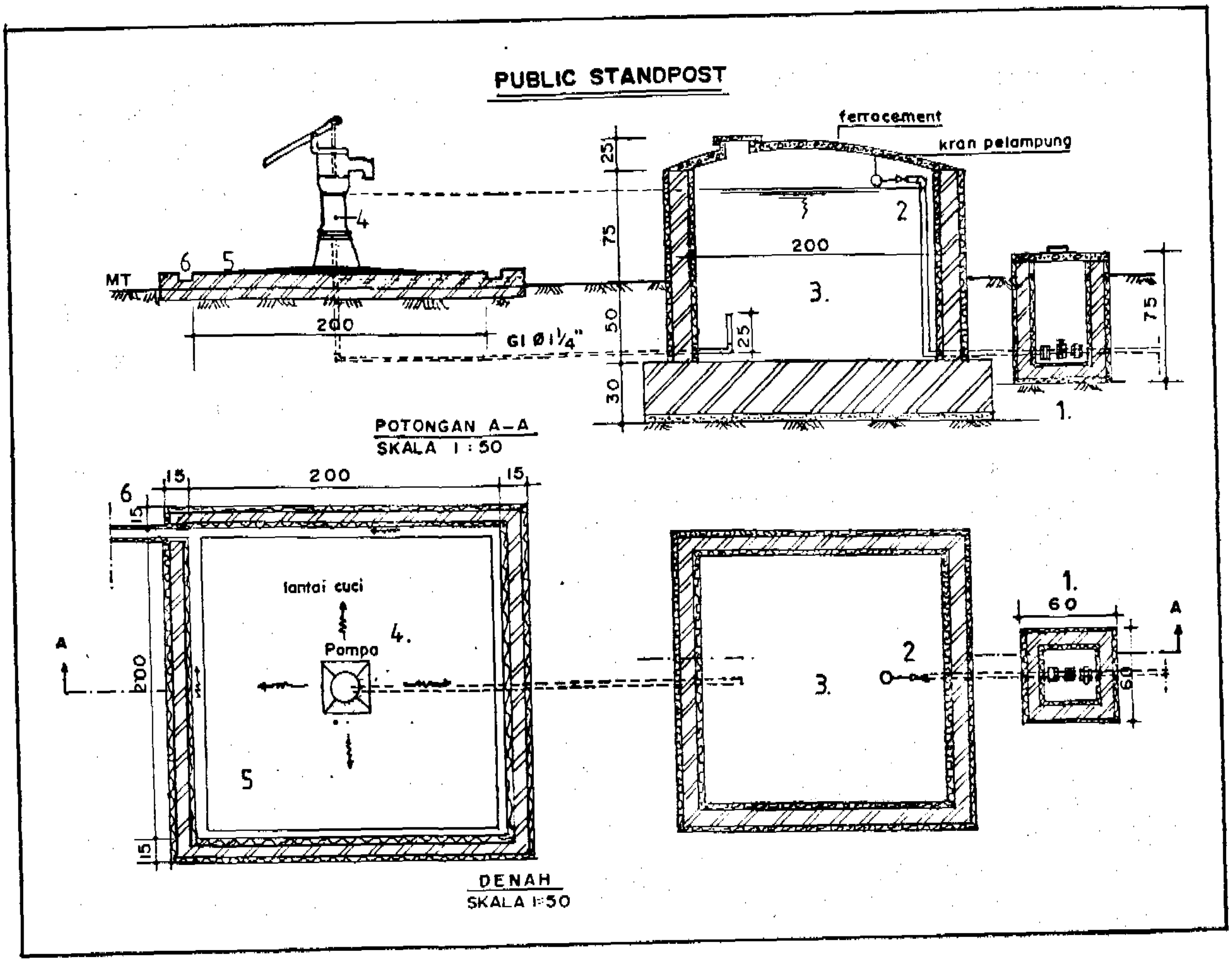
DISCUSSION;

Water is drawn from a partially submerged tank by a hand-pump. This has two advantages over a standpost with normal taps:

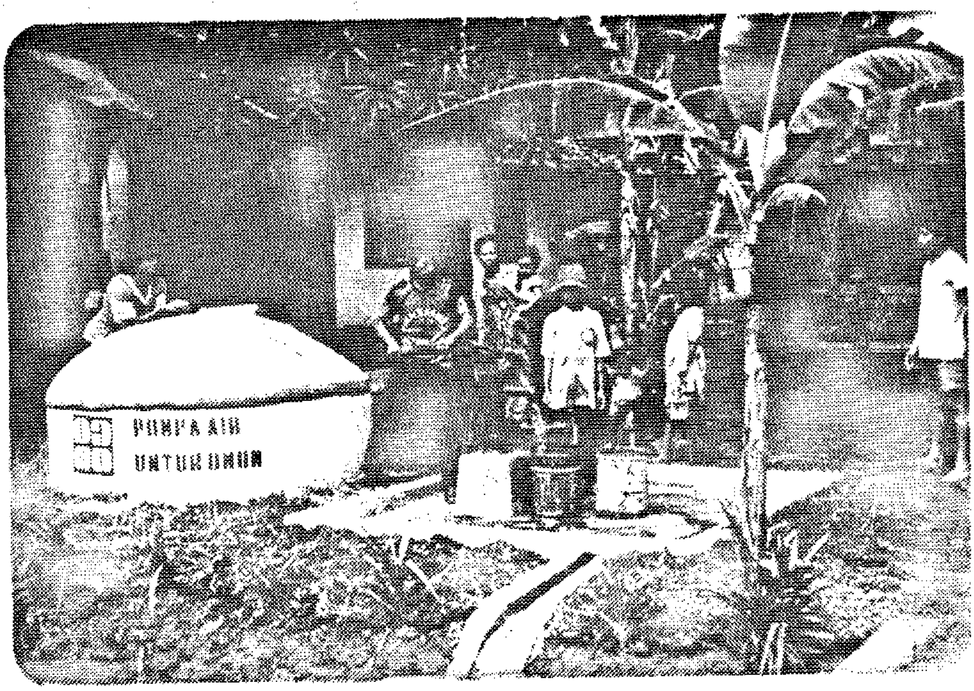
1. No spilling will occur due to leaking or non-closed taps; people draw only the water they need. In other words, this standpost saves money.

2. Buckets are filled-up faster than by using taps, in other words: this PSP is more user-friendly.

****



PUBLIC STAND POST



****

A3.1.3. UNIT; House Connection PRICE INDICATION; $30

ELEMENTS; 1 Connection to distribution grid of water supply scheme;
2 Cock valve in brick work box;
3 Small basin outside the house with floating valve;
4 Pipe leading into the house, directly into the
5 'Bak mandi', a brick work basin (about 0.5 m3).

DESCRIPTION;

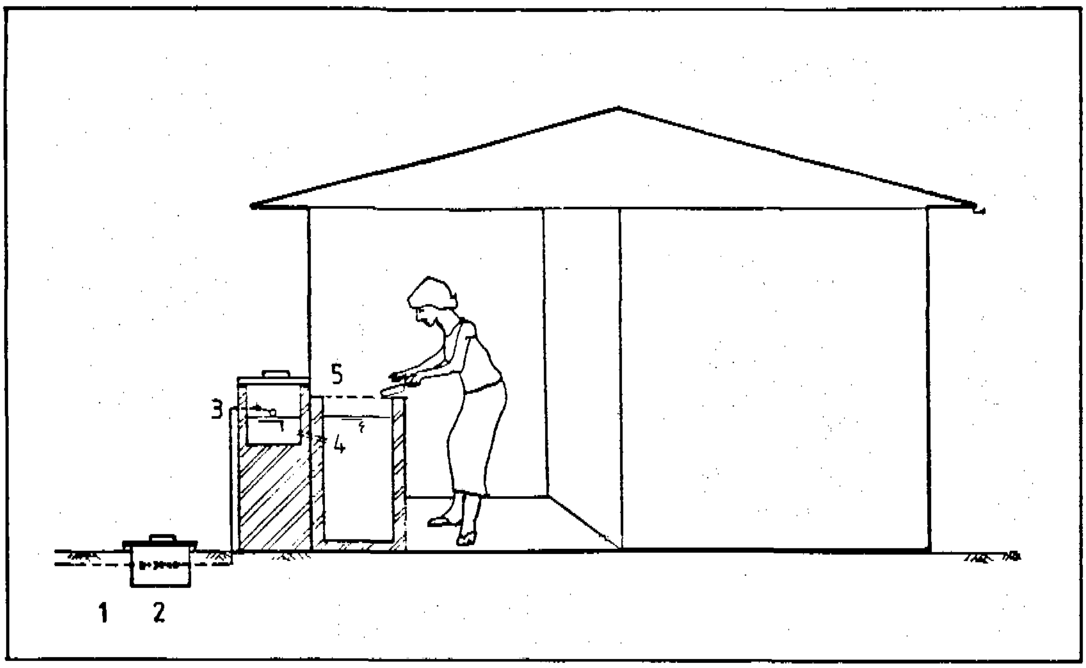
a) Water from a Water Supply Scheme flows into a small brick work basin, containing a floating valve.
b) The water level at which the valve closes corresponds with the highest level of the 'bak mandi' inside the house.
c) A pipe, drilled through the wall in the house, connects the small basin with the 'bak mandi'.
d) A cockvalve, built into a small brick work box, serves to close the house connection while in repair.

DISCUSSION;

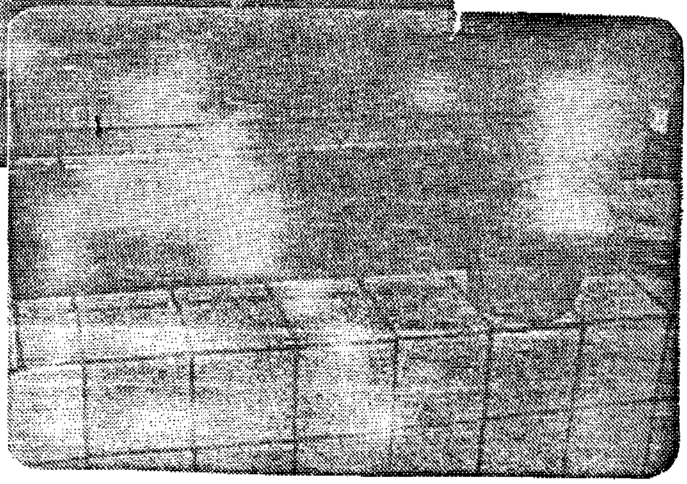
House connections play an important role in covering the costs of operation and maintenance.

The 'bak mandi' is already available in most Javanese houses. Water is fetched from the 'bak mandi' with a 'gayung', resembling a small whisker, with which people splash water over themselves. An important discovery with the implementation of house connections was that people completed the supply-use-disposal chain by themselves. After clean water entered their house, they built a toilet annex septic tank themselves. Often they also improved their kitchen and the facade of their house. From this event it is learned how the community will help improve sanitary conditions in the village. People in the village are prepared to invest substantially in 'development' when benefits for their own interests are clearly visible.

****



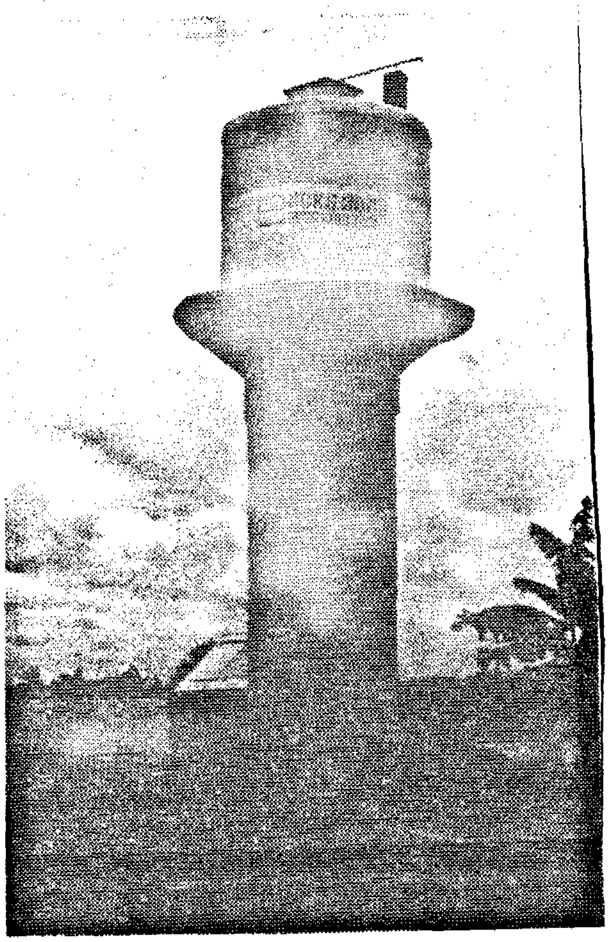
HOUSE CONNECTION



A3.2. SURFACE WATER TREATMENT SCHEMES.

This section contains a review of the following schemes that are realized in the project:

1. The MCKS 500, the first scheme built in the programme.
2. The MCKS 3000, the system of Lobener, complete with watertower and house connections.
3. The MCKS Wadjul, surface water treatment for a community of 10 families.
4. The MCKS-UFF 200, an experiment with up flow filtration.



****

UNITS: Surface Water Treatment systems MCKS 500, -2000, -3000.

PRICE INDICATION; see reference list OTA.

ELEMENTS;
1 Intake or Inlet;
2 Coaggulation, flocculation, sedimentation;
3 Storage pond in case water is taken from irrigation grid;
4 Slow sand filter;
5 Clear water tank in the center of the filter;
6 Pipe to draw water from clear water tank;
7 Diesel engine pump, in case of distribution under pressure
8 Water tower, in case of distribution under pressure;
9 Distribution grid;
10 House Connections, Public Stand Posts and Sanitary Units.

DESCRIPTION;

The principle of all the "MCKS" systems is similar, with differences when using river- or irrigation water.

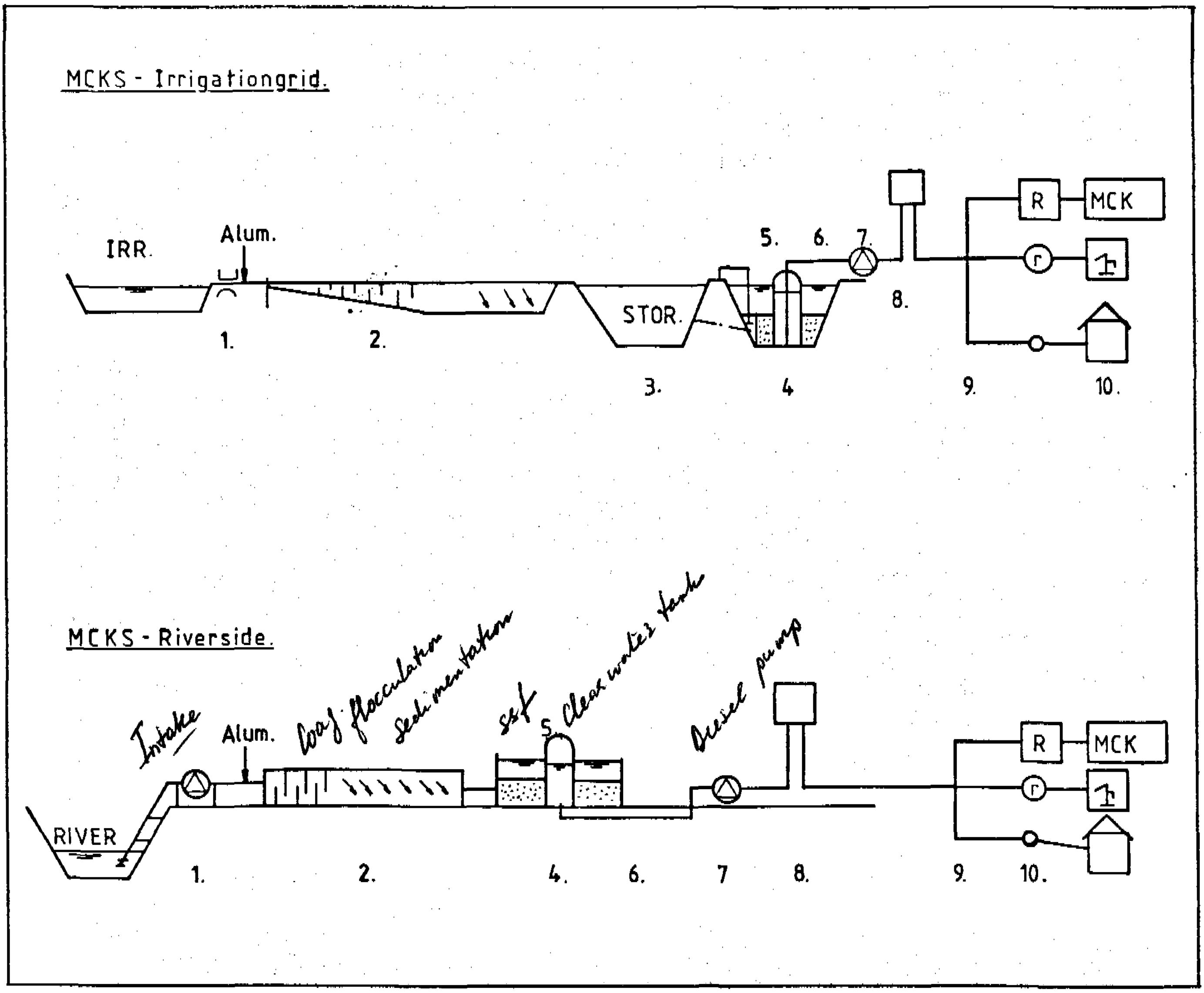
RIVERSIDE	IRRIGATION GRID
a. water is pumped from a continuous river;	a. water is let into the system by gravity;
b. alum is dosed ;	b. alum is dosed;

c. water flocculates and settles in a gutter around the slow sand filter;

d. then it enters a settlement basin;	d. then it enters into storage ponds, because during upto two months no irrigation water is supplied.

e. before entering the slow sand filter basin;
f. it is collected after filtration in a tank in the center of the filter.
g. from this tank it is pumped into the water tower by diesel pump;
e. and distributed to the consumers by house connections and public taps.

****



SCHEMATIC VIEW OF MCKS SYSTEMS.

****

A3.2.1. The MCKS 500.

DISCUSSION.

This system was the first system built in the programme. It served to get the staff of the Organization acquainted with the applied techniques.

An analysis of the technical functioning of the system is given in Annex-6, which is a reprint of an article in Volume 13 No. 2, April 1983 of the Journal of Ferrocement. The material of Ferrocement is used intensively and has proved to be an important element for innovation of rural water supply.

The lessons learned with this system are two fold:

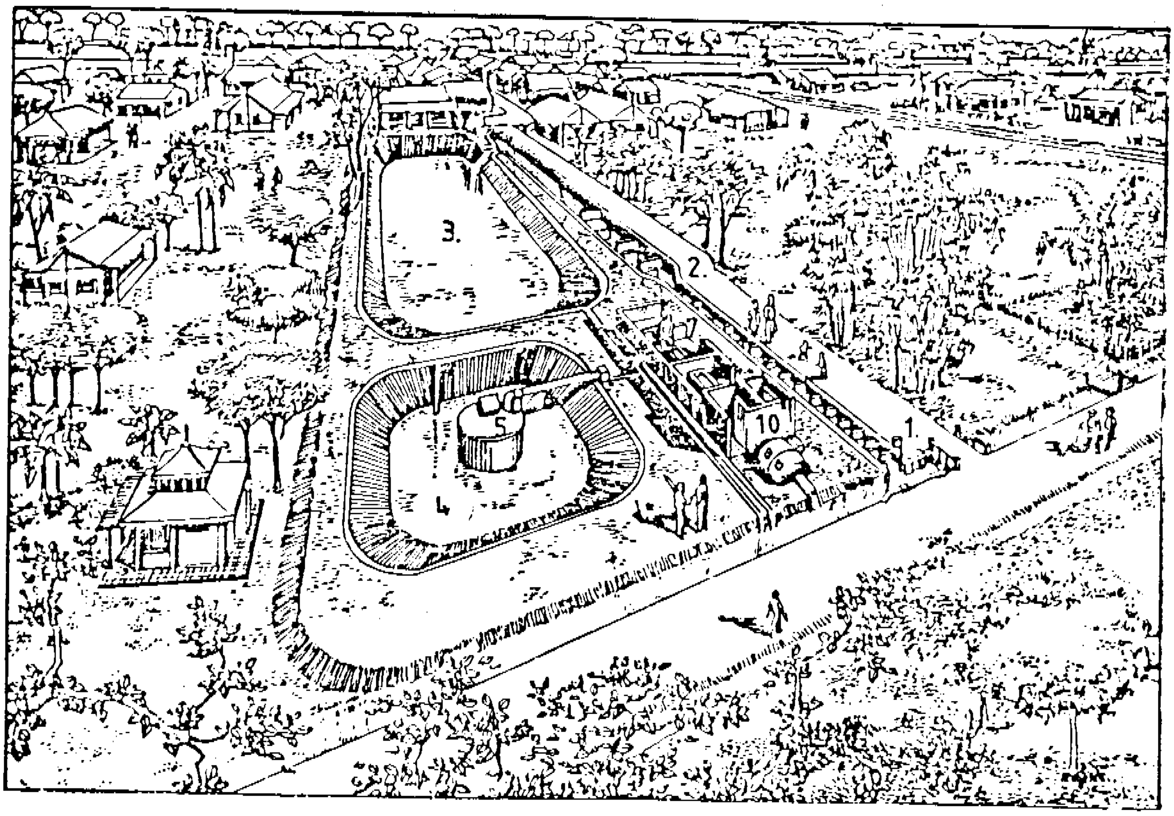
a. staff of Village Water Supply Organizations should not be parttimers (see discussion of this topic under chapter 2 on Organization, Man Power Development and Management);

b. since the system covers only part of a village, too little attention is given by the village leadership to the well functioning of the system. This results in breakdowns that are notcared for. Another point is that there is little chance that somebody in a small community of 100 households really understands tasks to be carried out.

A conclusion one may draw is that surface water treatment schemes should preferably cover a whole village. In this way there will be the political will with the village leadership to set-up a water supply team in the village. This conclusion is be-amed by experiences with the larger MCKS-3000 scheme.

****

MCKS-500
PAWIDEAN-INDRAMAYU



****

A3.2.2. The MCKS-3000.

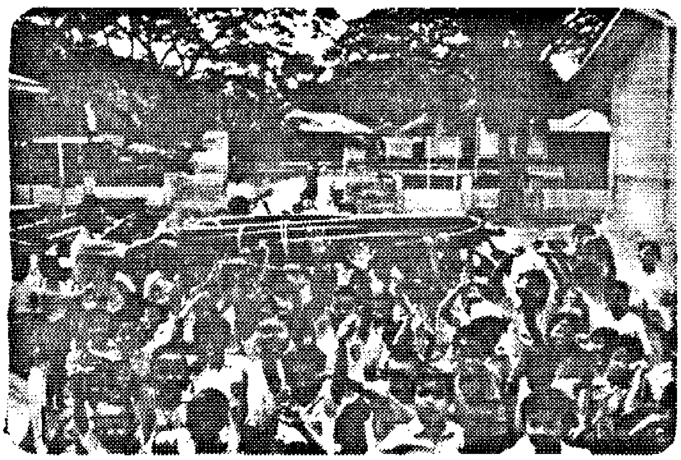
DISCUSSION.

Three systems of this type are built, in the villages of Lobener, Sukamulya and Kalianyar. The cost of running these schemes is very low, because of the use of only one diesel pump, connected to a watertower.

Since the bare material and the labour costs amount to about US $ 17 per capita, this system is affordable for the villages themselves. Nowadays they built beautiful mosques for up to US $ 50.000. They built the mosques themselves. The MCKS can be built by the villagers as well. Hopefully soon, clear water for the mosques is as important as the mosques themselves. Water does not have enough status yet and often is expected to be provided through government programmes.

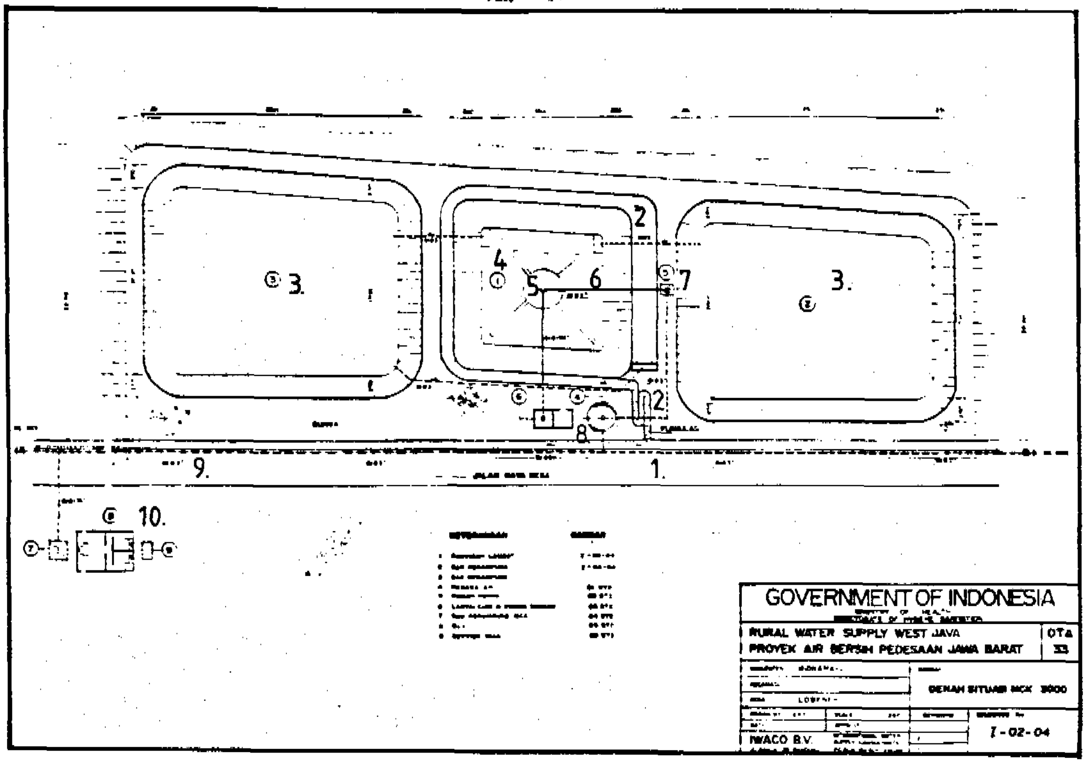
Decentralized storage allows minimization of the applied pipe diameter. Every tank is filled up through floating valves restricting the inflow (d=3 mm). Additionally the flow to the house connections is restricted with perforated coins in the joint to the service pipe. Towards the end of the grid, the diameter of the perforation increases.

In the system of Lobener the first batch of HDPE-pipe, produced in Indonesia, has been applied.

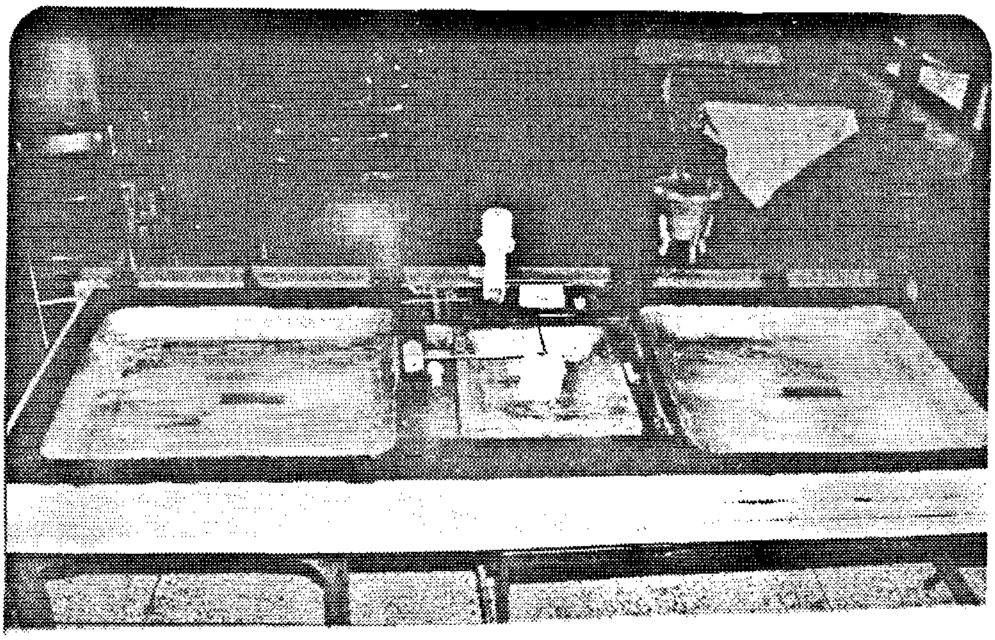


the first batch of HDPE produced in Indonesia.

****



Technical drawing of MCKS 3000 Lobener.



Maquet of the MCKS-3000 in the village of Lobener.

****

Instead of the usual HDPE joints, that are rather expensive, PVC-rubber ring joints are applied for connection of the pipe. For crossings of canals, galvanized iron ducts are applied. However, the market for HDPE is still underdeveloped in Indonesia. Also its price is not competative with PVC in diameters over 2". That can be a serious backdraw for the application of HDPE in RWS.

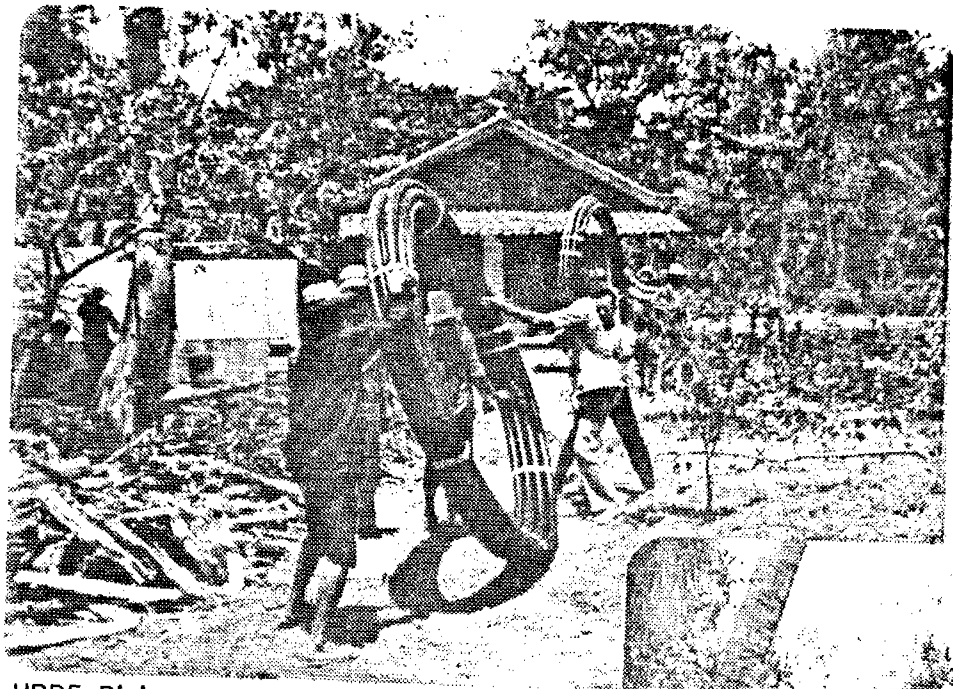
HDPE is very attractive and practical for village water supply because it is flexible and sold in rolls of 50m. Especially in densily housed villages full of economically important trees flexibility is very important. Also long uninterupted lengths of tube deminish the chance of leakage.

Another point concerning piping is that, where galvanized iron (GI) is applied, diameters up to 3" can be handled by a thread cutter in the field. 4" pipes are preferably not used, since threading must be done in a workshop in the district town, which gives rise to extra logistical complications. Because of the steady flow in the system due to decentralized storage, 3" pipe is sufficient for all distribution grids built so far.

For distribution of water to the community a watertower serves as a pressure device. The advantage is that the overhead tank can be filled up a few times a day, while pressure is available all day long. For pumping a diesel driven pump is applied, because operators of rice hullers in the villages are already acquainted with its operation and maintenance. One of them is also the operator of the scheme. Operation of gensets, electric motors pumps and pressure tanks need higher skilled labour that is often not available in villages. Also investments for the set-up with a water tower play a favourable rule.

The whole plant is made with the use of local labour. An important part of the reduction in the total investments of the system is due to the application of ferrocement as a construction material in most parts of the system. As an example of the use of ferrocement may be named the watertower. The price was about US $ 3.300, which is cheap in comparison with US $ 6.000 à 10.000 for a conventional construction. Annex-5 is a reprint of a publication of this watertower in the Journal of Ferrocement, issued by the International Ferrocement Information Center, Bangkok.

****



HDPE Piping

In the field training ⟶

Use of local material and labour.

****

A3.2.3. UNIT: Surface Water Treatment system PRICE INDICATION; $650
MCKS WADJUL

ELEMENTS:
1. Inlet from quartary irrigation canal;
2. Optional coaggulation, flocculation, sedimentation (alum)
3. Small pond; 50m2;
4. Infiltration well;
5. Slow sand filter; 4m2;
6. Clear water tank; 6m3;
7. Transmission pipe; (GI 1 1/4")
8. Handpump; (Type Bandung Pump)
9. Sanitary unit; 1/2 size;
10. Discharge into irrigation grid.

DISCRIPTION;

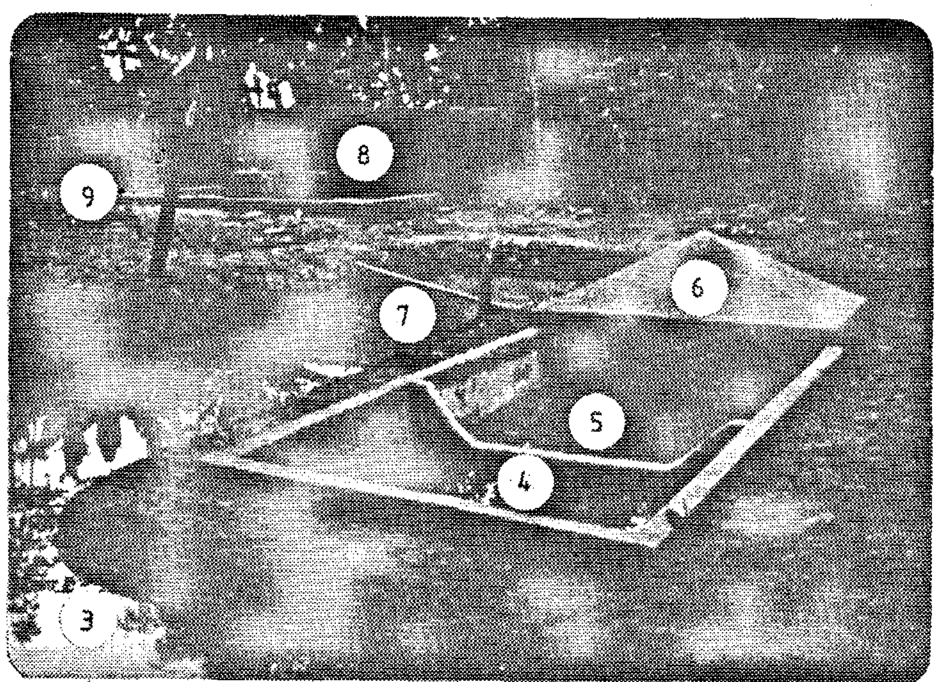
a) Water flows into traditional pond by gravity;
b) Optionally the water may be settled first with the use of alum;
c) The pond mainly serves as a storage facility, but since the water is clarified, sunrays will start-up a natural purification process;
d Water from the pond will filter through the ground into a well, that has an open brick work lining; turbidity is drastically reduced in case no sedimentation took place.
e) The next compartment of the system contains a small slow sand filter, with a surface of 4m2;
f) From the sand filter the water flows into a clear water tank;
g) A Bandung Pump draws the water directly from this tank,
h) To be used at the half-size MCK.
i) A drain leads disposed of water into the irrigation grid.

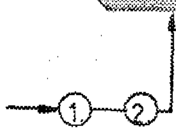
DISCUSSION.

Wadjul is one of the technicians who assisted in the construction of the first MCKS 2000 in the village of Cilandak. He suggested to make a very small MCKS from the little pond in his backyard. His design was technically almost sound.

****

The SDKI programme provided the final design, some supervision and materials. Wadjul organized labour and sand. The system is used by about 10 families. It should be noted that the system still functions well at the time this report is written. Of course Wadjul is very motivated to maintain HIS system well. This system has also been constructed elsewhere, but the appointed- and trained- operator was either not motivated or did not understand basics of the system. That second one is out of order now.





MCKS WADJUL.

****

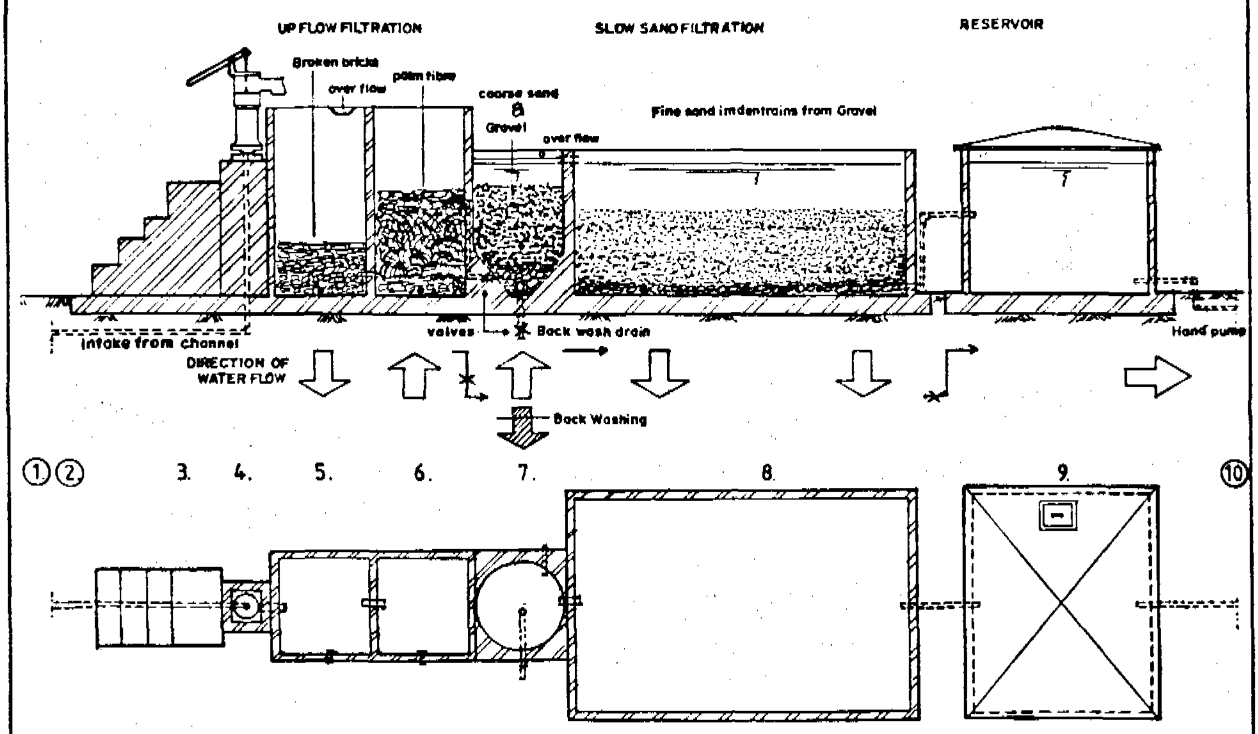
A3.2.4. UNIT: Surface Water Treatment system PRICE INDICATION; n.a.
MCKS UFF (Up Flow Filter)

ELEMENTS:
1. Inlet from quartary irrigation canal;
2. Small pond; 100 m2;
3. Intake from shallow well pump;
4. Shallow well hand pump;
5. Crushed brick filter; 0.5-1 m/hr.;
6. Palm fibre up-blow filter ("injuk"); 1-2 m/hr.;
7. Rapid sand filter; up-flow; 2-3 m/hr.;
8. Slow sand filter; 6m2;
9. Clear water tank; 6m3;
10. MCK sanitary unit;

DESCRIPTION:

a) water flows into traditional pond by gravity;
b) From this pond water is drawn by hand pump;
c) the very turbid water is settled on crushed bricks, this filter may be "primed" with a little alum ('tawas');
d) Then water is lead through an up-flow filter of palm fibre, this fibres should be cut in lengths of about 15 cm, in order to prevent short circuiting;
e) A pipe, that can be closed with a cock valve, runs down into a second up-flow filter. The medium of this filter consists of grade gravel and sand. The water level above this filter lays at 0.4 m. above the sand. The total thickness of the filter is about 1.20 m.; the sand bed is 0.85 m. The water level in the first two compartments should not be higher than 0.85 m. above the water level in the third compartment, in order to prevent liquafication of the sand bed. For daily back washing of the sand filter, the cock valve leading to the filter is closed and the valve in the outiet, D = 2", is opened. The 0.4 m. above the sand bed serves as an extra volume of flushing water.
f) After the rapid sand filter, water flows into a slow sand filter,
g) and then into a clear water tank, from which it is drawn,
h) by hand pump mounted on a sanitary unit (MCK).

****



WATER TREATMENT SCHEME IN CLUDING UP FLOW FILTER

****

A flaw of the system is that people had to pump water into the system, which means pumping twice. People just did not like to do that, even not after intensive community education. The conclusion of this research is:

a) the system could function in village conditions, provided;

1. a good dual handpump is used pumping with one stroke 60% raw water into the system and 40% clear water out of the system (coastal areas) or;
2. a gravity supply of raw water is available where water flows into the system automatically (mountainious areas) or;
3. inflow by using a small electrical pump (c.q. Sanyo series), electricity possibly paid for through cross subsidization between water and electricity.

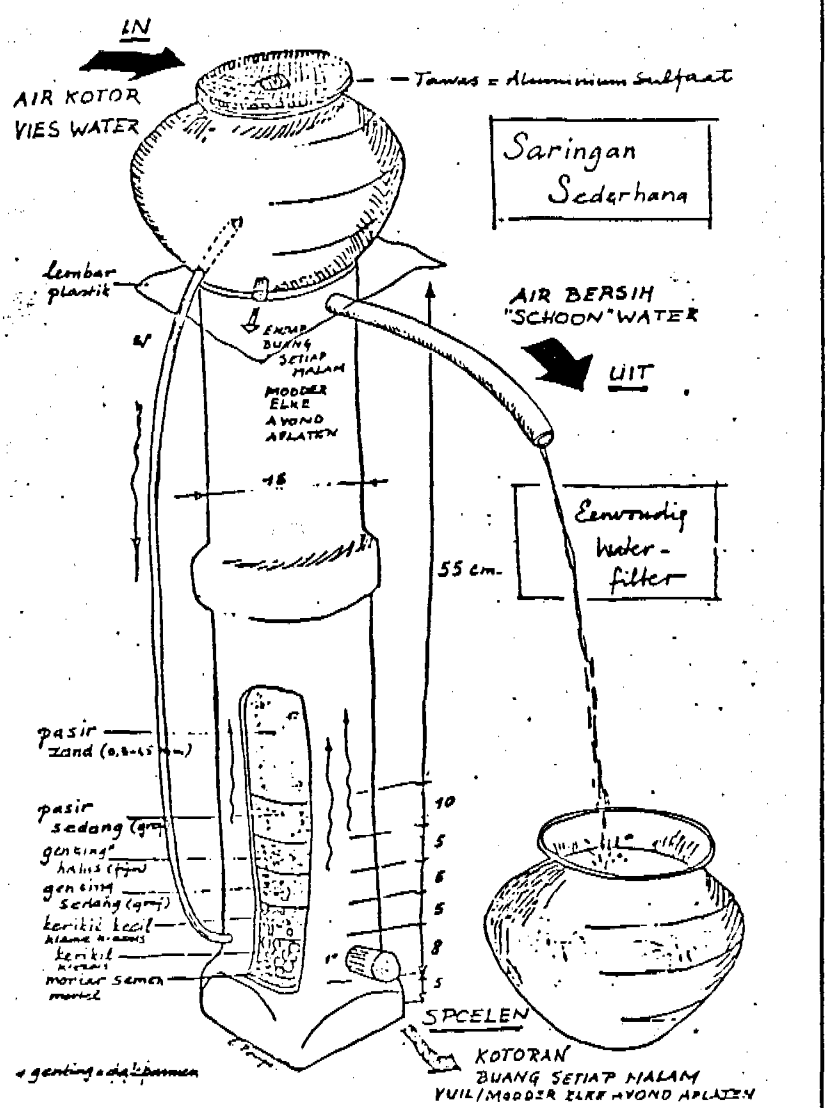
b) the system should be developed further, especially for use in mountainious areas.

The simpleness of functioning is illustrated with the next graph, which is a one family unit. For 'backwashing' the filter a valve underneath is opened. In simple systems the valve may be a plug. The whole system is made out of locally available materials.

****

SIMPLE WATER FILTER.

TRANSLATIONS:
Air kotor = raw water.
Tawas = alum.
Air bersih = clear water.
Pasir = sand.
Genting = crushed tiles.
Kerikil = gravel.



Back washing every evening

****

A3.2.5 Unit: Surface Water Treatment system Price indication; see list MCKS RAIN WATER 2000

Elements:
1) existing rainwater pond; (3 ha., 6 months dry season)
2) intake for pump
3) motor pump (5pk)
4) transmission pipe 3" PVC; 750 m.;
5) slow sand filter;
6) clear water tank;
7) distribution pipe 3" PVC; 750 m.;
8) connection to pipe footvalve;
9) shallow well hand pump (Bandung);
10) MCK" sanitary unit.

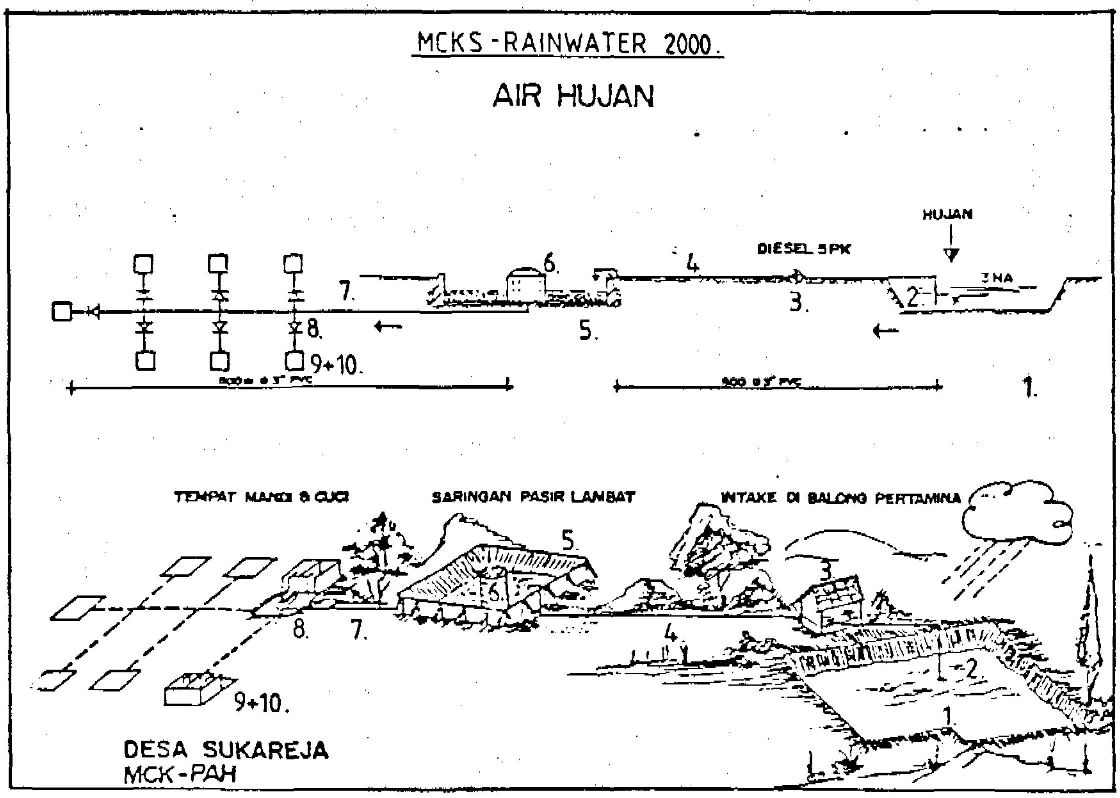
DESCRIPTION:

a) rain water is harvested in a pond;
b) from this pond water is drawn by diesel motor pump;
c) the pump transmits the water to the village some 750 m. away;
d) there it flows into a slow sand filter (brick work construction);
e) in the middle of the filter the water is collected in a tank with a diameter of 4 m.;
f) a 3" pipe runs from the tank along the mainstreet of the village;
g) with the aid of a shallow well handpump (suction) the water is drawn directly from the main. A foot valve is an essential part of the connection to the main. The level of the mouth of the hand pumps is related with the water level in the tank in the middle of the filter;
h) the hand pump is installed at a sanitary unit.

DISCUSSION

This water supply scheme is a combination of rainwater catchment, water treatment and the MCKP-DURIAT system.
The system only has one motorpump, to pump raw water to the village. Eventually a watertower and house connections can be added, but this will increase operational costs. Now the system runs well because the number of Public Standposts is sufficient; about every 200 people use one unit. The slow sand filter is made out of brickwork, reinforced with ferrocement.

****



MCKS RAINWATER 2000.

A3.3. GROUNDWATER SYSTEMS.

Generally spoken groundwater is the cheapest way of water supply. Family size units (handpumps) are available ~~to those who can afford them.~~

For community water supplies the project developed three systems:

1. the MCKP 250;
2. the MCKP 500;
3. the MCKP-Duriat.

A MCKP is a sanitary unit with handpumped water supply (P). Because an MCKP is more than just a handpump, and consists of a complete unit for several uses of water, involvement of the community was very important.

****

A3.3.1. UNIT: Groundwater Systems Price Indication: $ 975
MCKP 250

ELEMENTS : 1. drilled well;
2. horizontal no-return valve
3. shallow well hand pump (Bandung)

DESCRIPTION :

A drilled well is the source of water for the sanitary unit.

DISCUSSION

Interestingly, a soap factory from Jakarta liked the set-up and asked for a proposal for sponsoring construction of 15 units. On the walls of the units an advertisement should be painted. Soap producers also care for a healthy skin and clean clothes, an important reason for villagers to like better water supply. Unfortunately the project terminated before a contract could be made up.

****

A3.3.2. UNIT: Groundwater Systems Price Indication $ 2,200
MCKP 500

ELEMENTS: 1. three dug wells;
2. horizontal no-return valve;
3. shallow well hand pump (Bandung);
4. double sanitary unit.

DESCRIPTION

The source of water for the sanitary unit consisted of three interconnected dug wells.

DISCUSSION

The MCKP 500 was adopted by the OAMP for their own programme with funds from Kabupaten level. Four MCKP 500's were built.

****


LOCAL HANDS.


THE POPULAR MCKP 500 OF PEKANDANGAN.

****

A3.3.3 UNIT: Groundwater Systems   Price Indication: $2,340
MCKP DURIAT

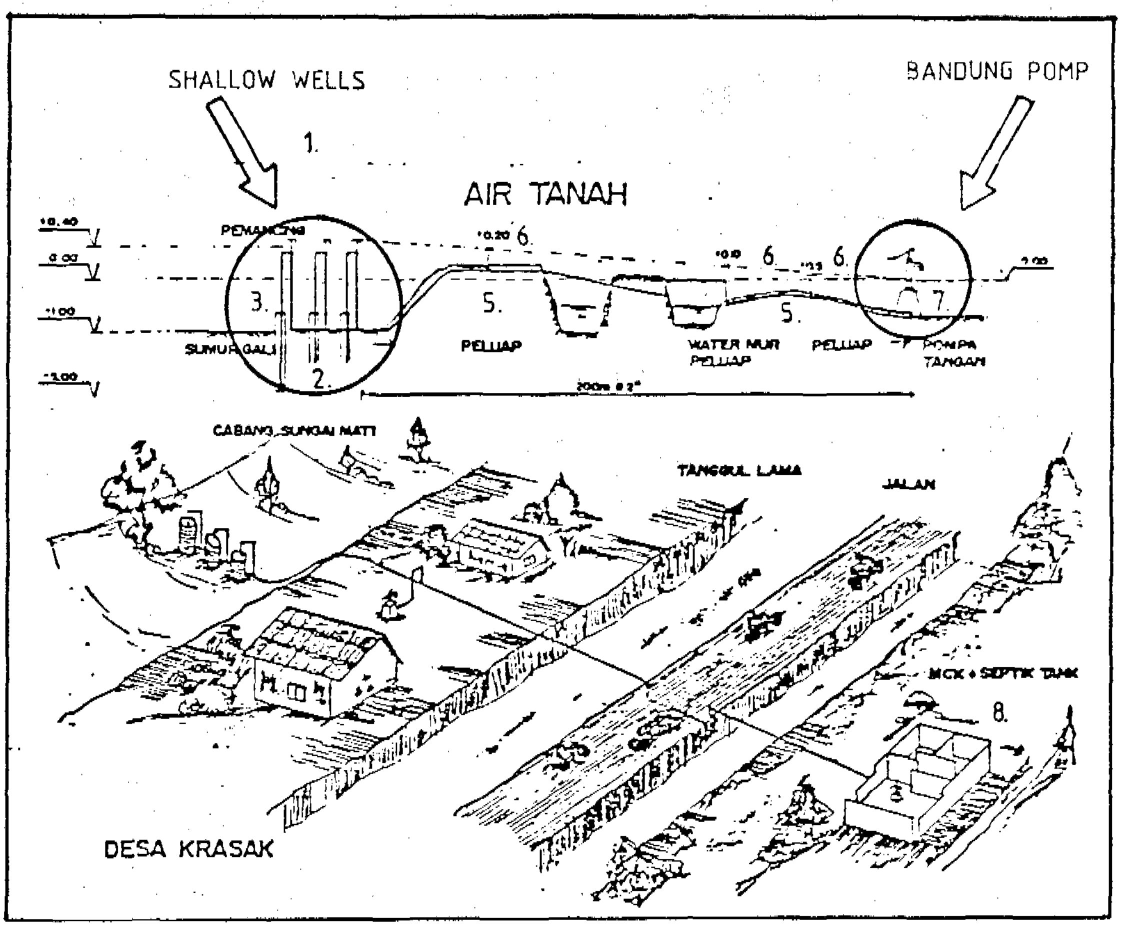
ELEMENTS : 1. three dug wells;
2. horizontal foot valves;
3. riser pipes;
4. priming vent;
5. transmission pipe 2" GI;
6. vent pipes;
7. shallow well hand pumps;
8. sanitary units.

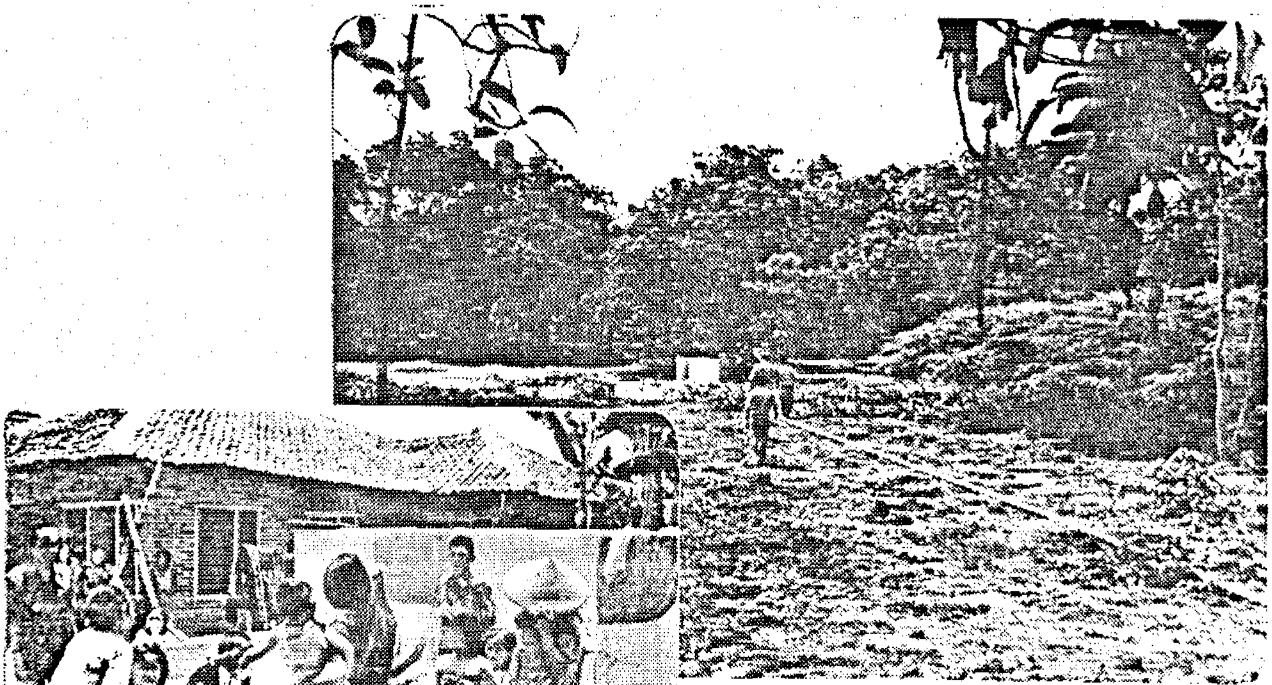
DESCRIPTION:

a) The source of the system is the sand layer of a dead river branch, some 200 m. from the most distant sanitary unit;
b) Three shallow dug wells have enough capacity for about 500 people. The wells have a lining of concrete precast rings, located above the former river bed with a height of 1.5 m. The reason for this is that, during the rainy season, the river branch is flooded. The higher rim of the well prevents water from flowing into the well.
c) Footvalves in the wells prevent the water from flowing back into the wells. It is observed that horizontal footvalves perform best in this set-up. The vertical valves leaked, making the system useless.
d) A riser pipe rises upto +1.20 m. compared to the level of the mouth of the hand pumps. On top of the risers a cap is placed, for the purpose of priming of the system. In case of priming, the caps from the vent pipes are opened as well. The level of the top of the vent pipes lays at the declining line from the top of the riser to the mouth of the hand pumps. When water starts flowing out of the vent pipes, caps are closed and the system can be used.
e) Water is drawn by shallow well hand pumps (suction) directly from the transmission pipe that runs from the wells to the sanitary unit. Some other hand pumps are connected to the main pipe as well.

DISCUSSION:

DURIAT is a project officer of the Health Service in the city of Indramayu. He built a horizontal piping system in which a handpump in his kitchen drew water from the sandlayers of a dead river branch about 40 meter from his house.
****


SHALLOW WELLS
BANDUNG POMP
AIR TANAH
SUMUR GALI
PELUAP
POMPA TANGAN
CABANG SUNGAI MATI
TANGGUL LAMA
JALAN
MCK + SEPTIK TANK
DESA KRASAK



MCKP-DURIAT

A3.4 Planning

Planning is not bound to be rigid. In methods in the field of rural water supply, a type of planning that allows for a flexible implementation is required.

The planning methods as described in the next sections aim to provide the administration down from provincial level with tools for flexible implementation planning.
A task-setting type of planning lets agencies follow their own set of regulation within committed task objectives. Bappeda II will have to play a coordinating role.

The planning methods that will be discussed are the two kinds of plans as actually produced in the course of the SDKI programme.

1. Sectorplan for the water supply of a kecamatan (Masterplan Air Bersih/M.A.B.);
2. Village Masterplan, a plan for integrated village development.

Finally the method of mapmaking as used in our project will be explained in detail.(section A3.4.3.)

A3.4.1. Sectorplan for the Water Supply of a Kecamatan (MAB)

Together with extension workers of the Kabupaten Planning Board (Bappeda II), the Village Development Organization (Bangdes) and the Kabupaten Health Service, a sectorplan for water supply of three kecamatens were made.
A first step was a meeting with staff of the involved agencies to plan the activities. Bappeda II was the coordinator. Extension workers were instructed what kind of information was to be collected. A format was designed. Then, the extension workers of these organizations provided detailed information on the villages of one kecamatan. Each extension worker covered about 6 villages of his area. In this way three workers (Bangdes, Health, Bappeda) covered one kecamatan in a week.
Bappeda II gathered general info on the area, such as existing plans, hydrogeological and socio-economical data.
Each villagehead write a small introductory note, as well as the Camat and the Doctor of the Puskesmas.
This information is evaluated and for each village the consultant indicated what kind of water supply was appropriate.
The last step that makes this "shopping list" into a Masterplan is the matrix on the right handside (see fig.). Each relevant agency commits itself to cover the villages of which the type of water supply complies with the programs they currently implement. More - year planning and implementation follow the specific rules.

SECTORPLAN FOR WATER SUPPLY OF KECAMATAN.

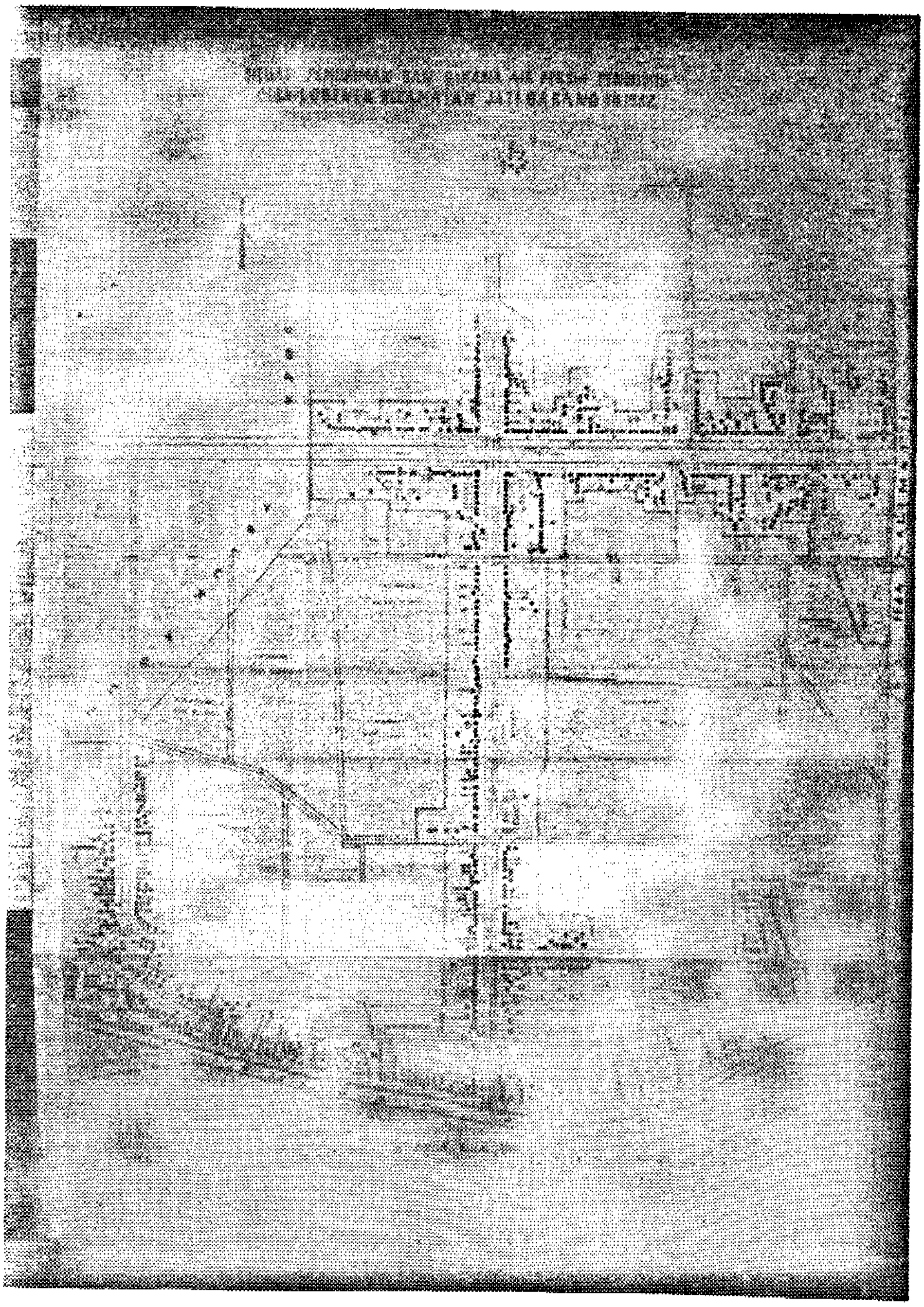
DAFTAR KESIMPULAN MASTERPLAN AIR BERSIH KECAMATAN INDRAMAYU (31)

No.	Kecamatan Indramayu	Penduduk x 1.000	Areal Desa Ha.	Listrik	Industri	Sumber Air: Sumur	Sumber Air: Sungai	Sumber Air: Kali	Kerawanan	Prioritas	Alternatif - A: Air Tanah: S.Gali S.P.T. Tanah	Air Tanah: MCKP (art.+S.Gali Dangkal)	Air Tanah: MCKP Besar	Air Tanah: P.A.M.	Air Permukaan: MCKS Kecil	Air Permukaan: MCKS Besar	Air Permukaan: P.A.M.	Air Hujan: P.A.H.	Air Hujan: Pola Suharaja	Perincian Biaya	Perincian Lain	Pelaksana: [illegible]	Pelaksana: [illegible]	Pelaksana: [illegible]	Pelaksana: PU.CK. [illegible]	Pelaksana: PU.Kab.	Pelaksana: PU.CK. P.A.B.	Pelaksana: PU.CK. IKK	Pelaksana: Lain-lain	Keterangan
1.	Pabean Hilir	5,7				*	*		2			9,= / 4.700				10,= / 1.000				21,=	19.200,-									....,= (jutaan) ....,- (ribuan)
2.	Pabean Udik	5,1					*		3								26,= / 2.100			26,=										....,- (ratusan)
3.	Brondong	3,1					*		2			3,= / 1.400				10,= / 1.700				23,=										
4.	Karang Song	3,25					*		3						4,= / 350		16,= / 2.900			20,=										
5.	Paoman	10,0		+					1			2,= / 1.000					p.m. / 9.000			2,=/p.m.					50% / 50%					
6.	Lemahabang	10,3		+	+				1								p.m. / 10.3			p.m.					100% / 93%					
7.	Karanganyar	6,4		+	+		*		1								p.m. / 6.400			p.m.					100%					
8.	Singaraja	5,3				(*)											17,= / 3.300		17,= / 2.000	34,=	[illegible] 10, 11, 12									
9.	Singajaya	4,0				*			3								22,= / 4.000			22,=										
10.	Tegalurung	3,2				(*)			2										28,= / 2.300	28,=	[illegible]									
11.	Balongan	3,3			Pertamina	(*)			2										28,= / 3.300	28,=	[illegible]									
12.	Suharja	1,8		-	-	(*)			2										15,= / 1.600	15,=	[illegible]	[illegible]								
13.	Sukaurip	4,6				*			2			9,= / 4.650								9,=										
14.	Tegal Sembadra	2,9				*			2			6,= / 2.900								6,=										
15.	Lepandaan	5,5				*		*	1								p.m. / 3.500			p.m.										
16.	Pekandangan	3,4				*	*	*	1								p.m. / 3.400			p.m.										
17.	Kandanghaur Jaya	3,5				*	*	*	3								20,= / 3.500			20,=										
18.	Dukuh	2,5				*	*	*	1		7.350,= / 2.500									7.350,=										
19.	Plumbon	5,3				*			1							50,= / 6.300				50,=	[illegible]									
20.	Teluk Agung	4,1				*	*	*	1			4.500,- / 1.600				30,= / 3.000				34.500,-	[illegible]									
21.	Cular Pendelis	1,2				*			2			1,= / 350			6,= / 850					7,=										
22.	Rawa Beleng	3,5				(*)	*		2			5,= / 2.200				12,= / 1.100				18,=										
TOTAL :		224,1																												

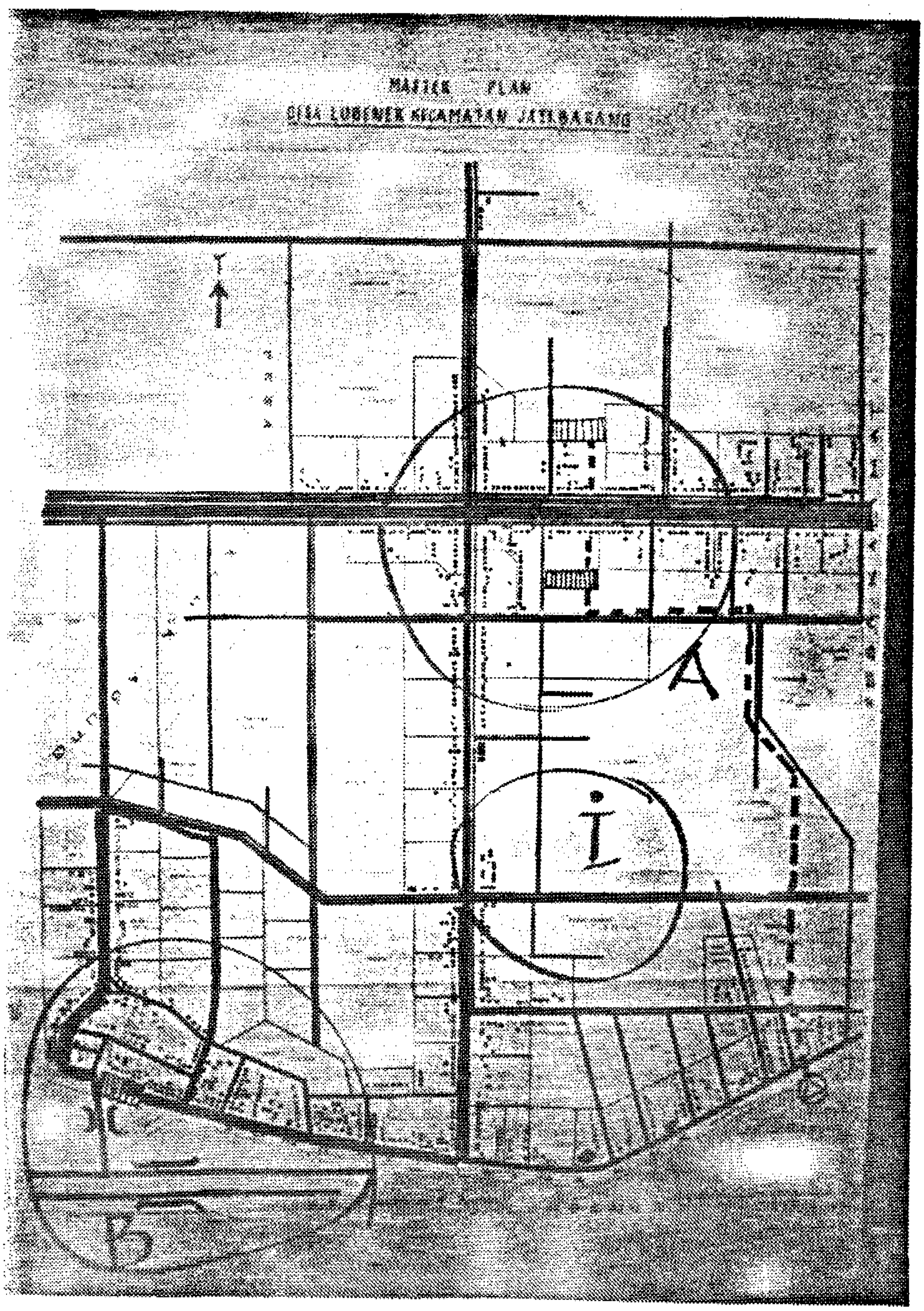
village population — economic data — water sources — status — priority — options for water supply — price indication — commitments of implementing agencies.

A3.4.1 Village Masterplan

A Village Masterplan is a plan indicating the possible development projects in a village.
Contributors of such a masterplan are the villagers and their le ders, the extension workers at Kecamatan level and staff of the several services at Kabupaten level.



The Masterplan is compiled by a local consultant in cooperation with all contributors. Planning of new infrastructure in indicated on a map of the village, that is made together with the village administration. (See next section)
How a Village Masterplan was the frame of an integrated project is described in chapter 3.



A3.4.3 Map of a village

To design a distribution system, a reliable map of the village is required. However, no maps that could be used were available. The dutch town planner Mr.Zandvoort paid a visit to West-Java to advise the SDKI programme on mapping and the village Masterplan (nov. 1982), to investigate the possibilities of using aerial photography for this purpose. It was found that often recent photo's were already several years old. It was rather difficult to obtain these photo's.

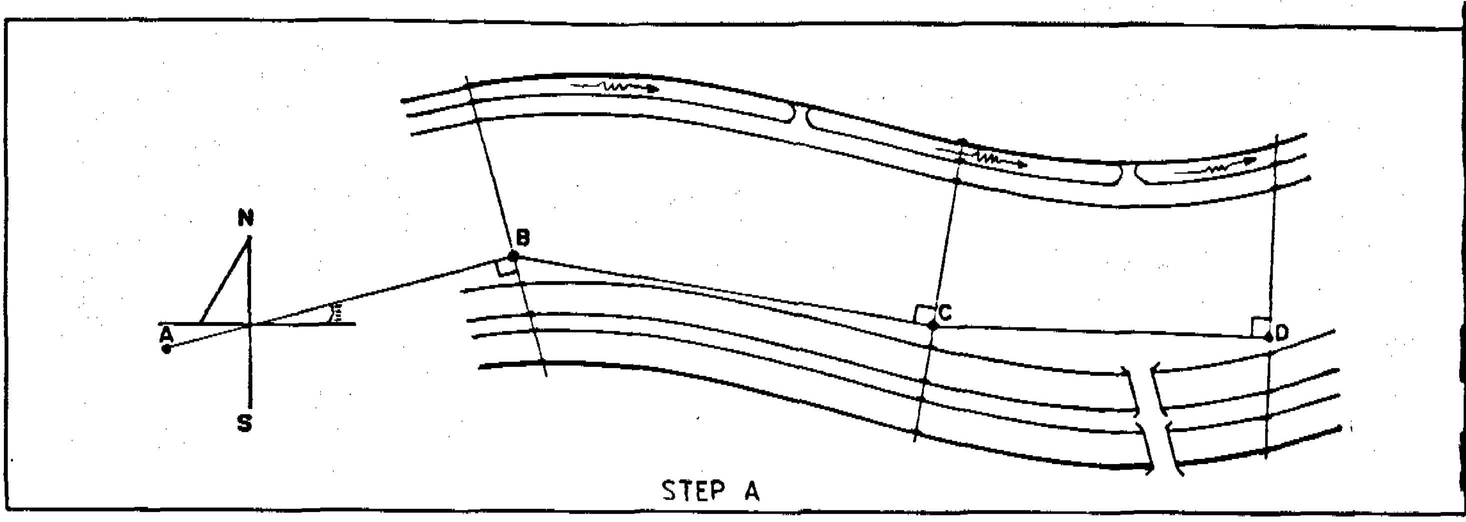
The Centre for Study on Human Environment developed a simplified method for aerial photography. After a preliminary map is made from the photo's, a terrestrial checking has to be excecuted, because the trees of the village cover a lot of detailed physical information. In the end the cost of a map for a village such as Lobener would amount to about Rp 2,5 million. When more villages were covered, the price would decrease considerably. However, the price only included the map, no baseline survey was yet included.

The cost to make a map with the method as developed in the SDKI programme would be about Rp 750,000,- for a village of about 3000 people (Lobener) including a base-line survey (1982-1983). It took the mapping team about one month to produce a map of a village.

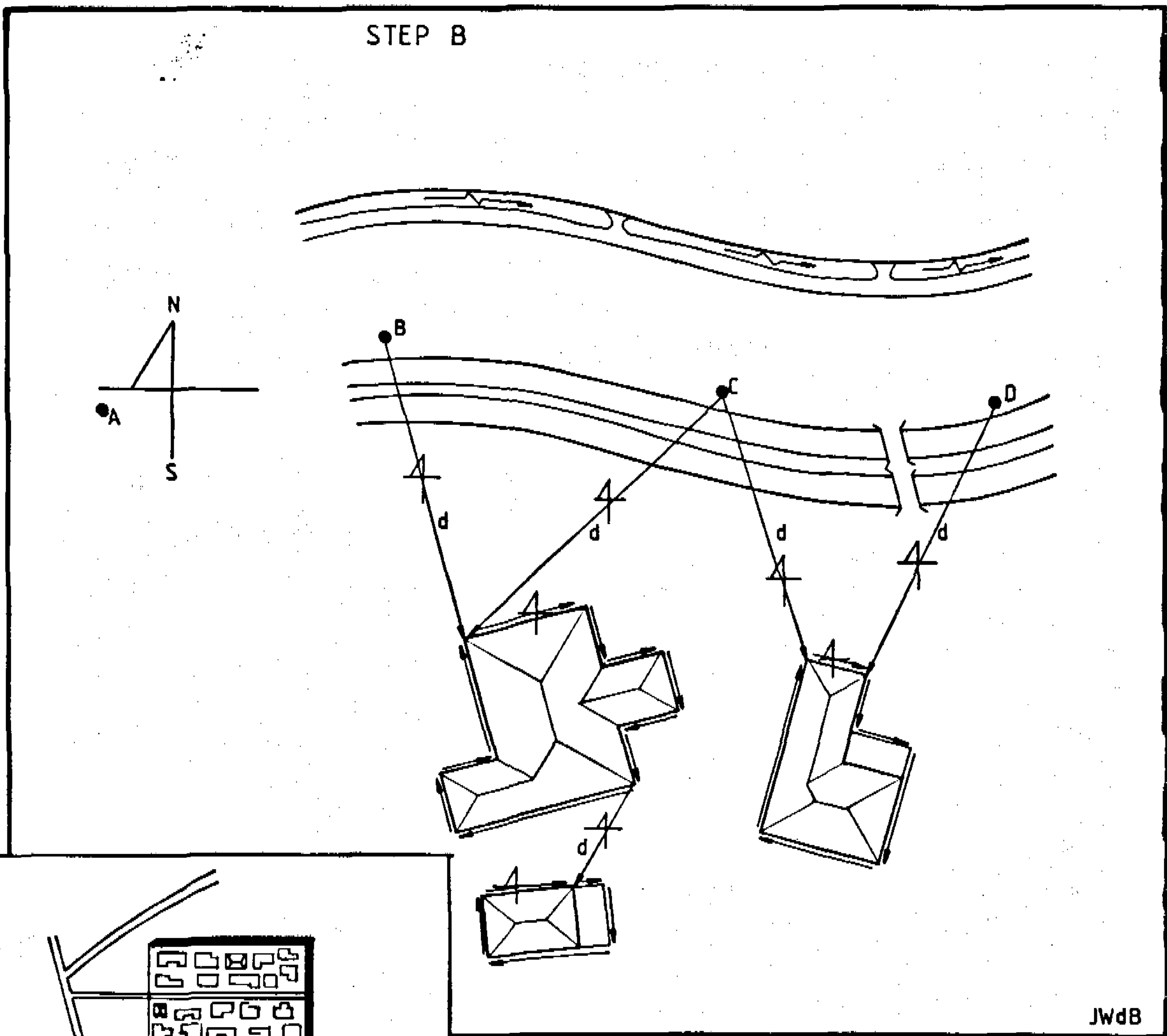
The steps to make a map are:

A. Mapping the road structure

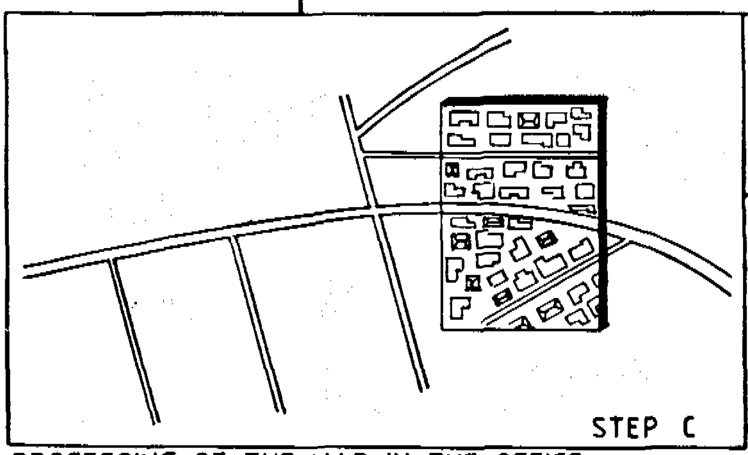
1. Every 30 meters (the length of the measure tape) or less a pole is planted.
2. Measure the distances between the poles.
3. Measure the orientation of the line connecting the poles with a millitary compass.
4. Set-up a drawing table with millimeter paper fixed on to it.
5. Align the orientation of the paper on the table with the orientation in the field.
6. Plot the projection of the measured field-situation on the millimeter paper -1 meter in the field equals 1 millimeter on paper.
7. Measure and plot the whole grid of roads and streets in one row.
8. During this process several marks are left in the field as a reference when making the detailed mapping.
9. Measure also widths of streets and drains and draw them on the map.



MAPPING THE ROAD STRUCTURE.



MAPPING BUILDINGS AND HOUSES.



PROCESSING OF THE MAP IN THE OFFICE.

Also other features should be indicated, such as intersections and bridges and also the direction of the flow in the drains.

B. Mapping Buildings and Houses

1. Start from a reference mark from the mapping of the grid of roads and streets.
2. Measure the distance from that point to a house.
3. Measure the orientation of the line between reference mark and house.
4. Measure the lengths and widths of the house and the orientation of the house. (Assume that all walls are perpendicular to each other).
5. Indicate the form of the roof (optional).
6. Note the number of the house (sometimes already a numbering exists, but not for all houses). In that case the houses get two numbers; the one already existing and another for the purpose of the survey.
7. Interview the occupants on several aspects needed for a base line survey (jobs, number of occupants per house, names, age, education, family planning, member of organisation etc.). In this interview people will already forward ideas on improving living conditions in the village.
8. Use the first house in a row or group as reference for the next houses.
9. Project the houses on the millimeter paper.

For detailed mapping, a loose leaf system is used, while for the road structure a roll is used. In the office we fix the loose leafs on the big road plan and process the map further.

C. Processing of the map in the office.

1. Copy the houses with carbon paper on the big map.
2. Copy the complete map to transparent paper for the purpose of blue printing.

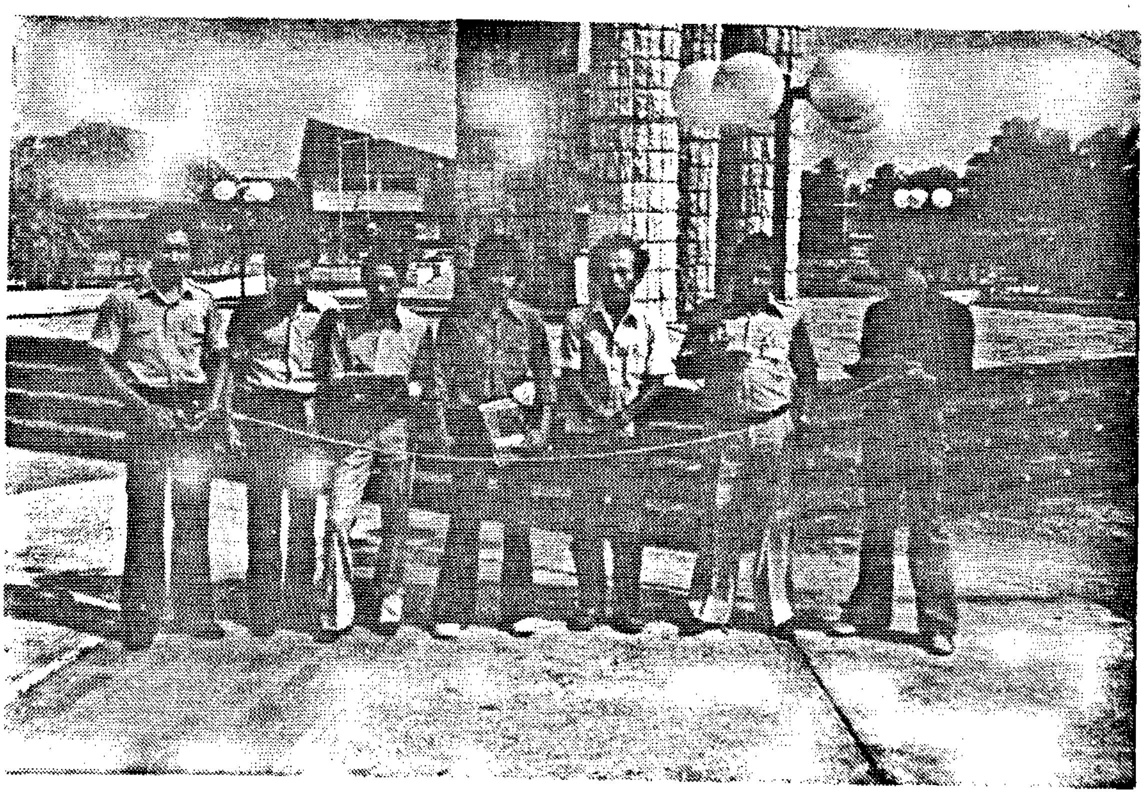
After the map is ready it can be used for several purposes (see Sukareja Case section 3.3).

Personnel needed for mapmaking:

1. Draughtsman for projection on table.
   Use always the same compass on the table, mark it with a "A".
2. Groups of surveyors consisting of:
   1. Surveyor, who notes down information, this task is very important, because information has to be processed later on.
   1. surveyor reading the compass, (always use the same compass, mark it with a "B").
   2. Surveyors for planting poles and measuring distances.
1. Draughtsman for processing the map in the office.

Reading the compass, and projecting the results on paper is mostly done by staff of the Village Water Supply Organization, the team is completed with people from the village.
Preferably the "Mangku Bumi", who deals with ground problems in the village, and the secretary of the village are involved as well.

Depending upon the circumstances about 30-50 houses a day can be projected.



MAPPING TEAM.

ANNEX 4

Evaluation of Per Capita Investments of the SDKI Programme

Summary of per Capita Costs for Rural Water Supply Systems as applied in the West Java Rural Water Supply Project OTA 33

	Ground water systems (humann energy)			Ground water systems (mech. en./ distribution)			Raw water from Rivers (continuous flow; no storage)				Raw water from Irrigation Grid (including storage ponds)			
	Shallow well wth bucket	Shallow well wth h. pump	Deep well wth h. pump	Spring Capt. Gravity	Spring Capt. Pumped	Deep well wth Subm. P.	SLOW SAND FILTER SYSTEMS 3000 p. (MCKS-systems)	2000 p.	500 p.	RSF 3000 p. (OTA-plnt	SLOW SAND FILTER SYSTEMS 3000 p. (MCKS-systems)	2000 p.	500 p.	RSF 3000 p. (OTA-pl
	1	2	3	4a	4b	5	6a	7a	8a	9a	6b	7b	8b	9b
I INVESTMENTS														
A LAND ACQUISITION	$0.00	$0.00	$0.00	$0.15	$0.15	$0.08	$0.38	$0.34	$1.36	$0.27	$1.29	$1.25	$2.73	$1.17
B CIVIL WORKS	$2.79	$4.99	$5.37	$22.92	$23.48	$24.84	$19.30	$21.63	$22.46	$24.63	$22.10	$22.40	$19.61	$27.9
B1 CONSTR./TREATMENT	$2.17	$3.70	$3.51	$11.83	$11.88	$12.26	$7.40	$9.41	$13.71	$11.67	$9.62	$10.03	$11.91	$12.2
B2 DISTRIBUTION GRID	$0.03	$0.25	$0.74	$4.55	$4.94	$5.64	$6.11	$4.95	$1.77	$6.06	$6.11	$4.95	$1.32	$8.0
B3 DISTRI. POINTS	$0.00	$0.00	$0.00	$1.74	$1.74	$1.74	$1.74	$2.73	$2.27	$1.74	$1.74	$2.73	$2.27	$1.7
B4 MISCELLANEOUS	$0.58	$1.05	$1.13	$4.80	$4.92	$5.20	$4.04	$4.53	$4.70	$5.16	$4.63	$4.69	$4.11	$5.8
C INDIRECT COST	$0.75	$0.86	$0.87	$1.75	$1.78	$1.85	$1.57	$1.76	$4.76	$1.84	$1.71	$1.80	$2.80	$2.0
TOTAL INV. PER CAPUT	$3.54	$5.85	$6.25	$24.83	$25.41	$26.77	$21.25	$23.73	$28.58	$26.73	$25.10	$25.45	$25.13	$31.0
II O & M PER M3	$0.01	$0.04	$0.02	$0.06	$0.09	$0.10	$0.08	$0.12	$0.13	$0.09	$0.07	$0.09	$0.06	$0.1

Asumptions;
In general the villages have a population of 3000 people. (For the Slow Sand Filter Systems also options for smaller villages are provided, because another technology is applied.)

60% of the capacity of the schemes is utilized, in relation with the Indonesian policy.
Also 50% of the population consumes water from house connections, and 50% through Public Stand Posts.

Table A4.1. Reference list O T A 3 3 on Per Capita Investments.

A N N E X   4

EVALUATION OF THE "PER CAPITA INVESTMENTS" OF THE SDKI PROGRAMME.
(including financial report)

In some publications on the MCKS system and the OTA plant, it is stated that the investments per capita of these systems are about 10 to 12 dollar. These statements served to illustrate the innovative effect of the application of ferrocement in water supply systems, or to promote 'Appropriate Technology'. The papers were written in 1982-1983. The final report of the OTA project (1985) rightly provides figures for the investments per capita of about 25 US $. The final report, however, assumes construction by contractors and applies prices of 1985. Also, the set-up of the standard of OTA includes many items, such as land acquisition, community participation and other indirect costs to the principal.

Consequently, for a comparison of figures of different systems and approaches, detailed definitions concerning the set-up of the systems are required.

The objective of this annex is to analize the financial figures of the SDKI programme in order to get a better understanding of the magnitude and the nature of the 'innovations' and the impact of 'appropriate technology'. The figures - and the background - of the list of the OTA Final Report serve as a reference for this evaluation.

Table A4.1 is a list of the systems applied in the OTA project. This list is used as a standard for calculation of PCI figures of the OTA project for the purpose of its final report (may 1985). As a reference for the evaluation of the SDKI figures, the OTA list is very usefull. PCI figures of the SDKI programme have to be adapted to 1985 figures, in order to be comparable with that reference list.

In the first sub-section of this evaluation, the differences between the OTA reference list and the SDKI figures are discussed. The second section will evaluate the outcome of the SDKI programme in relation with the reference list. The comparison has two elements; the investments and exploitation of the systems.

A4.1. DIFFERENCES BETWEEN THE O T A REFERENCE AND THE S D K I FIGURES

The basic assumptions for the reference list of the Final Report of OTA is that water is to be supplied to villages of 3000 people. In the case of slow sand filter systems, also figures are provided for villages of 2000 and 500 people, because another type of technology is applied. The components of the standard systems of the list are;

a. Land acquisition.

b. Constructions:
   1. Civil works; (BOW);
   2. Distribution System; (BOW);
   3. Distribution points; (BOW);
   4. Miscellaneous; 1. 10% of bl..3;
                     2. Contractor costs over bl..4, circa 15 %.

c. Indirect costs;
   1. Supervision; 5 % of b.;
   2. Survey and site selection;
   3. Design and planning;
   4. Community participation;
   5. Monitoring and training.

"BOW" stands for "Begroting Openbare Werken", which consists of guidelines for budgetting of public works. The BOW is a usefull tool to get an impression of the required investments for a certain structure. Based on common building practice, the BOW provides amounts of personnel, materials and equipment required to realize a construction. It will be clear that in case of special construction methods, the figures may differ considerably. In those cases, a bill of quantities (BQ) and a plan of construction determine the budget.

Because the SDKI programme always budgetted with Bills of Quantities, but Public Works projects mostly apply BOW budgets, it is interesting to make a comparison. (Also the reference list of OTA applies the BOW). For the purpose of the evaluation of the investments of the SDKI programme, the BOW will be the reference.

Figure A4.1. shows the structure of BOW Budgetting.

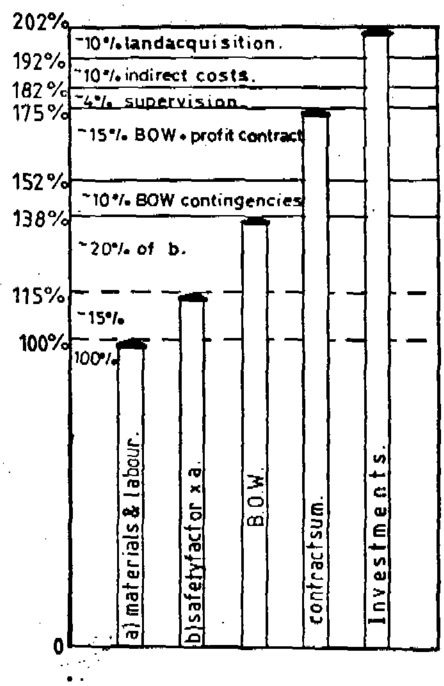


Fig. A4.1. Structure of BOW Budgetting.

1.	100 % represents materials, and required labour and equipment following the technical drawings. (100% efficiency);	100 %
2.	Bills of Quantities include inefficencies, leakages etc. specific per material, labour and equipment. Safeties vary from 10 to 20 %.	115 %
3.	BOW figures include, on top of 1 and 2, overhead costs for contractors.	138 %
4.	About 10 % extra work is budgetted as contingencies.	152 %
5.	Financial costs to the contractor. Normal practice in Indonesia is that contractors accept work for "BOW plus 15 %".	175 %
6.	Supervision is officially put at 4% of the Contracting Sum (1..5).	182 %
7.	Indirect costs are made by the principle for Community participation, training, operation and maintenance, survey and mapping.	p.m.
8.	The principle has to acquire land.	p.m.

For the purpose of comparability, first, an impression will be given on the difference between the two ways of budgetting; Bills of Quantities and BOW Budgetting.

! Comparison of construction costs calculated with a materials analysis!
! and with the "B.O.W." unit prices. !

MCKS 3000 Standard System		Material prices 1982	Material prices 1985	B.O.W." unit costs 1985
		In Rp * 1000		
I	PREPARATION	215	275	325
II	STORAGE POND	8,687	12,387	16,227
III	FILTER BASIN	2,771	3,929	5,788
IV	CLEAR WATER TANK	552	638	845
V	FLOCCULATION/SEDIMENTATION	1,086	1,415	1,958
VI	FILTER SAND	2,694	3,912	4,185
VII	WASH FLOOR FOR SAND	284	350	441
VIII	PUMP HOUSE	296	384	512
IX	WATER TOWER	2,664	3,314	3,613
X	PIPING IN SYSTEM	540	647	684
XI	PIPING FOR DISTRIBUTION	11,314	13,729	15,756
XI	DIESEL MOTOR PUMP	1,250	1,500	1,500
	TOTAL	32,354	42,479	51,835
	Indexed	100	131	160
		76	100	122
		62	82	100

Table A4.2. Comparison of Bill of Quantities and 'BOW' Budgetting.

Table A4.2 compares the budget of the MCKS 3000 of the village of Lobener, calculated in three ways; with Bill of Quantities and prices of 1982, when the system was built; with BQ and 1985 prices and thirdly with the BOW and 1985 prices. From these figures may be concluded that; a, BOW level lays at about 22 % above BQ level; b, inflation for construction lay at about 10% per year over the period 1982-1985. Included in the BQ budget are; 1, materials; 2, Labour from the village; 3, field supervisors of the OAMP. Not included in the available figures; 1, supervision by design section of the OAMP; 2, supervision by the consultant; 3, overhead of the OAMP; 4, transport (Toyota pick-up truck and motor cycles).

Another difference in figures may be caused by a different set-up of the systems. The systems as realized in Indramayu under the SDKI programme do not include all items as listed in the OTA reference, in order to make the investments affordable to lower level agencies.

Tables A4.3 and A4.4 provide some insight into the differences between the systems as realized and the same systems as quoted in the OTA reference list. The reference list gives a PCI of $ 25.10 for an MCKS, while, for example, the set-up of the MCKS 3000 in Lobener would amount to $ 17,89. The difference lays in several points;

1. Land is provided free to the SDKI programme.
2. The piping system has a length of 2300 m. only;
3. Public Stand Posts are more expensive, because sanitary units are included;
4. House Connections are bought by the consumers;
5. No contractor costs are included;

This last comparison places the "10 $ per capita" for OTA systems, as quoted in several papers in a wider perspective, in which both time and elements of the structures play a role. On a materials basis (B. of Q.) the $16.46 for civil works of A4.6 in 1985, would be reduced to $10.06 in 1982. (ref.Table A4.2)

System 6b; Slow Sand Filtration, MCKS 3000. Irrigation grid.

I INVESTMENT COSTS		Rp*10^6		Rp*10^3	US $
A Land Acquisition					
1700 m. @ Rp 2.500,--		4.250	===)	1.417	1.29
B1 Treatment Plant					
1 Site Preparation + Fences etc.		1.450			
2 Inlet		1.000			
3					
4 Flocculation - Sedimentation		2.250			
5 Filter Basin		5.800			
6 Sand for Filter		4.190			
7 Clear Water Tank		0.800			
8 Sand Washing Floor		0.440			
9 Pump House - Store		0.800			
10 Storage ponds		15.000			
	Total	31.730	===)	10.577	9.62
B2 Distribution					
1 Diesel Motor Pump (5 pk)		1.565			
2 Water Tower (20 m3)		3.610			
3 Piping System (2000 m.)		15.000			
	Total	20.175	===)	6.725	6.11
B3 Distribution Points					
1 Public Stand Posts (15)		4.500			
2 House Connections (25)		1.250			
	Total	5.750	===)	1.917	1.74
B4 Miscellaneous					
1 Continguencies (10 % of B1,B2,B3		5.766			
2 Financial Costs Contractor (15%)		9.513			
	Total	15.279	===)	5.093	4.63
	TOTAL B	72.934	===)	24.311	22.10
C Indirect Costs					
1 Supervision (5 % of B)		3.647			
2 Survey and Site Selection		1.000			
3 Design and Planning		0.500			
4 Community Participation		0.200			
5 Monitoring and Training		0.300			
	TOTAL C	5.647	===)	1.882	1.71
TOTAL INVESTMENT COSTS	======)	82.830	===)	27.610	25.10

Table A4.3. Investments MCKS 3000 Standard System (BOW 1985).

System 6b; Slow Sand Filtration, MCKS 3000 Desa LOBENER. Irrigation gri

			Rp*10^6		Rp*10^3	US $
I	INVESTMENT COSTS					
A	Land Acquisition					
	Land free			===)	0.000	0.00
B1	Treatment Plant					
1	Site Preparation		0.100			
2	Inlet		1.000			
3						
4	Flocculation - Sedimentation		2.250			
5	Filter Basin		5.800			
6	Sand for Filter		4.190			
7	Clear Water Tank		0.800			
8	Sand Washing Floor		0.440			
9	Pump House - Store		0.800			
10	Storage ponds		15.000			
		Total	30.380	===)	10.127	9.21
B2	Distribution					
1	Diesel Motor Pump (5 pk)		0.500			
2	Water Tower (20 m3)		3.610			
3	Piping System (2300 m.)		11.500			
		Total	15.610	===)	5.203	4.73
B3	Distribution Points					
1	4*MCK+Tank; 2*PSP		3.400			
2	House Connections (25)(private)		0.000			
		Total	3.400	===)	1.133	1.03
B4	Miscellaneous					
1	Continguencies (10 % of B1,B2,B3		4.939			
2	Construction by OAMP					
		Total	4.939	===)	1.646	1.50
		TOTAL B	54.329	===)	18.110	16.46
C	Indirect Costs					
1	Supervision (5 % of B)		2.716			
2	Survey and Site Selection		1.000			
3	Design and Planning		0.500			
4	Community Participation		0.200			
5	Monitoring and Training		0.300			
		TOTAL C	4.716	===)	1.572	1.43
TOTAL	INVESTMENT COSTS	======)	59.045	===)	19.682	17.89

Table A4.4. Investments MCKS 3000 Lobener (BOW 1985).

A4.2. EVALUATION OF S D K I PROGRAMME

The method of 'in-house implementation' as applied by the SDKI programme can be evaluated relating the investments of the programme with the accepted standard in Indonesia; the 'BOW', as applied by the Ministry of Public Works. A learning curve will become visible, that depicts the development of the Village Water Supply Organization of the Kabupaten of Indramayu.

The last section describes the elements of BOW Budgetting, and compares this with budgetting by Bill of Quantities. Evaluation of the financial report of the SDKI programme will show that, indeed, the difference between both methods of budgetting is about 22%.

From table A4.5 the total overhead costs of the SDKI programme can be calculated as a percentage of the expenditures for hardware. The asterix-marked items are hardware components. The figures do not include the expatriate consultant. On the average, 82.6 % of the funds were used for hardware. Overhead cost amounted to 20.1 % of the hardware in the period july 1983 to june 1984. When, instead of an expatriate consultant, the consultants team would have been completed with an Indonesian engineer (50 %, Rp 1,000,000.-/mth), overhead becomes 26.4 % of hardware. These overhead costs included survey and site selection, supervision, design and planning, monitoring and training, transport and incentives to personnel of the OAMP. Because overhead costs of the SDKI programme include part of the indirect costs to the principle of the reference list, for the purpose of comparison, the overhead of the SDKI will be put at 22 % (table A4.2). An important part of these overhead costs were incentives to the staff--about 10 %.

		BUDGET EXCHANGE RATE 230	EXPENDITURES JANUARY 1982 to APRIL 1983 EXCHANGE RATE 240	EXPENDITURES APRIL 1983 to JULY 1983 EXCHANGE RATE 340	EXPENDITURES JULY 1983 to MAY 1984 EXCHANGE RATE 320	EXPENDITURES MAY 1984 to AUGUST 1984 EXCHANGE RATE 315	TOTAL EXPENDITURES	REMARKS
A. MCKS Program								
Technical Assistance (TA)		3,431,000.-	* 3,431,000.-	-	-	-	* 3,431,000.-	
Kleine Ambassade Project (KAP)		5,500,000.-	* 5,500,000.-	-	-	-	* 5,500,000.-	
A.1. Funds :								
a) 6 MCKS - 3000		90,000,000.-	* 7,249,850.-	*20,754,050.-	* 82,780,187.-	*8,623,265.-*	*119,407,352.-	* Rehabilitation of the system of Kalianyar, Sukamulya and finishing of the system of Plumbon (Kabupaten Indramayu).
b) Preparation/monitoring/training		1,800,000.-	903,750.-	428,000.-	2,157,500.-	-	3,489,250.-	
c) Material & equipment :								
- Drawing table		414,000.-	413,875.-	-	-	-	413,875.-	
- 5 motor pumps		1,600,000.-						
- 160 hand pumps		5,650,000.-	* 8,695,625.-	* 2,445,826.-	* 2,721,132.-	-	*13,862,583.-	
- 3 motor bikes		2,100,000.-						
- Maintenance		600,000.-	19,350.-	120,200.-	-	-	139,550.-	
B. Development Program								
MCKS - 200 system		10,800,000.-	* 3,442,735.-	-	-	-	3,442,735.-	
Solar stills		1,000,000.-	-	-	-	-	-	
General		-	-	* 2,503,545.-	* 6,796,467.-	-	* 9,300,012.-	
C. Support								
Running cost OAMP		175,000.-	165,000.-	-	-	-	165,000.-	
Kecamatan organization		1,200,000.-	-	-	61,100.-	-	61,100.-	
Documentation		1,200,000.-	546,600.-	916,221.-	2,407,340.-	14,915.-	3,885,076.-	
Overtime expenditures		-	-	-	366,500.-	-	366,500.-	
D. Contingencies		9,300,000.-	2,230,180.-	907,000.-	10,955,220.-	630,180.-**	14,722,580.-	**Transportation, administration and exhibition.
Sub-total (I)	Rp.	134,780,000.-	32,597,965.-	28,074,842.-	108,245,446.-	9,268,360.-	178,186,613.-	
Sub-total in Dfl. (I)	Dfl.	(586,000.-)	(135,824.85)	(82,573.06)	(338,267.01)	(29,423.36)	(586,088.28)	
Local personnel in Kabupaten	Rp.	pm	5,151,975.-	1,082,000.-	6,932,670.-	586,615.-	13,753,260.-	
Pipe material	Dfl.	-	-	-	* (51,581.57)	-	* (51,581.57)	
Sub-total (II)	Rp.	-	5,151,975.-	1,082,000.-	6,932,670.-	586,615.-	13,753,260.-	
Sub-total in Dfl. (II)	Dfl.	-	(21,466.56)	(3,182.35)	(73,246.16)	(1,862.26)	(99,757.33)	
Grand-total in Dfl. (I+II)	Dfl.	(586,000.-)	(157,291.41)	(85,755.41)	(411,513.17)	(31,285.62)	(685,845.61)	

Table A4.5. Financial Report SDKI Programme.

A next step in the evaluation of the SDKI programme is the elaboration of the figures, in order to make them comparable with the BOW figures and the OTA Reference List.

1. The investments for seven realized MCKS systems are calculated in Dutch guilders, stemming from DGIS. Reason for this step is that some investments are paid in guilders and others in rupiahs. The total investments for the seven systems are amounting to Dfl 443,310.- over the years 1982 to 1984.

2. These figures are then corrected for inflation to 1985. Inflation of dutch guilders is about 4 % per year during this period. The investments in 1985 guilders amount to Dfl 478,350.-.

3. Since it is usance to compare this kind of figures in US Dollars, this amount is transferred to dollars with a rate of 3.40 guilders to a dollar. Total investment at 1985 level amount to US 140,690.-.

4. Because about 15,000 people are provided with water by the seven systems, Per Capita Investments amount to $ 9.38. on the average.

5. The realized investments via the SDKI programme do not yet include overhead costs, while the BOW figures do. Corrected in this sense, the PCI becomes $ 11.44 on the average.

6. Now it is interesting to have a look at the individual realized investments as compared to the BOW figures. For this purpose the systems are also budgetted with the use of the BOW. Not all figures for the same type of systems are the same, because the systems consist of different elements. For example, in two cases the storage ponds were already available.

7. Arranging the figures in a chronological way results in a learning curve. See column 13 of table A4.4. The first system was the example as set by the expatriate consultant. Then the investments are 43 % less than the BOW level. Learning was most "expensive" with the MCKS 3000 for the village of Lobener; investments were 19 % above BOW level. Finally, the OAMP was able to construct at about 50 % less than BOW.

Table A4.6 lists all elaborations in colums 4 through 12. Colum 12; Standard Prices, refers to BOW Budgetting. Colum 11 provides the investments of the SDKI programme, after correction for overhead and at price level of 1985. The difference between colum 11 and 12 shows the performance of the new Water Supply Organization. See colum 13.

Comparison of Per Capita Investments of realized MCKS-systems with standard prices calculated with BOW guidelines.
Construction only, no indirect costs, such as community participation or surveying, included.

1	2	3	4	5	6	7	8	9	10	11	12	13
	DESA	TYPE	TOTAL INVESTM. RP * 10^6	TOTAL INVESTM. Dfl * 10^3	YEAR	CORRECTION INFLATION 4% for Dfl	TOTAL INVESTM. US$ * 10^3	POPULATION	PCI REALIZED PRICES	PCI CORRECT. OVERHEAD	PCI STANDARD PRICES	% DIFFERENC
1	PAWIDEAN	MCKS 500	3.30	11.00	1982	12.37	$3.64	500	$7.28	$8.88	$12.74	43%
2	KALIMATI	MCKS 500	4.50	15.00	1982	16.87	$4.96	500	$9.93	$12.11	$12.74	5%
3	LOBENER	MCKS 3000	45.38	157.86	1983	170.74	$50.22	3000	$16.74	$20.42	$16.46	-19%
4	KALIANYAR	MCKS 3000	28.11	88.92	1983	96.18	$28.29	3000	$9.43	$11.50	$11.53	0%
5	SUKAMULYA	MCKS 3000	21.42	66.73	1983	72.18	$21.23	3000	$7.08	$8.63	$11.31	31%
6	SUKAREJA	MCKS 2000	15.97	49.60	1983	53.65	$15.78	2000	$7.89	$9.62	$14.51	51%
7	PLUMBON	MCKS 3000	17.12	54.20	1984	56.37	$16.58	3000	$5.53	$6.74	$10.25	52%
	TOTAL		135.80	443.31		478.35	$140.69	15,000	$9.38	$11.44		

COMMENTS

The first MCKS 500 system was constructed by part-time staff of two different agencies.
During construction of this system the consultant was supervising the work very closely.
Labour from the village was relatively cheap.
After this first system was completed, the Bupati decided to revitalise the OAMP with full-time staff.

The second system was again supervised by the consultant, but with new staff of the new OAMP.
The costs increased drastically; about 38% compared to the first system. This system was clearly mentioned as a technical training to the technical staff of the OAMP and the consultant.

A next step in the development of the OAMP was upgrading of planning and design abilities of the staff in the office.
The design of this bigger unit was made together with the OAMP. Planning was handed to the assistent of the consultant and the head of the design section of the OAMP. Local conditions as heavy rainfall and scarsity of labour during the harvesting season were encountered. This is clearly expressed in the figures.

The objective of the fourth step in the development of the OAMP was improvement of management.
Administration and cash management was fully handed to the OAMP. It was evident that the convential way of bookkeeping was not appropriate for a proper control of the funds.
A "Permanent Balancing Tabular Method" (PBT-Method) was introduced. The PBT-Method made an immediate comparison of of money in cash and the booked expenditures possible. A journal system for use in the field was part of the new set-up. Another improvement, that helped to get a better control, was the establishment of a clear system of incentives to the staff of the OAMP, both in the office and in the field.
The normal salary of about Rp 15.000,- was topped up with Per Diems (normal practice) and Incentives.
Monthly "salary" was now amounting to about Rp 90.000.-, with 90% certainty.

During construction of the next systems in Sukareja, Sukamulya and Plumbon, performance of the OAMP increased.
The schemes were designed and planned by the OAMP, technical performance in the field also improved.
Cooperation between field staff and office staff was not always perfect. It was very difficult to maintain a good book keeping system for the storage of materials. Auxilliary structures had a too short life time.
During the last half year, a young accountant was added to the consultants team.
On a weekly basis he assisted the OAMP to match expenditures with planned budget.
Monthly a report was send to the funding agent, the Dutch Directorate General of International Cooperation.

For the last two systems the difference between Standard and Realization is about 50%. This difference may consist of;
1) In Indramayu goods and labour tend to be cheaper, about 10 %.
2) The post for Continguencies is not used; 10 %.
3) Much attention was paid to a tidy work place, in order to decrease losses of materials.
4) Village labour was attracted on a daily basis.
5) Application of Ferro Cement required only local transport, while transport of bulk materials, such as gravel, sand and re-rods was reduced drastically. It is hard to estimate the impact of this item
6) Although for only 3 days a week, presence of the expatriate consultant may have had a cost reducing effect.

Table A4.6. Comparison of Per Capita Investments of SDKI Programme.

Table A4.6 shows the result of the approach of the SDKI programme. The approach was to start small and gradually increase complexity of tasks to be handled by the new agency. In the end, the OAMP was able to implement the programme efficiently. Savings of about 50% in relation to the BOW are acquired.
The difference of 50 % is the result of several items;

Labour costs and materials are less expensive in Indramayu than in the rest of West Java, while budgetting with BOW uses West Java figures.
Preferably labour from the village was employed, that was often a bit more expensive than the labour employed by contractors. But village labour was employed at a daily basis.
The consultant payed much attention to a tidy work place in order to increase efficiency.

The MCKS systems consist for an important part of ferrocement structures, which may have the biggest influence on the reduction of the investments. Application of ferrocement does not require heavy transport, as is the case with conventional structures (BOW). Appropriateness of the design to village conditions also has a cost reducing effect.

The way of management of the OAMP may have had its cost reducing effect. Much attention was paid to personnal responsability of the staff, while a strict, but open, reporting system was applied.

Conclusion.

The conclusion may be that the mix of consultancy by a foreign consultant, the application of ferrocement, implementation by the staff of the OAMP itself, and the open way of management resulted in a drastic reduction of investments. This evaluation may be of use for the formulation of future programmes, in which a decision has to be taken concerning in-house implementation or tendering, concerning employment of foreign consultants or not. The required PCI's for such programmes depend upon the set-up of the programmes. It should be noted that the way of financing often plays a more important role in these programmes than the level of the PCI, especially when funded from foreign funds.

A more important aspect of these systems is that operation and maintenance can be paid by the village communities, without subsidization from "above". This is the topic of the following section.

A4.3. OPERATION AND MAINTENANCE

Table A4.7 is a breakeven analysis of the system in the village of Lobener. At present 6 public stand posts are connected to the distribution grid and about 25 house connections sold. Twice a day the operator fills-up the water tower with the aid of a diesel driven pump, for the rest of the day he works at the rice huller across the street. Although not all consumers of public stand posts pay their bill, still the Water Supply Team keeps the system running. Major repairs are taken care of by the OAMP at Kabupaten level. In other words, the expenditures to run the system, including salaries of personnel, is fully covered by the revenues.

A Water Supply Team, consisting of a supervisor, an administrator and an operator, collects the water fees and from this money, fuel, salaries and small repairs can be paid. The fee for a house connection is about $ 2 per family. Consumers of water from public stand posts pay about 35 cents a month per family. The number of house connections play an important role in the financial management of the system. For the system in Lobener table A4.8. provides insight into the revenues in relation with the number of house connections. In the table it is assumed that the number of public stand posts remains unchanged.

The table indicates that already at ~~with~~ about 11 house connections, the system runs break even for the daily expenditures. When also major repairs have to be covered from the revenues, the required number of house connections is about 100. When about 50 % (300) house connections are connected, revenues also cover the recurrent costs of the system. It should be considered, however, that not all consumers of water from the public stand posts are able to pay their monthly fee. In practice it turns out that about 25 to 50% of the families pay. Because of their limited number, and social control in the village, all consumers of house connections pay their water bills. In fact, the fees from the house connections keep the system in production, thus subsidizing clear water to the less wealthy in the village.

The case of Lobener illustrates that surface water treatment may become affordable for the villages of the northern coastal plains of the island of Java. Water supply through house connections plays a vital role in the operation of the systems, especially in rural villages. Water through house connections to the more wealthy people in the village safeguards clear water to the poorest of the community through public stand posts.

Break-even analysis		
RATE	Exchange rate Rupiah/US Dollar	1100
POP	Population of Village	3000
FAM	Average Family Size	5
#FAM	Number of families in village = POP/FAM	600
#FAMPS	Number of families using PS	38
#HC	Number of HC's	25
#PS	Number of PS's	6
Consumption/month		
LCDHC	Liters per Caput per Day - HC	60
LCDPS	Liters per Caput per Day - PS	30
CONHC	Monthly Cons. HC = LCDHC*FAM*30.5	9.2
CONPS	Monthly Cons. PS = LCDPS*FAM*30.5	4.6
CHC	Total Mnthly Cons HC = CONHC*#HC	263.1
CPS	Total Mnthly Cons PS CONPS * #PS * #FAMPS*(1 - #HC/#FAM)	1,210.1
CTOT	Total Mnthly Consumption = CHC+CPS	1,473.2
CTOTBAS	Total Mnthly Consumption as assumed CONHC*PHC*#FAM+CONPS*PPS*#FAM	4,735.1
PHC	Assumed Percentage of POP using HC	50%
PPS	Assumed Percentage of POP using PS	50%
TARGET	Number of families using PS as assumed	20
Revenues/month		
FEEHC	Monthly fee per HC	2.000
FEEPS	Monthly fee per PS	0.250
RHC	Revenues HC = #HC*FEEHC	50.000
RPS	Revenues PS = #PS*FEEPS*#FAMPS*(1-#HC/ A	57.500
RTOT	Total Revenues per month = RHC+RPS	107.500
Expenditures/month		
EXO	Expenditures for Operation only	84.156
EXM	Expenditures for Maintenance only	118.123
EXTOT	Total Monthly Expenditures = EXO+EXM	202.278
Recurrent Costs/ month		
DPMP	Depreciation period mech. parts;	5
DPCW	Depreciation period civil works;	15
RCMP	Deprec. MP per month	65.000
RCCW	Deprec. CW per month	280.161
RCTOT	Total Depreciation per month	345.161
Subsidies/month		
STKI	Subsidies from Provincial Level	345.161
STKII	Subsidies from Kabupaten Level	118.123
STOT	Tot. Subs. per month = STKI+STKII	463.284

PROFIT = RTOT	+STOT	-RCTOT	-EXTOT	23.344
Per M3 0.073	0.314	0.234	0.137	

Unit Costs per m3 in case of basic assumptions
Investments/m3 0.073 ; O&M/m3 0.063

Table A4.7. Break-even Analysis of MCKS 3000 Lobener.

Financial Analysis of Village Water Supply System related with Percentage of Population served through House Connections
Profits as made by the Village Water Supply Team, in case major maintenanae and recurrent costs are subsidized.
The number of PSP's is 6, and will not change.

% HC's	#HC	PROFIT +R57	= RTOT +R35	+ STOT +R55	- EXTOT +R41	- RCTOT +R49
0%	0	(15.633)	60.000	459.992	190.464	345.161
10%	60	77.913	174.000	467.893	218.819	345.161
20%	120	171.460	288.000	475.795	247.174	345.161
30%	180	265.007	402.000	483.697	275.529	345.161
40%	240	358.553	516.000	491.599	303.885	345.161
50%	300	452.100	630.000	499.501	332.240	345.161
60%	360	545.647	744.000	507.403	360.595	345.161
70%	420	639.193	858.000	515.305	388.950	345.161
80%	480	732.740	972.000	523.207	417.305	345.161
90%	540	826.287	1,086.000	531.108	445.661	345.161
100%	600	919.833	1,200.000	539.010	474.016	345.161

Table A4.8. Profit of Village Water Supply Team related with number of House Connections.

ANNEX 5

Ferrocement Water Towers in Indonesia

Ferrocement Watertowers in Indonesia

C.L.P.M. Pompe* and W.R. van Kerkvoorden+

A 20 m³ watertower is built with the use of ferrocement for a cost of US $ 2,500 (pump house included). Further development using a combination of brickwork and ferrocement will decrease the costs and result in an easier way of construction.

INTRODUCTION

In the year 1976 the Indonesian and the Dutch Governments decided to start the West Java Rural Water Supply Project OTA-33. This project is aimed at the development of rural water supply options, appropriate to the West Javanese conditions.

In connection with the efficient use of available water resources, a handpump of sturdy design, the Bandung Pump and ferrocement as material for construction were promoted. Within the scope of the Project, ferrocement introduced as a building material in Indonesia in the late 70's by agencies such as the ITB based DTC (Development & Technology Centre of the University Technology) Bandung and the Dian Desa Foundation Yogyakarta, has been used for prototypes. Based on the experiences of DTC and Dian Desa no further experiments with the new material were undertaken.

A prototype rainwater collector of ferrocement was built by Tuinhof and van Kerkvoorden. The former wrote a detailed manual for building a tank of 10 m³ capacity and also devised a method for calculation and design.

At present thousands of ferrocement rainwater catchment tanks are to be found all over Java. Other applications of ferrocement were the construction, by Hofman, of small scale water purification plants in Karawang and of the slow sand filters of the so-called MCKS-500 system by Pompe in Indramayu. The latter system is a water purification scheme serving 500 people, whose consumption patterns dictate the process of slowsand filtration. The abbreviation MCKS consists of the first letters of the Indonesian words for bathing, washing, toilet and filter, in that order, designating a sanitary unit, annex to the slow sand filter. In 1983, after two years of experience, the MCKS-500 has been enlarged into a MCKS-2000 system. This unit or plant has only recently started to deliver clean water to the users through house connections and public sanitary units at which delivery points small reservoirs, commonly used in Indonesia catch the water flow.

The reservoirs allow a restricted outflow at those points and make for a distribution system in which no peak flows occur so that smaller pipes can be used. However, to maintain a constant pressure in the system in the absence of connection to an electric grid, the needed power has to be supplied by either:

a. A genset producing electricity to drive small electric pumps, readily available at local markets (e.g. the Japanese Sanyo series). These pumps automatically switch on when pressure falls below a certain level (upto 10 Ato). The plant designed by Hofman used this set up.

* Associate Expert, Directorate General for International Cooperation, Ministry of Foreign Affairs, The Netherlands.

+ IWACO B.V., International Water Supply Consultants, The Netherlands.

b. A diesel engine pumping water into an elevated reservoir to maintain a "constant" head (head varies between 6.5 m and 9.5 m (0.65-0.95 Ato). Several times a day the reservoir is replenished. This "direct drive" approach is applied in the MCKS-2000. Operation is rather simple and skills to run and maintain a diesel engine is available in the village.

So the next step in ferrocement promotion by the Project has been the construction of ferrocement watertowers.

A WATERTOWER OF FERROCEMENT

Watertowers, as we know them, are built in brick, concrete or steel and often dominate their environment as monuments of functional architecture. However, in Java there are many drawbacks in standard building techniques. Locally available bricks are of poor quality and heavy constructions in brick are easily damaged by the frequent earth tremors and earthquakes of Java.

Building in steel and concrete is expensive. Steel also needs proper coating against corrosion and concrete's main drawback is the construction of the formwork, a building in itself. Working in steel and concrete, moreover needs special skills which are not available in a village-setting. Construction in ferrocement, its low-cost materials easily transported, makes use of a typical village skill i.e. plastering.

The design first thought of took the form of a hyperboloid (Fig. 1) a form which in a mechanical sense is optimally suited to the properties of ferrocement. Regretfully the idea had to be abondoned for two reasons. Firstly, construction work itself would tax the capabilities

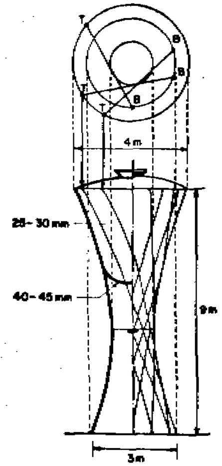


Fig. 1. The hyperboloid form.

of the locally available labour to the utmost. Scaffolding would raise enormous problems. Secondly, the calculations involved proved to be difficult to work out.

Two watertowers have now been built according to the design discussed in this paper.

Design of the Watertower

Basically the watertower consits, of three elements, one on top of the other; a ferrocement watertank (D = 3 m, H = 3 m) on top of a brickwork/ferrocement tube (D = 2 m) on a foundation slab (D = 5 m) of reinforced concrete which stands directly on a stiff undisturbed underground of heavy solid clay (Fig. 2). The resulting soil stress is only about 0.02 N/mm^2 (soil stress under the authors shoes amounts to about 0.03 N/mm^2), so no piling is required. The engineering firm Triweger Indonesia has checked the design on earthquake resistance and structural strength. In this paper only the structural background of the design will be discussed.

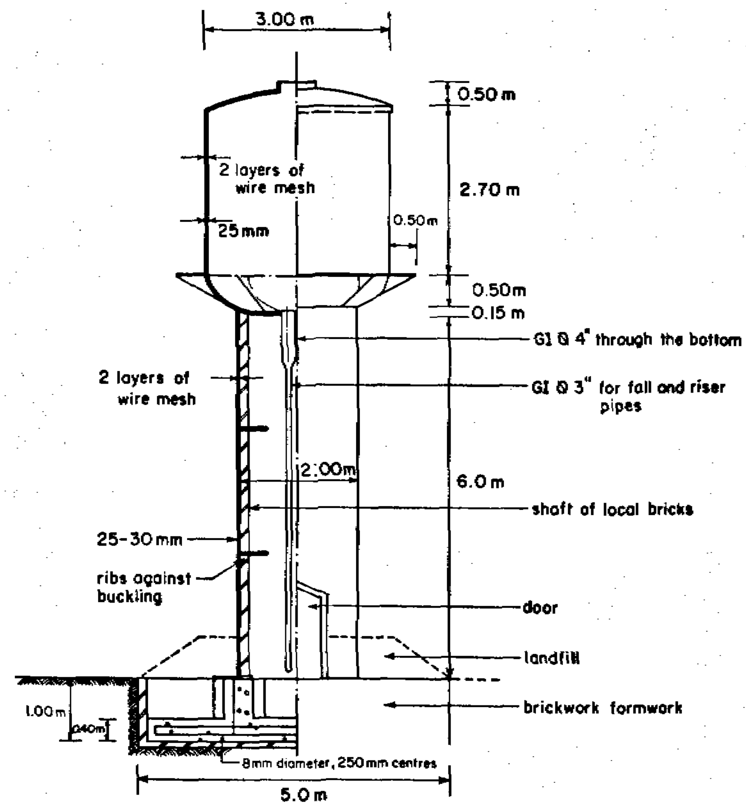


Fig. 2. The ferrocement watertower showing the basic three elements.

Foundation Slab

The circular foundation slab is of reinforced concrete with a thickness of 0.4 m. Formwork for the slab is a brickwork basin with a diameter of 5 m and a depth of 1 m (Fig. 3).

Tower

To keep construction simple, a lost mold method has been applied. The tube of brickwork having 2 m diameter is erected first. Bricks have no structural function and in calculating the strength of the construction are disregarded; in calculating the loads in relation to dynamic behaviour (of the construction as a whole) they are included (Fig. 4).

Floor of the Watertank

The saucer shaped bottom of the tank, upon which the tank will be constructed and forming the connection between the trunk of the tower and the tank, consists of a grid of steel rods encased in chickenwire mesh. Great care should be given to the proper anchoring of trunk and tank wall to the floor (Figs. 5-6).

Dimensioning of the reinforcing rods is based at the assumption that only the rods take the load; the mesh being disregarded in the calculation. Optimisation of reinforcement of concrete is expected here.

Tank

The tank is just a conventional watertank, designed according to the formulas determined by Naaman and Shah. In the center of the tank a pipe gives access into the tank from inside of the tower.

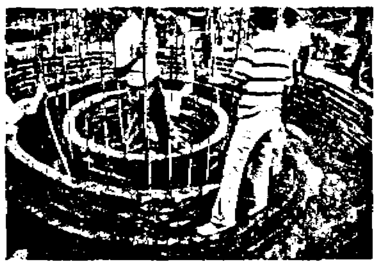


Fig. 3. Construction of the foundation.

The first tank built had a manhole on top of the tank which had to be reached by climbing 9.5 m up a vertical flight of stairs on the outside of the tank wall, which was not convenient.

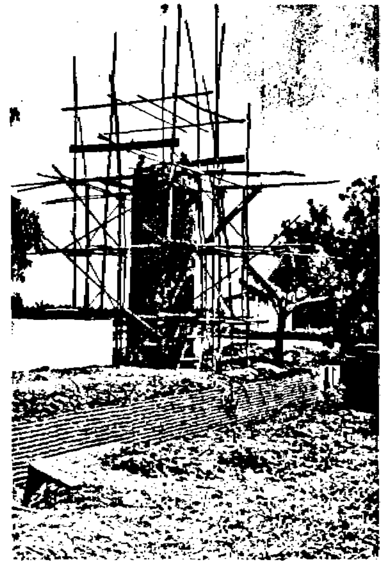


Fig. 4. Brickwork tower encased in ferrocement.

An overflow outlet, together with a piece of painted wood connected to a rubber bulb floating inside the tank provide visual contact from the outside of the water level in the tank.

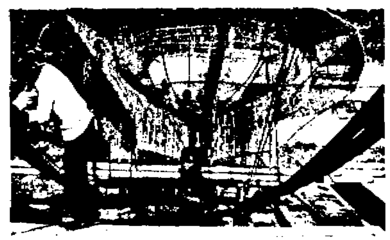


Fig. 5. Saucer shaped bottom of tank.

Figs. 7-8 show the different stages in construction of the tank and Fig. 9 shows the completed watertower.

Fig. 6. Tank bottom reinforcement cage lifted manually.

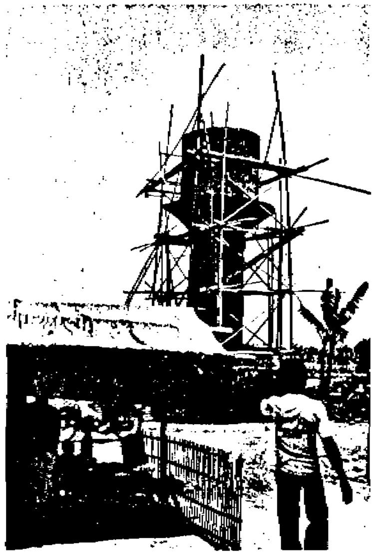


Fig. 8. The water tank after plastering.

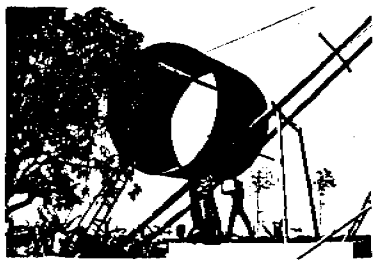


Fig. 7. Formwork of tank rolled up to position.

Fig. 9. General view of the MCKS 2000 and the completed water tank.

CONSIDERATION FOR FURTHER IMPROVEMENTS

Hoisting the tank bottom and its mold up to the top of the supporting column involves time consuming labour and prefabrication of its skeleton grid of concrete iron is relatively costly. To save time and money the next design has incorporated the utilization of a lost mold of bricks : on the inner side of the brickwork hollow column (H = $\pm$ 6 m; ϕ = 2.5 m to 3 m) ferrocement is applied in one layer. The tank bottom, $\pm$ 6 m above ground level together with its iron/steel skeleton will be constructed in situ. In cross section the structure resembles that of bamboo (Fig. 10).

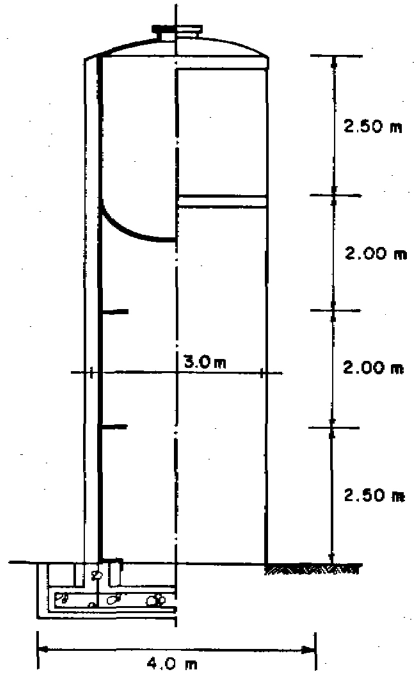


Fig. 10. The improved design. The structure resembles a bamboo.

A N N E X 6

The MCKS 500, a small scale integrated water supply and sanitation system

A Total-Water-System for 500 People
The "MCKS-500"

C. Pompe*

The MCKS 500 is a small scale water system for 500 users. Its three main functions are: water treatment, storage of water and healthy use of water at a sanitary unit. All the structures are constructed either of ferrocement, bamboo-cement or brickwork. Construction of the ferrocement slow-sand filter is discussed in detail. Cost of construction and operation cost estimates are given.

INTRODUCTION

In the village of Pawidean, West Java, Indonesia, a small scale water installation for 500 people came into use at the end of April 1982. It can be said to be a "total-water-system" since it not only supplies water, but also, provides a sanitary unit. In this way it is giving an answer to the water related health problems of the villages of West Java.

In Indonesia, its name is MCKS 500. The number indicates the number of users, while "MCKS" stands for Mandi, Cuci, Kakus, Saringan or: bathing, washing, toilet, waterfilter. In other words a sanitary "MCK" unit is supplied with water from a system of which the main part is a slow sand filter (saringan).

The aim of this paper is to provide information about the installation of the water supply unit.

THE "MCKS 500"

The MCKS 500 in Pawidean has three main functions:

a. water treatment of the irrigation water;
b. storage of water for a period of two months;
c. "healthy" use of water at a sanitary unit.

These functions will be discussed first, followed by a description of the construction of the slow sand filter basin. The completed system is shown in Fig. 1.

Water Treatment of the Irrigation Water

The northern coastal plains of the island of West Java is covered with a fine net of irrigation canals. This is the main source of water for most people in Indramayu; they bath in the canals, they wash in it and use it as a public toilet. Apart from this pollution, the water carries sediments from the hills colouring the water brownish. Another problem is : once a year for about two months, the canals are empty for maintenance work.

To improve this water supply situation, a system is designed consisting of three steps:

1. Flocculation / Sedimentation

* Assistant Expert, Rural Water Supply West Java Project, Dutch Ministry of Development.

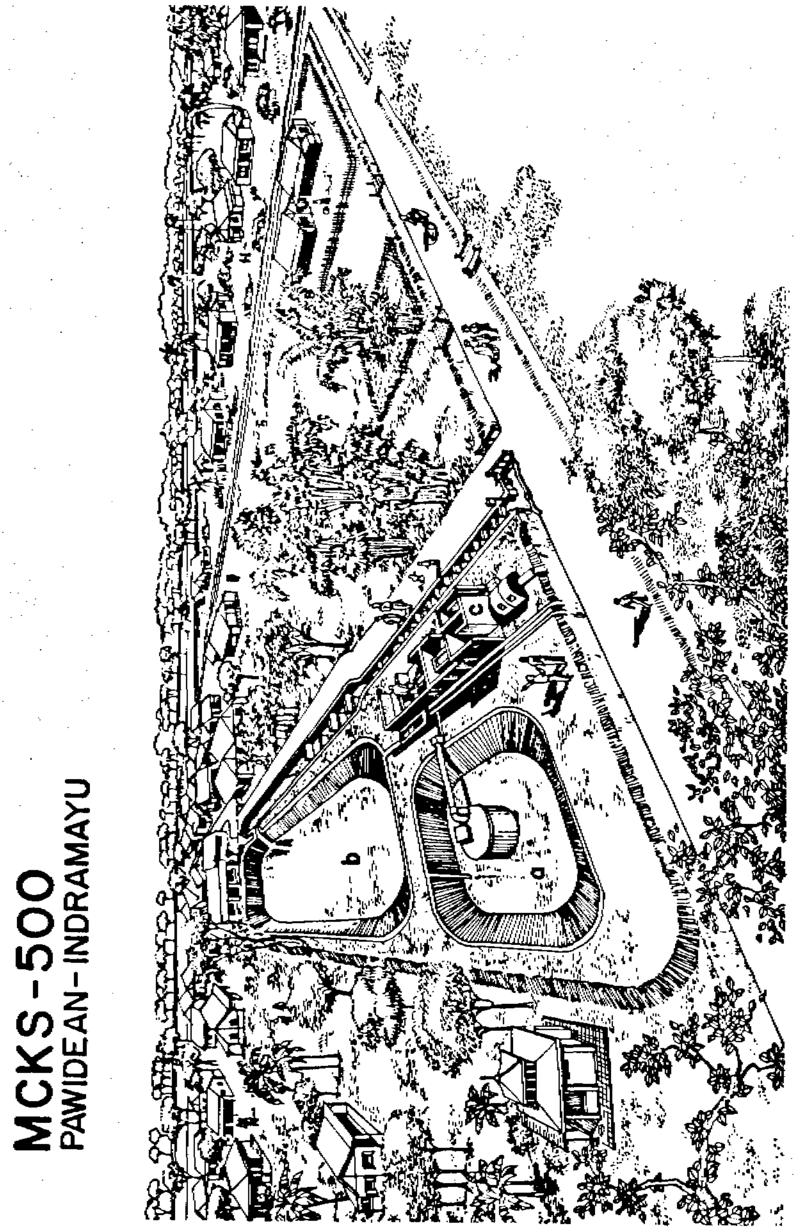


Fig. 1. The MCKS 500 showing (a) the water treatment plant (b) the storage reservoir and (c) the sanitary unit.

Flocculation/sedimentation is carried out in a stretched canal. In this way the operator, who is a farmer and cannot read or write, can see the process in a "natural" way.

The dosing of alum for flocculation is made as simple as possible. The alum salts are put in a perforated bucket which is hung in the water flow. Alum trickles into the raw water through the perforation and the water flow is made highly turbulent for mixing water and alum.

After the mixing of alum, the canal gradually gets deeper and wider. This is to ease the flow of water to have the flocks of sediment grow and finally settle at the end of the canal. Clarified water flows over the weir at the end of the canal into the reservoir.

2. Reservoir

In the reservoir, residual flocks have enough time to settle before entering the slow sand filter. Retention time is a period of over two weeks—due to the necessary storage capacity. This long retention period permits the elimination of the rapid sand filter which is conventionally used in the process of surface treatment. During this retention period natural processes also help to purify the water.

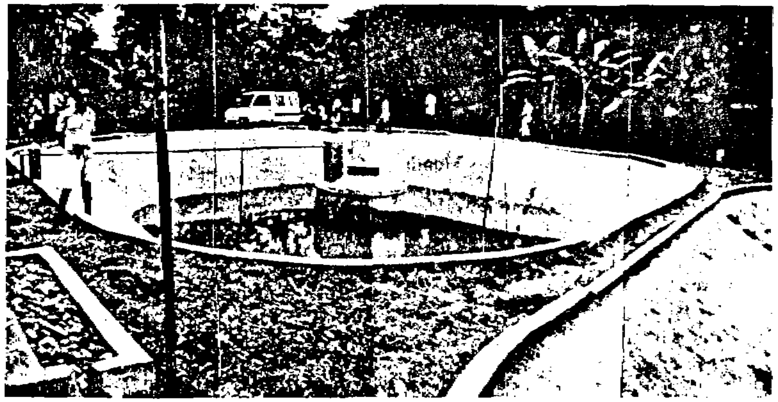
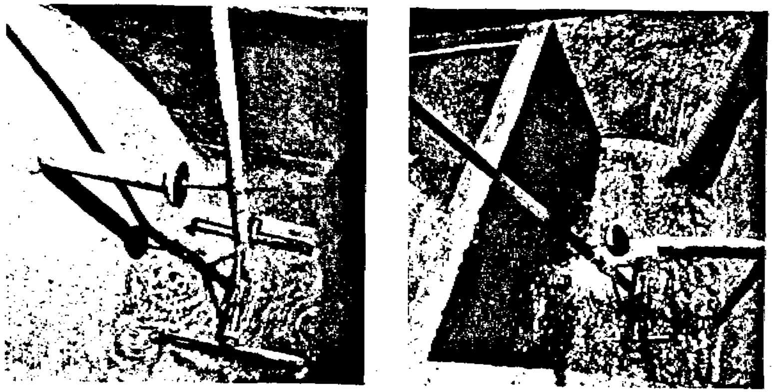


Fig. 2. The slow sand filter. The collection well is seen in the middle and the pole valve is on the right.

3. Slow Sand Filter

Still by gravitation, water flows from the reservoir into the slow sand filter basin. (Fig. 2) A "polevalve" may shut off the flow of water in case of filter cleaning (Fig. 3). This "polevalve" is adjustible and is expected to have a longer life than a normal cockvalve.



a) The valve closed. b) The valve open.

Fig. 3. The pole valve.

The slow sand filter purifies the water bacteriologically to a reasonable quality for rural circumstances (NTU < 2, total count 10 000/ml, E-coli = 0). The velocity of the water seeping through the filter is about 0.1 $m^3/m^2/hr$. This is the design velocity. In fact the flow through the filter will fluctuate around the value of 0.1 m/hr. for it is determined by the drawing off of water from the collection well.

Storage of Water for a Period of Two Months

The reservoir of the MCKS in Pawidean has a storage capacity of 800 m^3. This capacity is needed to bridge the periods when there is no water in the irrigation canal. In the Northeast area of Indramayu the distribution of irrigation water stops for about two months. The amount of water needed for two months would be about 2000 m^3. However, recirculating the washing and bathing water reduces the storage capacity needed. Soap from the washing and bathing water is filtered out by horizontal flow palmfibre filter (2.0m × 0.5m × 0.5 m) prior to entering the reservoir again.

Healthy Use of Water at a Sanitary Unit.

Often public standposts produce clean water in the middle of a pool of mud; a good source of contamination and diseases. A proper sanitary unit should aim to promote a "healthier" use of water. So, not only a wide space is made available for bathing and washing but also a water closet connected to a septic tank is provided.

THE STRUCTURES

All the structures are constructed either of ferrocement, bamboo-cement or brickwork. The choice of these construction materials is based on economy, functional conditions and

suitability to unskilled labor. The whole MCKS is built by people from the Rural Water Supply Organization of the Indramayu district, together with people from the village.

The lining of the reservoir is made of bamboo cement, while the slow sand filter is ferrocement lined. Only the construction of the slow sand filter will be described. This will show how the use of ferrocement or bamboo-cement facilitates construction by unskilled labor.

The Construction of The Slow Sand Filter

Figs. 4-9 show the stages of the construction of the slow sand filter. The construction procedure applies also to bamboo-cement lined reservoir except that the reinforcement is of bamboo matting.

Fig. 4. Digging of the basin.

Fig. 5. A brickwork floor for clean work.

Fig. 4 shows the digging of the basin to a depth of 3.30 m. Slopes are first dug in steps of 1 : 1. The slope are smoothed when the required depth is attained. In more sandy clay, slopes should not be as step as used in this project.

After smoothing the slopes, a brickwork floor is laid to make clean work possible (Fig. 5). For later projects, ditches are made in the floor to provide canals for the pebble drain.

The slopes are first plastered with mortar of 1 : 5 cement-sand ratio. Then one layer of chicken wire mesh is attached on the plastered slope by bamboo crampnails (Fig. 6). Finally, the slopes are plastered with mortar of 1 : 3 cement-sand ratio and a brickwork band is fixed around the basin. (Fig. 7)

The slopes may also be lined with bamboo matting, grass or plastic sheeting since the slope is stable at an angle of 45°, and these linings protect the slopes against erosion. However, grass may dry out and may be destroyed by children, bamboo may rot at the water line and plastic deteriorates In this case, ferrocement or bamboo-cement is a reasonable alternative since it is "lightweight", it needs no thrusts against sliding off the slopes and the lining "sits" on the slope.


Fig. 6. Plastering the slopes with ferrocement.

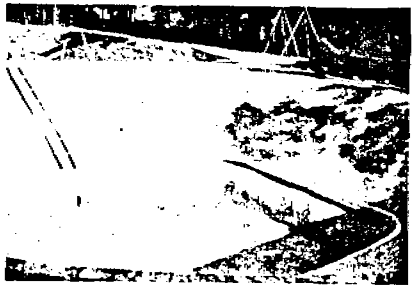


Fig. 7. The completed filter tank.

One disadvantage is that the lining will crack when the clays wells or shrinks. However, when major cracks occur these may be plastered again.

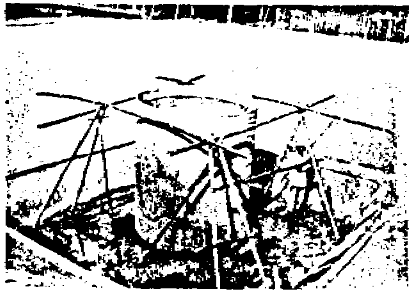


Fig. 8. Setting up of the mould for the collection well.

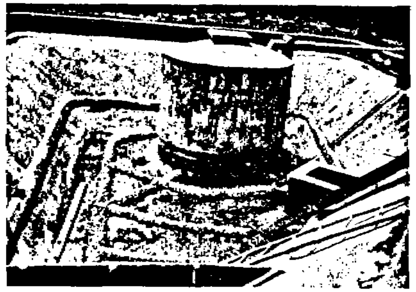


Fig. 9. Laying of under - drains.

Fig. 8. shows the setting up of the mould of the collection well. The water enters the collection well through holes in the wall at the bottom that are connected to the pebble drains underneath the sand filter.

As the wall of the well is always under compression, water level outside is always higher than water level inside, a construction material is to be used that can take compression. Again ferrocement provides a good solution; the fine cracks that eventually will occur in the walls will not allow water from outside to penetrate.

Construction of the collection well is similar to the construction of a ferrocement rainwater tank as described in reference 1. Preparing the plywood mould around steel ribs is still rather elaborate, as is fixing the mesh on it. Therefore, the well of the systems that are built later are made of brickwork lined with one layer mesh and mortar of 1 : 2.

The construction of the slow sand filter basin and the central collection well is now finished. Finally the pebble drains are laid and covered by 50 mm layers of pebbles of varying grain size: field instruction; pebbles sizes should be first of egg-size, then "beans", "rice", "sugar"

and finally 0.80 to 1.0 m of fine washed sea sand. Then pipes from the collection well are fitted and the "polevalve" fixed and adjusted.

Cost of the "MCKS 500" in Pawidean

The system was finished in May 1982. Since that date, prices of fuel and cement have risen in Indonesia quite substantially. Nevertheless, figures based on May 1982 prices are given in Table 1.

Table 1. Costs of the MCKS 500.

Description	Cost in Rp.	Cost in US$
Ground work (digging)	300,000.00	450.00
Canal for flocculation and sedimentation	250,000.00	375.00
Slow sand filter	750,000.00	1,125.00
Reservoir	750,000.00	1,125.00
Sanitary unit	400,000.00	600.00
Miscellaneous	250,000.00	375.00
Price level May 1982	Rp. 2,700,000.00	US$ 4,050.00
Per capita	Rp. 5,400.00	US$ 8.00

It should be noted however that another plant that has just been completed in the village of Kalimati cost approximately Rp. 4,000,000 (US$ 5,800.) due to higher prices and also because trucks could not reach the site. So all materials had to be handled twice. And at the end of the construction period, water had to be fetched from distant places since the dry season happened to be extremely dry.

All these circumstances have to be considered well before starting any project.

Table 2. Operation cost estimate per month.

Description	Cost in Rp.	Cost in US$
Operator	7,500.00	11.25
Maintenance	5,000.00	7.50
Alum	5,000.00	7.50
	Rp. 17,500.00	US$ 26.25
Per capita	Rp. 35.00	US$ 0.055

The operation costs estimate per month is given in Table 2. At the moment (January 1983) the operator is paid in nature; the reservoir is used as fishpond. Also it is seen that rainfall (about 2000 mm per year) reduces costs substantially. The operator is instructed to only fill the reservoir well after rainfall. This can economize the use of alum because shortly after rainfall water from the irrigation canal carries more sediments (NTU > 1000) thus requiring more alum.

CONCLUSION

In the first half year the plant was used satisfactorily. More than 500 people used the water for drinking and cooking. In the dry period recirculation of bathing and washing water was often abused causing flooding of the washing floor. The horizontal palm fiber filter functioned as expected.

This year however, the canals were dry for almost four months so just one and a half months after the draught started the reservoir was empty. This is because almost 1500 people fetched their drinking water from the plant.

A very positive fact is that people in Pawidean now start to think of improving water supply in the rest of the village. The Community Organization of the village took official command of the plant in December 1982 and made some minor improvements in the direct environment. Other villages start to drop in at the office of the Rural Water Supply Organization of the District to request improvement of their water supply.

The author now is coaching the District Rural Water Organization to be set up. In this effort, nine water supply schemes will be built which will serve as a vehicle for the development of the organization.

It is the use of bamboo-cement and ferrocement which made construction of the MCKS possible. The availability of this low technology scheme served as a catalyst towards a better organization for implementation of water supply in the villages of West Java.

REFERENCE

1. "Construction Manual for a 10 m^3 Rainwater Reservoir of Ferrocement", IWACO International Water Supply Consultants, Jalan Banda 23, Bandung, Indonesia. (available in English and in Indonesian language)

List of Manuals, Reports and Publications

1. Buku Petunjuk cara memelihara & Membersihkan Saringan Pasir Lambat (Jan.1984).

2. Buku Pedoman Pelatih, Memelihara & Membersihkan Sumur Gali. (Jan. 1984).

3. Petunjuk Pemeliharaan Pompa Tangan Dangkal. (Jan. 1984).

4. Buku Pedoman Pelatih, Cara Merawat dan Memperbaiki Pompa Tangan Dangkal. (Feb. 1984).

5. Buku Pedoman Pelatih cara Memelihara, Membersihkan Bak Saringan dan Tanki Air Bersih. (March 1984).

6. Buku Pedoman Pelatih cara Memelihara & Membersihkan Kamar Mandi, Lantai Cuci & Kakus. (March 1984).

7. Buku Pedoman Pelatih, cara Memelihara & Membersihkan Bak Penampung. (April 1984).

8. Buku Pedoman Pelatih, cara Memelihara, Membersihkan dan Mendayagunakan Saluran Flokulasi. (April 1984).

9. Struktur Tata Kerja Organisasi Air Minum Pedesaan (OAMP). Tingkat Desa. (April 1984).

10. Pola Kerja Organisasi Air Minum Pedesaan Kabupaten Daerah Tingkat II Indramayu. (April 1984).

11. Buku Petunjuk Penyertaan & Pengaturan Sumber Daya Masyarakat dalam Program MCK-X di Kabupaten Indramayu. (1984).

12. Lanjutan OTA-33/MCKS (Catatan kepada Pemda Tk.I Jawa Barat. (December 1983).

13. Rapport over de Korte Missie ir C.L.P.M.Pompe aan Nederland van tot en Met 19 oktober 1983.
    Rural Water Supply and Sanitation en Regionale Ontwikkelings Planning. (Dec.1983).

14. Planning and Implementation of Sanitation Programmes in Rural Areas. (National Symposium on Environmental Sanitation). (1982).

15. Sanitation, Its Effects on Health, Productivity and Economy. (National Symposium on Environmental Sanitation). (1982).

16. Rural Water Supply and Sanitation;
    A Regional Development Approach. (International Symposium on Environmental Sanitation in Bangkok by AIT). (1982).

17. A Total Water System for 500 People The "MCKS-500". (Journal of Ferrocement; vol.13, nr.2). (April 1983).

18. Petunjuk cara Pembuatan MCKS-500. (1982).

19. Petunjuk cara Memelihara MCKS-500. (1982).

20. Typology MCK-X. (1983).

21. Proposal Masterplanning Village Development West Java (Yayasan Desa Plan). (March 1984).

22. Proposal MCKS-1983 (Voorstel voor de dienst verlening aan de ontwikkeling van e dorpswatervoorziening in de Kab. Indramayu). Deel Project van het West Java Rural Water Supply Project. (April 1982). Dutch & Indonesian version.

23. Proposal MCKS-1983 (Voorstel voor de dienst verlening aan de ontwikkeling van de dorpswatervoorziening in de Kab.Indramayu). (April 1982).

24. Proposal MCKS-1984 (Annexes such as typology excluded) (1983).

25. Water Supply Indramayu - Towards a Master Plan - (1981).

26. Presentase Master Plan (September 1982).

27. Usaha Pengadaan Sarana Air Bersih konsep MCK-X Sistem MCKS-3000 untuk pelaksanaan fase pertama di dusun Karangbaru Desa Lobener, Kecamatan Jatibarang. (Dec. 1982).

28. Petunjuk Pemetaan Situasi Pemukiman Tingkat Desa. (April 1984).

29. Penentuan Lokasi MCKS-Sumur Gali. (April 1984).

30. Laporan Hasil Evaluasi Sarana Air Minum Pedesaan di Kabupaten Daerah Tk.II Indramayu. (1983).

31. MCKS Sanitation Unit. (1983).

32. Ferrocement Watertower in Indonesia. (Dec. 1983).

33. Master Plan Sarana Air Bersih di Wilayah Kec.JATIBARANG, Kabupaten Indramayu. (Sept. 1982).

34. Master Plan Sarana Air Bersih di Wilayah Kec.INDRAMAYU, Kabupaten Indramayu. (July 1983).

35. Master Plan Sarana Air Bersih di Wilayah Kec. SINDANG, Kabupaten Indramayu. (Aug. 1983).

36. Laporan hasil Evaluasi Sarana Air Minum Pedesaan di Kabupaten Indramayu. (1983).

37. Sub Project - MCKS Program Indramayu January to December 1983. (353 OTA-33/J-7 West Java Rural Water Supply Project). (July 1983).