

### 3 . Questionnaire

The Study on Comprehensive Groundwater Resources Development  
for Hambantota and Monaragala Districts in the Democratic  
Socialist Republic of Sri Lanka  
(Questionnaire by Preparatory Study Team)

For smooth implementation of our project, we would like to collect the following data and information. Please give answers to the following questions in writing and/or prepare the relevant data and information.

#### 1 . ORGANIZATION AND BACKGROUND OF THE PROJECT

- (1) Is the National Steering Committee for this project at the stage of planning? If yes, show the structure/organization chart.

- Ministry of Irrigation and Water Resources Management
- Ministry of Urban Development Construction and Public Utilities
- Ministry of Finance and Planning
- Water Resources Board
- National Water Supply and Drainage Board
- Irrigation Department
- District Secretary, Hambantota / Monaragala
- Chief Secretary Provisional Council, Hambantota / Monaragala

- (2) Key persons of the counterpart (C/P) team are supposed to be assigned from WRB or NWSDB. Please show the names of the divisions/section where they belong.

General Manager

- (3) Government organization handling the water resource development and supply sector

- Organization chart of Ministry of Irrigations and Power, indicating related divisions, local offices, and functions.
- Organization chart of Water Resources Board (WRB), indicating related divisions , local offices, and functions.

資料 3 - 1

- Organization chart of The National Water Supply and Drainage Board (NWSDB), indicating related divisions, local offices, and functions.

資料 3 - 2

- Relationship of the above Agencies.

WRB and NWSDB exchange data.

## 2 . GENERAL, LAWS, REGULATION AND OTHERS

- (1) Are there the laws, regulations, and procedures for employing local consultants? Does this require a fixed period for each process?

By advertising in news papers

- (2) Standards for design and waterworks.

What kind of standard(s) do you apply for civil, building, piping, electricity, instrumentation and machinery work?

Sri Lankan Standards

- (3) Have you any criteria like the US Standard (AWWA) or Japan Standard (JWWA) for material?

Sri Lankan standards

- (4) What kind of standard for potable water quality and what quality testing method do you use in Sri Lanka?

Sri Lankan portable water quality standards

- (5) Latest tariff table of waterworks in the project area.

資料 3 - 3

- (6) Are topographical maps and geological maps of the proposed district available?

Yes

(7) For the JICA Study team

- Daily rate for sedan type car and 4WD car rental.

Rs. 454 / km

- Fuels costs for Diesel and Gasoline.

Gasoline Rs. 95 / litter

- Wages for a Secretary, Typist, Driver, and Worker working as support stuff.

Secretary Rs 12,000

Typist Rs 10,000

Driver Rs 8,000

Worker Rs 6,000

### 3 . PRESENT WATER SUPPLY CONDITION

(1) Please explain what kind of water purification method is adopted in Sri Lanka.

Filtration and Chlorination

(2) Are personnel training programs executed especially for the training of operator and maintenance staff?

Yes

(3) Are there maintenance records/checklists for major facilities and equipment? Are in- house training courses carried out using such documents?

Yes

(4) Are the chemicals used for the filtration plant? Please explain the purity, testing ,and the storage procedures for those chemicals.

Yes 資料 3 - 4、 3 - 5、 3 - 6

(5) Where are machine services available in Sri Lanka?

(6) Which is responsible organization for maintenance after construction. NWSDB or local village?

Both NWS DB and local village

(7) Information of present water supply services such as service area, service population, water demand, per-capita consumption, water tariff structure, service ratio, and number of staffs.

Common tariff structure

(8) Financial condition of organization handling water supply including the revenue and expenditure with category breakdown for the past five years for the WRB, NWSDB, and Local Government of Hambantota and Monaragala Districts

(9) Information on the existing water supply system as follows :

- Location of intake facilities
- Location of wells
- Location of pump facilities
- Capacity and structure of water storage

#### 4 . PROCUREMENT OF MACHENARY, EQUIPMENT, ELECTRICAL EQUIPMENT AND SPARE PARTS

##### 4 - 1 Planning for Water Supply

(1) Please give a list of major materials produced in Sri Lanka and the equipment to be used for this project.

- Drilling machines, compressors, accessories
- Geophysical equipment
- Vehicles
- Well construction materials
- (PVC, foam, gravel, cement, etc.)

Major materials produced in Sri Lanka- PVC, gravel, cement. Other equipment to be imported.

- (2) Please explain the existing organization and/or the institute related with a remote sensing data analysis in Sri Lanka.

Survey Department, Meteorological Department

- (3) Please explain the stability of electrical power supply. Does the power supply for the filtration plant and pump facilities come from two sources ?

Main supply 220V 50Hz

Generator 220V 50Hz

#### 4 - 2 Planning for Arrangement of Drilling, Tools and Machinery

- (1) List of local companies

(Name, representatives, telephone, and facsimile, and address)

- a. Drilling company
- b. Geophysical exploration companys
- c. Construction company
- d. Dealers of drilling tools and materials
- e. Rig machine makers
- f. Pump dealers
- g. Dealers of tools and materials for constructing wells.
- h. Car dealers and rent a lease services
- i. Topographic survey company

資料 3 - 7

- (2) Tools and machinery held in stock by concerned Government agencies

(List of tools and machinery, quantities, dates manufactured, specifications)

- a. Rig machine
- b. Vehicles
- c. Pumping test equipment
- d. Geo-physical exploration and logging equipment
- e. Water quality analysis equipment
- f. Maintenance garage

資料 3 - 8

(3) Groundwater development agencies

- a. Organization chart
- b. Number of personnel and engineers

1 . Water Resources Board
Hydrogeologist      - 5
Geologist           - 8
Engineer            - 3
2 . NWS DB

(4) Cost of groundwater development

- a. Well construction, operation and maintenance
- b. Submersible pump, installing pipe

Well construction   Rs. 2,250/m
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5 . GROUNDWATER AND GEOLOGY

(1) Geological map Whole of Sri Lanka Study area Hydrogeological map

- a. Whole of Sri Lanka
- b. Study area

(2) Contour map of piezometric level and its fluctuation concerning :

- a. Drainage basin related to Study area
- b. Piezometric level recent and past
- c. Location map of observation station
- d. A secular change

(3) Geological exploration data concerning the Study area

- a. Report on drilling, test and construction work of boreholes
- b. Pumping test data

(4) Data of drilling and test for wells in and around the Study area

- a. Location map of existing wells
- b. Specification of wells
- c. Monitoring data

d. Discharge ratio

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(5) Laws, regulations, standards and water right to the groundwater development and construction

資料 3 - 8

## 6 . SURFACE WATER

(1) Basin and river conditions in the Study area

a. River, canal, lake and marsh network

b. Catchment area, river length, river width, gradient discharge capacity, runoff records, water quality, sediment data, etc.

a.1 Walawe Ganga

Length 138km, Catchment 2471km<sup>2</sup>

a.2 Manik Ganga

Length 114km,

a.3 Kumbukanoya

Catchment 1233km<sup>2</sup>

a.4 Kirindioya

Length 117km

a.5 Wilaoya

Catchment 490km<sup>2</sup>

a.6 Hedaoyaq

Catchment 611km<sup>2</sup>

(2) Inventory of springs in the Study area

a. Location map of springs

b. Discharge volume and discharge strata

(3) Inventory of existing, on going and proposed facilities and projects for surface water development and management in the study area

a. Dam

b. Reservoir

c. Canal

- d. Gate
- e. Surface water intake
- f. Others

(4) Laws, regulations, standards and water right to the surface water development and management

資料 3 - 9
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## 7 . CONSULTANTS, SURVEY COMPANY AND LABORATORIES

(1) List of consultants and survey companies which are capable for conducting a study together with JICA full-scale study team

(Name, representatives, telephone and facsimile number, and address)

- a. Engineering services including waterworks design
- b. Topographic survey.
- c. Geological and/or Hydrogeological investigation for boring test
- d. Environmental Impact Assessment (EIA)

(2) List of laboratories which are capable for water quality test

(Name, representatives, telephone and facsimile number, and address)

(3) Unit price of topographic survey

(4) Unit price of Geological and/or Hydrogeological investigation for boring test

- a. Senior Engineer (per month)
- b. Engineer (per month)
- c. Assistant Engineer (per month)
- d. Secretary (per month)
- e. CAD operator (per month)
- f. Driver (per month)
- g. Labor and foreman (per day)

(5) Unit price of water quality test

- a. Senior Engineer (per month)
- b. Engineer (per month)



- c. Assistant Engineer (per month)
- d. Secretary (per month)
- e. CAD operator (per month)
- f. Driver (per month)
- g. Labor and foreman (per day)

(1) ~ (5) 資料 3 - 10

## 8 . DEVELOPMENT PLAN

- (1) List and major issue of National Development Plan including water supply development plan.

資料 3 - 11

- (2) List and major issue of Development Plan regarding Hambatota and Monaragala Districts.

- (3) Water supply and sanitary sector development plan and situation of budgetary arrangement for implementation.

## 9 . ACTIVITIES OF OTHER DONERS IN HAMBATOTA AND MONARAGALA DISTRICTS

- (1) List and progress of other water development/supply projects under implementation or planed in near future with assistance of other donors.

- (2) List of projects implemented by Water Resources Board in last 5 years (project name. cost. source of fund ).

資料 3 - 12

## 10 . OTHER RELATED INFORMATION

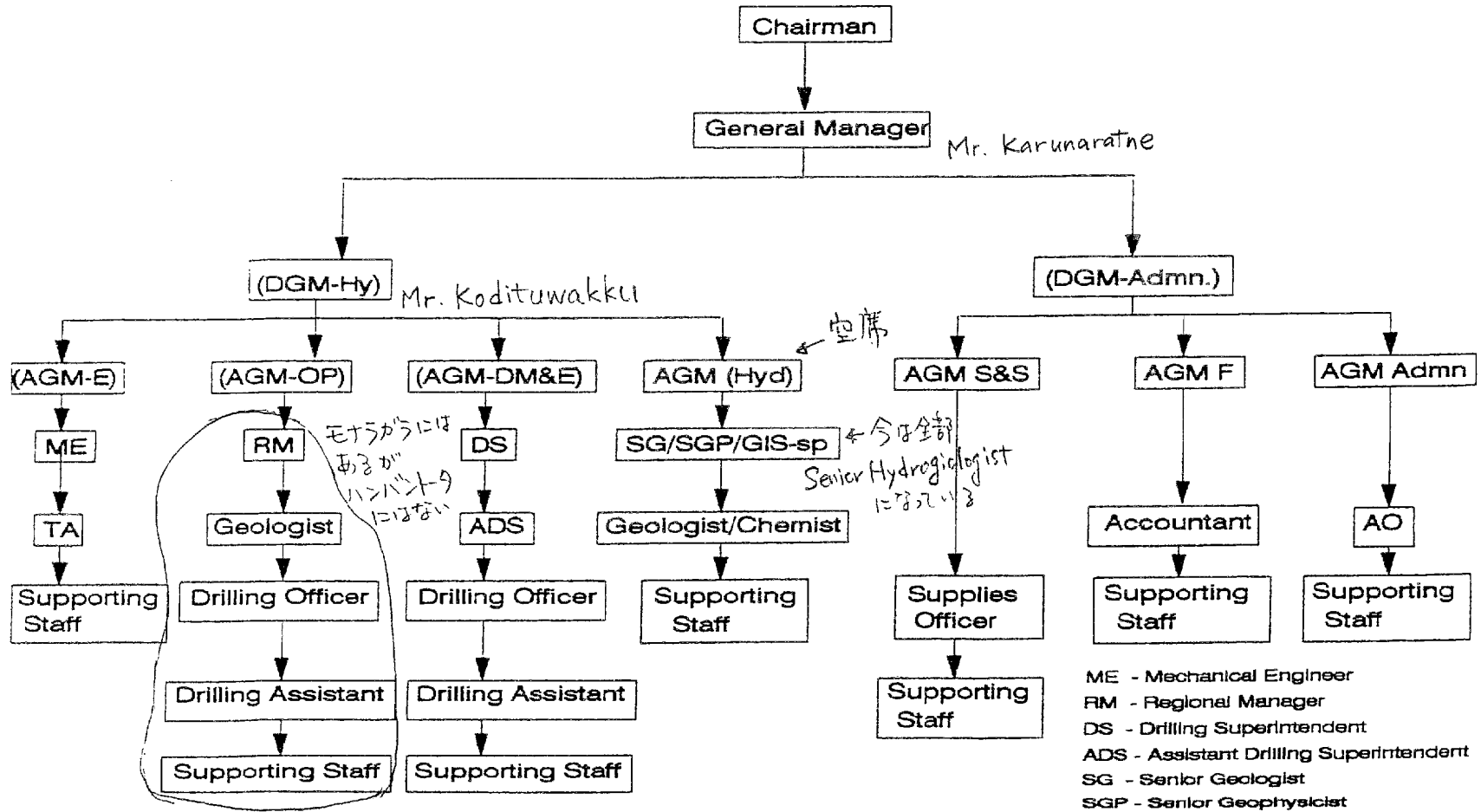
- (1) Population – Record and forecast of population at each community in Hambantota Monaragala Districts.

- (2) Sewerage and Sanitation – Existing sewerage system in Hambatota and Monaragala Districts  
– Other sanitation system

- (3) Other Infrastructure (Service ratio or condition of infrastructure development) – Transportation  
– Electricity Supply , – Telecommunication – Education

- (4) Economic Index – Land use – Gross National Products and Gross Domestic Products – Number of labor and product amount of major industries – Average income and expenditure per person  
– Inflation rate
  
- (5) Sanitary and Hygienic Condition – Major disease in past decade. for adult and infant – Major cause of death in past decade. for adult and infant – Average expect life period – Mortality rate of infant  
– Number of hospitals, public health offices. clinics
  
- (6) Administrative Boundary map

ORGANIZATION CHART - WATER RESOURCES BOARD

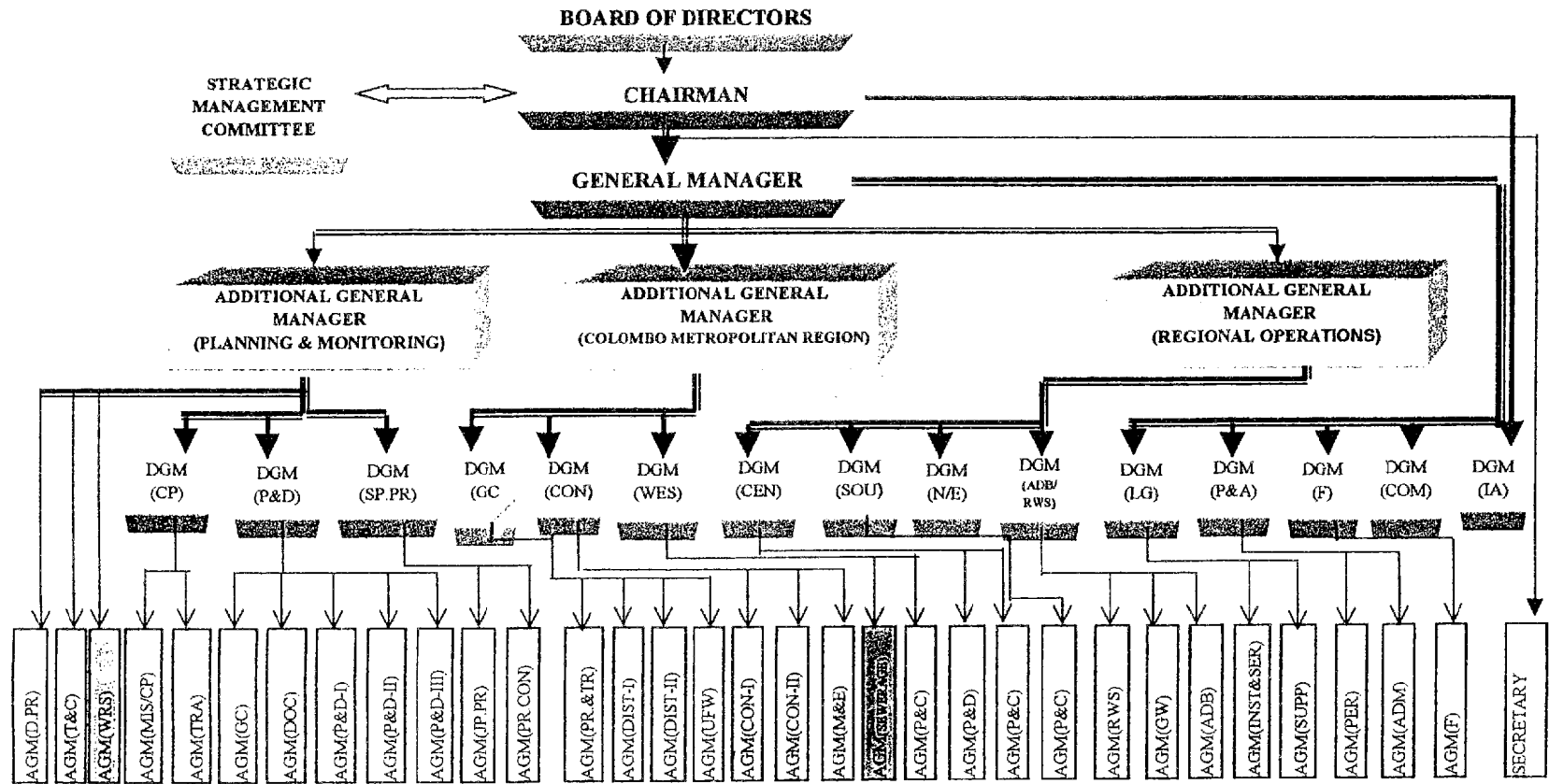


ME - Mechanical Engineer  
 RM - Regional Manager  
 DS - Drilling Superintendent  
 ADS - Assistant Drilling Superintendent  
 SG - Senior Geologist  
 SGP - Senior Geophysicist  
 AO - Administrative Officer

OP Operation  
 DM&E Drilling Maintenance & Engineering

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# NATIONAL WATER SUPPLY & DRAINAGE BOARD ORGANISATION STRUCTURE



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The Gazette of the Democratic Socialist Republic of Sri Lanka

EXTRAORDINARY

අංක 1089/12 — 1999 ජූලි 21 වැනි බදද — 1999.07.21

No. 1089/12 — WEDNESDAY, JULY 21, 1999

(Published by Authority)

PART I : SECTION (I) — GENERAL

Government Notifications

NATIONAL WATER SUPPLY & DRAINAGE BOARD LAW, No. 02 OF 1974

Notice under Section 84

NOTICE is hereby given in terms of Section 84 of the National Water Supply & Drainage Board Law, No. 02 of 1974. That the following tariffs will be charged with effect from the bill for the month of August 1999, from all the consumers supplied with water from the water supply schemes of the National Water Supply & Drainage Board.

This notice replace with effect from 01.08.1999, the notice appearing in the *Gazette Extraordinary* No. 1016/20 dated 27th February, 1998 in respect of the water tariffs applicable to all consumers who are supplied with water by the National Water Supply & Drainage Board.

Dr. N. S. K. N. DE SILVA,  
Chairman.

National Water Supply & Drainage Board,  
Ratmalana,  
14th July, 1999.

TARIFF 01

DOMESTIC TARIFF

(i) This tariff shall apply to supplies of water provided for domestic purposes in private residences, Government Quarters and Government Schools.

(ii) The monthly charges for supply under this tariff shall be—

- For the first 10000 litres inclusive of services charge at Rs. 35.00
- For consumption in excess of 10000 litres up to 20000 litres at Rs. 2.75 per 1000 litres.
- For consumption in excess of 21000 litres up to 25000 litres at Rs. 9.50 per 1000 litres.
- For consumption in excess of 26000 litres up to 30000 litres at Rs. 18.00 per 1000 litres.
- For consumption in excess of 31000 litres up to 40000 litres at Rs. 20.00 per 1000 litres.
- For consumption in excess of 41000 litres up to 50000 litres at Rs. 25.00 per 1000 litres.
- For consumption in excess of 51000 litres up to 75000 litres at Rs. 38.00 per 1000 litres.
- For consumption in excess of 75000 litres at Rs. 40.00 per 1000 litres.

The monthly charge under this tariff for unmetered private residence and Government Quarters shall be Rs. 400.00 per month until meters are fixed, when the metered tariff will be charged.

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PART I : Sec. (I) - GAZETTE EXTRAORDINARY OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA - 21.07.1999

TARIFF 02

CHARITABLE INSTITUTIONS AND PLACE OF WORSHIP IN A RELIGIOUS INSTITUTIONS

(i) This tariff shall be applied to supplies of water to Government approved charitable institutions and place of worship in a religious institutions,

(ii) The monthly charges under this tariff for supplies of water to Government approved charitable institutions shall be Rs. 03.00 per 1000 litres,

(iii) The monthly charges under this tariff for supplies of water for unmetered charitable institutions shall be Rs. 400.00 per month until meters are fixed, when the metered tariff will be charged.

TARIFF 03

NON DOMESTIC TARIFF

(i) This tariff shall supply to supplies of water for all purposes to Commercial, Industrial consumers,

(ii) The monthly charges under this tariff for supplies of water to Commercial Institutions shall be Rs. 30.00 per 1000 litres,

(iii) The monthly charges under this tariff for supplies of water to Industrial Institutions and for the construction purposes shall be Rs. 30.00 per 1000 litres,

(iv) The monthly charges under this tariff for supplies of water to Industries approved by the Board of Investment shall be Rs. 22.00 per 1000 litres,

(v) The monthly charges under this tariff for supplies of water to Tourist Hotels and Guest Houses approved by the Tourist Board shall be Rs. 30.00 per 1000 litres,

(vi) The monthly charges under this tariff for supplies of water to Shipping purposes shall be Rs. 120.00 per 1000 litres,

(vii) The monthly charges under this tariff for supplies of water to other Commercial and Private Institutions shall be Rs. 30.00 per 1000 litres,

(viii) The monthly charges under this tariff for supplies of water for unmetered Commercial, Industrial, Industries approved by the Board of Investment, Construction purposes, Tourist Hotels, Shipping and Private Institutions shall be Rs. 3,500.00 per month until meters are fixed when the metered tariff will be charged.

TARIFF 04

GOVERNMENT INSTITUTIONAL TARIFF

(i) This tariff shall apply to supplies of water for all purposes to Government Institutions,

(ii) The monthly charges for supplies of water under this tariff shall be Rs. 30.00 per 1000 litres,

(iii) The monthly charges for supplies of water for unmetered Government Institutions shall be Rs. 3,500.00 per month until water meters are fixed when the metered tariff will be charged.

TARIFF 05

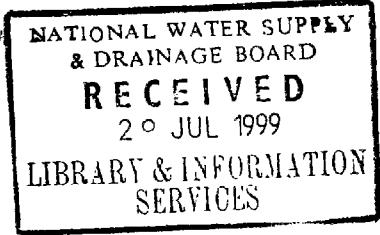
STAND POST AND GARDEN TAPS

(i) This tariff shall apply to supplies of water for distribution of public stand post and garden taps.

(ii) The monthly charges under this tariff shall be Rs. 5.00 per 1000 litres.

*Services Charges.*—In addition to the above stated rates a services charge for all nondomestic consumers will be levied per month on the diameter of the service connection, and would be as given below.

<i>Diameter of connection</i>	<i>Service charge for the month</i> Rs.
1/2"	60.00
3/4"	120.00
1" to less than 2"	240.00
2" to 3"	600.00
Above 3"	1,200.00



*Defective meters.*—If a meter is found to be out of order or if it is removed for repairs or alteration, the consumption of water during the time the meter was out of order or services rendered without a meter shall be calculated according to the average rate of daily consumption obtained during the period between any two successive readings immediately preceding the time the of the removal of meter or time the meter was defective.

MISCELLANEOUS CHARGES AND CONDITIONS

1. *New Service Connections.*—The cost of providing new connections will be levied from the consumer.

2. *Testing of water Meters at the request of consumers.*—The fee for testing of water meters at the request of the consumers shall be determined by the General Manager of the National Water Supply & Drainage Board on costs incurred for the testing of such meter. This fee will be refunded if the error in recording the consumption is in excess of 2%.

3. *Incentive for Prompt Payment.*—Consumers paying their water bills within 14 working days from the date of the bill given a rebate of 2% of the value of the bill. Arrangements could be made for consumers to deposit money with the Board in advance to meet the cost of water bills. A 4% rebate will automatically apply on water bills as long as sufficient deposits are available to meet the current water bill.

4. *Surcharge for delay in payment.*—Consumers should pay bills within a period of 14 days. If the consumer fails to settle the water bill within a period of 30 days from the date of submitting a bill, additional charge of 2.5% per month on the balance outstanding shall be made from date the bill was served.

5. *Disconnection of Service Connection.*—The General Manager of the National Water Supply & Drainage Board shall have the power of disconnect the service connection of consumers who are in arrears of payment of bills after period of 30 days.

6. *Re-connection Fee.*—The fee for re-connecting the supply after the supply has been disconnected shall be determined by the General Manager of the National Water Supply & Drainage Board on the cost incurred for such re-connections.

7. *Violation of Regulations.*—If any regulation under which the supply has been provided is violated by any consumer action will be taken under the provisions of National Water Supply & Drainage Board Act.

08-75/1

### *13. Operation and Maintenance*

Adequate operation and maintenance is essential to ensure the good functioning of the gravel filters. The procedures which have been developed are easy in their execution and do not require special equipment or highly qualified staff. Staff does require however, adequate training and a working environment which fully supports and respects them and stimulates them to carry out their important task which ensures the provision of good quality water to the community. This section presents the different operation and maintenance procedures involved in the maintenance of dynamic filters and upflow roughing filters. Procedures for the other systems are not presented because the URF alternative is being considered as the most promising and maintenance procedures of the other systems are rather similar.

#### **13.1 The operator's role**

To enable the operator of the system to carry out his maintenance tasks, adequate support from the organization responsible for the system and from the community is required. This implies that good communication needs to be established between the different parties involved. Furthermore, it is particularly important that the community is well informed about possible interruptions of the water distribution resulting from repairs or maintenance activities.

The work of the operator needs to be facilitated by the establishment of a detailed schedule of key activities and their frequency. Although the general activities involved in the operation and maintenance of the systems will not differ very much, their frequency can be affected by the quality of the water and the local conditions. This makes it necessary to develop individual schedules for each plant. These schedules need to be developed together with the operator and the responsible organization, and needs to be reviewed regularly on the basis of plant performance. The performance of the pilot units and the full scale plans in Colombia show that better results can be obtained if the maintenance activities are carried out on a regular basis. Often the tasks of the operator includes other activities outside the treatment system for example, in the inlet structure, the distribution system and may also include the collection of water tariffs and the support to the administrative body. Almost always such other activities can be carried out by the operator as they do not interfere much with maintenance tasks proper to the functioning of the system. These tasks also bring the operator in close contact with the community and will permit to establish good communication and facilitate the exchange of information between the operator and the community about interruption in the systems, repairs, problems in the distribution network, and satisfaction of the consumers about the water quality. To specify the activities of the operator, these have been broken down in activities which have to be carried out daily, weekly, monthly and occasionally.

#### **13.2 Daily tasks**

The daily tasks of the operator are very much focused on ensuring adequate operation of the system keeping it clean and checking different aspects to ensure that the small changes in headloss and flow velocities which may occur during normal operation are being detected so that an adequate response can be given. Floating material in the supernatant water of the



roughing filter has to be removed whenever this is present as this will avoid possible blockages of the system and makes the visual outlook of the plant more pleasant. The level of clogging of the DyRF needs to be checked by measuring the outlet flow from the unit. This flow needs to be larger or equal to the minimum flow which still guarantees adequate water supply for the community. A smaller value implies that the unit needs to be cleaned immediately. Larger values than 1.4 times the minimum design flow are also to be avoided as this will mean that the unit may be operating at a lower efficiency level. Dynamic filters in pumped schemes however may be operated differently to ensure that they continuously produce the design flow. This requires gradually opening of the outlet valve to compensate for the increase in the resistance in the filter bed.

In each of the roughing filter lines the rate of filtration has to be checked by measuring the output of the units to ensure that it is not over the design rate. The installation of an overflow weir and a flow indicator D, are adequate systems to control the flow and facilitate the work of the operator (figure 13.1). In Annex 1 these instruments are shown in detail. When the rate of filtration is above the design rate, valve B needs to be closed somewhat to ensure that part of the inflowing water is wasted over the overflow weir A.

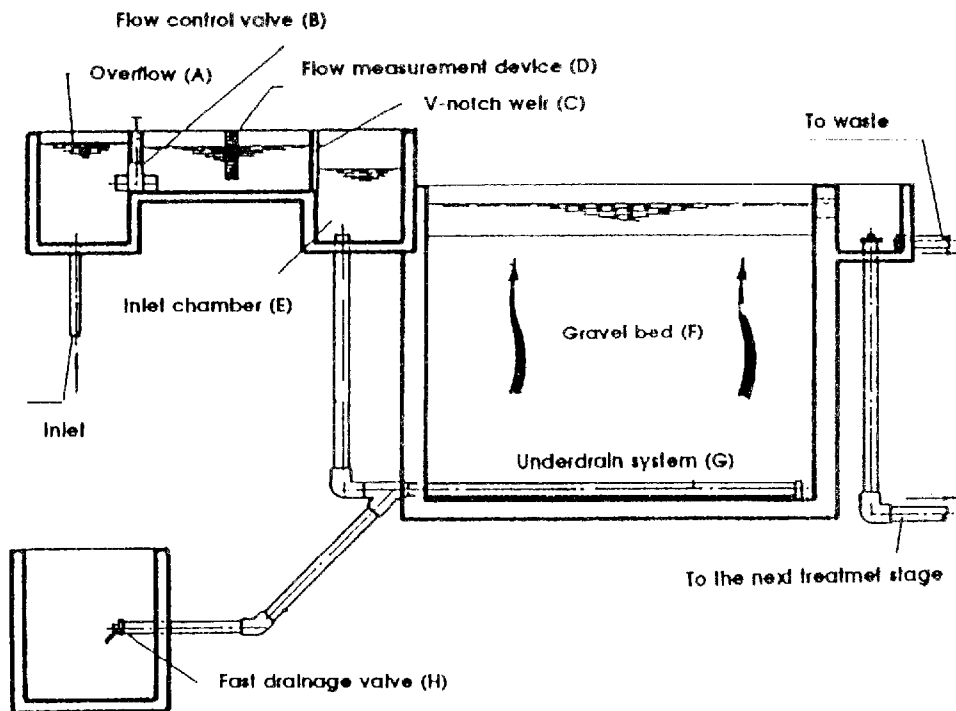


Figure 13.1. Upflow roughing filter in layers

Checking the headloss in the roughing filter will permit a decision to be taken about the cleaning frequency. The headloss can be observed by checking the water level in the inlet

### 13.4 Monthly operation

For the DyRF there are no real additional tasks to be fulfilled on a monthly basis. The monthly tasks in the roughing filters comprise: cleaning of the surface layer of the gravel bed, manipulation of the fast drainage valve 10 times, and subsequent drainage of the unit. These tasks may involve the operator for approximately half a day. The cleaning of the surface layer is carried out while the filter is operating under the design flow. The water however is not passed on to the subsequent unit, but wasted, as it comprises a lot of suspended solids and other impurities. The gravel in the surface layer is moved about from one side to the other to ensure adequate cleaning. This activity is ended when a visual inspection shows that the outflowing water and inflowing water are approximately of the same quality. Then the inlet and outlet box are cleaned. Subsequently, the fast drainage valve is being manipulated and the filter is drained. The draining is stopped when the quality of the drainage water shows a marked improvement. Then the inflow is re-opened until the filter is filled up completely and the process of hydraulic cleaning by opening the fast drainage valve 10 times can be repeated.

### 13.5 Occasional operation

Once the blockage of the filter media in the roughing filters or the DyRF is such that normal cleaning does not recuperate the initial headloss and allows the unit to operate on the designed rate of filtration, then it will be necessary to remove the gravel from the box and clean it outside the unit. Whether this activity is required depends very much on the efficiency of the weekly and monthly cleanings and should be avoided as much as possible because it is a costly and laborous process. For the DyRF, this task is less costly and laborous because the volume of gravel is much smaller than in the roughing filters. When this type of cleaning is required it is very important to handle the gravel with care in order to avoid the mixing of layers with different grain size. Such mixing will otherwise very much reduce the sludge volume which can be retained in the gravel layer. If mixing occurs then the gravel needs to be graded again before replacing it in the unit.

When the raw water quality deteriorates particularly due to an increase in suspended solids, the DyRF filter will very much protect the subsequent unit from excessive loads in suspended solids. Nevertheless, under these conditions the operator has to be alert and more frequently check the quality of the water flowing in and out of the different treatments units. If quality deteriorates it may be necessary to ensure the continuation of the flow through the units at a lower rate to avoid the interruption of the biological processes. Reduction of the flow velocity may be particularly necessary when the DyRF is fully blocked and peak turbidities are still present in the raw water. Another reason for reducing the flow is the quality of the outflowing water. The DyRF may not clog fully but still the water flowing to the next unit may show an increase in the level of turbidity. If this level exceeds 25 NTU, at the inlet of the slow sand filter then the operator has to reduce the filtration rate in the slow sand filter and the pre-treatment units with 50%. If even after this reduction turbidities are being presented over 25 NTU, a further reduction to 25% or in extreme cases 10% of the designed filtration rate is required. In the extreme the full treatment plant needs to be shut down. It needs however to be realized that the biological processes in the system will be affected and as a result re-establishing good quality effluent will take one to two days. It is therefore

structure E. This level will increase day by day until it reaches the level of the overflow. Then cleaning will be required to bring the headloss back to the initial level. Cleaning of the unit needs to be realized weekly unless the headloss development is quicker. This then needs to be done immediately. If headloss is not being restored after washing then this may be due to one of the following reasons:

- a. Entering of air in the drainage system
- b. Inefficient washing
- c. Full obstruction of the filter media

The cases a and b can be restored by draining the filter again. If however, the filter is fully blocked then new drainage will not solve the problem and only the full washing by taking out the gravel can then restore the initial headloss. This work needs to be discussed with the community as it involves a great deal of labor.

The operator needs also to carry out activities related to quality control of the water. This can be done by simple equipment for measuring turbidity, PH and residual chlorine. Daily checking of the water turbidity and registering it in a log book is essential. This information will permit the detection of operational problems in the units and will help in the decision making about modifications in the system.

### 13.3 Weekly operation

In most schemes the weekly routine will include the cleaning of the roughing filters and the dynamic filters. Cleaning of the DyRF comprises basically of the cleaning of the surface layer of the gravel. This cleaning is an easy task which usually only takes some 30 minutes. In this work it is important not to mix the fine gravel layer on top with the coarser gravel deeper in the bed. Therefore, the installation of a plastic wire mesh between the coarse and the fine gravel is very useful to help the operator to do a good job. Under normal conditions the DyRF needs cleaning once a week. During the rainy season or for sources which carry a high load of suspended solids the cleaning frequency may have to be increased to two or three times per week.

The cleaning of the URFL consists in draining the units after having opened and closed the fast drainage valve several times. Experience on pilot scale and in full scale plants has shown that opening the valve some 8 times within 10 seconds produces the best results. This was amongst others identified in the project "Hydraulic Cleaning of Roughing Filters" implemented with support of IDRC. The inlet to the roughing filter (I, Figure 13.1) needs to be closed before the fast drainage valve is being manipulated to ensure the highest impact of the opening and closing of the valve and avoid the entrance of air in the gravel bed.

In the weekly tasks, cleaning of the plant site needs to be included and particularly of those components where materials may settle such as inlet and outlet boxes. In the inlet box sludge is usually accumulated and in the outlet structure algae may grow. Keeping the plant site and the structures as clean as possible is important to establish a pleasant and professional environment which will raise the confidence of consumers.

資料 3 - 6 (1)

necessary to avoid wherever possible the complete shut down of the plant.

In case the water flow in the plant is being reduced it needs to be explored if the users need to be advised. This will be the case if as a result of the lower production of water, consumption has to be reduced. Experience will have to show the operator under which conditions it will be important to advise the community. It may however be obvious that if the full plant is being shut down then the consumers need to be informed preferably before hand so they can store some water in their homes and furthermore, they have to be advised not to use the water for drinking without boiling it a few days after the system is put in operation again. Advising the community can for example be done with help of the water committee.

### 13.6 Work plan

In each treatment system a work plan has to be established for the different activities together with the operator. Tables 13.1 and 13.2 give examples of the tasks of the operator related to the DyRF and URFL.

Table 13.1 Operators tasks in Dynamic Roughing Filtration

Frequency	Activity
Dynamic Filter	- Check the level of clogging
Daily Tasks	- Measure the quality of water at the intake - Register the water quality
Periodic Tasks	- Realize the cleaning of the filter media <ul style="list-style-type: none"> <li>* Close the outlet valve</li> <li>* Open the inlet valve further to obtain the flow velocity for cleaning</li> <li>* Rake the surface of the filter media in the direction opposite to the flow to re-suspend the settled material</li> <li>* Move about the first 20 cm of the gravel layer with a spade</li> <li>* Stop the inflow</li> <li>* Quickly open and close the fast drainage valve 10 times; thereafter leave it open until the quality of the drainage water shows a marked improvement</li> <li>* Close the drainage valve</li> <li>* Re-establish the inflow</li> <li>* Open the outlet valve</li> </ul> <p>NOTE: In the dry season this labor needs to be done weekly and in the wet season frequency may have to be increased to two or three times per week depending on the local conditions</p>
Occasional Tasks	- Cleaning of the filter by removing the gravel. If possible carry out a normal cleaning procedure; thereafter close all valves and open the drainage valve to fully empty the filter <ul style="list-style-type: none"> <li>* Remove the gravel layer avoiding mixing of the different gravel sizes.</li> <li>* Wash the gravel layers separately</li> <li>* Reinstall the gravel in the original position</li> <li>* Restart the flow in the units</li> </ul>

資料 3 - 6 (2)

Table 13.2 Operator Tasks in Upflow Roughing Filtration

Frequency	Activity
Daily Tasks	<ul style="list-style-type: none"> <li>- Check the water flow in each unit</li> <li>- Remove floating material</li> <li>- Measure water quality in the inlet and the outlet of each unit</li> <li>- Register the water quality data and other possible observations</li> </ul>
Weekly Tasks	<ul style="list-style-type: none"> <li>- Clean the inlet and outlet box ensuring that the wash water is being wasted through the overflow</li> <li>- Implement the weekly cleaning of the roughing filter                             <ul style="list-style-type: none"> <li>* Close the inlet flow to the unit</li> <li>* Insert the stop in the inlet pipe</li> <li>* Open and close the fast drainage valve 8 to 10 times within some 10 seconds</li> </ul> </li> <li>- Drain the water until a marked improvement in the quality of the drainage water is being observed</li> <li>- Close the valve, re-establish the flow in the filter by removing the stop and opening the inlet valve</li> </ul>
Monthly Tasks	<ul style="list-style-type: none"> <li>- Carry out the monthly cleaning of the filter                             <ul style="list-style-type: none"> <li>* Block the flow to the subsequent units</li> <li>* Move the first 20 cm of the gravel layer about with a spade until the visual quality of the inflowing and overflowing water is similar</li> <li>* Clean the inlet and outlet box ensuring that the water is wasted through the overflow</li> <li>* Close the inlet valve and insert the stop in the inlet pipe</li> <li>* Quickly open and close the fast drainage valve 10 times and drain the unit until the quality of the drainage water shows a marked improvement</li> <li>* Close the valve and re-fill the unit</li> <li>* Repeat the process of opening and closing the fast drainage valve and draining of the unit</li> <li>* Re-establish normal operation</li> </ul> </li> </ul>
Occasional Activity	<ul style="list-style-type: none"> <li>- When the quality of the inflowing water deteriorates as a result of a temporary peak load, the flow to the filter needs to be reduced or stopped</li> <li>- Cleaning of the inlet pipe to the filter using a brush</li> <li>- Full cleaning of the gravel layer by removing the gravel and cleaning it outside the filter box. In this operation care has to be taken not to mix the different gravel layers.</li> </ul>

**4. PROCUREMENT OF MACHENARY, EQUIPMENT,  
ELECTRICAL EQUIPMENT AND SPARE PARTS**

4 -(1) Equipment to be used for this project

- Drilling Machines, Compressors,  
Accessories
- Geophysical Equipment
- Vehicles
- Well Construction Materials ( PVC,  
Foam, Gravel, Cement .etc)
- \* Major materials produced in Sri Lanka -  
PVC, Gravel, Cement. Other equipment to  
Be imported

4 -(2) Survey Department, Meteorological  
Department

4 -(3) Main Supply 220v 50 Hz  
Generator 220v 50 Hz

4 -(2) Planning for Arrangement of Drilling,  
Tools and Machinery

a. Drilling Organizations

1. Water Resources Board  
2A.Gregory's Avenue  
Colombo 7. Tele 01-694835  
Fax 01-696910
2. National Water Supply  
and Drainage Board

POB.14,Galle Road  
Ratmalana. Tele 01-635281-3  
Fax 01-636449



d .Dealers of drilling tools and materials

1. Ceylon Supply and development co  
Operation pvt ltd,  
Senanayake bulding,  
7 Station road,  
Colombo - 3  
Tel - 01 - 574511-5  
Fax - 573673

e.Rig machine dealers Refer 4 -2f

f. Pump dealers 4-2 f

g. Dealers and tools and materials for  
constructing wells.

1. Ceylon supply and development  
co - op, Senanayake building, 7  
station road, Colombo - 3  
Tele 01-574511-5  
Fax 01-573673
2. Tozai Boeki Kaisha Ltd.  
21.Abdul Caffoor Mawatha,  
Colombo 3.  
Tele 01-575792  
Fax 01-574378

h. Car dealers and rent a lease services 4-2h



資料 3 - 7 (4)

Dealers of Drilling Tools and Materials spare parts  
for Drilling Rigs and Compressors including Hammers, Bits, Air Filters

1. Swedish Trading Co. Ltd.  
191, Galle Road,  
Mt. Lavinia  
Tel: 722677/8 738694/5
2. Dax Engineering Co. (Pvt) Ltd.,  
97, Galle Road,  
Colombo 3.  
Tel: 445585
3. K.C. Heavy Equipment Spares Co.  
85/1, Sirimavo Bandaranayake Mw.  
Colombo 14.  
Tel: 434098
4. Lanka Development Network (Pvt) Ltd.,  
60, S. de S Jayasinghe Mawatha,  
Kohuwala.  
Tel: 824775-6 , 822034
5. Damini International  
362/1, Sri Sangaraja Mawatha,  
Colombo 10.  
Tel: 343344-5
6. Ceylon Supply & Development Co. Ltd.,  
No. 07, Station Road,  
Colombo 3.  
Tel: 574511-5
7. KST Impex  
F 70, People's Park,  
Gas Work Street,  
Colombo 11.  
Tel: 422660 / 437327
8. M/s Speedex International  
33, Abeyasingharama Road,  
Colombo 10.  
Tel: 478463
9. Access International (Pvt) Ltd.  
278, Union Place,  
Colombo 2.  
Tel: 302302
10. Tozai Koeki Kaisha Ltd.,  
Liasion Office,  
21, Abdul Gaffoor Mawatha,  
Colombo 3.  
Tel: 575192
11. Central Bearing (Pvt) Ltd.,  
133, Panchikawatta Road,  
Colombo 10.  
Tel: 454555
12. Consolidated Bearings & Supply  
29/1, Bristol Street, Ltd.,  
Colombo 01.  
Tel: 448165
13. Sparklit Motor Trades &  
Engineering Services (Pvt) Ltd.,  
Kandy Road,  
Kadawatha  
Tel: 925209
14. Supuman Intrex  
85-18, Jawatte Road,  
Colombo 05.  
500424

13.12.00

RSW/sp

資料 3 - 7 (5)

BENTONITE CLAY

1. Lloyd's Steel  
147 - 147 A,  
Srimath Bandaranayake Mawatha,  
Colombo 12.  
Tel: 328203 / 470206
2. Swastik Chemicals (Pvt) ltd.,  
No. 17 A, Abdul Jabbar Mawatha,  
Colombo 12.  
Tel: 326493 / 324779
3. Lanka Development Network (Pvt) Ltd.,  
No. 60, S. De Jayasinghe Mawatha,  
Kohuwala.  
Tel: 824775-6 / 822034
4. M/s Lanka Kect (Pvt) Ltd.,  
No. 24, 10th Lane,  
Colombo 3.  
Tel:
5. Ceylon Supply & Development Co. Ltd.,  
"Senanayake Building",  
No. 07, Station Road,  
Colombo 3.  
Tel: 574511-5
6. Kannan & Co.,  
182, Bankshall Street,  
Colombo 11.
7. Cambridge Traders  
22 E, Quarry Road,  
Colombo 12.  
Tel: 432187 / 422206
8. Y.S.G.P. Pandian & Co.,  
291, Old Moor Street,  
Colombo 12.  
Tel: 448072 / 325833

15.12.2000

RSW/sp

資料 3 - 7 (6)

PVC Pipes

01.	Central Industries Ltd., 10 - 1/1, Albert Crescent Colombo 07	-	677286
02.	Duro Pipe Industrial (Pvt)Ltd., 307, George R.de.Silva Mawatha, Colombo 13.	-	440759
03.	St.Anthony's Industries Group (Pvt) Ltd., 510, Sri Singarajah Mawatha, Colombo 10	-	320622-4
04.	S-Lon Lanka (Pvt) Ltd., 330, T.B.Jayah Mawatha, Colombo 10.	-	698491,696871-6
05.	Industrial Plastics (Pvt) Ltd., 330, T.B.Jayah Mawatha, Colombo 10	-	698491

資料 3 - 7 (7)

Engineering Tools  
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01.	Lanka Development Network (Pvt) Ltd., No. 60 S.de.S.Jayasinghe Mawatha, Kohuwela.	-	824775-6
02.	A.C.Paul & Co.Ltd., 324 -326, Sri Sangaraja Mawatha, Colombo 10.	-	431018/9
03.	Mercantile Engineering Tools (Pvt) Ltd., 332/A, Sri Sangaraja Mawatha, Colombo 10.	-	440304,433950
04.	Overseas Quanlitoools (Pvt) Ltd., 354, Sri Sangaraja Mawatha, Colombo 10.	-	443213
05.	Hunter & Co.Ltd., 130, Front street, Colombo 11.	-	328171
06.	Brown & Co.Ltd., 481, T.B.Jayah Mawatha, Colombo 10	-	326701
07.	Building Materials Corp.Ltd., 541, Sri Sangaraja Mawatha, Colombo 12.	-	326701
08.	General Equipments Ltd., 400, Sri Sangaraja Mawatha, Colombo 12.	-	343822

資料3-7(8)

Hydraulic Hoses/Air/Pressure Hoses, Suction Hoses  
and Fittings

01.	M.I.P.Fernando & Co.Ltd 31, Abdul Jabbor Mawatha, Colombo 12.	-	436339,320638
02.	Swedish Trading Co. Ltd., 191, "Viking House" Galle Road, Mt.Launia.	-	722677/8,738671/5
03.	Mipco Engineer 82, St.Benedict's Mawatha, Colombo 13	-	074-810350
04.	Lanka Kect (Pvt) Ltd., 24, 10th Lane Colombo 03	-	592193/4/5
05.	Damin International 362/1, Sri Sangaraja Mawatha, Colombo 10.	-	343344-5
06.	Ceylon Supply & Development Co.Ltd., 7, Station Road, Colombo 03	-	574511-5
07.	K.C Heavy Equipment Spare, & Co., 85/1, Sirimavo Bandaranayake Mawatha, Colombo 14	-	434098
08.	Sparklit Motor Traders & Engineering Services (Pvt) Ltd., Kandy Road, Kadawata.	-	925204,928977
09.	Krishan Enterprises, 7, Messenger Street, Colombo 12.	-	332428
10.	Aristons (Pvt) Ltd., 36/55, Edmonton Road, Colombo 5	-	825111
11.	K.P.S.Marketing Ltd., 361/1A, Galle Road, Ratmalana.	-	

資料 3 - 7 (9)

Bearings for Drilling Rigs and Heavy Vehicles

01.	Swedish Trading Co.Ltd., 191, "Viking House" Galle Road, Mt.Lavunia.	-	722677/8
02.	Central Bearings (Pvt) Ltd., 133, Panchikawatte Road, Colombo 10.	-	454555
03.	K.C.Heavy Equipment Spare Co., 85/1, Sirimavo Bandaranayake Mawatha, Colombo 14.	-	343344-5
04.	Damin International 362/1, Sri Sangaraja Mawatha, Colombo 10.	-	448317
05.	Consolidated Bearings & Supply Ltd., 29/1, Bristol Street, Colombo 01.	-	448427
06.	Bearing Inn Lanka Enterprises, 234, Kumarage Bldg, Bandaranayake Mawatha, Colombo 12	-	

資料 3 - 7 (10)

Car Dealers

01.	Car Mart Ltd., 424, Union Place, Colombo 02	-	696311
02.	David Peiris Motor Co.Ltd., 75, Hyde Park Corner Colombo 02	-	687167
03.	Premier Automobiles (Pvt) Ltd., 30, Narahenpita Road, Nawala Road, Rajagiriya.	-	875195
04.	Sathosa Motors Ltd., 25, Vaxhall Street, Colombo 02	-	074-712807
05.	Prestige Automobile (Pvt) Ltd., 234-238, Pannipitiya Road, Batteramulla.	-	875666
06.	Stafford Motors Co. Ltd., 718/7, Maradana Road, Colombo 10	-	686841
07.	Toyota Lanka (Pvt) Ltd., 337, Negombo Road, Wattala.	-	939000
08.	United Motors Lanka Ltd., 100, Hyde Park Corner, Colombo 02	-	448112
09.	Assciated Motorways Group., 185, Union Place, Colombo 02	-	433371

資料 3 - 7 (11)

Pump Dealers

Submersible Water Pumps

01.	Lanka Development Network (Pvt) Ltd., 60, S.de.S.Jayasinghe Mawatha, Kohuwela.	-	594646/580450
02.	Lanka Kect (Pvt) Ltd., No. 24, 10th Lane Colombo 05	-	592193/4/5
03.	General Sales Co.Ltd., No. 07, Station Road, Colombo 03.	-	574511-5
04.	Damin International, 362/1, Sri Sangaraja Mawatha, Colombo 10.	-	343344
05.	Hayleys Engineering Ltd., 25, Foster Lane, Colombo 10.	-	687842
06.	M & E Tamkey Engineering 215 D, Galle Road, Ratmalana.	-	731264/5
07.	Swedish Trading Co.Ltd., 191, Galle Road, Mt.Lavunia.	-	738674-6
08.	Komuthi Engineering Services (Pvt) Ltd., 375, D.R.Wijewardena Mawatha, Colombo 10.	-	678986
09.	Onesh Trading (Pvt) Ltd., 127, W.A.D.Ramanayake Mawatha, Colombo 02	-	671435
10.	Dimo Ltd., 65, Jethawana Road, Colombo 14	-	449797

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資料 3 - 7 (12)

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11.	Jinasena Ltd., 4, Hunupitiya Road, Colombo 02	-	448848
12.	De Soysa & Co.Ltd., 810, Maradana Road, Colombo 10.	-	68901
13.	Samuel Sons & Co.Ltd., 164, Messenger Street, Colombo 12.	-	432341