CHAPTER 19 PROJECT EVALUATION

CHAPTER 19 PROJECT EVALUATION

19.1 General

The proposed projects for the expansion of the water supply system in the Greater Kandy and for the development of new sewerage system in the Kandy municipality were evaluated from the viewpoints of the expected benefits and appropriateness/feasibility. The evaluation items were composed of the following: financial, socio-economic, technical, institutional, and environmental.

19.2 Water Supply Project

19.2.1 Financial Aspect

(1) Greater Kandy Water Supply Project (Master Plan)

As shown in Table 17.3, the FIRR is 5.04 percent. As described in Chapter 17, the financial feasibility for the period through to 2050 was confirmed, although it will take time for the cash balance become positive.

(2) Greater Kandy Water Supply (F/S)

As shown in Table 17.3, the FIRR is 2.71 percent. As this is an infrastructure project intended for basic human needs, this number itself can not be judged infeasible. But additional efforts such as an interregional subsidy within the NWSDB or combination with cheaper water from the existing scheme should be considered as other water supply systems are doing. It should also be noted that to stop the project at the end of Phase 1 is not financially effective.

19.2.2 Socio-Economic Aspect

The primary objective of the Project is to ameliorate the social welfare of the population, especially in its initial stage of economic development. A qualitative economic analysis was not possible for this Study due to difficulties in obtaining and assigning meaningful measurements to costs and benefits.

The implementation of the Project will bring the following socio-economic benefits to the population in addition to other tangible benefits such as expansion of the area to be served and a steady supply of safe water;

- Increase of employment opportunity
- Increase in consumer's satisfaction
- Mitigation of fire damages
- Increase in income of the business sectors
- Increase in value-added of the land

It should be noted that the Project was initiated to expand the water supply coverage not only to the Kandy Municipality area but also to the surrounding area of which the development has been limited due to an insufficient water supply from existing water supply systems.

The above mention increase in value-added of the land in the area to be served by the Project will happen only when other infrastructure project are implemented that utilize the benefits afforded by with this water supply project. It should be noted therefore that the water supply project is an integral part of the infrastructure development of the area concerned.

Among several factors which hinder economic growth in developing countries, the introduction of a fiscal budget allocation to remove bottlenecks in infrastructure, development is expected to bring with its positive investment incentives which will benefit the national economy by stimulating investment in the development of industrial estates, etc.

In this respect, the implementation of the Project with the aim of augmenting the water supply capacity to provide for the development of other types of infrastructure, will be vital to securing steady growth of the economy. The implication of this Project should be made within the framework of the national economy in addition to the improvement in health of the population and the pursuit of the philosophy of "some for all, rather than more for some" as adopted at the New Delhi Global Consultation.

19.2.3 Technical Aspect

In the course of planning the Greater Kandy Water Supply System, various kinds of comparative studies with possible alternatives for the location of facilities, structure of the system, construction method, material, process were made to establish the optimum plan of the system. The object of this Study is aimed at energy- and cost-saving, ease of operation and

maintenance of the system and the minimization of environmental impact on the surroundings during and after construction, based on appropriate technologies and in due consideration of the current practices in Sri Lanka. The Project is considered technically feasible.

19.2.4 Institutional Aspect

Although due consideration will be given to the RSC (Central) which is obviously the most appropriate agency to be in charge of the Greater Kandy Water Supply Project during and after its implementation, the NWSDB has sufficient capability to cope with the implementation of the Project with some addition to its existing organization. The Project is considered institutionally sound.

19.2.5 Environmental Aspect

An Environmental Impact Assessment (EIA) of the proposed project was carried out during the course of the Study. The results of this EIA study have highlighted possible environmental impacts which will be made by the implementation of this project. Preventive measures and relevant legislative arrangements are thereby considered to mitigate the anticipated environmental impacts.

As a whole, the proposed project, including the said preventive measures, is determined to have minimal and tolerable impacts to the environment.

Among others, the following preventive measures are included in the scope of the proposed project:

(1) Wastewater from the water treatment plant will be discharged into the Polgolla impoundment after treatment at the sludge lagoons. Most of the solids produced during the treatment processes will not be discharged into the Polgolla impoundment.

(2) An intake mouth structure is employed to avoid the provision of obstacles in the Mahaweli River. It will also enable the construction work to take place without lowering the water level of the impoundment.

19.3 Sewerage Project

19.3.1 Financial Aspect

(1) Kandy Sewerage Project (Master Plan) (refer to Tables 17.5)

As shown in Table 17.5, the FIRR for the Master Plan is 4.42 percent. With a moderate supply of working funds the project is financially feasible and recommendable. However, if a portion of the capital investment should be recovered with a monthly fee, the situation will be drastically changed. Additional financial sources other than by monthly fee has to be considered.

(2) Kandy Sewerage Project (F/S) (refer to Tables 17.5)

As opposed to the water supply project, there is no difference in terms of financial perspective between the Master Plan and the Feasibility Study. The critical point is that the capital investment has to be supplied from funding sources other than by monthly fee. If the Government's grant does not cover all of the capital investment then other funding source have to be considered.

19.3.2 Socio-Economic Aspect

Safe drinking water and the sanitary disposal of waste have long been recognized as basic needs of society, as both of them function to safeguard human health and enable a more productive life. Health and environmental problems caused by inadequate water supply and poor waste disposal have been exacerbated by continued population growth and the high concentration of that population in urban areas.

While it is a given that advanced sewer systems help to alleviate these issues, the positive effects of sewer systems can be broken down into two categories. The first of these is direct effects, i.e., the direct contributions that sewer projects make to those individuals who discharge waste into the sewer system. The other is indirect effects, i.e., the indirect contributions a sewerage system makes to those individuals who are not connected to the system, as well as those contributions the system makes to future generations. In economic terms, such indirect benefits are called external economies, in which production or consumption yields positively benefit even those who are not paying for the said service directly. The following is a series of examples of such benefits.

(1) Improved public health

Improved public health is a community benefit which contributes to all members of the community regardless of whether or not they are connected to the sewage system. A concrete example of the benefits of improved overall community health is the decrease in social costs, since an increased level of sanitation will lead to a decrease in health care costs and in auxiliary sanitary service costs.

(2) Infrastructure as a basis for economic development

Investment in a sewerage system lays a positive base for economic development, both through the employment generated through the actual building of the system and through contributing to overall public welfare, which in turn can be used to induce investment into the private sector by both domestic and foreign enterprises. As such, the development of a sewerage system can be seen as a long-term investment, which may generate increased national income for future generations.

(3) Construction's short-term effects on the local economy

During the period of construction of the sewerage system, the public sector's expenditures have the effect of increasing district output (expansionary effect). When these expenditures are initially made, output will rise at first by an equal amount. But as those capital-goods industries begin receiving more income through this increase in expenditures, they will then set into motion a chain of additional secondary consumption spending and employment. This expansionary effect will generate an increase in national income.

(4) Construction's long-term effects on the local economy

Even after construction has been completed, the sewerage system will have a positive effect on local employment by absorbing a part of the labor force as maintenance workers. The consequent increase in income will serve to increase effective demand, which will in turn contribute to economic growth, as will the derived demand from the project's maintenance activities.

(5) Using construction to acquire technology

Developing nations have a potential advantage in that they can reap the benefits of the technological progress of more advanced nations. They do not have to repeat the trial and error period which more advanced nations had to go through. Advanced construction

and maintenance technologies which can be acquired through the building of a sewerage system will be a long-term benefit.

As explained above, economic benefits of developing a sewerage system are not limited to individual users, but rather are spread over society as a whole, as well as over multiple generations. Some of the public health benefits, such as the avoidance of epidemics, are external to the individual user and so not necessarily included in the price of service. Since the benefits of a sewerage system are reaped over many generations, in theory, the financial burden could be spread out over many generations as well. Annual maintenance and operating costs should also be borne by generations to come as such funds will be necessary in supporting a high level of future service. However, in actuality it is quite difficult to spread the costs of such projects over the various indirect beneficiaries of the completed project. As a result, the portion of public expenditures which are not attributable to the individual user are not always fairly charged to other possible beneficiaries. Thus, when calculated in these terms, the projected amount of funds to be generated by charging only direct users may appear to be insufficient. However, when also calculating the broad social benefits which are indirectly created by the project, and which are not included within standard FIRR procedures, one discovers that the negative financial results derived via accounting procedures (FIRR) may not be an appropriate index for gauging the overall economic meaning of a sewage project.

19.3.3 Technical Aspect

In the course of planning the Kandy Sewerage System, various kinds of comparative studies with possible alternatives as to the location of facilities, structure of the system, construction method, material, process and so on were made to establish the optimum plan of the system. The outcome of the Study is aiming at energy- and cost-saving, easy operation and maintenance of the system and minimization of the impact on the surrounding environment during and after construction, based on the appropriate technology and in due consideration of the current practice in Sri Lanka. The Project is therefore considered technically.

19.3.4 Institutional Aspect

Although due consideration be given to the KMC which is obviously the most appropriate agency that will be in charge of the Kandy Sewerage Project after its implementation, the NWSDB has the capability enough to cope with implementation of the Project during construction stage with some addition to the existing organization. After construction, the

NWSDB should play main roll for operation and maintenance under the agreement between the NWSDB and the KMC until the staff of the KMC will be well trained. On condition that those arrangements will be made, the Project is considered institutionally sound.

19.3.5 Environmental Aspect

An Environmental Impact Assessment (EIA) of the proposed project was carried out during the course of this Study. The results of this EIA study have highlighted possible environmental impacts which will be made by the implementation of this project. Preventive measures and relevant legislative arrangements are considered to mitigate the anticipated environmental impacts.

As a whole, the proposed project, including the said preventive measures, is determined to have minimal and tolerable impacts to the environment.

Among others, the following preventive measures are included in the scope of the proposed project:

(1) Oxidation ditch process was employed to minimize the required site area for the treatment plant.

(2) Sludge treatment will be conducted at a remote site to minimize the influence on the surrounding residential area.

(3) Wastewater from the sludge treatment process will be returned to the treatment plant to avoid outflow of the supernatant to the environment.

(4) The sludge discharged from septic tanks, which is presently discharged to environment directly, will be treated at the treatment plant.

CHAPTER 20

CONCLUSION AND RECOMMENDATIONS

CHAPTER 20 CONCLUSIONS AND RECOMMENDATIONS

20.1 General

The present status of the water supply systems in Greater Kandy is quite poor except for the KMC water supply system, though its capacity is already being stretched by the substantial water demand placed upon it. In the environs of Greater Kandy, several water supply system development/augmentation projects have been implemented. However, their capacity is not sufficient to fulfill the substantial demand of the whole Study Area (only the project area will benefit from such projects). Most people in the Study Area will suffer from continuous water shortage in the future, if countermeasure is not taken. Because of this, this study has been conducted to establish a comprehensive long-term development plan for the water supply system in Greater Kandy.

Development of the sewerage system is more difficult than the water supply system because it places an additional financial burden on the population. To date, the population has not had to shoulder the costs for these services. Even though the sewerage system will bring various indirect benefits to both users and non-users of the system, only the user should shoulder the direct financial burden to some extent. The difficulty in introducing a sewerage system stems mainly from this point.

The following conclusion and recommendations are made for the smooth implementation of the project.

20.2 Water Supply Project

20.2.1 Conclusion

The financial viability of the Greater Kandy water supply project is highly dependent on the tariff rate. The current tariff rate is considered to be lower than the proper level in terms of affordability and in comparison with other public utility charges. The results of the case study indicate that taking into account the current depressed tariff structure, the Project will be viable if the tariff rate is allowed to increase at one percent per annum for each complete phase of the long-term development plan. However, if the project is halted after the implementation of the Phase 1, which is the subject of the priority project of the feasibility study, the requirement for increasing the tariff becomes very high. Because the largest portion of

capital investment is in Phase 1, and because it has less water production than the other phases, the financial indicators for the project show worse figures. In order to make the project financially feasible, a three percent annual tariff increase in real terms is required. If the account can be integrated with other existing water supply systems including the KMC system, this tariff increase can be reduced because benefits from the existing system with less production costs would offset part of the deficit of the new system.

Additionally, the implementation of the Project will provide the water supply system in Greater Kandy with two major water sources, which will ensure a more reliable water supply at the time of emergency.

20.2.2 Recommendations

Recommendations for the implementation of the Project are summarized in accordance with their importance and priorities as follows:

(1) Taking necessary measures to ensure the feasibility and financial viability of the Project

For the debt service management along with the implementation of the proposed projects and for clearing up the accumulated deficit, the normal efforts of water supply management, such as reducing NRW, and the implementation of cost containment strategies will not be sufficient. The present depressed water tariff system will therefore need to be reviewed to set up a higher level of tariff structure, set at a reasonable level considering the ability of consumers in the study area to pay. The viability of the proposed project will be assured if such measures are taken.

(2) Reduction of Non-Revenue Water (NRW)

Reduction of non-revenue water (including unaccounted-for water) is a major subject to tackle in the management of the water supply system in greater Kandy. It will, if successfully implemented, result in an increase in revenue and a reduction in operational costs.

The most efficient and economical measures for reducing NRW may be recommended as follows:

- Leak detection and repair or replace of valves, pipes, service connections, and reservoirs

- Replacement of "bundles" of service connection lines with appropriately sized distribution main extension pipes
- Provision of water meters to every consumer, repairing the defective water meters, and calibration of registration error.
- Conducting efficient meter reading and billing collection
- Controlling the illegal connection and unbilled legal connections
- Provision or repair of the bulk flow meters to monitor the amount of supply.

(3) Protection of Water Source

It is necessary for the Government and the Municipality to establish a policy for the protection of the Mahaweli river in terms of quality and quantity of raw water. For water quality, in particular, the following possible sources of contamination must be attended to:

a) Discharge of domestic sewage from towns or communities upstream of the intake.
b) Toxic or harmful wastewater discharge from industries in upstream of the catchment area.
c) Leachate from garbage dumping sites upstream of the intake.
d) Wastewater from water purification plants upstream of the intake.
e) Detergent and soap originating from washing and bathing at the main river.

For the volume of raw water, a comprehensive water utilization plan for the Mahaweli river, including water supply, irrigation, power generation, flood control, industry etc., must be established.

(4) Role of the Regional Support Center (Central)

The Central Regional Support Center of the NWSDB is considered to be the most appropriate agency to be in charge of the Project during and after its implementation. After implementation of the Phase 1 of the Project, the water supply capacity in the Greater Kandy Area will be increased considerably and the RSC (C) should be geared to fully meet its increased roles, functions and activities that it will be charged with. Therefore, the involvement of the RSC (C) and the KMC from the initial stage of the planning and design of the Project is quite significant in order to reflect the real needs and problems experienced by the RSC (C) and the KMC.

(5) Conduct vigorous investigation of groundwater potentiality.

The groundwater potentiality investigation conducted in this study is based on the presently available data and information. As a result of the investigation, it was found that several remote areas have high potentiality for groundwater development. Because of time and budget constraints, the identification of sites to be developed and their available yield were not finalized. It is obvious that if groundwater sources can be developed with safe quality and sufficient quantity, the cost to water supply system can be reduced not only in O&M cost but also in capital costs for the treatment and transmission facilities. In this regard it is strongly recommended that the hydrogeological survey, with test well drilling and pumping tests should be conducted continuously by the NWSDB with the support of experienced foreign specialists.

(6) Timely Review of the Feasibility Study prior to Project Implementation

This Feasibility Study was prepared on the basis of currently available data and information and he most reasonable projection to be made from such information. In the future there may be more developments or changes in socio-economic or natural conditions in the project area, which are now unforeseeable but might affect, if they occur, the recommendations presented in this study. It is therefore recommended that the Feasibility Study be reviewed in the future to take into account the situation at the time of implementation of the Project.

(7) Provision of Sewerage Services

The expansion of the water supply capacity will bring an increase in the sewage to be discharged into the service area. At present, the Hantana housing scheme has a sewerage system in the Study Area. Other remaining areas are served by on-site facilities, which mainly treat excreta and do not treat other wastewater. The pollutant load to be discharged into watercourses will accordingly steadily increase in the area. In addition, although the maintenance of those facilities is left to the responsibility of owners, their neglect of proper maintenance to those facilities will lead to pollution of surface water and groundwater. The wastewater from the town center of the Kandy municipality, which is the major pollutant discharge area, is upstream of the Meda Ela river. It flows down to the Mahaweli River upstream of the proposed intake of the new water treatment plant. In this regard, high priority should be given to the provision of a proposed sewerage system.

20.3 Sewerage Project

20.3.1 Conclusion

The current water supply service in Kandy Municipality and its suburban area will be remarkably improved upon completion of the water supply project by the end of 2004. Increased water consumption will, on the other hand, further accelerate the deterioration of the urban environment and water pollution in rivers and streams.

The proposed sewerage project for Kandy Municipality is prepared to mitigate the above mentioned existing and foreseeable problems by the target year of 2005. Likewise, the necessity and appropriateness as well as urgency of the proposed project is substantially acknowledged and justified for the betterment of public hygiene and environmental conservation in the Kandy Municipality.

As stated in the previous discussions, the sewage tariff to be introduced after implementation of the project will be the most serious issue for the operation of the project. In order to enable the project to be financially feasible capital investment will need to be granted by the Central Government. In addition, utmost effort should be made to increase the number of connections in the service area. In the initial stage, the population should pay the costs for the service connection, including the modification of plumbing in private premises. In this regard, financial incentives should be given to the users in order to ease the burden of the payment.

It may be concluded that the scope and scale of investment for the project appears appropriate, and the effects of the investment seem satisfactory. Because the introduction of a sewerage system with treatment plant will be the first experience for both the NWSDB and Kandy Municipality, institutional arrangement should be made by both authorities with a close relationship each other.

It is quite difficult to recover the costs of capital investment without substantial financial complements through the Central Government subsidies, even on the condition that the tariff increases annually. As a result, special considerations should be made for the financial scheme to fund the project fully.

20.3.2 Recommendations

Recommendations for the implementation of the Project are summarized in accordance with their importance and priorities as follows:

(1) Taking necessary measures to ensuring the feasibility and financial viability of the Project

Securing funds for the project through Government grant is indispensable for the viability of the proposed project.

(2) Establishment of a legislative set-up for the sewerage services.

A sewerage service with a tariff system is a new concept for an urban public. In order to progress the project, to promote service connections, and to secure the tariff for its operation and maintenance, a legislative set-up is needed.

(3) Establishment of the tariff system

An affordable tariff system should be established through consultation with officials of the KMC.

(4) Monitoring of Industrial/Commercial effluent.

The sewerage system was designed for normal quality domestic sewage. If the quality of wastewater from large users becomes worse than the expected quality, its influence cannot be ignored. In this regard, the establishment of a quality standard for wastewater to be discharged into sewer system together with an effective monitoring system is an indispensable requirement.

(5) Role of the Regional Support Center (Central)

The Central Regional Support Center of the NWSDB is considered to be the most appropriate agency to be in charge of the Project during and after its implementation. After implementation of Phase 1 of the Project, the RSC (C) should play a major role in the operation and maintenance of the system until the staff members of the KMC become fully trained. There-

fore, the involvement of the RSC (C) and the KMC from the initial stage of the planning and design of the Project is quite significant in order to reflect the real needs and problems experienced by the RSC (C) and the KMC.

(6) Timely Review of the Feasibility Study prior to Project Implementation

This Feasibility Study was prepared on the basis of presently available data and information and the most reasonable projection to be made from such information. In the future there may be developments or changes in socio-economic or natural conditions in the project area, which are now unforeseeable but might affect, if they occur, the recommendations presented in this study. It is therefore recommended that the Feasibility Study be reviewed in the future to take into account the situation at the time of the implementation of the Project.

Figure 3.3

Block Diagram of Existing Water Supply Facilities (extraction from FINNIDA M/P)

HARISPATTUWA AKURANA/ PUJAPITIYA

DISTRIBUTION 2300 m³/d

GALMINNA 746 M.S.L

DISTRIBUTION 2800 m³/d

ϕ 225 mm PVC & ϕ 200 mm 0.1 L = 5.60 km

2700 m³/d

BOKKAWELA 590 M.S.L

5300 m³/d ϕ 280 mm PVC L = 3.90 km

2700 m³/d ϕ 225 mm PVC & ϕ 200 mm 0.1 L = 3.40 km

GODAHENA Booster sump 550 M.S.L

PUJAPITIYA 570 M.S.L

DISTRIBUTION HEEDENIYA 1000 m³/d

DISTRIBUTION 1500 m³/d

7200 m³/d

MADEDENIYA EXIST 564 M.S.L

ϕ 225 mm PVC L = 5.20 km

RAJAPIHILLA EXIST 532 M.S.L

1500 m³/d

3000 m³/d ϕ 280 mm PVC L = 2.30 km

DISTRIBUTION RAJAPIHILLA 1000 m³/d

UDUWAWALA 510 M.S.L

5000 m³/d ϕ 315 mm PVC L = 5.0 km

DISTRIBUTION RAJAPIHILLA 1900 m³/d

POLGOLLA NADAWALA

DISTRIBUTION HEDENIYA 1500 m³/d

NUGAWELA 545 M.S.L

DISTRIBUTION KULUGANNANA 2600 m³/d

KULUGANNANA EXIST 523 M.S.L

DISTRIBUTION 1500 m³/d

DISTRIBUTION ALAWATUGODA 2100 m³/d

HEEPITIYA 615 M.S.L

ALAWATUGODA BALANCING TANK 2100 m³/d

5000 m³/d ϕ 315 mm PVC L = 3.76 km

POLGOLLA KAHAWATTA

KURUGODA 571 M.S.L

DISTRIBUTION ALAWATUGODA 2100 m³/d

DISTRIBUTION AKURANA (UPPER) 500 m³/d

8100 m³/d ϕ 355 mm DI L = 2.20 km

EXIST AKURANA 514 M.S.L

2700 m³/d

ϕ 225 mm PVC L = 1.40 km

350 m³/d ϕ 110 PVC L = 1.00 km

TELANGUGAHAWATTA 570 M.S.L

DISTRIBUTION 2300 m³/d

DISTRIBUTION 600 m³/d

KAHAWATTA 560 M.S.L

7400 m³/d ϕ 400 mm DI L = 3.06 km

ϕ 280 mm DI L = 6.15 km

DISTRIBUTION AKURANA (LOWER) 5700 m³/d

26,400 m³/d

PHASE I – ϕ 450 mm DI

PHASE II – ϕ 450 mm DI – YEAR 2000

10,200 m³/d

L = 8.75 km

ϕ 450 mm DI L = 2.5 km

DISTPIBUTION 2500 m³/d 6700 m³/d ϕ 160 PVC EXISTING

EXISTING ϕ 160 mm PVC

EXISTING ϕ 160 mm PVC

ϕ 225 mm PVC L = 1.50 km YEAR – 2005

KONDADENIYA 533 M.S.L

14800 m³/d

ϕ 450 mm DI , L = 4.20 km

PROPOSED TREATMENT PLANT

POLGOLLA TREATMENT PLANT (PROPOSED) 480 M.S.L 118,100 m³/d

DISTRIBUTION 1700 m³/d

DISTRIBUTION 675 m³/d

4 JAMBUGAHAPITIYA 565 M.S.L

UDATALAWINNA 575 M.S.L

800 m³/d ϕ 160 mm PVC L = 2.70 km

DISTRIBUTION 675 m³/d

DISTRIBUTION 1300 m³/d

3 KAHALLA 500 M.S.L

ϕ 225 mm PVC L = 1.50 km

1500 m³/d

ϕ 225 mm PVC L = 0.60 km

1500 m³/d

L = 2.6 km

6 BALANAGALA EXIST 513 M.S.L

1800 m³/d 225 mm PVC

DISTRIBUTION 1500 m³/d

5400 m³/d ϕ 280 mm PVC L = 3.00 km

6100 m³/d

DISTRIBUTION 1200 m³/d

26 BANGALAWATTA 523 M.S.L

3700 m³/d ϕ 280 mm PVC L = 1.50 mm

ϕ 315 mm PVC L = 1.30 km

POLGOLLA

25 PIHILLADENIYA 523 M.S.L

1200 m³/d ϕ 225 mm L = 1.30 km

KANDY MUNICIPAL COUNCIL

DISTRIBUTION 2950 m³/d

65 GOHAGODA 526 M.S.L.

ϕ 250 mm PVC L = 0.10 km

3500 m³/d

DISTRIBUTION 150 m³/d

DISTRIBUTION 1000 m³/d

700 m³/d

EXISTING DISTRIBUTION 1200 m³/d

GOHAGODA EXIST 526 M.S.L

ϕ 225 mm PVC, 0.90 km L = 1.90 km

64 BOGAHAKANDA 562 M.S.L

64 BOGAHAKANDA Booster Sump 550 M.S.L

4800 m³/d ϕ 315 mm PVC L = 0.82

EXISTING ϕ 1600 PVC TYPE 1000

YATIHALAGALA 512 M.S.L

64 ϕ 160 mm PVC 1500 m³/d 1 km

ϕ 110 mm PVC L = 0.75 km

DISTRIBUTION 1500 m³/d

KMC GOHAGODA

6400 m³/d

EXISTING ϕ 225 mm PVC TYPE 1000

ϕ 350 mm DI L = 3.0 km

DISTRIBUTION 1000 m³/d

DISTRIBUTION 22000 m³/d

17 UPLANDS 545 M.S.L

L = 2.45 km 17 ϕ 600 mm DI 27,100 m³/d L = 0.4 km

2000 m³/d ϕ 600 mm DI ϕ 160 PVC 1.25 k

DISTRIBUTION 6800 m³/d

57 BAHIRAWAKAND 629 M.S.L

TALWATTA 18

DISTRIBUTION 1450 m³/d

30 DAMBARAWA TOWER 517 M.S.L

ϕ 225 mm PVC L = 1.35 km

1700 m³/d

0.7 km 3900 m³/d 29 DISTRIBUTION 3200 m³/d

2500 m³/d ϕ 225 mm PVC L = 0.10 km

SIRINALWTTA

POLGOLLA KUNDE

PATHA DUMBARA

KUNDASALE

KANDY MUNICIPAL COUNCIL

POLGOLLA, NADAWALA, MANIKHINNA

POLGOLLA KUNDESALE

KMC GOHAGODA

DISTRIBUTION ALAWATUGODA 2100 m³/d

HEEPITIYA 618 M.S.L

WATUGODA LANCING TANK 2100 m³/d

5000 m³/d ϕ 315 mm PVC L = 3.76 km

POLGOLLA KAHAWATTA

KURUGODA 571 M.S.L

DISTRIBUTION ALAWATUGODA 2100 m³/d

DISTRIBUTION AKURANA (UPPER) 500 m³/d

EXIST AKURANA 314 M.S.L

2700 m³/d

ϕ 225 mm PVC L = 1.40 km

8100 m³/d

350 m³/d ϕ 110 PVC L = 1.00 km

TELAMBUGAHAWATTA 570 M.S.L

DISTRIBUTION 600 m³/d

840 m³/d ϕ 400 mm DI L = 3.88 km

KAHAWATTA 380 M.S.L

DISTRIBUTION AKURANA (LOWER) 5700 m³/d

26,400 m³/d

PHASE I – ϕ 450 mm DI

PHASE II – ϕ 450 mm D.I – YEAR 2000 L = 8.75 km

10,200 m³/d

UDUWAWALA 510 M.S.L

DISTRIBUTION RAJAPHILLA 1900 m³/d

ϕ 450 mm DI L = 2.3 km

DISTRIBUTION 2500 m³/d

4700 m³/d ϕ 160 PVC EXISTING

EXISTING ϕ 160 mm PVC

EXISTING ϕ 200 mm PVC

ϕ 225 mm PVC, L = 2.55 km YEAR - 2005

KONDADENIYA 533 M.S.L

14900 m³/d

ϕ 450 mm DI , L = 4.20 km

KULUGANMANA EXIST 553 M.S.L

DISTRIBUTION 1500 m³/d

DISTRIBUTION 1000 m³/d

SOHAGODA EXIST 528 M.S.L

DISTRIBUTION 1300 m³/d

KAHALLA 500 M.S.L

ϕ 225 mm PVC L = 1.50 km

1500 m³/d

DISTRIBUTION 675 m³/d

UDATALAWINNA 575 M.S.L

DISTRIBUTION 675 m³/d

JANBUGAHAPITIYA 568 M.S.L

900 m³/d ϕ 160 mm PVC L = 2.70 km

ϕ 225 mm PVC L = 0.80 km

1800 m³/d

L = 2.6 km

BALANAGALA EXIST 513 M.S.L

1800 m³/d 225 mm PVC

DISTRIBUTION 1500 m³/d

3400 m³/d ϕ 280 mm PVC L = 3.00 km

5100 m³/d

PROPOSED TREATMENT PLANT

POLGOLLA TREATMENT PLANT (PROPOSED) 450 M.S.L 118,100 m³/d

13,300 m³/d ϕ 450 mm DI L = 2.00 km

L = 2.4

6900 m³/d

DISTRIBUTION 1700 m³/d

WATTEGAMA 557 M.S.L

WATTEGAMA EXIST. INTAKE 1400 m³/d

2000 m³/d ϕ 225 mm PVC L = 2.70 km

DISTRIBUTION 1200 m³/d

3700 m³/d ϕ 280 mm PVC L = 1.50 km

1700 m³/d ϕ 225 mm PVC L = 1.40 km

DISTRIBUTION PETIYEGEDARA 1450 m³/d

BANGALAWATTA 523 M.S.L

PITIYEGEDARA 550 M.S.L

ϕ 315 mm PVC L = 1.30 km

4600 m³/d ϕ 300 mm L = 0.60 km

3700 m³/d

NAPANA 502 M.S.L

ϕ 250 mm L = 1.00 km

1200 m³/d ϕ 225 mm PVC L = 1.30 km

DISTRIBUTION 1000 m³/d

PHILLADENIYA 523 M.S.L

5100 m³/d ϕ 250 mm PVC L = 2.15 km

DISTRIBUTION 2600 m³/d

MENIKHINNA 534 M.S.L

DISTRIBUTION 500 m³/d

DISTRIBUTION 1450 m³/d

DAMBARAWA TOWER 517 M.S.L

ϕ 225 mm PVC L = 1.30 km

1700 m³/d

2680 m³/d ϕ 225 mm PVC L = 0.10 km

EXIST FARM SCHOOL 515 M.S.L

9.7 km 3600 m³/d ϕ 300 mm DI

DISTRIBUTION 3200 m³/d

SIRIMALWTTA

DISTRIBUTION 1800 m³/d

AHASPOKUNA 508 M.S.L

400 m³/d ϕ 160 mm PVC L = 0.80 km

DISTRIBUTION 250 m³/d

MAHABERIY-TENNA

DISTRIBUTION 1200 m³/d

300 m³/d

DISTRIBUTION 22000 m³/d

UPLANDS 545 M.S.L

2000 m³/d ϕ 500 mm DI

ϕ 160 PVC

1.25 k

37,100 m³/d

L = 0.4 km

SAHIRAWAKAND 528 M.S.L

DISTRIBUTION 6500 m³/d

TALWATTA

L = 2.1 km

63,100 m³/d ϕ 800 mm DI

L = 1.25 km 118,000 m³/d

L = 2.45 km

ϕ 600 mm DI

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KULUGANMANA EXIST
DISTRIBUTION 1500 m³/d

POLGOLLA TREATMENT PLANT (PROPOSED)
450 M.S.L 118,100 m³/d

DISTRIBUTION 2950 m³/d
65 GOHAGODA 526 M.S.L
3500 m³/d
DISTRIBUTION 150 m³/d
DISTRIBUTION 1000 m³/d
700 m³/d
EXISTING DISTRIBUTION 1200 m³/d
65' GOHAGODA EXIST 526 M.S.L
64 BOGAHAKANDA 562 M.S.L
BOGAHAKANDA Booster Sump 550 M.S.L
EXISTING Ø 1600 PVC TYPE 1000
64 YATIHALAGALA 512 M.S.L
DISTRIBUTION 1500 m³/d
KMC GOHAGODA
6400 m³/d
EXISTING Ø 225 mm PVC TYPE 1000
Ø 350 mm DI L= 3·02km

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DISTRIBUTION 1000 m³/d
GANNORUWA INSTUTONAL SUPPLY
64 GANNORUWA 480 M.S.L
67 MURUTALAWA 575 M.S.L
39 SOORIYAGODA 625 M.S.L
DISTRIBUTION 1500 m³/d
38 KADGANNAWA EXIST 548 M.S.L
DISTRIBUTION 1500 m³/d
DISTRIBUTION 1500 m³/d
36 ERIYAGAMA 545 M.S.L
14,900 m³/d 36' 1600 m³/d
Ø 450 mm DI L=2·0km
DISTRIBUTION 4200 m³/d
1100 m³/d
KMC ERIYAGAMA
3200 m³/d ALONG THE EXISTING DISTRIBUTION
Ø 160 mm PVC L= 3·70 km
Ø 200 mm DI
34 HINDAGALA 560 M.S.L
DISTRIBUTION 900 m³/d
WELANBODA DISTRIBUTION 4700 m³/d
22 DAULAGALA EXIST 565 M.S.L Ø 350 mm DI L= 5·93 km
3560 m³/d
DISTRIBUTION 1500 m³/d
38 1800 m³/d
Ø 280/238/168 mm PVC L= 9·80 km 600 m³/d
DISTRIBUTION 1500 m³/d
3600 m³/d Ø 350 DI L= 4·20 km
24'
8000 m³/d

EXIST. TREATMENT PLANT Cap. 33,400 m³/d
Add. Cap. of 42,500 m³/d
EXISTING TREATMENT PLANT 33
PROPOSED TREATMENT PLANT
K.M.C INTAKE 475 M.S.L
Ø 500 mm DI L= 1·90 k
DANGOLLA 580 M.S.L (EXISTING) 1800 m³/d
66 EX: 4" 220 mm PVC
DISTRIBUTION 1500 m³/d
95'
MAHAKANDA 460 M.S.L
23 2400 m³/d
DISTRIBUTION 1000 m³/d
EXIST UDA PERADENIYA
12"-C.I EXISTING
TO BE USED IN 1997 TO TESO DISTRIBUTION UDA PERADENIYA
3500 m³/d

PRIMROSE 640 M.S.L
63 DISTRIBUTION 2000 m³/d
KMC R2
6000 m³/d YEAR - 1996
Ø 350 mm L= 1.00km
EXISTING Ø 300 mm DI IN PHASE II 4250 m³/d
2400 m³/d L=0·65 km
Ø 500 mm DI L= 1·10 km
54' 31,200 m³/d
57 Ø 500 mm DI L= 1·60 Ø 500 mm DI L= 1·48
3300 m³/d Ø 280 mm PVC L=0·80 km
EXISTING Ø 200 mm
EXISTING 13,000 m³/d L=0·30 km
R3 617 M.S.L
4200 m³/d Ø 300 mm DI L= 0·55 km
HEERESSAGALA (LOW LEVEL) 560 M.S.L
54 DISTRIBUTION MEDABOWALA HEERESSAGALA 400 m³/d
2460 m³/d
Ø 350 mm DI L= 1.10 km 6500 m³/d
R3 DISTRIBUTION 5900 m³/d
Ø 225 mm PVC L= 0·90 km
DISTRIBUTION 400 m³/d
HEERASSAGALA (MIDDLE LEVEL) 600 M.S.L
55 DISTRIBUTION 1000 m³/d
1200 m³/d Ø 160 mm PVC L= 1·00 km
HEERASSAGALA (UPPER LEVEL) 660 M.S.L
56 DISTRIBUTION 1000 m³/d
4700 m³/d L=1·60 km
PHASE II Ø 38 mm PVC DISTRIBUTION HOUSING SCHEME 1000 m³/d
HANTANA (Call Link Settlement) 660 M.S.L
DISTRIBUTION 850 m³/d
100 m³/d YEAR 1996
61 HANTANA EXIST (LOW LEVEL) 675 M.S.L
Ø 160 mm PVC L= 1·70 km
1200 m³/d Ø 160 mm PVC L= 0·71 km
HANTANA EXIST. (UPPER LEVEL) 770 M.S.L
DISTRIBUTION (LOW LEVEL) 600 m³/d
HANTANA EXIST. INTAKE 450 m³/d
KMC KANDY GRAVATES
DISTRIBUTION 1000 m³/d
19 GURUDENIYA 470 M.S.L
AUGUSTAWATTE 700 M.S.L
2400 m³/d
3400 m³/d Ø 280 mm PVC L= 2·0 km

DISTRIBUTION 2700 m³/d
ANPITIYA EXIST 580 M.S.L
60 1200 m³/d L=3·70 km YEAR 1995
950 m³/d YEAR - 1995
180 mm PVC L=2·30 km
60' ELHENA 586 M.S.L
DISTRIBUTION 1000 m³/d
MEEKANUWA 635 M.S.L
DISTRIBUTION 808 m³/d
60' NULLEPIHILLA 640 M.S.L L=2·0 km
YEAR-1998 STAGE II Ø 225 mm PVC
YEAR 1996
61 HANTANA PLACE 635 M.S.L
DISTRIBUTION 1000 m³/d
3000 m³/d 180 mm PVC L=0·90km EXISTING
L=1·4 km 4800 m³/d Ø 300 mm DI

POLGOLLA KUNDE
DAMBARAWA TOWER 517 M.S.L
DISTRIBUTION 450 m³/d
30 Ø 225 mm PVC L=1·35 km
1700 m³/d
0·7 km 5800 m³/d
29 DISTRIBUTION 3200 m³/d
SIRINALWTTA
2000 m³/d Ø 225mm PVC L= 0·10 km
31'
DISTRIBUTION 1500 m³/d
KUNDASALE EXIST 502 M.S.L
32 DISTRIBUTION 1800 m³/d 1400 m³/d
L=0·2 km
4200 m³/d Ø 315 mm PVC L=0·83 km
Ø 225 mm PVC
600 mm DI L=1·6 km
20100 m³/d
Ø 500 mm DI
E.N.T. GAM UDAWA 505 M.S.L
20100 m³/d Ø 500 mm DI
DISTRIBUTION 5000 m³/d
3600 m³/d Ø 280 mm PVC
L=0·45 km 15,700 m³/d
Ø 180mm PVC L= 1·00 km
L=0·35 km 33' Ø 450 mm DI
3200 m³/d Ø 280 mm PVC L= 0·4 km
600 m³/d Ø 180 mm PVC L=0·19 km
51 OPEN PRISON CAMP 460 M.S.L
50 PALLEKELE ESTATE 480 M.S.L
49 ARMY CAMP 435 M.S.L
DISTRIBUTION 500 m³/d
DISTRIBUTION 2700 m³/d

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KMC GOHAGODA

GOHAGODA EXIST
626 M.S.L
DISTRIBUTION 1000 m³/d

JANNANA EXIST
M.S.L
DISTRIBUTION 1500 m³/d

POLGOLLA TREATMENT PLANT (PROPOSED)
450 M.S.L 118,100 m³/d

EXISTING TREATMENT PLANT 55
PROPOSED TREATMENT PLANT

K.M.C INTAKE
475 M.S.L

KMC R2

PRIMROSE
640 M.S.L
DISTRIBUTION 2000 m³/d

UPLANDS
545 M.S.L
DISTRIBUTION 22 000 m³/d

BAHIRAWAKAND
626 M.S.L
DISTRIBUTION 6800 m³/d

R2 DISTRIBUTION 14 000 m³/d

TALWATTA
540 M.S.L

R2
555 M.S.L

HEERESSAGALA (LOW LEVEL)
560 M.S.L

HEERESSAGALA (MIDDLE LEVEL)
600 M.S.L

HEERASSAGALA (UPPER LEVEL)
650 M.S.L

MEDABOWALA HEERESSAGALA
DISTRIBUTION 400 m³/d

DANGOLLA
560 M.S.L (EXISTING)
DISTRIBUTION 1500 m³/d

MAHAKANDA
660 M.S.L
DISTRIBUTION 1000 m³/d

EXIST UDA PERADENIYA

TO BE USED IN 1997 TO TESD DISTRIBUTION UDA PERADENIYA

HOUSING SCHEME
1000 m³/d

HANTANA
(Col Link Settlement)
660 M.S.L

HANTANA EXIST. (UPPER LEVEL)
770 M.S.L

HANTANA EXIST (LOW LEVEL)
679 M.S.L

HANTANA PLACE
635 M.S.L

HANTANA EXIST. INTAKE
450 m³/d

ANPITIYA EXIST
580 M.S.L
DISTRIBUTION 2700 m³/d

ELHENA
586 M.S.L
DISTRIBUTION 1000 m³/d

MEEKANUWA
635 M.S.L
DISTRIBUTION 800 m³/d

MULLPIHILLA
640 M.S.L

KMC KANDY GRAVATES

SURUDENIYA
470 M.S.L
DISTRIBUTION 1000 m³/d

POLGOLLA KUNDESALE

DAMBARAWA TOWER
517 M.S.L
DISTRIBUTION 1450 m³/d

SIRINALWTTA

KUNDASALE EXIST
502 M.S.L
DISTRIBUTION 1500 m³/d

GAM UDAWA
505 M.S.L

EXIST FARN SCHOOL
515 M.S.L
DISTRIBUTION 2100 m³/d

KOLONGASWATTA
555 M.S.L

PIHILLADENIYA
525 M.S.L
DISTRIBUTION 1000 m³/d

MENIKHINNA
534 M.S.L
DISTRIBUTION 2600 m³/d

AHASPOKUNA
606 M.S.L
DISTRIBUTION 500 m³/d

MAHABERIYA-TENNA
DISTRIBUTION 250 m³/d

RAJAWELLA
540 M.S.L
DISTRIBUTION RAJAWELLA/ KUMBUKKANDURA 1500 m³/d

VIJAYASIRIGANA
550 M.S.L
DISTRIBUTION 1200 m³/d

DISANA VILLAGE
573 M.S.L
DISTRIBUTION 1500 m³/d

BALAGOLLA
492 M.S.L

AMBAKOTE
540 M.S.L
DISTRIBUTION 100 m³/d

OPEN PRISON CAMP
480 M.S.L
DISTRIBUTION 500 m³/d

PALLEKELE ESTATE
480 M.S.L
DISTRIBUTION 2700 m³/d

ARMY CAMP
455 M.S.L
DISTRIBUTION 500 m³/d

I D B
456 m M.S.L
750 m³/d
DISTRIBUTION 750 m³/d

TO BE CONSTRUCTED UNDER HULUGANGA PROJECT

KNC ERIYAGAMA

DISTRIBUTION 4200 m³/d

3200 m³/d ALONG THE EXISTING DISTRIBUTION

10"ø A.C.

200 mm DI

250 mm DI

1100 m³/d

ø 160 mm PVC L = 3·70 km

1

B

36 H

HINDAGALA 860 M.S.L

DISTRIBUTION 900 m³/d

WELANBODA

DISTRIBUTION 4700 m³/d

22 B

5560 m³/d

ø 350 mm DI L = 5·93 km

DAULAGALA EXIST 565 M.S.L

24'

DISTRIBUTION

24 B

2000 m³/d

B

24 A

8000 m³/d

ø 200/150 mm DI L = 1·3·30 km

DISTRIBUTION 6800 m³/d

24

KALUGAMUWA 560 M.S.L

MAHAKANDA 660 M.S.L

1 B 23

2·00 m³/d

DISTRIBUTION 1000 m³/d

EXIST UDA PERADENIYA (Proposed HW) 580 M.S.L

11500 m³/d

ø 450 mm D·I / 400 mm DI

L = 3·10

4700 m³/d L = 1·80 km

TO BE USED IN NEXT TO TESO DISTRIBUTION

UDA PERADENIYA

12"-C·I EXISTING

67 B

3500 m³/d

ø 280 mm PVC & ø 250 mm D·I L = 1·50 km

DISTRIBUTION LOW LEVEL 1000 m³/d

DISTRIBUTION UDA-PERADENIYA HIGH LEVEL/BOWALAWTTA 1000 m³/d

B 68

BOWALAWTTA 630 M.S.L

KNC - UDA PERADENIYA

1200 m³/d ø 280 mm PVC L = 2·0 km YEAR 1996

AUGUSTAWATTE 700 M.S.L

69 B

2400 m³/d ø 225 mm PVC L = 2·0 km YEAR 1996

1200 m³/d ø 160 mm PVC L = 1·40 km YEAR - 199

DISTRIBUTION 1000 m³/d

SPRING HILL ESTATE 750 M.S.L

70

DISTRIBUTION 1000 m³/d

HEERASSAGALA (UPPER LEVEL) 660 M.S.L

58

1200 m³/d ø 160 mm PVC L = 1·00 km

DISTRIBUTION 1000 m³/d

MEEKANUWA 635 M.S.L

60

DISTRIBUTION 800 m³/d

MULEPIHILLA 640 M.S.L L = 2·0 km

700 m³/d

B 61

HANTANA PLACE 635 M.S.L

DISTRIBUTION 1000 m³/d

YEAR - 1996 STAGE II Ø 225 mm

3000 m³/d 160 mm PVC L = 0·90 km EXISTING

HANTANA EXIST (LOW LEVEL) 675 M.S.L

DISTRIBUTION 950 m³/d

61 H

100 m³/d YEAR 1996

HANTANA (Coil Link Settlement) 660 M.S.L

ø 160 mm PVC L = 1·10 km ø 110 mm PVC

B 61

1200 m³/d ø 160 mm PVC L = 0·71 km

110 mm PVC

1700 m³/d L = 1·60 km

PHASE II

ø 315 mm PVC

DISTRIBUTION HOUSING SCHEME 1000 m³/d

HANTANA EXIST. (UPPER LEVEL) 770 M.S.L

DISTRIBUTION (LOW LEVEL) 600 m³/d

HANTANA EXIST. INTAKE 450 m³/d

KNC KANDY GRAVATES

L = 1·4 km 4600 m³/d ø 300 mm DI

DISTRIBUTION 1000 m³/d

19 GURUDENIYA 470 M.S.L

3400 m³/d ø 280 mm PVC L = 2·0 km

19' B

ø 225 mm PVC L = 3·0 km

20 B

TALATU O 500 M.S.L

DISTRIBUTION 1000 m³/d

21

EXISTING TREATMENT PLANT

ø 500 mm DI L = 200 m

C E B CHANEL

NILLAMBE OYA TREATMENT PLANT 583 M.S.L

TREATMENT PLANT CAPACITY 11,500 m³/d

UDUNUWARA / YATINUWARA

UDA PALATHA

KANDY & FOUR GRAVETS

REFERENCE

- Immediate Rehabilitation
- Existing Distribution / Transmition
- Proposed Stage I
- Proposed Stage II
- Existing Reservoirs Location
- Off Line Booster
- Balancing Tank
- Gravity
- Under Implementation
- Proposed Reservior
- Inline Booster

NOTES

ALL RESERVOIRS MARKED 'EXIST' ARE EXISTING STRUCTURES.
ALL OTHER RESERVOIRS ARE PROPOSED OR AUGMENTED STRUCTURES.

RESERVOIRS MARKED BOOSTER SUMP ARE ONLY FOR BOOSTING.
ALL OTHER RESERVOIRS ARE FOR BOOSTING AS WELL AS DISTRIBUTION OR DISTRICT ONLY

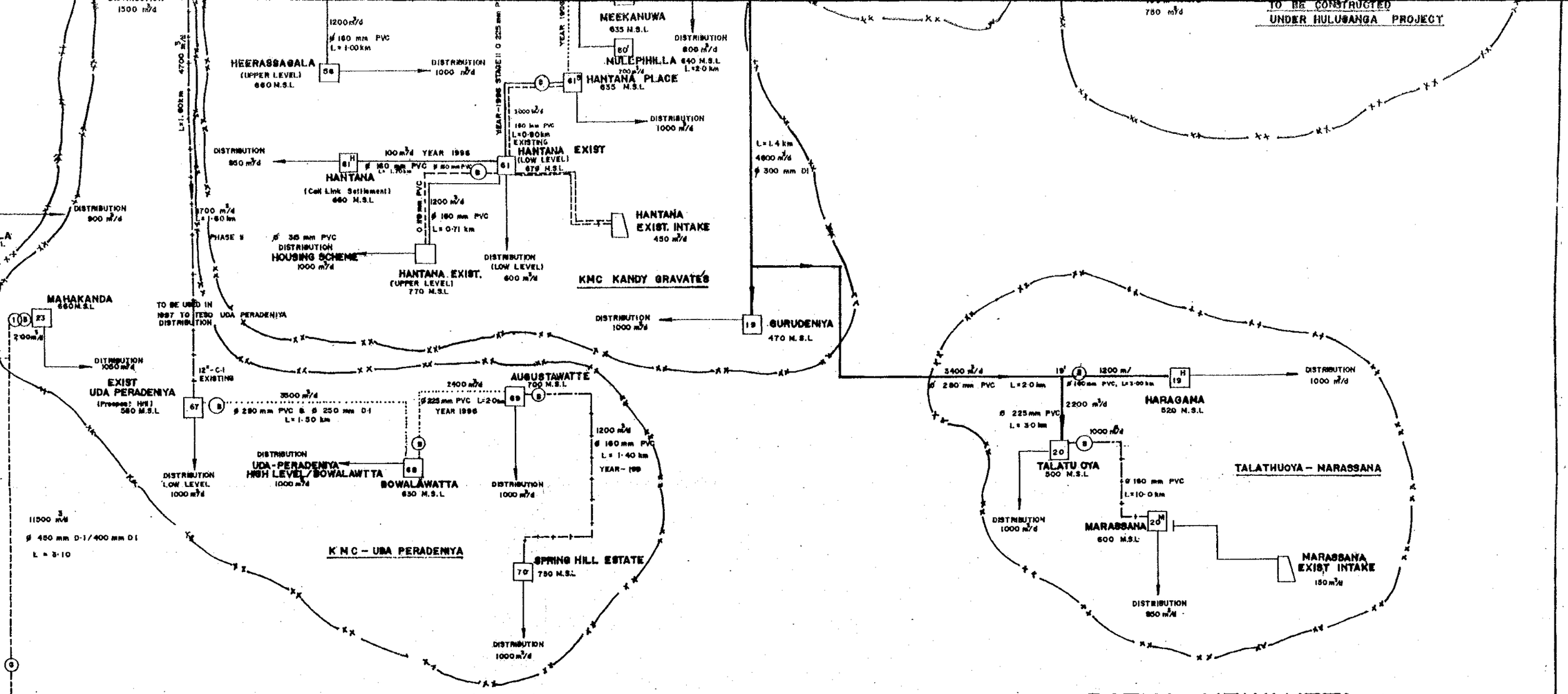
THE FLOWS MARKED ALONG TRANSMISSON LINES ARE PEAK DAY FLOWS (AV. DEMAND x 1.15)

DIAMETERES ARE SELECTED TO MATCH THESE FLOWS.

WATER SUPPLY MASTER PLAN FOR GREATER KAND

BLOCK DIAGRAM - YEAR 2015

Fig
Bloc



WATER SUPPLY MASTER PLAN FOR GREATER KANDY
BLOCK DIAGRAM - YEAR 2015

Figure 3.3
Block Diagram of Existing Water Supply Facilities (extraction from FINNIDA M/P)