Appendix-5  Soft Component Plan

(1) Background

Killinochchi water supply services had been conducted by NWSDB before the conflict; however, at present, the water supply system has been abandoned for years due to the destruction in the conflict in this region. The water supply system will be rehabilitated to maintain the original capacity of 3,000m³/day and consequently the number of service connections will increase instantaneously by the implementation of the Project.

Current water supply system in Killinochchi is to take water from dug wells and supply directly to the people by bowser, and actual operation and maintenance is conducted by an operator and a security person who stays in a small quarter adjacent to the pump house. NWSDB plans to enhance the present water supply system, to install a temporal water treatment unit and to increase staffs to 11. But for the water supply system which will be rehabilitated by the Project the number of staffs shall be increased about 30 before the completion of the Project.

The language that is spoken in Killinochchi is not Sinhalese but Tamil. The former NWSDB’s staffs who had been involved in operation and maintenance of the water supply system had left Killinochchi and/or retired already. NWSDB has staffs that are competent to operate and to maintain the newly rehabilitated water supply system in Killinochchi; however, to appoint appropriate staffs who can communicate fluently with people in Killinochchi will be a difficult subject. Taking into this aspect to hire the new staffs in Killinochchi will be inevitable for NWSDB. Especially the difference of languages shall be taken into account. To hire new staffs who understand Tamil will be important for NWSDB to organize well relation with their users through good communication.

However, it is considered not easy for NWSDB to recruit appropriate personnel that would possess the required knowledge and skills considering the current status of Northern Province. This means NWSDB have to develop their own human resources by themselves. This will take time and it is not secure, in short run, after the hand over the facilities to be reconstructed by the Project will be operated and maintained properly.

A well built management and engineering support with the soft component program to establish the operational system and technology transfer for facility operation of a new system and business operation are necessary.

(2) Objectives

The objective of the Project is to provide safe, reliable and adequate water supply to the people of Killinochchi with sufficient facility operation and management based on sound water supply services.

This soft component program will focus on the training on technical component including knowledge and technology transfer for operation and maintenance for the new water supply facilities and management of
water meters. This program will enhance the NWSDB’s capacity to secure the reliability of water supply service in Killinochchi and its suburbs the aspects of quantity and quality of water supply.

(3) Outputs of Soft Component Program

This Soft Component Program will expect the following outputs:

i) Water treatment plant operation
   - Operators and their assistants will understand the water treatment plant, and properly operate the plant.

ii) Water treatment plant maintenance
    - Supervisors, fitters and labours will understand the water treatment plant, and properly operate and maintain the plant.

iii) House connection and water meter installation
    - Supervisors, fitters and labours will understand the water treatment plant, and properly operate and maintain the plant.

iv) Mechanical/electrical facility maintenance
    - Mechanical and Electrical Engineers, Mechanics and Electricians will understand the water treatment plant and its equipment, and properly maintain the plant.

v) Water quality monitoring and control
    - Chemist and its assistants will understand the water treatment plant and distribution system in Killinochchi, and properly monitor and control water in the facilities and distribution network.

(4) Expected Results and Means of Evaluation

Objectives and outputs of each program are shown in Table-1. Instructors will check the training results by simple tests. In case some trainees fail to satisfy their requirement supplementary training will be imposed.

Table 1 Monitoring of the Outputs of Soft Component

<table>
<thead>
<tr>
<th>Program</th>
<th>Monitoring</th>
<th>Expected Output</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WTP Operation</td>
<td>To conduct a simple test</td>
<td>① To understand the component of water supply facilities and objectives/function of each facilities</td>
<td>70 % of the test mark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>② To adequately operate raw water pump to maintain required water production.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>③ To operate roughing filters running and washing the filters to maintain required water.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>④ To operate slow sand filters running and washing the</td>
<td>-ditto-</td>
</tr>
<tr>
<td>Program</td>
<td>Monitoring</td>
<td>Expected Output</td>
<td>Requirement</td>
</tr>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td></td>
<td></td>
<td>filters to maintain required water.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>⑤ To control chlorination system to maintain clear water to drinking water standard.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⑥ To drain the sludge pit and remove sand wash residues and sludge.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⑦ To implement daily inspection and keep records of each component of water supply facilities.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⑧ To check water quality on turbidity, colour, pH and residual chlorine at each treatment process.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⑨ To adequately operate clear water pump to maintain water level in water tower.</td>
<td>-ditto-</td>
</tr>
<tr>
<td>2. Distribution Network</td>
<td>To conduct a simple test</td>
<td>① To understand the functions of water distribution facilities</td>
<td>70 % of the test mark</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>② To understand the water levels at the Clearwater Reservoirs and water towers.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>③ To understand how to measure water flow and water pressure and the meanings of the measures results.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>④ To train how to clean water pipes.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>⑤ To train how to find leakage.</td>
<td>-ditto-</td>
</tr>
<tr>
<td>3. House Connections</td>
<td>To conduct a simple test</td>
<td>① To understand the boundary limit of NWSDB and house-owners</td>
<td>70 % of the test mark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>② To understand importance of water meters</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>③ To install house connections</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>④ To install/repair water meters</td>
<td>-ditto-</td>
</tr>
<tr>
<td>4. Mechanical/Electrical</td>
<td>To conduct a simple test</td>
<td>① To understand the component of water supply facilities and objectives/function of each facilities</td>
<td>70 % of the test mark</td>
</tr>
<tr>
<td>Facilities Maintenance</td>
<td></td>
<td>② To understand the importance of regular and preventive maintenance.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>③ To implement regular maintenance and keep records of each mechanical/electrical equipment.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>④ To check and select appropriate repair shops in town.</td>
<td>-ditto-</td>
</tr>
<tr>
<td>5. Water Quality</td>
<td>To conduct a simple test</td>
<td>① To understand the importance of monitor and control water quality</td>
<td>70 % of the test mark</td>
</tr>
<tr>
<td></td>
<td></td>
<td>② To set regular water quality monitoring points in the distribution network.</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>③ To understand the component of water supply facilities and objectives/function of each facilities</td>
<td>-ditto-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>④ To set the water quality target at each treatment process.</td>
<td>-ditto-</td>
</tr>
</tbody>
</table>

(5) Activities

Details of the Soft Component Plan are summarized in Table-2.
## Table 2  Details of Activities and Inputs

<table>
<thead>
<tr>
<th>Description</th>
<th>Achievement</th>
<th>Method</th>
<th>Required Input</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>i) WTP Operation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>① To understand the component of water supply facilities and objectives/function of each facilities</td>
<td>- Daily operation record</td>
<td>- Training Plan</td>
<td>- Water Treatment Specialist (Japanese Consultant) 1 x 2 month</td>
</tr>
<tr>
<td>② To adequately operate raw water pump to maintain required water production.</td>
<td>- Daily inspection</td>
<td>- Training Manual (Maintenance Guideline)</td>
<td></td>
</tr>
<tr>
<td>③ To operate roughing filters running and washing the filters to maintain required water.</td>
<td>- Regular maintenance record format</td>
<td>- Reporting Format (Maintenance Report)</td>
<td></td>
</tr>
<tr>
<td>④ To operate slow sand filters running and washing the filters to maintain required water.</td>
<td></td>
<td>- Trainees’ evaluation</td>
<td></td>
</tr>
<tr>
<td>⑤ To control chlorination system to maintain clear water to drinking water standard.</td>
<td></td>
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<tr>
<td>⑥ To drain the sludge pit and remove sand wash residues and sludge</td>
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<td></td>
<td></td>
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<tr>
<td>⑦ To implement daily inspection and keep records of each component of water supply facilities</td>
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<td></td>
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<tr>
<td>⑧ To check water quality on turbidity, colour, pH and residual chlorine at each treatment process.</td>
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<tr>
<td>⑨ To adequately operate clear water pump to maintain water level in water tower.</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>ii) Water Distribution Maintenance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>① To understand the functions of water distribution facilities</td>
<td>- Daily operation record</td>
<td>- Training Plan</td>
<td>- Water Distribution Specialist (Japanese Consultant) 1 x 1 month</td>
</tr>
<tr>
<td>② To understand the water levels at the Clearwater Reservoirs and water towers.</td>
<td>- Daily inspection</td>
<td>- Training Manual (Maintenance Guideline)</td>
<td></td>
</tr>
<tr>
<td>③ To understand how to measure water flow and water pressure and the meanings of the measures results</td>
<td>- Regular maintenance record format</td>
<td>- Reporting Format (Maintenance Report)</td>
<td></td>
</tr>
<tr>
<td>④ To train how to clean water pipes</td>
<td></td>
<td>- Trainees’ evaluation</td>
<td></td>
</tr>
<tr>
<td>⑤ To train how to find leakage</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>iii) House Connections</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>① To understand the boundary limit of NWSDB and house-owners</td>
<td>- Daily operation record</td>
<td>- Training Plan</td>
<td>- Piping Specialist (Japanese Consultant) 1 x 1 month</td>
</tr>
<tr>
<td>② To understand importance of water meters</td>
<td>- Daily inspection</td>
<td>- Training Manual (Maintenance Guideline)</td>
<td></td>
</tr>
<tr>
<td>③ To install house connections</td>
<td>- Regular maintenance record format</td>
<td>- Reporting Format (Maintenance Report)</td>
<td></td>
</tr>
<tr>
<td>④ To install/repair water meters</td>
<td></td>
<td>- Trainees’ evaluation</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>iv) Mechanical/ Electrical Maintenance</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>① To understand the component of water supply facilities and objectives/function of each facilities</td>
<td>- Daily operation record</td>
<td>- Training Plan</td>
<td>- Mechanical Engineer (Japanese Consultant) 1 x 1 month</td>
</tr>
<tr>
<td>② To understand the importance of regular and preventive maintenance</td>
<td>- Daily inspection</td>
<td>- Training Manual (Maintenance Guideline)</td>
<td></td>
</tr>
<tr>
<td>③ To implement regular maintenance and keep records of each mechanical/electrical equipment</td>
<td>- Regular maintenance record format</td>
<td>- Reporting Format (Maintenance Report)</td>
<td></td>
</tr>
<tr>
<td>④ To check and select appropriate repair shops in town</td>
<td></td>
<td>- Trainees’ evaluation</td>
<td></td>
</tr>
</tbody>
</table>
### Description

<table>
<thead>
<tr>
<th>v) Water Quality</th>
<th>Achievement</th>
<th>Method</th>
<th>Required Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>① To understand to clarify the boundary between public and private premises</td>
<td>- Daily operation record</td>
<td>- Training Plan</td>
<td>- Water Quality Specialist (Japanese Consultant) 1 x 1 month</td>
</tr>
<tr>
<td>② To understand how to install and fix water meter</td>
<td>- Daily inspection</td>
<td>- Training Manual (Maintenance Guideline)</td>
<td></td>
</tr>
<tr>
<td>③ To train pipe fixing skills for house connect water quality monitoring points in the distribution network.</td>
<td>- Regular maintenance record format</td>
<td>- Reporting Format (Maintenance Report)</td>
<td></td>
</tr>
<tr>
<td>④ To understand the component of water supply facilities and objectives/function of each facilities</td>
<td></td>
<td>- Trainees’ evaluation</td>
<td></td>
</tr>
<tr>
<td>⑤ To set the water quality target at each treatment process.</td>
<td></td>
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</tr>
<tr>
<td>i) - v)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Implementation Methods

This soft component program will be conducted by Japanese consultants and local engineers in class-room training, exercise training and on-the-job training.

1. Water Treatment Specialist (Japanese Consultant): 1 x 2 month
2. Water Distribution Specialist (Japanese Consultant): 1 x 1 month
3. Piping Specialist (Japanese Consultant): 1 x 1 month
4. Mechanical Engineer (Japanese Consultant): 1 x 1 month
5. Electrical Engineer (Japanese Consultant): 1 x 1 month
6. Water Quality Specialist (Japanese Consultant): 1 x 1 month

Basic requirement for the Japanese consultants are as follows:

- To possess competent knowledge and experience in each assignment filed
- To be competent to design training manuals (maintenance guidelines)
- To be competent to manage training programs
- To understand the problems of water supply systems in developing countries
- To be able to communicate with Sri Lankan engineers in English

The local engineers will also have roles of translation and interpretation of the training program.

Basic requirement for the local engineers are as follows:

- To support preparation of training materials from English to Tamil
- To understand technical terms especially for water supply system
- To possess experience working for some international programs with foreign experts
(7) Schedule

The construction term is assumed as 13 months and the WTP and the water towers will be handed over from the Contractor to the Sri Lankan side after three months initial operation. Taking into consideration of the construction term it is better that the training programs will be started during the commissioning period due to enforce the effectiveness of the training completed. It is also important that to confirm the hand over process to be completed.

The term of the soft component programs is planned to be 2 months; one month overlapping to the commissioning period, and another one month for secure NWSDB to operate and maintains new facilities by themselves.

The detailed schedules of the soft component programs are as shown in the Table 3.
Table 3 Detailed Schedules of the Soft Component Programs

<table>
<thead>
<tr>
<th>Sr</th>
<th>Activities</th>
<th>First Month</th>
<th>Second Month</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Treatment Plant: WTP Specialist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Assignment &amp; Preparation</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>①</td>
<td>Training course in water supply facilities and objectives/function of each facility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Training course in adequate operation of raw water pump to maintain required water production</td>
<td></td>
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<tr>
<td>③</td>
<td>Training course in to operate roughing filters running and washing the filters</td>
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<tr>
<td>④</td>
<td>Training course in to operate slow sand filters running and washing the filters</td>
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<tr>
<td>⑤</td>
<td>Training course in to control chlorination system to maintain clear water to drinking water standard</td>
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<tr>
<td>⑥</td>
<td>Training course in washing sludge pit</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>⑦</td>
<td>Training course in regular maintenance and keep records of performance of water supply facilities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑧</td>
<td>Training course in to check water quality on turbidity, colour, pH and residual chlorine at each treatment</td>
<td></td>
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</tr>
<tr>
<td>⑨</td>
<td>Training course in adequate operation of clear water pump to maintain water level in water towers</td>
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<tr>
<td>2</td>
<td>Water Distribution Maintenance: Water Distribution Specialist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Assignment &amp; Preparation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>①</td>
<td>Training course in understanding the functions of water distribution facilities</td>
<td></td>
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</tr>
<tr>
<td>②</td>
<td>Training course in understanding the water levels at the Clearwater Reservoirs and water towers</td>
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<tr>
<td>③</td>
<td>Training course in understanding how to measure water flow &amp; water pressure and the measured results</td>
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<tr>
<td>④</td>
<td>Training course in how to clean water pipes</td>
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<tr>
<td>⑤</td>
<td>Training course in how to find leakage</td>
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<tr>
<td>3</td>
<td>House Connections: Pipe Connection Specialist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Assignment &amp; Preparation</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>①</td>
<td>To understand the boundary limit of NWSDB and house-owners</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>②</td>
<td>To understand importance of water meters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>To install house connections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>To install/repair water meters</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Mechanical/Electrical Maintenance: Mechanical Engineer, Electrical Engineer</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1) Assignment &amp; Preparation</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>①</td>
<td>To understand the component of water supply facilities and objectives/function of each facilities</td>
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<tr>
<td>②</td>
<td>To understand the importance of regular and preventive maintenance</td>
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</tr>
<tr>
<td>③</td>
<td>To implement regular maintenance and keep records of each mechanical/electrical equipment</td>
<td></td>
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<tr>
<td>④</td>
<td>To check and select appropriate repair shops in town</td>
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<tr>
<td>5</td>
<td>Water Quality: Water Quality Specialist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Assignment &amp; Preparation</td>
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</tr>
<tr>
<td>①</td>
<td>To understand to clarify the boundary between public and private premises</td>
<td></td>
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</tr>
<tr>
<td>②</td>
<td>To train pipe fitting skills for house connect water quality monitoring points in the distribution network</td>
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</tr>
<tr>
<td>③</td>
<td>To understand the component of water supply facilities and objectives/function of each facilities</td>
<td></td>
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</tr>
<tr>
<td>④</td>
<td>To set the water quality target at each treatment process</td>
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</tr>
</tbody>
</table>
(8) **Outputs**

Following outputs of the Soft Component are expected.

1) **WTP Operation**
   - ① Training plan
   - ② Training material (WTP O&M Manual)
   - ③ Daily inspection and regular maintenance record format
   - ④ Trainees Evaluation report

2) **Distribution Network Maintenance**
   - ① Training plan
   - ② Training material (Distribution Network Maintenance Manual)
   - ③ Daily inspection and regular maintenance record format
   - ④ Trainees Evaluation report

3) **House Connection**
   - ① Training plan
   - ② Training material (House Connection Installation Manual)
   - ③ Daily work record format
   - ④ Trainees Evaluation report

4) **Mechanical/Electrical Facilities Maintenance**
   - ① Training plan
   - ② Training material (Mechanical/Electrical O&M Manual)
   - ③ Daily work record format
   - ④ Trainees Evaluation report

5) **Water Quality**
   - ① Training plan
   - ② Training material (Water Quality Monitoring Manual)
   - ③ Daily work record format
(9) **Responsibility of Recipient Country**

In order to achieve the object, it is required for NWSDB to secure/appoint the trainees (staff of water works and local staff) before the commencement of each program.

NWSDB also will support each program by providing the necessary materials and space, etc.

The programs will transfer the basic knowledge and technology for operation and maintenance of the water supply system in Killinochchi including water intake, and the achievement of the programs will be secured by NWSDB’s own effort.
Appendix-6 Other Relevant Data

6-1 Screening on Social and Environmental Considerations

Appendix 4. Screening Format

Name of Proposed Project: Rehabilitation of Kilinochchi Water Supply Scheme
Project Executing Organization, Project Proponent or Investment Company: National Water Supply and Drainage Board
Name, Address, Organization, and Contact Point of a Responsible Officer:

Name: Mr K.L. Premathu, General Manager
Address: Galle Road, Ratmalana
Organization: National Water Supply and Drainage Board
Tel: 011 2635990
Fax: 011 2636449
E-Mail: gm@waterboard.lk
Date: 30/02/20
Signature:  örnek

Check Items

Please write "to be advised (TBA)" when the details of a project are yet to be determined.

Question 1: Address of project site
Wilson Road, Kilinochchi

Question 2: Scale and contents of the project (approximate area, facilities area, production, electricity generated, etc.)
2-1. Project profile (scale and contents)
Water Treatment Plant Capacity – 3000m³/day
Approx. Project Area – 30 sq. km
Distribution Length – approx. 30km pipe length
2-2. how was the necessity of the project confirmed?
(The groundwater was not suitable for drinking purposes and wells dry out during drought season. There was a pipe born water supply scheme existed and thus was damaged during Conflicts)

Is the project consistent with the higher program/policy?
☐YES: Please describe the higher program/policy.
☐It is planned to provide 60% of the population safe access to drinking water in year 2020 and 100% population in 2030
☐NO

2-3. Did the proponent consider alternatives before this request?
☐YES: Please describe outline of the alternatives

1
2-4. Did the proponent implement meetings with the related stakeholders before this request?

☐ Implemented  ☐ Not implemented

If implemented, please mark the following stakeholders:

☑ Administrative body
☑ Local residents
☐ NGO
☑ Others (farmers)

Question 3:

Is the project a new one or an ongoing one? In the case of an ongoing project, have you received strong complaints or other comments from local residents?

☐ New  ☐ Ongoing (with complaints)  ☐ Ongoing (without complaints)

☐ Other ✓

It is a Rehabilitation Project; earlier one was demolished during the Conflict.

Question 4:

Is an Environmental Impact Assessment (EIA), including an Initial Environmental Examination (IEE) Is, required for the project according to a law or guidelines of a host country? If yes, is EIA implemented or planned? If necessary, please fill in the reason why EIA is required.

☐ Necessity (☑ Implemented  ☐ Ongoing/planning)

(Reason why EIA is required: )

☐ Not necessary ✓

☐ Other (please explain)

Question 5:

In the case that steps were taken for an EIA, was the EIA approved by the relevant laws of the host country? If yes, please note the date of approval and the competent authority.

☐ Approved without a supplementary condition  ☐ Approved with a supplementary condition  ☐ Under appraisal

(Date of approval: )

(Competent authority: )

☐ Under implementation

☐ Appraisal process not yet started

☐ Other ( )

Question 6:

If the project requires a certificate regarding the environment and society other than an EIA,
please indicate the title of said certificate. Was it approved?
☐ Already certified
☐ Title of the certificate: ( )
☐ Requires a certificate but not yet approved
☐ Not required √
☐ Other [ ]

Question 7:
Are any of the following areas present either inside or surrounding the project site?
☐ Yes ☐ No √

If yes, please mark the corresponding items.
☐ National parks, protection areas designated by the government (coastline, wetlands, reserved area for ethnic or indigenous people, cultural heritage)
☐ Primeval forests, tropical natural forests
☐ Ecologically important habitats (coral reefs, mangrove wetlands, tidal flats, etc.)
☐ Habitats of endangered species for which protection is required under local laws and/or international treaties
☐ Areas that run the risk of a large scale increase in soil salinity or soil erosion
☐ Remarkable desertification areas
☐ Areas with special values from an archaeological, historical, and/or cultural points of view
☐ Habitats of minorities, indigenous people, or nomadic people with a traditional lifestyle, or areas with special social value

Question 8:
Does the project include any of the following items?
☐ Yes ☐ No √

If yes, please mark the appropriate items.
☐ Involuntary resettlement (scale: households persons)
☐ Groundwater pumping (scale: m³/year)
☐ Land reclamation, land development, and/or land-clearing (scale: hectares)
☐ Logging (scale: hectares)

Question 9:
Please mark related adverse environmental and social impacts, and describe their outlines.
No Adverse Impacts

3
☐ Air pollution  ☐ Water pollution  ☐ Soil pollution
☐ Waste  ☐ Noise and vibrations  ☐ Ground subsidence
☐ Offensive odors
☐ Geographical features
☐ Bottom sediment
☐ Biota and ecosystems
☐ Water usage
☐ Accidents
☐ Global warming
☐ Involuntary resettlement
☐ Local economies, such as employment, livelihood, etc.
☐ Land use and utilization of local resources
☐ Social institutions such as social infrastructure and local decision-making institutions
☐ Existing social infrastructures and services
☐ Poor, indigenous, or ethnic people
☐ Misdistribution of benefits and damages
☐ Local conflicts of interest
☐ Gender
☐ Children’s rights
☐ Cultural heritage
☐ Infectious diseases such as HIV/AIDS
☐ Other (  )
Outline of related impact:

[ ]

Question 10:
In the case of a loan project such as a two-step loan or a sector loan, can sub-projects be specified at the present time?
☐ Yes ☐ No
(It is a Grant Project)

Question 11:
Regarding information disclosure and meetings with stakeholders, if JICA’s environmental and social considerations are required, does the proponent agree to information disclosure and meetings with stakeholders through these guidelines?
☐ Yes ☐ Yes ☐ No
Environmental Recommendation by CEA

Environmental Recommendation for the Rehabilitation of Kilinochchi Water Supply Scheme - Water Treatment Plant

This has reference to the Basic Information Questionnaire dated 26.04.2011, submitted by Regional Manager, National Water Supply & Drainage Board, Kandy Road, Jaffna to the Central Environmental Authority, Northern Provincial Office, Jaffna for the Environmental Recommendation for the Rehabilitation of Kilinochchi Water Supply Scheme – Water Treatment Plant.

The Environmental Recommendation for the above project is hereby granted subject to the following terms and condition. This Environmental Recommendation is valid for a period of one year from the date of issue of this letter. Extension will be considered on re-application one month prior to the expiry of the said letter.

1. General Condition

1.1 The NWS & DB should obtain fresh approvals in respect of any alternation or extensions that are intended to be made to the initial project proposal submitted to Central Environmental Authority.

1.2 The NWS & DB is bound to ensure that the terms and condition given in this letter are adhered to during project implementation.

1.3 The NWS & DB shall intimate to Central Environmental Authority the date of commencement of project activity / construction activities, inclusive of phased implementation scheme.

1.4 A copy of this approval letter should be kept at the project site at all times for the purpose of perusal by concerned agencies.
1.5 Necessary approvals from the Karachi Pradeshiya Sabha, Department of Irrigation and other relevant agencies should be obtained prior to the implementation of the project.

1.6 The NWS & DB is responsible for the equity in distribution of drinking water throughout the proposed project area by adopting appropriate mechanisms, in order to ensure the fairness in distribution and to mitigate wastage of drinking water.

1.7 Any waste water arising from cleaning and washing shall not be released freely into the environment and such waste water shall be discharged into a properly constructed soakage pit.

2. Noise & Vibration

2.1 Noise levels at the boundary of the site during the construction stage should be maintained at or below 75 dB (A) during day time (between 06.00 hrs to 21.00 hrs) and at or below 50 dB (A) during night time (between 21.00 hrs to 06.00 hrs).

2.2 Transport of loading and unloading of material shall be carried out in such a way to minimize the nuisance to the public and adjoining school by way of dust or noise.

3. Disposal of Solid Waste

3.1 Solid waste associated with the construction and the work force shall be collected regularly and disposed in consultation with the local Authority – Karachi Pradeshiya Sabha.
The Preparatory Survey on Rehabilitation of Kilinochchi Water Supply Scheme in Democratic Socialist Republic of Sri Lanka

Subject: Confirmation of Contents of CEA approval letter (NO/KN/08/ER/41/11) dated June 16, 2011.

1. Meeting Date: June 23, 2011, 9:00-10:00
2. Meeting Place: CEA office, Jaffna
3. Attendees: CEA, Northern Provincial office; Enfrm - Assistant Director, Mrs. Suguntha Sathyakumar
   JICA Study Team, Kenji Takayanagi
   NWSDB: R. Suwaththan, Engineer - Jaffna

4. Meeting Result
   (1) CEA approval letter (NO/KN/08/ER/41/11) dated June 16, 2011 is Environmental Clearance Letter by CEA.
   (2) By this letter, EIA and IEE report are not required and are not necessary for the rehabilitation project of Kilinochchi water supply scheme in democratic socialist republic of Sri Lanka.
   (3) In the implementation of the Project, constraint conditions described in the CEA Approval Letter NO/KN/08/ER/41/11) dated June 16, 2011 should keep by relating organizations to the Project.

V. Sathyakumar
Assistant Director
Central Environmental Authority
Northern Provincial Office
Jaffna

Vijitha Sathyakumar
Assistant Director
CEA, Jaffna

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AGREEMENT

BETWEEN THE

PROVINCIAL IRRIGATION DEPARTMENT

AND THE

NATIONAL WATER SUPPLY & DRAINAGE BOARD

FOR

WATER SHARING

FROM

IRANAMADU RESERVOIR (TANK)

FOR THE

JAFFNA PENINSULA WATER SUPPLY SCHEME
AGREEMENT BETWEEN THE
PROVINCIAL IRRIGATION DEPARTMENT (NEPC) AND THE NATIONAL WATER
SUPPLY & DRAINAGE BOARD FOR SHARING WATER
FOR THE JAFFNA PENINSULA WATER SUPPLY SCHEME

This agreement is made and entered into by and between the Secretary to the Ministry of Agriculture, Irrigation & Lands, NEPC, hereinafter called and referred to as the Party of the first part which term of expression as herein used shall mean and where the context so requires or admits of construction mean and include the said Secretary to the Ministry of Agriculture, Irrigation & Lands as aforesaid and his successor in the said office for the time being and the officers who for the time being are acting in the office of or are performing the functions now exercised by the Secretary to the Ministry of Agriculture, Irrigation & Lands acting herein for and on behalf of the North-East Provincial Council Democratic Socialist Republic of Sri Lanka (hereinafter called and referred to as the Party of the second part) of the business at Galle road, Ratmalana, herein called and referred to as the Party of the second part of the other part.

WHEREAS

(A) Implementation of the Jaffna Peninsula Water Supply Scheme (under Asian Development Bank Funding) is to be executed by the National Water Supply & Drainage Board, the Party of the second part.

(B) It has become necessary to form an agreement for abstraction of water from the Irana Medu reservoir (tank) for Jaffna Water Supply Scheme

(C) Such abstraction shall not have adverse effects on existing water users.

(D) It is intended to construct a permanent intake structure for the abstraction of water from the Irana Medu reservoir with the approval of the Director of the Irrigation Department, the Party of the first part.

(E) Such construction or operation of such infrastructure shall not have any adverse effects on the operation and safety of the existing system.

Now it is hereby mutually agreed by and between the parties as follows:

1. The Party of the first part agrees to the Party of the second part abstracting up to 1260 acre feet/month and that the Party of the first part undertakes to facilitate such process and to not take any steps to hinder such abstraction other than as provided in this agreement.

2. The Party of the first part agrees to the construction of permanent intake facilities by the Party of the second party subject to the approval of the designs and construction by the Party of the first part.

3. In order to accommodate the additional water requirement for provision of water for the Jaffna Peninsula Water Supply Scheme the Party of the second part shall provide funds for the works required to rehabilitate and extend the embankments, spillways and settling basin and to rehabilitate, replace or
add radial gates to permit an increase in the full storage level of the dam to 103 feet (31.39 metres) AMSL and to increase the capacity to pass the design flood as determined and agreed between the technical advisors to the Parties of the first and second parts. The works shall be substantially completed prior to the abstraction of water for the Jaffna Peninsula Water Supply.

4. Both Parties undertake to seek Government support through funding by the World Bank, the Japan Bank for International Cooperation and the Asian Development Bank for the rehabilitation of the downstream works of the Irannamadu system including distribution system improvements, crop diversification and institutional development to match the water savings criteria assumed in concluding that 1,250 acre feet per month of water is available for potable water supply. These assumptions were that 20,900 acres of paddy is supplied with irrigation water in Maha and 11,600 acres of other food crops is supplied with irrigation water in Yala. The works referred to in Paragraph 3 shall be substantially completed prior to the abstraction of water for the Jaffna Peninsula Water Supply.

5. The Party of the second part undertakes to contribute towards the cost of operation and maintenance of the head works on a pro rata basis of the quantity of water withdrawn by each Party through their respective off-takes. The head works comprise the dam embankment, spillways, radial gates, stilling basin and intake structures.

6. If the Party of the second part intends to modify, rehabilitate or refurbish the intake facilities of the Jaffna Peninsula Water Supply System at a later date with the intention of maximizing O & M efficiency and to minimize operation difficulties it shall be carried out with the prior approval of the Party of the first part.

7. The Party of the second part shall arrange for flow measuring devices at the intake and the Party of the first part shall be allowed to observe the readings jointly with the Party of the second part or individually by means of an agreed mechanism. The Party of the first part shall arrange for construction of new measuring devices to measure the flow in the left and right bank main canals with funding from the Party of the second part. Both Parties shall maintain daily records of the flow measurement of their usage, which shall be reported monthly or as required by the other Party.

8. The Party of the first part will pursue, through the water management committee, the right to control rates of or stop abstraction of water by the second Party in the event that the Party of the first part finds that the abstraction is having an adverse effect on cultivation in the command area of the reservoir. During the periods of exceptional water scarcity, priority of water allocation between the two parties shall be decided by the water management committee, comprising officers from the first and second parties, farmer representatives and other water user stakeholders. Priority shall be given to standing crops in Maha season then to domestic use for downstream settlers and cattle but in no instance will the percentile reduction in water provided to the Party of the second part be more than the percentile reduction in water provided for irrigation.

9. It shall be obligatory on the Party of the second part to allow the Party of the first part to inspect and observe any structure or part of it in the water supply infrastructure at any time.

---

1 The Water Management Committee shall comprise the following members or their representatives:
Government Agents from Kilinochchi and Jaffna; Deputy Provincial Director (NE) of the Irrigation Department; Regional Manager (N) of the NWS&DB; Planning & Development Secretariat, Kilinochchi; Jaffna Municipal Council; five representatives from farmers' organisations; and three representatives of Jaffna District water users.
10. No construction of other structures for the use of the Party of the second part is permitted without
the prior approval of the Party of the first part.

11. Staff of the Party of the second part attached to the intake facilities shall be responsible for and
shall have free access for the operation and maintenance of the intake facilities and shall be
allowed to be stationed at the intake facilities.

12. A representative of the Party of the second part shall be a member of the project management
committee of the Iranamadu scheme established under the Irrigation Ordinance and any
amendments thereof.

13. Any conflicts arising in implementation of this agreement shall be referred to a joint panel
consisting of the Governor of the North East Province and the Secretary of the Ministry under
which the NWSCB is placed for settlement in consultation with the Chief Secretary (N&E).

IN WITNESS WHEREOF THE PARTIES HAVE EXECUTED THIS AGREEMENT at the place (s) and date
(s) hereinafter mentioned.

PARTY OF THE FIRST PART

Signed by: Suppojil Mooshtar

[Signature]

Secretary to the Ministry of Agriculture, Irrigation &
Lands, North East Provincial Council, Trincomalee
Ministry of Agriculture, Livestock Development,
Lands, Irrigation & Fisheries,
Northern Province.

At _______ on _______ Day of _______ of the year 20_ of two thousand and six in the presence of the following Witnesses:

WITNESS

Signature:

Address:

Occupation:

Signed by:

WITNESS

Signature:

Address:

Occupation:

Signed by:

KILINOCHI RANGE

Eng. A. G. Dinetharaj
Deputy Director of Irrigation

N. Dethannythan
Govt. Agent /
Dist. Secretary
Kilinochchi District

Eng. S. Sarvaloganathan
Northern Province

N. Dethannythan
Govt. Agent /
Dist. Secretary
Kilinochchi District

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PARTY OF THE SECOND PART

The common seal of the National Water supply and Drainage Board is affixed in the presence of

Signed by: S.C. Amaratunge
Chairman of the National Water Supply and Drainage Board

Signed by: M.S. Mageer
Working Director of the National Water Supply and Drainage Board

In the presence of the following witnesses:

WITNESS
Signature: [Signature]
Address: [Address]
Occupation: [Occupation]
Signed by: [Name]

WITNESS
Signature: [Signature]
Address: [Address]
Occupation: [Occupation]
Signed by: [Name]
6-4 Dry Aru Water Sharing Agreement
வேளாண்மை பராமாண்மை பயணம் 1-2 மோதிப்புக்கு தொடர்பில் மேலும் நிற்குவதற்கு பயணம் பெற்றுள்ளது. 

1. வேளாண்மை போக்கிறது. 2018 முதல் மேலும் நிற்கப்பட்டு வருமானத் தொடர்பில் 85000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் 27000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் வேளாண்மை போக்கிறது. 

2. வேளாண்மை போக்கிறது. 2018 முதல் மேலும் நிற்கப்பட்டு வருமானத் தொடர்பில் 85000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் 27000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் வேளாண்மை போக்கிறது. 

3. வேளாண்மை போக்கிறது. 2018 முதல் மேலும் நிற்கப்பட்டு வருமானத் தொடர்பில் 85000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் 27000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் வேளாண்மை போக்கிறது. 

4. வேளாண்மை போக்கிறது. 2018 முதல் மேலும் நிற்கப்பட்டு வருமானத் தொடர்பில் 85000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் 27000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் வேளாண்மை போக்கிறது. 

5. வேளாண்மை போக்கிறது. 2018 முதல் மேலும் நிற்கப்பட்டு வருமானத் தொடர்பில் 85000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் 27000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் வேளாண்மை போக்கிறது. 

6. வேளாண்மை போக்கிறது. 2018 முதல் மேலும் நிற்கப்பட்டு வருமானத் தொடர்பில் 85000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் 27000 மீன்பொருள் அல்லது பொருள்நிலை பயணம் பொருள் வேளாண்மை போக்கிறது.
Translation of the Minutes of the Discussion that GA, Kilinochchi and the relevant officials had with representatives of the Farmers Federation about supply of water to Jaffna from Iranamadu Tank.

Venue: Kilinochchi District Secretariat, Auditorium
Time: 10.30 am
Date: 12th October 2010

The Discussion with the farmers began at 10.30 a.m at the Kilinochchi District Secretariat Auditorium with the Kilinochchi Government Agent Mrs. Rubawathy Ketheswaran in the chair. Project Director, The National Water Supply & Drainage Board (NWS&DB), the Engineers of the Provincial Irrigation Department, the Deputy Director of the Irrigation Department, the Divisional Secretaries of Kilinochchi and the Representatives of the Farmers Federation (attendants register is attached herewith). In the opening address of the Government Agent she welcomed the officials who attended at the meeting. She informed that the people of this district have been stressing the need for the rehabilitation of the tank in the past.

The Project Director, NWS&DB in his address, welcomed all those who took part in the discussion and informed them that this project was proposed in 2006 and the time has come for its implementation. This project involves in the rehabilitation of the Iranamadu Tank, the supply of water for the Farmers of Kilinochchi and the supply of drinking water for the people of Jaffna. The project will implement the rehabilitation of the Iranamadu tank through the Provincial Irrigation Department with the funds of the Asian Development Bank. NWS&DB will undertake the water supply and Sanitation Project for the people of Jaffna and Kilinochchi. He explained the aims of the NWS&DB and its targets with maps. After that he explained the present condition of the Iranamadu Tank;

- It could hold 106,500 acre feet of water
- The tank can store water up to a depth of 28.30 ft instead of the 31 feet full supply depth, because the tank bund and the radial gates are damaged. The surplus water is allowed to drain off.
- The main supply channels are damaged to the water goes to waste.
- The cultivation in highlands has been interrupted because the water supply has not been restored.

He said that the highland cultivation and the "Maha Season" cultivation and the people living along the channel in the lower reaches could get water for their use and for the cattle, if the tank bund is raised by 2 feet.

The Project Director in his speech said that out of 50,000 m³/day, 27,000 m³/day could be sent to Jaffna for the supply of drinking water, 2000m³/day for Poonagary, Palai and other places. 4000 m³/day could be provided for Kilinochchi water supply could be used. Further 8000 m³/day could be supplied for the second stage of the Kilinochchi town water supply and Iranamadu Tank will not be used for any other purpose.
purpose. As mentioned in the MOU the water will be taken with the consent of the Farmers and that the Farmers of Kilinochchi would continue to get water as they get now and they could also get additional water for highland cultivation. He further said that the NWS&DB supplies water only for 1-2 hours in the Jaffna Peninsula and that in the proposed demand in 2028, water would be 88,500m³/day. To obtain the balance needs of water we have to depend on various other projects. He spoke about the sanitation programs also. Further he thanked the Government Agent, the Irrigation Department, the Farmers and the People for their cooperation in implementing this project. As informed by the NWS&DB earlier, the 6000 copies of the Tamil translation of the MOU and the one page summary notice giving the main points are ready to be distributed among the Farmers (6000 copies are ready).

The President of the Farmers Federation raised some points during the explanation of the Project Director, they are as follows;

- As mentioned in the MOU under no-circumstances will more water should be taken other than the agreed 1250 acre feet/month.
- We would not permit any hindrance to the Kilinochchi Farmers at any time as mentioned in the MOU.
- A committee should be setup to discuss with the Farmer's Federation and the Irrigation Department at least once in three months regarding water distribution. In that committee Farmer representation should be in the majority.
- A meeting regarding water distribution should be held presided by the Kilinochchi Government Agent at the end of the rainy season every year.
- The Irrigation Department should meet each Farmer organization and explain the MOU.

Deputy Director of Irrigation Eng. Suthaharan said that they will start the program for rehabilitation of the Irnamadu Tank and that they will provide all possible help for the project. He further said that if there is any other project that is useful to fulfill the need for water in this very dry district that should also be included in this project.

Divisional Secretary Kandavalai said that, he was very sad that his division was not included in this project and that his division needs water for agriculture as well as drinking purposes. He requested that his division should be included in the project to full fill the needs of the division.

Finally the Government Agent requested the NWS&DB to start the water supply project for Kilinochchi quickly and thanked all officers for their participation cooperation and suggestions.

The meeting ended by 11.30a.m.
Wild Life Ranger,
Department of Wild Life,
Kachcheri,
Vavuniya.
2011.05.02.

Regional Manager,
National Water Supply and
Drainage Board,
Jaffna.

Rehabilitation of Kilinochchi
Water Supply Scheme.


We wish to refer to your letter of 26.04.2011 with regard to the above subject.

In this connection, we wish to inform that the mentioned area is not falls under our Wild Life.

Therefore, we have no objection or hesitation to carry out said project.

Thanking you,

Wild Life Ranger.

[Signature]
Confirmation Note on Dumping Site

June 10, 2011

1. Location of Dumping Site

2. Address / Show the location on the map

3. How much is the dumping fee / m³?

4. Who is the owner (private/public)?

5. Regarding dumping, what office supervises the dumping site?

6. Area of Dumping Site, (____ m²)

1. LUNAYAL PURAM

2. LUNAYAL PURAM KILINOCHI

3. Per m³ 496 /

4. KARACHI PRODANYASAR STATE LAND

5. 62500 m² (20 Acre)

[Signatures]

Technical Officer
KARACHI PRODANYASAR SABHA KILINOCHI

K.thawar Ali
Secretary
KARACHI PRODANYASAR SABHA KILINOCHI
<table>
<thead>
<tr>
<th>Name</th>
<th>Designation</th>
<th>Organization</th>
<th>TEL</th>
<th>Signature</th>
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<td>Mr. K. Thavosathy</td>
<td>Secretary</td>
<td>Karachchi P.S.</td>
<td>0212285761</td>
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<tr>
<td>Mr. C. C. Nagel</td>
<td>Technical Officer</td>
<td></td>
<td>0775395628</td>
<td></td>
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<tr>
<td>Kenji Takayangi</td>
<td>Environmental &amp; Social</td>
<td>JICA Study Team</td>
<td>0777617794</td>
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</tbody>
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6-7 Social Survey

1. SOURCES OF ECONOMIC AND SOCIAL DATA

The key socio-economic data used in this Study for Killinochchi Water Supply Rehabilitation Project are drawn from both primary and secondary sources. Secondary data were sourced from existing government and external reports while primary data were collected by means of (i) socio-economic surveys, (ii) focus group discussions with community members, and (iii) discussions with the key staff working in the private / public institutions. Specific findings relating to household income, health, access to water and sanitation, ability and willingness to pay for improved water supply services and other issues relevant to this Study are largely based on the results of the surveys and focus group discussions. Where appropriate, these findings are compared with available secondary data, which generally relate to Killinochchi District as a whole.

1.1 Socio-economic Surveys

Socio-economic surveys were conducted among households and institutions/ businesses in selected Grama Niladhari Divisions (GNDs) of proposed water supply distribution area of the Killinochchi water supply scheme. Issues addressed in the socio-economic surveys included the incidence of poverty; the health status of the population, and incidence of water-borne and water related diseases; existing sources of water, and access to the nearest water source; community perceptions of the quality and availability of water; water use; sanitation facilities; gender issues; maintenance and sustainability issues; and community member’s ability and willingness to pay for improved water supply.

Two survey questionnaires were designed by the Sociological Team: one for householders and the other for institutions and small businesses. Field activities were undertaken by a Socio –Economic Specialist with extensive experience in conducting socio-economic surveys. All Fourteen GNDs planned to be served under the proposed project were selected from two Divisional Secretary Divisions (DSDs) of Karachchi and Kandawalai in the Killinochchi District. Selection of the households was on the basis of population density and the extent of GND coverage by the proposed project. Sample size was 512 Households (HH) out of the total planned coverage of 3000 HH. The sample represents approximately 17% of the target HH. The following factors were considered when selecting the sample in each GND.

a) Population Density of the GND (high / low)
b) Proposed Water Supply Coverage in the GND (high / low)

Households were selected randomly but covering each and every community cluster and the core-areas of the GND as the sample of the survey. Households were selected from the area to be covered under the proposed project within the GND area. Enumerators selected households counting every fifth unit until they reached the target of households determined in each cluster of community.

Table 1 GN Divisions and Number of Households Selected For Household Survey

<table>
<thead>
<tr>
<th>DS Division</th>
<th>GND</th>
<th>Total HHs</th>
<th>Population Density</th>
<th>Proposed Coverage</th>
<th>Sample Size (%)</th>
<th>Sample Size (HH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Karachi</td>
<td>Kanagambikikulam</td>
<td>559</td>
<td>High</td>
<td>High</td>
<td>12%</td>
<td>66</td>
</tr>
<tr>
<td>Karachi</td>
<td>Thondamannagar</td>
<td>274</td>
<td>High</td>
<td>High</td>
<td>12%</td>
<td>33</td>
</tr>
<tr>
<td>Karachi</td>
<td>Ratnapuram</td>
<td>390</td>
<td>High</td>
<td>Low</td>
<td>8%</td>
<td>30</td>
</tr>
<tr>
<td>Karachi</td>
<td>Kanagapuram</td>
<td>415</td>
<td>Low</td>
<td>High</td>
<td>8%</td>
<td>32</td>
</tr>
<tr>
<td>Karachi</td>
<td>Thirunagar South</td>
<td>373</td>
<td>Low</td>
<td>High</td>
<td>8%</td>
<td>31</td>
</tr>
<tr>
<td>Karachi</td>
<td>Thirunagar North</td>
<td>472</td>
<td>Low</td>
<td>High</td>
<td>8%</td>
<td>36</td>
</tr>
<tr>
<td>Karachi</td>
<td>Killinochchi Town</td>
<td>385</td>
<td>High</td>
<td>High</td>
<td>12%</td>
<td>45</td>
</tr>
<tr>
<td>Karachi</td>
<td>Udayanagar East</td>
<td>637</td>
<td>High</td>
<td>Low</td>
<td>8%</td>
<td>50</td>
</tr>
<tr>
<td>Karachi</td>
<td>Muruthanagar</td>
<td>441</td>
<td>Low</td>
<td>Low</td>
<td>4%</td>
<td>17</td>
</tr>
</tbody>
</table>
Fifteen institutions and businesses were selected to take part in the second survey, selected to represent a wide range of type of institution. Details of the institution selected are given in the Table 2

<table>
<thead>
<tr>
<th>Category</th>
<th>No. of Staff</th>
<th>Avg. No. of Visitors per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 NGO –Mine clearing</td>
<td>07</td>
<td>80</td>
</tr>
<tr>
<td>2 NGO</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>3 Private Service provider - Telecom</td>
<td>06</td>
<td>75</td>
</tr>
<tr>
<td>4 Shop</td>
<td>04</td>
<td>250</td>
</tr>
<tr>
<td>5 Tailoring Shop</td>
<td>05</td>
<td>50</td>
</tr>
<tr>
<td>6 Bank</td>
<td>11</td>
<td>60</td>
</tr>
<tr>
<td>7 Hospital</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>8 Government Institution (Education Office)</td>
<td>12</td>
<td>70</td>
</tr>
<tr>
<td>9 Government Institution (Technical College)</td>
<td>115</td>
<td>75</td>
</tr>
<tr>
<td>10 Government Institution (Administration Office)</td>
<td>11</td>
<td>50</td>
</tr>
<tr>
<td>11 Hotel</td>
<td>04</td>
<td>120</td>
</tr>
<tr>
<td>12 Hotel</td>
<td>05</td>
<td>60</td>
</tr>
<tr>
<td>13 Hotel</td>
<td>04</td>
<td>50</td>
</tr>
<tr>
<td>14 Hotel</td>
<td>04</td>
<td>60</td>
</tr>
<tr>
<td>15 Hotel</td>
<td>09</td>
<td>100</td>
</tr>
</tbody>
</table>

To conduct the survey, a team of ten experienced researchers/enumerators were engaged. One day training was provided to enumerators on the survey formats and survey methodology.

1.2 Focus Group Discussions

To aware the people in the area regarding the household survey and to validate the results of the survey, three focus group discussions were held. Around twelve persons took part in each of the discussions which were held in an informal manner.

2. POPULATION PATTERNS AND FUTURE DEVELOPMENT

Within the boundaries defined, proposed project area consists of 14 GNDs with a total population of approximately 20,300 persons living in 6,400 households. While population growth rates for Killinochchi town itself are not available, it is expected that the area will experience high population growth with resettlement of people parallel to the rapid infrastructure development programs envisage in the area.

2.1 Household Composition and Housing Condition

Most households in the survey sample comprise nuclear families, with 15 percent headed by females. The average number of household members in the sample population is 4.2, which is slightly higher than the
National average of 4.1 indicated in the Household Income and Expenditure Survey (HIES) 2006/07. 23 percent of sample households, however, consist of a relatively large number of members (more than 5 members).

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of Adults in the family (over 18 years)</td>
<td>1,223</td>
<td>57</td>
</tr>
<tr>
<td>No of Children in the family (less than 18)</td>
<td>817</td>
<td>38</td>
</tr>
<tr>
<td>No of Adults outside family living in the house</td>
<td>64</td>
<td>3</td>
</tr>
<tr>
<td>No of Children outside family living in the house</td>
<td>38</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>2,142</td>
<td>100</td>
</tr>
</tbody>
</table>

The percentage of the sample population below 18 years is 40 percent.

The ethnic composition of Killinochchi town is predominantly Tamil which represent 99% of the sample surveyed. In the survey sample, there were 2 Muslim families and one Sinhala family.

The majority (55 percent) of households surveyed occupy permanent houses. Balance 45 percent of households occupies non-permanent type houses.

2.2. Households Income and Assets

Killinochchi District is primarily an agricultural area. Occupations details are given in the Table 4.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government service</td>
<td>68</td>
<td>7.5</td>
</tr>
<tr>
<td>Private / NGO sector</td>
<td>27</td>
<td>3.0</td>
</tr>
<tr>
<td>Skilled worker- carpentry, masonry, tailor, hair cutter etc.</td>
<td>118</td>
<td>13.0</td>
</tr>
<tr>
<td>Agriculture activities - paddy, vegetables growing etc.</td>
<td>64</td>
<td>7.0</td>
</tr>
<tr>
<td>Animal husbandry- cows, goats, poultry farming etc.</td>
<td>13</td>
<td>1.4</td>
</tr>
<tr>
<td>Unskilled casual worker - agricultural or non agricultural</td>
<td>12</td>
<td>1.3</td>
</tr>
<tr>
<td>Self employed - Beedi wrapping, sawing, three wheel driving etc.</td>
<td>32</td>
<td>3.5</td>
</tr>
<tr>
<td>Trade –shop, boutique, trade on bicycle, fishing boat owner etc.</td>
<td>18</td>
<td>2.0</td>
</tr>
<tr>
<td>Small industries – buckets making, lathe work etc.</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td>Unemployed</td>
<td>418</td>
<td>45.9</td>
</tr>
<tr>
<td>Other</td>
<td>137</td>
<td>15.0</td>
</tr>
<tr>
<td>Total</td>
<td>911</td>
<td>100</td>
</tr>
</tbody>
</table>

As there is no permanent income (salaried occupations) in most of the families, some of the adults are engaged in more than one occupation indicated above. However, for the survey, only main occupation was identified.

According to the survey results, almost 46 percent of the people in the area are unemployed. This is substantially high compared to the National average of 4.9 %. Only 10.5 percent of the people have jobs in the government/private and NGO sectors. Apart from this, most of the other households rely on government subsidies and seasonal income from various sources such as casual works. This indicates that the poverty situation in the area is high.

Average household income is given in the Table 5
Table 5  Average Household Income

<table>
<thead>
<tr>
<th>Income Range</th>
<th>No of HH</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than Rs 5,000</td>
<td>132</td>
<td>25.8</td>
</tr>
<tr>
<td>Rs. 5,000 – Rs. 10,000</td>
<td>143</td>
<td>27.9</td>
</tr>
<tr>
<td>Rs. 10,000 – Rs. 20,000</td>
<td>155</td>
<td>30.3</td>
</tr>
<tr>
<td>More than Rs. 20,000</td>
<td>62</td>
<td>12.1</td>
</tr>
<tr>
<td>No response</td>
<td>20</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>512</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

As household income is the most significant indicator of economic status. Therefore, data on income from all sources were given particular attention in the socio-economic survey. Average household monthly income from all sources in the surveyed area is estimated at LKR 12,853. According to the National Statistics, the mean income of Sri Lanka households is Rs. 20,427 (HIES 2009/10). Therefore, the average income in Killinochchi area is lower than the mean income of households of Sri Lanka.

According to the HIES 2009/10 report, the 20 percent of the population in Sri Lanka who get the lowest income receive an average of Rs. 8,211. In the surveyed area, 25.8 percent of households have an income less than Rs. 5,000. The total households less than Rs 10,000 income is 53.7 percent. Therefore more than half of the population in the surveyed area can be classified as poor.

Income patterns among the surveyed households indicate that the highest income contribution (46 percent) comes from self-employments such as casual /skilled laborers, agricultural activities etc. 22 percent of the households depends on salaried jobs. 24 percent households have indicated that they rely on other sources such as house members working abroad and assistance from NGOs.

3  INFORMATION ON EXISTING WATER SERVICES

3.1  Household Access to Services

Almost 98 percent of the households use same water source throughout the year while little over 2 percent of the households switch to alternative water sources during drought periods. Therefore, droughts have no major impacts on their drinking water sources. Access to water services by sample households is given in the Table 6.

Table 6 Access to Water Services by Sample Households

<table>
<thead>
<tr>
<th>Water source</th>
<th>No. of HH</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>House connection-piped system</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>Stand post-piped system</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pumping from own protected well</td>
<td>39</td>
<td>7.6</td>
</tr>
<tr>
<td>Protected well-1(private)</td>
<td>180</td>
<td>35.2</td>
</tr>
<tr>
<td>Protected well-2 (neighbour)</td>
<td>96</td>
<td>18.7</td>
</tr>
<tr>
<td>Protected well-3(common)</td>
<td>32</td>
<td>6.2</td>
</tr>
<tr>
<td>Unprotected well-1(private)</td>
<td>83</td>
<td>16.2</td>
</tr>
<tr>
<td>Unprotected well-2(neighbour)</td>
<td>59</td>
<td>11.5</td>
</tr>
<tr>
<td>Unprotected well-3(common)</td>
<td>9</td>
<td>1.8</td>
</tr>
<tr>
<td>Deep hand pump</td>
<td>6</td>
<td>1.2</td>
</tr>
<tr>
<td>River/ Stream/Irrigation Tank/canal</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rain water collection</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bowser supply</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>512</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

According to the Table 6, 97 percent of households use dug wells as their drinking water source. Dug wells
are the most common rural water supply source in Sri Lanka. However, particularly in the event of high population density, there is a risk of contamination of shallow dug wells due to seepage of waste water from toilet pits and other waste water sources. 30 percent of the dug wells are unprotected and therefore has high potential for contamination. The balance 70 percent of the households use protected dug wells where the contamination risk is low compared to unprotected dug wells. According to the survey 44 percent of the households have protected dug wells at their own premises which provide free access to the water source in relatively short fetching time.

As plenty of dug wells available in the area, no household is using surface water sources such as streams, ponds or irrigation channels as the drinking water source. There are no major piped water supply systems in the area. However, 2 households are taking water from a piped system established locally to cover few households.

3.2 Water Quality

Out of the total 512 households surveyed, 343 households (67%) have complained about the water quality. Perception of the surveyed households on water quality is given in the table below;

<table>
<thead>
<tr>
<th>Quality</th>
<th>Wet season</th>
<th>Dry season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad colour</td>
<td>51</td>
<td>48</td>
</tr>
<tr>
<td>Bad smell</td>
<td>39</td>
<td>41</td>
</tr>
<tr>
<td>Bad taste</td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td>Water is heavy</td>
<td>146</td>
<td>137</td>
</tr>
<tr>
<td>High content of algae</td>
<td>56</td>
<td>69</td>
</tr>
<tr>
<td>Sediment in water</td>
<td>45</td>
<td>59</td>
</tr>
<tr>
<td>White sediments are accumulated in container used to boil water</td>
<td>163</td>
<td>159</td>
</tr>
<tr>
<td>Other (specify)</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

There is no significant difference in water quality during the wet season and the dry season. One reason for this situation is that the most of the households use same water source throughout the year. This results also indicates that the area has good drainage system and flooding is not a major hazard in the area.

High incidence of “Heavy” water reported in the area. “Heavy” water means high content of Calcium and / or Magnesium in the water. This is also called the hardness. According to the survey result, hardness issue is prevailed in around 30 percent of the households. This result is confirmed by the result that white sediments are accumulated in containers used to boil water. This high level of hardness may be due to limestone layers in the shallow underground in the area. People may get kidney diseases with the long term consumption of this water and therefore is a potential health hazard in the long run.

Out of the total surveyed households, only 33 percent has not reported any water quality issue. According to the survey results, other than hardness, other water quality issues are reported in about 18 percent of the sample surveyed. Therefore hardness is the single most important water quality issue according to the survey. This indicates that improved water supply service is necessary to maintain good health condition in the area.

3.3 Impact on Economic Activities due to Time Spend on Water Collection

214 households (42 %) travel outside the premises to collect water. Mode of travel and the distance of travel by household members are given in the table below;

<table>
<thead>
<tr>
<th>Mode of</th>
<th>Distance (m)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A-92
207 households (40.4%) walk to fetch water while 7 households (1.4%) use foot bicycles to collect water. Therefore no household is spending money to collect water as they are not hiring outside laborers or use fuel consumed vehicles for this purpose. 170 households (33.2%) travel less than 100m to collect water. Total households travel more than 100m is 44 (8.6%) while 6 (1.2%) of them are travelling more than 500m.

Those households who take water from sources outside the premises, on average travel 4 times a day to fetch water. Average time to fetch water can be assumed as 10 minutes per trip. Therefore fetching water takes around 40 minutes every day for 42 percent of households who are going outside their premises to collect water. Of this group, around 20 percent spend more than an hour per day to collect water as they travel over 100 m.

However, only 8 households (1.6%) responded positively to the question on the impact on economic activities due to time spent on collecting water. According to this results, majority of the residents in the area do not consider the time spend on water fetching as lose of time. 14 households (2.7%) believe that water fetching affects children’s education. These results indicate that there are adequate members in families who are not involved in economic related activities and can spend time on fetching water.

### 3.4 Water Use Practices

Details of Household members that boil water before drinking is given in the Table 9 below;

<table>
<thead>
<tr>
<th>Category</th>
<th>No of HH</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>250</td>
<td>48.8</td>
</tr>
<tr>
<td>Only children</td>
<td>29</td>
<td>5.7</td>
</tr>
<tr>
<td>Only older members of family</td>
<td>6</td>
<td>1.2</td>
</tr>
<tr>
<td>Only children &amp; Old members of family</td>
<td>7</td>
<td>1.4</td>
</tr>
<tr>
<td>None</td>
<td>220</td>
<td>42.9</td>
</tr>
</tbody>
</table>

Close to 49 percent of households drink water after boiling. Only 43 percent do not drink boiled water at all while some 8 percent boil water only for children and/or old people. This is a reasonably good situation compared to typical rural areas of Sri Lanka where percentage of people who boil water before drinking is comparatively low. In most rural parts of Sri Lanka finding fire woods for water boiling is costly while boiling using kerosene or gas is expensive. Availability of sufficient firewood may be a one reason for using boiled water by a comparatively higher percentage of households. This outcome also indicates that people have fairly good awareness on hygiene aspects. It was reported in few households, kidney and heart patients use bottled water for drinking on the advice of medical doctors.

### 3.5 O& M of tube well/ common shallow well

Only 65 households (13%) reported to be used common water supply facilities. Management methods of these facilities are given in the Table 10 below;

<table>
<thead>
<tr>
<th>Method</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Care taker &amp; Consumer groups jointly</td>
<td>1</td>
<td>1.5</td>
</tr>
</tbody>
</table>
More than 70 percent of the common facilities are managed by user households without any formal organizational structure such as community based organizations or consumer societies. Formal managements can be seen only in 15 percent of common facilities. It is important to note that the Local Authority has not involved in operation and maintenance of any of the common water services.

4. SANITATION SITUATION

4.1 Type of Existing Sanitation Facilities

Table 11 shows the existing sanitation facilities in the sample households

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of HH</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water sealed latrine (closet) with cistern</td>
<td>145</td>
<td>28.4</td>
</tr>
<tr>
<td>Water sealed latrine – pour flush</td>
<td>13</td>
<td>2.5</td>
</tr>
<tr>
<td>Water sealed latrine – public</td>
<td>4</td>
<td>0.8</td>
</tr>
<tr>
<td>Permanent pit latrine (private)</td>
<td>140</td>
<td>27.4</td>
</tr>
<tr>
<td>Permanent pit latrine (public)</td>
<td>11</td>
<td>2.1</td>
</tr>
<tr>
<td>Temporary pit latrine (private)</td>
<td>58</td>
<td>11.3</td>
</tr>
<tr>
<td>Neighbor’s latrine</td>
<td>60</td>
<td>11.7</td>
</tr>
<tr>
<td>No latrine &amp; open defecation within premises</td>
<td>16</td>
<td>3.1</td>
</tr>
<tr>
<td>No latrine &amp; open defecation outside premises</td>
<td>62</td>
<td>12.1</td>
</tr>
<tr>
<td>No response</td>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>512</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Among the surveyed households, almost 85 percent use latrines. This is less than the National average for rural areas of 94.7 (HIES 2007). However, considering the conflict situation prevailed in the areas for 30 year, sanitation condition could be considered as satisfactory. Almost 31 percent have either pour flush or water sealed toilets, and 39 percent have pit latrines. 3 percent use public latrine while 12 percent use neighbor’s latrines. Therefore, altogether 70 percent has their own latrines while 30 percent rely on neighbor’s latrines, common latrines or open defecation. This 30 percent of the households are in need for private sanitation facilities.

15 percent of households defecate openly. This average is higher than the national average of 3 % (HIES 2007). Open defecation practices not only pose health risks to themselves, but also to the entire community living in the surrounding area. In addition, women, particularly grown up girls suffer mostly due to lack of sanitary facilities. Therefore, it is necessary to implement a sanitation improvement program parallel to water supply improvement in order to achieve health benefits of propose water supply development.

Most latrines in the surveyed households were connected to soakage pits, with associated risks of seepage and contamination of ground water. Therefore, in future sanitation improvement programs, awareness on communities on health risks associated with improper disposal of excreta is important. Further services of Public Health Inspectors have to be obtained to identify suitable locations for construction of latrines.

4.2 Condition of the Latrine

Physical conditions of latrines are summarized in the Table 12 below;
Table 12 - Physical conditions of latrines

<table>
<thead>
<tr>
<th>Condition of the Latrine</th>
<th>No of HH</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wattle-doubled with thatched roof</td>
<td>123</td>
<td>34.6</td>
</tr>
<tr>
<td>Cadjan cover with cadjan roof</td>
<td>25</td>
<td>7.0</td>
</tr>
<tr>
<td>Brick work with tiled roof</td>
<td>29</td>
<td>8.1</td>
</tr>
<tr>
<td>Brick work with thatched roof</td>
<td>142</td>
<td>39.9</td>
</tr>
<tr>
<td>Damaged pit</td>
<td>22</td>
<td>6.2</td>
</tr>
<tr>
<td>Damaged superstructure</td>
<td>32</td>
<td>9.0</td>
</tr>
<tr>
<td><strong>Total private latrines</strong></td>
<td><strong>356</strong></td>
<td></td>
</tr>
</tbody>
</table>

According to the survey results, 356 households (70 %) use their own latrines. Only 6.2 percent of households have latrines with damaged pits. These pits may be harmful to the environment due to entrance of flies, bad smell etc. Superstructure condition of the latrine is mostly concern with social status and aesthetic values rather than hygienic or environmental issues. According to the survey, only 9 percent of existing latrines have damaged superstructure. Almost half of the latrines have permanent superstructure with brickwork.

Survey enumerators have classified 9 percent of the latrines are in very good condition and 63 percent are in satisfactory condition. Only 27 percent of latrines are in unsatisfactory condition. Reasons for unsatisfactory conditions are mainly due to lack of money for maintenance, poor knowledge on hygiene and / or lack of water for proper maintenance.

4.3 Reasons for not constructing toilets

Altogether, 179 households (35 %) expressed desire to construct new toilets. Main Reasons for not constructing toilets are given in the Table 13 below;

Table 13 - Main Reasons for not Constructing Toilets

<table>
<thead>
<tr>
<th>Reason</th>
<th>No. of HH</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No land to construct a latrine</td>
<td>8</td>
<td>4.4</td>
</tr>
<tr>
<td>Live in rented house</td>
<td>11</td>
<td>6.1</td>
</tr>
<tr>
<td>Live in encroached crown land</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td>Temporary residence</td>
<td>54</td>
<td>30.2</td>
</tr>
<tr>
<td>Dispute over the site selected for latrine</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td>No money to construct a latrine</td>
<td>100</td>
<td>55.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>179</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Majority expressed that lack of money is the main reason for not constructing a latrine. The other main reason is they are living in temporary residence.

5 WATER-RELATED HEALTH ISSUES

Only 7.4 percent of surveyed households reported that they have experienced water-related health problems within the last year. Total number of water borne diseases incidence were 95. Those most affected were children. There were 91 cases of medical treatment for water related diseases. Main causes were hepatitis and fever associated with stomach pain or vomiting. The average money spend per incidence is Rs. 1,068 for medicine, Rs. 246 for transport and Rs. 22 for other expenses. Considering the average monthly income of around Rs. 12,800 per month, this is a substantial cost.

1 Cadjan: matted roof leaves
11 incidences of kidney related diseases and 151 incidences of dental fluorosis cases have been reported in
the sample. This indicates that the ground water contains fluoride, in addition to high calcium/magnesium
content reported under water quality aspects. The main problem with fluoride in rural areas is that this
substance cannot be identified without proper laboratory testing. There is no taste, smell or any short
term side effect indicating presence of high concentration of fluoride in water. In North Western, Eastern
and Northern provinces of Sri Lanka, there is high incidence of kidney failures. Fluoride has been
considered as the main cause for this health problem although this fact is yet to be scientifically proved.

6 SPECIFIC GENDER ASPECTS AND ISSUES

As the main users of water for domestic purposes, women are most affected if their families’ main source
of water is insufficient, difficult to access, contaminated or unreliable. In addition, with the main
responsibility for the care of infants, differently able and the elderly falling to women, poor health among
family members due to water-related or waterborne diseases can result in a significant additional burden on
women.

Distance to drinking water source impacts directly on women, since it is often (although certainly not
always) the task of women to fetch water each day. As around 90 percent of surveyed households’ main
water source less than 100 meters (within the premises or within 100 m from the premises), the task of
fetching water each day is somewhat eased. Even when the water source is nearby, however, the daily
burden of fetching water may be better understood when viewed in terms of the number of trips required,
and the number of pots carried, to meet the average family’s needs. Children, and girls in particular, are
often required to fetch water in the morning before school, which may cause them to be late or even miss
school. In addition, carrying heavy pots or buckets of water can, over long periods, cause injury to the hip
or spine – and is particularly inadvisable for young girls or pregnant women. Security may also be a
concern for some women who are obliged to walk long distances to fetch water.

The quality of water, particularly for drinking, also directly impacts on women. The task of boiling water
for drinking generally falls to women, and given the additional time and fuel required to carry out the task,
it is hardly surprising that water is only boiled if considered absolutely necessary.

Access to private latrines is particularly important to women, including the availability of water in the
latrine for personal washing. While the majority of households in the sample reported having satisfactory
latrine facilities, about 15 percent lacked their own latrines or access to neighbor’s latrines, forcing family
members to excrete in the open air. In addition to the obvious threat to health that unhygienic disposal of
human excrement poses, women in particular suffer from lack of privacy and even fear of molestation.

7 DEMANDS FOR THE PROJECT AND COMMUNITY PREFERENCES

The survey results and findings from the focus group discussions reveal that there exists a high demand for
piped water supply. This finding has confirmed with the findings of the household survey conducted in the
area as shown in the Table 14 below;

<table>
<thead>
<tr>
<th>Preference for Improved Water Supply</th>
<th>Number of HH</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piped water supply-house connection</td>
<td>450</td>
<td>87.8</td>
</tr>
<tr>
<td>Piped water supply- stand post</td>
<td>23</td>
<td>4.5</td>
</tr>
<tr>
<td>Piped water supply- yard tap</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Private shallow well</td>
<td>16</td>
<td>3.1</td>
</tr>
<tr>
<td>Common shallow wells</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Deep tube well</td>
<td>6</td>
<td>1.2</td>
</tr>
<tr>
<td>Shallow well with hand pump</td>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td>Rain water harvesting system</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0.6</td>
</tr>
<tr>
<td>No response</td>
<td>8</td>
<td>1.6</td>
</tr>
</tbody>
</table>
Altogether 92.5 percent has preferred piped water supply. 95 percent of the households opted for piped water supply, have been given their preference for house connections while balance 5 percent has preferred yard taps or stand posts. Only other significant option is private shallow wells which has preferred by 3.1 percent. According to these results, demand for piped water supply in the area is very high.

Most households indicated that they are willing to pay for improved water supply. Details of willingness to pay are given in the Table 15 below;

**Table 15 - Willingness to pay cash for water**

<table>
<thead>
<tr>
<th>Range Rs./month</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100</td>
<td>111</td>
<td>21.7</td>
</tr>
<tr>
<td>100-250</td>
<td>271</td>
<td>52.9</td>
</tr>
<tr>
<td>250-500</td>
<td>62</td>
<td>12.1</td>
</tr>
<tr>
<td>&gt;500</td>
<td>29</td>
<td>5.7</td>
</tr>
<tr>
<td>No response</td>
<td>39</td>
<td>7.6</td>
</tr>
<tr>
<td>Total</td>
<td>512</td>
<td>100</td>
</tr>
</tbody>
</table>

In relation to households’ ability and willingness to pay for piped water, 92.4 percent expressed both ability and willingness to pay an envisaged monthly charge. 70.7 percent of household are ready to pay more than Rs. 100 as the monthly bill while 21.7 percent prefer to pay less than Rs. 100. According to the existing tariff of the NWSDB, total bill for 10 cum/month is Rs. 100 and for 15 cum/month is Rs. 175. At the same time, 17.8 percent of households are willing to pay more than LKR 250 per month.

If the average monthly water bill of a household is Rs. 200, this represent approximately 1.6 % of the average monthly income of Rs. 12,800. It can be assumed that the poorest segment of the community who earn around Rs. 5,000 per month, can be obtained 10 cubic water per month at a cost of Rs. 100. This represents 2% of the monthly income. Therefore, based on the present billing rates of the National Water Supply and Drainage Board, piped water consumption rates can be considered as affordable.

**8 WATER DEMAND IN THE NON - DOMESTIC SECTOR**

As a part of the socio-economic survey, present water supply situation and the water demand in the Non Domestic Sector was assessed. Total of 15 institutions including 4 Government Institutions, 2 NGO Offices and 9 private sector institutions were selected randomly for the assessment. Table 16 shows the summary of the outcome of the survey.

**Table 16 – Summary of the Outcome – Survey of Non - Domestic Places**

<table>
<thead>
<tr>
<th>Category</th>
<th>Present Water Source</th>
<th>Adequate water available?</th>
<th>Present cost of water/month (Rs)</th>
<th>Preference to get pipe borne water</th>
<th>Preferred amount to be paid for water/month (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 NGO – Mine clearing</td>
<td>Dug Well</td>
<td>yes</td>
<td>none</td>
<td>yes</td>
<td>750</td>
</tr>
<tr>
<td>2 NGO</td>
<td>Dug Well</td>
<td>yes</td>
<td>none</td>
<td>yes</td>
<td>500</td>
</tr>
<tr>
<td>3 Private Service provider – Telecom</td>
<td>Bottled water</td>
<td>yes</td>
<td>4,500</td>
<td>yes</td>
<td>3,000</td>
</tr>
<tr>
<td>4 Shop</td>
<td>Dug Well/Bottled Water</td>
<td>yes</td>
<td>9,000</td>
<td>yes</td>
<td>500</td>
</tr>
<tr>
<td>5 Tailoring Shop</td>
<td>Bottled Water</td>
<td>yes</td>
<td>12,000</td>
<td>yes</td>
<td>500</td>
</tr>
</tbody>
</table>
6. Bank Dug Well/Bottled Water yes 9,000 yes 750

7. Hospital Dug Well yes Electricity cost (not known) yes No idea

8. Government Institution (Education Office) Dug Well Yes in most months Inadequate in Aug-Sept none 750


10. Government Institution (Administration Office) Bottled water yes 15,000 yes 2,000

11. Hotel Dug Well Yes in most months Inadequate in Aug-Sept Electricity cost (not known) yes 750

12. Hotel Dug Well Yes Electricity cost (not known) yes 500

13. Hotel Dug Well Yes none yes 325

14. Hotel Tube Well Yes 1,000 yes 150

15. Hotel Dug Well Yes none yes 500

8.1 Existing Water Source

Existing Water sources of the surveyed institutions are given in the Table 17 below:

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dug well</td>
<td>8</td>
<td>53</td>
</tr>
<tr>
<td>Tube Well</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Bottled Water</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Bottle Water + Dug Well</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

More than 50% of the institutions use dug wells as the water source. This includes all the hotels surveyed. These dug wells are prone to pollutions from nearby toilet soakage pits and waste disposed from households and other institutions. Therefore risks of contamination of dug wells are high. Nevertheless all institutions surveyed have indicated that they are satisfied with the water quality of existing water sources. This may be due to lack of awareness on water quality issues.

It was also noted that, some of the office staff brings water from houses for their consumption. 20% of institutions use bottled water for drinking while another 20% use bottle water in addition to the dug well water. Bottled water is the most expensive option for water supply. 1 liter of bottled water costs Rs. 50 (1 Cu. M costs Rs. 50,000). This indicates that some of the office managements in the area has understand the quality risks of water in the area and are spending substantially high amount of money to provide safe water to their staff. Only one institution which represents 7% of the sample use a tube well, which is relatively safe compared to dug wells.

8.2 Cost of Water and Preference for Piped Water Supply

Present expenses in relation to water supply and anticipated water fee for piped water supply system is shown in the Table 18
Table 18 – Cost of Existing Water Services and Anticipated Piped Water Fee

<table>
<thead>
<tr>
<th>Monthly fee (Rs.)</th>
<th>None</th>
<th>1-500</th>
<th>500-1500</th>
<th>&gt;1500</th>
<th>Not Known</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Service</td>
<td>6 (40%)</td>
<td>0 (0%)</td>
<td>1 (7%)</td>
<td>5 (33%)</td>
<td>3 (20%)</td>
</tr>
<tr>
<td>Proposed Piped Service</td>
<td>0 (0%)</td>
<td>7 (47%)</td>
<td>5 (33%)</td>
<td>2 (14%)</td>
<td>1 (7%)</td>
</tr>
</tbody>
</table>

6 (40%) Institutions get water free of charge, i.e. using their own dug wells using bucket and rope. 3 (20%) institutions get water from dug wells using electric pumps but they were not clear about the power cost as the same electricity connection is used for other purposes of the institution. 5 (33%) institutions pay over Rs. 1,500 per month (with an average of Rs. 9,900) for purchasing bottled water.

All 15 institutions prefer to get water services from a common piped water system. 7 (47%) institutions prefer to pay less than Rs. 500 for the services while 5 (33%) institution prefer to pay Rs. 500-1,500 as the monthly water fee.

According to shop owners, visitors to the town area prefer to drink bottled water as no piped water system is available in the area. The average cost of 1 liter of bottled water is Rs. 50. This amount is not affordable to poor people, including most of the school children who rely on the water provided from shallow dug wells of the area.

9 SUMMARY

The proposed project area is predominantly rural area of Northern Sri Lanka. People in the area have suffered heavily due to the conflict situation prevailed in the area for last 3 decades. After normalization of situation in year 2009, considerable progress has been made in resettlement, infrastructure development and the provision of community services.

People in the area are mostly relying on shallow, open dug wells to obtain their drinking water needs. Serious shortages of drinking water during dry season have not been recorded and most people use the same water source throughout the year. Almost 60 percent has water sources within their premises while the balance travels outside to obtain drinking water. Water quality of existing water sources is a serious issue considering percentage of the households complained about water quality. Health risks further aggravate due to the fact that about 15 percent of households do not have access to latrine facilities and practice open defecation.

It was also found that the Institutions, hotels and other common places in the area do not have safe drinking water sources. Domestic residents as well as staff / workers of institutions have shown their interest in obtaining piped water services.

Due to these reasons improvement of water supply and sanitation facilities in the area is a vital step to improve the living condition of people.
6-8 Base Map Preparation

Prior to conduct the outline design the JICA Study Team produced a digital base map in accordance with following procedures.

① To collect digital information from Department of Survey of Sri Lanka which prepared to produce the maps of Sri Lanka

② The digital map was produced in 1897, before the conflict had become fiercer. Therefore the Study Team conformed current situation such as new roads, new buildings on site and take digital information of them by GPS (Global Positioning System).

③ Based on the previous information of Department of Survey’s map the collected current situation was overlapped and supplementary.
6-9 Survey Works

Prior to conduct the outline design the JICA Study Team carried out survey works and all the surveyed information was digitalized by the JICA Study Team.

Survey Works

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
</table>
| Topographical Survey | Water Intake and WTP site: Approximately 8,300 m²  
 Killinochchi Central College site: Approximately 3,700 m²  
 Paranthan Water Tank site: Approximately 500 m² |
| Route Survey    | Transmission line: Approximately 14.9 km  
 Distribution line: Approximately 36.7 km  
 Elevation data taken each 20m and bridges and culvert points  
 Scale: H=1/1000, V=1/200 |
6-10 Soil Investigation

Prior to conduct the outline designs the JICA Study Team carried out a soil investigation to collect soil information under the water supply facility sites.

**Soil Investigation**

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Intake and WTP site</td>
<td>Boring Point: 3</td>
</tr>
<tr>
<td></td>
<td>− Core Boring Depth: 12.4 m ~16.6 m</td>
</tr>
<tr>
<td></td>
<td>− Standard Penetration Test: 35 times (10 + 12 + 13)</td>
</tr>
<tr>
<td></td>
<td>− Bearing Strength was confirmed by N-value exceeding 50</td>
</tr>
<tr>
<td></td>
<td>− Hard rock bearing stratum was confirmed</td>
</tr>
<tr>
<td>Paranthan Water Tank site</td>
<td>Boring Point: 3</td>
</tr>
<tr>
<td></td>
<td>− Core Boring Depth: 10.4 m</td>
</tr>
<tr>
<td></td>
<td>− Standard Penetration Test: 9 times</td>
</tr>
<tr>
<td></td>
<td>− Bearing Strength was confirmed by N-value exceeding 50</td>
</tr>
<tr>
<td></td>
<td>− Hard rock bearing stratum was confirmed</td>
</tr>
</tbody>
</table>
6-11 Water Quality Investigation

Prior to conduct the outline deigns the JICA Study Team a water quality investigation to collect water quality information of Dry Aru, the water resource of the Killinochchi water supply system.

**Water Quality Investigation**

<table>
<thead>
<tr>
<th>Sampling Place</th>
<th>Contents</th>
</tr>
</thead>
</table>
| Water Intake point for Killinochchi water supply system (Dry Aru Tank) | Sampling: 2 times  
1<sup>st</sup>: 8 March 2011  
2<sup>nd</sup>: 2 June 2011  
Measured Parameters: Colour, Odour, Taste, pH, Conductivity, Chloride, Alkalinity, Ammonia, Nitrate, Nitrite, Total residue, Total hardness, Iron, Sulphate, Total Phosphates, Turbidity, Fluorine, Magnesium, Copper, Manganese, COD, BOD, Agricultural Chemicals (MCPA, Glyphosate), Arsenic, Cadmium, Cyanide, Lead, Zinc, Mercury, Chromium, E-coli, Algae |
6-12 Specifications for Mechanical/Electrical Equipment

**M-1. Intake Pump**

Purpose: To pump raw water from the intake tank to the receiving well.

Quantity: 2 sets

Type: Submersible mixed flow pump

Rated: 2.85m³/min x 13.0m, IP68

Motor: 11kW-3phase, 400V, 50Hz, IP68

Material
- **Casing:** Cast iron or equivalent
- **Impeller:** Stainless steel casting or equivalent
- **Main shaft:** Stainless steel or equivalent

Standard accessories:
- **Detachable unit:** 1 lot
- **Guide pipes:** 1 lot
- **Lifting chain:** 1 lot (7m)
- **Pressure gauge:** 1 lot
- **Bolts & nuts:** 1 lot (SUS304)

**Others**

**M-2. Lifting Device for Intake Pump**

Purpose: To lift up the intake pumps for maintenance.

Quantity: 1 set

Type: Manual chain block with I-beam and post

Rated: 0.5ton, H=4m

**M-3. Transmission Pump**

Purpose: To pump clear water from the clear water reservoir to the water tower-1.

Quantity: 2 sets

Type: Horizontal centrifugal pump, indoor type

Rated: 2.64m³/min x 41.0m

Motor: 30kW-3phase, 400V, 50Hz, IP44

Material
- **Casing:** Cast iron or equivalent
- **Impeller:** Browns or equivalent
- **Main shaft:** Steel (S35C) or equivalent

Standard accessories:
- **Common base:** 1 lot
- **Foot valve:** 1 lot
- **Coupling cover:** 1 lot
- **Pressure gauge:** 1 lot
- **Bolts & nuts:** 1 lot (SUS304)

**Others**

Level:
- **Clear water reservoir:**
  - **LWL:** +17.20
  - **HWL:** +19.80
- **Pump room floor:**
  - **FL:** +20.30
- **Water tower:**
  - **LWL:** +40.60
M-4. **Lifting Device for Transmission Pump**

Purpose: To lift up the transmission pumps for maintenance.

Quantity: 1 set

Type: Manual chain block

Rated: 1.0ton, H=3m

M-5. **Chlorination facilities**

General: The chlorination facilities are composed of chlorine booster pumps, chlorinators, chlorine gas cylinders, chlorine neutralization tank and chlorine gas detector. The facility shall be installed in the chlorination room, and neutralization tank shall be installed outside adjacent to the chlorination room. The chlorination facility shall be able to feed chlorine solution at variable rates by manual operation as needed by the quantity and quality of the water to be treated at the transmission discharge point.

Quantity: 1 lot

**Chlorine Booster Pump**

Quantity: 1+1 (duty + standby)

Type: Vertical turbine pump

Rated: 0.04m³/min x 22m, 0.37kW (3p-400V)

**Chlorinator**

Quantity: 1+1 (duty + standby)

Type: Vacuum type with ejector

Rated: 0.5kg/hr

**Chlorine Gas Cylinder**

Quantity: 2

Type: Cylindrical tank with auto changeover unit

Rated: 68kg

**Chlorine Neutralization Tank**

Quantity: 1 lot

Type: Dry type or manufacturer standard

Rated: for 68kg chlorine gas

**Chlorine Gas Detector and Alam:** 1 lot

Control Panel: 1 lot

Standard accessories: 1 lot

M-6. **Sand Washer**

Purpose: To wash skimmed sand by manual

Quantity: 1 set

Type: Movable hydraulic type without water feed pump

Washing capacity: 0.7m³/hr

Material: Mild steel (SS400)

Standard accessories: 1 lot
E-1. **LV Incoming Panel**

Purpose: To receive power from the incoming pole at 400V, 3-phase and 50 Hz with an interlock mechanism, metering and protection devices.

Quantity: 1 set
Type: Indoor, self-supporting, metal-clad switchgear IP42
Rated insulation voltage: AC600V
Rated current: 600A
Control circuit voltage: AC 230V
Main breaker: MCCB 4P 225AF with mechanical interlock
Current transformer (CT): 3 sets, Molded type
Voltage transformer (VT): 2 sets, Molded type
Measuring instrument: As shown on the drawings
Protective relay: As shown on the drawings
Indications: 1 lot
Standard accessories: 1 lot

E-2. **DG Incoming Panel**

Purpose: To receive power from the stand-by generator at 415V, 3-phase and 50 Hz with an interlock mechanism, metering and protection devices.

Quantity: 1 set
Type: Indoor, self-supporting, metal-clad switchgear IP42
Rated insulation voltage: AC600V
Rated current: 600A
Control circuit voltage: AC 230V
Main breaker: MCCB 4P 225AF with mechanical interlock
Current transformer (CT): 3 sets, Molded type
Voltage transformer (VT): 2 sets, Molded type
Measuring instrument: As shown on the drawings
Protective relay: As shown on the drawings
Indications: 1 lot
Standard accessories: 1 lot

E-3. **LV Distribution Panel**

Purpose: To distribute power to pump starter panels and other DBs at 400V, 3-phase and 230V, single phase with protection devices.

Quantity: 1 set
Type: Indoor, self-supporting, metal-clad switchgear IP42
Rated insulation voltage: AC600V
Rated current: 600A
Control circuit voltage: AC 230V
E-4. **Intake Pump Starter Panel**

**Purpose:** To startup and control for the intake pump  
**Quantity:** 2 sets  
**Type:** Indoor, self-supporting, metal enclosed IP42  
**Rated insulation voltage:** AC600V  
**Rated current:** 200A  
**Control circuit voltage:** AC 230V  
**Starter:** VVVF (Variable voltage and variable frequency drive) with DOL bypass x1 set  
**Type:** Multi level voltage source inverter and PWM converter  
**Adapted motor:** 11kWx1 submersible motor [KM-IP-1]  
**Main breaker:** As shown on the drawings  
**Measuring instrument:** As shown on the drawings  
**Control switch:** As shown on the drawings  
**Protective relay:** As shown on the drawings  
**Indications:** 1 lot  
**Standard accessories:** 1 lot

E-5. **Transmission Pump Starter Panel**

**Purpose:** To startup and control for the transmission pump  
**Quantity:** 2 sets  
**Type:** Indoor, self-supporting, metal-clad switchgear IP42  
**Rated insulation voltage:** AC600V  
**Rated current:** 200A  
**Control circuit voltage:** AC 230V  
**Starter:** Soft-starter with DOL bypass x1 set  
**Adapted motor:** 30kWx1 squirrel-cage motor [KM-TP-1]  
**Main breaker:** As shown on the drawings  
**Measuring instrument:** As shown on the drawings  
**Control switch:** As shown on the drawings  
**Protective relay:** As shown on the drawings  
**Indications:** 1 lot  
**Standard accessories:** 1 lot

E-6. **Stand-by Diesel Generator Set**

**Purpose:** To supply power as back-up
Quantity: 1 lot
Base rating: Prime
Output capacity: 100 kVA

Diesel engine: 1 set
    Type: 4-cycle, turbocharged, radiator cooling
    Capacity: 90kW or over for each set
    Governing system: Electronic control
    Engine silencer: 85 dB at 1m away
    Radiator silencer: 85 dB at 1m away

Alternator: 1 sets
    Type: Brushless, 4 pole, synchronous alternator
    Output: 400V, 50Hz, 3 phase, 100kVA
    Insulation: Class F

Housing: Acoustic enclosure, 85 dB at 1m away

Control pane: 1 set
    Type: Indoor, self-supporting, metal enclosed, IP42
    Rated voltage: AC 400V
    System highest voltage: AC 600V
    Measuring instrument: As shown on the drawings
    Protective relay: As shown on the drawings
    Control switch: 1 lot
    Indication lamp: 1 lot

Day fuel tanks: 1 lot
    Capacity: Capable for 24 hours continuous running at full loads
    Accessories: Hand pump, Mechanical level indicator

Air intake filters: 1 lot, with sound attenuators

Standard accessories: 1 lot

**E-7. UPS**

Purpose: To distribute UPS power for instrumentations and monitoring equipment.

Quantity: 1 set

Type: Indoor, self-standing, metal enclosed, IP21

Input voltage: 230V+-10%

Output voltage: 230V+-2%

Capacity: 5kVA with 30 minutes backup

Battery: Sealed lead acid, Maintenance-free type

Charger: Silicon controlled automatic rectifier type for continuous use, 30A

Distribution board: MCCB30A, MCB x5

Protective relay: As shown on the drawings and the general specifications

Mounted device: As shown on the drawings

Indications: As shown on the drawings
Standard accessories: 1 lot

E-8.  Intake Pump Local Panel
Purpose: To control the intake pumps by manual at the site
Quantity: 1 set
Type: Metal enclosed, with stanchion, Outdoor use, IP54
Rated insulation voltage: AC 600V
Control circuit voltage: AC 230V
Protective relay: As shown on the drawings
Mounted device: As shown on the drawings
Indications As shown on the drawings
Standard accessories: 1 lot

E-9.  Transmission Pump Local Panel
Purpose: To control the transmission pumps by manual at the site
Quantity: 1 set
Type: Metal enclosed, with stanchion, Outdoor use, IP54
Rated insulation voltage: AC 600V
Control circuit voltage: AC 230V
Protective relay: As shown on the drawings
Mounted device: As shown on the drawings
Indications As shown on the drawings
Standard accessories: 1 lot

E-10. Intake Sump Level
Purpose: To detect pump pit level for the intake pump control
Quantity: 1 set
Type: Electrode Type Level Switch
Measurement liquid: Raw water
Number of electrode: 3 pieces
Material of electrode: Stainless steel, type 304
Protection pipe: 1 lot
Mounting device and accessories: 1 lot
Standard accessories: 1 lot

E-11. Intake Flow
Purpose: To measure and monitor intake flow
Quantity: 1 set
Type: Electromagnetic Flow Meter
Sensor
Fully submersible type, IP 68
Flange connection: ISO PN10
Material: body and flange: Stainless steel 304 or equivalent
Electrodes: Stainless steel 316 or equivalent
Size (diameter): 200A

Transmitter
Remotely installed from sensor, IP 54
Power: AC230V (UPS)
Indicator: Inbuilt flow rate and total flow display
Output: Isolated analog 4~20mA DC
Overall accuracy: better than +- 0.5%
Standard accessories: 1 lot

**E-12. Intake Turbidity**

Purpose: To measure and monitor intake turbidity
Quantity: 1 set
Type: Scattered laser type, LED and photo-diode receiver
Power: AC230V
Output: Isolated analog 4~20mA DC
Overall accuracy: better than +- 2.0%
Standard accessories: 1 lot

**E-13. Clear Water Reservoir Level**

Purpose: To detect and monitor pump pit level for the transmission pump control
Quantity: 1 set
Type: Submersible type level meter
Measurement liquid: Clear water
Power: AC230V (UPS)
Output: Isolated analog 4~20mA DC
Overall accuracy: better than +- 1.0%
Protection pipe: 1 lot
Mounting device and accessories: 1 lot
Standard accessories: 1 lot

**E-14. Transmission Pressure**

Purpose: To detect and monitor for the transmission pressure
Quantity: 1 set
Type: Pressure gauge transmitter
Measurement liquid: Clear water
Power: AC230V (UPS)
Output: Isolated analog 4~20mA DC
Overall accuracy: better than +- 1.0%
Protection pipe: 1 lot
Mounting device and accessories: 1 lot
Standard accessories: 1 lot

**E-15. Transmission Flow**

Purpose: To measure and monitor transmission flow
Quantity: 1 set
Type: Electromagnetic Flow Meter
Sensor
  - Fully submersible type, IP 68
  - Flange connection: ISO PN10
  - Material: body and flange: Stainless steel 304 or equivalent
  - Electrodes: Stainless steel 316 or equivalent
  - Size (diameter): 100A
Transmitter
  - Remotely installed from sensor, IP 54
  - Power: AC230V (UPS)
  - Indicator: Inbuilt flow rate and total flow display
  - Output: Isolated analog 4~20mA DC
  - Overall accuracy: better than ± 0.5%
Standard accessories: 1 lot

**E-16. Instrumentation Panel**

Purpose: To accommodate devices for instrumentation and to monitor value of those.
Quantity: 1 set
Type: Indoor, self-standing, metal enclosed, IP42
Mounted device: As shown on the drawings
Indication: As shown on the drawings
Main components: PLC, Integrating flow recorder, GSM modem
Standard accessories: 1 lot
Note: The flow data shall be transmittable from the flow recorder by a removable device with CSV data format.

**E-17. Monitoring Panel**

Purpose: To monitor the process values and alarms at the monitoring room
Quantity: 1 set
Type: Indoor, wall-mounted, metal enclosed, IP22
Graphics: Acrylic board with printing screen type
Mounted device: As shown on the drawings
Indication lamp: As shown on the drawings
Standard accessories: 1 lot

**E-18. Water Tower Level**

Purpose: To detect and monitor water tower level for the transmission pump control
Quantity: 1 set
Type: Submersible type level meter
Measurement liquid: Clear water
Power: AC230V (UPS)
Output: Isolated analog 4-20mA DC
Overall accuracy: better than ±1.0%
Protection pipe: 1 lot
Mounting device and accessories: 1 lot
Standard accessories: 1 lot

E-19. **GSM Modem**

Purpose: To collect the water level signal and send alarm signals to the instrumentation panel in WTP by GSM network.
Quantity: 1 set
Type: GSM telemetry data transmitter, IP67
Power: AC230V (UPS) with battery backup
Transmission data: HH, H, M, L, LL and power failure