Detailed Estimate
of
Greater Algapur-Hailakandi WSS
in
Hailakandi District under World Bank assisted
RWSSP –LS, Assam

World Bank Assisted RWSS – LIS Projects in Assam

EXECUTIVE SUMMARY :

1. Name of the Scheme	:	Greater Algapur – Hailakandi Water Supply Scheme in Algapur and Hailakandi Development Block of Hailakandi District
2. Name of the programme	:	World Bank Assisted RWSS – LIS Projects in Assam.
3. Location	:	Hailakandi District, Assam.
4. Area to be covered	:	The area to be covered by the project is complete area of Algapur and Hailakandi Development Block of Hailakandi District spanning between North latitude 24°40' to 24°51' and East 92°31' to 92°40' . All total 233 Habitations of 14 GPs of these two development block shall be benefited by the project.
5. Existing water supply facilities	:	Out of total 233 habitations proposed to be covered by the scheme, 75 Nos. is yet to be covered fully. There are 18 PWSS in the area, out of which only 3 nos. are with surface source and the rest are with ground water source, and all total 9 nos. are runed by diesel engine driven pump set. Out of the existing schemes, 3 are defunct and another 9 Nos has already crossed more than 25 years of commissioning and have outlived their design life and already due for a major overhaul. The existing schemes can hardly meet the existing demand and hence cannot cater to the minimum service standard of 40 LPCD.
6. Water quality issues in the project area	:	The quality affected habitation in the project area is a follows : (i) Iron Affected : 11

7. Ground water potential in the project area	:	It is experienced for long that ground water potentiality in entire Borak Valley is not at all encourageable. Seasonal depletion of water table causes the private sources to run dry during which period they have to depend on ponds which are contaminated. Hence the proposed scheme will greatly help in addressing health issues.
8. Need for Upgradation	:	The report of the economic survey conducted in the project area reveals that majority of the inhabitants of the area are willing to pay for getting individual house hold water supply connection and monthly terrif fixed thereof provided 70 lpcd. water is supplied to them for 24 x 7 in a sustainable manner. .
9. Design period	:	The project is designed for a period of 30 years, i.e., from the year 2015 to 2045.
10. Design Population to be served	:	(a) 2011 YSR Population – 83176 souls. (b) On commissioning in 2015 AD – 88928 souls. (c) After 10 years of commissioning in 2025 AD – 104046 souls (d) After 20 years of commissioning in 2035 AD – 121734 souls (e) After 30 years of commissioning in 2045 AD – 142428 souls The details of habitation wise population and population projection along with water demand at various stages are shown in **Annexure - B**
11. Proposed Rate of supply	:	70 lpcd .

12. Total Demand of Water	:	Total demand for the project area at Different stages are : • On commissioning in 2015 AD : 7.2 MLD • After 10 Years in 2025 AD : 8.4 MLD. • After 20 Years in 2035 AD : 9.8 MLD. • After 30 Years in 2045 AD : 11.5 MLD. The Calculation of Water Demand is Shown in **Annexure – B**
13. Source of water	:	Surface sources, proposed to be tapped from the river Katakhal.
14. Discharge of the source river	:	Average Run-off of River Katakhal is 85 Cumec.
15. Total length of Raw Water Pumping Main	:	5780.0 Rm. From Intake. The raw water main shall be of DI Class K9 pipe of dia 400 mm with inside cement mortar lighting. The Design for Economic dia of Raw Water Pumping main along with matching capacity of Raw Water Pump Set is shown in **Annexure – C**.
16. Type of treatment		Since source of water for the proposed project is surface water to be tapped from rivers, treatment process having facilities for Aeration – Coagulation – flocculation – Filtration, followed by Disinfection is proposed. Along with the treatment plant there shall be a quality monitoring laboratory. The treatment plant shall be operated for 20 hours a day. The Hydraulic Design for unit sizing of various system component of the TP is shown in **Annexure – E**. (The P & I Diagram is attached in the Drawing Folder.)
17. Storage of treated water	:	For collecting the treated water from the Rapid sand filter and to facilitate pumping of clear water to different service reservoir, one under ground clear water sump of capacity 900 Cum. is proposed along with the treatment plant to cater about 1 hour retention.

18. Elevated Service Reservoir : All total 15 Nos. Of elevated service reservoirs spreading over the project area is proposed. Total capacity of all these 15 ESR shall be 2820.0 Cu.m., which is almost equal to 8 hour requirement of the project.

19. Conveyance of treated Water : Treated water from the underground clear water sump at treatment plant shall be fed to the different ESR through common header type clear water pumping main. There shall be three different route for this purposes as listed below:

- Route – I : different required diameter DI S.S. (Class – K7) clear water pumping main for serving ESR Nos. 1,2,3,4 and 5, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc.
- Route – II : different required diameter DI S.S. (Class – K7) clear water pumping main for serving ESR Nos. 6,8,9 and 15, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc.
- Route – III : different required diameter DI S.S. (Class – K7) clear water pumping main for serving ESR Nos. 7,10,11,12,13 and 14, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc.
- From the ERS, clear water to the different constituent distribution pipe network shall be under gravity through 150 mm dia DI Class K7 pipe with inside C/M lining.

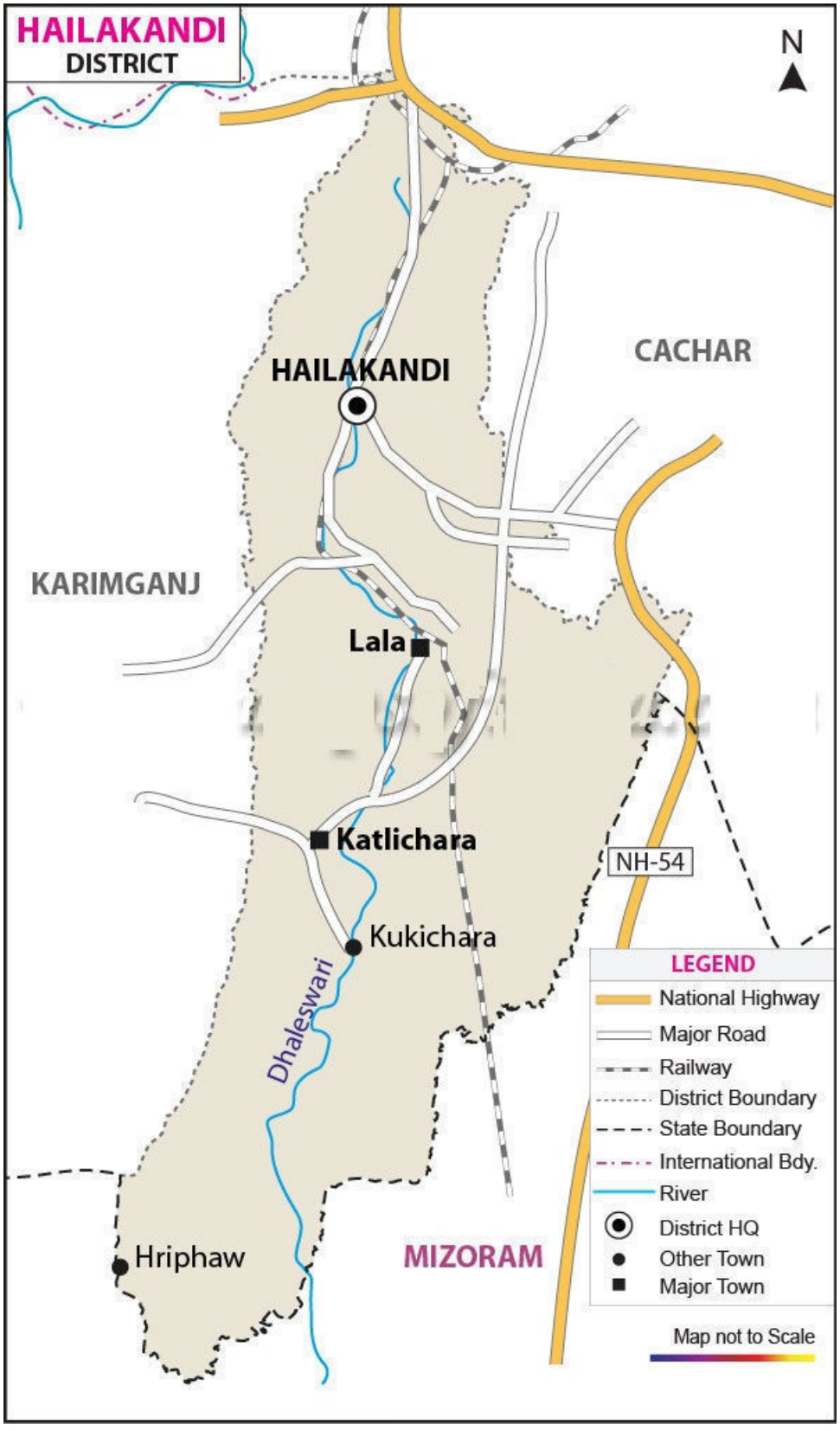
The Design for Different Clear Water Pumping Main is shown **in Annexure – D**.

20. Electrical power requirement : Total Electrical Power Requirement for raw & clear water pumping, as well as to run the agitator drive motors etc. of the treatment plants and for internal & compound lighting of the respective intake site & the treatment plant location is calculated as 500.0 KW.

21. Estimated Project cost	:	Rs. 82.13 (Rupees Eighty Two point one three) crore only. The Abstract of Cost estimate are Annexed at **Annexure – F**.
22. Per capita cost	:	• On commissioning (2015)AD : Rs. 9328.13 • After 10 Years (2025) AD : Rs. 7972.74 • After 20 Years (2035) AD : Rs. 6814.30 • After 30 Years (2045) AD : Rs. 5824.22
23. Executing authority	:	Public Health Engineering Department, Assam.

CONTENTS

DISTRICT MAP



CHAPTER – I

INTRODUCTION

1.0 Background:

The Government of Assam is going to implement the World Bank assisted Rural Water Supply & Sanitation Project in Hailakandi district for providing potable drinking water to the villagers in 24 x 7 model, with assistance from the World Bank. This Detailed Project report on the proposed scheme is prepared by incorporating the comments / observations on the preliminary report and discussions at various levels at different forums.

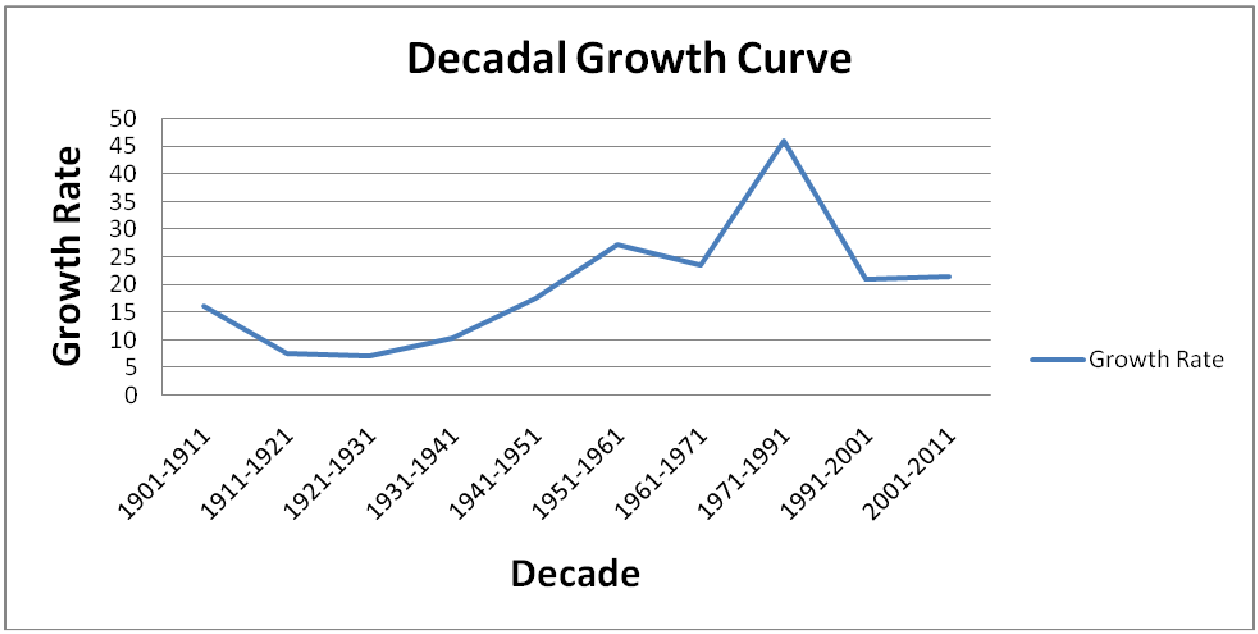
The Rural Water Supply Scheme in Hailakandi District will cover the habitations of Algapur and Hailakandi Development Block of Hailakandi District. Population under the project area is **83176 souls as per 2011** census and projected with 17% overall decadal growth as such the decadal growth in the last decade shows abnormal growth in rural population.

The decadal growth of the decade 2001-2011 in urban area and rural area of Hailakandi district are 9.27% and 22.51% respectively and the overall decadal growth of the district is 21.44%. The decadal population growth in rural area seems to be abnormally higher than the state overall. Hence, in order to rationalize the matter, the state overall growth rate i.e. 17% is considered in forecasting the design stage population.

Though 18 nos. existing water supply are in service, most of them have outlived their design period. Seasonal depletion of ground water and water quality problem creates a gap in between demand and supply of water.

The decadal growth of the project district is shown below in graphical manner-

Year	Growth Rate
1901-1911	16.09
1911-1921	7.59
1921-1931	7.08
1931-1941	10.29
1941-1951	17.48
1951-1961	27.23
1961-1971	23.61
1971-1991	45.94
1991-2001	20.89
2001-2011	21.44



River Katakhal is flowing by the side of the command area which has substantial surface flow throughout the year to draw required quantity of water for the proposed water supply scheme even in the lean period. As per the report collected from the Executive Engineer, Water Resource Division, Hailakandi, the average discharge in lean period 18.67 cumec and in monsoon period is 1490 cumec. (Report copy appended in Annexure - M). Intake arrangement with floating barge has been considered for withdrawal of raw water from river Katakhal.

Thus, this project is programmed to build a sustainable Large Multi-villages Piped water supply scheme, withdrawing water from the same, to serve a cluster of 57 nos. villages under Algapur and Hailakandi development Block for the design period 2045.

1.1 PROJECT OBJECTIVES:

The project implementation objective is to improve rural water supply and sanitation services through progressive decentralization, community participation and enhanced accountability. The objective of the project is also to augment the capacity of the water supply arrangement of Hailakandi district so as to bridge the existing gap between demand and supply and to adequately meet the projected need of the area to be covered till the year 2045. The proposed scheme will have provision for supply of water through house connection besides a few street hydrants for the benefit of the low income groups.

1.2 Project area:

District : Hailakandi

District Head quarters : Hailakandi

Geographical Position:

North Latitude : 24°40' - 24°51'

East Longitude : 92°31' - 92°40'

Distances from major locations :

District Headquarters at Hailakandi : 20 km

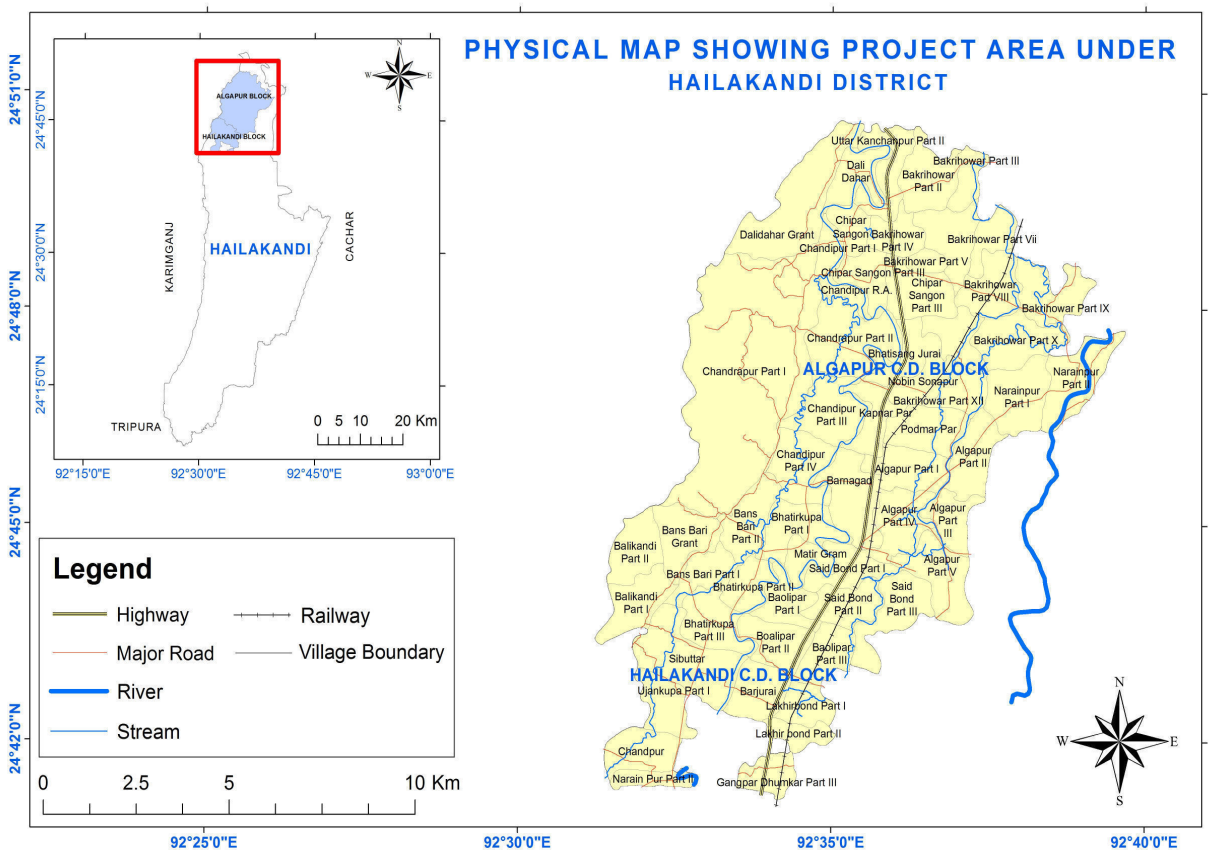
State capital, Guwahati : 340 Km

Nearest airport :Kumbhirgram, Silchar 72 km

The project area lies in Algapur- Hailakandi block of Hailakandi district and in bounded in four directions as below:

North : Cachar district, South : Mizoram, East: Rengti Hill ranges,West : Saraspur Hill ranges

1.3 Land availability: Govt, land is available for execution of the scheme at the intake point as well as for all intra-village ESRs'and WTP of respective area. The proposal for allotment of Govt. land has been moved to the District Land Advisory Board and document shall be produced after approval.



1.4 Communication:

The project area is well connected by National Highway & State Highway and also by railway with District HQ and State with the state Capital and rest of the country.

1.5 District Profile:

Hailakandi district is one of the 27 districts of Assam state in north-eastern India. It was constituted as a civil subdivision on 1 June 1869. Subsequently, it was upgraded to district in 1989, when it was split from Cachar district .As of 2011 it is the third least populous district of Assam (out of 27), after Dima Hasao and Chirang. There are three Legislative Assembly constituencies in this district viz. Hailakandi, Katlicherra, and Algapur. All three are in the Karimganj Lok Sabha constituency. Hailakandi district occupies an area of 1,327 square kilometres (512 sq mi). Out of this, more than 50% is reserve forest. There are total of two reserve forests in Hailakandi district viz. Inner line reserve forest and Katakhal reserve forest. The district has an inter-state border with Mizoram on its south having a length of 76 km besides inter district border on other sides with Karimganj district and Cachar district. The forests of Hailakandi

district were once rich in wildlife but now vanishing due to human onslaught. rare species found are Hoolock gibbon, Phayre's leaf monkey, Pig-tailed macaque, White-winged Wood Duck, Purple Wood Pigeon, etc., have been recorded. The southern part was also recommended as 'Dhaleswari' wildlife sanctuary.

1.5 Sector Background

The National Rural Drinking Water Programme (NRDWP) of the Government of India emphasizes the involvement of Panchayati Raj Institutions (PRIs) and communities in planning, implementing and managing drinking water supply schemes. States are incentivized to hand over management of their schemes to PRIs. Funds for sustainability of schemes are provided on a 100% central share basis. A separate component of support activities to fund Information Education and Communications (IEC),Human Resources Development (HRD), Management Information Systems (MIS), Water Quality Monitoring and Surveillance and other support activities has been introduced. Recently, as part of the NRDWP, the state departments responsible for drinking water supply and sanitation have prepared their long term strategic plan (2011-2022) for ensuring drinking water security to all rural households. The strategic plans aim to cover 90% of households with piped water and at least 80% of households with tap connections during this period. This forward looking strategy supports the creation of an enabling environment for the Panchayati Raj Institutions, SHG and local communities to manage rural drinking water sources and systems. The strategy emphasizes achieving water security through decentralized governance with oversight and regulation, participatory planning and implementation of sources and schemes. Capacity building programs will be required for communities to monitor and prudently use their water resources. Sustainable service delivery mechanisms are a central feature of the program, with State institutions or Zilla Panchayats implementing and managing large multi-village schemes, delivering bulk water to villages in water stressed areas, and GPs implementing and managing in-village and intra-Panchayat schemes. The strategy highlights source sustainability measures, water quality safety, monitoring and surveillance, service agreements with operators, convergence of different development programs, and building professional capacity at all levels.

The lagging states in terms of piped water coverage, viz. Assam faces constraints in institutional and technical capacity at the state, district, block and GP

levels for implementing sustainable rural water supply projects. The constraints are in terms of institutional capacity for involving communities and Panchayats in planning, implementing and managing their own drinking water supply schemes, and technical capacity of the State Rural Water Supply Departments for supporting and implementing the decentralization program. Also, operations and maintenance of existing schemes is not satisfactory, resulting in non-functionality of many schemes. Further, the States face issues of water quality affected habitations that require supply of water from distant safe sources.

Key Elements of the RWSS Program for Lagging States

The RWSS Program for Lagging States program will be a separate component of NRDWP focusing on lagging states with different allocation criteria and funding components, but implemented within the framework of NRDWP, supporting the following key elements of the reform program:

 Placing GPs and communities in the central role, supported by higher levels of PRIs, the State government and the local non-governmental and private sector, for facilitating, planning, implementing, monitoring and providing a range of O&M back-up services.

 Using sustainable, community or local government managed models for intra-GP RWSS schemes and using State-PRI partnership models for multi-GP schemes.

 Putting water resources security as a core theme of the new model, including increased community management of scarce resources.

 Moving the RWSS sector to recovery of at least 50% O&M and replacement costs and initiating contribution to capital costs keeping affordability and inclusiveness in mind.

 Moving towards metered household connections, with 24/7 water supply where feasible, as a basic level of service.

 Promoting professionalized service provision management models, and/or back-up support functions, for the different market segments (simple/small single village/GP schemes; large single village/GP schemes; multi village/GP schemes).

 Integrating water supply and sanitation, with effective sanitation promotion programs for achieving “clean villages”.

 Establishing M&E systems with independent reviews and social audits.

The Government of India has approached the World Bank for assistance on a National Project for the lagging states particularly Assam, Uttar Pradesh, Jharkhand and Bihar. The project will bring about positive health and environmental benefits through supply of 'safe' drinking water and creation of sanitary conditions in the village. The project will have programmes related to improved water quality monitoring, health and hygiene education as well as ground water recharge for water supply source protection.

1.6 PROJECT RATIONALE:

The project area of Hailakandi District is in shortage of drinking water.Most of the existing 18 nos. of rural PWSS viz.1.Lakhirbond,2.Boalipar, 3. Boalipar-II ,4.Boalipar-I,5.Bhatirkupa, 6.Saibond,7.Bornagad & kapnarpar 8. Chandipur RA ,9.Bagmara, 10.Algapur, 11.Chandipur, 12.Gulalia,13.Chiporsan gaon, 14.Bokrihower, 15.Ujankupa,16.Bagha, 17.Uttar Kanchanpur and 18. Chandipur-IV have outlived their design period and the service level has drastically come down from even 40lpcd. The burgeoning population has aggravated the situation and the prospect of growth in commercial activities is likely to make the position grimmer. In the habitations Algapur and Hailakandi development block of Hailakandi District, multi village rural water supply scheme is essential for following reasons.

1. Quality problem of existing sources.
2. Sustainability of existing ground water based sources is cynical and effective GWR not possible.
3. Going for individual treatment plant to each habitation is not be viable both financially and operationally

It is a well-known fact that Surface water as source of drinking water is costly due to comprehensive treatment required when supplied in small scale but is economical on large scale.

The report of the economic survey conducted in the project area reveals that majority of the inhabitants of the area are willing to pay for getting individual house hold water supply connection and monthly tarrif fixed thereof provided 70 lpcd. water is supplied to them for 24 x 7 in a sustainable manner.

In the context of the above, and water being a very basic need, the Public Health Engineering Department, Government of Assam has decided to go for a Large Multi

village rural water supply scheme in Hailakandi District under World Bank assisted RWSS-LIS project in Assam.

1.7 DEMOGRAPHY:

According to the 2011 census Hailakandi district has a population of 659,260. This gives it a ranking of 509th in India (out of a total of 640). The district has a population density of 497 inhabitants per square kilometre (1,290 /sq mi). The decadal population growth of the decade 2001-2011 in urban area and rural area of Hailakandi district are 9.27% and 22.51 % and overall decadal growth is 21.44%.The decadal growth in rural area population seems to be abnormally high than the state overall growth rate; hence the project population is projected by taking into account of the state overall decadal growth i.e. 17%.

Hailakandi has a sex ratio of 946 females for every 1000 males, and a literacy rate of 75.26%.Muslims 312,849 (57.62%), Hindus 223,191(41.11%), Christians 5,424(1.27%). The density of population is 451 per km2. against the state average of 340 per km2. Out of the total population of the district, approximately 120,000 belong to ST and about 40,000 to the SC communities (as per 1991 census). The district is the home of large number of different communities. There are Meitei, Bishnupriya, Kuki, Reang, Chakma, Indeginious Muslims, Immigrant population and total of (1991 census) 6,68,168, only 2,38,423 could read and write. The percentage of literate being 58.56% (2001 census) of the district. Majority of the population speaks Bengali which is the official language of the District. Manipuri is also an important language of the district, spoken by a large minority.

1.8 Economy

In 2006 the Indian government named Hailakandi one of the country's 250 most backward districts (out of a total of 640). It is one of the eleven districts in Assam currently receiving funds from the Backward Regions Grant Fund Programme (BRGF).

1.9 Geology:

The soils of Barak Valley Zone owe their origin to Shillong Plateau and other surrounding hills to a large extend and main river of the valley has minor contribution to it. The soils are formed from the sedimentary rocks like sand stone, shale and sandy shale depending upon situations and the soil varies from sandy to clay with pH ranging from 4.5 to 5.9. The texture of the soil varies from sandy to silky loam

Total wetland area in the district is 2600 ha that includes 30 small wetlands (<2.25 ha). The major wetland type is River/stream (66.27%). Total 19 Lake/pond are mapped with 575 ha area (22.12%). The other major wetland type is Waterlogged-natural (10.46%).

1.10 Climate:

The climate of the district is characterized by hot and humid. The summer starts from March and continue till October. Winter generally starts at the end of November and continues up to February.

The average annual rainfall of the district is 2441.94 mm with 123 average rainy days on the basis of last ten years record (1999-2008). High rainfall generally concentrates during the month of May to September though floods were also experienced during March to April due to the occurrences of heavy rainfall in Mizoram draining in Dhaleshwari river which flows through the middle of the district resulting floods in the Hailakandi district. Winter months December to January remains generally dry without or with scanty rainfall.

The annual mean maximum temperature ranges between 32.8° - 34.4° Celsius and mean annual minimum temperature ranges between 10.0° - 12.2° Celsius. Average Maximum temperature recorded at 33.9°c and minimum at 11.5°c from the last 10 years of temperature records (1999 – 2008).

1.12 HYDROGEOLOGY :

Hydro geologically Assam can be divided into three units namely consolidated formation, semi consolidated formation and unconsolidated formation. More than 75% of the state is underlain by unconsolidated formation comprising of clay, silt, sand, gravel, pebble and boulders. The Bhabar belt is about 11 to 15 km wide; the tubewells yield 27 to 59 m3/hr in this zone. The Tarai zone follows immediately down slope of the Bhabar zone where the yield of the wells ranges between 80-240 m3/hr. The flood

plains follow the Tarai in Brahmaputra valley where the shallow tube wells yield between 20-50 m3/hr and deep tube wells between 150-240 m3/hr. In the semi consolidated formations of Hailakandi district, the yield of the tube well ranges between 50 to 100 m3/hr.

The entire area of Hailakandi district is represented by i) unconsolidated, ii) semi consolidated and iii) consolidated (Compact formation of Tertiary) formations and these units are as follows.

1) Very compact formations comprising the Surma and Dihing series of rocks,

2) Semi-consolidated rocks comprising Tipam and Dupitila formations, and

3) Unconsolidated formation of alluvial deposits.

The semi-consolidated Tipam sandstones form good repository in the area. The depth to water level varies from a few metre to 4 m bgl in alluvial sediments particularly in north and south of Silchar and in western parts while it varies from a few metre to 2 m bgl in the central parts. The hydraulic gradient of ground water is from North to South in northern parts and ground water flows from South to North-West in southern parts. The static water level in shallow aquifers (within 5 m) is within 1.3 to 4.0 m bgl in the North of the Barak River and it varies from 1.8 to 2.22 m bgl in southern parts. Discharge of tube well varies from 5.5 to 8 m^3/hr with drawdown of 6.0 m. The storability value varies from 8.8 x 10^{-4} to 4.14 x 10^{-3}. The hydraulic conductivity is low in many area and ranges between 6.1 to 45.23 m/day in the district.

In the deeper aquifer, the granular zone occurs below a confining layer of clay, thus it is a confined aquifer. The static water level ranges from 1.92 to 6.88 m bgl in northern parts and from 0.50 to 8.50 m bgl in the southern parts of the River Barak. The yield of the tube well varies from 33 to 88 m^3/hr with drawdown varying between 9.9 to 32.65 m. The water level fluctuation, in general, is less than 1 m.

CHAPTER-2

DETAILED SCHEME REPORT (DSR):

The detailed project report is formulated for the large multi village rural water supply scheme in Algapur and Hailakandi Development Block of Hailakandi District covering the habitations of both the block after getting the habitations and the proposed scheme network surveyed with the Total station survey and maps in Auto CAD showing the layout, existing features of PWSS components and the proposed features of PWSS components.

The location of proposed new ESRs have been identified at locations suitable and as required as per design. The alignment & Layout plan was prepared based on the detailed survey conducted in the project area. The longitudinal levels were taken along the proposed alignment. In every village the Ground Level (GL) and Lowest Water Level (LWL) for ESRs were taken.

The Hydraulic Designs were done by using LOOP Software for the best suited design for the individual habitations and the overall extension Scheme. Based on the Outputs of designs the detailed estimate for the proposed water supply scheme, components were prepared covering the following Components of Multi Village Scheme

i. Intake arrangement with floating barge at Katakhal River.
ii. 8.4 MLD water treatment plant
iii. Sump of 900KL Capacity at Treatment Plant.
iv. Providing ESR of Capacity ranging from 140 KL to 250 KL with 16 m staging at 15 different locations.
v. Providing motors at intake point for Pumping main.
vi. Leading Mains from TP to ESRs in individual villages
vii. ESRs in Villages
viii. Distribution system in the intra- villages.
ix. House service connections/Public stand posts.
x. Valves and valve pits etc
xi. Other relevant Components

2.1 : Existing water supply facilities :

Out of total 233 habitations proposed to be covered by the scheme, 75 Nos. is yet to be covered fully. There are 18 PWSS in the area, out of which only 3 nos. are with surface source and the rest are with ground water source, and all total 9 nos. are run by diesel engine driven pump set. Out of the existing schemes, 3 are defunct and another 9 Nos. has already crossed more than 25 years of commissioning and have outlived their design life and already due for a major overhaul. The existing schemes can hardly meet the existing demand and hence cannot cater to the minimum service standard of 40 LPCD.

2.2 : Water quality issues in the project area :

The quality affected habitation in the project area is a follows :

(i) Iron Affected : 11

2.3 : Design period :

The project is designed for a period of 30 years, i.e., from the year 2015 to 2045.

2.4 : Design Population to be served:

(a) 2011 YSR Population – 83176 souls.

(b) On commissioning in 2015 AD – 88928 souls.

(c) After 10 years of commissioning in 2025 AD – 104046 souls

(d) After 20 years of commissioning in 2035 AD – 121734 souls

(e) After 30 years of commissioning in 2045 AD – 142428 souls

2.5 : Proposed Rate of supply : 70 lpcd .

2.6 : Total Demand of Water :

Total demand for the project area at Different stages are :

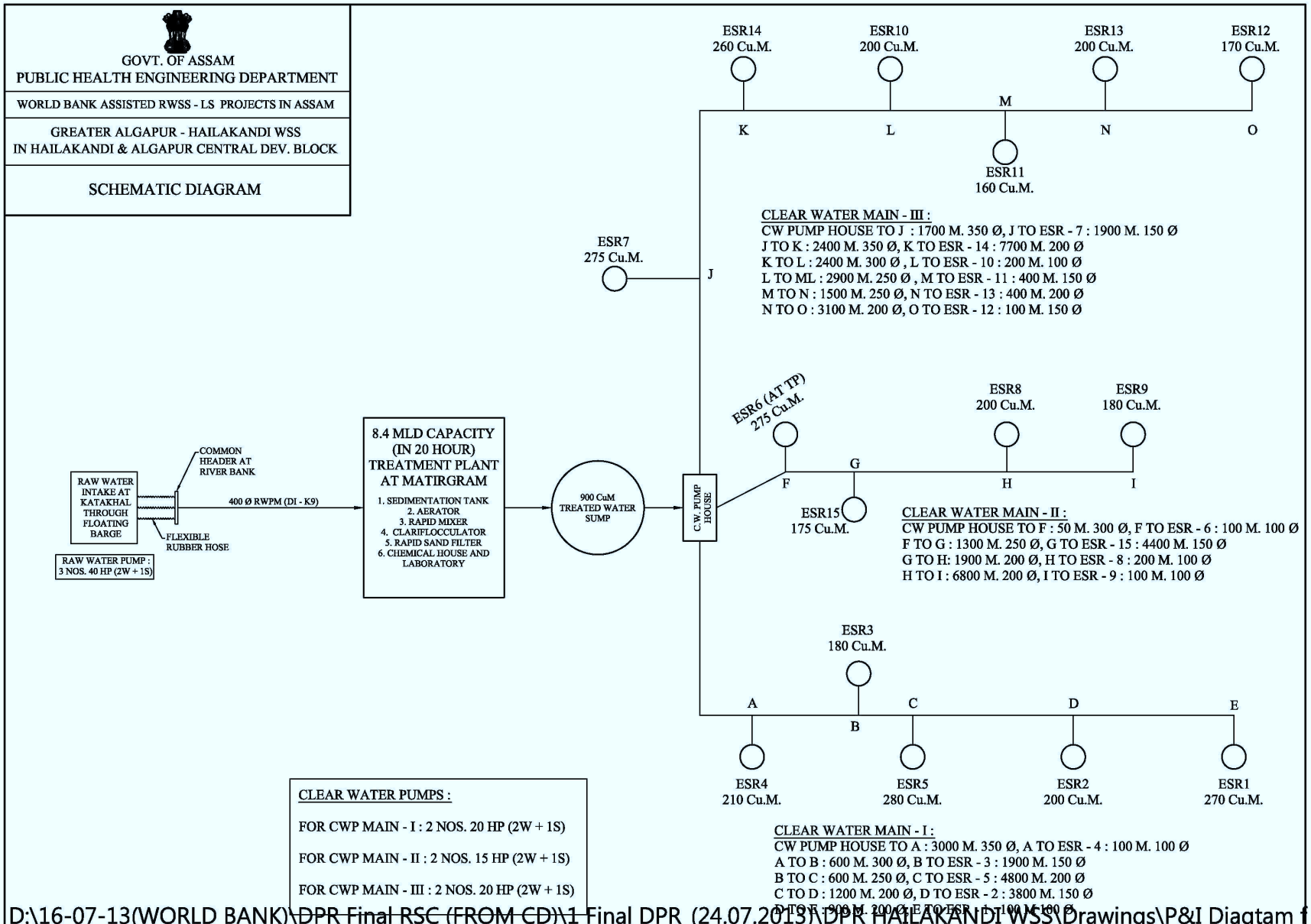
- On commissioning in 2015 AD : 7.2 MLD
- After 10 Years in 2025 AD : 8.4 MLD.
- After 20 Years in 2035 AD : 9.8 MLD.
- After 30 Years in 2045 AD : 11.5 MLD.

GOVT. OF ASSAM
PUBLIC HEALTH ENGINEERING DEPARTMENT

WORLD BANK ASSISTED RWSS - LS PROJECTS IN ASSAM

GREATER ALGAPUR - HAILAKANDI WSS
IN HAILAKANDI & ALGAPUR CENTRAL DEV. BLOCK

SCHEMATIC DIAGRAM



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CHAPTER-3

DESIGIN DETAILS

3.1 GENERAL

The water supply system has been planned as per the standard norms to ensure adequate & sufficient water supply for the proposed layout. Design parameters used have been adopted according to the guidelines provided in CPHEEO manual. The water distribution network is being designed with and LOOP Software.

The present proposed Scheme is designed to cover all streets and localities of the habitation with safe dependable local be pumped into ESR proposed within the habitation through pumping main and from the ESR, the water will be supplied to the end users through Gravity main (distribution main) with a ferrule provision outside each house, to enable the house holds to get their house hold connection through the GPWSC concerned.

3.2 Norms for water supply:

Norms adopted for water supply as per CPHEEO norms.

3.3 Water Requirement:

The water requirement has been estimated for the total estimated prospective population projected for the year 2045. The Per capita requirement has been Considered as 70 LPCD.

3.4 PER CAPITA DEMAND:

As per engineering matrices set for the implementation of Greater Algapur – Hailakandi Water Supply Scheme, per captia demand will be 70 litres. (70 LPCD).

The approximate activity-wise break-up is considered as follows:

Activity	Quantity (LPCD)
Drinking	5
Cooking	5
Bathing	30
Washing utensils & house	10
Washing Cloths	10
Ablution	10
Total	70

3.5 Source:

It is proposed to draw raw water from the river Katakhal having sufficient run-off. As per the report collected from the Executive Engineer, Water Resource Division, Hailakandi the average Run-off of River Katakhal is 18.67 cumec in lean period and in monsoon period it is 1490 cumec. (Report copy appended)

Fig.1: Katakhal Bridge

Fig. 2: Intake point at downstream of Katakhal bridge

3.6 Design period:

The project is designed for a period of 30 years, i.e., from the year 2015 to 2045.

3.7 Population Projection:

The decadal growth method as prescribed in the CPHEEO manual is used. The decadal growth in urban area and rural area of Hailakandi district are 9.27% and 22.51% respectively. The overall decadal population growth of the district is 21.44%. as such the population growth in rural area seems to be abnormally high ; hence the state overall growth rate i.e. 17% is considered for projection purpose.

3.8 Design Population to be served :

After 30 years of commissioning in 2045 AD – 142428 souls

3.9 Proposed Rate of supply: 70 lpcd .

3.10 Total Demand of Water :

Total demand for the project area at Different stages are :

- On commissioning in 2015 AD : 7.2 MLD
- After 10 Years in 2025 AD : 8.4 MLD.
- After 20 Years in 2035 AD : 9.8 MLD.
- After 30 Years in 2045 AD : 11.5 MLD.

3.11 Raw Water Pumping Main:

The raw water Main shall be of DI Class K9 pipe of dia 400 mm with inside cement mortar lining for a total length of 5780.00 RM. from Intake point at river Katkhal . The Design for economic dia. of Raw Water Pumping Main along with matching capacity of Raw Water Pump Set is shown in the design part.

3.12 Raw water quality:

Raw water quality conforms that all parameters other than turbidity are within the permissible limit and BOD level is below the prescribed limit. Water is treatable as per IS 2296. Turbidity ranges from 40 – 100 NTU for most part of the year while it goes upto appx. 500 NTU during rainy season following erosion in the upstream

3.13 Type of treatment:

Since source of water for the proposed project is surface water to be tapped from rivers, conventional treatment process having facilities for Aeration – Coagulation – flocculation – Filtration, followed by Disinfection is proposed. Along with the treatment plant there shall be a quality monitoring laboratory. The treatment plant shall be operated for 20 hours a day as per the engineering matrix fixed by WB Technical consultants.

3.14 Storage of treated water:

For collecting the treated water from the Rapid sand filter and to facilitate pumping of clear water to different service reservoir, one underground clear water sump of capacity 900 Cum. is proposed along with the treatment plant to cater about 1 hour retention.

3.15 Elevated Service Reservoir (ESR) :

All total 15 Nos. Of elevated service reservoirs spreading over the project area is proposed. Total capacity of all these 15 ESR shall be 2820.0 Cu.m, which is almost equal to 8 hour requirement of the project.

3.16 Conveyance of treated Water :

- Supplying, laying, jointing, testing and commissioning of different assorted diameter DI S.S. (Class K7) Clear water pumping main of approximate total length 56550 Rm. (in three different route) including all necessary earth work valves & specials, valve chamber, supporting structures, anchor / thrust block etc., all complete.
- From the ESR, clear water to the different constituent distribution pipe network shall be under gravity through required diameter DI Class K7 pipe with inside Cement Mortar lining.

The Design for different Clear Water Pumping Main is shown in **Annexure – D**.

3.17 Electrical power requirement :

Total Electrical Power Requirement for raw & clear water pumping, as well as to run the agitator drive motors etc. of the treatment plants and for internal &

compound lighting of the respective intake site & the treatment plant location is calculated as 500.0 KW.

3.18 Estimated Project cost :

Rs. 82.13 (Rupees Eighty Two point one three) crore only. The Abstract of Cost estimate are Annexed at **Annexure – F.**

3.19 Per capita cost :

- On commissioning (2015)AD : Rs. 9328.13
- After 10 Years (2025) AD : Rs. 7972.74
- After 20 Years (2035) AD : Rs. 6814.30
- After 30 Years (2045) AD : Rs. 5824.22

3.20 Executing Authority:

Public Health Engineering Department, Assam.

3.21 Improvements to the Sanitation System:

It is also in principle proposed to improve total sanitation system in the habitation duly utilizing the funds sanctioned under World Bank assistance. Efforts will be made to -

- Ensure 100% IHHL construction in BPL and APL houses for the entire habitation in order to prevent open defection in the village premises.
- Ensure safe solid waste disposal system in the entire habitation as per SWM Guidelines G.O.I.

COST ESTIMATE

4.1 Rates

The Total Project cost has been arrived based on the Revised Standard Data of government of Assam. The basic rates for the rate analysis are taken from the APWD Schedule of Rates for the year 2010-11 and APHED Schedule of Rates for the year 2008-09 of Government of Assam. The provision of price escalation is made to arrive at the current prices for estimating purpose.

4.2 ESTIMATE COMPONENTS

The MVS Scheme is proposed with by providing all the facilities detailed below

1.Raw water Intake System comprising of:

a.M.S. Floating Barge with all necessary mooring materials & lifesaving equipment; tying arrangement; Over Head gantry Crane etc.

b.RCC Single Storied Utility cum Operator's Room at River bank of Intake Point

c.River bank Protection Work at Intake Point

d.Approach Road to Intake Point from the nearby public road

e.Land Development & Security Wall at Intake Station

f.Twin Assam Type accommodation at Intake Location for 1 (one) No. Pump Operator and 1 (one) No. Chowkider

g. Dedicated Power Line to Intake including Substation.

h. Captive Power Generator at Intake Station

2.Raw Water Pumping Machinery and other accessories comprising of:

a. Raw Water Pumping machinery in the Intake barge including all necessary electrical and other installation works

b. Manifold type Common Header at river bank for the raw water Main and flexible hoses for connecting the same with the barge including campus Illumination at intake location

3.Raw Water Conveying Main

Supplying, laying, jointing, testing and commissioning of 400 mm dia DI S.S. raw water pumping main including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete

4. Water Treatment Plant comprising of:

a. Design and Construction of Complete Water Treatment Plant of capacity 8.4 MLD (in 20 hours of operation) with suitable design in conformity with the CPHEEO Manual having provision for Sedimentation, Aeration, Coagulation, Rapid Mixing, Clariflocculation & Filtration followed by disinfection, including all Mechanical and

Electrical Installation Work suitable for automated operation of the plant, Provision for Back Washing, Laboratory Facility, all internal connection & by-pass piping system including provision for one Water Works Office and for Storage accommodation.)

b. Construction of 9,00,000.0 ltrs. Capacity RCC Under Ground Treated Water Sump in 2 (two) compartment and with a suction pit for pumps having provision for all inlet, outlet & overflow arrangement; mechanical type water level indicator; Air Vent Pipe; Men Hole with Cover; CI Lugs inside the sump etc. , complete

c. Land Development & Security Wall at Treatment Plant Location

d. Twin Assam Type accommodation at Treatment Plant Location for 1 (one) No. Pump Operator And 1 (one) No. Chowkider

e. Twin Assam Type accommodation at Treatment Plant Location for 1 (one) No. Pump Operator and 1 (one) No. Chowkider

f. Internal Road / Path etc.; Landscaping & Arboriculture including Compound Illumination in the treatment plant site

g. Approach Road to Treatment Plant Site from the nearby public road

h. Dedicated Power Line to Treatment Plant including Substation

i. Captive Power Generator at Treatment Plant

5. Clear Water Pumping System comprising of:

a. Clear Water Pumping machinery at the treatment plant for all the Clear water feeder route including all necessary electrical and other installation works

b. Clear Water Pump House at Treatment Plant Location

c. Manifold type Common Header for the Clear water main of Different Route and RCC Pump foundation

6. Clear Water Conveying Main comprising of:

a. Supplying, laying, jointing, testing and commissioning of different required diameter DI S.S. Clear water pumping main for Route - I serving ESR Nos. 1,2,3,4 and 5, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete

b. Supplying, laying, jointing , testing and commissioning of different required diameter DI S.S. Clear water pumping main for Route - II serving ESR Nos. 6,8,9 and 15, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete

c. Supplying, laying, jointing , testing and commissioning of different required diameter DI S.S. Clear water pumping main for Route - III serving ESR Nos. 7,10,11,12,13 & 14, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete

7. Elevated Service Reservoir comprising of:

a. Construction of 15 (fifteen) elevated service reservoirs of capacities: 240,180,160,190,250,200,250,180,160,150,140,150,180,230,160 Cum with suitable foundation, including all necessary inlet/outlet etc. piping arrangement, control valves amenable to motorised operation, water level indicator, Lightening arrestor, solar power system, security wall, signboard, landscaping, & arboriculture etc.

b. Approach Road to ESR Location

8. Distribution System comprising of:

a. Laying of DI Feeder Main from respective ESR to the concerned Distribution network

b. Extension, Renovation, Augmentation of the existing Distribution network

c. House connection comprising of saddle piece, 10.0 m. PPR Pipe, Ferrule Cock etc.

9. Water meter with 5 year maintenance contract comprising of:

a. Supplying and fixing of Bulk Water meter

b. Supplying and fixing of Domestic Water meter

10.Auto Control System comprising of SCADA for auto control of the complete system

11.Provision towards Contingencies: Necessary provision is made in this estimate for contingencies like Survey, Soil investigation and Geo physical investigation of source etc.

4.3 COST OF THE PROJECT

The proposals as outlined have been worked out into detailed cost. The cost for the proposed MVS Scheme covering each and every element component necessary for taking up the work and completing the Scheme have been considered. Details of the various Subcomponents have been worked out in detailed below.

4.5 Annexures

Annexure-A: Name of GP and respective villages to be covered by the project

Annexure-B: Population of habitations to be covered with Population projection and Calculation of water demand

Annexure-C: Calculation of economic diameter Raw water Pumping Main & pump capacity for Raw water

Annexure-D: Calculation of sizes for Clear water Pumping Main & matching capacity of Clear Water Pump thereof.

Annexure-E: Hydraulic Design

Annexure-F: Abstract of Cost

Annexure-G: Disaster Management practices

Annexure-H: Environmental data sheet and EMF

Annexure-I: Annual maintenance cost sheet

Annexure-J: Water quality report of river Katakhal

Annexure-K: Soil testing reports

Annexure-L: Capacity of Sump

Annexure-M : Discharge report of river Katakhal

Annexure-N : Drawings

Annexure – A

Greater Algapur – Hailakandi Water Supply Scheme

Name of GP and Respective Villages to be covered by the Project

Sl. No.	Name of Development Block	Name of G.P.	Name of Village
1	Algapur	1 Algapur	1 Algapur Pt I
2			2 Bornagad
3			3 Kapnarpar
4			4 Padmarpar
5		2 Bashbari	1 Bansbari Pt II
6			2 Bhatirkupa Pt I
7			3 Chandipur Pt IV
8			4 Chandipur T.E.
9			5 Matirgram
10		3 Bokrihower	1 Bakri Howar Pt III
11			2 Bakri Howar Pt IX
12			3 Bakri Howar Pt VII
13			4 Bakri Howar Pt VIII
14			5 Bakri Howar Pt XII
15			6 Bakri Howar Pt X
16		4 Chandipur	1 Chandipur Pt I
17			2 Chandipur Pt II
18			3 Chandipur R.A.
19			4 Chandipur Pt III
20		5 Chiporsangoan	1 Bakri Howar Pt V
21			2 Batisang Jurai
22			3 Chiparsangam Pt I
23			4 Chiparsangan Pt II
24			5 Chiparsangan Pt III
25			6 Nabin Sonapur
26		6 Mohanpur	1 Algapur Pt III
27			2 Mohanpur-I
28			3 Mohanpur-II
29			4 Mohanpur-III
30			5 Mohanpur IV
31		7 North Narainpur	1 Narainpur Pt II
32			2 Algapur Pt II
33		8 Saidbond	1 Sayedbond Pt I
34			2 Sayedbond Pt II
35			3 Sayedbond Pt III
36			4 Algapur Pt IV
37		9 Uttar Kanchanpur	1 Bakri Howar Pt III
38			2 Dholidahar
39			3 Dholidahar Grant
40			4 Uttar Kanchanpur Pt II
41		10 West Mohanpur	1 Algapur Pt V

Sl. No.	Name of Development Block	Name of G.P.	Name of Village
42	Hailakandi	1 Bhatirkupa	1 Bhatirkupa Pt II
43			2 Bhatirkupa Pt III
44			3 Balikandi Pt I
45			4 Balikandi Pt II
46			5 Bansbari Grant
47			6 Bashbari Pt-I
48			7 Ujankupa Pt I
49			8 Sibuttar
50		2 Boalipar	1 Boalipar Pt I
51			2 Boalipar Pt Ii
52			3 Boalipar Pt Iii
53		3 Gangpar Dhumkar La	1 Barjurai
54			2 Gangpar Dhumkar-Iii
55			3 Lakhirbond Pt I
56			4 Lakhirbond Pt Ii
57		4 Chandpur Ujankupa	1 Narainpur Pt Ii

Annexure - B

Development Block wise List of GP, Village and Habitation Including Population Details

Block Name		Panchayat Name	Village Name		Habitation Name	Present Population			
						SC	ST	GEN	Total
1	Algapur	1 Algapur	1 Algapur Pt I	1	Algapur Bazar	0	0	390	390
				2	Algapur Station	0	0	270	270
				3	Algapur-I	105	0	383	488
				4	Lama Gram	0	0	200	200
				5	Paul Para	0	0	378	378
				6	Polarpar	0	0	138	138
				7	Polarpar West	0	0	123	123
			2 Bornagad	1	Bornagad	23	0	1323	1346
				2	Hanigram	0	0	1020	1020
				3	Kararpar	0	0	215	215
				4	Tingori	0	0	278	278
			3 Kapnarpar	1	Gangpar	0	0	33	33
				2	Gonirala	0	0	220	220
				3	Kapnarpar	0	0	824	824
				4	Lamagram	77	0	353	430
				5	Satgorigoan	0	0	31	31
			4 Padmarpar	1	Nath Para	0	0	240	240
				2	Padmarpar	0	0	521	521
				3	Roud Pura Kandi	0	0	233	233
				4	Roy Para	300	0	11	311
		2 Bashbari	1 Bansbari Pt II	1	Bashbari-Ii	85	0	847	932
				2	Kazi Para	0	0	275	275
				3	Nathnam Para	30	0	357	387
			2 Bhatirkupa Pt I	1	Bhatirkupa-I	0	0	390	390
				2	Choudhury Para	0	0	551	551
				3	Pattarwala	0	0	232	232
				4	Suklabaidya Para	150	0	113	263

Block Name		Panchayat Name	Village Name	Habitation Name		Present Population			
						SC	ST	GEN	Total
1	Algapur	2 Bashbari	3 Chandipur Pt IV	1	Bishnugarh	37	0	438	475
				2	Chandipur-Iv	0	0	715	715
				3	Kehya Ghat	0	0	218	218
				4	Tilla Para	0	0	304	304
			4 Chandipur T.E.	1	Chandipur T.E	529	0	0	529
			5 Matirgram	1	Kunagoan	0	0	95	95
				2	Matirgram	0	0	322	322
				3	South Raja Para	0	0	75	75
		3 Bokrihower	1 Bakri Howar Pt III	1	Bokrihower -Iii	257	0	283	540
				2	Ujanpola	0	0	345	345
			2 Bakri Howar Pt IX	1	Bokrialarpar	23	0	437	460
				2	Bokrihower -Ix	60	0	78	138
				3	Bongaon	0	0	225	225
			3 Bakri Howar Pt VII	1	Bokrihower -Vii	0	0	225	225
				2	Bokrikhalarpar	0	0	326	326
				3	Ujanpolarpar	0	0	320	320
			4 Bakri Howar Pt VIII	1	Bokrihower -Viii	20	0	460	480
				2	Bokrihower -Viii East	0	0	665	665
				3	Boronami	0	0	289	289
			5 Bakri Howar Pt XII	1	Bokrihower -Xii	0	0	200	200
				2	Bokrihower -Xii East	0	0	250	250
				3	Bokrihower -Xii West	0	0	193	193
			6 Bakri Howar Pt X	1	Bokrihower -X	0	0	355	355
				2	Bongoan	0	0	427	427
				3	Sikari Took	0	0	448	448
		4 Chandipur	1 Chandipur Pt I	1	Chandipur-I	0	0	439	439
				2	Majorpar	0	0	486	486
			2 Chandipur Pt II	1	Chandipur-Ii	23	0	585	608
				2	Damadirala	0	0	489	489
				3	Madirala	0	0	437	437
				4	Nayagram	0	0	146	146
				5	Sadrabond	0	0	545	545

Block Name		Panchayat Name	Village Name		Habitation Name		Present Population			
							SC	ST	GEN	Total
1	Algapur	4 Chandipur	3 Chandipur R.A.	1	Bagmara		308	0	771	1079
				2	Bowerthal		398	0	810	1208
				3	Chandipur Ra		668	0	223	891
				4	Darakapur		0	0	296	296
				5	Khasia Punjee		0	0	336	336
			4 Chandipur Pt III	1	Barabak		0	0	300	300
				2	Chandipur-Iii		0	0	510	510
				3	Dakajurai		0	0	313	313
				4	Lamargram		0	0	245	245
		5 Chiporsangoan	1 Bakri Howar Pt V	1	Bagarkuna		0	0	275	275
				2	Bagmara		0	0	280	280
				3	Bokrihower-V		0	0	240	240
			2 Batisang Jurai	1	Batisang Jurai		0	0	395	395
				2	Gulalia		0	0	260	260
				3	Panjaligram		0	0	380	380
				4	Sanjurai		0	0	225	225
			3 Chiparsangam Pt I	1	Chiporsangan-I		0	0	182	182
				2	Kalikuna		0	0	780	780
				3	Monipuri Basti		0	0	140	140
				4	Tillagram		0	0	110	110
			4 Chiparsangan Pt II	1	Chiporsangan-Ii		30	0	480	510
				2	Mukamtilla		0	0	380	380
				3	Tukorgram		0	0	400	400
			5 Chiparsangan Pt III	1	Bhyarpar		0	0	390	390
				2	Bhyarpar North		0	0	300	300
				3	Chiporsangan-Iii		0	0	252	252
				4	Lamargram		0	0	296	296
				5	Lamargram West		0	0	357	357
			6 Nabin Sonapur	1	Nabin Sunapur		130	0	223	353
				2	Nabin Sunapur West		50	0	248	298

Block Name		Panchayat Name	Village Name		Habitation Name		Present Population			
							SC	ST	GEN	Total
		6 Mohanpur	1 Algapur Pt III	1	Algapur-III		0	0	453	453
				2	Saidnapur		0	0	335	335
				3	Tukorgram		0	0	158	158
			2 Mohanpur-I	1	Mohanpur-I		66	0	944	1010
			3 Mohanpur-II	1	Mohanpur-II		0	0	1526	1526
			4 Mohanpur-III	1	Mohanpur-III		156	0	929	1085
			5 Mohanpur	1	Mohanpur-VI		18	0	1003	1021
		7 North Narainpur	1 Narainpur Pt II	1	Bankarpar		0	0	113	113
				2	Kandigram		0	0	75	75
				3	North Narainpur -II		362	0	637	999
			2 Algapur Pt II	1	Algapur-II		0	0	180	180
				2	Nouriarpar		0	0	390	390
				3	Nouriarpar North		0	0	330	330
				4	Polarpar		0	0	240	240
		8 Saidbond	1 Sayedbond Pt I	1	Barriakuna		0	0	360	360
				2	Choudhury Para		0	0	378	378
				3	Saidbond-I		49	0	381	430
				4	Tukorgram		0	0	300	300
			2 Sayedbond Pt II	1	Anowerpar		0	0	188	188
				2	Bokrikuna		0	0	150	150
				3	Paikani Para		0	0	338	338
				4	Saidbond -Ii		0	0	274	274
			3 Sayedbond Pt III	1	Mazumder Para		0	0	281	281
				2	Saidbond -Iii		0	0	375	375
				3	Suklabaidya Para		188	0	351	539
				4	Tilla Goan		0	0	488	488
			4 Algapur Pt IV	1	Algapur-Iv		0	0	388	388
				2	Kuna Para		0	0	413	413
				3	Mazumder Para		0	0	263	263
				4	Polarpar		0	0	240	240
				5	Tilla Para		0	0	330	330

Block Name		Panchayat Name	Village Name	Habitation Name		Present Population			
						SC	ST	GEN	Total
		9 Uttar Kanchanpur	1 Bakri Howar Pt Ii	1	Anukul Nagar	254	0	0	254
				2	Bokrihower-Ii	150	0	32	182
				3	Eachar Kandi	244	0	148	392
				4	Lamargram	0	0	150	150
		9 Uttar Kanchanpur	2 Dholidahar	1	Choudhury Took	101	0	312	413
				2	Dalidhar	244	0	420	664
				3	Monipuri Basti	0	0	225	225
				4	Nayagram	110	0	475	585
			3 Dholidahar Grant	1	Dalidhar Grant	0	0	260	260
				2	Nokicherra Punjee	0	0	158	158
				3	Pedla Punjee	0	0	167	167
				4	Tillagram	0	0	978	978
			4 Uttar Kanchanpur Pt Ii	1	Janki Bazar	60	0	159	219
				2	Tukorgram	135	0	112	247
				3	Ujangram	53	0	142	195
				4	Uttar Gram	414	0	375	789
				5	Uttar Kanchanpur-Ii	98	0	825	923
		10 West Mohanpur	1 Algapur Pt V	1	Algapur-V	0	0	153	153
				2	Changkuripar	0	0	300	300
				3	Coloney	0	0	109	109
				4	Kandigram	0	0	158	158
				5	Mothura Par	0	0	102	102
				6	Sadirkhalarpar	0	0	315	315
				7	Sarisakuripar	0	0	188	188
		1 Bhatirkupa	1 Bhatirkupa Pt Ii	1	Bhatirkupa-Ii	0	0	375	375
				2	Bhatirkupa-Iii Took	169	0	71	240
				3	Nayagram	0	0	158	158
				4	Roy Para	251	0	316	567
				5	Tillagram	0	0	515	515

Block Name	Panchayat Name	Village Name	Habitation Name		Present Population			
					SC	ST	GEN	Total
		2 Bhatirkupa Pt Iii	1	Bhatirkupa-Iii	0	0	529	529
			2	Kunagram	0	0	603	603
			3	Lumakigram	0	0	638	638
			4	Mazari Gram	0	0	165	165
		3 Balikandi Pt I	1	Balikandi-I	0	0	120	120
			2	Bororkuna	45	0	45	90
			3	Kalacherra	26	0	45	71
			4	Noon Khali	90	0	94	184
			5	Unbenu	75	0	105	180
		4 Balikandi Pt Ii	1	Balikandi-Ii	19	0	79	98
			2	Balikandi-Ii West	26	0	83	109
			3	Khasia Punji	0	94	52	146
		5 Bansbari Grant	1	Banderkuna	49	0	176	225
			2	Bashbari Grant Khas	0	0	150	150
			3	Bashbari Grant	41	0	75	116
			4	Bashbari T.E North	210	0	173	383
			5	Memorkuna	109	0	206	315
		6 Bashbari Pt-I	1	Bashbari East	0	0	233	233
			2	Bashbari West	0	0	218	218
			3	Bashbari-I	94	0	296	390
			4	Damcherra	0	0	135	135
		7 Ujankupa Pt I	1	Choudhury Para	0	0	233	233
			2	Gourgovinda	0	0	630	630
			3	Kamarpara	68	0	0	68
			4	Kowalarpar	0	0	83	83
			5	Lamargram	0	0	698	698
			6	Laskar Para	0	0	150	150
			7	Ujankupa-I	0	0	612	612

Block Name	Panchayat Name	Village Name	Habitation Name		Present Population			
					SC	ST	GEN	Total
2 Hailakandi	1 Bhatirkupa	8 Sibuttar	1	Monirgram	0	0	158	158
			2	Nunkuli	0	0	240	240
			3	Sibuttar	0	0	334	334
			4	Sibuttar North	0	0	210	210
			5	Sibuttar West	26	0	589	615
			6	Tundur Kandi	203	0	0	203
	2 Boalipar	1 Boalipar Pt I	1	Boalipar-I	0	0	308	308
			2	Byapari Para	0	0	473	473
			3	Choudhury Para	0	0	308	308
			4	Dholeswaripar	0	0	446	446
			5	Pir Bosti	0	0	285	285
		2 Boalipar Pt Ii	1	Anowerpar	0	0	285	285
			2	Boalipar Tin Ali	128	0	456	584
			3	Boalipar-Ii	49	0	262	311
			4	Mazarbhuiya Para	0	0	131	131
			5	Roy Para	0	0	240	240
			6	Tukorgram	0	0	488	488
		3 Boalipar Pt Iii	1	Badshapara	0	0	278	278
			2	Boalipar-Iii	0	0	1080	1080
			3	East Boalipar	0	0	394	394
			4	Kuripara	0	0	420	420
			5	Nuton Para	0	0	674	674
			6	Purnapara	0	0	383	383
	3 Gangpar Dhumkar Lakhirbond	1 Barjurai	1	Borjurai	0	0	225	225
			2	Dakhin Para	0	0	113	113
			3	Das Para	0	0	290	290
			4	Major Bari	0	0	198	198
			5	Major Gram	0	0	526	526
			6	Nal Gram	0	0	361	361
			7	Pachim Para	0	0	188	188

Block Name	Panchayat Name	Village Name	Habitation Name		Present Population			
					SC	ST	GEN	Total
2 Hailakandi	3 Gangpar Dhumkar Lakhirbond	2 Gangpar Dhumkar-Iii	1	Atikolarbak	0	0	202	202
			2	Atikolarbak South	0	0	153	153
			3	Atikolarchok	0	0	206	206
			4	Gangpar Dhumkar-Iii	0	0	453	453
			5	Khalarpar	0	0	531	531
			6	Napit Para	98	0	15	113
			7	North Gangpar	0	0	420	420
			8	South Gangpar	0	0	158	158
			9	Tukorgram	0	0	225	225
		3 Lakhirbond Pt I	1	Choudhury Para	11	0	154	165
			2	Lakhirbond Coloney	0	0	204	204
			3	Lakhirbond-I	135	17	7	159
			4	Muchi Para	89	0	136	225
			5	Uttar Gram	32	0	158	190
		4 Lakhirbond Pt Ii	1	Bagha North	0	0	521	521
			2	Bagha South	0	0	373	373
			3	Choudhury Para	0	0	129	129
			4	Lakhirbond-Ii	0	0	150	150
			5	Polarmukh	0	0	527	527
			6	Puborgaon	0	0	187	187
	4 Chandpur Ujankupa	1 Narainpur Pt Ii	1	Kalinagar	0	0	210	210
			2	Modupur	0	0	150	150
			3	Narainpur-Ii	0	0	456	456
			4	North Narainpur-Ii	0	0	198	198
			5	Rabidas Para	225	0	0	225
			6	South Narainpur-Ii	225	0	0	225

Total =	14 GP	57 Village	233 Habitation	8498	111	74567	83176

Population Projection for Design of Water Treatment Plant :

Population in 2011 AD :

A)	Algapur Development Block :	56245
B)	Hailakandi Development Block :	26931
Therefore, total population of the Project area in 2011 :		83176

Decadal Growth Rate : 17 %
Therefore, Annual; Growth Rate : 1.7 %

Present Population in 2013 = 83176 + 83176 x 0.034 = 86004 Souls
The project shall be commissioned in 2015 AD.
Therefore,
Population in the Year of commissioning (2015) :
= 86004 + 86004 x 0.034 = 88928 Souls
Population after 10 Years of commissioning in (2025) = :
= 88928 + 88928 x 1.17 = 104046 Souls
Population after 20 Years of commissioning in (2035) :
= 104046 + 104046 x 1.17 = 121734 Souls
Population after 30 Years of commissioning in (2045) :
= 121734 + 121734 x 1.17 = 142428 Souls

Water Demand for Design of the Water Treatment Plant:

Rate of Supply = 70 lpcd.
Losses = 5 % Production Loss + 10 % Transmission Loss, Total 15 %

Daily Requirement of Water at various stages

a) In the Year of commissioning in (2015) :	7158713.616 Ltr	7.2 MLD
b) After 10 Years of commissioning in (2025) :	8375694.931 Ltr	8.4 MLD
c) After 20 Years of commissioning in (2035) :	9799563.069 Ltr	9.8 MLD
d) After 30 Years of commissioning in (2045) :	11465488.79 Ltr	11.5 MLD

Annexure - C

CALCULATION OF ECONOMIC DIAMETER OF RAW WATER PUMPING MAIN AND PUMP FOR GREATER ALGAPUR - HAILAKANDI WATER SUPPLY SCHEME UNDER WORLD BANK ASSISTED RWSS - LIS PROGRAMME IN ASSAM.

1	Water Supply Scheme to be pumped					
		Year	Peak	Discharge	Population	Peak Factor
	Initial	2015	7.20	MLD	88928	1
	Intermediate	2030	9.00	MLD	108937	1
	Ultimate	2045	11.50	MLD	142428	1
2	Length of Rising main			5780	meter	
3	Static head including residual head			19	meter	
4	Design Period			30	Years	
5	Combined efficiency of Pumping set			70	%	
6	Cost of Pumping Unit Rs.			7000	Per KW	
7	Interest rate			10	%	
8	Life of electrical motor & Pump			15	Years	
9	Energy charges			6.4	Rs.per unit	
10	Hours of Pumping			Average		
				20	Hours	
11	Stand by KW 1st Stage			50.00%		
12	Stand by KW 2nd Stage			50.00%		

Input Data for Pipe

Dia of pipe (mm)	Pipe Material	Class	C" value of pipe	Cost of pipe (Rs.)	Remarks
250	DI	K9	140	2938	This rates are departmentally accepted rate for various on-going NRDWP Schemes of APHED
300	DI	K9	140	3695	
350	DI	K9	140	4603	
400	DI	K9	140	5537	
450	DI	K9	140	6588	
500	DI	K9	140	7733	
600	DI	K9	140	10058	
700	DI	K9	140	12977	
750	DI	K9	140	14603	

Solution

		1st 15 year		2nd15 years	
1)	Discharge at installation MLD	7.2	Mld	9.0	Mld
2)	Discharge at the end of 15 years	9.0	Mld	11.5	Mld
3)	Average discharge (MLD)	8.1	Mld	10.25	Mld
4)	Hours of pumping for discharge at the end of 15 years	20	hrs	20	hrs
5)	Average hours for pumping for average discharge	18.00	hrs	17.83	hrs
6)	Discharge in pumping hours	10.80	Mld	13.80	Mld
7)	KW required	1.75	H1	2.24	H2
8)	Annual cost of electrical energy	42075.65	KW1	41669.12	KW2
	=	73661.85	H1	93214.07	H2

Table1 showing velocity and loss of head for diff pipe size

Sr no	Pipe size in mm	Frictional head loss per 1000 meter		Velocity in m/sec		1st stage flow			2nd stage flow		
		1st stage flow	2nd stage	1st stage	2nd stage flow	Frictional loss	Other	Total losses	Frictional	Other	Total
		10.80 MLD	13.80 MLD			(in mt.)	10% of friction	19 (in mt.)	(in mt.)	10% of friction	19 (in mt.)
1	250	20.59	32.42	2.55	3.25	119.00	11.90	149.90	187.36	18.74	225.10
2	300	8.47	13.34	1.77	2.26	48.97	4.90	72.86	77.10	7.71	103.81
3	350	4.00	6.30	1.30	1.66	23.11	2.31	44.42	36.39	3.64	59.03
4	400	2.09	3.29	0.99	1.27	12.06	1.21	32.27	18.99	1.90	39.89
5	450	1.18	1.85	0.79	1.00	6.80	0.68	26.48	10.70	1.07	30.77
6	500	0.70	1.11	0.64	0.81	4.07	0.41	23.48	6.41	0.64	26.05

TABLE 2 SHOWING KILOWATTS REQUIRED AND COST OF PUMP SETS FOR DIFFERENT PIPE SIZES

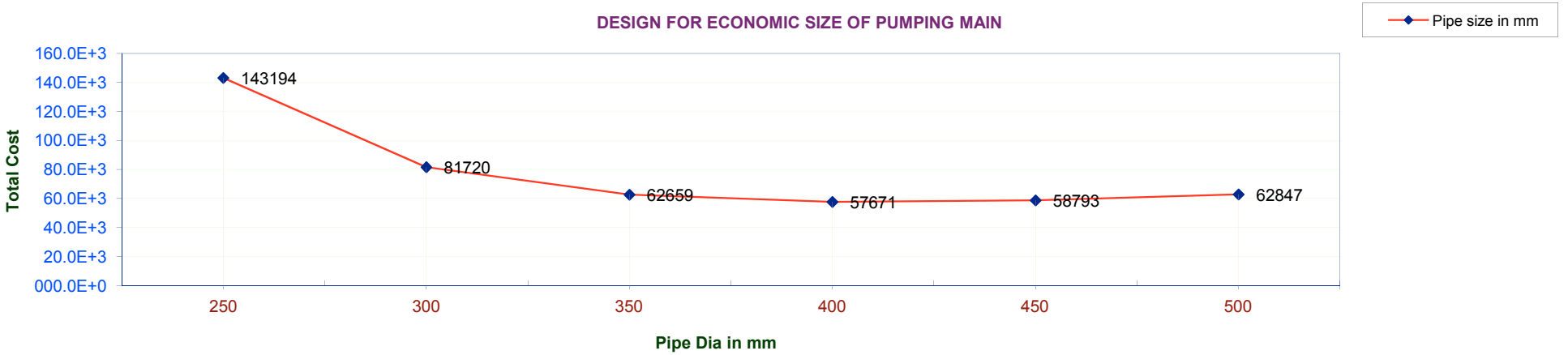
Sr no	Pipe size in mm	1st stage flow			2nd stage flow		
		H1 total head loss (in m)	Kw required with stand by	Cost of Pump (Rs. In thousand)	H2 total head loss (in m)	Kw required with stand by	Cost of Pump (Rs. In thousand)
1	250	149.90	393.64	2755	225.10	755.32	5287
2	300	72.86	191.34	1339	103.81	348.33	2438
3	350	44.42	116.66	817	59.03	198.07	1387
4	**400**	**32.27**	**84.74**	**593**	**39.89**	**133.85**	**937**
5	450	26.48	69.53	487	30.77	103.25	723
6	500	23.48	61.65	432	26.05	87.40	612

TABLE 3 SHOWING COMPARATIVE STATEMENT OF OVER ALL COST STRUCTURE OF PUMPING MAIN FOR DIFF. PIPE SIZES

Sr no	Pipe size in mm	Total head in (m)		Cost of Pipeline of length mts. 5780	Cost of Pump	Annual cost of energy charges	Energy charges capitalized	Total capitalized cost	Cost of Pump	Annual cost of energy charges	Energy charges capitalized	Initial capital investment for pumpset & annual electrical	Grand total of capitalized cost for 30 years
		1st stage	2nd stage										
1	250	150	225	16982	2755	11042	83986	103724	5287	20982	159591	39470	143194
2	300	73	104	21357	1339	5367	40822	63518	2438	9676	73596	18202	81720
3	350	44	59	26605	817	3272	24887	52309	1387	5502	41849	10350	62659
4	**400**	**32**	**40**	**32004**	**593**	**2377**	**18080**	**50677**	**937**	**3718**	**28279**	**6994**	**57671**
5	450	26	31	38079	487	1950	14832	53398	723	2868	21814	5395	58793
6	500	23	26	44697	432	1729	13151	58279	612	2428	18468	4567	62847

Table 3 shows that the most economical size of Main is **400** mm costing Capitalised Rs. **57670970.72**

Dia of economical size of rising main 400 mm



Therefore,

1. With this set of condiditions, economic diameter of raw water pumping main = 400 mm dia. DI (K9) pipe
2. Required capacity of pump with 50 % provision = 84.74 KW. = 114 HP Say, **120.0** HP.
3. Let Us Provide 3 Nos of Raw Water Pump (2 W + 1 S) of capacity = **40** HP Each

Annexure - D

DETAILED DESIGN OF CW PUMPING MAIN FROM TREATMENT PLANT TO RESPECTIVE ESR FOR ROUTE NO. - I

GREATER ALGAPUR-HAILAKANDI WATER SUPPLY SCHEME

Present population 2013	=	31,429	soul	Working period	=	20	hr
Population at installation 2015	=	32,498	soul	Pump Head available at TP Site	=	40	m
Population at installation 2030	=	40,784	soul	Minimum terminal head	=	20	m
Design population 2045	=	52,049	soul	RL OF TP SITE	=	49.80	m
Rate of supply	=	70	LPCD	Hydraulic level at TP location	=	40 + RL	m
Rate of supply with wastage	=	77	LPCD		=	89.80	m
Peak flow factor	=	1					
Peak flow in LPM	=	0.064166667	x design population	Design value of 'C'	DI	=	140
					PVC & AC	=	140

Line	Present population on the line (soul)	Present population to be served by the line (soul)	Design population on the the line (soul)	Design polulation to be served by the line (soul)	Length of line (m)	Peak flow (LPM)	Pipe dia				Head loss for 1000 m (m)	Total head loss (m)	Hydraulic level (m)	RL (m)	Termina l head (m)	Remarks
							DI	AC	PVC							
									OD	ID						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
PH-A	0	31429	0	52049	3000.00	3339.78	300				1.89	5.67	84.13	50.10	34.03	
A-A1	7687	7687	12730	12730	100.00	816.85	100				29.40	2.94	81.19	50.20	30.99	ESR-4
A-B	0	23742	0	39318	600.00	2522.93	250				2.74	1.64	82.49	49.80	32.69	
B-B1	5835	5835	9663	9663	1900.00	620.05	150				2.45	4.66	77.83	49.70	28.13	ESR-3
B-C	0	17907	0	29655	600.00	1902.88	250				1.62	0.97	81.51	50.20	31.31	
C-C1	4986	4986	8257	8257	4800.00	529.83	150				1.83	8.78	72.73	49.60	23.13	ESR-5
C-D	0	12921	0	21398	1200.00	1373.04	200				2.63	3.16	78.36	50.60	27.76	
D-D1	5441	5441	9011	9011	3800.00	578.18	150				2.15	8.17	70.19	50.20	19.99	ESR-2
D-E	0	7480	0	12387	900.00	794.86	150				3.88	3.49	74.87	49.70	25.17	
E-E1	7480	7480	12387	12387	100.00	794.86	100				27.95	2.80	72.07	49.90	22.17	ESR-1
Total	**31429**		**52049**		**17000.00**											

Summary of pipe dia and length

Dia (mm)	Length (m)
350	0
300	3000.00
250	1200.00
200	1200.00
150	11400.00
100	200.00
Total	**17000.00**

Design of Clear Water Pump Set (For 15 yrs)

(i) Total Daily Demand = 3140404.22 LPD

(ii) Total Hourly Demand = 157020.21 LPH

(iii) Total Demand Per Mir = 2617.00 LPM

(iv) Total Head of Pump = 40 M

$$\text{HP Reqd.} = \frac{2617.00 \times 40}{4500 \times 0.7}$$

= 33.23 HP

provide 3 Nos. pump (2W + 1S) of capacity = 20.00 HP each

For BoQ Purpose, let us have 3 Pump Set for giving 21.8 lps against a total head of 40.0 m

DETAILED DESIGN OF CW PUMPING MAIN FROM TREATMENT PLANT TO RESPECTIVE ESR FOR ROUTE NO. - II
GREATER ALGAPUR-HAILAKANDI WATER SUPPLY SCHEME

Present population 2013	=	21,400	soul	Working period	=	20	hr
Population at installation 2015	=	22,128	soul	Pump Head available at TP Site	=	40	m
Population at installation 2030	=	27,770	soul	Minimum terminal head	=	20	m
Design population 2045	=	35,440	soul	RL OF TP SITE	=	49.80	m
Rate of supply	=	70	LPCD	Hydraulic level at TP location	=	40 + RL	m
Rate of supply with wastage	=	77	LPCD		=	89.80	m
Peak flow factor	=	1					
Peak flow in LPM	=	0.064166667	x design population	Design value of 'C'	DI	=	140
					PVC & AC	=	140

Line	Present population on the line (soul)	Present population to be served by the line (soul)	Design population on the the line (soul)	Design polulation to be served by the line (soul)	Length of line (m)	Peak flow (LPM)	Pipe dia				Head loss for 1000 m (m)	Total head loss (m)	Hydraulic level (m)	RL (m)	Terminal head (m)	Remarks
							DI	AC	PVC							
									OD	ID						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
PH-F	0	21400	0	35440	50.00	2274.06	200				6.69	0.33	89.47	49.60	39.87	
F-F1	6062	6062	10039	10039	100.00	644.17	100				18.94	1.89	87.57	50.20	37.37	ESR-6
F-G	0	15338	0	25401	1300.00	1629.88	200				3.61	4.69	84.77	49.60	35.17	
G-G1	4828	4828	7995	7995	4400.00	513.04	150				1.72	7.57	77.20	49.20	28.00	ESR-15
G-H	0	10510	0	17405	1900.00	1116.84	200				1.79	3.40	81.37	49.10	32.27	
H-H1	5593	5593	9262	9262	200.00	594.34	100				16.31	3.26	78.11	49.80	28.31	ESR-8
H-I	0	4917	0	8143	6800.00	522.50	200				0.44	2.99	78.38	50.10	28.28	
I-I1	4917	4917	8143	8143	100.00	522.50	100				12.85	1.29	77.09	50.50	26.59	ESR-9
Total	**21400**				**14850.00**											

Summary of pipe dia and length

Dia (mm)	Length (m)
350	0.00
300	0.00
250	0.00
200	10050.00
150	4400.00
100	400.00
Total	**14850.00**

Design of Clear Water Pump Set (For 15 yrs)

(i) Total Daily Demand = 2138300.63 LPD
(ii) Total Hourly Demand = 106915.03 LPH
(iii) Total Demand Per Minu = 1781.92 LPM
(iv) Total Head of Pump = 40 M

$$\text{HP Reqd.} = \frac{1781.92 \times 40}{4500 \times 0.7} = 22.63 \text{ HP}$$

provide 3 Nos. pump (2W + 1S) of capacity = 15.00 HP each

For BoQ Purpose, let us have 3 Pump Set for giving 14.8 lps against a total head of 40.0 m

DETAILED DESIGN OF CW PUMPING MAIN FROM TREATMENT PLANT TO RESPECTIVE ESR FOR ROUTE NO. - III
GREATER ALGAPUR-HAILAKANDI WATER SUPPLY SCHEME

Present population 2013	=	33,676	soul	Working period	=	20	hr
Population at installation 2015	=	34,821	soul	Pump Head available at TP Site	=	40	m
Population at installation 2030	=	43,700	soul	Minimum terminal head	=	20	m
Design population 2045	=	55,770	soul	RL OF TP SITE	=	49.80	m
Rate of supply	=	70	LPCD	Hydraulic level at TP location	=	40 + RL	m
Rate of supply with wastage	=	77	LPCD		=	89.80	m
Peak flow factor	=	1					
Peak flow in LPM	=	0.064166667	x design population	Design value of 'C'	DI	=	140	
					PVC & AC	=	140	

Line	Present population on the line (soul)	Present population to be served by the line (soul)	Design population on the the line (soul)	Design polulation to be served by the line (soul)	Length of line (m)	Peak flow (LPM)	Pipe dia				Head loss for 1000 m (m)	Total head loss (m)	Hydraulic level (m)	RL (m)	Terminal head (m)	Remarks
							DI	AC	PVC							
									OD	ID						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
PH-J	0	33676	0	55770	1700.00	3578.56	300				2.15	3.6550	86.15	49.70	36.45	
J-J1	7581	7581	12555	12555	1900.00	805.59	150				3.98	7.5620	78.58	50.10	28.48	ESR - 7
J-K	0	26095	0	43215	2400.00	2772.97	300				1.34	3.2160	82.93	50.60	32.33	
K-K1	7015	7015	11617	11617	7700.00	745.44	200				0.85	6.5450	76.38	50.80	25.58	ESR-14
K-L	0	19080	0	31598	2400.00	2027.52	250				1.83	4.3920	78.54	50.20	28.34	
L-L1	4652	4652	7704	7704	200.00	494.34	100				11.60	2.3200	76.22	50.60	25.62	ESR-10
L-M	0	14428	0	23894	2900.00	1533.18	250				1.09	3.1610	75.38	50.40	24.98	
M-M1	4336	4336	7181	7181	400.00	460.76	150				1.41	0.5640	74.81	50.90	23.91	ESR-11
M-N	0	10092	0	16713	1500.00	1072.42	250				0.56	0.8400	74.54	50.10	24.44	
N-N1	5424	5424	8983	8983	400.00	576.38	150				2.14	0.8560	73.68	49.80	23.88	ESR-13
N-O		4668	0	7731	3100.00	496.04	200				0.40	1.2400	73.30	50.30	23.00	
O-O1	4668	4668	7731	7731	100.00	496.04	150				1.62	0.1620	73.13	50.10	23.03	ESR-12
Total	**33676**		**55769.741**		**24700.00**											

Summary of pipe dia and length

Dia (mm)	Length (m)
400	0.00
350	0.00
300	4100.00
250	6800.00
200	10800.00
150	2800.00
100	200.00
Total	**24700.00**

Design of Clear Water Pump Set (For 15 yrs)

(i) Total Daily Demand = 3364925.79 LPD
(ii) Total Hourly Demand = 168246.29 LPH
(iii) Total Demand Per Min = 2804.10 LPM
(iv) Total Head of Pump = 40 M

$$\text{HP Reqd.} = \frac{2804.10 \times 40}{4500 \times 0.7}$$

$$= 35.61 \text{ HP}$$

provide 3 Nos. pump (2W + 1S) of capacity = 20.00 HP each

For BoQ Purpose, let us have 3 Pump Set for giving 23.4 lps against a total head of 40.0 m

Annexure - E

HYDRAULIC DESIGN AND UNIT SIZING OF VARIOUS UNIT OF 8.4 MLD (IN 20 HOURS OPERATION) CAPACITY WATER TREATMENT PLANT

Capacity of the Treatment plant = 8.40 MLD.

Operating hours of the Plant = 20.0 hours

Therefore, hourly rate of treatment = 420.0 Cu.m.

Now, the unit size of various system component of the scheme are as below :

Now, the unit size of various system component of the scheme are as below :

1. The Aerator :

Since raw water is from surface source and does not contain much minerals viz. iron, manganese etc., cascade type aerator is proposed for the scheme. In cascade aerators water is allowed to flow downwards after spreading over inclined thin sheets and the turbulence is secured by allowing the water to pass through a series of steps ranging from 4 to 6 nos. As per CPHEEO manual, space requirement of the aerator varies from 0.015 to 0.045 m^2 /m^3/hour.

1.1 Influent Pipe Size :

Water from the River Intake shall directly come to the aerator through the raw water main. Therefore, a velocity of 0.8 m/sec is assumed in the influent pipe.

Rate of flow in the influent pipe = 420.0 Cu.m/hour.

= 0.117 Cu.m./sec.

With0.80 m/sec velocity, C/S area of the pipe required is

= 0.146 Sq.m.

Therefore, required dia of the influent pipe = 0.431 m.

Let us provide 450 mm dia CI pipe as aerator Inlet.

1.2 Aeration Deck Size :

In our case, we propose for 1 aerator with hourly rate of flow of 575.0 m^3/ hour, per aerator. Since, rate of flow is very large, providing a space of 0.03 m^2 /m^3/hour for the purpose, space required in the aerator deck is, 420.0 x 0.03 = 12.60 Sq.m. Let us provide a cascade aerator of overall inner diameter 5.10 m. with 5 steps.

2. Rapid Mix Unit (Flash mixer) :

To help in formation of micro floc with resultant utilization of chemical coagulant preventing localization of concentration and premature formation of hydroxides which leads to less efficient utilization of the coagulant and for rapid & uniform dispersion throughout the volume of water, mechanical type rapid mix unit is proposed.

In our case,

No. of Flash Mixer = 1

Therefore, design flow to be treated= 420.0 m^3/hour.

Detention time = 30 sec. (range – 20 to 60 sec.)

Ratio of height to dia = 1.5:1 (range – 1:1 to 3:1)

Dimension of the tank is given by,

Volume = Flow x detention time

$$= \left(\frac{420.0}{60 \times 60} \right) \times 40 = 4.67 \ M^3.$$

For a ratio of 1.5 : 1 for tank height to diameter, sizes of the tank shall be,

$$\left({}^{\pi}/_{4} \times D^2 \right) \times 1.5 \ D = 4.67 \ m^3$$

$\therefore$ D = 1.6 m, say, 2.0 m.

And height, H = 1.5 D = 3.0 m.

With a free board of 0.3 m., the total height of the rapid mixing tank shall be 3.3 m.

To match with the level of raw water channel and to maintain the required hydraulic gradient between various units of the treatment plant, suitable staging may have to provide for the flash mixer.

3 Clariflocculator :

The Clariflocculator is proposed to eliminate the alum floc developed in the flash mixer and to get clarified water to minimize the load on the filter unit and thus obviate the necessity of frequent back washing. We propose a circular Clariflocculator having vertical paddles. The water enters through a central influent pipe and is fed to the flocculation zone through ports. The effluent from flocculation zone passes below the partition wall dividing the flocculator portion and the clarifier portion. The clarified effluent is collected by a peripheral effluent launder. For our case, we are to design the Clariflocculator size for the following data :

Desired average outflow from Clariflocculator

$= 420.0 \ M^3$/hour

Detention period = 30 minute.

Average value of velocity gradient, G = 40 S^{-1}.

Now, considering a velocity of 0.7 m/sec, influent pipe diameter required is,

$$= \sqrt{\frac{420.0}{60 \times 60} \times \frac{1}{0.7} \times \frac{4}{\pi}} = 0.461 \text{ m.},$$

Let us provide a influent pipe of diameter, 500 mm.

Now, Volume of the flocculator

= (420.0 / 60) x 40 = 280.0 m^3

(Considering 40 sec detention)

Providing a water depth of 4.5 m., area of the flocculator required = 62.23 m^2

Let D_f be the diameter of the flocculator and D_p be the influent pipe diameter.

Then, $\frac{\pi}{4} \times (D_f^2 - D_p^2) = 62.23 \text{ m}^2$,

Since D_p = 500+350x2=1200 mm, therefore, D_f =8.98 m.

Let us provide a tank of 9.0 m. for flocculation zone.

For designing the Clarifier, let us assume a surface overflow rate of 60 $m^3/m^2/day$

Therefore, surface area of the clarifier required

$$= \frac{420.0 \times 20}{60} = 140.0 \text{ m}^2.$$

Let D_c be the diameter of the clarifier, and D_f be the outer diameter of the flocculator. Considering 250 thick wall for flocculator zone, outer diameter of the flocculator, D_f = 9.5 m.

Then, $\frac{\pi}{4} \times (D_c^2 - D_f^2) = 140.0\ m^2$,

Since D_f = 9.5 m., therefore, D_c =16.388 m.

Let us provide a tank of 17.0 m. for clarifier zone.

Now, length of the weir = π x 17 = 53.38 m.

Therefore, weir loading

$= \frac{420.0 \times 20}{53.38} = 157.30\ m^3/day/m < 300 m^3/day.m.$, O.K.

4. The Filter Unit :

As the raw water shall be discharged at atmospheric pressure at the outlet of the aerator, the aerated water shall travel under gravity to other units of the treatment plant. Therefore, instead of pressure filter, we propose a rapid sand filter for the purpose.

For rapid sand gravity filters, standard rate of filtration as prescribed in the said Manual is 4.8 to 6.0 m^3/m^2/hour. Since ours is a plant of high capacity having hourly requirement of 420.0 Cu.m, using an average limit of 5.0 m^3/m^2/hour, space required for the filter bed is worked out as 84.0 m^2 for a average outflow of 420.0 m^3 per hour. For having flexibility of use, if we provide 4 (four) beds, (out of which, 3 working + 1 standby) area of each bed required is 28.0 m^2. Applying a length to width ratio of 1.25:1, the size of each bed shall be 4.79 m. x 5.99 m.

Let us provide a rapid sand filter unit having eight beds of size 4.8 m. x 6.0 m. each. Therefore, area available for

filtration = 4.8 x 6.0 x 4 bed =115.2 Sq.m., giving a filtration rate of 4.991 m^3/m^2/hour, which is well within the range.

The Overall size of the building accommodating the filter units shall be kept more than this for accommodating the raw water and back wash water gutters; operating gallery; rate of flow controller; filtered water channel; Chlorine Dozer; and, air compressor etc.

5. Chemical dosing, disinfection etc.:

For chemical dosing (lime alum solution etc.) to the raw water; to add disinfecting chemicals (mostly bleaching powder); and, to monitor the quality of both raw & clear water, one laboratory cum chemical house shall be provided along with the treatment plant. This laboratory cum chemical house shall accommodate the storage of chemicals, chemical solution preparation tanks, and the quality-monitoring laboratory. In addition, the clear water pump room shall also be provided in the same building. The plinth area of each floor of the double storied chemical house, laboratory and clear water pump house building shall be 84.0 Sq.m.

6. Back Wash Water:

For back washing of one filter bed, water requirement @ 600 ltr. perSq.m. per minute for 10 minutes is worked out to be 180.0 Cu.m. This shall be provided in a tank above the roof of the Chemical House.

Annexure - F

DETAILED ESTIMATE FOR PROPOSED RWSS - LS PROJECTS IN ASSAM

ABSTRACT OF COST FOR GREATER ALGAPUR - HAILAKANDI WATER SUPPLY SCHEME IN HAILAKANDI DISTRICT

Sl. No.	Major Item of Works	Amount as per Estimate
(1)	(2)	(3)
1	**Raw water Intake System**	
1.1	M.S. Floating Barge with all necessarry mooring materials & life saving equipment; tying arrangement; Over Head gantry Crane etc.	Rs.15,98,680.00
1.2	RCC Single Storied Utility cum Operator's Room at River bank of Intake Point	Rs.9,41,150.00
1.3	River bank Protection Work at Intake Point	Rs.16,64,235.00
1.4	Approach Road to Intake Point from the nearby public road	Rs.30,29,320.00
1.5	Land Development & Security Wall at Intake Statior	Rs.21,59,500.00
1.6	Twin Assam Type accommodation at Intake Location for 1 (one) No. Pump Operator and 1 (one) No. Chowkider	Rs.11,03,720.00
1.7	Dedicated Power Line to Intake including Substation	Rs.32,63,610.00
1.8	Captive Power Generator at Intake	Rs.23,50,000.00
2	**Raw Water Pumping Machinery and other accessories**	
2.1	Raw Water Pumping machinery in the Intake barge including all necessary electrical and other installation works	Rs.25,91,175.00
2.2	Manifold type Common Header at river bank for the raw water main and flexible hoses for connecting the same with the barge including campus illumination at intake location	Rs.12,60,250.00
3	**Raw Water Conveying Main**	
3.1	Supplying, laying, jointing, testing and commissioning of 400 mm dia DI S.S. raw water pumping main including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete	Rs.7,34,77,670.00

(1)	(2)	(3)
4	**Water Treatment Plant**	
4.1	Design and Construction of Complete Water Treatment Plant of capacity 8.4 MLD (in 20 hours of operation) with suitable design in conformity with the CPHEEO Manual having provision for Sedimentation, Aeration, Coagulation, Rapid Mixing, Clariflocculation & Filtration followed by disinfection, including all Mechanical and Electrical Installation Work suitable for automated operation of the plant, Provision for Back Washing, Laboratory Facility, all internal connection & by-pass piping system, as per specification provided in the connected Annexure. (Note : The TP shall inclued provision for one Water Works Office and for Storage Accn.)	Rs.3,08,03,565.00
4.2	Construction of 9,00,000.0 ltrs. Capacity RCC Under Ground Treated Water Sump in 2 (two) compartment and with a suction pit for pumps having provision for all inlet, outlet & overflow arrangement; mechanical type water level indicator; Air Vent Pipe; Men Hole with Cover; CI Lugs inside the sump etc. , complete	Rs.60,25,490.00
4.3	Land Development & Security Wall at Treatment Plant Location	Rs.77,07,900.00
4.4	Twin Assam Type accommodation at Treatment Plant Location for 1 (one) No. Pump Operator and 1 (one) No. Chowkider	Rs.11,03,720.00
4.5	Internal Road / Path etc.; Landscaping & Arboriculture including Compound Illumination in the treatment plant site	Rs.8,02,100.00
4.6	Approach Road to Treatment Plant Site from the nearby public road	Rs.43,11,565.00
4.7	Dedicated Power Line to Treatment Plant including Substation	Rs.19,14,410.00
4.8	Captive Power Generator at Tretment Plant	Rs.35,25,000.00
5	**Clear Water Pumping System**	
5.1	Clear Water Pumping machinery at the treatment plant for all the Clear water feeder route including all necessary electrical and other installation works	Rs.42,95,670.00
5.2	Clear Water Pump House at Treatment Plant Location	Rs.14,81,100.00
5.3	Manifold type Common Header for the Clear water main of Different Route and RCC Pump Foundation	Rs.4,75,635.00

(1)	(2)	(3)
6	**Clear Water Conveying Main**	
6.1	Supplying, laying, jointing, testing and commissioning of different required diameter DI S.S. Clear water pumping main for Route - I serving ESR Nos. 1,2,3,4 and 5, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete	Rs.9,87,25,350.00
6.2	Supplying, laying, jointing , testing and commissioning of different required diameter DI S.S. Clear water pumping main for Route - II serving ESR Nos. 6,8,9 and 15, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete	Rs.8,20,52,720.00
6.3	Supplying, laying, jointing , testing and commissioning of different required diameter DI S.S. Clear water pumping main for Route - III serving ESR Nos. 7,10,11,12,13 and 14, including all necessary valves & specials, valve chamber, supporting structures, anchor / thrust block etc., complete	Rs.15,87,90,425.00
7	**Elevated Service Reservoir**	
7.1	Construction of 15 (fifteen) elevated service reservoirs of following capacity with suitable foundation, including all necessary inlet/outlet etc. piping arrangement, control valves amenable to motorised operation, water level indicator, lightening aerestor, solar power system, security wall, signboard, landscapping, & arboriculture etc., all complete	
	ESR No. 1 : 240 Cu.m.	Rs.61,69,927.00
	ESR No. 2 : 180 Cu.m.	Rs.54,51,333.00
	ESR No. 3 : 160 Cu.m.	Rs.48,95,606.00
	ESR No. 4: 190 Cu.m.	Rs.56,51,495.00
	ESR No. 5 : 250 Cu.m.	Rs.63,67,585.00
	ESR No. 6 : 200 Cu.m.	Rs.58,92,721.00
	ESR No. 7 : 250 Cu.m.	Rs.63,67,585.00
	ESR No. 8 : 180 Cu.m.	Rs.54,51,333.00
	ESR No. 9 : 160 Cu.m.	Rs.48,95,606.00
	ESR No. 10 : 150 Cu.m.	Rs.48,23,115.00
	ESR No. 11 : 140 Cu.m.	Rs.46,64,149.00
	ESR No. 12 : 150 Cu.m.	Rs.48,23,115.00
	ESR No. 13 : 180 Cu.m.	Rs.54,51,333.00
	ESR No. 14 : 230 Cu.m.	Rs.60,87,708.00
	ESR No. 15 : 160 Cu.m.	Rs.48,95,606.00
7.2	Approach Road to ESR Locations	Rs.77,95,176.00

(1)	(2)	(3)
8	**Distribution System**	
8.1	DI Feeder Main from respective ESR to the concerned Distribution network	Rs.6,67,54,218.20
8.2	Extension, Renovation, Augmentation of the existing Distribution network	Rs.8,35,25,012.00
8.3	House connection comprising of shaddle piece, 10.0 m. PPR Pipe, Ferruule Cock etc.	Rs.3,26,45,020.00
9	**Water meter with 5 year maintanence contract**	
9.1	Bulk Water meter	Rs.48,70,250.00
9.2	Domestic Water meter	Rs.3,27,79,500.00
10	**Auto Control System**	
10.1	SCADA for auto control of the complete system	Rs.1,56,07,600.00
	Sub Total =	**Rs.82,13,18,953.2**

Annexure - G

DISASTER MANAGEMENT PRACTICES IN PHED, ASSAM.

The very concept of disaster management is embedded in the departmental activity of Engineering Departments. In some cases only additional quick response and mitigation planning is required.

Disaster Management in Conceptual Stage:

The preventive measures of disasters are enforced in Engineering Departments in the form Codes, Byelaws etc in concept preparation stage and planning of an engineering project e.g. National Building Code of India (SP7), Building byelaws of local administrative bodies etc. At this stage itself evacuation plans during disaster, access for rescue / firefighting teams and facilities required fight such untoward incidents are worked out.

Disaster Management in Design Stage:

During design stage, all possible loads structures have to bear during its service life is taken in to account. Here, in the design process Importance Factor, Factor of Safety etc based on the degree of losses in case of failure, degree of vulnerability are taken in to account. For this there are clear guide lines set by Bureau of Indian Standards (BIS) in the form of codes of practices e.g. IS:875 for Loads (Dead Loads, Live Loads, Wind Loads) to be considered during design. There are also codes for design of Concrete Structures (IS:456), Steel Structures (IS:800) etc.

Disaster Management in Construction Stage:

There are guidelines for stages of construction, tests for assessment of strength of supporting structures to overcome any probable disaster. There are also Rules set by administrative authority for safety of workers, compulsory use of safety gadgets like apron, goggles, helmets, safety belt etc. and availability of First Aid facilities.

Disaster Management through Rehabilitation and Retrofitting of Structures:

There are Handbooks on Repair and Rehabilitation of structures published by Govt. agencies to overcome disaster from old and damaged structures. There is also handbook on Seismic Retrofit of buildings to support structures which were designed without considering the seismic forces properly.

Disaster Management during service life of Structures:

This includes inspection and structural safety assessment of structures at regular interval, regulating the intended use of structures to avoid overloading etc. For this there is scope for improvement by setting norms, capacity development through training, putting alert system to invite joint effort all departments working on it.

Annexure-H

A. Environmental Data Sheet (EDS) for Water Supply Schemes

Name of Scheme: Greater Algapur-Hailakandi Water Supply Scheme in Algapur and Hailakandi Development Block of Hailakandi District.

S. No.	Description	Particulars	Remarks
GENERAL			
1.	Name of Habitation(s)	233 Nos. (List annexed)	
2.	Name of Gram Panchayat(s)	14 Nos. (List annexed)	
3.	Name of Block(s)	Algapur and Hailakandi	
4.	Name of District	Hailakandi	
5.	Population (present)	86004 souls.(2013 AD)	
6.	Total water demand (Litres per day)	6.90 MLD (2013 AD)	
7.	Present water supply (Litres per day)	2.58 MLD	
8.	Present classification of habitation (s)	Partially Covered	
9.	Problem with present water supply	Ground Water Table depletion, Iron contamination, Lesser supply level.	
10.	Net demand of water from the proposed source (Litres/day)	8.4 MLD	
11.	Type of source	Surface water	
12.	Type of scheme	Large Multi Village Scheme (LMVS)	
13.	Is De-fluoridation/ RO planned?	No	
LOCATION			
14.	Where is the source located?	On Katakhal river	
15.	Has a sanitary survey of the source location been done? Enclose the report of the sanitary survey, conduct this survey as per the ECOP given in the Sanitary Survey of Water Supply Sources in the EMF.	No, Raw Water Quality test report enclosed.	
16.	Is any component of the scheme located in a forest area? If yes, obtain permission in writing from the Forest Department.	No	

	Legal status of forest: Area of forest land involved:		
17.	Is the source is near (within 5 km) any ecologically sensitive area (National Parks, Wildlife Sanctuaries, Game Reserves, Bio-spheres, etc.)? Avoid the sensitive areas. If not possible, obtain permission in writing from the Forest Department and follow mitigation measures as suggested by the Forest Department.	No	
18.	Is any historical/ archaeological/ protected monument located within 300 m distance? If yes, give details of monument: Name of Monument: Status of Monument: Distance from site:	No	
19.	Are any trees likely to be cut at the location for construction of the scheme? If yes, mention the number of trees per each species. Obtain permission in writing from the Forest Department.	No	
20.	Have approved/ legal sources been identified for the construction materials (sand, aggregate, bricks, etc.) If yes, mention details of sources identified for each material.	Already taken care of as per Assam PWD building schedule of rates 2010-11 including permission, forest royalty etc.	
21.	What is the amount of construction waste likely to be generated? Have appropriate sites been identified for disposal of construction waste? If yes, mention details of disposal sites; name of site, present land use and distance from work site, etc. for each site.	The contractor will be liable to clear the construction waste, if any.	
IN CASE OF SURFACE WATER SOURCE			
LOCATION			
22.	Will there be any significant land disturbance resulting in erosion, subsidence and instability?	No	

23.	Will the scheme involve alteration of natural drainage? If yes, indicate the measures for the drainage.	No	
24.	What is the distance of the source from the nearest sewage or industrial effluent disposal point. Please give details such as distance, location, upstream/ downstream, etc.	HPC Paper Mill sewage released to the river 20 Km downstream from the intake point.	
SUSTAINABILITY			
25.	Is the expected safe yield from the source greater than water demand?	Yes	
WATER QUALITY			
26.	What is the Turbidity of raw water (NTU)? (Enclose water quality test report)	Raw Water Quality test report as enclosed.	
27.	Is this source within 100 m from the nearest sewage/industrial effluent disposal point (disposal into the surface water source)?	No	
28.	Is there any chemical impurity present? If yes, furnish the details. (Enclose water quality test report)	No	
29.	What is the frequency planned for testing water for bacteriological contamination? (should be 1 every month)	Every day, There shall be a full-fledged water quality testing laboratory in the treatment plant.	
30.	What is the frequency planned for testing water for physical and chemical contamination? (should be 4 times/year)	Every 3 month	
31.	What is the frequency planned for testing residual chlorine? (should be once every day)	Every day	
32.	What is the frequency planned for sanitary inspection by VWSC? (should be 12 times/year)	Every month	
33.	What is the frequency planned for sanitary inspection by Dept.? (should be 2 times /year if population serviced is less than 5000; should be 24-48 times /year if population serviced is between 5000-20000)	36-48 times /year	
WATER TREATMENT			
34.	What is the method of water treatment proposed?	Aeration, Sedimentation, Coagulation, Flocculation, Filtration, Disinfection.	

35.	What is the capacity of treatment plant?	8.4 MLD	
36.	Will the proposed treatment bring water quality to the desirable limits?	Yes	
37.	What is the quantity of backwash water generated per day?	350 Cum, This will again be recycled.	
38.	What is the quantity of sludge generated per day? How will the sludge and other residue from the water treatment plant be disposed?		

Category of Scheme: Category II :MVSS with surface water source requiring treatment

EDS filled and Categorization done by:

Signature		
Name		
Designation	District Environment Expert	Executive Engineer
Date		

Environment Management Plan (EMP)

Name of Scheme: Greater Algapur-Hailakandi Water Supply Scheme in Algapur and Hailakandi Development Block of Hailakandi District.

S. No ...	Identified negative impacts on environment	Actions to be taken to mitigate (remove/reduce) negative impacts	Time frame	Responsible agencies	Reference of Coverage in bid document	Cost of activities
Site and Construction Related Aspects						
1	Extraction of materials from illegal or inappropriate locations.	• Verify suitability of all material sources and obtain approval of Project Authority. • List the approved quarry sites and sources:	Approval to be secured before construction.	• List of approved sources for materials to be made available Project Authority • Material to be sourced from approved sources by Contractor.		NA
2	Disposal of construction waste at inappropriate locations.	• Reuse the construction waste as much as possible. • Verify appropriateness of all construction waste disposal sites and obtain approval of Project Authority • List the approved disposal sites:	Approval to be secured before construction.	• List of approved disposal sites to be made available by Project Authority • Construction waste to be disposed at approved sites by Contractor.		NA
3	Dust pollution due to excavation.	• All earth work in habitation areas will be protected to minimize generation of dust. • Sprinkling of water on construction sites in habitation areas using water tanker as and when necessary during dry weather.	During construction phase.	Contractor.		NA
4	Risk of improper management of archaeological chance finds	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislations. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and/or damaging any such article or thing. He will, immediately upon discovery thereof and before	During construction phase.	Contractor.		NA

		removal acquaint the Project Authority of such discovery and carry out the given instructions for dealing with the same, waiting which all work shall be stopped. The Project Authority will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.				
5	Improper disposal of dewatered water.	• Do not let out dewatered water onto the road or into nearby water bodies. • Dewatered water is to be disposed into appropriate drains or disposal sites.	During construction phase.	Contractor.		NA
6	Risk of accidents and occupational health impacts.	Implement Health and Safety measures including: (a) excluding public from the site (including setting up barricades and warning signs) (b) ensuring all workers are provided with and use Personal Protective Equipment including: helmet, gloves and gumboots at concreting locations, nose mask at dust producing areas, safety belt during work at height, hearing protection at noise producing locations; (c) documentation of work-related accidents; (d) First Aid box shall be easily accessible throughout the site; (e) Provide supplies of potable drinking water at labour camp and work site. (f) Provide toilet facility at labour camp	During construction phase.	Contractor.		NA
7	Risk of improper clearance and restoration of construction sites.	On completion of the works, all temporary structures will be cleared away, all rubbish cleared, borrow pits, trenches, etc., filled/levelled and effectively sealed off and the site left clean and tidy, at the contractor' s expenses, to the satisfaction the Project Authority.	During construction phase.	Contractor.		NA

Water Supply Related Aspects						
8	Risk of poor water quality	Ensure that raw water quality and selected water treatment technology are appropriate to bring the water to desirable limits.	During scheme design.	Project Director		NA
		Ensure that water quality testing is undertaken regularly (test for residual chlorine – daily, test of bacteriological parameters – monthly, test of physical/chemical parameters – once in 3 months) and a record of the test results is maintained for a representative set of samples (including samples from clean water outlet at WTP, samples from chief and branch mains and samples from end of distribution system).	During O & M phase.	As per contract agreement		NA
9	Improper disposal of backwash water from WTP	Integrate system for reuse / recycling of backwash water into design of WTP.	During scheme design.	Project Director		NA
10	Improper disposal of sludge from WTP	Integrate system for proper disposal of sludge into design of WTP.	During scheme design.	Project Director		NA

EMP prepared by:

Name: ……., Designation: Environment Expert, Signature: ……

Name: ……., Designation: Executive Engineer, Signature: ……

Date: ……

EMF of Greater Algapur- Hailakandi water supply Project

None of the components of the **Greater Algapur- Hailakandi water supply Project** is located in any forest area; moreover, the source is sufficiently away from historical/archaeological monuments, ecologically sensitive areas such as, National Park, Wild Life Sanctuaries, bio-spheres etc. As all of the units are proposed in our existing premises or so, there is no scope of felling of existing trees. As per trend, there is no significant erosion, landslide, subsidence around the surface water source and along the distribution network. The construction and laying activities are so planned that nowhere, the natural drainage would be affected. In the upstream of the source, no industrial effluent is discharged into the river source .There seems to be no potential environmental threat to the project area

All the mitigation measures like- i) River Shore lining, ii) Water Treatment Plant and iii) Water Quality et. are integrated in the DPR as a part of Environmental management.

Annexure-I

ANNUAL OPERATION AND MAINTENANCE COST FOR GREATER ALGAPUR-HAILAKANDI WSS

Sl No.	Description	Qty	Unit	Rate (Rs.)	Amount
A)	Salary & Wages				
i)	Supervisor / Asstt. Manager (AE)	1	No.	35000	35000.00
ii)	Operator = 3 Nos. at Intake + 3 Nos. at TP	6	Nos.	15000	90000.00
iii)	Helper / fitter = 3 Nos. at Intake + 3 Nos. at TP + 4 Nos. for Raw & Clear Water Main	10	Nos.	12000	120000.00
iv)	Watchman =1 No. at Intake + 1 No. at TP + 14 Nos. for ESR	16	Nos.	12000	192000.00
B)	Energy Charges:				
i)	Power charge, considering average 18 hours availability of power @ Rs. 5.15 perKWH	95674.5	KWH	5.15	492723.68
ii)	Electricity Duty @ Rs. 0.10 per KWH	95674.5	KWH	0.10	9567.45
iii)	Fixed Electricity Charge @ Rs. 125.00 per KVA per month	500.0	KVA	125.00	62500.00
C)	Fuel Charge for balance 2 hours				
i)	For Intake station	4297.0	KWH	14.18	60926.60
ii)	For Treatment Plant	5908.3	KWH	13.93	82291.08
D)	Chemicals				
	i) Lime				16380.00
	ii) Alum				53625.60
	iii) Bleaching Powder				22982.40
E)	Maintenance of bulk water supply (except roads & buildings)., @ 0.05 % of the respective Capital Cost				289974.98
F)	Maintenance of Intra Village Water Supply @ 0.05 % of the respective Capital Cost				107030.98
Total monthly O&M Cost = Rs.					1635002.76
Therefore, Annual O& M Cost = Rs.					**19620033.09**
Hence, Cost of production of 1 KL Water = Rs.					**7.46**

Annexure -J

Test Report

Laboratory test due to ascertain the under mentions Para Meter of Raw Water under World Bank Project

SUMMER SEASON

Source -	Surface
River –	**Katakhal**
Collection Point –	**Near Mohanpur Bridge**
Date of collection & Time -	16.07.13 at 12.40 PM
Receive Time	1.30 PM
Testing Time	2.00 PM of 16.07.13

Physical Test

Turbidity	2100 J.T.U
Colour	Objectionable
Odour	Objectionable

Chemical Test

(1) P^H	6.00
(II)Iron	0.02 mg /lit
(III)Hardness	250mg /lit
(IV) Chloride	120 mg /lit
(V) Fluoride	0.091 mg /lit
(VI) Nitrate	15 mg /lit
(VII) Alkalinity	120 mg /lit

Bacteriological Test: :- Bacteria Present

Sd/-
Asstt Executive Engineer (PHE)
Hailakandi Sub-Division, Hailakandi

Sd/-
Executive Engineer (PHE)
Hailakandi Division ,Hailakandi

Annexure – K

Summary of Sub Soil Investigation Report for the Proposed World Bank Assisted RWSS – LS Projects in Assam : Greater Algapur – Hailakandi Water Supply Scheme in Algapur and Hailakandi Development Block of Hailakandi District.

Sl. No.	Name of Structure	Location	Safe Bearing Capacity of Soil at 2.0 m. below existing G.L. (in MT / m2	R.L. of existing G.L.
1.	Treatment Plant and Elevated Service Reservoir	Matirgram	Non seismic net safe soil pressure : 7.40 T / m2 Seismic net safe soil pressure : 9.25 T / m2	49.80
2.	Elevated Service Reservoir	Lakhirbond	Non seismic net safe soil pressure : 6.90 T / m2 Seismic net safe soil pressure : 8.63 T / m2	49.90
3.	Elevated Service Reservoir	Uzankupa	Non seismic net safe soil pressure : 7.50 T / m2 Seismic net safe soil pressure : 9.38 T / m2	50.20
4.	Elevated Service Reservoir	Bowalipar Pt - III	Non seismic net safe soil pressure : 7.80 T / m2 Seismic net safe soil pressure : 9.75 T / m2	49.70
5.	Elevated Service Reservoir	Bowalipar	Non seismic net safe soil pressure : 6.90 T / m2 Seismic net safe soil pressure : 8.63 T / m2	50.20

Continued to Page -2

Summary of Sub Soil Investigation Report for the Proposed World Bank Assisted RWSS – LS Projects in Assam : Greater Algapur – Hailakandi Water Supply Scheme in Algapur and Hailakandi Development Block of Hailakandi District.

6.	Elevated Service Reservoir	Bhatirkupa	Non seismic net safe soil pressure : 7.20 T / m2 Seismic net safe soil pressure : 9.00 T / m2	49.60
7.	Elevated Service Reservoir	Bamagao Kapnarpar	Non seismic net safe soil pressure : 7.70 T / m2 Seismic net safe soil pressure : 9.63 T / m2	50.10
8.	Elevated Service Reservoir	Algapur	Non seismic net safe soil pressure : 7.50 T / m2 Seismic net safe soil pressure : 9.38 T / m2	49.10
9.	Elevated Service Reservoir	Narainpur	Non seismic net safe soil pressure : 7.40 T / m2 Seismic net safe soil pressure : 9.25 T / m2	49.50
10.	Elevated Service Reservoir	Gulalia	Non seismic net safe soil pressure : 7.90 T / m2 Seismic net safe soil pressure : 9.88T / m2	50.60
11.	Elevated Service Reservoir	Chipasangram	Non seismic net safe soil pressure : 7.60 T / m2 Seismic net safe soil pressure : 9.50 T / m2	50.90

Continued to Page -3

Summary of Sub Soil Investigation Report for the Proposed World Bank Assisted RWSS – LS Projects in Assam : Greater Algapur – Hailakandi Water Supply Scheme in Algapur and Hailakandi Development Block of Hailakandi District.

12.	Elevated Service Reservoir	Uttar Kanchanpur	Non seismic net safe soil pressure : 8.10 T / m2 Seismic net safe soil pressure : 11.13 T / m2	50.10
13.	Elevated Service Reservoir	Chipasangram - I	Non seismic net safe soil pressure : 7.80 T / m2 Seismic net safe soil pressure : 9.75 T / m2	49.80
14.	Elevated Service Reservoir	Chandipur	Non seismic net safe soil pressure : 7.90 T / m2 Seismic net safe soil pressure : 9.88 T / m2	50.80
15.	Elevated Service Reservoir	Mohanpur	Non seismic net safe soil pressure : 6.80 T / m2 Seismic net safe soil pressure : 8.50 T / m2	49.20

Annexure – L

CAPACITY OF UNDER GROUND CLEAR WATER SUMP

For collecting and storage of the treated water coming out from the filter unit, and to facilitate pumping of treated water to the elevated service reservoirs, underground sump is provided. Retention capacity of the underground sump is generally provided as ½ to 2 hour production of the plant. Therefore, in this particular case, the capacity requirement of the sump is ranging between 210.0 to 840.0 Cu.m.

Hence, Let us provide a sump of capacity 900.0 Cu.m.

Annexure - M

Please find below the discharge records of River Katakhal in Hailakandi district for the last 3 years :-

Period	Average lean period discharge in cumec	Average monsoon period discharge in cumec
2010-11	18	1500
2011-12	17	1500
2012-13	12	1470

17-7-13

Signature of the officer

Executive Engineer
Water Resources Division
Hailakandi.