Supporting Report 14

Environmental and Social Conditions

Table of Contents

List of Tables

Chapter 14 Environmental and Social Conditions

14.5 Scoping

(1) Stage V Conveyance Pipeline Project

The scoping results of the project are shown in Table 14.5.1. The project site is the existing BWSSB's facility areas of pipeline roads.

Table 14.5.1 Scoping Results for Water Supply Project for Stage V Conveyance Pipeline Project

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
Natural Environment	1	Protected Area	D	D	The project site and surrounding area is not located in any national parks or nature reserves.
	2	Ecosystem	D	D	Most of the project sites are located in the existing developed areas of BWSSB's pipeline road. Only some shrubs and grasses are identified.
	3	Hydrology	D	D	At construction stage: The proposed pipeline crosses river stream of Hulluhalla and Shimsha rivers. However, the construction will be carried out at dry season when the water level is low and may cause less impact on the river flow.. At operation stage: The completed structure will change the river flow locally at the crossing points of the rivers. However, the overall flow regime will be recovered at the downstream.
	4	Topography / Geology	D	D	The project does not include large scaled excavation works.
Social Environment	5	Resettlement / Land Issue	D	D	The project site is the existing BWSSB's facility area of pipeline road where no residential houses exists.
	6	Poverty	D	D	The project is a part of the construction work of the Stage V water supply scheme and has less direct relation to the future tariff system.
	7	Ethic Minority	D	D	There are neither ethnic minorities nor indigenous people at the project sites.
	8	Employment, sustenance and regional economy	B+	D	The construction works will contribute to employment local labors which may cause positive impact on local economy.
	9	Land Use / Regional Resource	D	D	The construction is carried out within the existing BWSSB's facility area, which may not cause land use change.
	10	Water Use	D	D	The project is a part of the construction work of the Stage V water supply scheme and has less direct relation to the future tariff system.
	11	Social Infrastructure / Service	D	D	The proposed pipeline crosses several village roads. However, the current traffic at the project site is small compared to the urban area of BBMP.
	12	Local society for decision making	D	D	The project is to implement a public works by the government which aim to bring public benefit and will not affect local society.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	13	Unbalance of damages and benefits	D	D	The project will not bring unbalance damage and benefit.
	14	Local Conflicts of Interests	D	D	The project does not supply water to specific people or structure, and it will not bring local conflicts.
	15	Heritage or Cultural Assets	D	D	The project is implemented at the existing BWSSB's facility area of pipeline road where no historical and cultural assets exists.
	16	Landscape	D	D	The laying of water pipelines will be carried out at existing BWSSB's pipeline road where existing CWSS pipelines are exposed.
	17	Gender	D	D	The project does not relate to the issues of gender.
	18	Right of Children	D	D	The project is not related to the issue of right of children. Child labor is prohibited for implementation of the project by compliance with national laws or international guidelines.
	19	Infectious Diseases (e.g. HIV / AIDS)	D	D	The scale of the construction works is small compared to overall stage V project.
	20	Occupational Health and Safety	B-	D	At Construction stage: Appropriate care should be taken for the working environment of the construction workers. At Operation stage: There will be no operation works which increase the risks for operation staffs.
Pollution	21	Air Pollution	B-	D	The construction vehicles and equipment at construction stage will generate dust.
	22	Water Pollution	D	D	At Construction stage: Turbid water will be generated at the crossing points of the rivers by the construction works. However, the construction is temporary and local scale. At Operation stage: The operation works does not generate water pollution.
	23	Waste	B-	D	During Construction stage: Construction debris, excavation soil and the garbage at construction camps will be generated. At Operation stage: The operation works will not generate waste.
	24	Soil Contamination	D	D	The hazardous matter causing soil contamination will not be generated.
	25	Noise / Vibration	D	D	During Construction stage: The construction work is carried out existing public roads where surrounding traffic noise is large. At Operation stage: The operation works will not use equipment which will generate noise.
	26	Ground Subsidence	D	D	The project does not extract groundwater.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	27	Odour	D	D	The project does not include the activities which generates odour.
	28	Sediments	D	D	The construction works is not carried out at rivers.
Others	29	Accident	B-	D	During Construction: Care should be taken for the accidents which are estimated at the construction works. At Operation: The operation works which cause significant accidents will not be generated.
	30	Climate Change	D	D	The project does not use equipment which use large amount of electricity or chemical substances of GHGs.

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

(1) Branch Feeding Pipes (Expansion of City Trunk Mains) to Share Water to Core/ULBs

The scoping results of the project are shown in Table 14.5.2. The project site is the existing public roads in Core / ULB areas of BBMP.

Table 14.5.2 Scoping Results for Stage V Transmission Pipeline Project in the City

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
Natural Environment	1	Protected Area	D	D	The project site and surrounding area is not located in any national parks or nature reserves.
	2	Ecosystem	D	D	Most of the project sites are located in the existing public roads in Core/ULB areas of BBMP.
	3	Hydrology	D	D	At construction stage: There are no construction works at crossing points of rivers. At operation stage: There are no construction works at crossing points of rivers.
	4	Topography / Geology	D	D	The project does not include large scaled excavation works.
Social Environment	5	Resettlement / Land Issue	D	D	The project site is the existing pubic road areass.
	6	Poverty	D	D	The project is a part of the construction work of the Stage V water supply scheme and has less direct relation to the future tariff system.
	7	Ethic Minority	D	D	There are neither ethnic minorities nor indigenous people at the project sites.
	8	Employment, sustenance and regional economy	B+	D	The construction works will contribute to employment local labors which may cause positive impact on local economy.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	9	Land Use / Regional Resource	D	D	The construction is carried out within the existing public road areas which may not cause land use change.
	10	Water Use	D	D	The project is a part of the construction work of the Stage V water supply scheme and has less direct relation to the future tariff system.
	11	Social Infrastructure / Service	B-	D	At Construction stage: The construction works at existing public road areas in Core/ULBs may affect surrounding traffic and underground utilities.
	12	Local society for decision making	D	D	The project is to implement a public works by the government which aim to bring public benefit and will not affect local society.
	13	Unbalance of damages and benefits	D	D	The project will not bring unbalance damage and benefit.
	14	Local Conflicts of Interests	D	D	The project does not supply water to specific people or structure, and it will not bring local conflicts.
	15	Heritage or Cultural Assets	D	D	The project is implemented at the existing public road areas where no historical and cultural assets exists.
	16	Landscape	D	D	The laying of water pipelines will be carried out at existing BWSSB's pipeline road where existing CWSS pipelines are exposed.
	17	Gender	D	D	The project does not relate to the issues of gender.
	18	Right of Children	D	D	The project is not related to the issue of right of children. Child labor is prohibited for implementation of the project by compliance with national laws or international guidelines.
	19	Infectious Diseases (e.g. HIV / AIDS)	D	D	The scale of the construction works is small compared to overall stage V project.
	20	Occupational Health and Safety	B-	D	At Construction stage: Appropriate care should be taken for the working environment of the construction workers. At Operation stage: There will be no operation works which increase the risks for operation staffs.
Pollution	21	Air Pollution	B-	D	The construction vehicles and equipment at construction stage will generate dust.
	22	Water Pollution	D	D	At Construction stage: Turbid water will be generated at the crossing points of the rivers by the construction works. However, the construction is temporary and local scale.l At Operation stage: The operation works does not generate water pollution.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	23	Waste	B-	D	During Construction stage: Construction debris, excavation soil and the garbage at construction camps will be generated. At Operation stage: The operation works will not generate waste.
	24	Soil Contamination	D	D	The hazardous matter causing soil contamination will not be generated.
	25	Noise / Vibration	D	D	During Construction stage: Noise will be generated temporarily by the construction works. However, there are sparse residential houses around the project site. At Operation stage: The operation works will not use equipment which will generate noise.
	26	Ground Subsidence	D	D	The project does not extract groundwater.
	27	Odour	D	D	The project does not include the activities which generates odour.
	28	Sediments	D	D	The scale of the pipe support bridges is not large and will not affect the sediments of the river bed.
Others	29	Accident	B-	D	During Construction: Care should be taken for the accidents which are estimated at the construction works. At Operation: The operation works which cause significant accidents will not be generated.
	30	Climate Change	D	D	The project does not use equipment which use large amount of electricity or chemical substances of GHGs.

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

(2) 110 Villages Water Supply Project (Distribution Pipeline and Service Connections; and Feeder Pipes between GLRs and OHTs, OHTs and Pumping facilities)

The scoping results for the 110 villages water supply project (distribution pipeline and service connections) is shown in Table 14.5.3. The environmental and social elements of poverty, social infrastructure / service, infectious diseases, occupational health and safety, air pollution (dust), waste, noise and accident are to be assessed for IEE.

Table 14.5.3 Scoping Results for Water Supply Project for 110 Villages Distribution Pipelines

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
Natural Environment	1	Protected Area	D	D	The project site and surrounding area is not located in any national parks or nature reserves.
	2	Ecosystem	D	D	Most of the project sites are located in the existing built-up area of BBMP
	3	Hydrology	D	D	At construction stage: The construction works of laying water pipes are implemented at existing public road areas and not at rivers. At operation stage: The future operation works will be implemented at public road areas and not at rivers.
	4	Topography / Geology	D	D	The project does not include large scaled excavation works.
Social Environment	5	Resettlement / Land Issue	D	D	The project sites does not include residential area nor compensation problems since the project sites are all public lands, not private lands.
	6	Poverty	D	B-	At Operation stage: The increase of water tariff may affect the household economy of low income level.
	7	Ethic Minority	D	D	There are no ethnic minorities nor indigenous people at the project sites.
	8	Employment, sustenance and regional economy	B+	D	At construction stage: An opportunity for employment of local residents is expected by the construction works and may contribute to local economy.
	9	Land Use / Regional Resource	D	D	The project sites at existing public road areas and the vacant area in the built-up area will not affect the local land use nor regional resources.
	10	Water Use	D	D	The project does not relate to water use.
	11	Social Infrastructure / Service	B-	D	At construction stage: The construction works of the water pipelines at road areas may affect the traffic flow and existing underground utilities. At Operation stage: The operation works does not interfere the road areas.
	12	Local society for decision making	D	D	The project is to implement a public works by the government which aim to bring public benefit and will not affect local society.
	13	Unbalance of damages and benefits	D	D	The project will not bring unbalance damage and benefit.
	14	Local Conflicts of Interests	D	D	The project does not supply water to specific people or structure, and it will not bring local conflicts.
	15	Heritage or Cultural Assets	D	D	The project is implemented at public road areas where the historical and cultural assets are reserved separately from roads.
	16	Landscape	D	D	The replacement of water pipelines will be laid under existing public road areas.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	17	Gender	D	D	The project does not relate to the issues of gender.
	18	Right of Children	D	D	The project is not related to the issue of right of children. Child labor is prohibited for implementation of the project by compliance with national laws or international guidelines.
	19	Infectious Diseases (e.g. HIV / AIDS)	B-	D	The inflow of construction workers may generate or expand infection diseases.
	20	Occupational Health and Safety	B-	D	At Construction stage: Appropriate care should be taken for the working environment of the construction workers. At Operation stage: There will be no operation works which increase the risks for operation staffs.
Pollution	21	Air Pollution	B-	D	The construction vehicles and equipment at construction stage will generate dust.
	22	Water Pollution	D	D	At Construction stage: Turbid water will not be generated by the generation of underground water at excavation works due to the low table of the groundwater. At Operation stage: The operation works does not generate water pollution.
	23	Waste	B-	D	During Construction stage: Construction debris, excavation soil and the garbage at construction camps will be generated. At Operation stage: The operation works will not generate waste.
	24	Soil Contamination	D	D	The hazardous matter causing soil contamination will not be generated.
	25	Noise / Vibration	B-	D	During Construction stage: Noise will be generated by the operation of construction vehicles and equipment. At Operation stage: The operation works will not use equipment which will generate noise.
	26	Ground Subsidence	D	D	The project does not extract groundwater.
	27	Odour	D	D	The project does not include the activities which generates odour.
	28	Sediments	D	D	The scale of the pipe support bridges is not large and will not affect the sediments of the river bed.
Others	29	Accident	B-	D	During Construction: Care should be taken for the accidents which are estimated at the construction works. At Operation: The operation works which cause significant accidents will not be generated.
	30	Climate Change	D	D	The project does not use equipment which use large amount of electricity or chemical substances of GHGs.

Notes: A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

(3) 110 Villages Sewerage Component Project (Lateral Sewers and House Connections)

The scoping results for the 110 village sewerage component project for lateral sewers and house connection is shown in Table 14.5.4. The environmental and social elements of poverty, social infrastructure / service, infectious diseases, occupational health and safety, air pollution (dust), waste, noise and accident are to be assessed for IEE.

Table 14.5.4 Scoping Results for 110 Villages Sewerage Component Project (Lateral and House Connection)

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
Natural Environment	1	Protected Area	D	D	The project site and surrounding area is not located in any national parks or nature reserves.
	2	Ecosystem	D	D	Most of the project sites are located in the existing built-up area of BBMP
	3	Hydrology	D	D	At construction stage: The construction works of laying lateral sewers and house connection are implemented at existing public road areas and not at rivers. At operation stage: The future operation works will be implemented at public road areas and not at rivers.
	4	Topography / Geology	D	D	The project does not include large scaled excavation works.
Social Environment	5	Resettlement / Land Issue	D	D	The project sites does not include residential area nor compensation problems since the project sites to will be implemented at public lands, not private lands.
	6	Poverty	D	B-	At Operation stage: The increase of sewerage tariff may affect the household economy of low income level.
	7	Ethic Minority	D	D	There are no ethnic minorities nor indigenous people at the project sites.
	8	Employment, sustenance and regional economy	B+	D	At construction stage: An opportunity for employment of local residents is expected by the construction works and may contribute to local economy.
	9	Land Use / Regional Resource	D	D	The project sites at the BWSSB's facility areas, public road areas and the vacant area in the built-up area will not affect the local land use nor regional resources.
	10	Water Use	D	D	The downstream water use and maintenance flow in Cauvery river will be secured.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	11	Social Infrastructure / Service	B-	D	At construction stage: The construction works of the lateral pipes at road areas may affect the traffic flow and existing underground utilities. At Operation stage: The operation works does not interfere the road areas.
	12	Local society for decision making	D	D	The project is to implement a public works by the government which aim to bring public benefit and will not affect local society.
	13	Unbalance of damages and benefits	D	D	The project will not bring unbalance damage and benefit.
	14	Local Conflicts of Interests	D	D	The project does not supply water to specific people or structure, and it will not bring local conflicts.
	15	Heritage or Cultural Assets	D	D	The project is implemented at public road areas where the historical and cultural assets are reserved separately from roads.
	16	Landscape	D	D	The replacement of water pipelines will be laid under existing public road areas.
	17	Gender	D	D	The project does not relate to the issues of gender.
	18	Right of Children	D	D	The project is not related to the issue of right of children. Child labor will be prohibited for implementation of the project by compliance with national laws or international guidelines.
	19	Infectious Diseases (e.g. HIV / AIDS)	B-	D	The inflow of construction workers may generate or expand infection diseases.
	20	Occupational Health and Safety	B-	D	At Construction stage: Appropriate care should be taken for the working environment of the construction workers. At Operation stage: There will be no operation works which increase the risks of operation staffs.
Pollution	21	Air Pollution	B-	D	The construction vehicles and equipment at construction stage will generate dust.
	22	Water Pollution	D	D	At Construction stage: Turbid water will not be generated by the generation of underground water at excavation works due to the low table of the groundwater. At Operation stage: The operation works does not generate water pollution.
	23	Waste	B-	D	During Construction stage: Construction debris, excavation soil and the garbage at construction camps will be generated. At Operation stage: The operation works will not generate waste.
	24	Soil Contamination	D	D	The hazardous matter causing soil contamination will not be generated.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	25	Noise / Vibration	B-	D	During Construction stage: Noise will be generated by the operation of construction vehicles and equipment. At Operation stage: The operation works will not use equipment which will generate noise.
	26	Ground Subsidence	D	D	The project does not extract groundwater.
	27	Odour	D	D	The project does not include the activities which generates odour.
	28	Sediments	D	D	The scale of the pipe support bridges is not large and will not affect the sediments of the river bed.
Others	29	Accident	B-	D	During Construction: Care should be taken for the accidents at working area or traffic accidents which are estimated at the construction works. At Operation: The operation works which cause significant accidents will not be generated.
	30	Climate Change	D	D	The project does not use equipment which use large amount of electricity or chemical substances of GHGs.

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

(4) UFW Reduction Project

The scoping results for the UFW reduction project are shown in Table 14.5.5. The environmental and social elements of poverty, social infrastructure / service, infectious diseases, occupational health and safety, air pollution (dust), waste, noise and accident are to be assessed for IEE.

Table 14.5.5 Scoping Results for UFW Reduction Project

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
Natural Environment	1	Protected Area	D	D	The project site and surrounding area is not located in any national parks or nature reserves.
	2	Ecosystem	D	D	Most of the project sites are located in the existing built-up area of BBMP
	3	Hydrology	D	D	At construction stage: The construction works of replacing the existing water pipes are implemented at existing public road areas and not at rivers. At operation stage: The future operation works will be implemented at public road areas and not at rivers.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	4	Topography / Geology	D	D	The project does not include large scaled excavation works.
Social Environment	5	Resettlement / Land Issue	D	D	The project sites does not include residential area nor compensation problems since the project sites to be acquired are all public lands, not private lands.
	6	Poverty	D	B-	At Operation stage: The increase of water tariff may affect the household economy of low income level.
	7	Ethic Minority	D	D	There are no ethnic minorities nor indigenous people at the project sites.
	8	Employment, sustenance and regional economy	B+	D	At construction stage: An opportunity for employment of local residents is expected by the construction works and may contribute to local economy.
	9	Land Use / Regional Resource	D	D	The project sites at public road areas and the vacant area in the built-up area will not affect the local land use nor regional resources.
	10	Water Use	D	D	The project replaces existing water pipelines and does not relate to water use.
	11	Social Infrastructure / Service	B-	B-	At construction stage: The replacing works of the water pipelines at road areas may affect the traffic flow and existing underground utilities. At Operation stage: The leakage detection survey at road areas may interfere the traffic flow.
	12	Local society for decision making	D	D	The project is to implement a public works by the government which aim to bring public benefit and will not affect local society.
	13	Unbalance of damages and benefits	D	D	The project will not bring unbalance damage and benefit.
	14	Local Conflicts of Interests	D	D	The project does not supply water to specific people or structure, and it will not bring local conflicts.
	15	Heritage or Cultural Assets	D	D	The project is implemented at public road areas where the historical and cultural assets are reserved separately from roads.
	16	Landscape	D	D	The replacement of water pipelines will be laid under existing public road areas without any appearance of structure on the ground.
	17	Gender	D	D	The project does not relate to the issues of gender.
	18	Right of Children	D	D	The project is not related to the issue of right of children. Child labor will be prohibited for implementation of the project by compliance with national laws or international guidelines.
	19	Infectious Diseases (e.g. HIV / AIDS)	B-	D	The inflow of construction workers may generate or expand infection diseases.

Type	No.	Elements to be Assessed	Rating		Reason for Evaluation
			Const.	Oper.	
	20	Occupational Health and Safety	B-	D	At Construction stage: Appropriate case should be taken for the working environment of the construction workers. At Operation stage: There will be no operation works which increase the risks of operation staffs.
Pollution	21	Air Pollution	B-	D	The construction vehicles and equipment at construction stage will generate dust.
	22	Water Pollution	D	D	At Construction stage: Turbid water will not be generated by the generation of underground water at excavation works due to the low table of the groundwater. At Operation stage: The operation works does not generate water pollution.
	23	Waste	B-	D	During Construction stage: Construction debris, excavation soil and the garbage at construction camps will be generated. At Operation stage: The operation works will not generate waste.
	24	Soil Contamination	D	D	The hazardous matter causing soil contamination will not be generated.
	25	Noise / Vibration	D	D	During Construction stage: The construction works will be carried out at existing public road areas in Core/ULB areas of BBMP where surrounding traffic noise is large. At Operation stage: The operation works will not use equipment which will generate noise.
	26	Ground Subsidence	D	D	The project does not extract groundwater.
	27	Odour	D	D	The project does not include the activities which generates odour.
	28	Sediments	D	D	The scale of the pipe support bridges is not large and will not affect the sediments of the river bed.
Others	29	Accident	B-	B-	During Construction: Care should be taken for the accidents which are estimated at the construction works. At Operation: The leakage detection survey at operation stage will increase the risk of traffic accidents.
	30	Climate Change	D	D	The project does not use equipment which use large amount of electricity or chemical substances of GHGs.

Notes:
A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.
Source: JICA Survey Team

14.7 Estimation of Potential Impacts at IEE Level

(1) Stage V Conveyance Pipeline Project

The potential adverse impacts to be caused by the project are shown in Table 14.7.1.

Table 14.7.1 Potential Adverse Impacts by Stage V Conveyance Pipeline Project

No.	Environmental and Social Elements	Potential Adverse Impacts
1	Occupational Health and Safety	At construction phase: During construction stage, the adverse impacts on construction workers, surrounding residents potentially to be caused by the construction works or traffic accidents is estimated.
2	Air Pollution	At construction phase: At the construction phase, dust will be generated by the operation of construction vehicles and construction equipment at construction sites and surrounding areas. Some adverse impact is estimated.
3	Waste	At construction phase: The excavation works or demolition works at the construction sites will generate excavated soil and demolition waste. And also, domestic garbage will be generated at the construction camps.
4	Accident	At construction phase: The increase of vehicles for the construction works may cause some risk of traffic accidents around the construction sites. The vehicles carrying the materials, wastes to and from the construction area may drop spoil or soil on the road surface which cause slippery condition and increases the risk of unsafe traffic.

Source: JICA Survey Team

(1) Branch Feeding Pipes (Stage V Transmission Pipeline in the City) to Share Water to Core/ULBs

The potential adverse impacts to be caused by the project are shown in Table 14.7.2.

Table 14.7.2 Potential Adverse Impacts by Stage V Transmission Pipeline in the City

No.	Environmental and Social Elements	Potential Adverse Impacts
1	Social infrastructure / service (At construction phase)	At construction phase: The laying works of water pipes may affect the traffic at major roads because of the temporary use of the road areas.
2	Occupational Health and Safety	At construction phase: During construction stage, the adverse impacts on construction workers, surrounding residents potentially to be caused by the construction works or traffic accidents is estimated.
3	Air Pollution	At construction phase: At the construction phase, dust will be generated by the operation of construction vehicles and construction equipment at construction sites and surrounding areas. Some adverse impact is estimated.

No.	Environmental and Social Elements	Potential Adverse Impacts
4	Waste	At construction phase: The excavation or demolition works at the construction sites will generate excavated soil and demolition waste. And also, domestic garbage will be generated at the construction camp The issues of handling or disposal of asbestos should be clarified.
5	Accident	At construction phase: The increase of vehicles for the construction works may cause traffic congestions on the local road network, and increase the risk of traffic accidents around the construction sites. A part of roads around the project sites may be temporarily blocked and cause traffic congestion at some sections. Traffic may be encroached due to the arrangement of the works such as scaffold, material yard and operation of construction equipment. The vehicles carrying the materials, wastes to and from the construction area may drop spoil or soil on the road surface which cause slippery condition and increases the risk of unsafe traffic.

Source: JICA Survey Team

(2) 110 Villages Water Supply Project (Distribution Pipeline and Service Connections; and Feeder Pipes between GLRs and OHTs, OHTs and Pumping facilities)

The potential adverse impacts to be caused by the project is shown in Table 14.7.3.

Table 14.7.3 Potential Adverse Impacts by Water Supply Project for 110 Villages

No.	Environmental and Social Elements	Potential Adverse Impacts
1	Poverty (At Operation Phase)	At operation phase: At the operation phase after the construction of the pipe laying works and the house connection, the water tariff will be increased to recover the future increase of the operation and maintenance cost. Therefore, future increase of water tariff may affect the household economy of the urban poor.
2	Social infrastructure / service (At construction phase)	At construction phase: The laying works of water pipes may affect the traffic at major roads because of the temporary use of the road areas.
3	Infectious Diseases (e.g. HIV / AIDS)	At construction phase: According to National AIDS Control Organization of India, the prevalence of AIDS in India in 2013 was 0.27, while they estimated that 2.39 million people live with HIV/AIDS in India in 2008–09, and the British Medical Journal (2010) estimates the population to be between 1.4–1.6 million people. And also, Karnataka state is one of the states with high HIV prevalence as shown that Manipur (1.40%), Andhra Pradesh (0.90%), Mizoram (0.81%), Nagaland (0.78%), Karnataka (0.63%) and Maharashtra (0.55%). During the construction phase, risk of HIV/AIDS infection may increase among construction workers around construction sites.
4	Occupational Health and Safety	At construction phase: During construction stage, the adverse impacts on construction workers, surrounding residents potentially to be caused by the construction works or traffic

No.	Environmental and Social Elements	Potential Adverse Impacts
		accidents is estimated.
5	Air Pollution	At construction phase: At the construction phase, dust will be generated by the operation of construction vehicles and construction equipment at construction sites and surrounding areas.Some adverse impact is estimated.
6	Waste	At construction phase: The excavation works or demolition works at the construction sites will generate excavated soil and demolition waste. And also, domestic garbage will be generated at the construction camps.
7	Noise / Vibration	At construction phase: The excavation works or demolition works at the construction sites will generate noise and may affect the residents in case that the site is close to residential area.
8	Accident	At construction phase: The increase of vehicles for the construction works may cause traffic congestions on the local road network, and increase the risk of traffic accidents around the construction sites. A part of roads around the project sites may be temporarily blocked and cause traffic congestion at some sections. Traffic may be encroached due to the arrangement of the works such as scaffold, material yard and operation of construction equipment. The vehicles carrying the materials, wastes to and from the construction area may drop spoil or soil on the road surface which cause slippery condition and increases the risk of unsafe traffic.

Source: JICA Survey Team

(3) 110 Villages Sewerage Component Project (Lateral Sewers and House Connection)

The potential adverse impacts to be caused by the project are shown in Table 14.7.4.

Table 14.7.4 Potential Adverse Impacts by 110 Villages Sewerage Component Project

No.	Environmental and Social Elements	Potential Adverse Impacts
1	Poverty (At Operation Phase)	At operation phase: At the operation phase after the construction of the pipe laying works and the house connection, the sewerage tariff will be increased to recover the future increase of the operation and maintenance cost. Therefore, future increase of sewerage tariff may affect the household economy of the urban poor.
2	Social infrastructure / service (At construction phase)	At construction phase: The laying works of lateral sewers and house connection may affect the traffic at major roads because of the temporary use of the road areas.
3	Infectious Diseases (e.g. HIV / AIDS)	At construction phase: According to National AIDS Control Organization of India, the prevalence of AIDS in India in 2013 was 0.27, while they estimated that 2.39 million people live with HIV/AIDS in India in 2008–09, and the British Medical Journal (2010) estimates the population to be between 1.4–1.6 million people. And also,

No.	Environmental and Social Elements	Potential Adverse Impacts
		Karnataka state is one of the states with high HIV prevalence as shown that Manipur (1.40%), Andhra Pradesh (0.90%), Mizoram (0.81%), Nagaland (0.78%), Karnataka (0.63%) and Maharashtra (0.55%). During the construction phase, risk of HIV/AIDS infection may increase among construction workers around construction sites.
4	Occupational Health and Safety	At construction phase: During construction stage, the adverse impacts on construction workers, surrounding residents potentially to be caused by the construction works or traffic accidents is estimated.
5	Air Pollution	At construction phase: At the construction phase, dust will be generated by the operation of construction vehicles and construction equipment at construction sites and surrounding areas.Some adverse impact is estimated.
6	Waste	At construction phase: The excavation works or demolition works at the construction sites will generate excavated soil and demolition waste. And also, domestic garbage will be generated at the construction camps.
7	Noise / Vibration	At construction phase: The excavation works or demolition works at the construction sites will generate noise and may affect the residents in case that the site is close to residential area.
8	Accident	At construction phase: The increase of vehicles for the construction works may cause traffic congestions on the local road network, and increase the risk of traffic accidents around the construction sites. A part of roads around the project sites may be temporarily blocked and cause traffic congestion at some sections. Traffic may be encroached due to the arrangement of the works such as scaffold, material yard and operation of construction equipment. The vehicles carrying the materials, wastes to and from the construction area may drop spoil or soil on the road surface which cause slippery condition and increases the risk of unsafe traffic.

14.8 Recommended Mitigation Measures

(1) Stage V Conveyance Pipeline Project

The recommended mitigation measures indicating its actor, regulatory authority and budget / cost are shown in Table 14.8.1.

Table 14.8.1 Recommended Mitigation Measures for Stage V Conveyance Pipeline Project

At Construction Phase

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
1	Occupational Health and	• Preparation of construction plan • Training of construction workers • Provide construction workers with sufficient personal	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
	Safety	• Protection equipment such as hard hats, earpiece, safety shoes, and others; • Conduct explanation meetings on safety issues for local communities • Install warning signs whereas the potential dangers are expected • Erect temporary fence around high risk areas to control public access and light them at night if that is on the regular roads used by the locals; • Assign construction staffs on or near places where construction vehicles are crowded to ensure safety.			
2	Air Pollution	• Preparation of construction plan for control dust • Training of construction workers • Provide construction workers with sufficient personal • Examination of Contractor's construction plan • Monitoring of Contractor's dust control	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
3	Waste	• Preparation of construction plan for excavated soil and demolition waste • Examination of Contractor's construction plan • Monitoring of Contractor's management of excavated soil, construction debris	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
4	Accident	• Preparation of appropriate construction vehicle operation plan to avoid concentration of machinery and vehicles in limited roads. • Allotment of traffic guide for proper control of traffic in order to minimize disruption to traffic flows • The construction site should be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. • Contractor's advance notification to communities in case of blocking traffic for transport of heavy equipment the contractor • Environmental monitoring	Project Cost / Contract Amount	Project Cost / Contract Amount	Project Cost / Contract Amount

Source: JICA Survey Team

(2) Stage V Transmission Pipeline in the City to Share Water to Core/ULBs

The recommended mitigation measures indicating its actor, regulatory authority and budget / cost is shown in Table 14.8.2 .

Table 14.8.2 Recommended Mitigation Measures for Stage V Transmission Pipeline Project

At Construction Phase

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
1	Social Infrastructure / Service	• Prior notice to traffic police before the construction works • Placement of traffic guides at each end of construction sections for smooth inducement of traffic • Careful examination of construction schedule • Setting detouring route if necessary. • Sufficient information disclosure such as construction period or work section to media such as television, radio, newspapers, etc. as well as utilization of internet media • Socialization activity to local residents including distribution of leaflet or announcement letters, or holding meetings if required. • Implementation of underground utility survey for existing water pipes, power lines, telephone lines and gas pipes not to cause damage on these utilities	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
2	Occupational Health and Safety	• Preparation of construction plan • Training of construction workers • Provide construction workers with sufficient personal • Protection equipment (PPE) such as hard hats, earpiece, safety shoes, and others; • Conduct explanation meetings on safety issues for local communities • Install warning signs whereas the potential dangers are expected • Erect temporary fence around high risk areas to control public access and light them at night if that is on the regular roads used by the locals; • Assign construction staffs on or	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
		near places where construction vehicles are crowded to ensure safety.			
3	Air Pollution	• Preparation of construction plan for control dust • Training of construction workers • Provide construction workers with sufficient personal • Examination of Contractor's construction plan • Monitoring of Contractor's dust control	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
4	Waste	• Preparation of construction plan for excavated soil and demolition waste • Examination of Contractor's construction plan • Monitoring of Contractor's management of excavated soil, construction debris	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
5	Accident	• Preparation of appropriate construction vehicle operation plan to avoid concentration of machinery and vehicles in limited roads. • Allotment of traffic guide for proper control of traffic in order to minimize disruption to traffic flows • The construction site should be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. • Contractor's advance notification to communities in case of blocking traffic for transport of heavy equipment the contractor • Environmental monitoring	Project Cost / Contract Amount	Project Cost / Contract Amount	Project Cost / Contract Amount

Source: JICA Survey Team

(3) Water Supply Project for 110 Villages

The recommended mitigation measures indicating its actor, regulatory authority and budget / cost is shown in Table 14.8.3.

Table 14.8.3 Recommended Mitigation Measures for UFW Reduction Project

At Construction Phase

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
1	Social Infrastructure / Service	• Prior notice to traffic police before the construction works • Placement of traffic guides at each end of construction sections for smooth inducement of traffic • Careful examination of construction schedule • Setting detouring route if necessary. • Sufficient information disclosure such as construction period or work section to media such as television, radio, newspapers, etc. as well as utilization of internet media • Socialization activity to local residents including distribution of leaflet or announcement letters, or holding meetings if required. • Implementation of underground utility survey for existing water pipes, power lines, telephone lines and gas pipes not to cause damage on these utilities	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
2	Infectious Diseases (e.g. HIV / AIDS)	• Preparation of appropriate working health plan • Training of construction workers	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
3	Occupational Health and Safety	• Preparation of construction plan • Training of construction workers • Provide construction workers with sufficient personal • Protection equipment (PPE) such as hard hats, earpiece, safety shoes, and others; • Conduct explanation meetings on safety issues for local communities • Install warning signs whereas the potential dangers are expected • Erect temporary fence around high risk areas to control public access and light them at night if that is on the regular roads used by the locals; • Assign construction staffs on or near places where construction vehicles are crowded to ensure safety.	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
4	Air	• Preparation of construction plan for	Contractor	KPCB/BWSSB/C	Project Cost /

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
	Pollution	control dust • Training of construction workers • Provide construction workers with sufficient personal • Examination of Contractor's construction plan • Monitoring of Contractor's dust control		onsultant	Contract Amount
5	Waste	• Preparation of construction plan for excavated soil and demolition waste • Examination of Contractor's construction plan • Monitoring of Contractor's management of excavated soil, construction debris	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
6	Noise / Vibration	• Utilization of low-noise type construction machineries if applicable. • Temporary enclosure of the site during the construction works if necessary • Instructing the contractors to examine low noise/vibration construction methods. • Encouragement of idling reduction to the workers. • To avoid works at night and early morning at the sites close to residential areas, schools and hospitals • Monitoring of noise level at facility boundaries	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
7	Accident	• Preparation of appropriate construction vehicle operation plan to avoid concentration of machinery and vehicles in limited roads. • Allotment of traffic guide for proper control of traffic in order to minimize disruption to traffic flows • The construction site should be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. • Contractor's advance notification to communities in case of blocking traffic for transport of heavy equipment the contractor • Environmental monitoring	Project Cost / Contract Amount	Project Cost / Contract Amount	Project Cost / Contract Amount

Source: JICA Survey Team

(4) 110 Villages Sewerage Component Project (Lateral Sewers and House Connection)

The recommended mitigation measures indicating its actor, regulatory authority and budget / cost is shown in Table 14.8.4.

Table 14.8.4 Recommended Mitigation Measures for 110 Villages Sewerage Component Project

At Construction Phase

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
1	Social Infrastructure / Service	• Prior notice to traffic police before the construction works • Placement of traffic guides at each end of construction sections for smooth inducement of traffic • Careful examination of construction schedule • Setting detouring route if necessary. • Sufficient information disclosure such as construction period or work section to media such as television, radio, newspapers, etc. as well as utilization of internet media • Socialization activity to local residents including distribution of leaflet or announcement letters, or holding meetings if required. • Implementation of underground utility survey for existing water pipes, power lines, telephone lines and gas pipes not to cause damage on these utilities	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
2	Infectious Diseases (e.g. HIV / AIDS)	• Preparation of appropriate working health plan • Training of construction workers	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
3	Occupational Health and Safety	• Preparation of construction plan • Training of construction workers • Provide construction workers with sufficient personal • Protection equipment (PPE) such as hard hats, earpiece, safety shoes, and others;	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
		• Conduct explanation meetings on safety issues for local communities • Install warning signs whereas the potential dangers are expected • Erect temporary fence around high risk areas to control public access and light them at night if that is on the regular roads used by the locals; • Assign construction staffs on or near places where construction vehicles are crowded to ensure safety.			
4	Air Pollution	• Preparation of construction plan for control dust • Training of construction workers • Provide construction workers with sufficient personal • Examination of Contractor's construction plan • Monitoring of Contractor's dust control	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
5	Waste	• Preparation of construction plan for excavated soil and demolition waste • Examination of Contractor's construction plan • Monitoring of Contractor's management of excavated soil, construction debris	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
6	Noise / Vibration	• Utilization of low-noise type construction machineries if applicable. • Temporary enclosure of the site during the construction works if necessary • Instructing the contractors to examine low noise/vibration construction methods. • Encouragement of idling reduction to the workers. • To avoid works at night and early morning at the sites close to residential areas, schools and hospitals • Monitoring of noise level at	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
		facility boundaries			
7	Accident	• Preparation of appropriate construction vehicle operation plan to avoid concentration of machinery and vehicles in limited roads. • Allotment of traffic guide for proper control of traffic in order to minimize disruption to traffic flows • The construction site should be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. • Contractor's advance notification to communities in case of blocking traffic for transport of heavy equipment the contractor • Environmental monitoring	Project Cost / Contract Amount	Project Cost / Contract Amount	Project Cost / Contract Amount

Source: JICA Survey Team

At Operation Phase

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
1	Poverty	• Establishment of tariff collection system for urban poor • Implementation of public awareness survey	Contractor	KPCB/BWSSB/Consultant	O & M Cost

Source: JICA Survey Team

(5) UFW Reduction Project

The recommended mitigation measures indicating its actor, regulatory authority and budget / cost is shown in Table 14.8.5.

Table 14.8.5 Recommended Mitigation Measures for UFW Reduction Project

At Construction Phase

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
1	Social Infrastructure / Service	• Prior notice to traffic police before the construction works • Placement of traffic guides at each end of construction sections for	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
		smooth inducement of traffic • Careful examination of construction schedule • Setting detouring route if necessary. • Sufficient information disclosure such as construction period or work section to media such as television, radio, newspapers, etc. as well as utilization of internet media • Socialization activity to local residents including distribution of leaflet or announcement letters, or holding meetings if required. • Implementation of underground utility survey for existing water pipes, power lines, telephone lines and gas pipes not to cause damage on these utilities			
2	Infectious Diseases (e.g. HIV / AIDS)	• Preparation of appropriate working health plan • Training of construction workers	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
3	Occupational Health and Safety	• Preparation of construction plan • Training of construction workers • Provide construction workers with sufficient personal • Protection equipment (PPE) such as hard hats, earpiece, safety shoes, and others; • Conduct explanation meetings on safety issues for local communities • Install warning signs whereas the potential dangers are expected • Erect temporary fence around high risk areas to control public access and light them at night if that is on the regular roads used by the locals; • Assign construction staffs on or near places where construction vehicles are crowded to ensure safety.	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
4	Air Pollution	• Preparation of construction plan for control dust • Training of construction workers • Provide construction workers with sufficient personal • Examination of Contractor's construction plan	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
		• Monitoring of Contractor's dust control			
5	Waste	• Preparation of construction plan for excavated soil and demolition waste • Examination of Contractor's construction plan • Monitoring of Contractor's management of excavated soil, construction debris	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
6	Noise / Vibration	• Utilization of low-noise type construction machineries if applicable. • Temporary enclosure of the site during the construction works if necessary • Instructing the contractors to examine low noise/vibration construction methods. • Encouragement of idling reduction to the workers. • To avoid works at night and early morning at the sites close to residential areas, schools and hospitals • Monitoring of noise level at facility boundaries	Contractor	KPCB/BWSSB/Consultant	Project Cost / Contract Amount
7	Accident	• Preparation of appropriate construction vehicle operation plan to avoid concentration of machinery and vehicles in limited roads. • Allotment of traffic guide for proper control of traffic in order to minimize disruption to traffic flows • The construction site should be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. • Contractor's advance notification to communities in case of blocking traffic for transport of heavy equipment the contractor • Environmental monitoring	Project Cost / Contract Amount	Project Cost / Contract Amount	Project Cost / Contract Amount

Source: JICA Survey Team

<u>At Operation Phase</u>

No.	Elements	Proposed Mitigation Measures	Actor for Mitigation Measures	Regulatory authority	Budget / Cost
1	Poverty	• Establishment of tariff collection system for urban poor	Contractor	KPCB/BWSSB/Consultant	O & M Cost

		• Implementation of public awareness survey			

Source: JICA Survey Team

14.9.2 Environmental Monitoring Plan (JICA Environmental Monitoring Form)

(1) Stage V Water Supply Project, Transmission Pipelines to share water to Core Area and Connection pipelines between GLRs and OHTs

1) Construction Phase

a) Air Quality（Dust）

Method	Proposed Location	Frequency	Measured Value			
Visual inspection	Facility boundaries at construction sites	Monthly (Examination of daily or monthly report)	Item	Yes	No	If Yes, Mdeasures Taken (e.g. water sprinkling)
			Dusts			
			Other (Specify:)			

b) Waste

Method	Proposed Location	Frequency	Measured Value	
Visual inspection	• Construction sites for excavation works • Construction sites for backfill • Final disposal site of construction debris	Monthly (Examination of daily or monthly report)	Item	Amount
			Type of construction debris	
			Amount of construction debris	
			Amount of excavated soil	
			Location of final disposal sites of construction debris	
			Location of final disposal sites of excavated soil	

c) Noise / Vibration

Monitoring Item	Measured Value (Mean)	Measured Value (Max.)	Standards	Frequency	Measurement Point
Noise Level			Indian standard*	Monthly	Facility boundaries at the following facilities; • Gottigere GLR • Singapura GLR • Kingadeeranahalli GLR

* Indian standard as per Schedule III under the Noise Pollution (Regulation and Control) Rules, 2000 and amendment 2002

Area Code	Category of Area	Limits in dB (A)	
		Day time	Night time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence zone	50	40

Note 1: Daytime is reckoned in between six (6) am to 10 p.m.

Note 2: Night time is reckoned in between 10 p.m. to six (6) a.m.

Note 3: Silence zone is defined as areas up to 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by the Competent Authority. Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.

Note 4: Mixed categories of areas should be declared as one of the four above-mentioned categories by the Competent Authority and the corresponding standards shall apply.

d) Accident

Item	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
Adequate safety traffic control manners	Construction Site	• Visual inspection • Examination of daily / monthly report	Monthly (Examination of daily or monthly report)	

2) Operation Phase

a) Water Quality

	Parameters	Raw Water	Treated Water	Frequency	Proposed Location
1	Turbidity	✔	✔	Daily	• WTP at TK Halli (Raw water, treated water) • Vasudevapura GLR (Treated water) • Singapura GLR (Treated water) • Chokkanahalli GLR (Treated water) • Lingadeeranahalli GLR (Treated water) • Lingadeeranahalli GLR (Treated water) • Doddakanalli GLR (Treated water) • Kadugodi GLR (Treated water)
2	pH	✔	✔	Daily	
3	Alkalinity	✔	✔	Daily	
4	Total hardness	✔		Daily	
5	Total dissolved solids	✔		Daily	
6	Electrical conductivity	✔		Daily	
7	Calcium	✔		Daily	
8	Iron	✔	✔	Daily	
9	Magnesium	✔		Daily	
10	Total Coliforms	✔		Daily	
11	Temperature	✔		Daily	
12	Color		✔	Daily	
13	Fecal coliforms		✔	Daily	
14	Residual chlorine		✔	Daily	

b) Waste

Method	Proposed Location	Frequency	Measured Value	
Visual inspection	• WTP at TK Halli • Final Disposal Site	Monthly (Examination of daily or monthly report)	Item	Amount
			Type of construction debris	
			Mount of construction debris	
			Amount of excavated soil	

c) Noise / Vibration

Monitoring Item	Measured Value (Mean)	Measured Value (Max.)	Standards	Frequency	Measurement Point
Noise Level			Indian standard*	Monthly	Facility boundaries at the following facilities; • TK Halli WTP • Haraholi Pumping Station • Tataguni Pumping Station

*Refer to information at “Noise/Vibration”, 1) Construction Phase, (1) Stage V Water Supply Project.

d) Accident

Item	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
Adequate safety traffic control manners	The following facilities and surrounding road areas; • TK Halli WTP • Harohalli Pumping Station • Tataguni Pumping Station	• Visual inspection • Examination of daily / monthly report	Monthly (Examination of daily or monthly report)	

(2) Sewerage Project for 110 Villages

1) Constriction Phase

a) Air Quality（Dust）

Method	Proposed Location	Frequency	Measured Value			
Visual inspection	Facility boundaries at construction sites	Monthly (Examination of daily or monthly report)	Item	Yes	No	If Yes, Mdeasures Taken (e.g. water sprinkling)
			Dusts			
			Other (Specify:)			

b) Waste

Method	Proposed Location	Frequency	Measured Value	
Visual inspection	- Construction sites for excavation works - Construction sites for backfill - Final disposal site of construction debris	Monthly (Examination of daily or monthly report)	Item	Amount
			Type of construction debris	
			Mount of construction debris	
			Amount of excavated soil	
			Location of final disposal sites of construction debris	
			Location of final disposal sites of excavated soil	

c) Noise / Vibration

Monitoring Item	Measured Value (Mean)	Measured Value (Max.)	Standards	Frequency	Measurement Point
Noise Level			Indian standard*	Monthly	Facility boundaries at the following facilities; • Herohhali STP • Hosahalli STP • Doddabettahalli STP • Chikkabanavara STP

*Refer to information at “Noise/Vibration”, 1) Construction Phase, (1) Stage V Water Supply Project.

d) Accident

Item	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
Adequate safety traffic control manners	Construction sites	• Visual inspection • Examination of daily / monthly report	Monthly (Examination of daily or monthly report)	

2) Operation Phase

a) Water Quality (Treated Effluent)

	Parameters	Measured Value (Mean)	Measured Value (Max.)	Standards*	Frequency	Measurement Point
1	pH			6.0 – 9.5	Daily	• Jakkur • Hemigepura • Yelahankakere • Nagasandra • Doddabettahalli • Karivobanahalli • Bilishivalli • Herohalli • Varthur • Hosahalli • Pillaganahalli • Chikkabanavara-2 • Talaghattapura • Somapura
2	BOD			< 10	Daily	
3	COD			< 50	Daily	
4	TSS			< 20	Daily	
5	NH4-N			< 5	Daily	
6	T-N			< 10	Daily	
7	Fecal Coliform**			< 100	Daily	

* As per CPCB New Standards dated 27th April 2016, **MPN/100 ml

b) Waste

Method	Proposed Location	Frequency	Measured Value	
Visual inspection	i) The following STPs* • Jakkur • Yelahankakere • Doddabettahalli • Bilishivalli • Varthur • Pillaganahalli • Talaghattapura • Somapura • Hemigepura • Nagasandra • Karivobanahalli • Herohalli • Hosahalli • Chikkabanavara-2 ii) Final disposal site	Monthly (Examination of daily or monthly report)	Item	Amount
			Generation amount of treated sludge	
			Disposal amount of treated sludge	
			Location of final disposal site of treated sludge	

c) Noise / Vibration

Monitoring Item	Measured Value (Mean)	Measured Value (Max.)	Standards	Frequency	Measurement Point
Noise Level			Indian standard*	Monthly	Facility boundaries at the following STPs; • Herohhali STP • Hosahalli STP • Doddabettahalli STP • Chikkabanavara -2 STP

*Refer to information at "Noise/Vibration", 1) Constriction Phase, (1) Stage V Water Supply Project.

d) Offensive Odor

Monitoring Item	Measured Value (Mean)	Measured Value (Max.)	Standards* (ppm)	Measurement Point	Frequency
Ammonia			1.0	Facility boundaries at the following STPs; • Herohhali STP • Hosahalli STP • Doddabettahalli STP • Chikkabanavara -2 STP	Monthly
Methyl mercaptan			0.002		
Hydrogen Sulfide (H_2S)			0.02		
Methyl sulfide			0.01		
Styrene			0.4		

Notes; Japanese Offensive Odour Control Law, Law No. 91 / 1971 or latest amendment by Law No. 71 / 1995

e) Accident

Item	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
Adequate safety traffic control manners	• All STP sites and surrounding areas • All ISPS sites and surrounding areas	• Visual inspection • Examination of daily / monthly report	Monthly (Examination of daily or monthly report)	

Supporting Report 14.12

Stakeholder Meeting

Minutes of Meeting
for
Stakeholders' Meeting
on
CAUVERY WATER SUPPLY AND SEWERAGE PROJECT STAGE V

Date and Time: 11 AM, August 22, 2017
Venue: BWSSB Auditorium, 4th floor

Stakeholders (list attached) and the representatives of Bangalore Water Supply and Sewerage Board (BWSSB) exchanged opinions on the contents of CAUVERY WATER SUPPLY AND SEWERAGE PROJECT STAGE V. The main points discussed are as attached hereto.

Tushar Giri Nath, Chairman, BWSSB

<List of Attachment>
(1) Invitation letter to attendants
(2) Attendants list
(3) Explanation materials
(4) Minutes of Discussions
(5) Photos of the Meetings

Email: ceed@bwssb.gov.in
Phone / Fax : 91-080-22945103

Attachment (1)

BANGALORE WATER SUPPLY AND SEWERAGE BOARD
Office of the Chief Engineer(K), 5th Floor, Cauvery Bhavan, K.G.Road, Bangalore 560009.

No.BWSSB/CH/CE(K)/ 546 /2017-18 Dated: 16-08-2017

To,

Commissioner, BBMP Hudson Circle, Sampangi Rama Nagar, Bengaluru, Karnataka 560002, India	Commisioner, Bangalore Devclopment Authority, T. Chowdaiah Road, Kumara park West, Bangalore.	Chairman, Karnataka State Pollution Control Board, "Parisara Bhavan", #49,4th & 5th Floor, Church Street, Bangalore-560001
Chief Executive Officer, Lake Development Authority No.49, 2nd Floor, Parisara Bhavan, Church Street, Bangalore - 560001, Near Mg Road	Metropolitan Commissioner Bangalore Metropolitan Region Development Authority (BMRDA), Bangalore. , # 1, Ali Askar Road, LRDE Building, Bangalore- 560052.	Managing Director, BESCOM, Corporate Office, K.R.Circle, Bengaluru-560001
MLAs of 110 Villages	Corporators of 110 Villages	

Sir ,

Sub: Stake Holder Meeting on Cauvery Water Supply Scheme (CWSS) V stage to provide drinking water supply and Sewerage facility to 110 Villages of BBMP.

Ref: Japan International Cooperation Agency (JICA) , Japan and BWSSB agreed Minutes of Discussion on Project.

-*-*-

Adverting to above, Government of Karnataka (GOK) has taken decision to provide drinking water facility and sanitation for the newly added 110 villages of BBMP on priority. The Detailed Project Report (DPR) is forwarded to JICA, Japan to fund the project in terms of Loan to BWSSB. JICA study team did the feasibility of this project and based on their recommendation JICA is considering loan facilities to the project.

Main components of the Project;

7) Augmenting BWSSB with additional 775 MLD of water from Cauvery Source to 110 Villages and to satisfy the needs of entire Bangalore city (800 Sq KM).
8) 7 Ground level reservoirs on periphery of the city.
9) Providing Sewerage System to cover entire 110 Villages

.....2

4) 14 numbers of Sewage treatment Plants (STP's)all round the Bangalore to treat the sewage and make environmentally viable solutions for the water bodies located in 110 villages.
5) 7 numbers of Intermediate sewage Pumping Stations (ISPS) to pump the sewage to STP.
6) SCADA system for entire system to Control monitoring and all the above works to be executed by BWSSB under the supervision and coordination by International consultants appointed by funding agency based on the guide line prescribed by JICA.

The time frame for this project is 36 months and expected to start by 2019 March.

This project is counter guaranteed by Government of India (GoI) and all the other formalities are under process. As a preconditions to the final approval from JICA towards this project, a Stake Holders meeting is to be conveyed to explain the importance of this project and the necessity of this project to all the agency taking the benefit of this project.

1. The underlying principle of stakeholder engagement is to have the opportunity to know about the details of the Project.
2. to establish what issues matter most to them
3. develop understanding and agree how best to deal with issues of concern
4. ensure project sustainability by involving stakeholders in implementation and monitoring
5. Through working together, key stakeholders can identify common concerns, develop common goals and reap the benefits of the impact of a Stage V project.
6. Making project more effective

In this regard, I request you to attend the Stake Holders meeting to be held on **22nd August 2017, Tuesday at 11:00AM in Auditorium, 4th Floor, Cauvery Bhavan, K.G.Road, Bangalore** and oblige.

Thanking You ,

Yours faithfully

Chairman,
BWSSB.

Copy submitted to Additional Chief Secretary, UDD for kind information.
Copy to EIC/all CEs for information and necessary action.
Copy to M/s NJS for information.

Bengaluru Water Supply and Sewerage Project (Stage V)

Bangalore Water Supply & Sewerage Board

In Coordination with NJS Consultants Co. Ltd., Japan

Agenda of the Stakeholder Meeting		
Purpose/Objective	Stakeholder Meeting	
Meeting Date and Time	22nd August 2017	11:00 – 13:00
Venue	BWSSB Auditorium, 4th floor	
Registration		
Welcome Speech by Shri Tushar Giri Nath, IAS., Hon'able Chairman, BWSSB		
Presentation on the Project by Shri K R Manjunath, Chief Engineer – Projects, BWSSB		
Discussion and Suggestions from the Stake Holder		
Summary of Workshop		
Vote of Thanks by Shri Dr. P N Ravindra, Chief Engineer - Kaveri		
Lunch		

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

enue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
1	Yoshihiro KIRISHIMA	Sr. Engineer NJS Consultants Co., Ltd		
2	RAGHV	BWSSB AEE		
3	P.R. Praveen	AE K-1-2		
4	Gangalakshmamma.HC	BBK - 4		
5	Pavan . N	AE BK-1.2		
6	Farha Ashraffi	AE		
7	Narelh. B.K	AEE (K-3)2		
8	Raghavendra, C.P.	EE (K-3)		
9	Chethan K.V	AEE (K-1)-1		
10	Elizabeth	AE (K-1) 1		
11	B.M. Manjunatha	AEE(BSOL)M-1		
12	Naveen	BWSSB		
13	SRINATH.S	AE CEC(N)		
14	Kanakaraj	AE(K) Ele -1		
15	FIROZ PASHA	AE CEC(K)		
16	Srinivas.	Pa to Nandish 4th RBmp.		
17	SURESH ST	AEE(K) Ele-1		
18	T.R. Somvanshi	BE NW-2		
19	Ramesh Annegeri	AE (K-9)		
20	Shwetha S	AE (K-1)		

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

enue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
21	G.V. NABARAT	A.C. Urban D.C.O.H		
22	[illegible]	BWSSB		
23	Chandini G	AEE/BWSSB		
24	K R Ramakrishna	EE CMC-2/BWSSB		
25	SOMASHEKAR	ACE C-2 BWSSB		
26	Raveendranath	EE (new water)		
27	B.C. Gangadhar	EE (South)		
28	Mudassar	AE (Proj)		
29	Narayanaswamy	CE (MC-2)		
30	Rahul Alyadaki	EE STP (U&M)		
31	Hemanth Kumar	AEE (K) Ele-2		
32	Mussavir.P	AE (K) Ele-2		
33	G. Mahadevaiah	EE (DW)-2,		
34	P.N Nayak	CE/BDA		
35	H.M. RAVINDRA	CE (M) BWSSB		
36	Dorairaju M	ACE (M-2) BWSSB		
37	R. Raman	F-A		
38	H. Lakshman	S.E.O, KSPCB		
39	SURESH D	EE (Control)		
40	Somasekar	AO. - Contract BDA		

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

enue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
41				
42	Gopalakrishna	Ramanagara Board		
43	AMRUTESHPL	BWSSB		
44	R.S.Dakaiah	BWSSB		
45	RANGASWAMY	B.W.S.S.B		
46	M. Vageesha	BWSSB		
47	Chandrakumara	BBMP. Corporator - ward(4)		
48	Pradeep B.R	AEE BWSSB		
49	B.S. JAYACHAR	BWSSB		
50	T. Puttaswamy	BWSSB AEE		
51	B. Shivaprasad	AEE(DCW), BWSSB		
52	A. Ravi	Junior Assistant		
53	R. Sreenivas	AEE(CM)?		
54	B.M. Nagendrababu	AEE BWSSB		
55	Rajeev-J	EE SE-X		
56		Ward 92 BBMP		
57		194		
58		(Consilor)		
59		Ward 194		
60		BWSSB		

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

Venue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
61	Chaluvegowda	EE KT		
62	MANJUNATH	AEE		
63	Sathish	Computer.		
64	Shashi	CTSM		Shashi
65	Veerayana Reddy.	CA BMRCL Depot.		
66	T. Hanuma	AAE		
67	Manohar Singh	AE r		
68	Mohan	Sr Ste (NJSEM)		Mohan
69	Nizam	S.R.F (NJS)		Nizam
70	Rajashekhar	BBMP		
71	Renu	Design Engg		
72	Sruthi Vijaykumar	Word Nature Foundation		
73	Savitha	Corporation		
74	Chandpasha	BBMP.		
75	Radha Sudha	AE		
76	Ahmed CK.	AEE		
77	Rajesh kumar	Bescom.		
78	Devaraj.	B.B.M.P.		
79	Ramananda	BEE (SE) BWSSB		
80	S.V. Ramesh	ACE (M-4)		

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

enue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
81	K.R. Manjunath	BWSSB		
82	Jagadeesh K.L	CAO-S BWSSB		
83	P.N. Ravindra	CE(K) RWSS		
84	N. Satish	CE. WWM		
85	KEMPARA	BWSSB		
86	MALATH			
87	Suresh. T	NJS BWSSB (Project)		
88	Lakshmi	(NJS) Company Ltd.. BWSSB (Project)		
89	Seemakumari	BBMP		
90	Muthumjaya.			
91	Krishnamurthy	Corporation		
92	Harish Kumar	BWSSB		
93	Rajiv	BWSSB/EE		
94	R.K. SRINATH	BWSSB/EE		
95	Anugami	NJSEL		
96	P. Sankar	NJSEL		
97	Savitha	NJS		
98	Sirisha	NJS		
99	Chand Pasha	NJS		
100	Prathibha	NJS(S)		

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

enue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
101	Rajesh Kumar.	NJS		
102	Madhu	BWSSB.		
103	Bhagyalakshmi	NJS		
104	Gangadhara	NJS		
105	Vaibhav V.	NJS		
106	Shivakumar	BWSSB		
107	M. Jayamma	PS to CE(K) BWSSB		
108	Suresh Shetty	Dec. Exp.		
109	Yogesh Gokhale	NJS		
110	[illegible]	[illegible]		
111	Rajesh. Y	Corporate.		
112	[illegible]	BWSSB		
113	Rajani	KPTCL		
114	Nandini	Corporate		
115	[illegible]	BWSSB		
116	Ravikumar	Corporation		
117	Sunil	BBMP		
118	Trupti	BWSSB		
119	[illegible]	Pophulka Bond		
120	[illegible]	[illegible]		

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

enue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
121	Jayesh .S	J.E		
122	Raju S.P	ARE		
123	ವೆಂಕಟೇಶ .ಕೆ.	ಜೂನಿಯರ್		
124	Siddappasamy.	Corporator Ward		
125	Jayaprakash	BBMP		
126	Timmegowda	BBMP		
127				
128				
129				
130				
131				
132				
133				
134				
135				
136				
137				
138				
139				
140				

In coordination with NJS Consultants Co. Ltd.

Date: 22-Aug-2017

enue: Cauvery Bhavan 4th Floor Conference Hall

Attendence List of Stakeholder Meeting

S/N	Name	Designation/ Organization	Contact Details (Tel./E-mail)	Signature
141				
142				
143				
144				
145				
146				
147				
148				
149				
150				
151				
152				
153				
154				
155				
156				
157				
158				
159				
160				

Bengaluru Water Supply and Sewerage Project (Stage V)

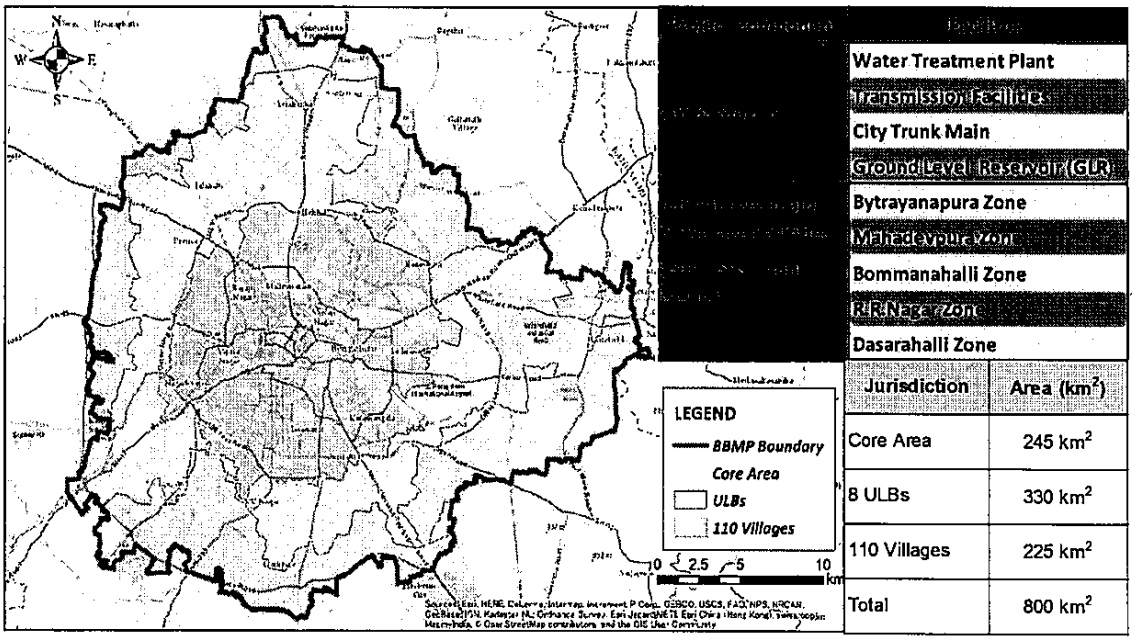
General

Bangalore is among the fastest growing cities in Asia and one of India's rapidly developing modern urban centers with quality residential complexes; tree lined street corridors, parks, natural valleys and lakes. In spite of its burgeoning growth the city is still attractive for its open parkland environment with naturally undulating topography and water bodies. It is aptly called the "Garden City". As a result of its moderate climate and cosmopolitan nature, the city has attracted people from all over India including pensioners and young professionals alike. It is also home to some of the most high tech industries of India and many multinational information technology companies and the city is often referred to as "Silicon Valley" of India. As a result of growth of information technology companies in the urban agglomeration the habitation started increasing and the cultivation lands are being converted to residential and industrial layouts.

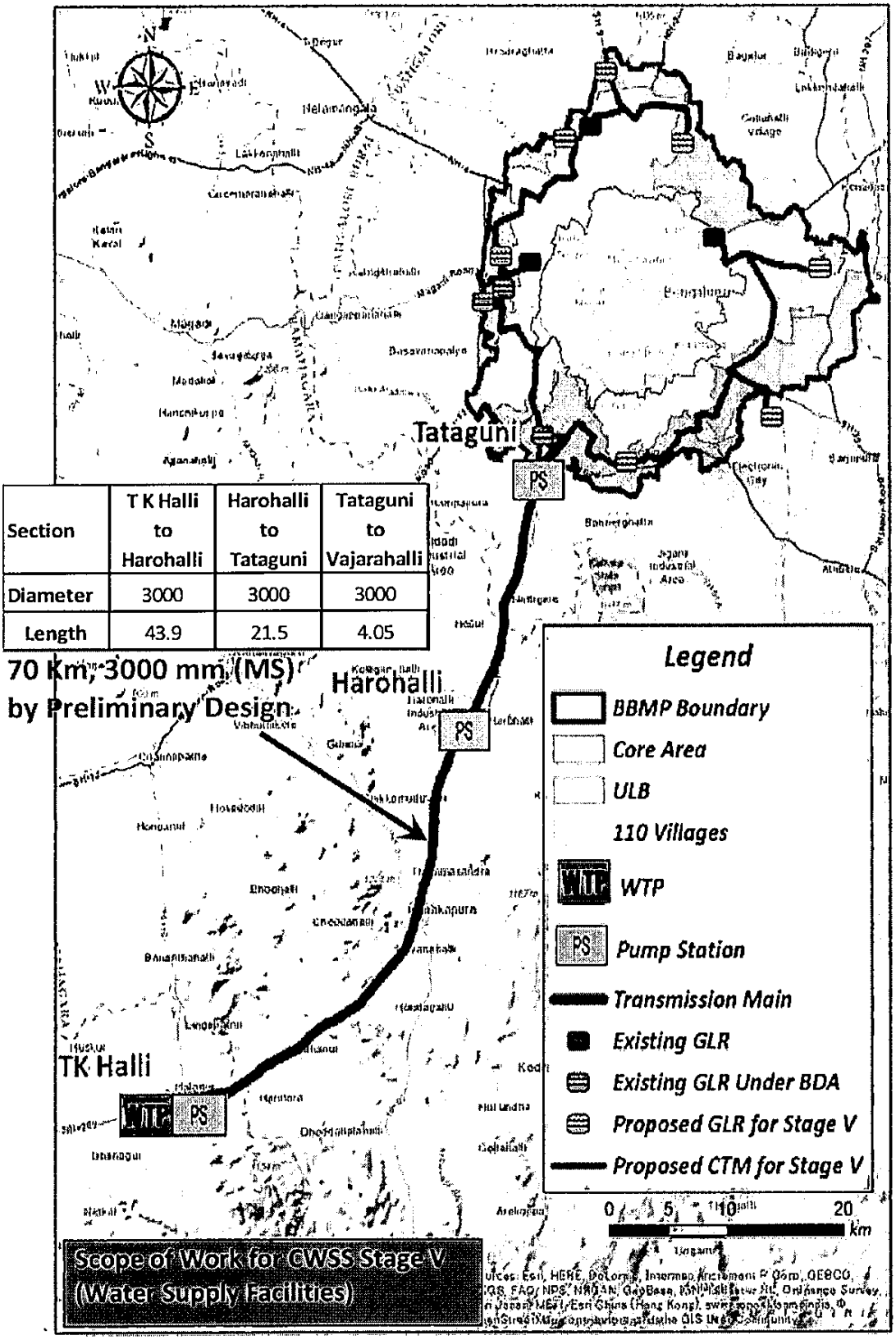
Objective of the Project

The objective of the Project is to provide residents in BBMP area with safe and stable water supply, and sewerage services to meet increasing water demand and the need of environmental improve-ment and to contribute to the promotion of industry. The location of project area is presented in the location map, which covers the jurisdiction of the BWSSB incuding core, ULBs (Urban Local Bodies) and 110 villages, and pipeline routes from the water intake at Cauvery River to the en-trance of BBMP.

Overall Project Scope

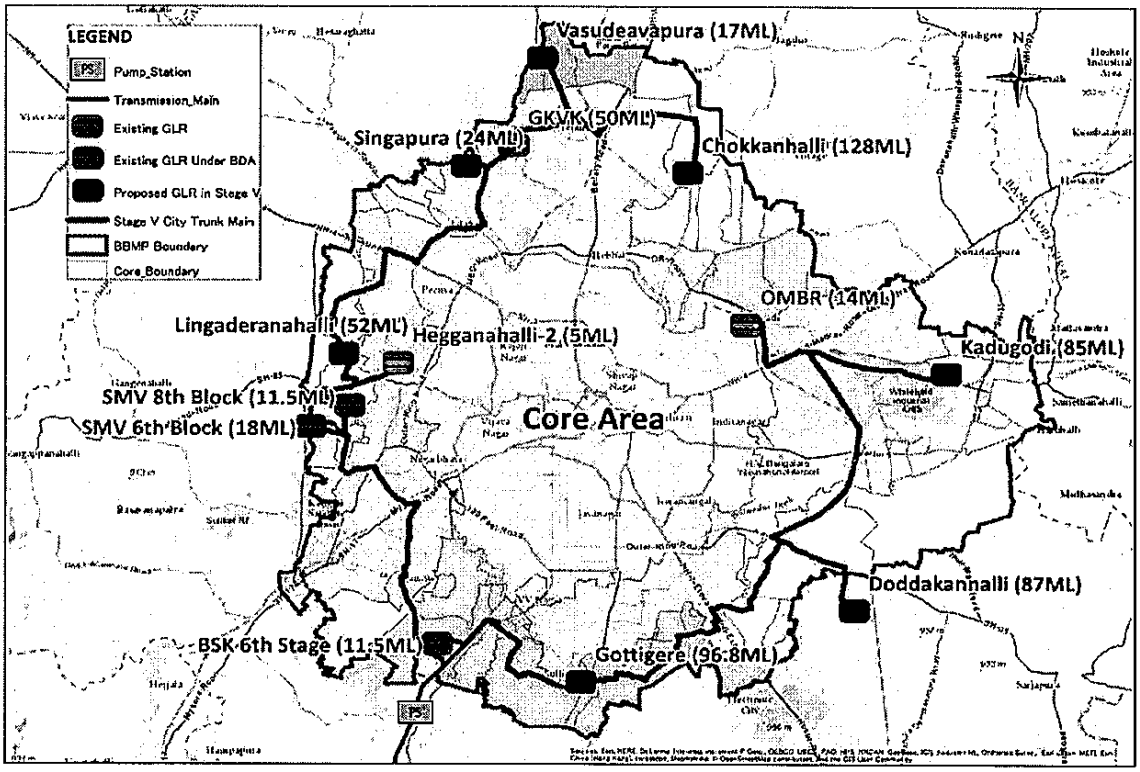


Jurisdiction	Area (km²)
Core Area	245 km²
8 ULBs	330 km²
110 Villages	225 km²
Total	800 km²



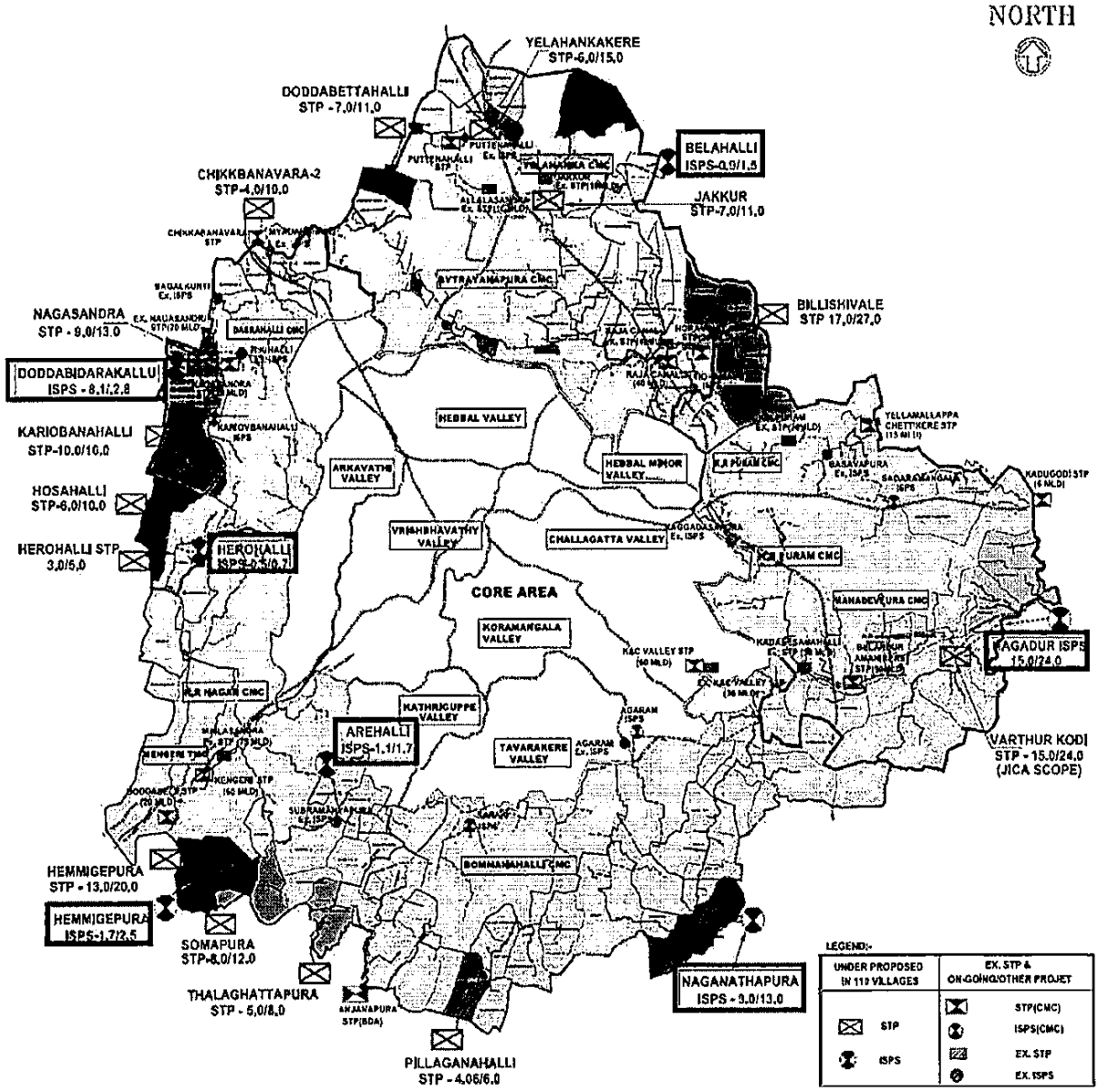
Section	T K Halli to Harohalli	Harohalli to Tataguni	Tataguni to Vajarahalli
Diameter	3000	3000	3000
Length	43.9	21.5	4.05

Proposed GLR Capacities and Locations			
Sl No	Name of GLR	Proposed GLR Capacity (MLD)	Location of GLR
1	Gottigere GLR	112.9	Gottigere Village
2	Doddakannahalli GLR	48	Hadosiddapura Village
3	Kadugodi GLR	48	Kadugodi Plantation
4	Chokkanhalli	128	Chokkanahalli Village
5	Vasudevapura GLR	64.8	Harohalli Village
6	Singapura	40	Singapura
7	Lingadeeranahalli GLR	17.8	Lingadeeranahalli Village



Scope of 110 Villages Sewerage Systems

Zone	STPs		ISPSs		Pipe Size	Length
	(Nos)	(MLD)	(Nos)	(MLD)	(mm)	(km)
Bytrayanapura	4	7+6+7+17=37	1	0.9	ϕ300-ϕ1,000	50.3
Mahadevapura	1	15	1	15.0	ϕ300-ϕ900	44.7
Bommanahalli	2	4+5=9	1	9.0	ϕ300-ϕ1,200	65
RR Nagar	2	8+13=21	2	1.1+1.6=2.7	ϕ300-ϕ700	14.8
Dasarahalli	5	10+3+6+4+9=32	2	0.5+8.1=8.6	ϕ300-ϕ600	27.5
Total	14	114	7	36.2	-	202.3



Proposed Location of STPs and ISPSs

Zone	STPs		ISPSs	
	Name	Location	Name	Location
Bytrayana pura	1.Jakkur	Adjacent Exsting STP Jakkkur	1.Bellahalli	Near Bellhalli Village
	2. Yelahankakere	Near Yelahanka Lake		
	3. Doddabettahalli	Near Attur Lake		
	4. Bilishivalli	Near Rampur Lake		
Mahadev pura	5. Varthur	Near Varthur Kodi	2.Hagadur	Near Sammethanahalli Village
Bommana halli	6. Pillaganahalli	Near Bilavardahalli Lake	3.Naganatha pura	Near Naganathapura Lake
	7. Talaghattapura	Near Nice Road		
R.R.Nagar	8. Somapura	Near Somapura Lake	4.Arehalli	Areahalli Village
	9. Hemigepura	Near Nice Road	5.Hemmigepura	Near Varasandra Lake
Dasara halli	10. Kariobavanahalli	Near Kariobavanahlli Lake	6.Herohalli	Herohalli Village
	11. Herohalli	Near Kodihalli Lake	7.Doddabidarkallu	Near Anchepalya Lake
	12. Hosahalli	Near Kachohalli Lake		
	13. Chikka banavara-2	Near Chikkabanavar Lake		
	14. Nagasandra*	Adjacent Exsting STP Nagasandra		

ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಮಂಡಳಿ

BANGALORE WATER SUPPLY AND SEWERAGE BOARD

ಬೆಂಗಳೂರು ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಯೋಜನೆ (೫ ನೇ ಹಂತ)

BENGALURU WATER SUPPLY
AND SEWERAGE PROJECT (Stage -V)

Stakeholder Meeting

22nd/AUGUST/2017

BWSSB / JICA Survey Team

1

Purpose of this Discussion
ಯೋಜನೆಯ ಉದ್ದೇಶ

(1) Provide Information on the JICA assisted Water Supply and Sewerage Project

(1) Discuss on the Project and to promote understanding /Cooperation by Stakeholders

೧) ಜೈಕಾ ನೆರವಿನೊಂದಿಗೆ ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿ ಯೋಜನೆಯ ಬಗ್ಗೆ ಮಾಹಿತಿಯನ್ನು ಒದಗಿಸುವದು.

೨) ಯೋಜನೆಯ ಬಗ್ಗೆ ಅರಿವು, ಮುಂದುವರಿಯುವಿಕೆ ಮತ್ತು ಪಾಲುದಾರರಗೆ ಸಹಕಾರದ ಬಗ್ಗೆ ಚರ್ಚೆ.

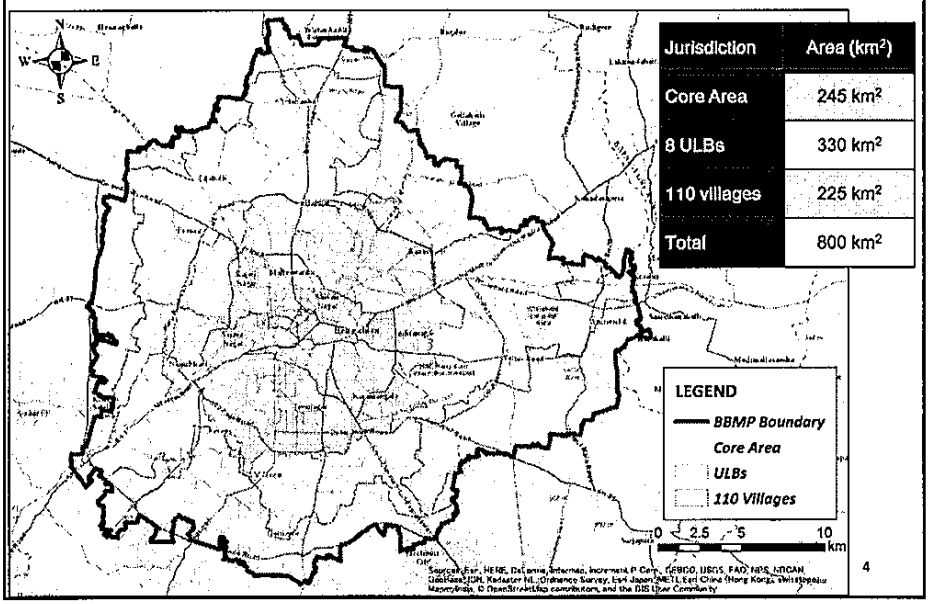
2

Project Scope

Project Group	Project Component	Facilities
JICA Survey Project	CWSS Stage V	Water Treatment Plant
		Transmission Facilities
		City Trunk Main
		Ground Level Reservoir (GLR)
	110 Villages major Sewerage Facilities (STP, ISPS, Trunk Sewer)	Bytrayanapura Zone
		Mahadevpura Zone
		Bommanahalli Zone
		R.R.Nagar Zone
		Dasarahalli Zone
BWSSB Undertaken Project	CWSS Stage V	Conveyance pipeline
		Branch Feeding Pipes in the City to share water to Core /ULB
	110 Villages Water Supply	Distribution pipeline and, House connections
		Distribution facilities between GLRs and OHTs for permanent systems
	110 Villages Sewerage	Lateral sewer and House connection

3

General Description of the Project Area

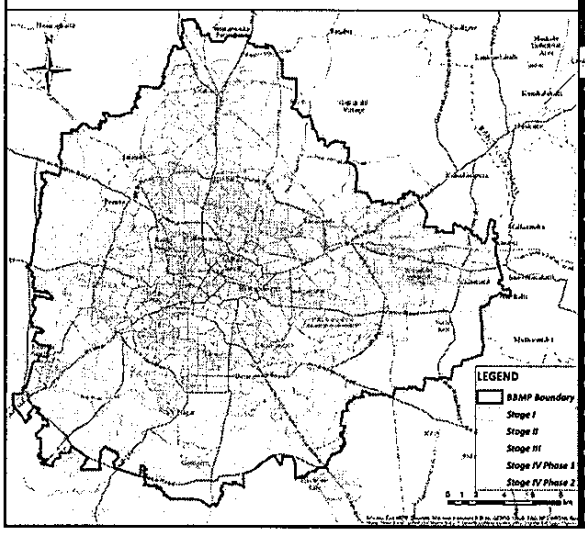


Jurisdiction	Area (km²)
Core Area	245 km²
8 ULBs	330 km²
110 villages	225 km²
Total	800 km²

4

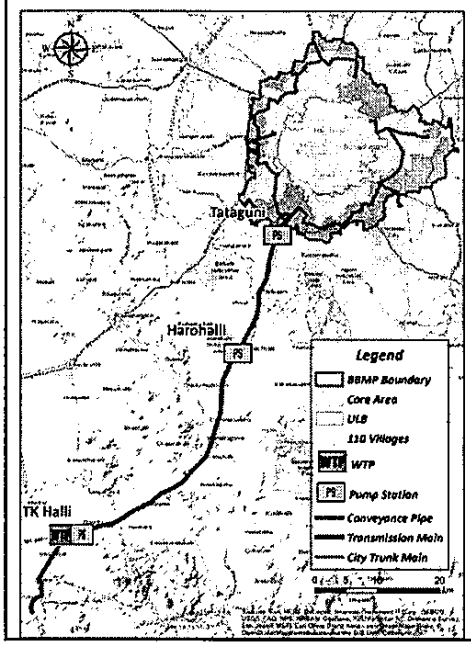
Existing Water Supply and On-going/Planned Water Supply Projects

Present Supply Area and Index of BWSSB



Item	Figure	Unit
	1,460	MLD
Population Served (As per 2011 Census)	8,500,000	People
Served Area by BWSSB	570	km²
House Service Connections	865,000	nos
Total Length of Water Supply Pipelines	8,746	km
Pipe Diameters' Range	100 to 3000	mm
No of GLRs	84 at 51 sites	nos
Total Capacity of GLRs	1,064	ML
No of OHTs	52	nos
Total Capacity of OHTs	33	ML
No of Booster Pumping Stations	62	nos
No of Public Faucet	7,477	nos
No of Public Tap	371	nos
No of Water Tanker Lorries	62	nos
Quantity of Water Supplied/Month	42,200	ML
Average Cost of Water	28	INR/m³
Design per capita water consumption(CPHEEO)	150	lpcd
Present per capita water supply	172	lpcd
Present NRW	48	%
Present per capita water consumption	89	lpcd

Outline of Existing WTP and Transmission Main



S/N	CWSS Stage, Phase	Nominal Abstraction (MLD)	Nominal Capacity (MLD)	Actual Supply (MLD)	Year of Commissioning
1	Stage I	155	135	147	1974
2	Stage II	155	135	146	1982
3	Stage III	315	330	335	1992
4	Stage IV, Phase 1	315	330	308	2002
5	Stage IV, Phase 2	520	550	469	2012
	Total	1460	1450	1,404	

S/N	CWSS Stage, Phase	Diameter (mm)	Length (km)	Material
1	Stage I	1,200	78	Mild Steel
2	Stage II	1,200	78	Mild Steel
3	Stage III	1,750	78	Mild Steel
4	Stage IV, Phase 1	1,950	70	Mild Steel
5	Stage IV, Phase 2	2,700	69	Mild Steel

6

Existing Sewerage Facilities and On-going/ Planned Sewerage Projects

Outline of STP

1	K&C Valley	308	Activated Sludge Process (ASP)
2	V Valley	180	Trickling Filter (TF)
3	Hebbal	60	ASP
4	Raja Canal -I	40	Extended Aeration (EA)
	Raja Canal -II	40	
5	Cubbon Park	1.5	Membrane Bio Reactor
6	Labaugh	1.5	EA
7	Kempbudhi	1	EA
8	(ITI Colony)		
9	Mallasandra	75	EA
10	Kadabesanahalli	50	EA
11	Nagasandra-I	20	EA
	Nagasandra-II	20	
12	K.R. Purum	20	UASB
13	Yelahanka	10	ASP+Filtration
14	Jakkur	10	UASB+EA
15	Chikkabanavar	5	SBR
16	Kadugodi	6	SBR
17	Horamavu	20	SBR
18	Yellamallappchetti	15	SBR
19	Doddabele	20	SBR
20	Belanduramanikere	90	ASP
21	Kengeri	80	ASP

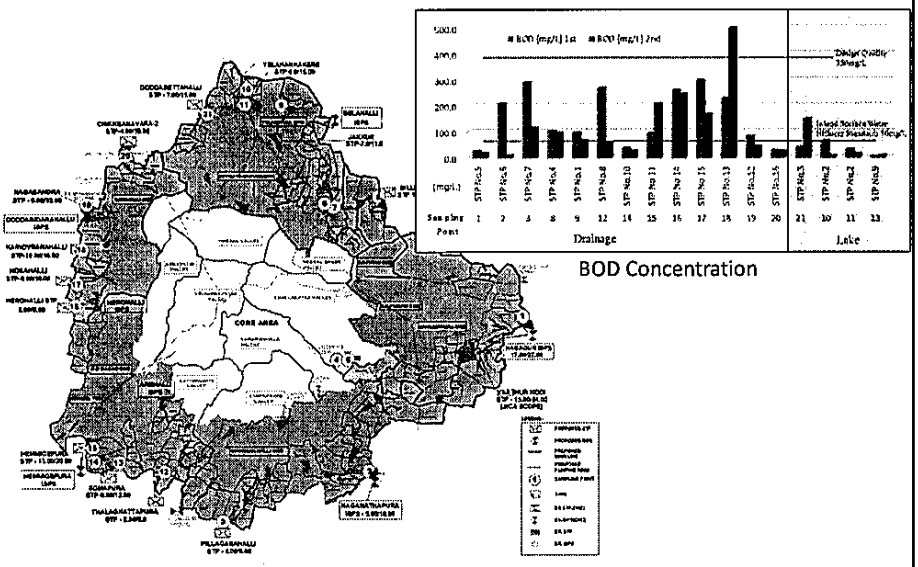
Treated Sewage Discharge Standard

Parameter	Design Standards of BWSSB	NDS Standards adopted from CPCB
pH	5.5 to 9.00	6.5 to 9.00
BOD5	Not more than 20 mg/l	Not more than 10 mg/l
COD	Not more than 250 mg/l	Not more than 50 mg/l
SS	Not more than 30 mg/l	Not more than 10 mg/l
TK-N	Not more than 100 mg/l	Not more than 10 mg/l as T-N
NH4-N	Not more than 50 mg/l	Not more than 5 mg/l
Nitrate Nitrogen	Not more than 10 mg/l	N.A.
Dissolved Phosphate	Not more than 5 mg/l	N.A.
PO4-P	N.A.	Not more than 2 mg/l
Fecal Coliform	N.A.	100 MPN/ 100ml
Total Residual Chlorine	Not more than 1 mg/l	N.A.

N.A.: Not Applicable

7

Water Pollution Status in Public Water Bodies



BOD Concentration

Locations of Water Sampling Points

8

Projects Needs and Implementation Arrangements for Proposed Projects

ಉದ್ದೇಶಿತ ಯೋಜನೆಯ ಬೇಡಿಕೆ ಮತ್ತು ಜಾಲನೆಗೆ ಸಲಕರಣೆ

(1) General Project Needs ಯೋಜನೆಗೆ ವಾಡಿಕೆಯ ಅಗತ್ಯ

1) To meet the increasing water demand and need of sanitation improvement
೧) ನೀರು ಮತ್ತು ನಿರ್ಮಲೀಕರಣದ ಬೇಡಿಕೆ ಮತ್ತು ಅಗತ್ಯತೆಯ ಹೆಚ್ಚುವರಿಯನ್ನು ಸರಿದೂಗಿಸುವದು

2) To use limited groundwater effectively avoiding over exploitation
೨) ಅಂತರ್ಜಲವನ್ನು ತುಂಬಾ ಪ್ರಜ್ಞಾಪೂರ್ವಕವಾದ ಬಳಕೆ ಹಾಗು ದುರ್ಲಾಭವನ್ನು ತಡೆಯುವದು.

(2) Specific Project Needs and Benefits
ಯೋಜನೆಯ ನಿರ್ದಿಷ್ಟ ಉದ್ದೇಶ ಮತ್ತು ಲಾಭ

1) Water demand for the BBMP area can be satisfied up to 2034 in provision of CWSS Stage V Project. Therefore, satisfactory / continuous water supply can be practiced through the cooperation by all stakeholders.
2) Uniform water supply services can be provided for entire BBMP area
3) Profile of the city with environmental soundness can be enhanced. Investment in BBMP area both by domestic and foreign companies will be promoted.

೧) ಕಾವೇರಿ ೫ ನೇ ನೇ ಹಂತ ಯೋಜನೆಯಿಂದ ಬಿ ಬಿ ಎಂ ಪಿ ಪ್ರದೇಶಕ್ಕೆ ೨೦೩೪ ಇಸವಿವರೆಗೆ ನೀರಿನ ಬೇಡಿಕೆಯನ್ನು ಪೂರೈಸುವುದು. ಇದರಿಂದ ಸಂತೃಪ್ತಿಯಾಗಿ ನಿರಂತರ ನೀರು ಸರಬರಾಜನ್ನು ಪಾಲುದಾರರ ಸಹಾಯದಿಂದ ಮಾಡುವುದು

೨) ನೀರು ಸರಬರಾಜನ್ನು ಬಿ ಬಿ ಎಂ ಪಿ ಪ್ರದೇಶಕ್ಕೆ ಸಮನಾಗಿ ಪೂರೈಕೆ

೩) ನಗರದ ಭೌಗೋಳಿಕ ಆದಾರದಂತೆ ಪರಿಸರಕ್ಕೆ ತಕ್ಕಂತೆ ವಿಸ್ತರಿಸುವುದು. ಬಿ ಬಿ ಎಂ ಪಿ ಪ್ರದೇಶಕ್ಕೆ ಸ್ಥಳೀಯ ಮತ್ತು ಹೊರದೇಶದ ಕಂಪನಿಗಳನ್ನು ಆಕರ್ಷಿಸಿ ನಗರವನ್ನು ಮೇಲ್ದರ್ಜೆಗೆ ಕೊಂಡೊಯುವುದು.[9]

Water Demand for 110 villages

(1) Water Supply
Water Demand of 110 villages

Sn	Name of Zone	Area (in Sq.Km.)	2011 population as per census	Projected Population (Person)				Water Demand (MLD)			
				2019	2024	2034	2049	2019	2024	2034	2049
1	Bytrayanpura (26 Villages)	55.0	243,210	342,710	416,991	593,904	941,116	61	74	106	168
2	Mahadevpura (23 Villages)	51.0	225,491	317,709	386,568	550,573	872,455	57	69	98	156
3	Bommanahalli (33 Villages)	64.3	285,174	401,838	488,932	696,365	1,103,482	72	87	124	197
4	R.R Nagar (17 Villages)	31.4	165,763	313,233	379,077	529,350	824,182	56	68	95	147
5	Dasarahalli (11 Villages)	23.5	193,656	272,877	332,030	472,882	749,344	49	59	84	134
Total		225.2	1,113,294	1,648,367	2,003,598	2,843,074	4,490,579	294	358	508	802
			1,110,000	1,650,000	2,000,000	2,840,000	4,490,000	290	360	510	800
Water Source											
	Cauvery								775	775	775
	Ground water								100	100	100
	Balance								517	367	73

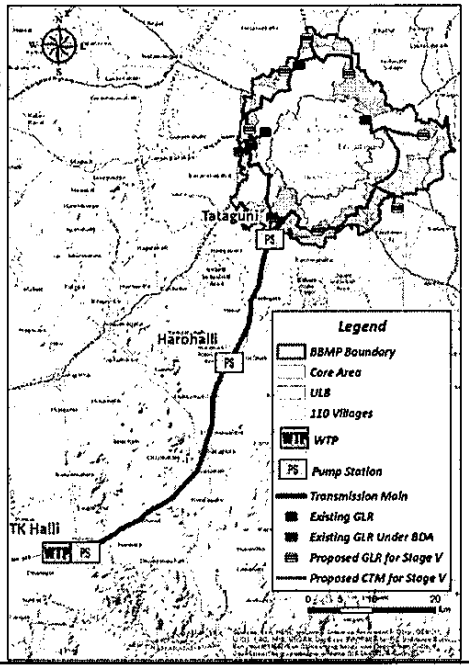
10

ಕಾವೇರಿ ಯೋಜನೆಯ 5 ನೇ ಹಂತದ ಕಾಮಗಾರಿ
Scope of Work for CWSS Stage V

- WTP
  ನೀರು ಸಂಸ್ಕರಣಾ ಘಟಕ
- Pump Stations and CWR's
- ಯಂತ್ರಾಗಾರಗಳು ಮತ್ತು ಕಾವೇರಿ ನೀರು ಶೇಖರಣಾ ಕೊಟ್ಟಿಗಳು
- Transmission Pipeline
- ನೀರು ಸಾಗಣೆ ಕೊಳವೆ ಮಾರ್ಗ
- City Trunk Main
- ನಗರದ ಪ್ರಮುಖ ಮುಖ್ಯ ಕೊಳವೆ
- City Reservoirs (GLR)
- ನಗರದಲ್ಲಿರುವ ಜಲಾಶಯಗಳು
- STP's and ISPS in 110 villages
- ೧೧೦ ಹಳ್ಳಿಗಳ ವ್ಯಾಪ್ತಿಯಲ್ಲಿರುವ ತ್ಯಾಜ್ಯ ನೀರು ಸಂಸ್ಕರಣಾ ಮತ್ತು ಯಂತ್ರಾಗಾರಗಳು
- Trunk Sewers in 110 villages
- ೧೧೦ ಹಳ್ಳಿಗಳಲ್ಲಿ ಪ್ರಮುಖ ದೊಡ್ಡ ಗಾತ್ರದ ಒಳಚರಂಡಿ ಕೊಳವೆಗಳು

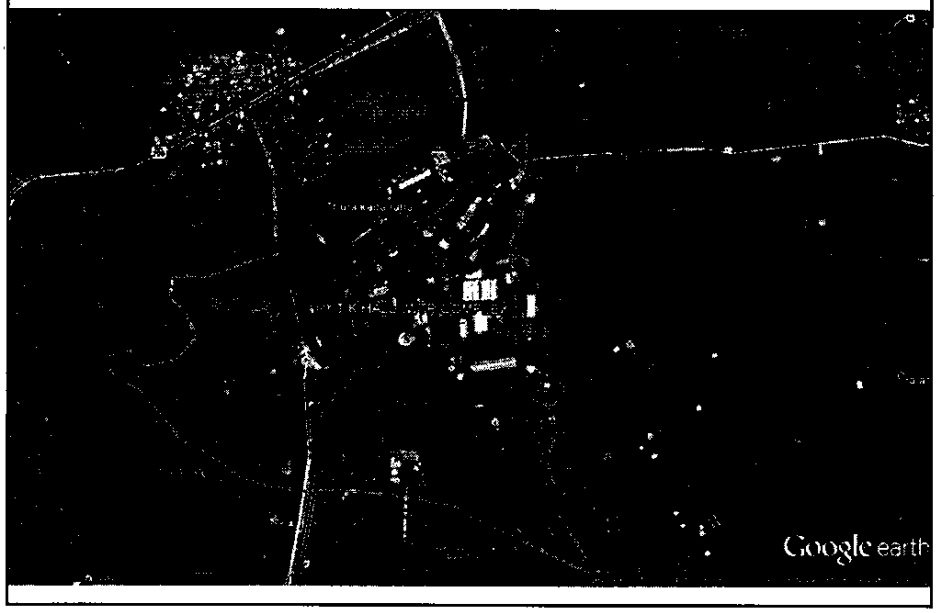
11

Recommended Scope of Work for Water Supply Facilities

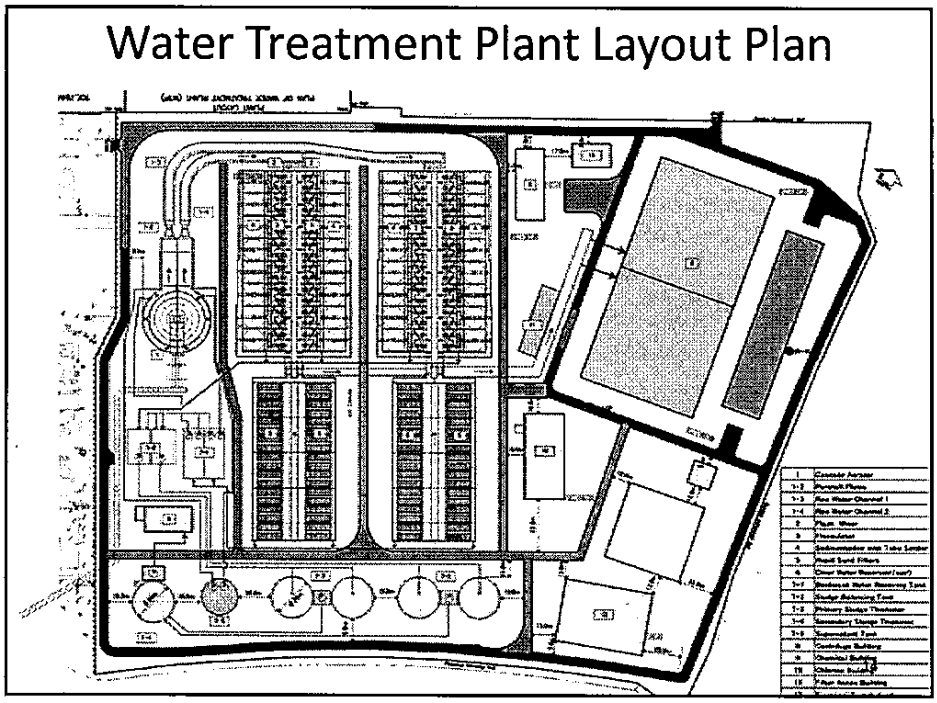


12

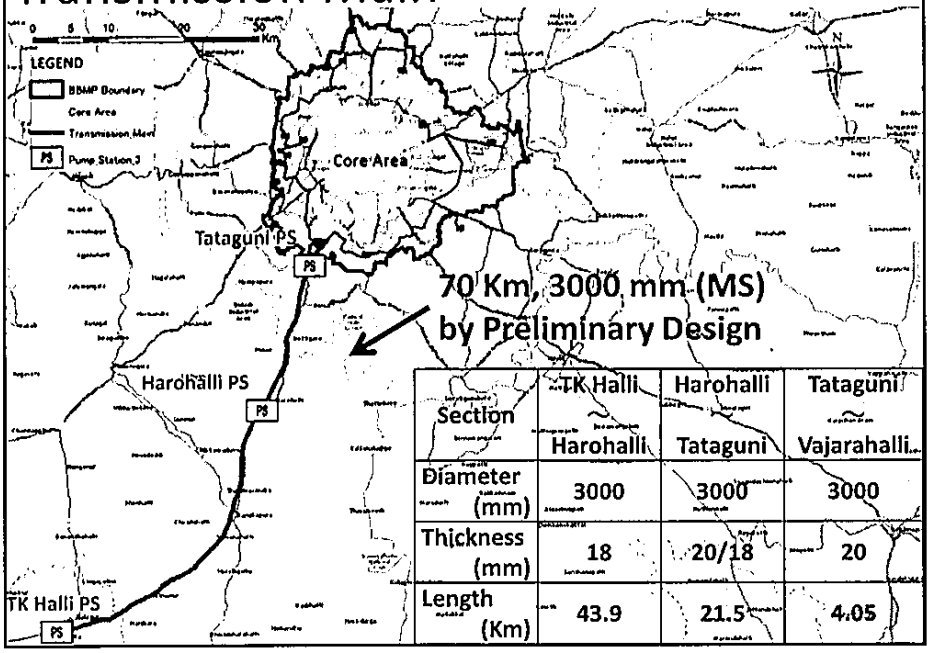
Water Treatment Plant Location



Water Treatment Plant Layout Plan



Transmission Main

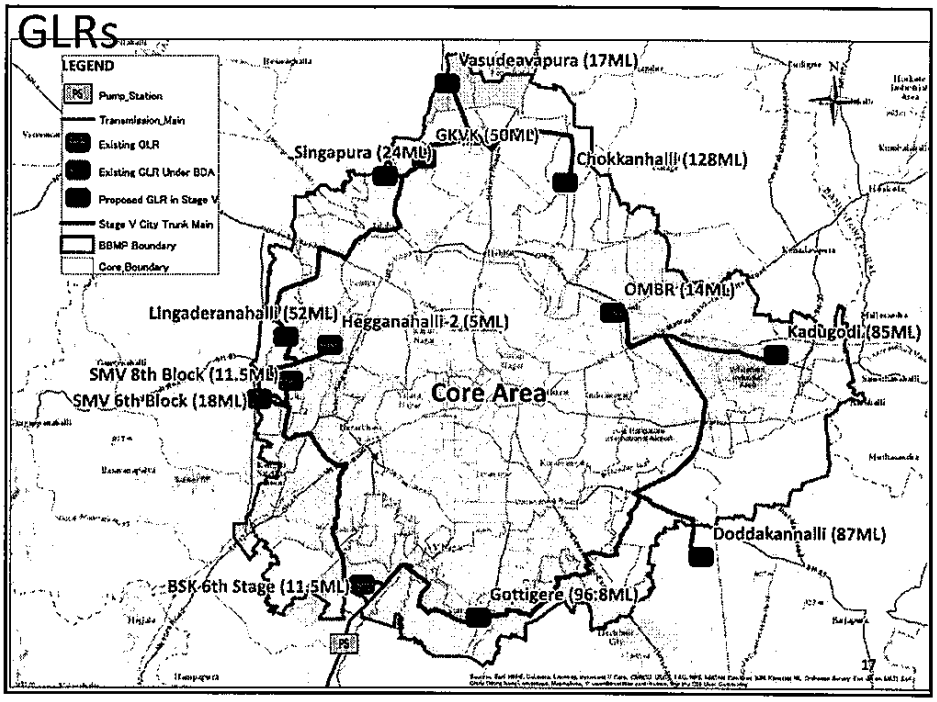


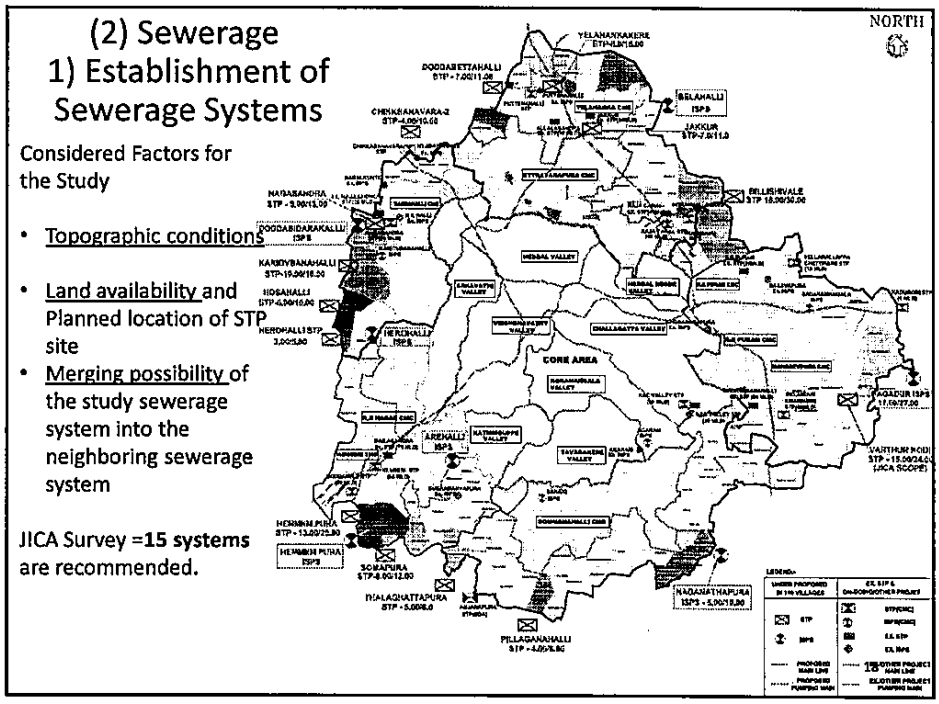
Section	TK Halli - Harohalli	Harohalli - Tataguni	Tataguni - Vajarahalli
Diameter (mm)	3000	3000	3000
Thickness (mm)	18	20/18	20
Length (Km)	43.9	21.5	4.05

ಉದ್ದೇಶಿತ ನೆಲಮಟ್ಟದ ಜಲಾಶಯಗಳು ಹಾಗೂ ಸ್ಥಳ
Proposed Ground Level Reservoirs(GLR's)

Proposed GLR Capacities and Locations			
ಕ್ರ ನಂ Sl No	ಜಲಾಶಯದ ಹೆಸರು Name of GLR	ಸಾಮರ್ಥ್ಯ Proposed GLR Capacity (ML)	ನೆಲಮಟ್ಟದ ಜಲಾಶಯದ ಸ್ಥಳ Location of GLR
1	Gottigere GLR	96.8	Gottigere Village
2	Doddakannahalli GLR	87	Hadosiddapura Village
3	Kadugodi GLR	85	Kadugodi Plantation
4	Chokkanhalli	128	Chokkanahalli Village
5	Vasudevapura GLR	17	Harohalli Village
6	Singapura	24	Singapura
7	Lingadeeranahalli GLR	52	Lingadeeranahalli Village

16


GLRs
LEGEND
Pump_Station
Transmission_Main
Existing GLR
Existing GLR Under BDA
Proposed GLR in Stage V
Stage V City Trunk Main
BBMP Boundary
Core_Boundary
Vasudeavapura (17ML)
GKVK (50ML)
Singapura (24ML)
Chokkanhalli (128ML)
OMBR (14ML)
Lingaderanahalli (52ML)
Hegganahalli-2 (5ML)
Kadugodi (85ML)
SMV 8th Block (11.5ML)
SMV 6th Block (18ML)
Core Area
Doddakannalli (87ML)
BSK 6th Stage (11.5ML)
Gottigere (96.8ML)


(2) Sewerage
1) Establishment of Sewerage Systems
Considered Factors for the Study
• Topographic conditions
• Land availability and Planned location of STP site
• Merging possibility of the study sewerage system into the neighboring sewerage system
JICA Survey =15 systems are recommended.
NORTH
CORE AREA

3) Plan of Sewage Treatment Plant

Application of EA process with chlorination of effluent is recommended for all 14 STPs. For sludge treatment, thickening and mechanical dewatering process shall be adopted. But, in case of the STPs with less than 10 MLD capacity, thickening process may be omitted depending on types of dewatering machine

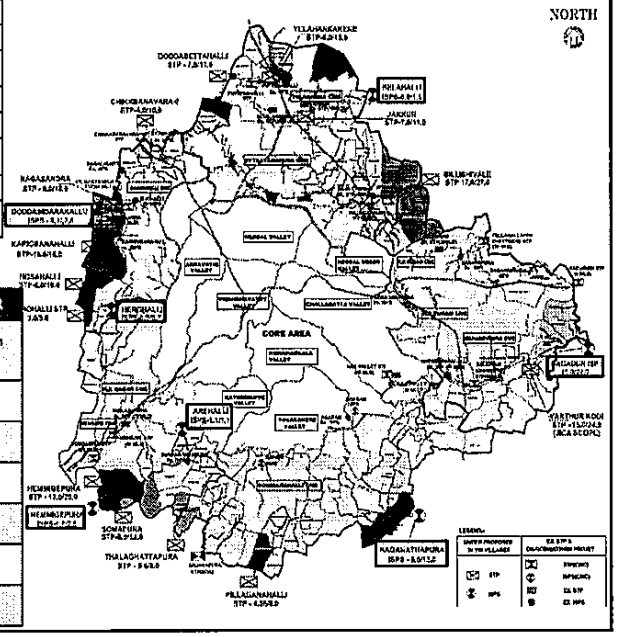
Zone	Name	Flow (MLD)	Treatment Method		Sludge Disposal/ Utilization
			Sewage	Sludge	
Bytrayanapura	1. Jakkur Changed from Kattigenahalli	7.0	EA + CHL	(TH) + DW	Fertilizer for farmland
	2. Yelahankakere	6.0	ditto	ditto	ditto
	3. Doddabettahalli	7.0	ditto	ditto	ditto
Mahadevpura	4. Bilishivalli	17.0	ditto	TH + DW	ditto
	5. Varthur	15.0	ditto	ditto	ditto
Bommanahalli	~~6. Naganathapura~~	~~9.0~~	Changed to ISPS		
	7. Pillaganahalli	4.0	ditto	(TH) + DW	ditto
R.R.Nagar	8. Talaghattapura	5.0	ditto	ditto	ditto
	9. Somapura	8.0	ditto	ditto	ditto
	10. Hemigepura (&11)	13.0 (Merged)	ditto	TH + DW	ditto
Dasarahalli	13. Kariobavanahalli	10.0	ditto	ditto	ditto
	14. Herohalli	3.0	ditto	(TH) + DW	ditto
	15. Hosahalli	6.0	ditto	ditto	ditto
	16. Chikkabanavara-2	4.0	ditto	ditto	ditto
	12. Nagasandra*	9.0	ditto	ditto	ditto
Total	14 STPs	114 MLD	EA + CHL	-	-

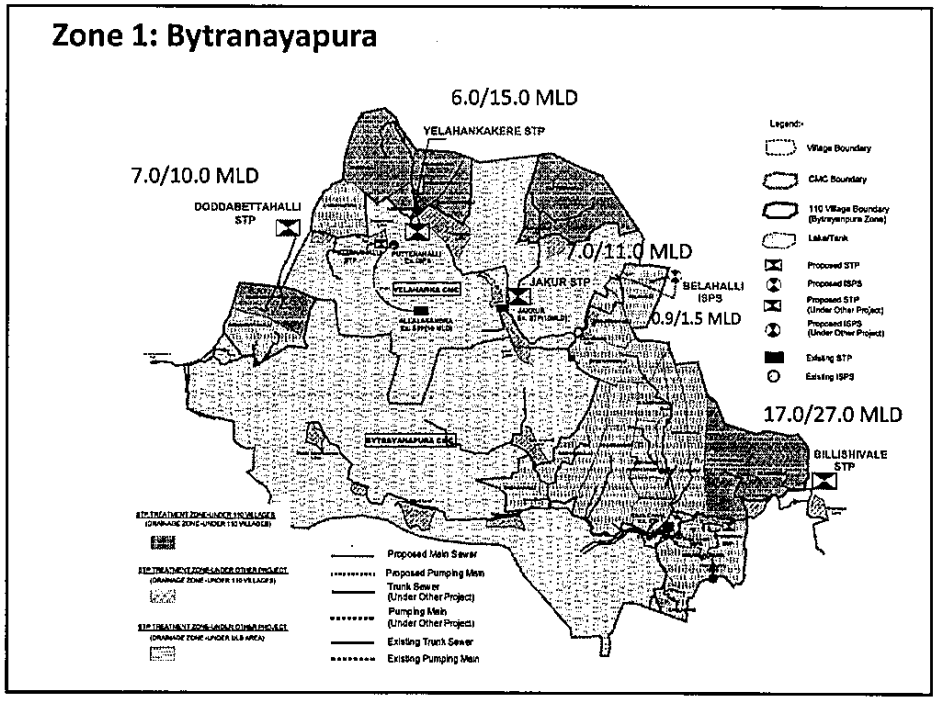
Note: EA: Extended Aeration Process, CHL: Chlorination, TH: Thickener, ( ): Possibility of Cancel, DW: Mechanical Dewatering 19

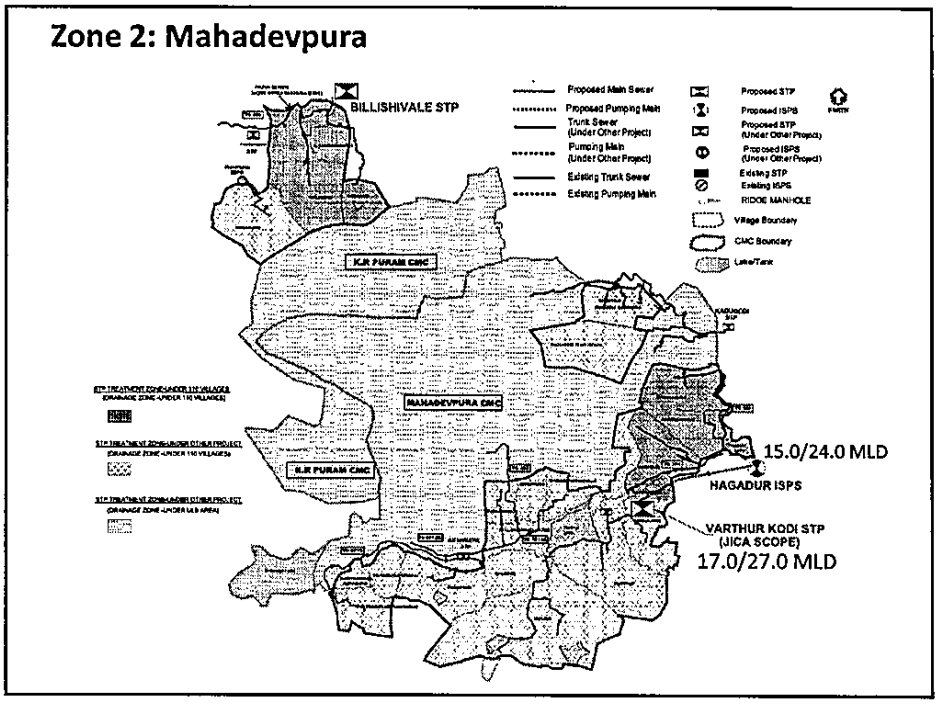
4. Plan of ISPS and Main Sewer

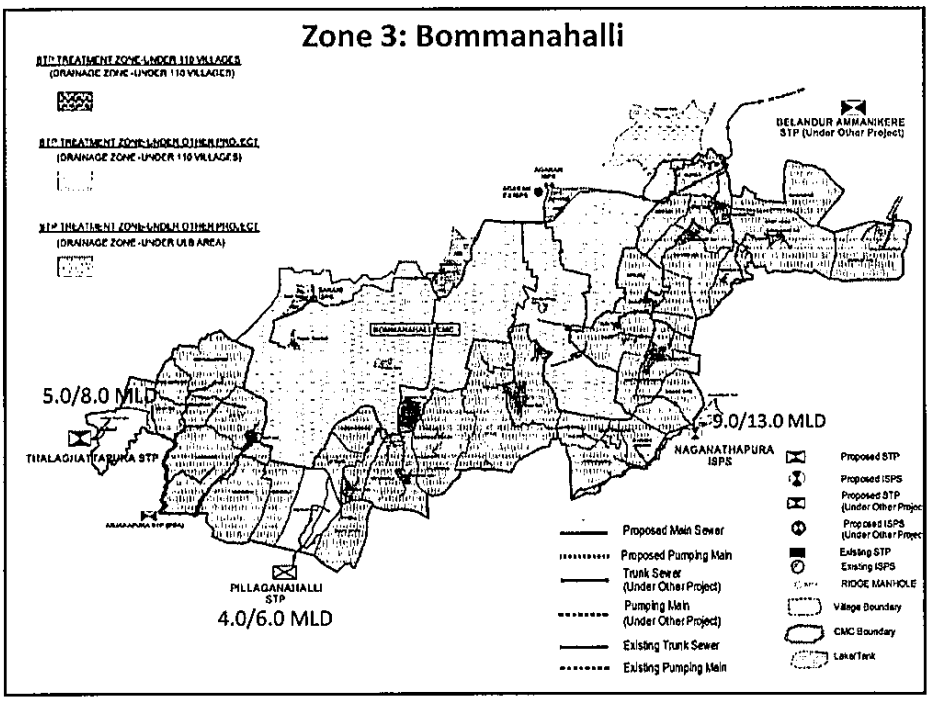
Zone	ISPS	Design Flow (MLD)
	Name	2034
Byatrayanpura	Bellahalli	0.9
Bommanahalli	Naganatha pura	9.0
Mahadevpura	Hagadur	15.0
	Arehalli 1	1.1
R.R Nagar	Hemigepur a	1.6
	Herohalli	0.5
Dasarahalli	Daddabida rakallu	8.1

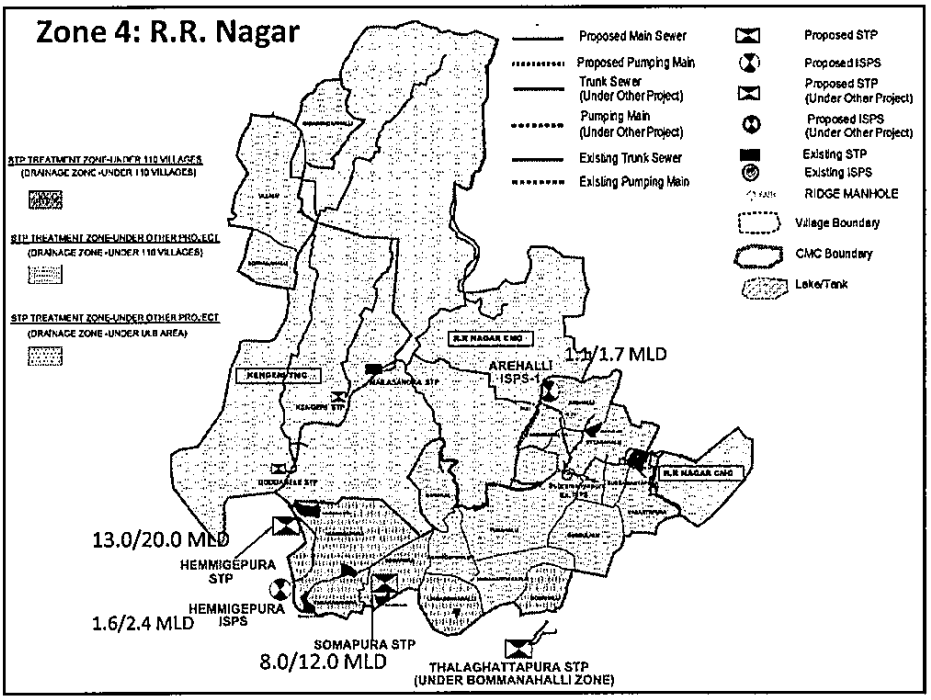
Zone	JICA Survey		In DPR
	Range of Pipe Size (mm)	Lengt h (km)	Length (km)
Bytrayanapur a	ϕ300 ~ ϕ1,000	50.3	44.4
Mahadevapu ra	ϕ300 ~ ϕ900	44.7	43.6
Bommanahol li	ϕ300 . ~ ϕ1,200	65.0	58.8
RR Nagar	ϕ300 ~ ϕ700	14.8	19.0
Dasarahalli	ϕ300 ~ ϕ600	27.5	23.9
Total		202.3	189.7



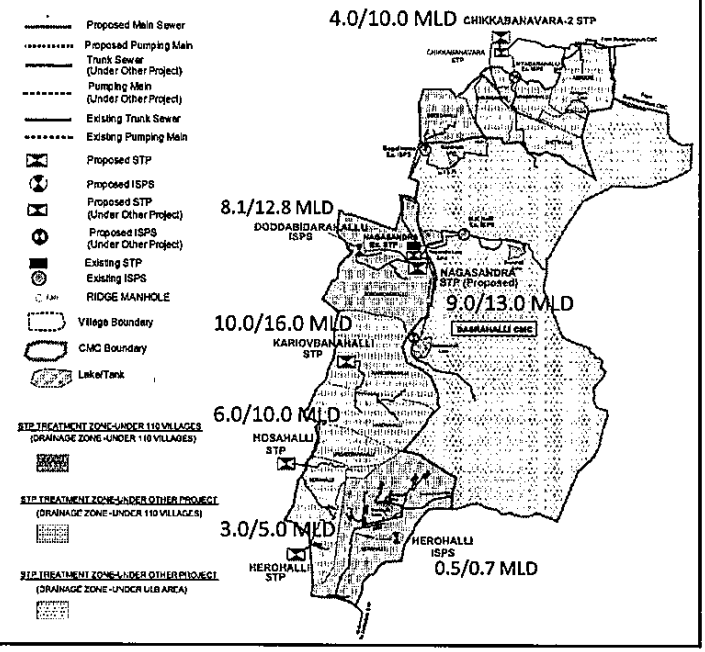

Zone 1: Bytranayapura
6.0/15.0 MLD
YELAHANKAKERE STP
7.0/10.0 MLD
DODDABETTAHALLI STP
7.0/11.0 MLD
JAKUR STP
BELAHALLI ISPS
0.9/1.5 MLD
17.0/27.0 MLD
BILLISHIVALE STP
Legend:
Village Boundary
CMC Boundary
110 Village Boundary (Bytrayanpura Zone)
Lake/Tank
Proposed STP
Proposed ISPS
Proposed STP (Under Other Project)
Proposed ISPS (Under Other Project)
Existing STP
Existing ISPS
Proposed Main Sewer
Proposed Pumping Main
Trunk Sewer (Under Other Project)
Pumping Main (Under Other Project)
Existing Trunk Sewer
Existing Pumping Main


Zone 2: Mahadevpura
BILLISHIVALE STP
K.R PURAM CMC
MAHADEVPURA CMC
K.R PURAM CMC
15.0/24.0 MLD
HAGADUR ISPS
VARTHUR KODI STP (JICA SCOPE)
17.0/27.0 MLD
Proposed Main Sewer
Proposed Pumping Main
Trunk Sewer (Under Other Project)
Pumping Main (Under Other Project)
Existing Trunk Sewer
Existing Pumping Main
Proposed STP
Proposed ISPS
Proposed STP (Under Other Project)
Proposed ISPS (Under Other Project)
Existing STP
Existing ISPS
RIDGE MANHOLE
Village Boundary
CMC Boundary
Lake/Tank


Zone 3: Bommanahalli
BELANDUR AMMANIKERE STP (Under Other Project)
5.0/8.0 MLD
THALAGHATTAPURA STP
9.0/13.0 MLD
NAGANATHAPURA ISPS
PILLAGANAHALLI STP
4.0/6.0 MLD
Proposed Main Sewer
Proposed Pumping Main
Trunk Sewer (Under Other Project)
Pumping Main (Under Other Project)
Existing Trunk Sewer
Existing Pumping Main
Proposed STP
Proposed ISPS
Proposed STP (Under Other Project)
Proposed ISPS (Under Other Project)
Existing STP
Existing ISPS
RIDGE MANHOLE
Village Boundary
CMC Boundary
Lake/Tank


Zone 4: R.R. Nagar
Proposed Main Sewer
Proposed Pumping Main
Trunk Sewer (Under Other Project)
Pumping Main (Under Other Project)
Existing Trunk Sewer
Existing Pumping Main
Proposed STP
Proposed ISPS
Proposed STP (Under Other Project)
Proposed ISPS (Under Other Project)
Existing STP
Existing ISPS
RIDGE MANHOLE
Village Boundary
CMC Boundary
Lake/Tank
1.1/1.7 MLD
AREHALLI ISPS-1
13.0/20.0 MLD
HEMMIGEPURA STP
HEMMIGEPURA ISPS
1.6/2.4 MLD
SOMAPURA STP
8.0/12.0 MLD
THALAGHATTAPURA STP (UNDER BOMMANAHALLI ZONE)

Zone 5: Dasarahalli



Construction Cost for the Project (JICA funded)

Unit: Crore

No.	Project Budget	
	Component	Cost
1	Water Supply Component	31,825
2	Sewerage Component	8,819
	Total Base Cost of the Project (Land Acquisition Excluded)	40,644
	Funding Pattern JICA - 85 % GOK - 7.5 % BWSSB - 7.5 %	

Associated Projects of BWSSB

No	Project	Funding Source	Implementation Period	Detailed information
1.	110 Villages Water Supply	GOK (67%) + BWSSB (33%)	24 Months	GBWASP funds
2.	UFW Reduction	GOK (67%) + BWSSB (33%)	36 Months (Construction) + 5 years Maintenance	GBWASP funds
3.	110 Villages Sewerage: Lateral sewers and House connections	BWSSB	Lateral sewers – 36 months House connections as per requests	BCC funds
4.1	Stage V Project Conveyance pipeline	BWSSB	24 Months	Already awarded
4.2	Stage V Project Branch Feeding Pipes for sharing water from Stage V to Core & ULBs	BWSSB	36 Months	

27

ಸಮಾಲೋಚಕರು ಸೇವೆಯ ಗುರಿ
Scope of Consultancy Services

- The Design and Project Management Consultants will be appointed as per the procurement guidelines of JICA
- ಯೋಜನೆಯ ವಿನ್ಯಾಸ ಮತ್ತು ಕಾರ್ಯನಿರ್ವಹಣೆಗೆ ಜೈಕಾ ಮಾರ್ಗದರ್ಶದದ ಆಧಾರದಂತೆ ಸಮೋಲೋಚಕರು ನೇಮಕ ಮಾಡಿ ಕೊಳ್ಳುವುದು
- The Consultants will be responsible for
- ಸಲಹೆಗಾರರ ಹೊಣೆಗಾರಿಕೆಗಳು
  - Design and Engineering
  - ವಿನ್ಯಾಸ ಮತ್ತು ತಾಂತ್ರಿಕತೆ
  - Tendering assistance for procurement
    ಖರೀದಿಸಲು ದರ್ಖಾಸ್ತುವಿಗೆ ಸಹಾಯ
  - Project Management
    ಯೋಜನೆಯ ಕಾರ್ಯನಿರ್ವಹಣೆ
  - Construction supervision and Quality Control
    ಕಾಮಗಾರಿಯ ವೀಕ್ಷಣೆ ಮತ್ತು ಗುಣಮಟ್ಟ
  - Commissioning and Testing
    ಪರೀಕ್ಷೆ ಮತ್ತು ಕಮಿಷನಿಂಗ್

28

ಸಲಹಾ ಸೇವೆಯ ಮಾಹಿತಿ
Input of Consultancy Services

- Period of Consultancy Services – 70 months
- ಸಲಹಾ ಸೇವೆಯ ಅವಧಿ-೭೦ ತಿಂಗಳು
- Input of Experts
  ತಜ್ಞರ ಬಳಕೆ
  - International Experts – 492 manmonths
  - ಅಂತಾರಾಷ್ಟ್ರೀಯ ತಜ್ಞರು-೪೯೨ ತಿಂಗಳದಿನ
  - National Experts – 2515 manmonths
  - ರಾಷ್ಟ್ರೀಯ ತಜ್ಞರು-೨೫೧೫ ತಿಂಗಳದಿನ
  - Supporting Staffs – 2112 manmonths
  - ಅಭಿಯಂತರರು -೨೧೧೨ ತಿಂಗಳದಿನ

29

Operation and Maintenance of Water Supply and Sewerage Facilities

ನೀರು ಸರಬರಾಜು ಮತ್ತು ಒಳಚರಂಡಿಯ
ಕಾರ್ಯಾಚರಣೆ ಮತ್ತು ನಿರ್ವಹಣೆ

30

The appointed Contractors will be responsible for10 years of O&M for the water supply and sewerage facilities

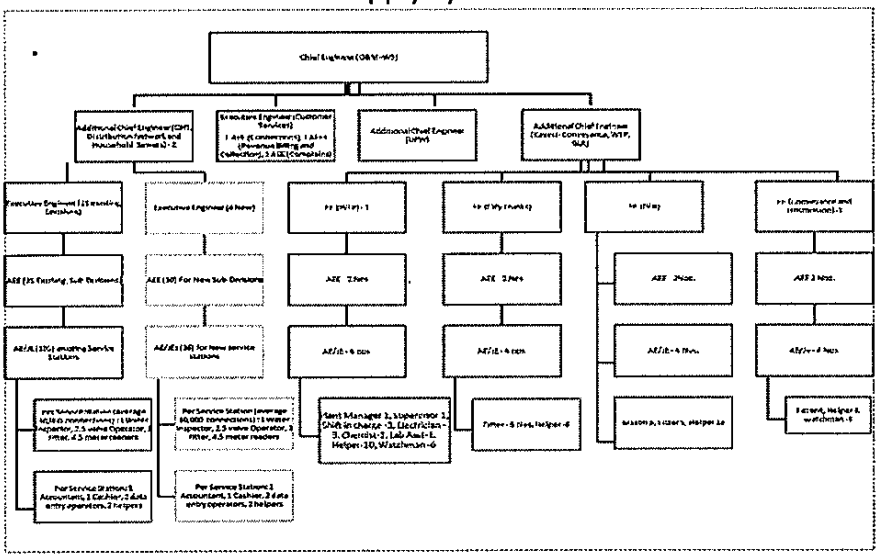
ನಿಯೋಜಿತ ಗುತ್ತೆಗೆದಾರರಿಗೆ ನೀರಿನ ಮತ್ತು ಒಳಚರಂಡಿಯ ಸೌಲಭ್ಯವನ್ನು ೧೦ ವರ್ಷದವರಗೆ ಕಾರ್ಯಾಚರಣೆ ಮತ್ತು ನಿರ್ವಹಣಿಯ ಜವಾಬ್ದಾರಿಯಾಗಿರುತ್ತದೆ

The distribution systems and sewerage network O&M will be undertaken by BWSSB

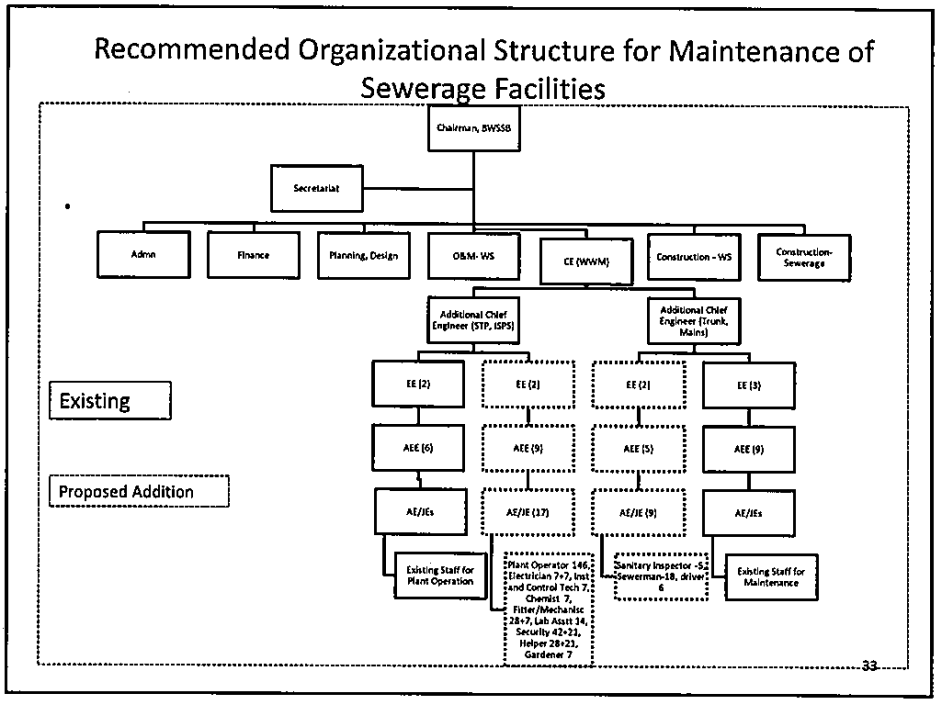
ಜಲಮಂಡಳಿಯಿಂದ ವಿತರಣಾ ವ್ಯವಸ್ಥೆ ಮತ್ತು ಒಳಚರಂಡಿ ಜಾಲದ ಕಾರ್ಯಾಚರಣೆ ಮತ್ತು ನಿರ್ವಹಣಿ ಮಾಡಲಾಗುತ್ತದೆ

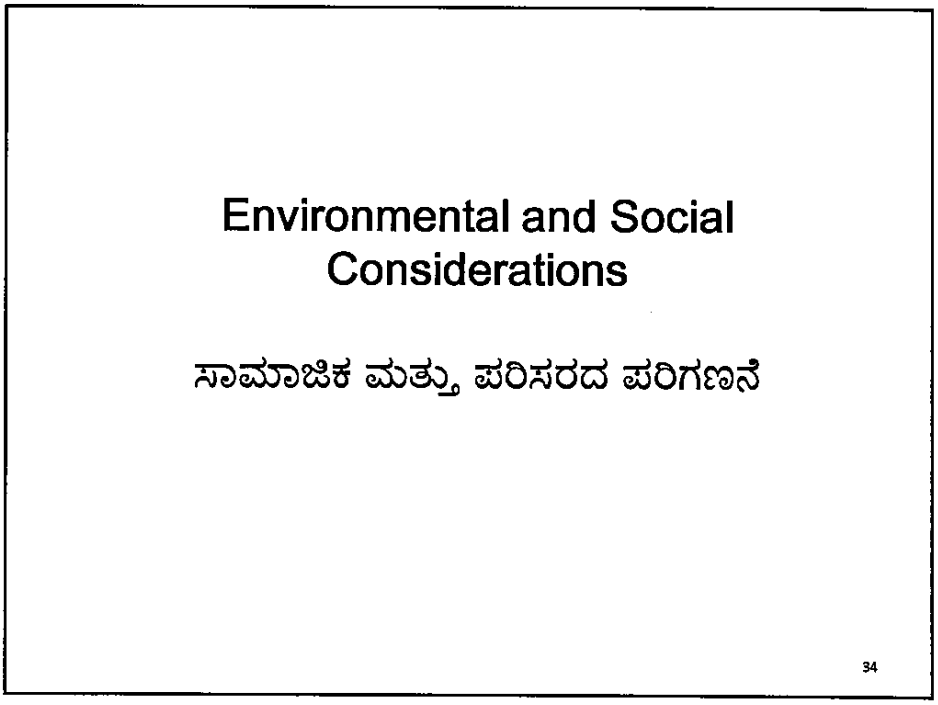
31

Recommended Organizational Structure for O&M of Water Supply Systems



32


Recommended Organizational Structure for Maintenance of Sewerage Facilities
Chairman, BWSSB
Secretariat
Admn
Finance
Planning, Design
O&M- WS
CE (WWM)
Construction - WS
Construction- Sewerage
Additional Chief Engineer (STP, ISPS)
Additional Chief Engineer (Trunk, Mains)
EE (2)
EE (2)
EE (2)
EE (3)
AEE (6)
AEE (9)
AEE (5)
AEE (9)
AE/JEs
AE/JE (17)
AE/JE (9)
AE/JEs
Existing Staff for Plant Operation
Plant Operator 146, Electrician 7+7, Inst and Control Tech 7, Chemist 7, Fitter/Mechanisc 28+7, Lab Asstt 14, Security 42+21, Helper 28+21, Gardener 7
Sanitary Inspector -5, Sewerman-18, driver 6
Existing Staff for Maintenance
Existing
Proposed Addition
33


Environmental and Social Considerations
ಸಾಮಾಜಿಕ ಮತ್ತು ಪರಿಸರದ ಪರಿಗಣನೆ
34

(1) Baseline Situation ಪ್ರಾರಂಭಿಕ ಸಂದರ್ಭ

1) Site Description ಜಾಗದ ವಿವರಣೆ

- WTP / Pump Stations: Existing BWSSB's Facility Areas
  ನೀರು ಸಂಸ್ಕರಣಾ ಘಟಕ / ಯಂತ್ರಾಗಾರಗಳು ಪ್ರಸ್ತುತ ಜಲಮಂಡಳಿಯ ಸೌಲಭ್ಯದ ಪ್ರದೇಶ
- Clear Water Transmission: Existing BWSSB's Pipeline Road
  ನಿಖರ ನೀರು ಸಾಗಿಸುವಿಕೆ ಕೊಳವೆ ಮಾರ್ಗ - ಪ್ರಸ್ತುತ ಜಲಮಂಡಳಿಯ ಕೊಳವೆ ಮಾರ್ಗ ರಸ್ತೆ
- City Trunk Main: Public Roads in Built-up Areas
  ನಗರದ ಪ್ರಮುಖ ಮುಖ್ಯ ಕೊಳವೆ - ಅಭಿವೃದ್ಧಿ ಹೊಂದಿದ ಪ್ರದೇಶದ ರಸ್ತೆಗಳು
- GLRs: Vacant Lands of Government (GoK, BBMP, BDA), Lands in Built-up Areas
  ನೆಲಮಟ್ಟದ ಜಲಾಶಯ : ಸರ್ಕಾರದ ಖಾಲಿ ಜಾಗ (ಬಿ ಬಿ ಎಂ ಪಿ, ಬಿ ಡಿ ಎ) ಅಭಿವೃದ್ಧಿ ಹೊಂದಿದ ಪ್ರದೇಶದ ಖಾಲಿ ಜಾಗ

Sewerage Project for 110 Villages: ೧೧೦ ಹಳ್ಳಿಗಳಲ್ಲಿ ಒಳಚರಂಡಿ ಯೋಜನೆ

- STPs / SPSs: Vacant Lands of Government (GoK, BBMP, BDA), Lands in Built-up Areas
  ಸರ್ಕಾರದ ಖಾಲಿ ಜಾಗ ಅಭಿವೃದ್ಧಿ ಹೊಂದಿದ ಪ್ರದೇಶದ ಖಾಲಿ ಜಾಗ
- Main Sewers: Public Roads and Along the Drain in Built-up Areas
  ಮುಖ್ಯ ಒಳಚರಂಡಿ ಕೊಳವೆ : ಸಾರ್ವಜನಿಕ ರಸ್ತೆ ಮತ್ತು ಸಮಾನಂತರ ಚರಂಡಿಯ ಉದ್ದಗಲಕ್ಕೂ.

2) EIA Requirement EIA ಅವಶ್ಯಕತೆ

- The projects (CWSS Stage V, Sewerage project for 110 Villages) do not require EIA according to EIA Notification 2006.
  ಯೋಜನೆಗಳು (ಕಾವೇರಿ ನೀರು ೫ ನೇ ಹಂತ, ಒಳಚರಂಡಿ ಯೋಜನೆ ೧೧೦ ಹಳ್ಳಿಗಳಿಗೆ) EIA ಅಭಿಯೋಜನೆಯ ೨೦೦೬ ರಂತೆ ಅವಶ್ಯಕತೆಯಿರುವುದಿಲ್ಲ

35

(3) Recommended Mitigation Measures

- Coordination mechanism with Stakeholders
- Appropriate traffic management at pipe laying works
- Incorporation of requirements for mitigation measures into bidding documents, contract documents
- Examination of Contractor's construction plan, O& M plan
- Environmental monitoring (Dust, noise, water quality, odour)
- Climate change : Selection of higher efficient pump units,
- Recommendation of future installation of biogas recovery system (Biogas power generation, incineration, etc.)

36

(4) Land Acquisition ಭೂಮಿಗಳಿಗೆ

The project sites to require Land Acquisition or Land Transfer:
ಯೋಜನಾ ಜಾಗದ ಅಗತ್ಯಗೆ ದರ್ಖಾಸ್ತುವಿಗೆ ಅಥವಾ ವರ್ಗಾವಣೆ

- CWSS Stage V Project: GLRs
  ಕಾವೇರಿ ೫ ನೇ ಹಂತ ಯೋಜನೆ : ನೆಲಮಟ್ಟದ ಜಲಾಶಯ
- Sewerage Project for 110 Villages: STPs and ISPSs
  ೧೧೦ ಹಳ್ಳಿಗಳಿಗೆ ಒಳಚರಂಡಿ ಕಾಮಗಾರಿ
- All project sites located on government lands (GoK, BBMP, BDA)
  ಎಲ್ಲಾ ಒಳಚರಂಡಿ ಯೋಜನೆಯ ಜಾಗವು ಸರ್ಕಾರಿ ಪ್ರದೇಶವಾಗೇರಬೇಕು
- Resettlement is not required.
- Land Transfer of ALL Project Sites to BWSSB is required before implementation of the projects.
- ಯೋಜನೆಯ ಪ್ರಾರಂಭಿಕ ಹಂತದಲ್ಲೇ ಎಲ್ಲಾ ನಿವೇಶನಗಳು ಜಲಮಂಡಳಿಗೆ, ವರ್ಗಾವಣೆಯಾಗಬೇಕು

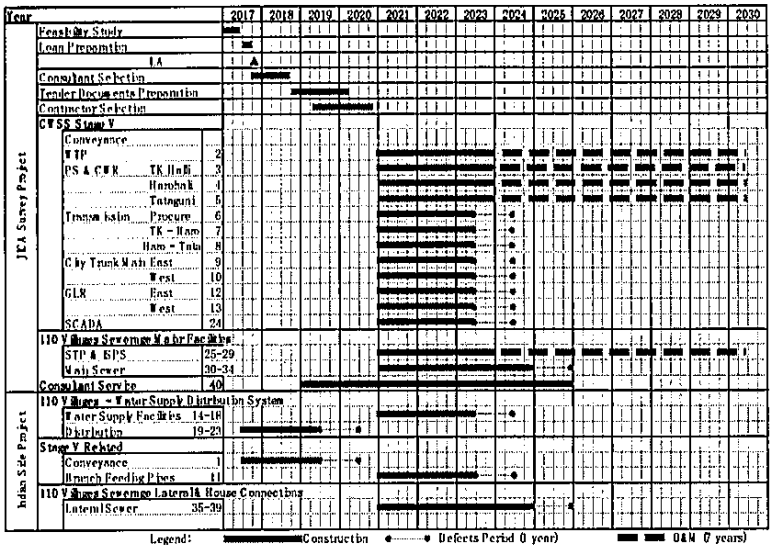
37

Implementation Plan

ಕಾರ್ಯಾಚರಣೆ ರಚನೆ

38

Project Schedule (complete by 2023)



Note: BWSSB intend to complete by 2022

39

Institutional Development

ಸಂಸ್ಥೆಯ ಅಭಿವೃದ್ಧಿ

40

ಪಾಲುದಾರರಿಂದ ಅಪೇಕ್ಷೆ
Expectations from the Key Stakeholders

- **Revenue Department ಕಂದಾಯ ಇಲಾಖೆ**
  Govt Land to be Transferred to BWSSB With in Time Frame.
  ಕಾಲಾವಧಿಯೊಳಗೆ ಸರ್ಕಾರೀ ಜಾಗವನ್ನು ಜಲಮಂಡಳಿ ವರ್ಗಾಯಿಸುವುದು

- **BDA ಬೆಂಗಳೂರು ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ**
  BDA Land to be transferred to BWSSB with in Time Frame.
  ಕಾಲವಾದಿಯೊಳಗೆ ಬಿ ಡಿ ಎ ಯಿಂದ ಜಲಮಂಡಳಿಗೆ ಜಾಗವನ್ನು ವರ್ಗಾಯಿಸುವುದು

Some of the identified land for immediate attention.
ಗುರುತಿಸುವ ಜಾಗವನ್ನು ತಕ್ಷಣ ಗಮನ ಹರಿಸುವುದು

- STP Land Near Talaghattapura Survey No.41 of Thalaghattapura Village
- ತಲಘಟ್ಟಪುರ ಗ್ರಾಮದೊಳಗಿನ ತಲಘಟ್ಟಪುರ ಸರ್ವೇ ನಂ ೪೧ ಜಾಗವನ್ನು ತ್ಯಾಜ್ಯನಿರು ಸಂಸ್ಕರಣೆ ಘಟಕ
- STP Land Near Sompura Lake Survey No 2,3(P) at Somapura Village
- ಸರ್ವೇ ನಂ ೨,೩ (ಪಿ) ನಲ್ಲಿ ಸಂಸ್ಕರಣೆ ಘಟಕ ಸೋಮಪುರ ಗ್ರಾಮ
- ISPS Land Near Varasandra Lake Survey No.25 at Varasandra Village
- ವಾರಸಂದ್ರ ಗ್ರಾಮ ಸರ್ವೇ ನಂ ೨೫ ವಾರಸಂದ್ರ ಕೆರೆ ISPS ಜಾಗ

41

ಪಾಲುದಾರರಿಂದ ಆಪೇಕ್ಷ ಮುಂದುವರಿದಿದೆ
Expectations from the Key Stakeholders (Cont..)

- BESCOM
  Permission to provide Power Supply to STP's ,ISPS, Pumping station at GLR's
  ವಿದ್ಯುತ್ ಸಂಪರ್ಕವನ್ನು STP ಮತ್ತು ISPS ಯಂತ್ರಾಗಾರಗಳಿಗೆ ಒದಗಿಸಲು ಅನುಮತಿ
- Power Requirement for ISPS / STP : 1,14,884 Kwh / day
  – ವಿದ್ಯುತ್ ಅಗತ್ಯತೆ ISPS ಗೆ ಪ್ರತಿದಿನ 1,14,884 Kwh /day
- Power Requirement for Pumping Station GLR : 329 Kwh / day
  – ಯಂತ್ರಾಗಾರಕ್ಕೆ ವಿದ್ಯುತ್ ಬೇಡಿಕೆ 329 Kwh ಪ್ರತಿದಿನ

- **KPTCL**
  Permission to provide Power Supply to WTP in T K Halli,Pumping station's
  ಟಿ ಕೆ ಹಳ್ಳಿ ಯಂತ್ರಾಗಾರಕ್ಕೆ ನೀರು ಸಂಸ್ಕರಣೆ ಘಟ್ಟಕ್ಕಕ್ಕೆ ವಿದ್ಯುತ್ ಸರಬರಾಜುವಿಗೆ ಅನುಮತಿ
- Power Requirement for Pumping Station at T K Halli :3,36,346 Kwh/day
  – ಯಂತ್ರಾಗಾರಕ್ಕೆ ವಿದ್ಯುತ್ ಬೇಡಿಕೆ ಟಿ ಕೆ ಹಳ್ಳಿ ಘಟ್ಟಕ್ಕಕ್ಕೆ3,36,346 KWH ಪ್ರತಿದಿನ
- Power Requirement for Pumping Station at Harohalli: 3,93,101 Kwh/day
  – ಯಂತ್ರಾಗಾರಕ್ಕೆ ವಿದ್ಯುತ್ ಬೇಡಿಕೆ ಹಾರೋಹಳ್ಳಿ ಘಟ್ಟಕ್ಕಕ್ಕೆ3,93,101 Kwh ಪ್ರತಿದಿನ
- Power Requirement for Pumping Station at Tataguni : 3,87,960 kwh/day
  – ಯಂತ್ರಾಗಾರಕ್ಕೆ ವಿದ್ಯುತ್ ಬೇಡಿಕೆ ತಾತಗುಣಿ ಘಟ್ಟಕ್ಕಕ್ಕೆ:3,87,960 kwh ಪ್ರತಿದಿನ
- Power Requirement for WTP : 70666 KWH/day
  – ವಿದ್ಯುತ್ ಬೇಡಿಕೆ ಸಂಸ್ಕರಣೆ ಘಟ್ಟಕ್ಕಕ್ಕೆ 70666 Kwh

42

ಪಾಲುದಾರರಿಂದ ಆಪೇಕ್ಷ ಮುಂದುವರಿದಿದೆ
Expectations from the Key Stakeholders (Cont..)

- **Pollution Control Board ಮಾಲಿನ್ಯ ನಿಯಂತ್ರಣ ಮಂಡಳಿ**
  Permission for construction STP's near by lake as per Govt Direction held 11-1-2017
  ಕೆರೆಯ ಹತ್ತಿರದಲ್ಲಿ ತ್ಯಾಜ್ಯನಿರು ಸಂಸ್ಕರಣೆ ಘಟ್ಟಕ್ಕದ ಕಾಮಗಾರಿ ಮತ್ತು ಕೊಳವೆಮಾರ್ಗ ಅಳವಡಿಸಲು ಸರ್ಕಾರದ ನಿರ್ದೇಶನದಂತೆ ದಿನಾಂಕ 11-1-2017 ರ ಆದಾರದಂತಿರುತ್ತದೆ

- **Traffic Police ಟ್ರಾಫಿಕ್ ಪೊಲೀಸ್**
  Permission for Traffic diversion
  ಟ್ರಾಫಿಕ್ ಬದಲಾಯಿಸಲು ಅನುಮತಿ

- **LCDA**
  Permission to lay the pipe line and construct the STP near by lake as per Govt Direction held 11-1-2017
  ಕೆರೆಯ ಹತ್ತಿರದಲ್ಲಿ ತ್ಯಾಜ್ಯನಿರು ಸಂಸ್ಕರಣೆ ಘಟ್ಟಕ್ಕದ ಕಾಮಗಾರಿ ಮತ್ತು ಕೊಳವೆಮಾರ್ಗ ಅಳವಡಿಸಲು ಸರ್ಕಾರದ ನಿರ್ದೇಶನದಂತೆ ದಿನಾಂಕ 11-1-2017 ರ ಆದಾರದಂತಿರುತ್ತದೆ

- **Elected Representative's**
  Cooperation for Implementation of the project and make the people aware of the benefits of the project
  ಚುನಾಯಿತ ಪ್ರತಿನಿಧಿ ಯೋಜನೆಯನ್ನು ಕಾರ್ಯಗತಗೊಳಿಸಲು ಸಾರ್ವ ಜನಿಕರಿಗೆ ಯೋಜನೆಯ ಉಪಯುಕ್ತತೆಯ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸಲು ಸಹಕಾರ ಕೋರಲಾಗಿದೆ

43

ಪಾಲುದಾರರಿಂದ ಅಪೇಕ್ಷೆ ಮುಂದುವರಿದಿದೆ
Expectations from the Key Stakeholders (Cont...)

Citizens of the 110 villages area:
೧೧೦ ಹಳ್ಳಿಯ ಪ್ರದೇಶದ ನಾಗರಿಕರು

Co-operation is requested from the Citizens of the 110 villages area who will be the main Stake Holder for this project. The project is going to improve the water and sanitation facilities in the 110 villages area.

೧೧೦ ಹಳ್ಳಿಗಳಲ್ಲಿರುವ ನಾಗರಿಕರು ಪ್ರಮುಖ ಪಾಲುದಾರರಾಗಿದ್ದು ಇವರ ಸಹಕಾರವನ್ನು ಕೋರಲಾಗಿದೆ. ಈ ಯೋಜನೆಯಿಂದ ನೀರಿನ ಮತ್ತು ಒಳಚರಂಡಿ ಸೌಲಭ್ಯವು ೧೧೦ ಹಳ್ಳಿ ಪ್ರದೇಶಕ್ಕೆ ದೊರಕುವುದರಿಂದ ಇದು ಅವರಿಗೆ ತುಂಬ ಉಪಯುಕ್ತವಾಗಿಲಿದೆ

The cooperation of the citizens are critical for the success of the project.

ಈ ಯೋಜನೆಯೇ ಯೆಶಸ್ವಿಗೆ ನಾಗರಿಕರ ಸಹಕಾರ ಪ್ರಮುಖವಾಗಿರುತ್ತದೆ

44

Thank You
ವಂದನೆಗಳು

45

ಯೋಜನೆಯದ ವ್ಯತಿರಿಕ್ತ ಪರಿಣಾಮಗಳು

(2) Potential Adverse Impacts by the Projects

Both CWSS Stage V Project and Sewerage Project for 110 Villages : ಕಾವೇರಿ ೫ ನೇ ಹಂತ ಮತ್ತು ೧೧೦ ಹಳ್ಳಿಗೆ ಒಳಚರಂಡಿ ಯೋಜನೆ

- Social infrastructure / service: Impacts on underground utilities, traffic ಸಾಮಾಜಿಕ ಮೂಲಬೂತ ಸೌಕರ್ಯಗಳು/ಸೇವೆ : ಬೂಮಿಯೊಳಗಿನ ಸೌಕರ್ಯಗಳ ಮೇಲೆ ಪರಿಣಾಮ ವಾಹನದಟ್ಟಣೆ
- Occupational health & safety: Impacts on work environment ಉದ್ಯೋಗದಾರರ ಆರೋಗ್ಯ ಮತ್ತು ರಕ್ಷಣೆ : ಕೆಲಸದ ಪರಿಸರದ ಮೇಲೆ ಪರಿಣಾಮ
- Water pollution: Water pollution due to malfunction of facilities ನೀರಿನ ಮಾಲಿನ್ಯತೆ ಸೌಲಭ್ಯತೆಯಿಂದ ನೀರಿನ ಮಾಲಿನ್ಯ
- Waste (Excavation soil, treated sludge) ತ್ಯಾಜ್ಯ (ಮಣ್ಣಿನ ಆಗೆತ, ಶುದ್ಧಿಕರಿಸಿದ ತ್ಯಾಜ್ಯ)
- Noise: Noise due to construction equipment, pump operation ಶಬ್ದ ಮಾಲಿನ್ಯ : ಕಾಮಗಾರಿ ಸಾಮಗ್ರಿಗಳಿಂದ ಮತ್ತು ಯಂತ್ರಗಳ ಚಾಲನೆಯಿಂದ
- Accidents: Accidents due to construction and operation ಅಪಘಾತ : ಕಾಮಗಾರಿ ಮತ್ತು ಕಾರ್ಯನಿರ್ವಹಣೆಯಿಂದ ಅಪಘಾತ
- Climate change (Generation of GHGs): due to consumption of electricity ವಾತಾವರಣ ಬದಲಾವಣೆ (Generation of GHGs) ವಿದ್ಯುತ್ಶಕ್ತಿ ಬಳಿಕೆಯಿಂದ

Sewerage Project for 110 Villages :

- Odour: due to treatment and transport of sludge ವಾಸನೆ : ಸಂಸ್ಕರಣೆ ಮತ್ತು ಕೆಸರು ಸಾಗಾಣಿಕೆಯಿಂದ

46

Approach to Institutional Development

- **Situational Analysis**: Review, Feedback, Analysis and validation of "AS IS" situation of BWSSB encompassing its Plans, Policies, Management Systems, Organizational Structure, Human Resources, other resources, Work Environment etc.
- **Review** of Vision, mission, mandate and plans/targets of BWSSB, emerging external developments, public demand etc.
- Projection of main attributes of a **TO BE** State for BWSSB
- Assessment of gaps in present **(AS IS)** and desired **(TO BE)** scenario
- Development **of strategies** to bridge the gap
- Development of action plans with resource requirements
- Implementation Plan
- Monitoring, Evaluation, Feedback and Integration Plan

47

Cauvery Water Supply and Sewerage Project (Stage V)

Bangalore Water Supply and Sewerage Board

In Coordination with
NJS Consultants Co. Ltd.

Minutes of Discussions

Purpose/Objective	Stakeholder Meeting		
Meeting Date	22nd August 2017		11:00 – 13:30
Venue	BWSSB Auditorium, 4th floor	**Reporter Name**	Mr.Yoshihiro Kirishima
Attendees	Stakeholders (list attached) : 125 persons		

Documents

- Meeting Notice
- Meeting Agenda
- Short Write-up on the Project
- Project Presentation

Topics	Actions / Decisions
1. **Meeting Opening**	● Hon'ble Chairman, BWSSB inagurated the conference and welcomed all the participants and provided a brief background of the project.
2. **Explanation of the Project**	● Presentation on the Project was given by Dr. Ravindra, CE(K), BWSSB
3. **Clarification & recommendation on proposed project**	● Following recommendations are stated from the stakeholders. (1) Karnataka State Pollution Control Board (KSPCB): • It was suggested to explore the possibility of setting up of STP's with Private Partnership like Factories, Golf Courses etc in the BBMP area. This is mainly due to non availability of land issues. • Care should be taken that untreated sewage is not diverted into nalas / Storm Water Drains • KSPCB informed that all possible support will be extended for the project (2) Bangalore Development Authority (BDA) – Represented by Chief Engineer • It was conveyed that BDA will extend all assistance for smooth implementation of the Project. (3) Corporator, Ward No 196 (110 villages), Mr K Somashekhar • Welcomed the decision to take up the project • Sanitary problem to be attended on priority • All the road restoration works during project implementation to be taken up on priority. • Better coordination is required between Public and Government Departments (4) Corporator, Ward No 1 (110 Villages), Ms Chandramma • Welcomed the decision to take up the project • Piped water Supply to be provided on priority

	• The present water supply is from Bore wells which are not reliable and frequenty under repair. (5) Corporator, Ward No 192 (110 Villages), Mr. Anjanappa • Welcomed the decision to take up the project • Water problem to be attended on priority • Actual start of the works to be intimated in advance (6) Corporator, Ward No 14 (110 villaged), Mr Narasimha Naidu • Water supply to be provided on priority. Requested to speed up the project implementation as the borewells are all drying up fast. • Coordination with all departments are required for smooth project implementation • Corodination meeting with all the coorporators, MLA's during project implementation • Borewell maintenance to be taken up on priority • It was requested for arranging a visit to the Water Works facility of BWSSB for the Corporators so that they get proper exposure and hence can explain the public accordingly. (7) Corporator, Ward No 197 (110 villages), Ms Shobha Narayan • Welcomed the decision to take up the project as 60% of the area in 110 villages area is having no water. • Pro Rata charges to be collection by disconnection of the sewerage connections. • Sanitary issues to be resolved (8) Corporator, Ward No 85 (110 villages) • Welcomed the decision to take up the project. • The project implementation to be expedited (9) Corporator, Ward No 26 (110 villages), Ramamurthy Nagar • Welcomed the decision to take up the project. • The project implementation to be expedited ● Protection of Vulnerable groups in society BWSSB indicated that special provisions will be made for improving the water supply and sanitation facilties for the vulnerable groups in the society (slum dewellers etc). ● Notice methods on the project, cooperation and undertakings by beneficiaries Internet and newspaper will be used and report periodically every month initially and then every quarterly. ● Plan for the succeeding meeting. As suggested a Coordination Meeting will be taken up on monthly basis during the project implementation period.
4. Closing Remarks	● Closing remarks was given by Mr Kemparamaiah, Engineering Chief, BWSSB
5. Vote of Thanks	● Vote of Thanks was given by Mr Rajiv K N, EE (K-1), BWSSB

Meeting Program

Time schedule	In charge
10:45 - 11:00 Tea	
11:00 Opening Remarks	Hon'ble Chairman, BWSSB
11:30 - 12:00 Explanation of the Project	Dr. Ravindra (CE-K, BWSSB)
12:00 -13:00 Discussion	All Stakeholders
13:15 Closing Remarks	Mr Kemparamaiah (EIC, BWSSB)
13:25 Vote of Thanks	Mr Rajiv K N (EE-K1, BWSSB)
13:30 - 14:30 Lunch	

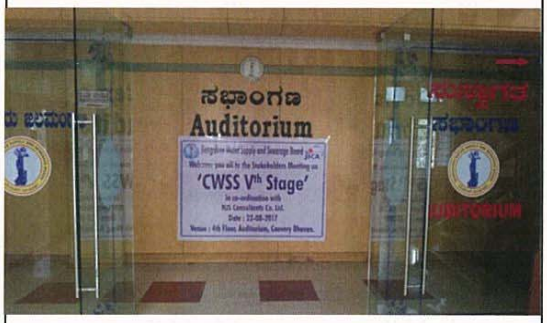


Photo Title	Venue: Auditorium & Welcome Board
Description	Welcome Board in front of Autitorium
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Set of Documents
Description	Distribution Documents and Materials
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

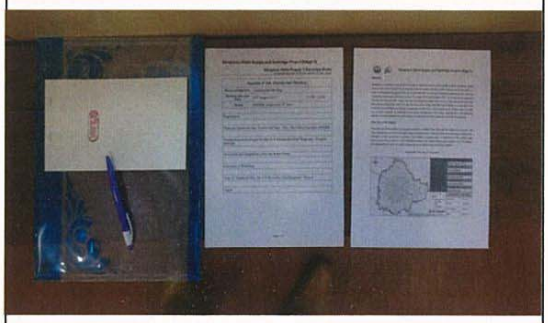


Photo Title	Set of Documents etc.
Description	Distribution Documents and Materials (inside the clear file)
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Reception
Description	Attendants list was filled at the reception
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Paticipants
Description	126 paticipants including BWSSB staff
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Paticipants
Description	126 paticipants including BWSSB staff (Before starting the meeting)
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Opening by BWSSB Chairman
Description	Chairman, BWSSB inagurated the conference and welcomed all
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Explanation of the Project
Description	Explanation (PPT) was given by Dr. Ravindra, Chief Engineer (Kaveri), BWSSB
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

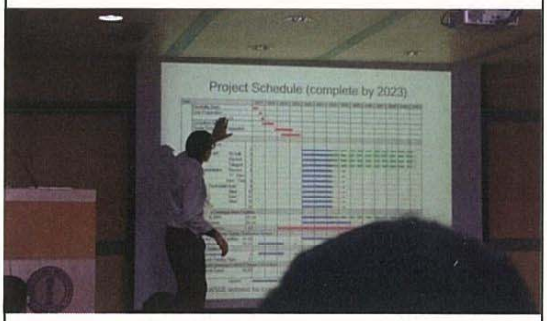


Photo Title	Explanation of the Project
Description	Explanation (PPT) was given by Dr. Ravindra, Chief Engineer (Kaveri), BWSSB
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

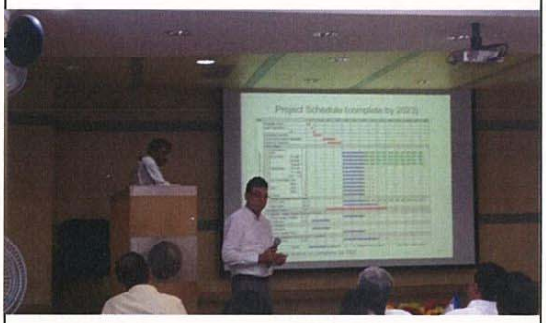


Photo Title	Explanation of the Project
Description	Additional Explanation given by Chairman, BWSSB
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Paticipants
Description	126 paticipants including BWSSB staff (During the meeting)
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Photo Title	Question from the Stakeholder
Description	Discussion, question-and-answer session after the presentation
Venue	Auditorium 4th Floor, BWSSB
Date Taken	2017/Aug/22 (Tue)

Supporting Report 15.7.1

Draft TOR for Consulting Services

Terms of Reference (TOR) of the consultancy services

1. Background and Objectives of the Project

(1) Background

Bengaluru, the capital city of Karnataka State with 8,500 thousand population in 2011 is one of the fastest developing Metropolitan cities in India. Bengaluru is an industrial center of South India and is a center for research institutions and high-tech electronic houses. The population of Metro Bengaluru in 2024 are projected to be beyond 11 million with required water demand of 2,355 MLD. However, present water supply for the area is limited to 1,400 MLD. The ever-increasing water demand needs augmentation/improvement of water supply and sewerage services.

Under these conditions, Government of India decided to provide water supply and sewerage facilities for the urban population in its 12th Five Year Plan (from April 2012 to March 2017). The plan policy emphasizes on the water saving through the reduction of unaccounted for water (UFW) and the recycle/ re-use of treated sewage considering limited water sources available.

The Government of India through Bangalore Water Supply and Sewerage Board (hereinafter referred to as BWSSB) utilizing Japanese Government ODA loan proposed “Bengaluru Water Supply and Sewerage Project” in March 2016. In this connection, BWSSB, responsible for implementation of the Project and O&M of the water supply and sewerage facilities, prepared some “Detailed Project Reports (DPR)” to confirm the Project feasibility.

After a series of discussions on the scope and implementation arrangements of the Preparatory Survey between the Japanese and Indian sides, M/M (Minutes of Meetings) was exchanged in March 7th, 2016 to start “the Preparatory Survey on the Bengaluru water Supply and Sewerage Project, Phase III. Then, the survey work for the Project commenced in May 25th, 2016.

(2) Objectives of the Project

The objective of the Project is to provide residents in BBMP (Bruhat Bengaluru Mahanagara Palike) area with safe and stable water supply, and sewerage facilities to meet increasing water demand. The Project is expected to improve sanitary environment in BBMP area and contribute to the promotion of industry.

(3) Location of the Project

The Project area covers the jurisdiction of BWSSB (Bangalore Water Supply and Sewerage Board) for

water supply and sewerage services, located in the State of Karnataka, as shown in Attachment 1, including core area, 8 ULBs and 110 Villages as shown in Table 1.

Table 1 : The project area

Core Area	245 km^2
8 ULBs (Yelahanka, K.R. Puram, Mahadevpura, Bommanahalli, R.R. Nagar, Kengeri, Dasarahalli, Byatrayanapura)	330 km^2
110 Villages	225 km^2

2. Outline of the Project

(1) Construction Items

The component of the Project is shown in Attachment 2. The contractors' work for CP-2 to CP-5 for water supply and CP-25 to CP-29 for sewerage will include O&M of facilities for seven years after construction/installation of the facilities.

(2) Procurement packages and procedure

Local Competitive Bidding (LCB) will be applied for CP-1 and CP-14 to CP-23 for water supply and CP-35 to CP-39 for sewerage. On the other hand International Competitive Bidding (ICB) based on Single-Stage Two-Envelope Bidding Procedure with Pre-qualification (P/Q) in compliance with the JICA's Procurement Guideline (Section 2.03, Part II) will be employed for other packages.

Table 2: Procurement Package and Procedure of the Project

Package	Procurement procedure
CP-1 and CP-14 to CP-23	Local Competitive Bidding (LCB). Out of Consulting Service
CP-30 to CP-39	Local Competitive Bidding (LCB). With Consulting Service
CP-2 to CP-5 and CP-25 to CP-29	International Competitive Bid (ICB) with P/Q Single-Stage Two-Envelope Design-Build-Operation (DBO) contract 7 years of O&M after the commissioning JICA's Standard Bidding Document "Design-Build"* *It is noted that the general conditions of the contract shall be prepared using the FIDIC Gold book (Edition 2008)
CP-24	International Competitive Bid (ICB) with P/Q Single-Stage Two-Envelope Design-Build (DB) contract JICA's Standard Bidding Document "Design-Build"*
Others	International Competitive Bid (ICB) with P/Q Single-Stage Two-Envelope Design-Bid-Build contract JICA's Standard Bidding Document "Works"

(3) Funding Source

Funding sources of the Project, including that for the Services, are both Japanese ODA Loan and Government of Karnataka (GoK) own budget.

- CP-2 to CP-10, CP-12 to CP-13 and CP-24 to CP-34 are funded by Japanese ODA Loan
- CP-1, CP-11, CP-14 to CP-23 and CP 35 to CP-39 are funded by GoK own budget/BCC fund
- Consulting Service for all packages excluding CP-1 and CP-19 to CP-23 is funded by Japanese ODA Loan

(4) Executing Agency

The Executing Agency / Implementing Agency of the project is BWSSB.

(5) Technical Information

The final report on the "Preparatory Survey on Bengaluru Water Supply and Sewerage Project Phase 3 as well as the results of topographical surveys, raw water quality and wastewater quality analysis, test pit surveys at the water supply and sewerage facility sites are available at BWSSB.

3. Objective of the Consulting Service

The consulting services shall be provided by an international consulting firm (hereinafter referred to as "the Consultant") in association with national consultants in compliance with Guidelines for the Employment of Consultants under Japanese ODA Loans (April 2012). The objective of the consulting services is to achieve the efficient and proper preparation and implementation of the Project through the following works:

- Conceptual design for DB / DBO packages
- Detailed design
- Bid document preparation
- Tender assistance
- Construction supervision for DB and DBO contract packages
- Construction supervision including defect notification period for other contract packages
- Facilitation of Implementation of Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP) and Resettlement Action Plan (RAP)
- Management assistance for the construction of all components of the project including supervision during the defect liability period
- NRW reduction management and technology transfer
- Water saving campaign
- Development of recycle and reuse program based on demand assessment and reuse need for effective implementation.
- Facilitation of a platform to discuss surface water pollution abatement in Bengaluru

4. Scope of the Consulting Service

The Consultant shall carry out the Consulting Services through the following work items:

(1) Conceptual Design for DBO packages

The conceptual design will include the following works:

a) Review of the technical information on the Project and recommend modifications with justifications, if necessary;

b) Implementation of the land availability survey, soil condition survey and traffic impact survey for conceptual design, as applicable to the project components;

c) Implementation of the topographic survey, geotechnical surveys, raw water quality analysis, wastewater quality analysis and other related engineering survey, which will be provided as a part of the tender document, as applicable to the project components;

d) Conceptual design of the DBO contract packages;

e) Preparation of conceptual design report, which includes a description of all the processes, general layout plan, water and material balance sheet, overall process flow diagram, and instrumentation plan;

f) Preparation of technical specifications to be included in the bid documents; and

g) Preparation of "Operation and Maintenance Requirement (including risk allocation, payment method, monitoring and evaluation method etc.) to be included in the bid documents of DBO contract packages.

(2) Detailed design

The detailed design will include the following works:

a) Review of the technical information on the Project and recommend modifications with justifications, if necessary;

b) Collect and review topographic data of the BBMP;

c) Implementation of the land availability survey, soil condition survey and traffic impact survey for detailed design, as applicable to the project components;

d) Implementation of the topographic survey, geotechnical surveys and other related engineering survey for detailed design, as applicable to the project components;

e) Preparation of large sectorization plan including hydraulic analyses, namely Distribution Blocking System, for optimization of water distribution, especially for detail design of CP-14 to CP-18;

f) Hydraulic analyses of the pipelines for final determination of the pump head, countermeasure for water hammer and diameter of pipes;

g) Detailed design of all facilities including architectural, structural, civil, mechanical and electrical works;

h) Preparation of the construction plan including design of the temporary works;

i) Preparation of detailed design drawings; and

j) Preparation of technical specifications and bill of quantities to be included in the bid documents

(3) Bid document preparation

The bid document preparation will include the following works:

a) Preparation of the pre-qualification (PQ) document, complying with the following instructions:

- ✓ The technical and financial requirements for PQ shall take into account the technical feature and the magnitude of the Project;
- ✓ The PQ part shall be in accordance with the latest version of Standard Prequalification Documents under Japanese ODA Loans;
- ✓ Assistance to BWSSB in PQ announcement, addendum/corrigendum, and clarifications to the applicants' queries;
- ✓ PQ evaluation of the applicants in accordance with the criteria set forth; and
- ✓ Preparation of PQ evaluation report to be submitted to BWSSB.

b) Preparation of the Bid document, complying with the following instructions:

- ✓ For procurement of goods and services under CP 2 to 6 and 24 to 29 the latest version of "Standard Bidding Documents under Japanese ODA Loans, Procurement of Electrical and Mechanical Plant, and for Building and Engineering Works, Designed by the Contractor" will be applied, together with all relevant specifications, drawings and other documents. The general conditions of the contract shall be prepared using the FIDIC Gold book (Edition 2008), since the operation work of the DSP will be included in these packages under DBO scheme;
- ✓ For procurement of goods and services under CP7 to 18 and 30 to 39, the latest version of "Standard Bidding Documents under Japanese ODA Loans, Procurement of Works" will be applied, along with all relevant specifications, drawings, and other documents;

- ✓ Prepare bidding documents which includes i) clauses stating that the Contractor is to comply with the requirement of the Environmental Management Plan (EMP) and JICA Guidelines for environmental and social considerations (April 2010) (JICA Environmental Guidelines) and to conduct environmental monitoring following the Environmental Monitoring Plan (EMoP), ii) the specification clearly stipulating the safety requirements in accordance with the laws and regulations in the country of the Borrower, relevant international standards (including guidelines of international organization), if any, and also in consideration of "the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects of JICA," iii) the requirement to furnish a safety plan to meet the safety requirements, iv) the requirement for the personnel for key positions to include an accident prevention officer, and v) the requirement to submit method statements of safety to BWSSB and the consultant at the construction stage;

(4) Tender Assistance

The Consultant shall assist BWSSB in the bid by the following works:

a) Assistance to BWSSB in tender call, addendum/corrigendum, clarifications to the bidders and conducting pre-bid conferences;

b) Evaluations of the bids in accordance with the criteria set forth in the bidding documents. In such evaluation, the Consultant shall carefully confirm that bidders' submissions in their technical proposal including, but not limited to; site organization, mobilization schedule, method statement, construction schedule, safety plan, and EMP, have been prepared in consistent with each other and meet requirements set forth in applicable laws and regulations, specifications and other parts of the bidding documents;

c) ,Preparation of bid evaluation reports for approval to be submitted to BWSSB;

d) Assistance to BWSSB in contract negotiations by preparing agenda and facilitating negotiations including preparation of minutes of negotiation meetings; and

e) Preparation of draft and final contract agreements.

(5) Construction supervision for DBO contract packages

The Consultant shall perform his duties during the construction period in accordance with the contracts to be executed between BWSSB and the contractors. In this context, the Consultant shall act as the Engineer for DB and DBO packages to execute construction supervision and contract administration services in accordance with the power and authority delegated by BWSSB. Construction supervision by the Consultant will include the following works:

a) Act as the Engineer to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by the Employer;

b) Provide assistance to the Employer concerning variations and claims that are to be ordered/issued at the initiative of the Employer. Advise the Employer on resolution of any dispute with the Contractor;

c) Issue instructions, approvals, and notices as appropriate;

d) Provide recommendation to the Employer for acceptance of the Contractor's performance security, advance payment security and required insurances;

e) Provide commencement order to the Contractor;

f) Assess adequacy of all inputs such as materials, labor, and equipment provided by the Contractor;

g) Check and approve the Contractor's method of work, including site organization, program of performance, quality assurance system, safety plan, method statements of safety, and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;

h) Regularly monitor physical and financial progress and take appropriate action to expedite progress, if necessary, so that the time for completion set forth in the contract will be duly respected by the Contractor;

i) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions;

j) Review and approve the Contractor's design for the works to be constructed, working drawings, shop drawings and drawings for temporary works;

k) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;

l) Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the contract;

m) Organize, as necessary, management meetings with the Contractor to review the arrangements for future work. Prepare and deliver minutes of such meetings to the Employer and the Contractor;

n) Supervise the works so that all the contractual requirements are met by the Contractor, including those in relation to i) quality of the works, ii) safety, and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractor is duly assigned at the project site. Require the contractors to take appropriate remedies if any questions are recognized regarding the safety measures;

o) Supervise field tests, sampling, and laboratory test to be carried out by the Contractor;

p) Inspect the construction method, equipment to be used, and workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the Employer's Requirements;

q) Verify statements submitted by the Contractor and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;

r) Coordinate the works among different contractors employed for the Project;

s) Modify the Employer's Requirements as may be necessary in accordance with the actual site conditions and issue variation orders (including necessary actions in relation to the works performed by other contractors working on other projects, if any);

t) Carry out timely reporting to the Employer for any inconsistency / causes of delay in executing the works and suggesting appropriate corrective measures to be applied;

u) Inspect, verify and fairly determine claims issued by the parties to the contract (i.e. the Employer and Contractor) in accordance with the contract;

v) Supervise the Test on Completion carried out by the Contractor and assist the Employer in carrying out the Test after Completion, if applicable;

w) Perform the inspection of the works and issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the contract,

x) Check and certify as-built drawings prepared by the Contractor; and

y) Check and certify the operation and maintenance manual prepared by the Contractor.

(6) Construction supervision including notification period for other contract packages

The Consultant shall perform his duties during the construction period in accordance with the contracts to be executed between BWSSB and the contractors. In this context, the Consultant shall act as the Engineer for other packages to execute construction supervision and contract administration services in accordance with the power and authority delegated by BWSSB. Construction supervision by the Consultant will include the following works:

a) Act as the Engineer to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by the Employer;

b) Provide assistance to the Employer concerning variations and claims that are to be ordered/issued at the initiative of the Employer. Advise the Employer on resolution of any dispute with the Contractor;

c) Issue instructions, approvals, and notices as appropriate;

d) Provide recommendation to the Employer for acceptance of the Contractor's performance security, advance payment security and required insurances;

e) Provide commencement order to the Contractor;

f) Assess adequacy of all inputs such as materials, labor, and equipment provided by the Contractor;

g) Check and approve the Contractor's method of work, including site organization, program of performance, quality assurance system, safety plan, method statements of safety, and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;

h) Regularly monitor physical and financial progress and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected by the Contractor;

i) Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions. Issue further drawings and give instructions to the Contractor for any works that may not be sufficiently detailed in the contract documents, if any;

j) Review and approve the Contractor's working drawings, shop drawings, and drawings for temporary works. Also review and approve, if any, designs prepared by the Contractor for any part of the permanent works;

k) Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;

l) Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines, and levels of reference specified in the contract;

m) Organize, as necessary, management meetings with the Contractor to review the arrangements for future work. Prepare and deliver minutes of such meetings to the Employer and the Contractor;

n) Supervise the works so that all the contractual requirements are met by the Contractor, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractor is duly assigned at the project site. Require the contractors to take appropriate remedies if any questions are recognized regarding the safety measures;

o) Supervise field tests, sampling, and laboratory test to be carried out by the Contractor;

p) Inspect the construction method, equipment to be used, and workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the specifications;

q) Survey and measure the work output performed by the Contractor. Assist the Employer to verify statements submitted by the Contractor and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;

r) Coordinate the works among different contractors employed for the Project;

s) Modify the designs, technical specifications and drawings, relevant calculations and cost estimates as may be necessary in accordance with the actual site conditions, and issue variation orders (including necessary actions in relation to the works performed by other contractors working on other projects, if any);

t) Carry out timely reporting to the Employer for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;

u) Inspect, verify, and provide recommendation to the Employer concerning claims issued by the parties to the contract (i.e. the Employer and Contractor) in accordance with the civil works contract;

v) Perform the inspection of the works and issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the contract;

w) Supervise commissioning and carry out tests during the commissioning, if applicable;

x) Provide periodic and/or continuous inspection services during defects notification period, and if any defects are noted, instruct the Contractor to rectify;

y) Check and certify as-built drawings; and

z) Check and certify an operation and maintenance manual for the works constructed in the Project.

(7) Facilitation of Implementation of Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP) and Resettlement Action Plan (RAP)

The Consultant shall assist BWSSB in the environmental management and monitoring through the following works:

a) Review and update EMP according to the actual site conditions, designs, technical specifications and contract documents;

b) Review and update EMoP according to the updated EMP;

c) During the preparation of bidding documents, clearly identify environmental responsibilities as explained in the EIA, Final Report of Preparatory Survey and EMP;

d) Assist BWSSB to review the Construction Contractor's Environmental Program to be prepared by the contractor in accordance with EMP, relevant plans and JICA Environmental Guidelines and to make recommendations to BWSSB regarding any necessary amendments for its approval

e) Supervision of EMP implementation and implementation of regular compliance monitoring according to EMoP to ensure that the construction works are implemented in accordance with the EMP;

f) Assist BWSSB to implement the measures identified in the EMP

g) Monitor the effectiveness of EMP and negative impacts on environment caused by the construction works and provide technical advice, including a feasible solution, so that BWSSB can improve situation when necessary;

h) Assist BWSSB in monitoring the compliance with conditions stated in the environmental permit certifications and the requirements under EMP and JICA Environmental Guidelines;

i) Assist BWSSB in preparation of the answer to the request from JICA's advisory committee for environmental and social considerations if necessary; and

j) Assistance to BWSSB in the capacity building of BWSSB staff on environmental management through on-the-job training so that the EMoP would be carried out appropriately in the O&M of the seawater desalination plant.

(8) Management assistance for the construction of all components of the project including supervision during the defect liability period

The Consultants shall provide technical assistance and training for the PIU members in the field from design stage to O&M stage. Required control items for the project implementation shall include schedule, quality of facilities and risk avoidance.

The Consultant shall provide the opportunity to the BWSSB officers and staff to be involved in the working team of the Consultant during the design, contract administration and supervision works for their capacity building wherever possible. If requested by BWSSB, the Consultant shall brief and demonstrate the survey and design procedure, the construction supervision and contract management process and procedures. The consultant shall assist BWSSB and its staff to build their capacity as a part of on the job training under the Project.

(9) NRW Deduction Management

The consultants shall assist existing organization established in the BWSSB to promote the reduction of UFW. The management required with reference to field staff shall be studied to reflect in the systematic arrangements including tariff collection. Aside from management improvement,

at least one team for field work shall be established by BWSSB and they shall be trained by Japanese expert team.

(10) Water saving campaign

The Consultant shall assist BWSSB to carry out the campaign for the saving of water. During the campaign, community meeting shall be conducted from administrative chief level to common people level to cover larger areas in the BBMP. Implementation plan for the meeting shall be prepared in the initial stage of consulting services and the meetings shall be implemented periodically in the two years during project implementation period.

(11) Development of recycle and reuse program based on demand assessment and reuse need for effective implementation.

The proposed recycle and reuse program task will be conducted to achieve the following specific objectives:

a) Identify impact of water demands based on currently planned water supply projects;

b) Develop and analyze zonal water supply and demand for the entire PMC areas to be served by the water utilities in the future;

c) Conduct a GAP analysis – Demand and Supply and prepare a survey of potential consumers of recycle water.

d) Prepare and conduct a willingness survey for use of recycled water based on end use application – such as agriculture, construction industry, horticulture, washing etc.

e) Assessment of "what if" scenarios for dynamic streamlining of the reuse water supply to identify projects for the medium term and long term; and

f) Development and Prioritization of reuse potential projects for their future service areas.

(12) Facilitation of a platform to discuss surface water pollution abatement in Bengaluru

The Consultants shall assist BWSSB to facilitate a platform to discuss surface water pollution abatement in Bengaluru through the following works:

a) Hold a seminar where the stakeholders, encountering the water pollution problem, such as pollution dischargers, regulators and/or surface water users can understand and discuss the causes and the effects of pollution; and

b) Arrange inputs of successful experiences on wastewater discharge regulations such as administrative system and monitoring technologies to the seminar stipulated in item a).

(13) Promotion of the construction of sewerage house connections

The Consultants shall assist BWSSB to promote the construction of sewerage house connections through the following works:

a) Hold information sessions where target residents and business establishments for sewerage services easily understand the sewerage system and the importance of the house connections; and
b) Make and distribute visual materials to help target residents and business establishments for sewerage services to understand the sewerage system and the importance of the house connections.

5. Expected Time Schedule

The total duration of consulting services will be 87 months including defects notification period. The implementation schedule expected is as shown in Table 3.

Table 3: Implementation Schedule Expected

Key Activities	Date	Duration in Months	Duration from the start, Months
Commencement of Consulting Services	October 2018	-	-
Completion of Detailed Design	October 2018 to March 2020	18	18
Tender process including Pre-Qualification	January 2019 to February 2020	14	32
Construction Works	January 2021 to December 2024	48	80
Completion of the Const. Works	December 2024	-	-
Defect Notification Period	January 2025 to December 2025	12	12
Completion of Consulting Services	31 December 2025		87.5

6. Staffing

(1) Staffing and Consulting Input

It is proposed that 9 Professional (A) consultants (Foreign Persons) and 58 Professional (B) consultants (Local Persons) will be engaged for a total of 678 man-months (MM) and 2,233 MM, respectively. Total consulting input is 2,911 MM. In addition to the consultants, supporting staff such as secretaries, CAD operators, GIS operators, office keepers, and inspectors will be necessary, and the total input is estimated at 2,036 MM.

(2) Basic professional requirements of key expert

The qualification of Key Experts is shown in Table 4.

Table 4 : Qualification of Key Experts

Designation	Qualifications
Key International Staff	
Team Leader – Design (Overall management –	Should have at least 20 years' experience in urban water supply and wastewater / sewerage related projects. Should have degree in Civil / Mechanical / Electrical / Chemical

Designation	Qualifications
Design period)	engineering. He should be well versed with e-governance procedures and handled coordination of a project with similar size. Should have handled at least one comprehensive urban water supply and/or wastewater/sewerage project with capacity of 250MLD involving planning, design, detailed engineering, pre-qualification and Bid document development and contract award. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
TL - Construction Management (Overall management – Construction Period)	Should have at least 20 years' experience in urban water supply and wastewater / sewerage related projects. Should have degree in Civil / Mechanical / Electrical / Chemical engineering. He should we well versed with e-governance procedures and handled coordination of a project with similar size. Should have handled at least one comprehensive urban water supply and/or wastewater/sewerage project with capacity of 250MLD during construction phase and commissioning including Defect Liability Period. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Senior Resident Engineer – Water Treatment, pumping and transmission (Overall responsibility of the conveyance, water treatment, and transmission at construction stage)	Should have at least 15 years' experience in urban water supply related projects. Should have degree in Civil / Mechanical / Electrical / Chemical engineering. Should have handled at least one comprehensive urban water supply project with capacity of 250MLD during planning, detailed engineering, construction phase and commissioning including Defect Liability Period. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Senior Resident Engineer – Sewage Conveyance and Sewage Treatment (Overall responsibility of the sewage conveyance and treatment at construction stage)	Should have at least 15 years' experience in urban water supply related projects. Should have degree in Civil / Mechanical / Electrical / Chemical engineering. Should have handled at least one comprehensive urban sewerage and treatment project with combined capacity of 250MLD during planning, detailed engineering, construction phase and commissioning including Defect Liability Period. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Senior Design Engineer (Hydraulics Transmission)	Should be at least bachelor's degree in Civil / Mechanical Electrical / Environmental Engineering with 12 years overall experience, with at least 10 years relevant experience in water transmission hydraulics including modelling, in Water GEMS or equivalent including water hammer. He should be well versed with pumped conveyance system for minimum total head of 100m design of water system. He should be familiar with English Language. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Senior Design Engineer (Sewage Hydraulics)	Should be at least bachelor's degree in Civil / Mechanical Electrical / Environmental Engineering with 12 years overall experience, with at least 10 years relevant experience in sewers and pumping stations including modelling, in Sewer GEMS or equivalent. He should be well versed with sewage conveyance system for minimum total capacity of 100MLD. He should be familiar with English Language. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Senior Design Engineer (Water Supply / Water Treatment Plant)	Should be at least bachelor's degree in Civil / Mechanical Electrical / Chemical Environmental Engineering with 20 years overall experience, with at least 10 years relevant experience in water pumping stations and water treatment plants. He should be familiar with English Language. Should have handled at least one comprehensive urban water supply project involving detailed design, construction supervision and project management consultancy for a project with capacity of 250MLD. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Senior Design Engineer (ISPS / STP)	Should be at least bachelor's degree in Civil / Mechanical Electrical / Chemical Environmental Engineering with 20 years overall experience, with at least 10 years relevant experience in sewage conveyance and sewage treatment. He should be familiar with English Language. Should have handled at least one comprehensive urban sewerage project involving detailed design and construction supervision. Should have handled at

Designation	Qualifications
	least one Japanese ODA Loan project. Experience in India preferred
Senior Design Engineer (Electrical and Instrumental Control and Automation)	Should be at least bachelor's degree in Electrical / Instrumentation Control and Automation with 20 years overall experience, with at least 10 years relevant experience in water supply transmission and sewerage, pumping and treatment. He should be familiar with English Language. Should have handled at least one comprehensive urban water supply / sewerage project involving detailed design, construction supervision and project management consultancy with a total capacity of 100MLD. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Senior Design Engineer (Mechanical)	Should be at least bachelor's degree in Electrical / Instrumentation Control and Automation with 20 years overall experience, with at least 10 years relevant experience in water supply transmission and sewerage, pumping and treatment. He should be familiar with English Language. Should have handled at least one comprehensive urban water supply project / sewerage involving detailed design, construction supervision and project management consultancy. Should have handled at least one Japanese ODA Loan project. Experience in India preferred
Key National Staff	
DTL (Sewerage, ISPS and STPs)	Should have at least 20 years' experience in urban water supply and wastewater / sewerage related projects. Should have degree in Civil / Mechanical engineering. Should have handled at least one comprehensive urban sewerage / Sewage Treatment project comprising of sewers, sewage pumping stations and sewage treatment plants having area greater than 100sqkm including process design, detailed design, construction supervision, monitoring and commissioning of sewerage project including project management consultancy. Should have handled at least one Japanese ODA Loan project.
DTL (Water Conveyance, WTP, Water Pumping Station and Transmission)	Should have at least 20 years' experience in urban water supply and wastewater / sewerage related projects. Should have degree in Civil / Mechanical engineering. Should have handled at least one comprehensive urban water supply / water treatment project comprising of conveyance and transmission, pumping stations and water treatment plants with capacity of 250MLD for more including involving contract award, process, design, detailed design, construction supervision, monitoring and commissioning of sewerage project including project management consultancy. Should have handled at least one Japanese ODA Loan project.
Sr. Design Engineer (Instrumentation Control and Automation)	Should be at least bachelor's degree in Electrical / Instrumentation Control and Automation with 15 years overall experience, with at least 10 years relevant experience in Instrumentation Control and Automation in water supply transmission and sewerage, pumping and treatment. Should have completed at least 1 project in India with water treatment / pumping facility capacity of 100MLD or more involving centralized SCADA system for a city comparable to Bangalore. Should have handled at least one Japanese ODA Loan project. Should have international experience.

Consultant may propose other experts and supporting staff required to accomplish the tasks outlined in the ToR.

(3) Scope of works for the respective personnel

Detailed information on the major tasks and duties to be undertaken by Key Experts of the detailed engineering design team and the construction supervision team is summarized in Table 5.

Table 5: Major Tasks and Duties of Key Expert

Designation	Responsibilities
International Staff	
Team Leader – Design	Pre-Construction Stage – Design and package award stage:

Designation	Responsibilities
(Overall management – Design period)	• General coordination • Supervises the Consultant's services • Review Bidding documents prepared by Contract specialist. Interact with client to provide input in particular conditions of the contract. • Assumes direct responsibility for day-to-day consulting services • Represents the Consultant's Team in all matters relating to the performance of services • Prepare monthly and quarterly progress reports • Interact and liaison with BWSSB, GOK as well as JICA.
TL - Construction Management (Overall management – Construction Period)	Construction Stage: • General coordination • Supervises the Consultant's services during Construction • Assumes direct responsibility for day-to-day consulting services and construction activities on all the packages – • Coordinate with client and contractors for each package • Assist client in resolving construction issues as well as review and assist client in preparing progress charts for financial as well as construction activities. • Interact and liaison with BWSSB, GOK as well as JICA.
Senior Resident Engineer – Water Treatment, pumping and transmission (Overall responsibility of the conveyance, water treatment, and transmission at construction stage)	Pre-Construction Stage – Design stage • Review existing designs and specifications as prepared in study report and DPR • Prepare basis of design for all the Water Conveyance / Water Transmission WTP / WPS packages • Prepare PQ documents and provide detailed evaluation of PQ and bidder submittals. • Prepare Bid document for each package considering selected basis of design and client requirements • Prepare cost estimates for comparative Assessment. • Assist client in technical evaluation of bids and making recommendations on selection of contractor for each package. • Direct local engineers attending the designs • Review and make recommendations to STP designs submitted by contractors. • Prepare the basic design of civil structures for the WTP / STP / GLRs packages including WPS / ISPS • Prepare Bill of Quantities for sewerage and WTP / WPS / STP / ISPS work • Direct the local civil engineers attending the designs of civil works for the WTP/ STPs as well as WPS / ISPS facilities • Prepare Specifications works • Supervise process review during construction • Providing assessment and input during operation and maintenance – during Defect liability period. • Review and contractors' proposed O&M supervision work program and training programs for Distribution Control System • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training • Monitor and assess the effect of training and instruct any improvement of training services if necessary
Senior Resident Engineer – Sewage Conveyance and Sewage Treatment (Overall responsibility of the sewage conveyance and treatment at construction stage)	Pre-Construction Stage – Design stage • Review existing designs and specifications as prepared in study report and DPR • Prepare basis of design for all the Sewage Conveyance / ISPS / STP packages • Prepare PQ documents and provide detailed evaluation of PQ and bidder submittals. • Prepare Bid document for each package considering selected basis of design and client requirements • Prepare cost estimates for comparative Assessment. • Assist client in technical evaluation of bids and making recommendations on selection of contractor for each package.

Designation	Responsibilities
	• Direct local engineers attending the designs • Review and make recommendations to STP designs submitted by contractors. • Prepare the basic design of civil structures for the WTP / STP / GLRs packages including WPS / ISPS • Prepare Bill of Quantities for sewerage and WTP / WPS / STP / ISPS work • Direct the local civil engineers attending the designs of civil works for the WTP/ STPs as well as WPS / ISPS facilities • Prepare Specifications works • Supervise process review during construction • Providing assessment and input during operation and maintenance – during Defect liability period. • Review and contractors' proposed O&M supervision work program and training programs for Distribution Control System • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training • Monitor and assess the effect of training and instruct any improvement of training services if necessary
Senior Design Engineer (Hydraulics Transmission)	• Pre-construction stage • Review existing designs • Prepare the basic design of civil structures for the hydraulic transmission in water conveyance and transmission packages • Direct the local civil engineers attending the designs of civil works for the Water Conveyance and transmission pipelines • Prepare hydraulic models in Water GEMS of the water transmission pipelines up to GLRs.
Senior Design Engineer (Sewage Hydraulics)	• Pre-construction stage • Review existing designs • Prepare the basic hydraulic design of civil structures for sewage conveyance packages • Direct the local civil engineers attending the designs of civil works for the sewage conveyance pipelines • Prepare hydraulic models in Sewer GEMS of the sewage conveyance pipelines up to STPs including sub-mains, mains and trunk mains network
Senior Design Engineer (Water Supply / Water Treatment Plant)	<u>Pre-Construction Stage – Design stage</u> • Review existing designs and specifications as prepared in study report and DPR • Prepare basis of design for all the WTP / WPS packages • Prepare PQ documents and provide detailed evaluation of PQ and bidder submittals. • Prepare Bid document for each package considering selected basis of design and client requirements • Prepare cost estimates for comparative Assessment. • Assist client in technical evaluation of bids and making recommendations on selection of contractor for each package. • Direct local engineers attending the designs • Review and make recommendations to WTP designs submitted by contractors. • Supervise process review during construction • Providing assessment and input during operation and maintenance – during Defect liability period. • Review and contractors' proposed O&M supervision work program and training programs for Distribution Control System • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training • Monitor and assess the effect of training and instruct any improvement of training services if necessary
Senior Design Engineer	• Review existing designs and specifications as prepared in study report and DPR

Designation	Responsibilities
(ISPS / STP)	• Prepare basis of design for all the STP / ISPS packages • Prepare PQ documents and provide detailed evaluation of PQ and bidder submittals. • Prepare Bid document for each package considering selected basis of design and client requirements • Prepare cost estimates for comparative Assessment. • Assist client in technical evaluation of bids and making recommendations on selection of contractor for each package. • Direct local engineers attending the designs • Review and make recommendations to STP designs submitted by contractors. • Supervise process review during construction • Providing assessment and input during operation and maintenance – during Defect liability period. • Review and contractors' proposed O&M supervision work program and training programs • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training] • Monitor and assess the effect of training and instruct any improvement of training services if necessary
Senior Design Engineer (Electrical and Instrumental Control and Automation)	<u>Pre-construction stage</u> • Review existing designs • Prepare the basic design of electrical equipment, SCADA and I&C for the WTP / STPs including WPS / ISPS facilities • Direct the local electrical engineers attending the designs electrical, SCADA, I&C of the WTP / STP and WPS / ISPS facilities • Prepare Specifications for electrical works • Prepare Bill of Quantities for electrical works • Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of electrical equipment • Attend the factory inspection together with BWSSB engineer, if requested • Attend the trial operation of mechanical equipment
Senior Design Engineer (Mechanical)	<u>Pre-construction stage</u> • Review existing designs • Prepare the basic design of mechanical equipment for the WTP / STP packages including WPS and ISPS • Direct the local mechanical engineers attending the designs of mechanical works for the WTP / STPs as well as WPS / ISPS facilities • Prepare Specifications for mechanical works • Prepare Bill of Quantities for mechanical works • Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of mechanical equipment • Attend the factory inspection together with PMC's engineer, if requested Attend the trial operation of mechanical equipment
Project Director Review (Overall review of the project and liaison with higher levels of JICA and BWSSB)	<u>Pre-Construction Stage – Design and package award stage:</u> • General coordination • Occasional Interact and liaison with BWSSB, GOK as well as JICA. • Assist client in resolving construction issues as well as review and assist client in preparing progress charts for financial as well as construction activities.
DTL (Sewerage, ISPS and STPs)	• Assist Team Leader in carrying out all tasks and duties of Team Leader • Represent the Consultant's team during absence of the Team Leader • Perform specific issues/aspects delegated by Team Leader in Sewage conveyance,

Designation	Responsibilities
	pumping and sewage treatment plants
DTL (Water Conveyance, WTP, Water Pumping Station and Transmission)	• Assist Team Leader in carrying out all tasks and duties of Team Leader • Represent the Consultant's team during absence of the Team Leader • Perform specific issues/aspects delegated by Team Leader in Water conveyance, pumping and water treatment plants
Sr. Design Engineer (Water Hydraulics)	• Assist the Sr. Design Engineer – International • Pre-construction stage • Review existing designs • Prepare the basic design of civil structures for the hydraulic transmission in water conveyance and transmission packages • Direct the local civil engineers attending the designs of civil works for the Water Conveyance and transmission pipelines • Prepare hydraulic models in Water GEMS of the water transmission pipelines up to GLRs.
Sr. Design Engineer (Water Treatment Plant)	• Assist the Sr. Design Engineer – International • Review existing designs and specifications as prepared in study report and DPR • Prepare basis of design for all the WTP / WPS packages • Prepare PQ documents and provide detailed evaluation of PQ and bidder submittals. • Prepare Bid document for each package considering selected basis of design and client requirements • Prepare cost estimates for comparative Assessment. • Assist client in technical evaluation of bids and making recommendations on selection of contractor for each package. • Direct local engineers attending the designs • Review and make recommendations to WTP designs submitted by contractors. • Supervise process review during construction • Providing assessment and input during operation and maintenance – during Defect liability period. • Review and contractors' proposed O&M supervision work program and training programs for Distribution Control System • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training • Monitor and assess the effect of training and instruct any improvement of training services if necessary
Sr. Design Engineer (Sewage Treatment Plants)	• Assist the Sr. Design Engineer – International • Review existing designs and specifications as prepared in study report and DPR • Prepare basis of design for all the STP / ISPS packages • Prepare PQ documents and provide detailed evaluation of PQ and bidder submittals. • Prepare Bid document for each package considering selected basis of design and client requirements • Prepare cost estimates for comparative Assessment. • Assist client in technical evaluation of bids and making recommendations on selection of contractor for each package. • Direct local engineers attending the designs • Review and make recommendations to STP designs submitted by contractors. • Supervise process review during construction • Providing assessment and input during operation and maintenance – during Defect liability period. • Review and contractors' proposed O&M supervision work program and training programs • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training • Monitor and assess the effect of training and instruct any improvement of training services if necessary

Designation	Responsibilities
Sr. Design Engineer (Sewerage Hydraulics)	• Assist the Sr. Design Engineer – International • Pre-construction stage • Review existing designs • Prepare the basic hydraulic design of civil structures in sewage conveyance packages • Direct the local civil engineers attending the designs of civil works for the sewage conveyance pipelines • Prepare hydraulic models in Sewer GEMS of the sewage conveyance pipelines up to STPs including sub-mains, mains and trunk mains network
Sr. Design Engineer (Mechanical)	• Assist the Senior Design Engineer - International • Review existing designs • Prepare the basic design of mechanical equipment for the WTP / STP packages including WPS and ISPS • Direct the local mechanical engineers attending the designs of mechanical works for the WTP / STPs as well as WPS / ISPS facilities • Prepare Specifications for mechanical works • Prepare Bill of Quantities for mechanical works • Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of mechanical equipment • Attend the factory inspection together with PMC's engineer, if requested • Attend the trial operation of mechanical equipment
Sr. Design Engineer (Electrical)	• Assist the Senior Design Engineer - International • Review existing designs • Prepare the basic design of electrical equipment, SCADA and I&C for the WTP / STPs including WPS / ISPS facilities • Direct the local electrical engineers attending the electrical designs of the WTP / STP and WPS / ISPS facilities • Prepare Specifications for electrical works • Prepare Bill of Quantities for electrical works • Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of electrical equipment • Attend the factory inspection together with BWSSB engineer, if requested • Attend the trial operation of mechanical equipment
Sr. Design Engineer (Instrumentation Control and Automation)	• Assist the Senior Design Engineer - International • Review existing designs • Prepare the basic design of SCADA and I&C for the WTP / STPs including WPS / ISPS facilities • Direct the ICA engineers under him attending the designs- SCADA, I&C of the WTP / STP and WPS / ISPS facilities • Prepare Specifications for instrumentation / SCADA works • Prepare Bill of Quantities for instrumentation / SCADA works • Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of electrical equipment • Attend the factory inspection together with BWSSB engineer, if requested • Attend the trial operation of mechanical equipment
Sr. Design Engineer (Structural)	• Assist the Senior Design Engineer - International • Review existing designs • Prepare the basic design of SCADA and I&C for the WTP / STPs including WPS / ISPS facilities

Designation	**Responsibilities**
	• Direct the ICA under him engineers attending the designs- SCADA, I&C of the WTP / STP and WPS / ISPS facilities • Prepare Specifications for structural works • Prepare Bill of Quantities for structural works • Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of electrical equipment • Attend the factory inspection together with BWSSB engineer, if requested Attend the trial operation of mechanical equipment
Construction Supervision Staff	
Procurement Engineer (All Components)	
Senior. Resident Engineer (Water)	• Assist the Senior Design Engineer – International and national • Check the drawings submitted by the contractors • Assess the substitution proposed by the contractors • Supervise the work of water supply component • Attend the factory inspection together with BWSSB engineer, if requested
Senior. Resident Engineer (Sewerage Component)	• Assist the Senior Design Engineer - International • Check the drawings submitted by the contractors • Assess the substitution proposed by the contractors • Supervise the work of sewerage component • Attend the factory inspection together with BWSSB engineer, if requested
Contract Engineer (All Components)	• Assist the Team Leader • Check the drawings submitted by the contractors • Assess the substitution proposed by the contractors • Supervise the work of sewerage component Attend the factory inspection together with BWSSB engineer, if requested
HRD and Institutional	

7. Reporting

Within the scope of consulting services, the Consultant shall prepare and submit reports and documents to Project Director/ Project Manager in charge in BWSSB as shown in Table 6. The Consultant shall provide electronic copy of each of these reports.

Table 6: Summary of Reports to be submitted

Category	Type of Report	Timing	No. of Copies
Consultancy Services	Inception Report	Within 1 month after commencement of the services	10
	Monthly Progress Report	Every month	10
	Quarterly Progress Report	Every quarter	10
	Project Completion Report	At the end of the services	10
Detailed Design	Project Definition Report	Within 3 months after commencement of the services	10
	Draft Design Report	Within 6 months after commencement of the services	10
	Cost Estimate Report	As per the Project Schedule for each Package	10
	Final Design Report	As per the Project Schedule for each Package	10
Tender Assistance	Pre-qualification Document	As per the Project Schedule for each Package	10
	Bidding Document	As per the Project Schedule for each Package	10
	Pre-qualification Evaluation	At appropriate timing	10

Category	Type of Report	Timing	No. of Copies
	Report		
	Technical Evaluation Report	At appropriate timing	10
	Price and Commercial Evaluation Report	At appropriate timing	10
Assistance in Environment Monitoring	Environmental Monitoring Report	Every quarter after commencement of the services	10
Construction Supervision	Quality Control Report	Every month	10
	Construction Completion Report	Within 3 months after completion of construction	10
Technology Transfer	O&M Manual – review comments based on Contractor's submittal and suggestions for improvements	At appropriate timing in accordance with the Inception Report	10
	Evaluation Report of Contractors' Training Services	Within 1 month after completion of training	10
Other Report	Development of Recycle and Reuse Program	Within 6 months after commencement of the services	10
	NRW Deduction Management Program	Within 1 month after commencement of the services and every year	10
	Water Saving Campaign Program	Within 1 month after commencement of the services and every year	10
	Technical Report	As required or upon request	As required

Contents to be included in each report are as follows:

For Inception Report

Inception Report: presents the methodologies, schedule, organization, etc.

For Monthly and Quarterly Progress Report

Monthly Progress Report: describes briefly and concisely all activities and progress for the previous month by the 10th day of each month. Problems encountered or anticipated will be clearly stated, together with actions to be taken or recommendations on remedial measures for correction. Also indicates the work to be performed during the coming month.

Quarterly Progress Report: presents the progress status of the Project.

For Detailed Design

Project Definition Report: presents the design criteria and standards.

Draft Design Report: presents detailed engineering design as well as 30% designs for WTP/ WPS / STPs /ISPS.

Cost Estimate Report: presents detailed cost estimate.

Final Design Report: presents final documents of detailed design and cost estimate and bid plan through

the incorporation of comments on the Draft Design Report provided by the Consultant.

For Tender Assistance

Pre-qualification Document: presents the pre-qualification documents and its evaluation criteria.

Bidding Document: presents the bidding documents and bid evaluation criteria.

Pre-qualification Evaluation Report: presents the results of the evaluation with recommendation on the selection of the qualified applicants.

Technical Evaluation Report: presents the results of technical evaluation with recommendation on technically responsive bidders.

Price and Commercial Evaluation Report: presents the results of the tenders with recommendation on the successful bidder for award of contract.

For Construction Supervision

Quarterly Progress Report: presents the progress status of the Project.

Construction Completion Report: comprises outline of all facilities completed and construction records from the commencement through completion, together with key data and records.

For Technology Transfer

O&M Manuals: Comments on O&M Manuals submitted by Contractors and Consultants suggestions on its improvement.

Evaluation Report of Contractors' Training Services: presents the evaluation of contractors training services.

For Other Report

Development of Recycle and Reuse Program:

Summarize present practices on recycle and reuse with issues and problems. Relevant laws and regulations are also to be reviewed and recommend improvement plan.

NRW Reduction Management Program:

Analyze achieved performances on completed UFW reduction projects. Prepare plan for the improvement in NRW Reduction management and develop program for the implementation of the plan.

Water Saving Campaign Program:

Prepare plan with methodology for water saving by different water user together with community development. Required materials for information provision on water supply and sewerage services and improvement of environment will be prepared. Based on the plan, community meetings shall be carried out starting from local government staff up to residents. Strategic annual program shall be prepared to cover as much area as possible in the BBMP during consulting service period.

8. Obligation of Executing Agency

A certain range of arrangements and services will be provided by BWSSB to the Consultant for smooth implementation of the Consulting Services. In this context, PMC will:

(1) Reports and data

Make available to the Consultant existing reports and data related to the Project as required.

(2) Office space

The Consultant's requirement for office space, including necessary equipment, furniture and utilities, shall be clearly stated in the proposal with its rental cost for the case where BWSSB would be unable to provide such facilities;

(3) Cooperation and counterpart staff

Appoint counterpart officials, agent and representative as may be necessary for effective implementation of the Consulting Services. Required arrangements for Community Development shall be made timely;

(4) Assistance and exemption

Use its best efforts to ensure that the assistance and exemption, as described in the Standard Request for Proposal issued by JICA, will be provided to the Consultant, in relation to:

- work permit and such other documents;
- entry and exit visas, residence permits, exchange permits and such other documents
- clearance through customs;
- instructions and information to officials, agent and representatives of the GOI as well as GoK;
- Privilege pursuant to the applicable law in India.

Supporting Report 15.8.1

Preliminary Cost Estimates

Annual Fund Requirement

Base Year for Cost Estimation: Apr, 2017
Exchange Rates INR = JPY 1.7
Price Escalation: FC: 2.0% LC:
Physical Contingency 5%
Physical Contingency for Consultant 5%

Item		Total			Million INR
		FC	LC	Total	
A. ELIGIBLE PORTION					
Ⅰ)	Procurement / Construction		10,153	17,260	
	VBY-U1 Bytrayanapura		912	1,551	
	VBY-U2 Bytrayanapura		369	628	
	VBY-U3 Bytrayanapura		853	1,450	
	VM-U1 Mahadevpura		158	268	
	VM-U2 Mahadevpura		1,488	2,530	
	VBO-U1 Bommanahalli		507	862	
	VBO-U2 Bommanahalli		348	591	
	VBO-U3 Bommanahalli		372	632	
	VBO-U4 Bommanahalli		438	744	
	VR-U1 R.R.Nagar		479	813	
	VR-U2 R.R.Nagar		524	891	
	VD-U1 Dasarahalli		291	495	
	VD-U2 Dasarahalli		1,603	2,726	
	Base cost for JICA financing		8,341	14,180	**8,341**
	Price escalation		1,328	2,258	1,328
	Physical contingency		483	822	483
Ⅱ)	Consulting services	234	348	826	
	Base cost	212	302	726	427
	Price escalation	11	29	61	36
	Physical contingency	11	17	39	23
Total (Ⅰ + Ⅱ)		234	10,501	18,086	
B. NON ELIGIBLE PORTION					
a	Procurement / Construction				
	Base cost for JICA financing				
	Price escalation				
	Physical contingency				
b	Land Acquisition				
	Base cost				
	Price escalation				
	Physical contingency				
c	Administration cost		319	543	319
d	VAT		7	12	7
e	Import Tax		21	35	21
Total (a+b+c+d+e)			347	589	
TOTAL (A+B)		234	10,848	18,675	
C. Interest during Construction		204		204	
	Interest during Construction(Const.)	204		204	120
	Interest during Construction (Consul.)	0		0	0
D. Front End Fee		37		37	22
GRAND TOTAL (A+B+C+D)		475	10,848	18,916	**11,127**
E. JICA finance portion incl. IDC (A + C)		438	10,501	18,290	**10,759**

Indirect Cost Total (Eligible)	2,418
Indirect Cost Total (Non Eligible)	368
Indirect Cost Total	**2,786**
Direct Cost Total	**8,341**

Pre-Conditions for Cost Estimation

1. General Conditions

Exchange Rate

			INR	
(1)	JPY/USD	USD 1 =	100	JPY
(2)	LC/USD	USD 1 =	70	INR
(3)	JPY/INR	INR 1 =	1.7	JPY

Price Escalation

FC	2.0%	LC	3.7%

Physical Contingency

Construction	5.0%	Consultant	5.0%

Base Year for Cost Estimation: 2017/04

Schedule

Start	2017/01	End	2024/12

Billing Rate of Consultant

	FC JPY	LC INR
Pro-(A)	2,600,000	0
Pro-(B)	0	210,000
Supporting Staff	0	60,000

2. Others

Rate of Tax

VAT	5.0%	Import Tax	15.0%

Rate of Administration Cost

3.0%

Rate of Interest During Construction

Construction	0.30%	Consultant	0.01%

Rate of Front End Fee

0.2%

Payment Method for Interest during construction: loan_covered

Front End Fee: not loan_covered

Fiscal Year

Apr - Mar

VAT and Import TAX

	VAT		Import TAX
	FC	LC	FC
Construction/Procurement Works	TRUE	FALSE	TRUE
Consultant Services	TRUE	FALSE	TRUE
Land Acquisition	FALSE	FALSE	

Advanced Payment / **Retention Money**

	Advanced Payment	RM at Completion	After DNP
Construction	30.0%	0.0%	0.0%
Consultant Services	30.0%	0.0%	0.0%

Defect Notification Period(DNP)

12 months

Cost Breakdown for Package

USD	=JPY	100
INR	=JPY	1.7

item	Local	Total
	INR	JPY
Land Acquisition Cost	0	0

VBY-U1 Bytrayanapura Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and trunk sewer	Set	1		289,736,711	0	289,736,711	492,552,408
Construction of STP	Set	1		578,000,000	0	578,000,000	982,600,000
Construction of Wet Well cum pumphouses	Set	1		9,900,000	0	9,900,000	16,830,000
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		3,148,616	0	3,148,616	5,352,648
Roads restration	Set	1		31,608,034	0	31,608,034	53,733,658
Total					0	912,393,361	1,551,068,714

VBY-U2 Bytrayanapura Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and trunk sewer	Set	1		71,172,251	0	71,172,251	120,992,827
Construction of STP	Set	1		278,000,000	0	278,000,000	472,600,000
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		5,934,000	0	5,934,000	10,087,800
Restration of Storm Water Drains	Set	1		1,297,677	0	1,297,677	2,206,051
Roads restration	Set	1		13,027,000	0	13,027,000	22,145,901
Total					0	369,430,929	628,032,579

VBY-U3 Bytrayanapura Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and trunk sewer	Set	1		297,511,215	0	297,511,215	505,769,065
Construction of STP	Set	1		516,000,000	0	516,000,000	877,200,000
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		3,553,706	0	3,553,706	6,041,301
Roads restration	Set	1		35,674,613	0	35,674,613	60,646,842
Total					0	852,739,534	1,449,657,209

VM-U1 Mahadevpura Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		143,342,217	0	143,342,217	243,681,769
Construction of STP	Set	1		0	0	0	0
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		1,197,350	0	1,197,350	2,035,494
Roads restration	Set	1		13,173,170	0	13,173,170	22,394,389
Total					0	157,712,737	268,111,652

VM-U2 Mahadevpura Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		566,987,224	0	566,987,224	963,878,281
Construction of STP	Set	1		472,000,000	0	472,000,000	802,400,000
Construction of Wet Well cum pumphouses	Set	1		183,400,000	0	183,400,000	311,780,000
Providing D.I.Pumping mains	Set	1		196,100,000	0	196,100,000	333,370,000
Restration of Storm Water Drains	Set	1		5,802,650	0	5,802,650	9,864,506
Roads restration	Set	1		63,840,417	0	63,840,417	108,528,708
Total					0	1,488,130,291	2,529,821,495

VBO-U1 Bommanahalli Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		218,055,035	0	218,055,035	370,693,559
Construction of STP	Set	1		253,000,000	0	253,000,000	430,100,000
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		5,075,747	0	5,075,747	8,628,769
Roads restration	Set	1		31,042,368	0	31,042,368	52,772,025
Total					0	507,173,149	862,194,354

VBO-U2 Bommanahalli Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		97,645,970	0	97,645,970	165,998,149
Construction of STP	Set	1		231,000,000	0	231,000,000	392,700,000
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		2,686,064	0	2,686,064	4,566,309
Roads restration	Set	1		16,427,493	0	16,427,493	27,926,738
Total					0	347,759,528	591,191,197

VBO-U3 Bommanahalli Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		137,236,213	0	137,236,213	233,301,562
Construction of STP	Set	1		0	0	0	0
Construction of Wet Well cum pumphouses	Set	1		136,600,000	0	136,600,000	232,220,000
Providing D.I.Pumping mains	Set	1		73,800,000	0	73,800,000	125,460,000
Restration of Storm Water Drains	Set	1		3,360,569	0	3,360,569	5,712,967
Roads restration	Set	1		20,552,646	0	20,552,646	34,939,498
Total					0	371,549,428	631,634,027

VBO-U4 Bommanahalli Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		388,834,943	0	388,834,943	661,019,403
Construction of STP	Set	1		0	0	0	0
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		6,877,620	0	6,877,620	11,691,954
Roads restration	Set	1		42,062,306	0	42,062,306	71,505,921
Total					0	437,774,870	744,217,278

VR-U1 R.R.Nagar Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		120,064,504	0	120,064,504	204,109,656
Construction of STP	Set	1		313,000,000	0	313,000,000	532,100,000
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		20,839,000	0	20,839,000	35,426,300
Restration of Storm Water Drains	Set	1		3,359,968	0	3,359,968	5,711,945
Roads restration	Set	1		21,247,632	0	21,247,632	36,120,975
Total					0	478,511,103	813,468,876

VR-U2 R.R.Nagar Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		28,296,980	0	28,296,980	48,104,867
Construction of STP	Set	1		439,000,000	0	439,000,000	746,300,000
Construction of Wet Well cum pumphouses	Set	1		51,900,000	0	51,900,000	88,230,000
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		640,032	0	640,032	1,088,055
Roads restration	Set	1		4,047,412	0	4,047,412	6,880,600
Total					0	523,884,425	890,603,522

VD-U1 Dasarahalli Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		50,700,586	0	50,700,586	86,190,996
Construction of STP	Set	1		228,000,000	0	228,000,000	387,600,000
Construction of Wet Well cum pumphouses	Set	1		0	0	0	0
Providing D.I.Pumping mains	Set	1		0	0	0	0
Restration of Storm Water Drains	Set	1		1,930,676	0	1,930,676	3,282,149
Roads restration	Set	1		10,262,539	0	10,262,539	17,446,315
Total					0	290,893,801	494,519,461

VD-U2 Dasarahalli Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			JPY	INR	JPY	INR	JPY
Providing Submain and t runk sewer	Set	1		185,048,967	0	185,048,967	314,583,244
Construction of STP	Set	1		1,181,000,000	0	1,181,000,000	2,007,700,000
Construction of Wet Well cum pumphouses	Set	1		138,700,000	0	138,700,000	235,790,000
Providing D.I.Pumping mains	Set	1		60,320,000	0	60,320,000	102,544,000
Restration of Storm Water Drains	Set	1		6,069,324	0	6,069,324	10,317,851
Roads restration	Set	1		32,261,586	0	32,261,586	54,844,696
Total					0	1,603,399,877	2,725,779,790

Cost Breakdown for the Consulting Services

USD = JPY 100
INR = JPY 1.7

	Unit	Qty.	Foreign Portion (JPY) Rate	Foreign Portion (JPY) Amount ('000)	Local Portion INR Rate	Local Portion INR Amount ('000)	Combined Total ('000) JPY
A Remuneration							
1 Professional (A)	M/M	81	2,600,000	210,600	0	0	210,600
2 Professional (B)	M/M	189	0	0	210,000	39,690	67,473
3 Supporting Staffs	M/M	720	0	0	60,000	43,200	73,440
Subtotal of A				210,600		82,890	351,513
B Direct Cost							
1 International Airfare		6.75	250,000	1,688		0	1,688
2 Domestic Airfare		90		0	18,000	1,620	2,754
3 Domestic Travel				0	3,000	0	0
3 Accommodation Allowance	Month	81		0	30,000	2,430	4,131
	Month	189		0	20,000	3,780	6,426
	Month	720		0	5,000	3,600	6,120
4 Vehicle Rental	Month	90		0	47,000	4,230	7,191
5 Office Rental	M/M	990		0	165,000	163,350	277,695
6 International Communications	M/M	81		0	25,000	2,025	3,443
7 Domestic Communications	M/M	990		0	20,000	19,800	33,660
8 Office Supply	M/M	1		0	10,000,000	10,000	17,000
9 Office Furniture and Equipment	M/M	1		0	3,000,000	3,000	5,100
10 Report Preparation	Month	70		0	75,000	5,250	8,925
Subtotal of B				1,688		219,085	374,132
Total				212,288		301,975	725,645

Summary of Cost for Construction of Main facility of 110 Village's Sewarage

Item			Million INR	
S-1	Providing Submain and trunk sewer	Open cut	198,944MR	2,370
		Trenchless	1,130MR	218
		Miscellaneous	-	7
		Sub-Total	-	2,595
S-2	Construction of STP		14 NOS	4,489
S-3	Construction of Wet Well cum pumphouses		7 NOS	521
S-4	Providing D.I.Pumping mains		15,310MR	357
S-5	Restration of Storm Water Drains		-	45
S-6	Roads restration		-	335
Direct cost Total				**8,341**
Indirect cost Total				**2,786**
Land acquisition				**0**
Grand Total				**11,127**

Summary of Direct Cost for Construction of Main facility of 110 Village's Sewarage

Zone	Item			JICA Servey										DPR
				Total		Package-U1		Package-U2		Package-U3		Package-U4		
Bytrayanapura	S-1	Providing Submain and trunk sewer	Open cut	DIA 300～100(48,598 MR	599.2	DIA 300～60 19,127 MR	251.5	DIA 300～60(7,883 MR	50.6	DIA 300～100(21,588 MR	297.1			DIA 300～100(75,762 MR
			Trenchless	DIA 300～600 290 MR	58.3	DIA 400～60 170 MR	37.9	DIA 300～ 120 MR	20.4					DIA 600～900 170 MR
			Miscellaneous		0.9		0.3		0.1		0.4			
			Sub-Total		658.4		289.7		71.2		297.5			
	S-2	Construction of STP		4 NOS	1,372.0	2 NOS	578.0	1 NOS	278.0	1 NOS	516.0			4 NOS
	S-3	Construction of Wet Well cum pumphouses		1 NOS	9.9	1 NOS	9.9							1 NOS
	S-4	Providing D.I.Pumping mains		DIA 250～ 1,380 MR	5.9			DIA250 ～ 1,380 MR	5.9					DIA 200 2,000 MR
	S-5	Restration of Storm Water Drains			8.0		3.1		1.3		3.6			
	S-6	Roads restration			80.3		31.6		13.0		35.7			
	Total				2,134.6		912.4		369.4		852.7			
Mahadevpura	S-1	Providing Submain and trunk sewer	Open cut	DIA 300～800 44,620 MR	677.5	DIA 300～50 7,632 MR	143.2	DIA 300～80(36,988 MR	534.3					DIA 300～600 80,650 MR
			Trenchless	DIA 300～600 170 MR	31.9			DIA 300～60(170 MR	31.9					DIA 600～100(230 MR
			Miscellaneous		0.9		0.2		0.8					
			Sub-Total		710.3		143.3		567.0					
	S-2	Construction of STP		1 NOS	472.0			1 NOS	472.0					1 NOS
	S-3	Construction of Wet Well cum pumphouses		1 NOS	183.4			1 NOS	183.4					
	S-4	Providing D.I.Pumping mains		DIA 800～ 5,300 MR	196.1			DIA800～ 5,300 MR	196.1					
	S-5	Restration of Storm Water Drains			7.0		1.2		5.8					
	S-6	Roads restration			77.0		13.2		63.8					
	Total				1,645.8		157.7		1,488.1					
Bommanahalli	S-1	Providing Submain and trunk sewer	Open cut	DIA 300～120(64,741 MR	734.0	DIA 300～70 18,256 MR	172.8	DIA 300～60(9,661 MR	85.1	DIA 300～500 12,087 MR	104.1	DIA 300～120(24,737 MR	372.0	DIA 300～120(99,330 MR
			Trenchless	DIA 300～600 520 MR	103.4	DIA 500～60 200 MR	44.0	DIA 300～ 70 MR	11.9	DIA 400～ 170 MR	32.3	DIA 400～450 80 MR	15.2	DIA 600～180(700 MR
			Miscellaneous		4.4		1.2		0.7		0.8		1.7	
			Sub-Total		841.8		218.1		97.6		137.2		388.8	
	S-2	Construction of STP		2 NOS	484.0	1 NOS	253.0	1 NOS	231.0					3 NOS
	S-3	Construction of Wet Well cum pumphouses		1 NOS	136.6					1 NOS	136.6			
	S-4	Providing D.I.Pumping mains		DIA 600～ 3,000 MR	73.8					DIA 600～ 3,000 MR	73.8			
	S-5	Restration of Storm Water Drains			18.0		5.1		2.7		3.4		6.9	
	S-6	Roads restration			110.1		31.0		16.4		20.6		42.1	
	Total				1,664.3		507.2		347.8		371.5		437.8	
R.R.Nagar	S-1	Providing Submain and trunk sewer	Open cut	DIA 300～500 14,818 MR	142.9	DIA 300～50 12,447 MR	114.7	DIA 300～40(2,371 MR	28.2					DIA 300～900 29,056 MR
			Trenchless	DIA 300～ 30 MR	5.1	DIA 300～ 30 MR	5.1							DIA 600～900 140 MR
			Miscellaneous		0.4		0.3		0.1					
			Sub-Total		148.4		120.1		28.3					
	S-2	Construction of STP		2 NOS	752.0	1 NOS	313.0	1 NOS	439.0					3 NOS
	S-3	Construction of Wet Well cum pumphouses		2 NOS	51.9			2 NOS	51.9					1 NOS
	S-4	Providing D.I.Pumping mains		DIA 250～400 2,230 MR	20.8	DIA 250～40 2,230 MR	20.8							DIA 250 800 MR
	S-5	Restration of Storm Water Drains			4.0		3.4		0.6					
	S-6	Roads restration			25.3		21.2		4.0					
	Total				1,002.4		478.5		523.9					
Dasarahalli	S-1	Providing Submain and trunk sewer	Open cut	DIA 300～700 26,167 MR	216.0	DIA 300～70 6,315 MR	40.4	DIA 300～70(19,852 MR	175.6					DIA 300～700 53,535 MR
			Trenchless	DIA 200～300 120 MR	19.2	DIA 300～ 60 MR	10.2	DIA 200～ 60 MR	9.0					DIA 600～900 160 MR
			Miscellaneous		0.6		0.1		0.5					
			Sub-Total		235.7		50.7		185.0					
	S-2	Construction of STP		5 NOS	1,409.0	1 NOS	228.0	4 NOS	1,181.0					5 NOS
	S-3	Construction of Wet Well cum pumphouses		2 NOS	138.7			2 NOS	138.7					1 NOS
	S-4	Providing D.I.Pumping mains		DIA 200～600 3,400 MR	60.3			DIA 200～60(3,400 MR	60.3					DIA 150 300 MR
	S-5	Restration of Storm Water Drains			8.0		1.9		6.1					
	S-6	Roads restration			42.5		10.3		32.3					
	Total				1,894.3		290.9		1,603.4					
Total	S-1	Providing Submain and trunk sewer	Open cut	DIA 300～120(198,944 MR	2,369.6									DIA 300～120(338,333 MR
			Trenchless	DIA 200～600 1,130 MR	217.9									DIA 600～180(1,400 MR
			Miscellaneous		7.1									
			Sub-Total		2,594.6									
	S-2	Construction of STP		14 NOS	4,489.0									16 NOS
	S-3	Construction of Wet Well cum pumphouses		7 NOS	520.5									3 NOS
	S-4	Providing D.I.Pumping mains		DIA 200～800 15,310 MR	357.0									DIA 150～250 3,100 MR
	S-5	Restration of Storm Water Drains			45.0									
	S-6	Roads restration			335.2									
	Total				8,341.4									

Summary of Direct Cost for Construction of Main sewers and Pumping Mains

Package	Item		Pipe Length (RM)										Cost of Pipe (INR)									
		Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
VBY-U1	Opun cut	Up to 2	1,865	2,263									7,460,000	9,278,300								
		Above 2 Up to 4	1,703	4,249		4,565							16,348,800	41,215,300		46,563,000						
		Above 4 Up to 6	351	2,848		844							10,038,600	81,726,120		24,636,040						
		Above 6		91			349							2,857,400			11,364,360					
		Sub Total	3,919	9,451		5,409	349						33,847,400	135,077,120		71,199,040	11,364,360					
			19,127										251,487,920									
	Trenchless		400 Dia	600 Dia	700 Dia								400 Dia	600 Dia	700 Dia							
			30	140									5,700,000	32,200,000								
			170										37,900,000									
	D.I.Pumping mains		250 Dia	300 Dia									250 Dia	300 Dia								
VBY-U2	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	2,955	1,893	26		102						11,820,000	7,761,300	111,800		540,600					
		Above 2 Up to 4	674	1,967	148								6,470,400	19,079,900	1,465,200							
		Above 4 Up to 6	73	45									2,087,800	1,291,500								
		Above 6																				
		Sub Total	3,702	3,905	174		102						20,378,200	28,132,700	1,577,000		540,600					
			7,883										50,628,500									
	Trenchless		300 Dia										300 Dia									
			120										20,400,000									
			120										20,400,000									
	D.I.Pumping mains		250 Dia										250 Dia									
			1,380										5,934,000									
			1,380										5,934,000									
VBY-U3	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	6,375	3,764		92							25,498,800	15,433,630		423,200						
		Above 2 Up to 4	2,675	852		244	160	879					25,676,160	8,262,460		2,488,800	1,742,910	10,199,880				
		Above 4 Up to 6	653	1,045		143	516	766	1,181	168			18,678,660	29,994,370		4,175,600	15,416,440	23,430,420	37,214,100	5,842,920		
		Above 6				27	871		260	789	129					861,300	28,384,820		8,881,740	29,595,000	4,916,340	
		Sub Total	9,702	5,661		506	1,546	1,645	1,441	957	129		69,853,620	53,690,460		7,948,900	45,544,170	33,630,300	46,095,840	35,437,920	4,916,340	
			21,588										297,117,550									
	Trenchless																					
	D.I.Pumping mains																					
VM-U1	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	317		169	1,036							1,266,800		727,990	4,764,220						
		Above 2 Up to 4	1,859		127	211							17,850,240		1,252,350	2,147,100						
		Above 4 Up to 6	1,191	1,376	217	50							34,056,880	39,491,200	6,265,520	1,460,000						
		Above 6	281	800									8,782,780	25,120,000								
		Sub Total	3,648	2,176	513	1,296							61,956,700	64,611,200	8,245,860	8,371,320						
			7,632										143,185,080									
	Trenchless																					
	D.I.Pumping mains																					
VM-U2	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	6,951	584	2,792	287	800	152					27,804,000	2,394,400	12,005,600	1,320,200	4,240,000	912,000				
		Above 2 Up to 4	3,939	394	5,758	441	577	2,750	186				37,814,400	3,821,800	57,004,200	4,498,200	6,289,300	31,900,000	2,325,000			
		Above 4 Up to 6	3,333		2,064	606	994	845	1,564				95,323,800		59,649,600	17,695,200	29,720,600	25,857,000	49,266,000			
		Above 6	369		222	66	150	983	181				11,549,700		7,015,200	2,105,400	4,890,000	32,733,900	6,190,200			
		Sub Total	14,592	978	10,836	1,400	2,521	4,730	1,931				172,491,900	6,216,200	135,674,600	25,619,000	45,139,900	91,402,900	57,781,200			
			38,998										534,325,700									
	Trenchless		300 Dia	600 Dia									300 Dia	600 Dia								
			120	50									20,400,000	11,500,000								
			170										31,900,000									
	D.I.Pumping mains		800 Dia										800 Dia									
			5,300										196,100,000									
			5,300										196,100,000									
VBO-U1	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	1,891	2,136	169	91	1,219	125					7,564,000	8,757,600	726,700	418,600	6,460,700	750,000				
		Above 2 Up to 4	1,623	4,162	566	1,281	2,135	1,909					15,580,800	40,371,400	5,603,400	13,066,200	23,271,500	22,144,400				
		Above 4 Up to 6	193	197			244	315					5,519,800	5,653,900			7,295,600	9,639,000				
		Above 6																				
		Sub Total	3,707	6,495	735	1,372	3,598	2,349					28,664,600	54,782,900	6,330,100	13,484,800	37,027,800	32,533,400				
			16,256										172,823,800									
	Trenchless		500 Dia	600 Dia									500 Dia	600 Dia								
			100	100									21,000,000	23,000,000								
			200										44,000,000									
	D.I.Pumping mains																					
VBO-U2	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	2,016	1,400		445	66						8,064,000	5,740,000		2,047,000	349,800					
		Above 2 Up to 4	749	3,333	166	697	135						7,190,400	32,330,100	1,643,400	7,109,400	1,471,500					
		Above 4 Up to 6		285		297								8,179,500		8,672,400						
		Above 6				72										2,296,800						
		Sub Total	2,765	5,018	166	1,511	201						15,254,400	46,249,600	1,643,400	20,125,600	1,821,300					
			9,661										85,094,300									
	Trenchless		300 Dia										300 Dia									
			70										11,900,000									
			70										11,900,000									
	D.I.Pumping mains																					
VBO-U3	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	3,051	2,306		31							12,204,000	9,454,600		142,600						
		Above 2 Up to 4	1,994	2,853	515	427							19,142,400	27,674,100	5,098,500	4,355,400						
		Above 4 Up to 6	677	233									19,362,200	6,687,100								
		Above 6																				
		Sub Total	5,722	5,392	515	458							50,708,600	43,815,800	5,098,500	4,498,000						
			12,087										104,120,800									
	Trenchless		400 Dia										400 Dia									
			170										32,300,000									
			170										32,300,000									
	D.I.Pumping mains		600 Dia										600 Dia									
			3,000										73,800,000									
			3,000										73,800,000									

VBO-U4	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	3,822	1,381	348		112	279					15,286,400	5,662,100	1,496,400		593,600	1,674,000				
		Above 2 Up to 4	4,738	2,070	370	93	894	197	211	3,430	347	328	45,486,144	20,074,538	3,663,000	943,500	9,744,600	2,285,200	2,637,500	54,194,000	5,725,500	6,297,600
		Above 4 Up to 6	1,485	781	102	964	34			606	753	680	42,471,000	22,425,319	2,948,956	28,137,996	1,016,600			21,088,800	26,731,500	25,976,000
		Above 6	126	268								319	3,943,800	8,415,200								13,047,100
		Sub Total	10,171	4,500	820	1,056	1,040	476	211	4,036	1,100	1,327	107,187,344	56,577,157	8,108,356	29,081,496	11,354,800	3,959,200	2,637,500	75,282,800	32,457,000	45,320,700
			24,737										**371,966,353**									
	Trenchless		400 Dia	450 Dia									400 Dia	450 Dia								
			30	50									5,700,000	9,500,000								
			80										**15,200,000**									
	D.I.Pumping mains																					
VR-U1	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	4,241	1,437	36	199							16,964,000	5,891,700	154,800	915,400						
		Above 2 Up to 4	3,311	1,297	92	382							31,785,600	12,580,900	910,800	3,896,400						
		Above 4 Up to 6	1,206	217		29							34,491,600	6,227,900		846,800						
		Above 6																				
		Sub Total	8,758	2,951	128	610							83,241,200	24,700,500	1,065,600	5,658,600						
			12,447										**114,665,900**									
	Trenchless		300 Dia										300 Dia									
			30										5,100,000									
			30										**5,100,000**									
	D.I.Pumping mains		250 Dia	400 Dia									250 Dia	400 Dia								
			730	1,500									3,139,000	17,700,000								
			2,230										**20,839,000**									
VR-U2	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	411	569									1,644,000	2,332,900								
		Above 2 Up to 4	486	333									4,665,600	3,230,100								
		Above 4 Up to 6	489	83									13,985,400	2,382,100								
		Above 6																				
		Sub Total	1,386	985									20,295,000	7,945,100								
			2,371										**28,240,100**									
	Trenchless																					
	D.I.Pumping mains																					
VD-U1	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	2,929	1,056		88		52					11,716,000	4,329,600		404,800		312,000				
		Above 2 Up to 4	1,230	663				185					11,808,000	6,431,100				2,146,000				
		Above 4 Up to 6	48	64									1,372,800	1,836,800								
		Above 6																				
		Sub Total	4,207	1,783		88		237					24,896,800	12,597,500		404,800		2,458,000				
			6,315										**40,357,100**									
	Trenchless		300 Dia										300 Dia									
			60										10,200,000									
			60										**10,200,000**									
	D.I.Pumping mains																					
VD-U2	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	6,819	2,157	363	212	471						27,276,000	8,843,700	1,560,900	975,200	2,496,300					
		Above 2 Up to 4	3,496	2,142	94	701	835	788					33,561,600	20,777,400	930,600	7,150,200	9,101,500	9,140,800				
		Above 4 Up to 6	426	55		67	587						12,183,600	1,578,500		1,956,400	17,551,300					
		Above 6	211	36			392						6,604,300	1,130,400			12,779,200					
		Sub Total	10,952	4,390	457	980	2,285	788					79,625,500	32,330,000	2,491,500	10,081,800	41,928,300	9,140,800				
			19,852										**175,597,900**									
	Trenchless		200 Dia										200 Dia									
			60										9,000,000									
			60										**9,000,000**									
	D.I.Pumping mains		200 Dia	600 Dia									200 Dia	600 Dia								
			1,100	2,300									3,740,000	56,580,000								
			3,400										**80,320,000**									
Total (JICA surbey)	Opun cut	Depth (MR)	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia	300 Dia	400 Dia	450 Dia	500 Dia	600 Dia	700 Dia	800 Dia	900 Dia	1000 Dia	1200 Dia
		Up to 2	43,642	20,946	3,903	2,481	2,770	608					174,568,000	85,879,830	16,784,190	11,411,220	14,681,000	3,648,000				
		Above 2 Up to 4	28,477	24,314	7,836	9,041	4,736	6,708	397	3,430	347	328	273,380,544	235,849,098	77,571,450	92,218,200	51,621,310	77,816,280	4,962,500	54,194,000	5,725,500	6,297,600
		Above 4 Up to 6	10,125	7,229	2,383	2,999	2,375	1,926	2,745	774	753	680	289,572,140	207,474,309	68,864,076	87,580,436	71,000,540	58,926,420	86,480,100	26,931,720	26,731,500	25,976,000
		Above 6	987	1,195	222	165	1,761	983	441	789	129	319	30,880,580	37,523,000	7,015,200	5,263,500	57,418,380	32,733,900	15,071,940	29,595,000	4,916,340	13,047,100
		Sub Total	83,231	53,685	14,344	14,686	11,642	10,225	3,583	4,993	1,229	1,327	768,401,264	566,726,237	170,234,916	196,473,356	194,721,230	173,124,600	106,514,540	110,720,720	37,373,340	45,320,700
			198,944										**2,389,610,903**									
	Trenchless		**1,130**										**217,900,000**									
	D.I.Pumping mains		**15,310**										**356,993,000**									

	Depth (MR)	Dia 300	Dia 400	Dia 450	Dia 500	Dia 600	Dia 700	Dia 800	Dia 900	Dia 1,000	Dia 1,200
Open cut	Up to 2	4,000	4,100	4,300	4,600	5,300	6,000	6,900	10,200	10,900	13,600
	Above 2 Up to 4	9,600	9,700	9,900	10,200	10,900	11,600	12,500	15,800	16,500	19,200
	Above 4 Up to 6	28,600	28,700	28,900	29,200	29,900	30,600	31,500	34,800	35,500	38,200
	Above 6	31,300	31,400	31,600	31,900	32,600	33,300	34,200	37,500	38,200	40,900

Unit Cost

Pumping Main	150	2,700
	200	3,400
	250	4,300
	300	5,400
	400	11,800
	500	18,200
	600	24,600
	700	31,000
	800	37,000

Trenchiless	200	150,000
	300	170,000
	400	190,000
	500	210,000
	600	230,000
	700	250,000
	800	270,000

Summary of Cost for Construction of 110 Village's Main Facility of Sewerage by DPR (Rate Revised)

INR (Crore)

Sl. No.	Particulars		Byatarayanpura			Mahadevapura			Bommanahalli			R R Nagar Total			Dasarahalli			Grand Total	
A..	Providing Sewerage System		Open Cut Trenchless Other		**0.09**	Open Cut Trenchless Other		**0.09**	Open Cut Trenchless Other		**0.44**	Open Cut Trenchless Other		**0.04**	Open Cut Trenchless Other		**0.06**	**0.71**	
			Sub-Total		54.6	Sub-Total		62.3	Sub-Total		77.2	Sub-Total		20.7	Sub-Total		42.9	**258**	**44.2%**
B	Construction of STP		Kattigenahalli	14.0	68.0	Hagadur	34.0	34.0	Talaghattapura	10.0	26.0	Sompura	16.0	64.0	Kariobanahalli	20.0	66.0	**258**	**44.3%**
			Dottabettahalli	8.0					t Pillaganahalli	6.0		Hemigepura-1	26.0		Herohalli	6.0			
			Yelhankakere	10.0					Naganathapur	10.0		Hemigepura-2	22.0		Chikkabanavara	10.0			
			Billeshivalli	36.0											Doddabidaraukallu	16.0			
															Hosahalli	14.0			
C	Construction of Wet Well cum pumphouses, D.G.Set room with office building, Pumping machinery & allied accessories , and KPTCL, BESCOM Deposits.		Intermediate Sewage Pumping Station – Bellahalli	1.39	1.4							ISPS (Arehalli –1)	0.99	1.0	Manhole Pump & Sump (IV. Herohallii–1477)	0.62	0.6	**3**	**0.5%**
D.	Providing D.I.Pumping Mains																		
E	Restoration of Storm Water Drains				0.8		0.7			1.8				0.4			0.8	**4.5**	
F	House Service Connection																		
G	Sewer Cleaning Machine (SCM)																		
H	Roads Restore				12.5		13.9			16.9				5.0			8.7	**57**	
	Sub-total(without road restore)				126.1		97.0			105.0				87.1			110.4	**526**	
	Sub-total				138.6		110.9			121.9				92.1			119.1	**583**	
	Physical Contingencies @ 3%	3.0%			4.2		3.3			3.7				2.8			3.6	**17**	
	Administrative Charges @ 0.5%	0.5%			0.7		0.6			0.6				0.5			0.6	**3**	
	Land Acquisition (I.P.S/OHT,SUMP,PUMP HOUSE,DG RROOM)				41.3		11.3			15.0				23.0			25.3	**115.9**	
	Indirect Costs Total				34.2		26.9			29.8				22.7			29.4	**143**	
	Price Escalation at 6% / annum of Total Project Cost for 3 years period	6.0% 3 years			24.9		20.0			21.9				16.6			21.4	**105**	
	Price Escalation at 5% SOR Price escalation																		
	Environmental Compliance Cost @ 1% of Total Project Cost.																		
	Technical and Supervisory Staff to be Employed for the specified Works in 110 villages.																		
	Insurance for employees / workers employed by the contractor @ 0.6% per year																		
	Bank Commission on B.G. for Performance security @ 0.2%/annum over 10% of Total Project Cost for for 3 years period for UGD & WS only.																		
	VAT for local currncy(5%)																		
	Important tax(15%)/(of the expenditure in FC potion)																		
	Insterest of construction(1.4%)																		
	Front end fee(0.2%)																		
	Construction workers welfare cess @ 1% of Total Project Cost.	1.0%			1.4		1.1			1.2				0.9			1.2	**6**	
	Consultancy fees for DPR preperation (Reimbursement) On UGD component 0.75%,Road Restoration Component 0.50%	0.5% 0.75%			1.0		0.8			0.9				0.7			0.9	**4**	
	Consultancy fees Including price escaration and tax(0.01%)																		
	Project Management Consultants & Material Inspection charges at 1.5%	0.5%			0.7		0.6			0.6				0.5			0.6	**3**	
	Work contract Tax @ 4% of Total Project Cost.	4.0%			5.5		4.4			4.9				3.7			4.8	**23**	
	Provision of Vehicle and Laptop for Department																0.3	**0**	
	Miscellaneous & Rounding Off				0.7		0.0			0.3				0.4			0.3	**2**	
	G R A N D T O T A L =				**219.0**		**153.0**			**171.0**				**141.0**			**178.0**	**862**	

Direct Cost for Construction of STPs

Sample Data

Unit : Million INR

Capacity	Item	INR
3MLD	Civi and Archtect	92,400,000
	Mechanical	56,100,000
	Electrical	44,800,000
	Total INR	**193,300,000**
	Unit cost	64.4
10MLD	Civi and Archtect	187,200,000
	Mechanical	100,400,000
	Electrical	70,400,000
	Total INR	**358,000,000**
	Unit cost	35.8
15MLD	Civi and Archtect	241,200,000
	Mechanical	124,400,000
	Electrical	85,600,000
	Total INR	**451,200,000**
	Unit cost	30.1
24MLD	Civi and Archtect	346,800,000
	Mechanical	175,500,000
	Electrical	108,700,000
	Total INR	**631,000,000**
	Unit cost	26.3

Cost Function

MLD		Million INR
x = 3	y =	**193**
x = 4	y =	**217**
x = 5	y =	**241**
x = 6	y =	**265**
x = 7	y =	**289**
x = 8	y =	**313**
x = 9	y =	**337**
x = 10	y =	**358**
x = 11	y =	**377**
x = 12	y =	**396**
x = 13	y =	**415**
x = 14	y =	**434**
x = 15	y =	**451**
x = 16	y =	**471**
x = 17	y =	**491**
x = 18	y =	**511**
x = 19	y =	**531**
x = 20	y =	**551**
x = 21	y =	**571**
x = 22	y =	**591**
x = 23	y =	**611**
x = 24	y =	**631**

Construction Cost of STPs

Zone	Package	STP	Design Flow 2034 (MLD)		Cost (Million INR)			
			JICA Surbey	DPR	JICA Surbey			
					Basis	Foundation ※1	Land Filling ※2	Total
Bytrayanapura	VBY-U1	Doddabettahalli	7.0	4.0	289			1,372
		Jakkur	7.0	–	289			
	VBY-U2	Yelahankakere	6.0	5.0	265	13		
	VBY-U3	Bilishivalli	17.0	18.0	491	25		
		Kattigenahalli	–	7.0	–			
Mahadevpura	VM-U2	Varthur*	15.0	–	451		21	472
		Hagadur	–	17.0	–			
Bommanahalli	VBO-U1	Talaghattapura	5.0	5.0	241	12		484
	VBO-U2	Pillaganahalli	4.0	–	217		14	
		t Pillaganahalli	–	3.0	–			
		Naganathapur	–	5.0	–			
R.R.Nagar	VR-U1	Somapura	8.0	8.0	313			752
	VR-U2	Hemigepura(-1)	13.0	13.0	415		24	
		Hemigepura-2	–	11.0	–			
Dasarahalli	VD-U1	Chikkabanavara-2	4.0	5.0	217	11		1,409
	VD-U2	Kariobavanahalli	10.0	10.0	358	18		
		Herohalli	3.0	3.0	193	10		
		Hosahalli	6.0	7.0	265			
		Nagasandra*	9.0	–	337			
		Doddabidaraukallu	–	8.0	–			
Total					**4,489**			

※1 5% of basis

※2 required Sqm ×600 INR/Sqr

Cost function for Civil Construction of STPs (3MLD)

UNIT:INR

Items	Size of Facility				Excavation				Backfilling					Disposal	PCC				Rainforced Cement Concrete																		Reinforcement Steel	Form Work 1						Form Work 2		Water Proofing			Miscellaneous
																			Basement				Wall/L				Wall/W				Slab																	
	Nos	W /Dia	L	SWD/H	W/Dia	L	H	V1	W/Dia	L	H	V2	V3=V1−V2	V4 =V1−V3	W/Dia	L	t	V	W/Dia	L	t	V1	L	H	t	V2	W	H	t	V3	W	L	t	V4	Sub Total	Sub Total	Basement	Wall/L	Wall/W	Sub Total	Slab	Sub Total	Wall/L	Wall/W	Sub Total	
		MR	MR	MR	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Tone	L MR	A1 Sqm	A2 Sqm	A3 Sqm	Cum	A4 Sqm	Cum	A1 Sqm	A2 Sqm	Cum	
MPS(TSPS)																																															
1 Inlet Chamber	1	1.8	1.5	1.0	5.50	5.20	5.00	143.0	2.50	2.20	5.00	27.5			2.50	2.20	0.20	1.1	2.50	2.20	0.40	2.2	2.20	1.75	0.35	2.7	1.80	1.75	0.35	3.3	1.80	1.50	0.25	0.7	8.9		9.40	3.76	7.70	9.45	20.9	2.70	2.7	3.85	4.73	8.58	
2 Main Screen Channel	1	0.6	6.0	0.4	4.30	9.70	5.00	208.6	1.30	6.70	5.00	43.6			1.30	6.70	0.20	1.7	1.30	6.70	0.40	3.5	6.70	1.15	0.35	5.4	0.60	1.15	0.35	0.7	0.60	6.00	0.25	0.9	10.5		16.00	6.40	15.41	2.07	23.9	3.60	3.6	7.71	1.04	8.74	
3 Bypass Screen Channel	1	0.6	6.0	0.4	4.30	9.70	5.00	208.6	1.30	6.70	5.00	43.6			1.30	6.70	0.20	1.7	1.30	6.70	0.40	3.5	6.70	1.15	0.35	5.4	0.60	1.15	0.35	0.7	0.60	6.00	0.25	0.9	10.5		16.00	6.40	15.41	2.07	23.9	3.60	3.6	7.71	1.04	8.74	
4 Raw Sewage Sump	1	Dia 6.0		1.7	9.70		5.00	369.3	6.70		5.00	176.2			6.70		0.20	7.0	6.70		0.40	14.1	21.04	2.45	0.35	18.0	6.00	2.45	0.35		6.00		0.25	7.1	39.2		21.04	8.42	103.09		111.5	28.26	28.3	51.54		51.54	
					3.00																																									
STP																																														
Civil Work					3.00																																									
1 Inlet Chamber	1	1.8	1.5	1.0	5.50	5.20	1.00	28.6	2.50	2.20	1.00	5.5			2.50	2.20	0.20	1.1	2.50	2.20	0.40	2.2	2.20	1.75	0.35	2.7	1.80	1.75	0.35	3.3	1.80	1.50	0.25	0.7	8.9		9.40	3.76	7.70	9.45	20.9	2.70	2.7	3.85	4.73	8.58	
2 Main Screen Channel	1	0.6	6.0	0.4	4.30	9.70	1.00	41.7	1.30	6.70	1.00	8.7			1.30	6.70	0.20	1.7	1.30	6.70	0.40	3.5	6.70	1.15	0.35	5.4	0.60	1.15	0.35	0.7	0.60	6.00	0.25	0.9	10.5		16.00	6.40	15.41	2.07	23.9	3.60	3.6	7.71	1.04	8.74	
3 Bypass Screen Channel	1	0.6	6.0	0.4	4.30	9.70	1.00	41.7	1.30	6.70	1.00	8.7			1.30	6.70	0.20	1.7	1.30	6.70	0.40	3.5	6.70	1.15	0.35	5.4	0.60	1.15	0.35	0.7	0.60	6.00	0.25	0.9	10.5		16.00	6.40	15.41	2.07	23.9	3.60	3.6	7.71	1.04	8.74	
4 Grit Chamber	2	Dia 3.0		0.9	6.70		1.00	70.5	3.70		1.00	21.5			3.70		0.20	4.3	3.70		0.40	8.6	11.62	1.65	0.35	13.4	3.00	1.65	0.35		3.00		0.25	3.5	25.5		11.62	9.29	76.68		86.0	14.13	14.1	38.34		38.34	
5 Parshall Flume	1	1.5	10.0	0.8	5.20	13.70	1.00	71.2	2.20	10.70	1.00	23.5			2.20	10.70	0.20	4.7	2.20	10.70	0.40	9.4	10.70	1.55	0.35	11.6	1.50	1.55	0.35	2.4	1.50	10.00	0.25	3.8	27.2		25.80	10.32	33.17	6.98	50.5	15.00	15.0	16.59	3.49	20.07	
6 Distribution Chamber					3.00																																									
7 Anoxic/Aerobic Tank	2	8.0	39.0	5.5 H	11.70	42.70	5.00	4,995.9	8.70	39.70	5.00	3,453.9			8.70	39.70	0.20	138.2	8.70	39.70	0.40	276.3	39.70	6.25	0.35	347.4	8.00	6.25	0.35	105.0	8.00	39.00	0.25	156.0	884.7		96.80	77.44	992.50	300.00	1,369.9	624.00	624.0				
8 Secandary Clarifire	2	Dia 13.0		3.5	16.70		5.00	2,189.3	13.70		5.00	1,473.4			13.70		0.20	58.9	13.70		0.40	117.9	43.02	4.25	0.35	128.0	13.00	4.25	0.35		13.00		0.25	66.3	312.2		43.02	34.41	731.31		765.7	265.33	265.3				
9 Secondary Sludge Sump					3.00																																									
10 Chlorine Contact Tank	1	1.5	30.0	1.5	5.20	33.70	5.00	876.2	2.20	30.70	5.00	337.7			2.20	30.70	0.20	13.5	2.20	30.70	0.40	27.0	30.70	2.25	0.35	48.4	1.50	2.25	0.35	3.5	1.50	30.00	0.25	11.3	90.2		65.80	26.32	138.15	10.13	174.6	45.00	45.0				
11 Dechlorine Mixing Tank	1	5.3	3.0	1.5	9.00	6.70	5.00	301.5	6.00	3.70	5.00	111.0			6.00	3.70	0.20	4.4	6.00	3.70	0.40	8.9	3.70	2.25	0.35	5.8	5.30	2.25	0.35	12.5	5.30	3.00	0.25	4.0	31.2		19.40	7.76	16.65	35.78	60.2	15.90	15.9				
12 Sludge Thickner																																														
13 Thickened Sludge Sump																																														
14 Centrifuge Feed Sump	2	4.0	4.5	3.5	7.70	8.20			4.70	5.20					4.70	5.20	0.20	9.8	4.70	5.20	0.40	19.6	5.20	4.25	0.35	30.9	4.00	4.25	0.35	35.7	4.00	4.50	0.25	9.0	95.2		19.80	15.84	88.40	102.00	206.2	36.00	36.0				
15 Filtrate Sump	1	1.0	1.0	1.0	4.70	4.70			1.70	1.70					1.70	1.70	0.20	0.6	1.70	1.70	0.40	1.2	1.70	1.75	0.35	2.1	1.00	1.75	0.35	1.8	1.00	1.00	0.25	0.3	5.3		6.80	2.72	5.95	5.25	13.9	1.00	1.0				
Quantity								**9,546**				**5,735**	**3,811**	**5,735**				**251**																	**1,570**	**157**					**2,976**		**1,064**			**162**	
Rate （INR）							Rate	521				Rate	126	146			Rate	5,829																Rate	6,542	76,219					373	Rate	490		Rate	901	
Sub Total Cost （INR）								4,974,412					480,500	834,974				1,460,767																	10,274,217	11,970,032					1,109,893		521,118			146,088	10% of Sub Total
							≒	**4,975,000**					**481,000**	**835,000**			≒	**1,461,000**																≒	**10,275,000**	**11,971,000**					**1,110,000**	≒	**522,000**		≒	**147,000**	**≒3,177,700**
Total Cost (INR)																																														**35,000,000**
Architecht																																									Sqm		INR/Sqm		INR		
20 Administration Building	1	15.0	15.0	10.0 H																																					225		39,000		8,775,000		9,000,000
21 Maintenance Building	1	10.0	8.0	4.5 H																																					80		27,000		2,160,000		3,000,000
22 D.G Room	1	10.0	10.0	5.0 H																																					100		27,000		2,700,000		3,000,000
23 Air Blower Building	1	8.0	12.0	6.0 H																																					96		46,000		4,416,000		5,000,000
24 Centrifuge Building	1	15.0	15.0	10.0 H																																					225		64,000		14,400,000		15,000,000
25 Chemical Building	1	8.0	10.0	6.0 H																																					80		62,000		4,960,000		5,000,000
26 Clolorination Building	1	5.0	5.0	4.0 H																																					25		44,000		1,100,000		2,000,000
Other Work																																														
27 Sewer and Sludge Pipe Lines																																													10.0% of above		7,700,000
28 Road Construction and other																																													10.0% of above		7,700,000
Gran Total																																														**92,400,000**
																																														3MLD

Cost function for Civil Construction of STPs (10MLD)

UNIT:INR

Items	Size of Facility				Excavation				Backfilling					Disposal	PCC				Rainforced Cement Concrete																				Reinforcement Steel	Form Work 1						Form Work 2		Water Proofing			Miscellaneous
																			Basement				Wall/L				Wall/W				Slab																				
	Nos	W /Dia	L	SWD/H	W/Dia	L	H	V1	W/Dia	L	H	V2	V3=V1−V2	V4 =V1−V3	W/Dia	L	t	V	W/Dia	L	t	V1	L	H	t	V2	W	H	t	V3	W	L	t	V4	Sub Total	Sub Total	Basement				Wall/L	Wall/W	Sub Total	Slab	Sub Total	Wall/L	Wall/W	Sub Total	
		MR	MR	MR	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Tone	L MR	A1 Sqm	A2 Sqm	A3 Sqm	Cum	A4 Sqm	Cum	A1 Sqm	A2 Sqm	Cum	
MPS(TSPS)																																																	
1 Inlet Chamber	1	2.0	2.5	0.6	5.70	6.20	5.00	176.7	2.70	3.20	5.00	43.2			2.70	3.20	0.20	1.7	2.70	3.20	0.40	3.5	3.20	1.35	0.35	3.0	2.00	1.35	0.35	2.8	2.00	2.50	0.25	1.3	10.6		11.80	4.72	8.64	8.10	21.5	5.00	5.0	4.32	4.05	8.37	
2 Main Screen Channel	2	1.0	6.0	0.6	4.70	9.70	5.00	455.9	1.70	6.70	5.00	113.9			1.70	6.70	0.20	4.6	1.70	6.70	0.40	9.1	6.70	1.35	0.35	12.7	1.00	1.35	0.35	2.8	1.00	6.00	0.25	3.0	27.6		16.80	13.44	36.18	8.10	57.7	12.00	12.0	18.09	4.05	22.14	
3 Bypass Screen Channel	1	1.0	6.0	0.6	4.70	9.70	5.00	228.0	1.70	6.70	5.00	57.0			1.70	6.70	0.20	2.3	1.70	6.70	0.40	4.6	6.70	1.35	0.35	6.3	1.00	1.35	0.35	1.4	1.00	6.00	0.25	1.5	13.8		16.80	6.72	18.09	4.05	28.9	6.00	6.0	9.05	2.03	11.07	
4 Raw Sewage Sump	1	Dia 11.0		1.7	14.70		5.00	848.2	11.70		5.00	537.3			11.70		0.20	21.5	11.70		0.40	43.0	36.74	2.45	0.35	31.5	11.00	2.45	0.35		11.00		0.25	23.7	98.2		36.74	14.70	180.02		194.7	94.99	95.0	90.01		90.01	
					3.00																																										
STP																																																
Civil Work					3.00																																										
1 Inlet Chamber	1	2.0	2.0	2.0	5.70	5.70	1.00	32.5	2.70	2.70	1.00	7.3			2.70	2.70	0.20	1.5	2.70	2.70	0.40	2.9	2.70	2.75	0.35	5.2	2.00	2.75	0.35	5.8	2.00	2.00	0.25	1.0	14.9		10.80	4.32	14.85	16.50	35.7	4.00	4.0	7.43	8.25	15.68	
2 Main Screen Channel	2	0.8	6.0	0.4	4.50	9.70	1.00	87.3	1.50	6.70	1.00	20.1			1.50	6.70	0.20	4.0	1.50	6.70	0.40	8.0	6.70	1.15	0.35	10.8	0.80	1.15	0.35	1.9	0.80	6.00	0.25	2.4	23.2		16.40	13.12	30.82	5.52	49.5	9.60	9.6	15.41	2.76	18.17	
3 Bypass Screen Channel	1	0.8	6.0	0.4	4.50	9.70	1.00	43.7	1.50	6.70	1.00	10.1			1.50	6.70	0.20	2.0	1.50	6.70	0.40	4.0	6.70	1.15	0.35	5.4	0.80	1.15	0.35	1.0	0.80	6.00	0.25	1.2	11.6		16.40	6.56	15.41	2.76	24.7	4.80	4.8	7.71	1.38	9.09	
4 Grit Chamber	2	Dia 5.0		0.9	8.70		1.00	118.8	5.70		1.00	51.0			5.70		0.20	10.2	5.70		0.40	20.4	17.90	1.65	0.35	20.7	5.00	1.65	0.35		5.00		0.25	9.8	50.9		17.90	14.32	118.13		132.4	39.25	39.3	59.06		59.06	
5 Parshall Flume	1	1.5	10.0	0.8	5.20	13.70	1.00	71.2	2.20	10.70	1.00	23.5			2.20	10.70	0.20	4.7	2.20	10.70	0.40	9.4	10.70	1.55	0.35	11.6	1.50	1.55	0.35	2.4	1.50	10.00	0.25	3.8	27.2		25.80	10.32	33.17	6.98	50.5	15.00	15.0	16.59	3.49	20.07	
6 Distribution Chamber					3.00																																										
7 Anoxic/Aerobic Tank	2	8.0	123.0	5.5 H	11.70	126.70	5.00	14,823.9	8.70	123.70	5.00	10,761.9			8.70	123.70	0.20	430.5	8.70	123.70	0.40	861.0	123.70	6.25	0.35	1,082.4	8.00	6.25	0.35	105.0	8.00	123.00	0.25	492.0	2,540.3		264.80	211.84	3,092.50	300.00	3,604.3	1,968.00	1,968.0				
8 Secandary Clarifire	2	Dia 23.0		3.5	26.70		5.00	5,596.2	23.70		5.00	4,409.3			23.70		0.20	176.4	23.70		0.40	352.7	74.42	4.25	0.35	221.4	23.00	4.25	0.35		23.00		0.25	207.6	781.8		74.42	59.53	1,265.11		1,324.6	830.53	830.5				
9 Secondary Sludge Sump					3.00																																										
10 Chlorine Contact Tank	1	2.0	54.0	2.0	5.70	57.70	5.00	1,644.5	2.70	54.70	5.00	738.5			2.70	54.70	0.20	29.5	2.70	54.70	0.40	59.1	54.70	2.75	0.35	105.3	2.00	2.75	0.35	5.8	2.00	54.00	0.25	27.0	197.1		114.80	45.92	300.85	16.50	363.3	108.00	108.0				
11 Dechlorine Mixing Tank	1	6.8	5.0	2.0	10.50	8.70	5.00	456.8	7.50	5.70	5.00	213.8			7.50	5.70	0.20	8.6	7.50	5.70	0.40	17.1	5.70	2.75	0.35	11.0	6.80	2.75	0.35	19.6	6.80	5.00	0.25	8.5	56.2		26.40	10.56	31.35	56.10	98.0	34.00	34.0				
12 Sludge Thickner																																															
13 Thickened Sludge Sump																																															
14 Centrifuge Feed Sump	2	6.0	7.0	4.0	9.70	10.70			6.70	7.70					6.70	7.70	0.20	20.6	6.70	7.70	0.40	41.3	7.70	4.75	0.35	51.2	6.00	4.75	0.35	59.9	6.00	7.00	0.25	21.0	173.3		28.80	23.04	146.30	171.00	340.3	84.00	84.0				
15 Filtrate Sump	1	2.0	2.0	1.0	5.70	5.70			2.70	2.70					2.70	2.70	0.20	1.5	2.70	2.70	0.40	2.9	2.70	1.75	0.35	3.3	2.00	1.75	0.35	3.7	2.00	2.00	0.25	1.0	10.9		10.80	4.32	9.45	10.50	24.3	4.00	4.0				
Quantity								**24,584**				**16,987**	**7,597**	**16,987**				**719**																	**4,038**	**404**					**6,350**		**3,219**			**254**	
Rate (INR)							Rate	521				Rate	126	146			Rate	5,829																Rate	6,542	76,219				Rate	373	Rate	490		Rate	901	
Sub Total Cost (INR)								12,810,404					957,744	2,473,263				4,193,655																	26,414,462	30,774,312					2,368,461		1,576,038			228,647	10% of Sub Total
							₹	**12,811,000**				₹	**958,000**	**2,474,000**			₹	**4,194,000**																₹	**26,415,000**	**30,775,000**				₹	**2,369,000**	₹	**1,577,000**		₹	**229,000**	**₹8,180,200**
Total Cost (INR)																																															**90,000,000**
Architecht																																									Sqm	INR/Sqm	INR	
20 Administration Building	1	15.0	23.0	10.0 H																																						345	39,000	13,455,000	14,000,000
21 Maintenance Building	1	15.0	8.0	4.5 H																																						120	27,000	3,240,000	4,000,000
22 D.G Room	1	15.0	15.0	5.0 H																																						225	27,000	6,075,000	7,000,000
23 Air Blower Building	1	8.0	20.0	6.0 H																																						160	46,000	7,360,000	8,000,000
24 Centrifuge Building	1	15.0	25.0	10.0 H																																						375	64,000	24,000,000	24,000,000
25 Chemical Building	1	8.0	10.0	6.0 H																																						80	62,000	4,960,000	5,000,000
26 Clolorination Building	1	10.0	7.0	5.5 H																																						70	44,000	3,080,000	4,000,000
Other Work																																															
27 Sewer and Sludge Pipe Lines																																													10.0% of above	15,600,000
28 Road Construction and other																																													10.0% of above	15,600,000
Gran Total																																														**187,200,000**

10MLD

Cost function for Civil Construction of STPs (15MLD)

UNIT:INR

Items	Size of Facility				Excavation				Backfilling					Disposal	PCC				Rainforced Cement Concrete																					Reinforcement Steel	Form Work 1												Form Work 2		Water Proofing			Miscellaneous
																			Basement				Wall/L				Wall/W				Slab																														
	Nos	W /Dia	L	SWD/H	W/Dia	L	H	V1	W/Dia	L	H	V2	V3=V1−V2	V4 =V1−V3	W/Dia	L	t	V	W/Dia	L	t	V1	L	H	t	V2	W	H	t	V3	W	L	t	V4	Sub Total	Sub Total	Basement	Wall/L	Wall/W	Sub Total	Slab	Sub Total	Wall/L	Wall/W	Sub Total	
		MR	MR	MR	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Tone	L	A1	A2	A3	Sum	A4	Sqm	A1	A2	Cum	
																																					Sqm	Sqm	Sqm	Sqm		Sqm		Sqm	Sqm		
MPS(TSPS)																																																							
1 Inlet Chamber	1	2.9	2.5	0.6	6.60	6.20	5.00	204.6	3.60	3.20	5.00	57.6			3.60	3.20	0.20	2.3	3.60	3.20	0.40	4.6	3.20	1.35	0.35	3.0	2.90	1.35	0.35	4.1	2.90	2.50	0.25	1.8	13.6		13.60	5.44	8.64	11.75	25.8	7.25	7.3	4.32	5.87	10.19	
2 Main Screen Channel	2	1.2	8.0	0.6	4.90	11.70	5.00	573.3	1.90	8.70	5.00	165.3			1.90	8.70	0.20	6.6	1.90	8.70	0.40	13.2	8.70	1.35	0.35	16.4	1.20	1.35	0.35	3.4	1.20	8.00	0.25	4.8	37.9		21.20	16.96	46.98	9.72	73.7	19.20	19.2	23.49	4.86	28.35	
3 Bypass Screen Channel	1	1.2	8.0	0.6	4.90	11.70	5.00	286.7	1.90	8.70	5.00	82.7			1.90	8.70	0.20	3.3	1.90	8.70	0.40	6.6	8.70	1.35	0.35	8.2	1.20	1.35	0.35	1.7	1.20	8.00	0.25	2.4	18.9		21.20	8.48	23.49	4.86	36.8	9.60	9.6	11.75	2.43	14.18	
4 Raw Sewage Sump	1	Dia 11.0		2.2	14.70		5.00	848.2	11.70		5.00	537.3			11.70		0.20	21.5	11.70		0.40	43.0	36.74	2.95	0.35	37.9	11.00	2.95	0.35		11.00		0.25	23.7	104.7		36.74	14.70	216.75		231.4	94.99	95.0	108.38		108.38	
					3.00																																															
STP																																																						
Civil Work					3.00																																														
1 Inlet Chamber	1	2.9	2.5	2.0	6.60	6.20	1.00	40.9	3.60	3.20	1.00	11.5			3.60	3.20	0.20	2.3	3.60	3.20	0.40	4.6	3.20	2.75	0.35	6.2	2.90	2.75	0.35	8.4	2.90	2.50	0.25	1.8	21.0		13.60	5.44	17.60	23.93	47.0	7.25	7.3	8.80	11.96	20.76	
2 Main Screen Channel	2	1.0	6.0	0.5	4.70	9.70	1.00	91.2	1.70	6.70	1.00	22.8			1.70	6.70	0.20	4.6	1.70	6.70	0.40	9.1	6.70	1.25	0.35	11.7	1.00	1.25	0.35	2.6	1.00	6.00	0.25	3.0	26.5		16.80	13.44	33.50	7.50	54.4	12.00	12.0	16.75	3.75	20.50	
3 Bypass Screen Channel	1	1.0	6.0	0.5	4.70	9.70	1.00	45.6	1.70	6.70	1.00	11.4			1.70	6.70	0.20	2.3	1.70	6.70	0.40	4.6	6.70	1.25	0.35	5.9	1.00	1.25	0.35	1.3	1.00	6.00	0.25	1.5	13.2		16.80	6.72	16.75	3.75	27.2	6.00	6.0	8.38	1.88	10.25	
4 Grit Chamber	2	Dia 6.0		0.9	9.70		1.00	147.7	6.70		1.00	70.5			6.70		0.20	14.1	6.70		0.40	28.2	21.04	1.65	0.35	24.3	6.00	1.65	0.35		6.00		0.25	14.1	66.6		21.04	16.83	138.85		155.7	56.52	56.5	69.43		69.43	
5 Parshall Flume	1	1.5	10.0	0.8	5.20	13.70	1.00	71.2	2.20	10.70	1.00	23.5			2.20	10.70	0.20	4.7	2.20	10.70	0.40	9.4	10.70	1.55	0.35	11.6	1.50	1.55	0.35	2.4	1.50	10.00	0.25	3.8	27.2		25.80	10.32	33.17	6.98	50.5	15.00	15.0	16.59	3.49	20.07	
6 Distribution Chamber					3.00																																													
7 Anoxic/Aerobic Tank	2	8.0	180.0	5.5 H	11.70	183.70	5.00	21,492.9	8.70	180.70	5.00	15,720.9			8.70	180.70	0.20	628.8	8.70	180.70	0.40	1,257.7	180.70	6.25	0.35	1,581.1	8.00	6.25	0.35	105.0	8.00	180.00	0.25	720.0	3,663.8		378.80	303.04	4,517.50	300.00	5,120.5	2,880.00	2,880.0				
8 Secandary Clarifire	2	Dia 28.5		3.5	32.20		5.00	8,139.2	29.20		5.00	6,693.2			29.20		0.20	267.7	29.20		0.40	535.5	91.69	4.25	0.35	272.8	28.50	4.25	0.35		28.50		0.25	318.8	1,127.0		91.69	73.35	1,558.70		1,632.0	1,275.23	1,275.2				
9 Secondary Sludge Sump					3.00																																													
10 Chlorine Contact Tank	1	2.0	81.0	2.0	5.70	84.70	5.00	2,414.0	2.70	81.70	5.00	1,103.0			2.70	81.70	0.20	44.1	2.70	81.70	0.40	88.2	81.70	2.75	0.35	157.3	2.00	2.75	0.35	5.8	2.00	81.00	0.25	40.5	291.8		168.80	67.52	449.35	16.50	533.4	162.00	162.0				
11 Dechlorine Mixing Tank	1	6.8	8.0	2.0	10.50	11.70	5.00	614.3	7.50	8.70	5.00	326.3			7.50	8.70	0.20	13.1	7.50	8.70	0.40	26.1	8.70	2.75	0.35	16.7	6.80	2.75	0.35	19.6	6.80	8.00	0.25	13.6	76.1		32.40	12.96	47.85	56.10	116.9	54.40	54.4				
12 Sludge Thickner	2	Dia 11.0		4.0	14.70		5.00	1,696.3	11.70		5.00	1,074.6			11.70		0.20	43.0	11.70		0.40	86.0	36.74	4.75	0.35	122.2	11.00	4.75	0.35		11.00		0.25	47.5	255.6		36.74	29.39	698.02		727.4	189.97	190.0				
13 Thickened Sludge Sump	2	3.5	4.0	3.0	7.20	7.70	5.00	554.4	4.20	4.70	5.00	197.4			4.20	4.70	0.20	7.9	4.20	4.70	0.40	15.8	4.70	3.75	0.35	24.7	3.50	3.75	0.35	27.6	3.50	4.00	0.25	7.0	75.0		17.80	14.24	70.50	78.75	163.5	28.00	28.0				
14 Centrifuge Feed Sump	2	6.0	6.0	4.0	9.70	9.70	5.00	940.9	6.70	6.70	5.00	448.9			6.70	6.70	0.20	18.0	6.70	6.70	0.40	35.9	6.70	4.75	0.35	44.6	6.00	4.75	0.35	59.9	6.00	6.00	0.25	18.0	158.3		26.80	21.44	127.30	171.00	319.7	72.00	72.0				
15 Filtrate Sump	1	2.0	2.0	1.0	5.70	5.70	5.00	162.5	2.70	2.70	5.00	36.5			2.70	2.70	0.20	1.5	2.70	2.70	0.40	2.9	2.70	1.75	0.35	3.3	2.00	1.75	0.35	3.7	2.00	2.00	0.25	1.0	10.9		10.80	4.32	9.45	10.50	24.3	4.00	4.0				
Quantity								**38,324**				**26,583**	**11,740**	**26,583**				**1,086**																	**5,988**	**599**				**9,340**		**4,893**			**302**	
Rate (INR)							Rate	521				Rate	126	146			Rate	5,829																Rate	6,542	76,219				373	Rate	490		Rate	901	
Sub Total Cost (INR)							₹	19,970,391 **19,971,000**				₹	1,480,148 **1,481,000**	3,870,516 **3,871,000**			₹	6,328,144 **6,329,000**																₹	39,174,427 **39,175,000**	45,640,378 **45,641,000**				3,483,592 **3,484,000**	₹	2,395,712 **2,396,000**		₹	272,322 **273,000**	10% of Sub Total **₹12,262,100**
Total Cost (INR)																																																		**135,000,000**
Architecht																																																Sqm	INR/Sqm	INR	
20 Administration Building	1	15.0	23.0	10.0 H																																											345	39,000	13,455,000	14,000,000
21 Maintenance Building	1	15.0	8.0	4.5 H																																											120	27,000	3,240,000	4,000,000
22 D.G Room	1	15.0	15.0	5.0 H																																											225	27,000	6,075,000	7,000,000
23 Air Blower Building	1	8.0	20.0	6.0 H																																											160	46,000	7,360,000	8,000,000
24 Centrifuge Building	1	15.0	25.0	10.0 H																																											375	64,000	24,000,000	24,000,000
25 Chemical Building	1	8.0	10.0	6.0 H																																											80	62,000	4,960,000	5,000,000
26 Clolorination Building	1	10.0	7.0	5.5 H																																											70	44,000	3,080,000	4,000,000
Other Work																																																			
27 Sewer and Sludge Pipe Lines																																																10.0% of above		20,100,000
28 Road Construction and other																																															10.0% of above		20,100,000
Gran Total																																																		**241,200,000**

15MLD

Cost function for Civil Construction of STPs (24MLD)

UNIT:INR

Items	Size of Facility				Excavation				Backfilling					Disposal	PCC				Rainforced Cement Concrete																				Reinforcement Steel	Form Work 1						Form Work 2		Water Proofing			Miscellaneous
																			Basement				Wall/L				Wall/W				Slab																				
	Nos	W /Dia	L	SWD/H	W/Dia	L	H	V1	W/Dia	L	H	V2	V3=V1−V2	V4 =V1−V3	W/Dia	L	t	V	W/Dia	L	t	V1	L	H	t	V2	W	H	t	V3	W	L	t	V4	Sub Total	Sub Total	Basement				Wall/L	Wall/W	Sub Total	Slab	Sub Total	Wall/L	Wall/W	Sub Total	
		MR	MR	MR	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	MR	MR	MR	Cum	Cum	Tone	L MR	A1 Sqm	A2 Sqm	A3 Sqm	Sub Total	A4 Sqm	Cum	A1 Sqm	A2 Sqm	Cum	
MPS(TSPS)																																																
1 Inlet Chamber	1	4.4	2.8	0.6	8.10	6.50	5.00	263.3	5.10	3.50	5.00	89.3			5.10	3.50	0.20	3.6	5.10	3.50	0.40	7.1	3.50	1.35	0.35	3.3	4.40	1.35	0.35	6.2	4.40	2.80	0.25	3.1	19.8		17.20	6.88	9.45	17.82	34.2	12.32	12.3	4.73	8.91	13.64	
2 Main Screen Channel	3	1.2	6.0	0.6	4.90	9.70	5.00	713.0	1.90	6.70	5.00	191.0			1.90	6.70	0.20	7.6	1.90	6.70	0.40	15.3	6.70	1.35	0.35	19.0	1.20	1.35	0.35	5.1	1.20	6.00	0.25	5.4	44.8		17.20	20.64	54.27	14.58	89.5	21.60	21.6	27.14	7.29	34.43	
3 Bypass Screen Channel	1	1.2	6.0	0.6	4.90	9.70	5.00	237.7	1.90	6.70	5.00	63.7			1.90	6.70	0.20	2.5	1.90	6.70	0.40	5.1	6.70	1.35	0.35	6.3	1.20	1.35	0.35	1.7	1.20	6.00	0.25	1.8	14.9		17.20	6.88	18.09	4.86	29.8	7.20	7.2	9.05	2.43	11.48	
4 Raw Sewage Sump	1	Dia 14.0		2.2	17.70		5.00	1,229.7	14.70		5.00	848.2			14.70		0.20	33.9	14.70		0.40	67.9	46.16	2.95	0.35	47.7	14.00	2.95	0.35		14.00		0.25	38.5	154.0		46.16	18.46	272.33		290.8	153.86	153.9	136.17		136.17	
					3.00																																										
STP																																																
Civil Work					3.00																																										
1 Inlet Chamber	1	2.8	2.8	1.5	6.50	6.50	1.00	42.3	3.50	3.50	1.00	12.3			3.50	3.50	0.20	2.5	3.50	3.50	0.40	4.9	3.50	2.25	0.35	5.5	2.80	2.25	0.35	6.6	2.80	2.80	0.25	2.0	19.0		14.00	5.60	15.75	18.90	40.3	7.84	7.8	7.88	9.45	17.33	
2 Main Screen Channel	2	1.2	6.0	0.6	4.90	9.70	1.00	95.1	1.90	6.70	1.00	25.5			1.90	6.70	0.20	5.1	1.90	6.70	0.40	10.2	6.70	1.35	0.35	12.7	1.20	1.35	0.35	3.4	1.20	6.00	0.25	3.6	29.8		17.20	13.76	36.18	9.72	59.7	14.40	14.4	18.09	4.86	22.95	
3 Bypass Screen Channel	1	1.2	6.0	0.6	4.90	9.70	1.00	47.5	1.90	6.70	1.00	12.7			1.90	6.70	0.20	2.5	1.90	6.70	0.40	5.1	6.70	1.35	0.35	6.3	1.20	1.35	0.35	1.7	1.20	6.00	0.25	1.8	14.9		17.20	6.88	18.09	4.86	29.8	7.20	7.2	9.05	2.43	11.48	
4 Grit Chamber	2	Dia 7.5		0.9	11.20		1.00	196.9	8.20		1.00	105.6			8.20		0.20	21.1	8.20		0.40	42.2	25.75	1.65	0.35	29.7	7.50	1.65	0.35		7.50		0.25	22.1	94.0		25.75	20.60	169.94		190.5	88.31	88.3	84.97		84.97	
5 Parshall Flume	1	1.5	12.0	0.8	5.20	15.70	1.00	81.6	2.20	12.70	1.00	27.9			2.20	12.70	0.20	5.6	2.20	12.70	0.40	11.2	12.70	1.55	0.35	13.8	1.50	1.55	0.35	2.4	1.50	12.00	0.25	4.5	31.9		29.80	11.92	39.37	6.98	58.3	18.00	18.0	19.69	3.49	23.17	
6 Distribution Chamber					3.00																																										
7 Anoxic/Aerobic Tank	4	8.0	147.0	5.5 H	11.70	150.70	5.00	35,263.8	8.70	147.70	5.00	25,699.8			8.70	147.70	0.20	1,028.0	8.70	147.70	0.40	2,056.0	147.70	6.25	0.35	2,584.8	8.00	6.25	0.35	210.0	8.00	147.00	0.25	1,176.0	6,026.7		312.80	500.48	7,385.00	600.00	8,485.5	4,704.00	4,704.0				
8 Secandary Clarifire	4	Dia 26.0		3.5	29.70		5.00	13,848.8	26.70		5.00	11,192.4			26.70		0.20	447.7	26.70		0.40	895.4	83.84	4.25	0.35	498.8	26.00	4.25	0.35		26.00		0.25	530.7	1,924.9		83.84	134.14	2,850.49		2,984.6	2,122.64	2,122.6				
9 Secondary Sludge Sump					3.00																																										
10 Chlorine Contact Tank	1	2.0	130.0	2.0	5.70	133.70	5.00	3,810.5	2.70	130.70	5.00	1,764.5			2.70	130.70	0.20	70.6	2.70	130.70	0.40	141.2	130.70	2.75	0.35	251.6	2.00	2.75	0.35	5.8	2.00	130.00	0.25	65.0	463.5		266.80	106.72	718.85	16.50	842.1	260.00	260.0				
11 Dechlorine Mixing Tank	1	11.6	8.0	2.0	15.30	11.70	5.00	895.1	12.30	8.70	5.00	535.1			12.30	8.70	0.20	21.4	12.30	8.70	0.40	42.8	8.70	2.75	0.35	16.7	11.60	2.75	0.35	33.5	11.60	8.00	0.25	23.2	116.2		42.00	16.80	47.85	95.70	160.4	92.80	92.8				
12 Sludge Thickner	2	Dia 14.0		4.0	17.70		5.00	2,459.3	14.70		5.00	1,696.3			14.70		0.20	67.9	14.70		0.40	135.7	46.16	4.75	0.35	153.5	14.00	4.75	0.35		14.00		0.25	76.9	366.1		46.16	36.93	877.00		913.9	307.72	307.7				
13 Thickened Sludge Sump	2	3.5	4.0	3.5	7.20	7.70	5.00	554.4	4.20	4.70	5.00	197.4			4.20	4.70	0.20	7.9	4.20	4.70	0.40	15.8	4.70	4.25	0.35	28.0	3.50	4.25	0.35	31.2	3.50	4.00	0.25	7.0	82.0		17.80	14.24	79.90	89.25	183.4	28.00	28.0				
14 Centrifuge Feed Sump	2	6.0	7.0	4.0	9.70	10.70	5.00	1,037.9	6.70	7.70	5.00	515.9			6.70	7.70	0.20	20.6	6.70	7.70	0.40	41.3	7.70	4.75	0.35	51.2	6.00	4.75	0.35	59.9	6.00	7.00	0.25	21.0	173.3		28.80	23.04	146.30	171.00	340.3	84.00	84.0				
15 Filtrate Sump	1	2.0	2.0	1.0	5.70	5.70	5.00	162.5	2.70	2.70	5.00	36.5			2.70	2.70	0.20	1.5	2.70	2.70	0.40	2.9	2.70	1.75	0.35	3.3	2.00	1.75	0.35	3.7	2.00	2.00	0.25	1.0	10.9		10.80	4.32	9.45	10.50	24.3	4.00	4.0				
Quantity								**60,939**				**43,014**	**17,925**	**43,014**				**1,750**																	**9,587**	**959**					**14,757**		**7,934**			**356**	
Rate (INR)							Rate	521				Rate	126	146			Rate	5,829																Rate	6,542	76,219				Rate	373	Rate	490		Rate	901	
Sub Total Cost (INR)							₹	31,755,231				₹	2,259,897	6,262,792			₹	10,200,151																₹	62,718,092	73,070,052				₹	5,503,914	₹	3,884,272		₹	320,536	10% of Sub Total
							₹	**31,756,000**				₹	**2,260,000**	**6,263,000**			₹	**10,201,000**																₹	**62,719,000**	**73,071,000**				₹	**5,504,000**	₹	**3,885,000**		₹	**321,000**	**₹19,598,000**
Total Cost (INR)																																															**216,000,000**
Architecht																																									Sqm	INR/Sqm	INR				
20 Administration Building	1	15.0	30.0	10.0 H																																						450	39,000	17,550,000	18,000,000			
21 Maintenance Building	1	12.0	8.0	4.5 H																																						96	27,000	2,592,000	3,000,000			
22 D.G Room	1	15.0	15.0	5.0 H																																						225	27,000	6,075,000	7,000,000			
23 Air Blower Building	1	8.0	20.0	6.0 H																																						160	46,000	7,360,000	8,000,000			
24 Centrifuge Building	1	15.0	25.0	10.0 H																																						375	64,000	24,000,000	24,000,000			
25 Chemical Building	1	8.0	20.0	6.0 H																																						160	62,000	9,920,000	10,000,000			
26 Clolorination Building	1	6.5	7.5	5.5 H																																						49	44,000	2,145,000	3,000,000			
Other Work																																															
27 Sewer and Sludge Pipe Lines																																													10.0% of above		28,900,000
28 Road Construction and other																																												10.0% of above		28,900,000
Gran Total																																														**346,800,000**

24MLD

Cost function for Mechanical and Electrical Construction of STPs

Unit : Million INR

Item	3MLD			10MLD			15MLD			24MLD		
	TSPS	STP	Sub-Total	TSPS	STP	Sub-Total	TSPS	STP	Sub-Total	TSPS	STP	Sub-Total
Mechanical	**8,945,522**	**47,118,456**	**56,063,978** **≒56,100,000**	**18,475,324**	**81,852,871**	**100,328,195** **≒100,400,000**	**25,526,974**	**98,790,264**	**124,317,238** **≒124,400,000**	**29,556,489**	**145,868,425**	**175,424,914** **≒175,500,000**
Electrical	Included in STP	**44,782,240**	**44,782,240** **≒44,800,000**	Included in STP	**70,329,420**	**70,329,420** **≒70,400,000**	Included in STP	**85,526,640**	**85,526,640** **≒85,600,000**	Included in STP	**108,635,584**	**108,635,584** **≒108,700,000**
Total	**8,945,522**	**91,900,696**	**100,846,218** **≒100,900,000**	**18,475,324**	**152,182,291**	**170,657,615** **≒170,700,000**	**25,526,974**	**184,316,904**	**209,843,878** **≒209,900,000**	**29,556,489**	**254,504,009**	**284,060,498** **≒284,100,000**

Mechanical Cost for TSPSs (3MLD)

	MECHANICAL ITEMS	SPECIFICATION	(k W/UNIT	NUMBER W	NUMBER S	NUMBER T	DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon hours/d	Electrical power Consumptioon kWh/d	NJS 積算単価	BESIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算 TOTAL	Toshiba 見積額
								k W	3.0	0.70	Rs./unit	8	12.36% 9=8×	12.50% 10=(8+9)×	2.00% 11=8×	2.00% 12=8×	13=SUM(8:12)	14=13×TOTAL NO.	3.00% 15=14×	16=14+15	
1	INLET GATE	W (m) : 0.40 L(m) : 0.60 Design Water Depth(m) : 8.00	–	2		2	Manually Sluice Gate, Wall Thimble:Cast iron, Gate: cast iron, Frame: cast iron. Floor+5.000, Bottom+0.000	0.00			190,000	190,000	23,484	26,686	3,800	3,800	247,770	495,539	14,866	510,405	1,368,000
2	COARSE SCREEN (MECHANICAL)	W (m) : 0.60 L(m) : 6.00 SWD(m) : 0.50	1.50	1	0	1	Climber screen, including control panel. Screen: SS316L Open space 20mm Floor+5.000, Bottom+0.000	1.50			1,500,000	1,500,000	185,400	210,675	30,000	30,000	1,956,075	1,956,075	58,682	2,014,757	
3	COARSE SCREEN (MANUAL)	W (m) : 0.60 L(m) : 6.00 SWD(m) : 0.50	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 50mm Floor+5.000, Bottom+0.000	0.00			160,000	160,000	19,776	22,472	3,200	3,200	208,648	208,648	6,259	214,907	1,044,000
4	BELT CONVEYOR	Belt Width (m) : 0.60 L(m) : 5.00 –	1.50	0	0	0	Frame: MS+ Epoxy, Belt: NBR 3mm	0.00			400,000	400,000	49,440	56,180	8,000	8,000	521,620	0	0	0	
5	SEWAGE PUMP 1	Dia (mm) : 200 Q(m3/h) : 315 H(m): 15.00	30.00	1	1	2	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%. Floor+8.000, Bottom+0.000	30.00	9.5	203.75	800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	2,086,480	62,594	2,149,074	5,940,000
6	SEWAGE PUMP 2											0	0	0	0	0	0	0	0	0	
7	ELECTRIC HOIST	RL(T) : 3.00 L(m) : 6.00 –	8.50	1	0	1	Single-girder overhead type.	8.50			800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537	1,224,000
						TOTAL		40.00		203.75										5,963,681	9,576,000
							Total	kW		kWh/d											

Mechanical Cost for TSPSs (10MLD)

	MECHANICAL ITEMS	SPECIFICATION	(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算額 TOTAL	Toshiba 見積額
				W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		
									10.0	0.70		8	9=8 ×	10=(8+9) ×	11=8 ×	12=8 ×	13=SUM(8:12)	14=13 × TOTAL NO.	15=14 ×	16=14+15	
1	INLET GATE	W (m) : 0.60 L(m) : 0.90 Design Water Depth(m) : 8.00	–	2	1	3	Manually Sluice Gate, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. Floor+5.000, Bottom+0.000	0.00			270,000	270,000	33,372	37,922	5,400	5,400	352,094	1,056,281	31,688	1,087,969	2,511,000
2	COARSE SCREEN (MECHANICAL)	W (m) : 1.00 L(m) : 6.00 SWD(m) : 0.60	1.50	1	0	1	Climber screen, including control panel. Screen: SS316L Open space 20mm Floor+5.000, Bottom+0.000	1.50	6.0	6.30	2,100,000	2,100,000	259,560	294,945	42,000	42,000	2,738,505	2,738,505	82,155	2,820,660	4,950,000
3	COARSE SCREEN (MANUAL)	W (m) : 1.00 L(m) : 6.00 SWD(m) : 0.60	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 50mm Floor+5.000, Bottom+0.000	0.00			260,000	260,000	32,136	36,517	5,200	5,200	339,053	339,053	10,172	349,225	1,710,000
4	BELT CONVEYOR	Belt Width (m) : 0.60 L(m) : 5.00 –	1.50	1	0	1	Frame: MS+ Epoxy, Belt: NBR 3mm	1.50	7.0	7.35	400,000	400,000	49,440	56,160	8,000	8,000	521,620	521,620	15,649	537,269	963,000
5	SEWAGE PUMP 1	Dia (mm) : 200 Q(m3/h) : 380 H(m): 15.00	30.00	2	1	3	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%. Floor+8.000, Bottom+0.000	60.00	10.5	543.33	1,000,000	1,000,000	123,600	140,450	20,000	20,000	1,304,050	3,912,150	117,365	4,029,515	6,210,000
6	SEWAGE PUMP 2	Dia (mm) : 150 Q(m3/h) : 190 H(m): 15.00	15.00	1	1	2	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%. Floor+8.000, Bottom+0.000	15.00	10.5	135.83	900,000	900,000	111,240	126,405	18,000	18,000	1,173,645	2,347,290	70,419	2,417,709	3,510,000
7	ELECTRIC HOIST	RL(T) : 3.00 L(m) : 6.00 –	8.50	1	0	1	Single-girder overhead type.	8.50			800,000	800,000	98,880	112,380	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537	1,440,000
						TOTAL		86.50		692.82										12,316,883	21,294,000
								kW		kWh/d										INR	INR

Mechanical Cost for TSPSs (15MLD)

	MECHANICAL ITEMS	SPECIFICATION						(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算額 TOTAL	
									W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Re
														15.0	0.70		8	9=8 ×	10=(9+0) ×	11=8 ×	12=8 ×	13=SUM(8:12)	14=13 × TOTAL NO.	15=14 ×	16=14+15	
1	INLET GATE	W (m) :	0.60	L(m) :	0.90	Design Water Depth(m) :	8.00	–	2	1	3	Manually Sluice Gate, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. Floor+5.000, Bottom+0.000	0.00			270,000	270,000	33,372	37,922	5,400	5,400	352,094	1,056,281	31,688	1,087,969	
2	COARSE SCREEN (MECHANICAL)	W (m) :	1.00	L(m) :	6.00	SWD(m) :	0.60	1.50	2	0	2	Climber screen, including control panel. Screen: SS316L Open space 20mm Floor+5.000, Bottom+0.000	3.00	6.0	12.60	2,100,000	2,100,000	259,560	294,945	42,000	42,000	2,738,505	5,477,010	164,310	5,641,320	
3	COARSE SCREEN (MANUAL)	W (m) :	1.00	L(m) :	6.00	SWD(m) :	0.60	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 50mm Floor+5.000, Bottom+0.000	0.00			260,000	260,000	32,136	36,517	5,200	5,200	339,053	339,053	10,172	349,225	
4	BELT CONVEYOR	Belt Width (m) :	0.60	L(m) :	5.00		–	1.50	1	0	1	Frame: MS+ Epoxy, Belt: NBR 3mm	1.50	7.0	7.35	400,000	400,000	49,440	56,160	8,000	8,000	521,620	521,620	15,649	537,269	
5	SEWAGE PUMP 1	Dia (mm) :	300	Q(m3/h) :	570	H(m):	15.00	45.00	2	1	3	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%. Floor+8.000, Bottom+0.000	90.00	10.5	815.00	1,400,000	1,400,000	173,040	196,630	28,000	28,000	1,825,670	5,477,010	164,310	5,641,320	
6	SEWAGE PUMP 2	Dia (mm) :	200	Q(m3/h) :	285	H(m):	15.00	30.00	1	1	2	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%. Floor+8.000, Bottom+0.000	30.00	10.5	203.75	1,000,000	1,000,000	123,600	140,450	20,000	20,000	1,304,050	2,608,100	78,243	2,686,343	
7	ELECTRIC HOIST	RL(T) :	3.00	L(m) :	6.00		–	8.50	1	0	1	Single-girder overhead type.	8.50			800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537	
											TOTAL		133.00		1038.70										17,017,983	0
													k W		kWh/d										INR	

Mechanical Cost for TSPSs (24MLD)

	MECHANICAL ITEMS	SPECIFICATION	(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumption		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算額 TOTAL	Toshiba 見積額
				W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Rs.
									24.0	0.70		8	9=8×	10=(8+9)×	11=8×	12=8×	13=SUM(8:12)	14=13×TOTAL NO.	15=14×	16=14+15	
1	INLET GATE	W (m) : 0.60 L(m) : 0.90 Design Water Depth(m) : 8.00	–	3	1	4	Manually Sluice Gate, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. Floor+5.000, Bottom+0.000	0.00			270,000	270,000	33,372	37,922	5,400	5,400	352,094	1,408,374	42,251	1,450,625	3,348,000
2	COARSE SCREEN (MECHANICAL)	W (m) : 1.20 L(m) : 6.00 SWD(m) : 0.60	1.50	2	0	2	Climber screen, including control panel. Screen: SS316L Open space 20mm Floor+5.000, Bottom+0.000	3.00	6.0	12.60	2,200,000	2,200,000	271,920	308,990	44,000	44,000	2,868,910	5,737,820	172,135	5,909,955	7,680,000
3	COARSE SCREEN (MANUAL)	W (m) : 1.20 L(m) : 6.00 SWD(m) : 0.60	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 50mm Floor+5.000, Bottom+0.000	0.00			340,000	340,000	42,024	47,753	6,800	6,800	443,377	443,377	13,301	456,678	2,160,000
4	BELT CONVEYOR	Belt Width (m) : 0.60 L(m) : 7.00 –	1.50	1	0	1	Frame: MS+ Epoxy, Belt: NBR 3mm	1.50	7.0	7.35	400,000	400,000	49,440	56,180	8,000	8,000	521,620	521,620	15,649	537,269	1,143,000
5	SEWAGE PUMP 1	Dia (mm) : 350 Q(m3/h) : 900 H(m): 15.00	75.00	2	1	3	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%. Floor+8.000, Bottom+0.000	150.00	10.7	1304.00	1,750,000	1,750,000	216,300	245,788	35,000	35,000	2,282,088	6,846,263	205,388	7,051,650	9,990,000
6	SEWAGE PUMP 2	Dia (mm) : 250 Q(m3/h) : 450 H(m): 15.00	37.00	1	1	2	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%. Floor+8.000, Bottom+0.000	37.00	10.7	326.00	1,200,000	1,200,000	148,320	168,540	24,000	24,000	1,564,860	3,129,720	93,892	3,223,612	4,500,000
7	ELECTRIC HOIST	RL(T) : 3.00 L(m) : 6.00 –	8.50	1	0	1	Single-girder overhead type.	8.50			800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537	1,440,000
						TOTAL		200.00		1649.95										19,704,326	30,261,000
								k W		kWh/d										INR	INR

Mechanical Cost for STPs (3MLD)

	MECHANICAL ITEMS	SPECIFICATION						(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算額 TOTAL	Toshiba 見積価額
									W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Rs./unit
														3.0	0.70		8	9=8×	10=(8+9)×	11=8×	12=8×	13=SUM(8:12)	14=13×TOTAL NO.	15=14×	16=14+15	
1	INLET GATE	W (m) :	0.40	L(m) :	0.60	Design Water Depth(m) :	2.00	–	1	1	2	Manually Sluice Gate, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+＊＊＊＊＊＊ bottom+＊＊＊＊＊＊	0.00	0.0		190,000	190,000	23,484	26,686	3,800	3,800	247,770	495,539	14,866	510,405	1,674,000
2	FINE SCREEN (MECHANICAL)	W (m) :	0.60	L(m) :	6.00	SWD(m) :	0.40	1.50	1	0	1	Step Type Screen including control panel. Screen: SS316L Open space 6mm	1.50	6.0	6.30	1,900,000	1,900,000	234,840	266,855	38,000	38,000	2,477,695	2,477,695	74,331	2,552,026	3,330,000
3	FINE SCREEN (MANUAL)	W (m) :	0.60	L(m) :	6.00	SWD(m) :	0.40	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 20mm	0.00	0.0		160,000	160,000	19,776	22,472	3,200	3,200	208,648	208,648	6,259	214,907	900,000
4	BELT CONVEYOR	Belt Width (m) :	0.60	L(m) :	5.00		–	1.50	1	0	1	Frame: MS+ Epoxy, Belt: NBR 3mm	1.50	7.0	7.35	400,000	400,000	49,440	56,180	8,000	8,000	521,620	521,620	15,649	537,269	540,000
5	GRIT CHAMBER	W (m) :	3.00	L(m) :	3.00	SWD(m) :	0.90	2.25	1	1	2	DETRITOR MECHANIS including a grit collector, a classifier, an organic return pumps, control panel. Wetted Parts : MS+Epoxy coated	2.25	24.0	37.80	1,100,000	1,100,000	135,960	154,495	22,000	22,000	1,434,455	2,868,910	86,067	2,954,977	3,240,000
6	INLET WEIR GATE	W (m) :	0.30	H(m) :	0.30	Stroke (m) :	0.35	–	2	0	2	Manually Sluice Weir, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+＊＊＊＊＊＊ bottom+＊＊＊＊＊＊	0.00	0.0		110,000	110,000	13,596	15,450	2,200	2,200	143,446	286,891	8,607	295,498	1,116,000
7	MIXERS FOR ANAEROBIC TANK	W (m) :	8.00	L(m) :	3.00	SWD(m) :	5.50	4.00	2	0	2	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	8.00	24.0	134.40	750,000	750,000	92,700	105,338	15,000	15,000	978,038	1,956,075	58,682	2,014,757	3,150,000
8	MIXERS FOR ANOXIC TANK	W (m) :	8.00	L(m) :	8.00	SWD(m) :	5.50	4.00	2	0	2	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	8.00	24.0	134.40	750,000	750,000	92,700	105,338	15,000	15,000	978,038	1,956,075	58,682	2,014,757	3,150,000
9	DIFFUSER	SOR(kg/h)	65	The setting depth of diffusers H(m) :	5.0	Efficiency E(%)	28.0	–	2	0	2	Fine Bubble Membrane Type.	0.00	0.0		800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	2,086,480	62,594	2,149,074	1,980,000
	Air Grid Pipe Work for Diffuser imported UPVC Pipes.	W (m) :	8.00	L(m) :	30.00	SWD(m) :	5.50	–	2	0	2	Air Grid Pipe Work for Diffuser imported UPVC Pipes.	0.00	0.0		0	0	0	0	0	0	0	0	0	0	1,800,000
10	AIR BLOWER	Dia (mm) :	150	Q(m3/h) :	1000	P(K Pa)	65	30.00	2	1	3	Rotary lobe blower, Tri-lube type with VFD. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	60.00	24.0	1284.05	500,000	500,000	61,800	70,225	10,000	10,000	652,025	1,956,075	58,682	2,014,757	3,024,000
11	CIRCULATION PUMP	Dia (mm) :	150	Q(m3/h) :	120	H(m):	5.00	3.70	4	2	6	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%.	14.80	24.0	246.64	350,000	350,000	43,260	49,158	7,000	7,000	456,418	2,738,505	82,155	2,820,660	3,888,000
12	RAS PUMP	Dia (mm) :	100	Q(m3/h) :	40	H(m):	5.00	1.50	2	2	4	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%.	3.00	24.0	50.40	220,000	220,000	27,192	30,899	4,400	4,400	286,891	1,147,564	34,427	1,181,991	900,000
13	SAS PUMP	Dia (mm) :	80	Q(m3/h) :	14	H(m):	15.00	2.20	2	2	4	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316. Pump efficiency shall be more than 60%.	4.40	6.0	18.48	200,000	200,000	24,720	28,090	4,000	4,000	260,810	1,043,240	31,297	1,074,537	792,000
14	HAND OPERATION CHAIN BLOC FOR RAS/SAS PUMP	RL(T) :	1.00	L(m) :	6.00		–	–	3	0	3		0.00	0.0		170,000	170,000	21,012	23,877	3,400	3,400	221,689	665,066	19,952	685,017	999,000
15	FINAL CLARIFIER	Dia (m) :	13.00	L(m) :	–	SWD(m) :	3.50	0.40	2	0	2	Bridge-supported type including a centre drum, two scraper arms, a scum collector, a fixed bridge. MS+epoxy resin painting	0.80	24.0	13.44	2,200,000	2,200,000	271,920	308,990	44,000	44,000	2,868,910	5,737,820	172,135	5,909,955	6,840,000
16	ALUM DOSING PUMP	Dia (mm) :	25	Q(l/h) :	60	H(MPa):	0.70	0.40	2	1	3	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	0.80	24.0	13.44	40,000	40,000	4,944	5,618	800	800	52,162	156,486	4,695	161,181	450,000
17	MIXERS FOR ALUM SOLUTION	W (m) :	1.00	L(m) :	1.00	SWD(m) :	1.00	0.40	2	0	2	Turbine impeller. SS316L	0.80	2.0	1.12	60,000	60,000	7,416	8,427	1,200	1,200	78,243	156,486	4,695	161,181	450,000
18	CHLORINATOR	Q(kg/h) :	3.1	–	–	–	–	0.10	1	1	2	Gas Chlorination System including Vacuum Chlorinators, Booster Pumps , Interconneoting Piping , Leak Detector, Residual Chlorine Analyses, Leak Absorption System ,Safety equipment and other accessories	0.10	24.0	1.68	1,300,000	1,300,000	160,680	182,585	26,000	26,000	1,695,265	3,390,530	101,716	3,492,246	6,480,000
19	CHLORINE BOOSTER PUMP	Dia (mm) :	25	Q(m3/h) :	2.1	H(m):	50.00	0.75	1	1	2		0.75	24.0	12.60	0	0	0	0	0	0	0	0	0	0	450,000
20	CHLORINE TONNERS		–		–		–	–	2	2	4		0.00			150,000	150,000	18,540	21,068	3,000	3,000	195,608	782,430	23,473	805,903	864,000
21	ELECTRIC HOIST FOR TONNERS	RL(T) :	3.00	L(m) :	6.00		–	8.60	1	0	1	Single-girder overhead type.	8.60	1.0	8.02	800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537	495,000
22	DECHLORINE DOSING PUMP	Dia (mm) :	15	Q(l/h) :	7.5	P(M Pa)	1.0	0.20	1	1	2	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	0.20	24.0	3.36	20,000	20,000	2,472	2,809	400	400	26,081	52,162	1,565	53,727	270,000
23	MIXER FOR DECLORINE SOLUTION	Capacity(m3) :	0.20					0.10	1	0	1	Turbine impeller. SS316L	0.10	2.0	0.14	50,000	50,000	6,180	7,023	1,000	1,000	65,203	65,203	1,956	67,159	153,000
24	AIR BLOWER FOR DECHLORINE MIXING TANK	Dia (mm) :	40	Q(m3/h) :	12	P(K Pa)	20	0.75	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	0.75	24.0	12.60	100,000	100,000	12,360	14,045	2,000	2,000	130,405	260,810	7,824	268,634	810,000
25	ELECTRIC HOIST FOR CHEMICALS	RL(T) :	1.00	L(m) :	6.00		–	4.70	1	0	1	Single-girder overhead type.	4.70	1.0	3.29	500,000	500,000	61,800	70,225	10,000	10,000	652,025	652,025	19,561	671,586	495,000
26	AIR BLOWER FOR CENTRIFUGE FEED SUMP	Dia (mm) :	65	Q(m3/h) :	130	P(K Pa)	40	3.70	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	3.70	12.0	31.08	160,000	160,000	19,776	22,472	3,200	3,200	208,648	417,296	12,519	429,815	756,000

	MECHANICAL ITEMS	SPECIFICATION	(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算額 TOTAL	Toshiba 見積額
				W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Rs./unit
									3.0	0.70		8	9=8×	10=(8+9)×	11=8×	12=8×	13=SUM(8:12)	14=13×TOTAL NO.	15=14×	16=14+15	
27	CENTRIFUGE FEED PUMP	Dia (mm) : 100 Q(m3/h) : 16 H(m): 20	5.50	1	1	2	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	5.50	10.3	39.66	210,000	210,000	25,956	29,495	4,200	4,200	273,851	547,701	16,431	564,132	594,000
28	CENTRIFUGE	Q(m3/h) : 16.00 – – – –	22.20	1	1	2	Solid bowl type with Motor including a control panel. Wetted Parts SS304. Input TSS 0.5% w/w. Dewatered sludge TSS required 18%w/w at polymer dose	22.20	10.3	160.06	3,600,000	3,600,000	444,960	505,620	72,000	72,000	4,694,580	9,389,160	281,675	9,670,835	7,920,000
29	ELECTRIC HOIST	RL(T) : 5.00 L(m) : 6.00 –	17.10	1	0	1	Single-girder overhead type.	17.10	0.0	0.00	1,100,000	1,100,000	135,960	154,495	22,000	22,000	1,434,455	1,434,455	43,034	1,477,489	1,440,000
30	POLYELECTROLYTE DOSING SYSTEM	W (m) : 1.00 L(m) : 1.50 SWD(m) : 1.80	0.75	2	0	2	Agitator 100RPM,Slow Speed, SS304	1.50	2.0	2.10	80,000	80,000	9,888	11,236	1,600	1,600	104,324	208,648	6,259	214,907	540,000
31	POLYELECTROLYTE DOSING PUMP	Dia (mm) : 20 Q(m3/h) : 0.50 H(m): 20.00	0.40	1	1	2	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	0.40	10.3	2.88	100,000	100,000	12,360	14,045	2,000	2,000	130,405	260,810	7,824	268,634	450,000
32	CENTRATE TRANSFER PUMP	Dia (mm) : 100 Q(m3/h) : 40 H(m): 15	5.50	1	1	2	CI, Submersible Type with detachable device Efficiency >50%	5.50	4.0	15.40	300,000	300,000	37,080	42,135	6,000	6,000	391,215	782,430	23,473	805,903	306,000
						TOTAL		176.95		2240.89										47,118,456	60,246,000
								kW		kWh/d										INR	INR

Mechanical Cost for STPs (10MLD)

	MECHANICAL ITEMS	SPECIFICATION						(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算額 TOTAL	Toshiba 見積額
									W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Rs.
														10.0	0.70		8	9=8×	10=(9+8)×	11=8×	12=8×	13=SUM(8:12)	14=13×TOTAL NO.	15=14×	16=14+15	
1	INLET GATE	W (m) :	0.40	L(m) :	0.60	Design Water Depth(m) :	2.00	–	2	1	3	Manually Sluice Gate, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+******* bottom*******	0.00			190,000	190,000	23,484	26,686	3,800	3,800	247,770	743,309	22,299	765,608	2,511,000
2	FINE SCREEN (MECHANICAL)	W (m) :	0.80	L(m) :	6.00	SWD(m) :	0.40	1.50	2	0	2	Step Type Screen including control panel. Screen: SS316L Open space 6mm	3.00	6.0	12.60	2,000,000	2,000,000	247,200	280,900	40,000	40,000	2,608,100	5,216,200	156,486	5,372,686	6,660,000
3	FINE SCREEN (MANUAL)	W (m) :	0.80	L(m) :	6.00	SWD(m) :	0.40	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 20mm	0.00			250,000	250,000	30,900	35,113	5,000	5,000	326,013	326,013	9,780	335,793	1,350,000
4	BELT CONVEYOR	Belt Width (m) :	0.60	L(m) :	7.00		–	1.50	1	0	1	Frame: MS+ Epoxy, Belt: NBR 3mm	1.50	7.0	7.35	400,000	400,000	49,440	56,180	8,000	8,000	521,620	521,620	15,649	537,269	810,000
5	GRIT CHAMBER	W (m) :	5.00	L(m) :	5.00	SWD(m) :	0.90	2.25	1	1	2	DETRITOR MECHANIS including a grit collector, a classifier, an organic return pumps, control panel. Wetted Parts : MS+Epoxy coated	2.25	24.0	37.80	1,550,000	1,550,000	191,580	217,698	31,000	31,000	2,021,278	4,042,555	121,277	4,163,832	4,140,000
6	INLET WEIR GATE	W (m) :	0.80	H(m) :	0.40	Stroke (m) :	0.45	–	2	0	2	Manually Sluice Weir, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+******* bottom*******	0.00			340,000	340,000	42,024	47,753	6,800	6,800	443,377	886,754	26,603	913,357	1,566,000
7	MIXERS FOR ANAEROBIC TANK	W (m) :	8.00	L(m) :	8.00	SWD(m) :	5.50	4.00	2	0	2	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	8.00	24.0	134.40	750,000	750,000	92,700	105,338	15,000	15,000	978,038	1,956,075	58,682	2,014,757	6,300,000
8	MIXERS FOR ANOXIC TANK	W (m) :	8.00	L(m) :	12.50	SWD(m) :	5.50	4.00	4	0	4	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	16.00	24.0	268.80	750,000	750,000	92,700	105,338	15,000	15,000	978,038	3,912,150	117,365	4,029,515	6,300,000
9	DIFFUSER	SOR(kg/h)	218	The setting depth of diffusers h(m) :	5.0	Efficiency E(%)	28.0	–	2	0	2	Fine Bubble Membrane Type.	0.00			2,500,000	2,500,000	309,000	351,125	50,000	50,000	3,260,125	6,520,250	195,608	6,715,858	2,700,000
10	AIR BLOWER	Dia (mm) :	200	Q(m3/h) :	1700	P(K Pa)	65	55.00	4	2	6	Rotary lobe blower, Tri-lube type with VFD. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	220.00	24.0	4365.79	550,000	550,000	67,980	77,248	11,000	11,000	717,228	4,303,365	129,101	4,432,466	6,588,000
11	CIRCULATION PUMP	Dia (mm) :	200	Q(m3/h) :	385	H(m):	5.00	11.00	4	2	6	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	44.00	24.0	739.20	880,000	880,000	108,768	123,596	17,600	17,600	1,147,564	6,885,384	206,562	7,091,946	10,098,000
12	RAS PUMP	Dia (mm) :	100	Q(m3/h) :	125	H(m):	5.00	3.70	2	2	4	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	7.40	24.0	124.32	250,000	250,000	30,900	35,113	5,000	5,000	326,013	1,304,050	39,122	1,343,172	2,088,000
13	SAS PUMP	Dia (mm) :	100	Q(m3/h) :	50	H(m):	15.00	5.50	2	2	4	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	11.00	6.0	46.20	300,000	300,000	37,080	42,135	6,000	6,000	391,215	1,564,860	46,946	1,611,806	1,800,000
14	HAND OPERATION CHAIN BLOC FOR RAS/SAS PUMP	RL(T) :	1.00	L(m) :	6.00		–	–	3	0	3		0.00			170,000	170,000	21,012	23,877	3,400	3,400	221,689	665,066	19,952	685,017	999,000
15	FINAL CLARIFIER	Dia (m) :	23.00	L(m) :	–	SWD(m) :	3.50	2.20	2	0	2	Column-supported type including a centre drum, two scraper arms, a scum collector, a fixed bridge. MS+epoxy resin painting	4.40	24.0	73.92	3,500,000	3,500,000	432,600	491,575	70,000	70,000	4,564,175	9,128,350	273,851	9,402,201	12,600,000
16	ALUM DOSING PUMP	Dia (mm) :	25	Q(l/h) :	180	H(MPa):	0.70	0.40	2	1	3	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	0.80	24.0	13.44	40,000	40,000	4,944	5,618	800	800	52,162	156,486	4,695	161,181	1,026,000
17	MIXERS FOR ALUM SOLUTION	W (m) :	1.20	L(m) :	1.20	SWD(m) :	1.80	0.75	2	0	2	Turbine impeller. SS316L	1.50	2.0	2.10	60,000	60,000	7,416	8,427	1,200	1,200	78,243	156,486	4,695	161,181	666,000

	MECHANICAL ITEMS	SPECIFICATION	(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS積算価 TOTAL	Toshiba 見積価
				W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Rs.
18	CHLORINATOR	Q(kg/h) : 9.4 – – – –	0.10	1	1	2	Gas Chlorination System including Vacuum Chlorinators, Booster Pumps , Interconnecting Piping , Leak Detector, Residual Chlorine Analyses, Leak Absorption System ,Safety equipment and other	0.10	24.0	1.68	2,000,000	2,000,000	247,200	280,900	40,000	40,000	2,808,100	5,216,200	156,486	5,372,686	6,480,000
19	CHLORINE BOOSTER PUMP	Dia (mm) : 25 Q(m3/h) : 3.6 H(m): 50.00	1.50	1	1	2		1.50	24.0	25.20	0	0	0	0	0	0	0	0	0	0	450,000
20	CHLORINE TONNERS	– – –	–	2	2	4		0.00			150,000	150,000	18,540	21,068	3,000	3,000	195,608	782,430	23,473	805,903	864,000
21	ELECTRIC HOIST CRANE	RL(T) : 3.00 L(m) : 6.00 –	8.60	1	0	1	Single-girder overhead type.	8.60	1.0	6.02	800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537	900,000
22	DECHLORINE DOSING PUMP	Dia (mm) : 15 Q(l/h) : 23 H(MPa): 1.00	0.20	1	1	2	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	0.20	24.0	3.36	20,000	20,000	2,472	2,809	400	400	26,081	52,162	1,565	53,727	450,000
23	MIXER FOR DECLORINE SOLUTION	Capacity(m3) : 0.36	0.10	1	0	1	Turbine impeller. SS316L	0.10	2.0	0.14	60,000	60,000	7,416	8,427	1,200	1,200	78,243	78,243	2,347	80,590	324,000
24	AIR BLOWER FOR DECHLORINE MIXING TANK	Dia (mm) : 40 Q(m3/h) : 40 P(K Pa) 20	1.50	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	1.50	24.0	25.20	110,000	110,000	13,596	15,450	2,200	2,200	143,446	286,891	8,607	295,498	1,152,000
25	ELECTRIC HOIST FOR CHEMICALS	RL(T) : 1.00 L(m) : 6.00 –	4.70	1	0	1	Single-girder overhead type.	4.70	1.0	3.29	500,000	500,000	61,800	70,225	10,000	10,000	652,025	652,025	19,561	671,586	900,000
26	AIR BLOWER FOR CENTRIFUGE FEED SUMP	Dia (mm) : 100 Q(m3/h) : 400 P(K Pa) 40	11.00	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	11.00	12.0	92.40	220,000	220,000	27,192	30,899	4,400	4,400	286,891	573,782	17,213	590,995	1,926,000
27	CENTRIFUGE FEED PUMP	Dia (mm) : 125 Q(m3/h) : 27 H(m): 20	7.50	2	1	3	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	15.00	10.3	108.15	550,000	550,000	67,980	77,248	11,000	11,000	717,228	2,151,683	64,550	2,216,233	1,755,000
28	CENTRIFUGE	Q(m3/h) : 27.00 – – – –	44.50	2	1	3	Solid bowl type with Motor including a control panel. Wetted Parts SS304. Input TSS 0.8% w/w. Dewatered sludge TSS required 18%w/w at	89.00	10.3	641.69	4,200,000	4,200,000	519,120	589,680	84,000	84,000	5,477,010	16,431,030	492,931	16,923,961	20,520,000
29	ELECTRIC HOIST	RL(T) : 5.00 L(m) : 6.00 –	17.10	1	0	1	Single-girder overhead type.	17.10	0.0	0.00	1,100,000	1,100,000	135,960	154,495	22,000	22,000	1,434,455	1,434,455	43,034	1,477,489	1,440,000
30	MIXER FOR POLYELECTROLYTE SOLUTION TANK	W (m) : 1.50 L(m) : 1.50 SWD(m) : 2.00	1.50	2	0	2	Agitator 100RPM,Slow Speed, SS304	3.00	2.0	4.20	90,000	90,000	11,124	12,641	1,800	1,800	117,365	234,729	7,042	241,771	666,000
31	DRY POLYELECTROLYTE FEEDER	Capacity (kg/h) : 15.00	0.40	2	0	2	Automatic feed system for batch-wise preparation and metering of polymer solutions from powdered.	0.80	0.5	0.28	200,000	200,000	24,720	28,090	4,000	4,000	260,810	521,620	15,649	537,269	2,520,000
32	POLYELECTROLYTE DOSING PUMP	Dia (mm) : 32 Q(m3/h) : 0.80 H(m): 20.00	0.75	2	1	3	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	1.50	10.3	10.82	140,000	140,000	17,304	19,663	2,800	2,800	182,567	547,701	16,431	564,132	945,000
33	CENTRATE TRANSFER PUMP	Dia (mm) : 100 Q(m3/h) : 40 H(m): 15	5.50	2	1	3	CI, Submersible Type with detachable device Efficiency >50%	11.00	6.6	50.82	300,000	300,000	37,080	42,135	6,000	6,000	391,215	1,173,645	35,209	1,208,854	594,000
						TOTAL		484.95		6799.17										81,852,871	110,088,000
								k W		kWh/d										INR	INR

Mechanical Cost for STPs (15MLD)

	MECHANICAL ITEMS	SPECIFICATION						(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURANCE	BASIC COST	TOTAL COST	ERECTION	NJS積算値 TOTAL
									W	S	T		k W	hours/d	kWh/d										
														15.0	0.70		8	12.36% 9=8 ×	12.50% 10=(8+9)×	2.00% 11=8 ×	2.00% 12=8 ×	13=SUM(8:12)	14=13 × TOTAL NO.	3.00% 15=14 ×	Rs. 16=14+15
1	INLET GATE	W (m) :	0.50	L(m) :	0.75	Design Water Depth(m) :	2.00	–	2	1	3	Manually Sluice Gate, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+‥‥‥ bottom+‥‥‥	0.00			240,000	240,000	29,664	33,708	4,800	4,800	312,972	938,916	28,167	967,083
2	FINE SCREEN (MECHANICAL)	W (m) :	1.00	L(m) :	6.00	SWD(m) :	0.50	1.50	2	0	2	Step Type Screen including control panel. Screen: SS316L Open space 6mm	3.00	6.0	12.60	2,100,000	2,100,000	259,560	294,945	42,000	42,000	2,738,505	5,477,010	164,310	5,641,320
3	FINE SCREEN (MANUAL)	W (m) :	1.00	L(m) :	6.00	SWD(m) :	0.50	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 20mm	0.00			310,000	310,000	38,316	43,540	6,200	6,200	404,256	404,256	12,128	416,383
4	BELT CONVEYOR	Belt Width (m) :	0.60	L(m) :	7.00		–	1.50	1	0	1	Frame: MS+ Epoxy, Belt: NBR 3mm	1.50	7.0	7.35	400,000	400,000	49,440	56,180	8,000	8,000	521,620	521,620	15,649	537,269
5	GRIT CHAMBER	W (m) :	6.00	L(m) :	6.00	SWD(m) :	0.90	2.25	1	1	2	DETRITOR MECHANIS including a grit collector, a classifier, an organic return pumps, control panel. Wetted Parts : MS+Epoxy coated	2.25	24.0	37.80	1,600,000	1,600,000	197,760	224,720	32,000	32,000	2,086,480	4,172,960	125,189	4,298,149
6	INLET WEIR GATE	W (m) :	0.80	H(m) :	0.50	Stroke (m) :	0.55	–	2	0	2	Manually Sluice Weir, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+‥‥‥ bottom+‥‥‥	0.00			340,000	340,000	42,024	47,753	6,800	6,800	443,377	886,754	26,603	913,357
7	MIXERS FOR ANAEROBIC TANK	W (m) :	8.00	L(m) :	12.00	SWD(m) :	5.50	4.00	2	0	2	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	8.00	24.0	134.40	750,000	750,000	92,700	105,338	15,000	15,000	978,038	1,956,075	58,682	2,014,757
8	MIXERS FOR ANOXIC TANK	W (m) :	8.00	L(m) :	12.40	SWD(m) :	5.50	4.00	6	0	6	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	24.00	24.0	403.20	750,000	750,000	92,700	105,338	15,000	15,000	978,038	5,868,225	176,047	6,044,272
9	DIFFUSER	SOR(kg/h)	345	The setting depth of diffusers H(m) :	5.0	Efficiency E(%)	28.0	–	2	0	2	Fine Bubble Membrane Type.	0.00			3,200,000	3,200,000	395,520	449,440	64,000	64,000	4,172,960	8,345,920	250,378	8,596,298
10	AIR BLOWER	Dia (mm) :	200	Q(m3/h) :	2800	P(K Pa)	65	90.00	4	2	6	Rotary lobe blower, Tri-lube type with VFD. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	360.00	24.0	6676.99	650,000	650,000	80,340	91,293	13,000	13,000	847,633	5,085,795	152,574	5,238,369
11	CIRCULATION PUMP	Dia (mm) :	300	Q(m3/h) :	580	H(m):	5.00	18.50	4	2	6	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	74.00	24.0	1243.20	1,300,000	1,300,000	160,680	182,585	26,000	26,000	1,695,265	10,171,590	305,148	10,476,738
12	RAS PUMP	Dia (mm) :	150	Q(m3/h) :	190	H(m):	5.00	5.50	2	2	4	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	11.00	24.0	184.80	400,000	400,000	49,440	56,180	8,000	8,000	521,620	2,086,480	62,594	2,149,074
13	SAS PUMP	Dia (mm) :	100	Q(m3/h) :	80	H(m):	15.00	7.50	2	2	4	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	15.00	6.0	63.00	340,000	340,000	42,024	47,753	6,800	6,800	443,377	1,773,508	53,205	1,826,713
14	HAND OPERATION CHAIN BLOC FOR RAS/SAS PUMP	RL(T) :	1.00	L(m) :	6.00		–	–	3	0	3		0.00			170,000	170,000	21,012	23,877	3,400	3,400	221,689	665,066	19,952	685,017
15	FINAL CLARIFIER	Dia (m) :	28.50	L(m) :	–	SWD(m) :	3.50	2.20	2	0	2	Column-supported type including a centre drum, two scraper arms, a scum collector, a fixed bridge. MS+epoxy resin painting	4.40	24.0	73.92	4,000,000	4,000,000	494,400	561,800	80,000	80,000	5,216,200	10,432,400	312,972	10,745,372
16	ALUM DOSING PUMP	Dia (mm) :	40	Q(l/h) :	260	H(MPa):	0.30	0.75	2	1	3	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	1.50	24.0	25.20	100,000	100,000	12,360	14,045	2,000	2,000	130,405	391,215	11,736	402,951
17	MIXERS FOR ALUM SOLUTION	W (m) :	1.40	L(m) :	1.40	SWD(m) :	1.80	0.75	2	0	2	Turbine impeller. SS316L	1.50	2.0	2.10	60,000	60,000	7,416	8,427	1,200	1,200	78,243	156,486	4,695	161,181
18	CHLORINATOR	Q(kg/h) :	14.1	–	–	–	–	0.10	1	1	2	Gas Chlorination System including Vacuum Chlorinators, Booster Pumps , Interconnecting Piping , Leak Detector, Residual Chlorine Analyses, Leak Absorption System ,Safety equipment and other accessories	0.10	24.0	1.68	2,550,000	2,550,000	315,180	358,148	51,000	51,000	3,325,328	6,650,655	199,520	6,850,175
19	CHLORINE BOOSTER PUMP	Dia (mm) :	25	Q(m3/h) :	5.4	H(m):	50.00	2.20	1	1	2		2.20	24.0	36.96	0	0	0	0	0	0	0	0	0	0
20	CHLORINE TONNERS		–		–		–	–	2	2	4		0.00			150,000	150,000	18,540	21,068	3,000	3,000	195,608	782,430	23,473	805,903
21	ELECTRIC HOIST CRANE	RL(T) :	3.00	L(m) :	6.00		–	8.60	1	0	1	Single-girder overhead type.	8.60	1.0	8.02	800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537
22	DECHLORINE DOSING PUMP	Dia (mm) :	15	Q(l/h) :	17	H(MPa):	1.00	0.20	2	1	3	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	0.40	24.0	6.72	20,000	20,000	2,472	2,809	400	400	26,081	78,243	2,347	80,590
23	MIXER FOR DECLORINE SOLUTION	Capacity(m3) :	0.20					0.10	2	0	2	Turbine impeller. SS316L	0.20	2.0	0.28	60,000	60,000	7,416	8,427	1,200	1,200	78,243	156,486	4,695	161,181
24	AIR BLOWER FOR DECHLORINE MIXING TANK	Dia (mm) :	40	Q(m3/h) :	55	P(K Pa)	20	1.50	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	1.50	24.0	25.20	110,000	110,000	13,596	15,450	2,200	2,200	143,446	286,891	8,607	295,498
25	ELECTRIC HOIST FOR CHEMICALS	RL(T) :	1.00	L(m) :	6.00		–	4.70	1	0	1	Single-girder overhead type.	4.70	1.0	3.29	500,000	500,000	61,800	70,225	10,000	10,000	652,025	652,025	19,561	671,586
26	SLUDGE THICKENER	Dia (m) :	11.00	L(m) :	–	SWD(m) :	4.00	0.40	2	0	2	Bridge-supported type including a centre drum, two scraper arms, a scum collector, a fixed bridge. MS+epoxy resin painting	0.80	24.0	13.44	2,000,000	2,000,000	247,200	280,900	40,000	40,000	2,808,100	5,216,200	156,486	5,372,686

	MECHANICAL ITEMS	SPECIFICATION	(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURANCE	BASIC COST	TOTAL COST	ERECTION	NJS積算額 TOTAL
				W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%	Rs.
									15.0	0.70		8	9=8×	10=(8+9)×	11=8×	12=8×	13=SUM(8:12)	14=13×TOTAL NO.	15=14×	16=14+15
27	THICKENED TRANSFERSLUDGE PUMP	Dia (mm) : 100 Q(m3/h) : 80 H(m): 15.00	11.00	2	2	4	CI, submersible sludge pump with detachable device	22.00	6.0	92.40	520,000	520,000	64,272	73,034	10,400	10,400	678,106	2,712,424	81,373	2,793,797
28	AIR BLOWER FOR CENTRIFUGE FEED SUMP	Dia (mm) : 100 Q(m3/h) : 350 P(K Pa) 40	11.00	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	11.00	12.0	92.40	220,000	220,000	27,192	30,899	4,400	4,400	286,891	573,782	17,213	590,995
29	CENTRIFUGE FEED PUMP	Dia (mm) : 100 Q(m3/h) : 14 H(m): 20	5.50	2	1	3	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	11.00	10.3	79.31	210,000	210,000	25,956	29,495	4,200	4,200	273,851	821,552	24,647	846,198
30	CENTRIFUGE	Q(m3/h) : 14.00 - - - -	22.20	2	1	3	Solid bowl type with Motor including a control panel. Wetted Parts SS304. Input TSS 0.8% w/w. Dewatered sludge TSS required 18%w/w at polymer dose	44.40	10.3	320.12	3,600,000	3,600,000	444,960	505,620	72,000	72,000	4,694,580	14,083,740	422,512	14,506,252
31	ELECTRIC HOIST	RL(T) : 3.00 L(m) : 6.00 -	8.60	1	0	1	Single-girder overhead type.	8.60	0.0	0.00	800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537
32	MIXER FOR POLYELECTROLYTE SOLUTION TANK	W (m) : 1.50 L(m) : 2.00 SWD(m) : 2.00	1.50	2	0	2	Agitator 100RPM,Slow Speed, SS304	3.00	2.0	4.20	90,000	90,000	11,124	12,641	1,800	1,800	117,365	234,729	7,042	241,771
33	DRY POLYELECTROLYTE FEEDER	Capacity Kg/h) : 20.00	0.40	2	0	2	Automatic feed system for batch-wise preparation and metering of polymer solutions from powdered.	0.80	0.5	0.28	200,000	200,000	24,720	28,090	4,000	4,000	260,810	521,620	15,649	537,269
34	POLYELECTROLYTE DOSING PUMP	Dia (mm) : 32 Q(m3/h) : 1.30 H(m): 20.00	0.75	2	1	3	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	1.50	10.3	10.82	140,000	140,000	17,304	19,663	2,800	2,800	182,567	547,701	16,431	564,132
35	CENTRATE TRANSFER PUMP	Dia (mm) : 100 Q(m3/h) : 40 H(m): 15	5.50	2	1	3	CI, Submersible Type with detachable device Efficiency >50%	11.00	12.0	92.40	300,000	300,000	37,080	42,135	6,000	6,000	391,215	1,173,645	35,209	1,208,854
						TOTAL		637.95		9,650.08	28,980,000									98,790,264
								k W		kWh/d										INR

Mechanical Cost for STPs (24MLD)

	MECHANICAL ITEMS	SPECIFICATION						(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS見積額 TOTAL	Toshiba 見積額
									W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Rs.
														24.0	0.70		8	9=8×	10=(9+8)×	11=8×	12=8×	13=SUM(8:12)	14=13×TOTAL NO.	15=14×	16=14+15	
1	INLET GATE	W (m) :	0.60	L(m) :	0.90	Design Water Depth(m) :	2.00	–	2	1	3	Manually Sluice Gate, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+＊＊＊＊＊＊ bottom+＊＊＊＊＊＊	0.00			270,000	270,000	33,372	37,922	5,400	5,400	352,094	1,056,281	31,688	1,087,969	2,511,000
2	FINE SCREEN (MECHANICAL)	W (m) :	1.20	L(m) :	6.00	SWD(m) :	0.60	2.20	2	0	2	Step Type Screen including control panel. Screen: SS316L Open space 6mm	4.40	6.0	18.48	2,660,000	2,660,000	328,776	373,597	53,200	53,200	3,468,773	6,937,546	208,126	7,145,672	9,180,000
3	FINE SCREEN (MANUAL)	W (m) :	1.20	L(m) :	6.00	SWD(m) :	0.60	–	0	1	1	Manually Bar Screen. Screen: SS316L Open space 20mm	0.00			370,000	370,000	45,732	51,967	7,400	7,400	482,499	482,499	14,475	496,973	1,530,000
4	BELT CONVEYOR	Belt Width (m) :	0.60	L(m) :	9.00		–	1.50	1	0	1	Frame: MS+ Epoxy, Belt: NBR 3mm	1.50	7.0	7.35	400,000	400,000	49,440	56,180	8,000	8,000	521,620	521,620	15,649	537,269	963,000
5	GRIT CHAMBER	W (m) :	7.50	L(m) :	7.50	SWD(m) :	0.90	2.25	1	1	2	DETRITOR MECHANIS including a grit collector, a classifier, an organic return pumps, control panel. Wetted Parts : MS+Epoxy coated	2.25	24.0	37.80	1,800,000	1,800,000	222,480	252,810	36,000	36,000	2,347,290	4,694,580	140,837	4,835,417	5,400,000
6	INLET WEIR GATE	W (m) :	0.80	H(m) :	0.40	Stroke (m) :	0.45	–	4	0	4	Manually Sluice Weir, Wall Thimble:Cast Iron, Gate: cast iron, Frame: cast iron. floor+＊＊＊＊＊＊ bottom+＊＊＊＊＊＊	0.00			340,000	340,000	42,024	47,753	6,800	6,800	443,377	1,773,506	53,205	1,826,713	3,348,000
7	MIXERS FOR ANAEROBIC TANK	W (m) :	8.00	L(m) :	10.00	SWD(m) :	5.50	4.00	4	0	4	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	16.00	24.0	268.80	750,000	750,000	92,700	105,338	15,000	15,000	978,038	3,912,150	117,365	4,029,515	18,900,000
8	MIXERS FOR ANOXIC TANK	W (m) :	8.00	L(m) :	10.00	SWD(m) :	5.50	4.00	12	0	12	Submersible Mixer. Casing: SS316L, Impeller: SS316L.	48.00	24.0	806.40	750,000	750,000	92,700	105,338	15,000	15,000	978,038	11,736,450	352,094	12,088,544	18,900,000
9	DIFFUSER	SOR(kg/h)	262	The setting depth of diffusers H(m) :	5.0	Efficiency E(%)	28.0	–	4	0	4	Fine Bubble Membrane Type.	0.00			3,000,000	3,000,000	370,800	421,350	60,000	60,000	3,912,150	15,648,600	469,458	16,118,058	5,400,000
10	AIR BLOWER	Dia (mm) :	250	Q(m3/h) :	4100	P(K Pa)	65	130.00	4	2	6	Rotary lobe blower, Tri-lube type with VFD. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	520.00	24.0	10529.18	900,000	900,000	111,240	126,405	18,000	18,000	1,173,645	7,041,870	211,256	7,253,126	10,152,000
11	CIRCULATION PUMP	Dia (mm) :	250	Q(m3/h) :	460	H(m):	5.00	15.00	8	4	12	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	120.00	24.0	2016.00	750,000	750,000	92,700	105,338	15,000	15,000	978,038	11,736,450	352,094	12,088,544	20,196,000
12	RAS PUMP	Dia (mm) :	150	Q(m3/h) :	150	H(m):	5.00	5.50	4	4	8	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	22.00	24.0	369.60	400,000	400,000	49,440	56,180	8,000	8,000	521,620	4,172,960	125,189	4,298,149	4,032,000
13	SAS PUMP	Dia (mm) :	100	Q(m3/h) :	65	H(m):	15.00	5.50	4	4	8	Submersible sludge pump with detachable device. Overall efficiency more than 60%. Casing: CI, Impeller SS ASTM A743, Guide/Lifting chain: SS316.	22.00	6.0	92.40	300,000	300,000	37,080	42,135	6,000	6,000	391,215	3,129,720	93,892	3,223,612	3,672,000
14	HAND OPERATION CHAIN BLOC FOR RAS/SAS PUMP	RL(T) :	1.00	L(m) :	6.00		–	–	6	0	6		0.00			170,000	170,000	21,012	23,877	3,400	3,400	221,689	1,330,131	39,904	1,370,035	1,998,000
15	FINAL CLARIFIER	Dia (m) :	26.00	L(m) :	–	SWD(m) :	3.50	2.20	4	0	4	Column-supported type including a centre drum, two scraper arms, a scum collector, a fixed bridge. MS+epoxy resin painting	8.80	24.0	147.84	3,800,000	3,800,000	469,680	533,710	76,000	76,000	4,955,390	19,821,560	594,647	20,416,207	33,120,000
16	ALUM DOSING PUMP	Dia (mm) :	40	Q(l/h) :	410	H(MPa):	0.30	0.75	2	1	3	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	1.50	24.0	25.20	100,000	100,000	12,360	14,045	2,000	2,000	130,405	391,215	11,736	402,951	1,215,000
17	MIXERS FOR ALUM SOLUTION	W (m) :	1.60	L(m) :	1.60	SWD(m) :	2.00	1.50	2	0	2	Turbine impeller. SS316L	3.00	2.0	4.20	80,000	80,000	9,888	11,236	1,600	1,600	104,324	208,648	6,259	214,907	846,000
18	CHLORINATOR	Q(kg/h) :	23.0	–	–	–	–	0.10	1	1	2	Gas Chlorination System including Vacuum Chlorinators, Booster Pumps , Interconnecting Piping , Leak Detector, Residual Chlorine Analyses, Leak Absorption System ,Safety equipment and other accessories	0.10	24.0	1.68	4,000,000	4,000,000	494,400	561,800	80,000	80,000	5,216,200	10,432,400	312,972	10,745,372	11,880,000
19	CHLORINE BOOSTER PUMP	Dia (mm) :	40	Q(m3/h) :	8.1	H(m):	50.00	3.70	1	1	2		3.70	24.0	62.16		0	0	0	0	0	0	0	0	0	648,000
20	CHLORINE TONNERS		–		–		–	–	3	2	5		0.00			150,000	150,000	18,540	21,068	3,000	3,000	195,608	978,038	29,341	1,007,379	1,080,000
21	ELECTRIC HOIST CRANE	RL(T) :	3.00	L(m) :	6.00		–	8.60	1	0	1	Single-girder overhead type.	8.60	1.0	6.02	800,000	800,000	98,880	112,360	16,000	16,000	1,043,240	1,043,240	31,297	1,074,537	900,000
22	MIXER FOR DECLORINE SOLUTION	Capacity(m3) :	0.36					0.10	2	0	2	Turbine impeller. SS316L	0.20	2.0	0.28	60,000	60,000	7,416	8,427	1,200	1,200	78,243	156,486	4,695	161,181	648,000
23	DECHLIRINE DOSING PUMP	Dia (mm) :	15	Q(l/h) :	27	H(MPa):	0.30	0.20	2	1	3	Diaphragm Type. Casing: SS, Diaphragm: PTFE.	0.40	24.0	6.72	100,000	100,000	12,360	14,045	2,000	2,000	130,405	391,215	11,736	402,951	1,215,000
24	AIR BLOWER FOR DECHLORINE MIXING TANK	Dia (mm) :	50	Q(m3/h) :	95	P(K Pa)	30	2.20	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Acoustic Enclosures Noise Level:85dB at 1m DISTANCE	2.20	24.0	36.96	140,000	140,000	17,304	19,663	2,800	2,800	182,567	365,134	10,954	376,088	1,476,000
25	ELECTRIC HOIST FOR CHEMICALS	RL(T) :	1.00	L(m) :	6.00		–	4.70	1	0	1	Single-girder overhead type.	4.70	1.0	3.29	500,000	500,000	61,800	70,225	10,000	10,000	652,025	652,025	19,561	671,586	900,000
26	SLUDGE THICKENER	Dia (m) :	14.00	L(m) :	–	SWD(m) :	4.00	0.75	2	0	2	Bridge-supported type including a centre drum, two scraper arms, a scum collector, a fixed bridge. MS+epoxy resin painting	1.50	24.0	25.20	2,200,000	2,200,000	271,920	308,990	44,000	44,000	2,868,910	5,737,820	172,135	5,909,955	6,660,000
27	THICKENED TRANSFERSLUDGE PUMP	Dia (mm) :	100	Q(m3/h) :	120	H(m):	15.00	15.00	2	2	4	CI, submersible sludge pump with detachable device	30.00	6.0	126.00	450,000	450,000	55,620	63,203	9,000	9,000	586,823	2,347,290	70,419	2,417,709	2,016,000

	MECHANICAL ITEMS	SPECIFICATION	(k W/UNIT	NUMBER			DESCRIPTION	ELECTRIC CAPACITY	Electrical power Consumptioon		NJS 積算単価	BISIC COST	EXCISE DUTY	SALES TAX/VAT	PACKING & FORWAR	FREIGHT INSURA	BASIC COST	TOTAL COST	ERECTION	NJS見積額 TOTAL	Toshiba 見積額
				W	S	T		k W	hours/d	kWh/d			12.36%	12.50%	2.00%	2.00%			3.00%		Rs.
									24.0	0.70		8	9=8×	10=(8+9)×	11=8×	12=8×	13=SUM(8:12)	14=13×TOTAL NO.	15=14×	16=14+15	
28	AIR BLOWER FOR CENTRIFUGE FEED SUMP	Dia (mm) : 100 Q(m3/h) : 400 P(K Pa) 40	11.00	1	1	2	Rotary lobe blower, Tri-lube type. Casing: CI, Lobes CI. With Accoustic Enclosures Noise Level:85dB at 1m DISTANCE	11.00	12.0	92.40	500,000	500,000	61,800	70,225	10,000	10,000	652,025	1,304,050	39,122	1,343,172	1,926,000
29	CENTRIFUGE FEED PUMP	Dia (mm) : 125 Q(m3/h) : 25 H(m): 20	7.50	2	1	3	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	15.00	10.3	108.15	550,000	550,000	67,980	77,248	11,000	11,000	717,228	2,151,683	64,550	2,216,233	2,079,000
30	CENTRIFUGE	Q(m3/h) : 21.00 – – – –	44.50	2	1	3	Solid bowl type with Motor including a control panel. Wetted Parts SS304. Input TSS 0.8% w/w. Dewatered sludge TSS required 18%w/w at polymer dose	89.00	10.3	641.89	4,000,000	4,000,000	494,400	561,800	80,000	80,000	5,216,200	15,648,600	469,458	16,118,058	16,200,000
31	ELECTRIC HOIST	RL(T) : 5.00 L(m) : 6.00 –	17.10	1	0	1	Single-girder overhead type.	17.10	0.0	0.00	1,100,000	1,100,000	135,960	154,495	22,000	22,000	1,434,455	1,434,455	43,034	1,477,489	1,440,000
32	MIXER FOR POLYELECTROLYTE SOLUTION TANK	W (m) : 2.00 L(m) : 2.00 SWD(m) : 2.50	2.20	2	0	2	Agitator 100RPM,Slow Speed, SS304	4.40	2.0	6.16	120,000	120,000	14,832	16,854	2,400	2,400	156,486	312,972	9,389	322,361	900,000
33	DRY POLYELECTROLYTE FEEDER	Capacity (kg/h) : 37.00	0.40	2	0	2	Automatic feed system for batch-wise preparation and metering of polymer solutions from powdered.	0.80	0.5	0.28	750,000	750,000	92,700	105,338	15,000	15,000	978,038	1,956,075	58,682	2,014,757	2,880,000
34	POLYELECTROLYTE DOSING PUMP	Dia (mm) : 40 Q(m3/h) : 1.90 H(m): 20.00	0.75	2	1	3	Progress Cavity Pump. Casing: CI, Rotor: SS316, Stator: NB.	1.50	10.3	10.82	140,000	140,000	17,304	19,663	2,800	2,800	182,567	547,701	16,431	564,132	891,000
35	CENTRATE TRANSFER PUMP	Dia (mm) : 100 Q(m3/h) : 40 H(m): 15	5.50	3	1	4	CI, Submersible Type with detachable device Efficiency >50%	16.50	12.0	138.60	300,000	300,000	37,080	42,135	6,000	6,000	391,215	1,564,860	46,946	1,611,806	594,000
						TOTAL		976.15		15589.66										145,866,425	195,696,000
								kW		kWh/d										INR	INR

Direct Cost for Construction of ISPSs

Sample Data

Capacity	Estimated cost INR		Unit cost Million INR/MLD	Reference
0.5MLD	9,900,000		19.8	DPR
1.0MLD	13,900,000		13.9	
5MLD	92,000,000	Ave105,500,000	18.4	StageⅣ phaseⅡ (Except O&M)
5MLD	119,000,000		23.8	
20MLD	222,000,000		11.1	

※1 92,000,000 ≒72,100,000 × 1.27

※2 119,000,000 ≒77,400,000 × 1.53

※3 222,000,000 ≒145,000,000 × 1.53

Cost Function

MLD		Million INR
x = 0.5	y =	9.9
x = 1.0	y =	20.6
x = 1.5	y =	31.3
x = 2.0	y =	42.0
x = 2.5	y =	52.7
x = 3.0	y =	63.4
x = 3.5	y =	74.1
x = 4.0	y =	84.8
x = 4.5	y =	95.5
x = 5.0	y =	105.5
x = 6.0	y =	113.3
x = 7.0	y =	121.0
x = 8.0	y =	128.8
x = 9.0	y =	136.6
x = 10.0	y =	144.4
x = 11.0	y =	152.2
x = 12.0	y =	160.0
x = 13.0	y =	167.8
x = 14.0	y =	175.6
x = 15.0	y =	183.4
x = 16.0	y =	191.2
x = 17.0	y =	199.0
x = 18.0	y =	206.8
x = 19.0	y =	214.6
x = 20.0	y =	222.0

Construction Cost of ISPSs

Zone	Package	Name of ISPS		Design Flow 2034 (MLD)		Million INR
				JICA Surbey	DPR	JICA Surbey
Byatrayanpura	VB-U1	Bellahalli		0.9	1.0	9.9
Mahadevapura	VM-U2	Hagadur	Changed from STP	15.0	–	183.4
Bommanahari	VBO-U3	Naganathapura	Changed from STP	9.0	–	136.6
R.R Nagar	VRRN-U2	Arehalli 1		1.1	0.5	20.6
		Hemigepura	Changed from STP	1.7	–	31.3
Dasarahalli	VD-U2	Herohalli	Changed from MP	0.5	0.5	9.9
		Daddabidarakallu	Changed from STP	8.1	–	128.8
Total						**520.5**

Result of StageⅣ hase Ⅱ (Unit Cost for Construction of STPs and ISPSs)

Project			Items	Avg Initial Capacity	Treatment Process	Total HRT (at high level for SBR)	Estimated Direct Cost ※1		Estimated Cost ※2	Awarded Cost ※2	Estimated (SOR) Year	Awarded Year	Escalation for Estimated 5-2017	Escalation for Awarded 6-2017	Revised Estimated Cost 2017	Revised Awarded Cost 2017	Estimated Unit Direct cost MillionINR / MLD	Estimated Unit Direct cost MillionINR / MLD	Awarded Unit Direct cost MillionINR / MLD	NOTE 1 (Range of Capacity)	NOTE 2
				1			2		3	4	5	6	7	8	9=3*7	10=4*8	11=2/1	12=11*7	13=12*10/9		
Phase Ⅱ StageⅣ	S1a1	STP	Raja canal	40 MLD	EA	23 hrs	590	1,521	247.8	290.6	2010	2013	1.53	1.16	379.1	337.1	14.8	22.6	20.1		
			Horamavu agara	20 MLD	SBR	34 hrs	366										18.3	28.0	24.9	STP 20～40 MLD	
			Nagasandra	20 MLD	SBR	34 hrs	342										17.1	26.1	23.2		
		ISPS	Horamavu agaraat Rajacanal	20 MLD	—	—	145										7.3	11.1	9.9	ISPS 20 MLD	Not Include Pumping Main
			Karibuvanahalli	5 MLD	—	—	77.4										15.5	23.7	21.1	ISPS 5 MLD	Not Include Pumping Main
	S1a2	STP	Kadugodi	6 MLD	SBR	37 hrs	246	461	72.3	95.6	2010	2014	1.53	1.10	110.6	105.2	41.0	62.8	59.7	STP 5～6 MLD	
			Chika banavara	5 MLD	SBR	36 hrs	214										42.9	65.6	62.4		
	S1a3	STP	Kachohalli,(Agaram？)	3 MLD	MBR	23 hrs	—		—	—					—	—	—	—			
	S1b	STP	Kengari	60 MLD	AS w/o PG	14 hrs	—		—	—					—	—	—	—			
	S1c	STP	K&C Valley	60 MLD	AS with PG	14 hrs	—		—	—					—	—	—	—		Expantion	
	S1d	STP	Bellundor Amanikere	90 MLD	AS w/o PG	14 hrs	—		—	—					—	—	—	—			
	S1e	STP	Doddabela	20 MLD	SBR	34 hrs	486	1,016	151.9	155.0	2012	2014	1.27	1.10	192.9	170.5	24.3	30.8	27.3	STP 15～20 MLD	
			Yellemall-appa Chetty	15 MLD	SBR	35 hrs	458										30.5	38.8	34.3		
		ISPS	Sadoramangala	5 MLD	—	—	72.1										14.4	18.3	16.2	ISPS 5 MLD	Not Include Pumping Main

※1 Based on Excel Data obtained from BWSSB. In the Civil Cost, O & M Cost is not included and It is considered the defferance of HRT. (HRT of JICA-S = 25 hrs)

※2 Based on MONTHLY PROGRESS REPORT of StageⅣ Phase Ⅱ

Cost of ISPSs【Based on DPR】

Area	Item	Capacity(MLD) 2034 ①	Capacity(MLD) 2049	INR (Crore) ②	②/①	Note
Byatarayanpura	Intermediate Sewage Pumping Station – Bellahalli	1.00	1.55	13.9	13.9	Not Include Pumping Main
R R Nagar Total	ISPS (Arehalli -1)	0.50	0.75	9.9	19.8	Not Include Pumping Main
Dasarahalli	Manhole Pump & Sump (IV. Herohallii-1477)	0.50	0.75	6.2	12.4	Manhole Pump

Price Escaration in India

Base Year	escaration/Year		2010	2011	2012	2013	2014
2009	10.61						
2010	9.50	1.000	1.000				
2011	9.54	1.095	1.095	1.000			
2012	9.94	1.099	1.204	1.099	1.000		
2013	9.44	1.094	1.318	1.203	1.094	1.000	
2014	5.93	1.059	1.396	1.275	1.159	1.059	1.000
2015	4.91	1.049	1.465	1.337	1.216	1.111	1.049
2016	2.00	1.020	1.494	1.364	1.241	1.134	1.070
2017	2.00	1.020	1.524	1.391	1.265	1.156	1.091
			→ 1.53	→ 1.40	→ 1.27	→ 1.16	→ 1.10

Note: : http://www.globalnote.jp/p-cotime/ (Based on IMF Data)

Supporting Report 16

Financial and Economic Considerations

Chapter 16 FINANCIAL AND ECONOMIC CONSIDERATIONS

16.3 PRESENT PRACTICE FOR WATER AND SEWERAGE TARIFF

16.3.2 Study on Present Water and Sewerage Tariff

(1) Other Special Arrangement

The details of special sanitary charges are shown in Table 16.3.1 to Table 16.3.2

Table 16.3.1 Special Sanitary Charges for Domestic-Connection

Conditions of Domestic-Connection
INR.50 per month per individual house or per flat

Source: BWSSB

Table 16.3.2 Special Sanitary Charges for Non-Domestic-Connection

Conditions of Non-Domestic Connection		Special Sanitary Charge (INR/month)
1.Hotels	All Kinds of Hotels	2,000
	Darshini hotels, cafeteria and coffee bars	1,000
2.Hotels with lodging facility	Up to 50 rooms	2,000
	50 to 100 rooms	4,000
	more than 100 rooms	10,000
	Bar and Restaurant	2,000
3.Star Hotels	Less than 50 rooms	10,000
	51 to 100 rooms	15,000
	More than 100 rooms	20,000
4.Hospitals	Without beds	2,500
	Up to 50 beds	5,000
	More than 50 and up to 100	7,500
	More than 100 beds	10,000
	Dispensary, Clinic	100
5.Hostels	Paying Guest accommodations	2,000
	Hostels with Non Domestic Water Supply	2,000
6.Shopping Malls	Having theatres	25,000
	Without theatres	5,000
	Super Bazaars	1,000
7.Multiplex, Theatres, Cinema halls		10,000
8.Community halls/ Kalyana Mantapas	With A.C	7,500
	Without A.C	5,000
9.Choultries/Party halls	Less than 250 seats	2,000

Source: BWSSB

The details of new connection charges are shown in Table 16.3.3 to Table 16.3.11

Table 16.3.3 Application form fee rate

Application form fee rate (INR/Application)
100

Source: BWSSB.

Table 16.3.4 Attachment Fee for Pro Rata Charges

1. Pro Rata Charges		**2. Attachment Cost**	
Class/Nature of Building	Rate (INR/m^2 of built up area)	Class of water supply connection	Rate (INR/connection)
1)Residential building	150	1)15 mm & 20 mm dia	25
2)Multi storeyed residential building	200	2)25 mm up to 80 mm dia	50
3)Fully owned buildings by Central/State Govt.(not applicable to Govt undertakings organization)	240	3)100 mm & above dia	100
4)Commercial Buildings	300		

Source: BWSSB

Table 16.3.5 Inspection Charges

1. Inspection Charge for Residential Buildings		**2. Inspection Charge for Commercial Buildings**	
Residential Building type	Charge (INR/Application)	Built up area (m^2)	Charge (INR/Application)
A)Domestic connections & temporary Non-Domestic connection for construction purpose	250	1)up to 100	500
B)Residential apartments:		2)101 up to 200	2,000
1)up to 50 apartments	1,000	3)201 up to 400	4,000
2)50 and above up to & inclusive of 100 apartments	2,000	4)from 401 up	5,000
3)for every increase of 100 apartments or part thereof of 100 apartments	Plus 1,000		

Source: BWSSB

Table 16.3.6 Three Months Minimum Deposit

No.	Size	Rate for Non-Domestic Connection (INR)	Rate for Domestic Connection (INR)
1	15 mm dia	1,300/- for 10,000 ltrs	315/- for 15,000 ltrs
2	20 mm dia	5,900/- for 40,000 ltrs	1,800/- for 40,000 ltrs
3	25 mm dia	11,600/- for 70,000 ltrs	4,300/- for 70,000 ltrs
4	40 mm dia	28,600/- for 1,50,000 ltrs	14,500/- for 1,50,000 ltrs
5	50 mm dia	61000/- for 3,00,000 ltrs	35,300/- for 3,00,000 ltrs

Source: BWSSB

Table 16.3.7 Water Meter Cost (AMR)

No.	Size	AMR Meter Cost (INR/Meter)
1	15 mm multi jet mech meters with AMR facilities for Non Domestic	37,200
2	20 mm multi jet mech meters with AMR facilities for Non Domestic	43,800
3	25 mm multi jet mech meters with AMR facilities for Domestic & Non Domestic	50,400
4	40 mm multi jet mech meters with AMR facilities for Domestic & Non Domestic	56,400
5	50 mm electromagnetic AMR flow meters	84,000
6	80 mm electromagnetic AMR flow meters	96,000
7	100 mm electromagnetic AMR flow meters	114,500
8	150 mm electromagnetic AMR flow meters	133,000
9	200 mm electromagnetic AMR flow meters	154,500
10	150 mm electromagnetic AMR flow meters	133,000
11	200 mm electromagnetic AMR flow meters	154,500

Source: BWSSB

Table 16.3.8 Water Meter Cost (Mechanical)

No	Size	Mechanical Meter Cost for Domestic (INR./Meter)	Mechanical Meter Cost for Non-Domestic (INR./Meter)
1	1/2inch mech meter	965	965
2	3/4inch mech meter	2,250	2,250

Source: BWSSB

Table 16.3.9 Sanitary Point Charges

Sanitary Point Charge Rate (INR./point)
120

Source: BWSSB

Table 16.3.10 GBWASP Charges

No.	Conditions	Total Charges (INR.)
A	Residential SITES	
1	up to 600 sq. ft.	NIL
2	600 to 1200 sq. ft.	8,000/- per site
3	1200 to 2400 sq. ft.	16,000/- per site
4	up to 2400 sq. ft. & above	24,000/- per site
B	Residential HOUSE/ FLAT	
1	up to 600 sq. ft. built up area (B.A)	4,000/- per house or flat
2	600 to 1200 sq. ft. B.A	8,000/- per house or flat
3	1200 to 2400 sq. ft. B.A	16,000/- per house or flat
4	up to 2400 sq. ft. & above B.A	24,000/-per house or flat
C	Educational Institutions / Hospitals / Nursing Homes, Charity etc.,	14/-per sft per B.A
D	Commercial Establishments / Shops etc.,	14/-per sft per B.A
E	Office / Industries / Software & Hardware companies / BPOs/ Call Centers / Convention Halls / Community Halls / Marriage Halls etc.,	11/-per sft per B.A
F	Hotels / Restaurants	24/-per sft per B.A

Source: BWSSB

Table 16.3.11 Pro Rata Charges

No.	Particulars	Conditions and Remarks	Rates (INR.)
1	Residential building having basement, GF + 1st floor & 2nd Floor	Up to 1,199 sq.ft. Sital area (Does not apply Pro Rata charges up to 2nd Floor)	1. Regular deposit and meter cost 2. Sanitary point charges at INR.120/-per point (minimum 5 points per house) 3. Inspection charges at INR.250/-per building
2	Residential building having basement, GF + 1st floor, 2nd Floor & additional floors	For 1,200 sq.ft. sital area (Does not attract Pro Rata charges up to 1st Floor)	1. INR.150/-per m^2 on built area for both water supply connection & sanitary connection. 2. Sanitary point charges at INR120/-per point (minimum 5 points per house) 3. Inspection charges at INR.250/-per building.
3	Residential building having basement, GF + 1st Floor (a single kitchen house accommodation)	Above 1,200 sq.ft. sital area Does not apply Pro Rata charges up to 1st Floor)	1. Regular deposit and meter cost 2. Sanitary point charges at INR.120/-per point (minimum 5 points per house). 3. Inspection charges at INR.250/-per building
4	Residential building having base-	Above 1,200 sq.ft. sital area Attracts Pro Rata charges for	1. INR.150/-per m^2 on built area for both water supply connection & sanitary connection.

No.	Particulars	Conditions and Remarks	Rates (INR.)
	ment, GF + 1st Floor + additional floors (a single / double kitchen house accommodation)	2nd Floor & above floors	2. Sanitary point charges at INR.120/-point (minimum 5 points per house) 3. Inspection charges at INR.250/-per building.
5	Residential building having GF +1st floor + additional floors(in the erstwhile 7 CMC & 1 TMC areas)	For sital area of 2,400 sq.ft. Attracts Pro Rata charges for 2nd Floor & above floors	1. INR.150/-per sqmt on built area for both water supply connection & sanitary connection. 2. Sanitary point charges at INR.120/-point (minimum 5 points per house) 3. Inspection charges at INR.250/-per building
6	Residential multistoried building (having 3 & above kitchen house accommodation) Exclusively in the jurisdiction of BBMP core area	Above 1,200 sq.ft. sital area Attracts Pro Rata charges for all floors inclusive of Basement Floor (since it is considered as an apartment)	1. INR.200/-per sqmt on built area for both water supply connection & sanitary connection. 2. Sanitary point charges at INR.120/-per point (minimum 5 points per house) 3. Inspection charges at INR.1,000/-up to 50 flats 4. Inspection charges at INR.2,000/-from 51up to 100 flats 5. Inspection charges at INR.,3000/-from 101 up to 200 flats 6. Inspection charges at INR.4,000/-from 201 up to 300 flats 7. Inspection charges at INR.5,000/-from 301 up to 400 flats 8. Inspection charges at INR.6,000/-from 401 up to 500 flats 9. Inspection charges at INR.7,000/-from 501 up to 600 flats
7	Residential apartment	Irrespective of sital area Attractive Pro Rata for the entire built area inclusive of basement area	1. INR.200/-per sqmt on built area for both water supply connection & sanitary connection. 2. Sanitary point charges at INR.120/-per point (minimum 5 points per house) 3. Inspection charges at INR.1,000/-up to 50 flats 4. Inspection charges at INR.,2000/-from 51upto 100 flats 5. Inspection charges at INR.3,000/-from 101 up to 200 flats 6. Inspection charges at INR.4,000/-from 201 up to 300 flats 7. Inspection charges at INR.5,000/- from 301 up to 400 flat 8. Inspection charges at INR.6,000/- from 401 up to 500 flat 9. Inspection charges at INR.7,000/- from 501 up to 600flats
8	Government owned buildings	Irrespective of sital area Attractive pro rate for the entire built area inclusive of basement area	1. INR.240/-per sqmt on built area for water supply connection& sanitary connection. 2. Sanitary point charges at INR.120/-per point (minimum 5 point per house)

No.	Particulars	Conditions and Remarks	Rates (INR.)
			3. Inspection charges at INR.500/-up to 1000 sft built up area 4. INR.2,000/-up to 2,000 sft built up area 5. INR.4,000/-up to 4,000 sft built up area 6. INR.5,000/-above 4,000 sft built up area
9	Commercial buildings & Educational Institutions	Irrespective of sital area Attractive prorate for the entire built area inclusive of basement area	1. INR.300/-per sqmt on built area for water supply connection& sanitary connection. 2. Sanitary point charges at INR.120/-per point (minimum 5point per house) 3. Inspection charges at INR.500/-up to 1000 sft built up area 4. INR.2000/-up to 2000 sft built up area 5. INR.4000/-up to 4000 sft built up area 6. INR.5000/-above 4000 sft built up area

Source: BWSSB

16.4 STUDY ON ALTERNATIVES FOR WATER AND SEWERAGE TARIFF

16.4.3 Study for the Number of Beneficiary

Beneficiaries to be served by the JICA Survey Project are shown in Table 16.4.1

Table 16.4.1 Population Projections for Water & Sewerage (Core + ULB + 110 Villages)

Unit: Person

	Population Projections for Water & Sewerage (Core + ULB + 110 Villages)									Water+ Sewerage	
Year	Core Area	ULB	Service Population	Service Population	Service Population	Projected Connections for Water	110 Villages - Service Population	Projected Connections for Sewerage	Avg HH Size	Total Households Served	Total Service Population
		MLD	1,827	367	1,460		408				
2016	5,636,817	2,440,189	8,077,006	1,622,475	6,454,531	-	1,429,293	-	4.00	-	9,506,299
2017	5,680,784	2,547,069	8,227,853	1,652,776	6,575,077	-	1,491,896	-	4.00	-	9,719,749
2018	5,725,094	2,658,631	8,383,725	1,684,087	6,699,638	-	1,557,241	-	4.00	-	9,940,966
2019	5,769,750	2,775,080	8,544,830	1,716,449	6,828,381	-	1,648,369	-	4.00	-	10,193,199
2020	5,814,754	2,879,146	8,693,900	1,746,394	6,947,506	-	1,720,568	-	4.00	-	10,414,467
2021	5,860,109	2,987,113	8,847,223	1,777,192	7,070,030	-	1,795,928	-	4.00	-	10,643,151
2022	5,905,818	3,099,130	9,004,948	1,808,876	7,196,072	-	1,874,590	-	4.00	-	10,879,538
2023	5,951,883	3,215,348	9,167,231	1,841,474	7,325,757	100%	1,956,697	24%	4.00	577,770	11,123,928
2024	5,998,307	3,376,559	9,374,866	1,883,183	7,491,683	100%	2,003,593	37%	4.00	656,128	11,378,459
2025	6,045,094	3,503,180	9,548,274	1,918,017	7,630,257	100%	2,078,728	47%	4.00	723,755	11,627,001
2026	6,092,246	3,634,549	9,726,795	1,953,877	7,772,918	100%	2,156,680	57%	4.00	795,796	11,883,475
2027	6,139,765	3,770,845	9,910,610	1,990,801	7,919,809	100%	2,237,556	67%	4.00	872,491	12,148,165
2028	6,187,655	3,912,251	10,099,907	2,028,826	8,071,080	100%	2,321,464	77%	4.00	954,088	12,421,371
2029	6,235,919	4,058,961	10,294,880	2,067,992	8,226,888	100%	2,408,519	87%	4.00	1,040,851	12,703,399
2030	6,284,559	4,211,172	10,495,731	2,108,338	8,387,393	100%	2,498,838	92%	4.00	1,101,817	12,994,569
2031	6,333,579	4,369,091	10,702,670	2,149,907	8,552,763	100%	2,592,545	95%	4.00	1,153,206	13,295,214
2032	6,382,981	4,532,932	10,915,912	2,192,742	8,723,170	100%	2,689,765	97%	4.00	1,200,454	13,605,677
2033	6,432,768	4,702,917	11,135,685	2,236,889	8,898,796	100%	2,790,631	99%	4.00	1,249,903	13,926,316
2034	6,482,943	4,809,070	11,292,013	2,268,292	9,023,722	100%	2,843,080	100%	4.00	1,277,843	14,135,093
2035	6,533,510	4,965,365	11,498,875	2,309,845	9,189,030	100%	2,935,480	100%	4.00	1,311,331	14,434,355
2036	6,584,472	5,126,739	11,711,211	2,352,498	9,358,713	100%	3,030,883	100%	4.00	1,345,845	14,742,094
2037	6,635,831	5,293,358	11,929,189	2,396,285	9,532,904	100%	3,129,387	100%	4.00	1,381,418	15,058,576
2038	6,687,590	5,465,392	12,152,982	2,441,239	9,711,743	100%	3,231,092	100%	4.00	1,418,083	15,384,074
2039	6,739,753	5,643,018	12,382,771	2,487,398	9,895,372	100%	3,336,102	100%	4.00	1,455,875	15,718,873
2040	6,792,323	5,826,416	12,618,739	2,534,799	10,083,940	100%	3,444,526	100%	4.00	1,494,831	16,063,265
2041	6,845,303	6,015,774	12,861,078	2,583,479	10,277,599	100%	3,556,473	100%	4.00	1,534,988	16,417,551
2042	6,898,697	6,211,287	13,109,984	2,633,478	10,476,506	100%	3,672,058	100%	4.00	1,576,384	16,782,042
2043	6,952,507	6,413,154	13,365,660	2,684,837	10,680,823	100%	3,791,400	100%	4.00	1,619,059	17,157,060
2044	7,006,736	6,621,581	13,628,317	2,737,599	10,890,719	100%	3,914,621	100%	4.00	1,663,055	17,542,938
2045	7,061,389	6,836,782	13,898,171	2,791,806	11,106,366	100%	4,041,846	100%	4.00	1,708,413	17,940,017
2046	7,116,468	7,058,978	14,175,446	2,847,503	11,327,942	100%	4,173,206	100%	4.00	1,755,177	18,348,651
2047	7,171,976	7,288,395	14,460,371	2,904,738	11,555,633	100%	4,308,835	100%	4.00	1,803,393	18,769,206
2048	7,227,917	7,525,268	14,753,185	2,963,557	11,789,628	100%	4,448,872	100%	4.00	1,853,107	19,202,057
2049	7,284,295	7,620,606	14,904,901	2,994,033	11,910,868	100%	4,490,582	100%	4.00	1,871,154	19,395,483

Source: JICA Survey Team

16.5 FINANCIAL ANALYSIS AND CONSIDERATIONS ON THE PROPOSED PROJECT

16.5.4 Financial Sensitivity

The detailed analysis is shown in Table 16.5.1 to Table 16.5.2.

Table 16.5.1 Sensitivity Analysis (Benefit Base)

Unit: Million INR.

Cost in Total	Benefit in Total		Cost in Total	Benefit in Total		Cost in Total	Benefit in Total	
Base			5%			10%		
Total	Total	Cash Balance	Total	Total	Cash Balance	Total	Total	Cash Balance
7,485	0	-7,485	7,859	0	-7,859	8,233	0	-8,233
4,428	0	-4,428	4,649	0	-4,649	4,870	0	-4,870
2,001	0	-2,001	2,102	0	-2,102	2,202	0	-2,202
23,524	0	-23,524	24,700	0	-24,700	25,876	0	-25,876
15,665	0	-15,665	16,449	0	-16,449	17,232	0	-17,232
15,912	0	-15,912	16,708	0	-16,708	17,503	0	-17,503
7,774	6,183	-1,591	8,162	6,183	-1,980	8,551	6,183	-2,368
4,518	6,183	1,664	4,744	6,183	1,439	4,970	6,183	1,213
2,782	6,183	3,401	2,921	6,183	3,261	3,060	6,183	3,122
2,816	6,183	3,366	2,957	6,183	3,225	3,098	6,183	3,085
2,862	6,183	3,321	3,005	6,183	3,178	3,148	6,183	3,035
2,907	6,183	3,276	3,052	6,183	3,131	3,197	6,183	2,985
2,952	6,183	3,231	3,099	6,183	3,083	3,247	6,183	2,936
2,974	6,183	3,208	3,123	6,183	3,059	3,272	6,183	2,911
2,988	6,183	3,195	3,137	6,183	3,045	3,287	6,183	2,896
2,997	6,183	3,186	3,147	6,183	3,036	3,297	6,183	2,886
3,006	6,183	3,177	3,156	6,183	3,026	3,307	6,183	2,876
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
4,513	6,183	1,670	4,738	6,183	1,444	4,964	6,183	1,219
4,513	6,183	1,670	4,738	6,183	1,444	4,964	6,183	1,219
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
3,011	6,183	3,172	3,161	6,183	3,022	3,312	6,183	2,871
149,732	148,383	(1,350)	157,219	148,383	(8,836)	164,706	148,383	(16,323)
		-0.13%			-0.85%			-1.54%

Source: JICA Survey Team

Table 16.5.2 Sensitivity Analysis (Benefit-5%)

Unit: Million INR.

Cost in Total	Benefit in Total		Cost in Total	Benefit in Total		Cost in Total	Benefit in Total	
Base	-5%		5%	-5%		10%	-5%	
Total	Total	Cash Balance	Total	Total	Cash Balance	Total	Total	Cash Balance
7,485	0	-7,485	7,859	0	-7,859	8,233	0	-8,233
4,428	0	-4,428	4,649	0	-4,649	4,870	0	-4,870
2,001	0	-2,001	2,102	0	-2,102	2,202	0	-2,202
23,524	0	-23,524	24,700	0	-24,700	25,876	0	-25,876
15,665	0	-15,665	16,449	0	-16,449	17,232	0	-17,232
15,912	0	-15,912	16,708	0	-16,708	17,503	0	-17,503
7,774	5,873	-1,900	8,162	5,873	-2,289	8,551	5,873	-2,678
4,518	5,873	1,355	4,744	5,873	1,129	4,970	5,873	903
2,782	5,873	3,091	2,921	5,873	2,952	3,060	5,873	2,813
2,816	5,873	3,057	2,957	5,873	2,916	3,098	5,873	2,775
2,862	5,873	3,012	3,005	5,873	2,869	3,148	5,873	2,726
2,907	5,873	2,967	3,052	5,873	2,821	3,197	5,873	2,676
2,952	5,873	2,922	3,099	5,873	2,774	3,247	5,873	2,626
2,974	5,873	2,899	3,123	5,873	2,750	3,272	5,873	2,602
2,988	5,873	2,885	3,137	5,873	2,736	3,287	5,873	2,587
2,997	5,873	2,876	3,147	5,873	2,727	3,297	5,873	2,577
3,006	5,873	2,867	3,156	5,873	2,717	3,307	5,873	2,567
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
4,513	5,873	1,361	4,738	5,873	1,135	4,964	5,873	910
4,513	5,873	1,361	4,738	5,873	1,135	4,964	5,873	910
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
3,011	5,873	2,863	3,161	5,873	2,712	3,312	5,873	2,562
149,732	140,964	(8,769)	149,732	140,964	(16,255)	149,732	140,964	(23,742)
		-0.88%			-1.62%			-2.34%

Source: JICA Survey Team

Table 16.5.3 Sensitivity Analysis (Benefit-10%)

Unit: Million INR.

Cost in Total	Benefit in Total	Cash Balance	Cost in Total	Benefit in Total	Cash Balance	Cost in Total	Benefit in Total	Cash Balance
Base	-10%		5%	-10%		10%	-10%	
Total	Total		Total	Total		Total	Total	
7,485	0	-7,485	7,859	0	-7,859	8,233	0	-8,233
4,428	0	-4,428	4,649	0	-4,649	4,870	0	-4,870
2,001	0	-2,001	2,102	0	-2,102	2,202	0	-2,202
23,524	0	-23,524	24,700	0	-24,700	25,876	0	-25,876
15,665	0	-15,665	16,449	0	-16,449	17,232	0	-17,232
15,912	0	-15,912	16,708	0	-16,708	17,503	0	-17,503
7,774	5,564	-2,209	8,162	5,564	-2,598	8,551	5,564	-2,987
4,518	5,564	1,046	4,744	5,564	820	4,970	5,564	594
2,782	5,564	2,782	2,921	5,564	2,643	3,060	5,564	2,504
2,816	5,564	2,748	2,957	5,564	2,607	3,098	5,564	2,466
2,862	5,564	2,703	3,005	5,564	2,560	3,148	5,564	2,417
2,907	5,564	2,658	3,052	5,564	2,512	3,197	5,564	2,367
2,952	5,564	2,612	3,099	5,564	2,465	3,247	5,564	2,317
2,974	5,564	2,590	3,123	5,564	2,441	3,272	5,564	2,292
2,988	5,564	2,576	3,137	5,564	2,427	3,287	5,564	2,278
2,997	5,564	2,567	3,147	5,564	2,417	3,297	5,564	2,268
3,006	5,564	2,558	3,156	5,564	2,408	3,307	5,564	2,258
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
4,513	5,564	1,052	4,738	5,564	826	4,964	5,564	601
4,513	5,564	1,052	4,738	5,564	826	4,964	5,564	601
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
3,011	5,564	2,554	3,161	5,564	2,403	3,312	5,564	2,253
149,732	133,544	(16,188)	149,732	133,544	(23,675)	149,732	133,544	(31,161)
		-1.70%			-2.46%			-3.22%

Source: JICA Survey Team

16.6 ECONOMIC ANALYSIS AND CONSIDERATIONS ON THE PROPOSED PROJECT

Table 16.6.1 shows population projections for water & sewerage services in 110 Villages.

Table 16.6.1 Population Projections for Water & Sewerage (110 Villages)

Unit: Number.

Year	110 villages HH
2016	357,323
2017	372,974
2018	389,310
2019	412,092
2020	430,142
2021	448,982
2022	468,648
2023	489,174
2024	500,898
2025	519,682
2026	539,170
2027	559,389
2028	580,366
2029	602,130
2030	624,710
2031	648,136
2032	672,441
2033	697,658
2034	710,770
2035	733,870
2036	757,721
2037	782,347
2038	807,773
2039	834,026
2040	861,131
2041	889,118
2042	918,015
2043	947,850
2044	978,655
2045	1,010,461
2046	1,043,301
2047	1,077,209
2048	1,112,218
2049	1,122,646

Source: JICA Survey Team

16.6.5 Economical Sensitivity

The detailed analysis is shown in Table 16.6.2 to Table 16.6.4

Table 16.6.2 Economic Sensitivity Analysis (Benefit: Base)

Unit: Million INR.

Cost in Total	Benefit in Total		Cost in Total	Benefit in Total		Cost in Total	Benefit in Total	
Base			5%			10%		
Total	Total	Cash Balance	Total	Total	Cash Balance	Total	Total	Cash Balance
7,230	0	-7,230	7,592	0	-7,592	7,954	0	-7,954
4,277	0	-4,277	4,491	0	-4,491	4,705	0	-4,705
1,933	0	-1,933	2,030	0	-2,030	2,127	0	-2,127
22,724	0	-22,724	23,860	0	-23,860	24,996	0	-24,996
15,133	0	-15,133	15,889	0	-15,889	16,646	0	-16,646
15,371	0	-15,371	16,140	0	-16,140	16,908	0	-16,908
7,359	25,142	17,783	7,727	25,142	17,415	8,095	25,142	17,047
4,390	25,032	20,643	4,609	25,032	20,423	4,829	25,032	20,204
2,529	25,026	22,497	2,655	25,026	22,371	2,782	25,026	22,245
2,744	25,055	22,311	2,881	25,055	22,174	3,018	25,055	22,037
2,787	25,086	22,299	2,926	25,086	22,160	3,066	25,086	22,020
2,830	25,118	22,289	2,971	25,118	22,147	3,113	25,118	22,006
2,872	25,153	22,280	3,016	25,153	22,137	3,160	25,153	21,993
2,894	25,102	22,208	3,039	25,102	22,063	3,183	25,102	21,919
2,907	25,088	22,181	3,052	25,088	22,036	3,197	25,088	21,890
2,915	24,995	22,079	3,061	24,995	21,934	3,207	24,995	21,788
2,924	25,009	22,085	3,070	25,009	21,938	3,216	25,009	21,792
2,928	25,019	22,091	3,075	25,019	21,944	3,221	25,019	21,798
2,928	25,025	22,097	3,075	25,025	21,951	3,221	25,025	21,804
2,928	25,032	22,104	3,075	25,032	21,957	3,221	25,032	21,811
2,928	25,038	22,110	3,075	25,038	21,964	3,221	25,038	21,818
4,379	25,045	20,666	4,598	25,045	20,447	4,817	25,045	20,228
4,379	25,053	20,674	4,598	25,053	20,455	4,817	25,053	20,236
2,928	25,060	22,132	3,075	25,060	21,986	3,221	25,060	21,839
2,928	25,068	22,140	3,075	25,068	21,993	3,221	25,068	21,847
2,928	25,076	22,148	3,075	25,076	22,001	3,221	25,076	21,855
2,928	25,084	22,156	3,075	25,084	22,009	3,221	25,084	21,863
2,928	25,093	22,164	3,075	25,093	22,018	3,221	25,093	21,872
2,928	25,101	22,173	3,075	25,101	22,027	3,221	25,101	21,880
2,928	25,104	22,176	3,075	25,104	22,029	3,221	25,104	21,883
0	0	0	0	0	0	0	0	0
137,556	601,603	464,047	144,434	601,603	457,169	151,312	601,603	450,291
		21.26%			20.39%			19.57%

Source: JICA Survey Team

Table 16.6.3 Economic Sensitivity Analysis (Benefit-5%)

Unit: Million INR.

Cost in Total	Benefit in Total		Cost in Total	Benefit in Total		Cost in Total	Benefit in Total	
Base	-5 %		5%	-5 %		10%	-5 %	
Total	Total	Cash Balance	Total	Total	Cash Balance	Total	Total	Cash Balance
7,230	0	-7,230	7,592	0	-7,592	7,954	0	-7,954
4,277	0	-4,277	4,491	0	-4,491	4,705	0	-4,705
1,933	0	-1,933	2,030	0	-2,030	2,127	0	-2,127
22,724	0	-22,724	23,860	0	-23,860	24,996	0	-24,996
15,133	0	-15,133	15,889	0	-15,889	16,646	0	-16,646
15,371	0	-15,371	16,140	0	-16,140	16,908	0	-16,908
7,359	23,885	16,526	7,727	23,885	16,158	8,095	23,885	15,790
4,390	23,781	19,391	4,609	23,781	19,172	4,829	23,781	18,952
2,529	23,775	21,246	2,655	23,775	21,120	2,782	23,775	20,993
2,744	23,802	21,058	2,881	23,802	20,921	3,018	23,802	20,784
2,787	23,832	21,045	2,926	23,832	20,905	3,066	23,832	20,766
2,830	23,862	21,033	2,971	23,862	20,891	3,113	23,862	20,750
2,872	23,895	21,023	3,016	23,895	20,879	3,160	23,895	20,735
2,894	23,847	20,953	3,039	23,847	20,808	3,183	23,847	20,663
2,907	23,833	20,927	3,052	23,833	20,781	3,197	23,833	20,636
2,915	23,745	20,830	3,061	23,745	20,684	3,207	23,745	20,538
2,924	23,758	20,834	3,070	23,758	20,688	3,216	23,758	20,542
2,928	23,768	20,840	3,075	23,768	20,693	3,221	23,768	20,547
2,928	23,774	20,846	3,075	23,774	20,699	3,221	23,774	20,553
2,928	23,780	20,852	3,075	23,780	20,706	3,221	23,780	20,559
2,928	23,787	20,858	3,075	23,787	20,712	3,221	23,787	20,566
4,379	23,793	19,414	4,598	23,793	19,195	4,817	23,793	18,976
4,379	23,800	19,421	4,598	23,800	19,202	4,817	23,800	18,983
2,928	23,807	20,879	3,075	23,807	20,733	3,221	23,807	20,586
2,928	23,814	20,886	3,075	23,814	20,740	3,221	23,814	20,593
2,928	23,822	20,894	3,075	23,822	20,747	3,221	23,822	20,601
2,928	23,830	20,902	3,075	23,830	20,755	3,221	23,830	20,609
2,928	23,838	20,910	3,075	23,838	20,763	3,221	23,838	20,617
2,928	23,846	20,918	3,075	23,846	20,772	3,221	23,846	20,625
2,928	23,849	20,921	3,075	23,849	20,774	3,221	23,849	20,628
0	0	0	0	0	0	0	0	0
137,556	571,523	433,967	144,434	571,523	427,089	144,434	571,523	420,211
		20.35%			19.49%			18.69%

Source: JICA Survey Team

Table 16.6.4 Economic Sensitivity Analysis (Benefit-10%)

Unit: Million INR.

Cost in Total	Benefit in Total		Cost in Total	Benefit in Total		Cost in Total	Benefit in Total	
Base	-10 %		5%	-10 %		10%	-10 %	
Total	Total	Cash Balance	Total	Total	Cash Balance	Total	Total	Cash Balance
7,230	0	-7,230	7,592	0	-7,592	7,954	0	-7,954
4,277	0	-4,277	4,491	0	-4,491	4,705	0	-4,705
1,933	0	-1,933	2,030	0	-2,030	2,127	0	-2,127
22,724	0	-22,724	23,860	0	-23,860	24,996	0	-24,996
15,133	0	-15,133	15,889	0	-15,889	16,646	0	-16,646
15,371	0	-15,371	16,140	0	-16,140	16,908	0	-16,908
7,359	22,627	15,268	7,727	22,627	14,900	8,095	22,627	14,533
4,390	22,529	18,139	4,609	22,529	17,920	4,829	22,529	17,701
2,529	22,524	19,995	2,655	22,524	19,868	2,782	22,524	19,742
2,744	22,550	19,806	2,881	22,550	19,668	3,018	22,550	19,531
2,787	22,577	19,790	2,926	22,577	19,651	3,066	22,577	19,512
2,830	22,607	19,777	2,971	22,607	19,635	3,113	22,607	19,494
2,872	22,637	19,765	3,016	22,637	19,621	3,160	22,637	19,478
2,894	22,592	19,698	3,039	22,592	19,553	3,183	22,592	19,408
2,907	22,579	19,672	3,052	22,579	19,527	3,197	22,579	19,382
2,915	22,495	19,580	3,061	22,495	19,434	3,207	22,495	19,288
2,924	22,508	19,584	3,070	22,508	19,438	3,216	22,508	19,291
2,928	22,517	19,589	3,075	22,517	19,442	3,221	22,517	19,296
2,928	22,523	19,594	3,075	22,523	19,448	3,221	22,523	19,302
2,928	22,529	19,600	3,075	22,529	19,454	3,221	22,529	19,308
2,928	22,535	19,606	3,075	22,535	19,460	3,221	22,535	19,314
4,379	22,541	18,162	4,598	22,541	17,943	4,817	22,541	17,724
4,379	22,547	18,168	4,598	22,547	17,949	4,817	22,547	17,730
2,928	22,554	19,626	3,075	22,554	19,480	3,221	22,554	19,333
2,928	22,561	19,633	3,075	22,561	19,487	3,221	22,561	19,340
2,928	22,568	19,640	3,075	22,568	19,494	3,221	22,568	19,347
2,928	22,576	19,647	3,075	22,576	19,501	3,221	22,576	19,355
2,928	22,583	19,655	3,075	22,583	19,509	3,221	22,583	19,362
2,928	22,591	19,663	3,075	22,591	19,517	3,221	22,591	19,370
2,928	22,593	19,665	3,075	22,593	19,519	3,221	22,593	19,372
0	0	0	0	0	0	0	0	0
144,434	541,443	403,886	144,434	541,443	397,009	144,434	541,443	390,131
		19.40%			18.56%			17.77%

Source: JICA Survey Team

Supporting Report 17.1.1

Details of Service Stations with Number of Connections and Water Consumption

Supporting Report 17.1.1

Details of Service Stations with Number of Connections and Water Consumption

Sl No.	SDID	Name of Service Station	No. of Connections	Consumption in ML
1	C-1	Banappa Park	5,632	94.49
2	C-1	Chikkalalbagh	8,403	126.12
3	C-1	L.L.R Station	3,068	338.62
4	C-1	Sudhamanagar	4,457	91.36
5	C-2	Coles Park	6,671	299.50
6	C-2	H.G.R	6,979	319.25
7	C-3	Frazer Town	6,729	183.69
8	C-3	Machalibetta	9,206	251.06
9	C-3	Pillanna Garden	20,621	211.90
10	E-1	Banasawadi	7,013	118.58
11	E-1	H.B.R	10,153	170.30
12	E-1	H.R.B.R	5,077	136.92
13	E-1	Lingarajapuram	9,421	135.69
14	E-1	O.M.B.R	4,516	100.41
15	E-2	AECS Layout	5	1.07
16	E-2	AECS-1	6,840	169.72
17	E-2	AECS-2	2,545	101.07
18	E-2	Hoodi	4,599	469.63
19	E-3	A.Narayanapura	4	0.04
20	E-3	Devasandra Service Station	3,578	53.35
21	E-3	K.R.Puram	10,496	140.54
22	E-3	Ramamurthynagar	10,058	249.76
23	E-3	Vijinapura Service Station	4,711	65.49
24	E-4	A. Narayanapura	5,647	115.57
25	E-4	HAL Airport	6,039	125.72
26	E-4	Vignananagar	7,121	183.32
27	N-1	Bahubali Nagar N-1	5,890	330.31
28	N-1	M.E.I Layout (DSH)	13,857	242.57
29	N-2	Yelahanka New Town	8,687	430.49
30	N-2	Yelahanka Old Town	1,495	25.01
31	N-3	Jakkur	8,231	191.92

Sl No.	SDID	Name of Service Station	No. of Connections	Consumption in ML
32	N-3	Sahakara Nagar	5,095	98.28
33	N-3	Vidyaranyapura	14,198	234.06
34	NE1	Bhashym Park	8,445	152.34
35	NE1	Malleswaram	9,879	345.42
36	NE1	No Name	1	0.00
37	NE1	SRIRAMPURAM	5,546	136.08
38	NE1	YASHWANTHPURA	14,881	306.82
39	NE2	JayaMahal	6,140	238.40
40	NE2	K.G.Tower	3,875	108.52
41	NE2	Kumara Park	7,012	157.20
42	NE3	R.T.Nagar	26,816	543.99
43	NE3	Sanjayanagar	13,175	242.67
44	NW1	Kethmaranahalli	6,265	164.00
45	NW1	Mahalakshmi Layout	7,134	170.26
46	NW1	Nandini Layout	13,846	321.74
47	NW1	Rajajinagar	9,645	275.53
48	NW1	Yet to be assigned	3	0.00
49	NW2	A.D.Halli	5,216	142.73
50	NW2	Kamalanagar / Kamakshi Palya	16,341	393.80
51	NW2	West Of Chord Road – I	11,188	320.37
52	NW2	Yet to be Assigned	1	0.00
53	NW3	Hegganahally	17,994	383.06
54	NW3	Peenya	17,828	360.13
55	NW3	Peenya Dasarahalli	5,942	158.75
56	S-1	Banashankari-I	5,277	135.90
57	S-1	Banashankari-II	4,680	148.56
58	S-1	ISRO Layout	5,448	100.36
59	S-1	Kumaraswamy Layout	7,496	209.04
60	S-1	Poornapragna Layout	7,195	215.18
61	S-2	KothnurDinne	25,269	693.22
62	S-2	Vijayabank Layout S-2	9,043	333.28
63	S-3	B.T.M layout-1	13,970	427.64
64	S-3	B.T.Mlayout-2	7,129	249.70
65	S-4	HSR Layout	13,865	463.67

Sl No.	SDID	Name of Service Station	No. of Connections	Consumption in ML
66	S-4	KodiChikkanahalli	11,897	418.92
67	SE1	CLR	10,955	240.55
68	SE1	Domlur	10,484	382.47
69	SE1	Jhonson Market	11,789	255.17
70	SE1	Ulsoor	8,406	307.19
71	SE1	Yet to be Assigned	1	0.00
72	SE2	Bayappanahalli	2,384	54.71
73	SE2	Bhuvaneshwari Nagar	4,547	360.31
74	SE2	H.A.L	4,224	130.55
75	SE2	Indiranagar	4,264	85.71
76	SE2	Jeevan Bhimanagar	7,789	158.80
77	SE3	Koramangala-1	7,281	319.76
78	SE3	Koramangala-2	7,374	202.61
79	SE3	Bellandur	1,033	10.13
80	SW1	Chamarajpet	10,652	227.48
81	SW1	JJNager	10,668	188.15
82	SW1	K.G.Nagar	3,666	81.17
83	SW1	V.V.Puram	8,458	162.42
84	SW2	Devagiri-1	5,456	139.45
85	SW2	Devagiri-2	7,727	193.02
86	SW2	Giri Nagar	5,836	134.00
87	SW2	Hosakerehalli	6,824	146.48
88	SW2	Ittamadu	4,010	97.86
89	SW2	Kathriguppa	5,155	122.00
90	SW3	Girinagar SW3	1,899	35.74
91	SW3	M.N.K Park	10,209	233.65
92	SW3	MountJoy	9,375	223.59
93	SW3	Nagendra Block	11,679	258.29
94	SW3	Yet to be assigned	1	0.00
95	SW4	Byrasandra – I	7,520	181.79
96	SW4	Hombegowda Nagara	8,623	298.99
97	SW4	J.P.Nagar I Phase	4,234	134.29
98	SW4	J.P.Nagar III Phase	4,833	149.09
99	SW4	Jayanagar	3,247	89.04

Sl No.	SDID	Name of Service Station	No. of Connections	Consumption in ML
100	SW4	Jayanagar T – Block	7,156	187.06
101	W-1	Hosahalli	8,759	228.16
102	W-1	MagadiRoad	12,061	206.59
103	W-1	Mysore Road	68,52	154.55
104	W-2	Annapoorneshwari Nagara	11,525	271.58
105	W-2	Nagarbhavi	6,635	143.31
106	W-2	Sir M. Visveswaraiah – I	1,868	31.73
107	W-3	Ideal Home (B E M L)	5,236	110.75
108	W-3	Kengeri Satalite Town	14,291	232.04
109	W-3	W-3-BEML Layout	6,683	133.83
110	W-4	Chandra Layout	20,703	522.18
111	W-4	Moodalapalya W-4	7,562	166.57
112	W-4	Vijayanagara OHT	7,508	165.58
	Total		**872,926**	**22,281.48**
	There are 105 operational service stations out of a total of 112. The seven stations (Sl no. 15, 19, 36, 48, 52, 71 and 94) are yet to be made fully operational.			

Supporting Report 17.1.2

Existing Staff Strength of BWSSB as on Jan 25, 2017

Supporting Report 17.1.2

Existing Staff Strength of BWSSB as on Jan 25, 2017 (Source: Personnel Officer, BWSSB)

No.	Category of the Post	Sanctioned strength	In-position Strength	Vacant Positions
	GROUP- 'A'			
1	Chairman	**1**	**1**	
2	Chief Administrative officer cum Secretary	**1**	**1**	
3	Project Director	**1**	**0**	1
4	Financial Advisor & Chief Accounts Officer	**1**	**1**	
5	Engineer in Chief	**1**	**0**	1
6	Chief Engineer	**4**	**2**	2
7	Additional Chief Engineer	13	11	2
8	Executive Engineer	39	37	2
9	Assistant Executive Engineer	133	95	38
10	Law Officer	1	1	
11	Personnel Manager	1	0	1
12	Administrative Officer	1	0	1
13	Public Relation Officer	1	1	
14	Accounts Officer	8	6	2
15	Asst. Labor Commissioner (Depu)	1	0	1
	Total	207	155	52
	GROUP- 'B'			
1	Assistant Personnel Manager	1	0	1
2	Asst. Welfare Officer	1	0	1
3	Medical Officer (Depu)	1	0	1
4	Asst. Law Officer	1	1	
5	Asst. Public Relation Officer	1	0	1
6	Sr. Labor Inspector	1	0	1
7	Asst. Accounts Officer	14	13	1
8	Asst. Engineer	233	126	107
9	Asst. Chemical Examiner	1	0	1
10	Asst. Stores Officer	2	1	1
11	Asst. Marketing Officer	1	1	
12	PS to Chairman	1	1	
13	Revenue Recovery Officer (Depu)	1	0	1
14	Accounts Superintendent	50	48	2
	Total	309	191	118

No.	Category of the Post	Sanctioned strength	In-position Strength	Vacant Positions
	GROUP- 'C'			
1	Junior Engineer	82	59	23
2	J. E. (Operation)	12	11	1
3	Draughtsman	1	0	1
4	Senior Manager	14	10	4
5	Superintendent	45	28	17
6	Superintendent (PRO)	1	0	1
7	Senior Personal Asst.	4	3	1
8	Junior Personal Asst.	6	0	6
9	Stenographer	10	9	1
10	Special Grade Typist cum DEO	10	9	1
11	Senior Typist cum DEO	21	16	5
12	Typist cum Data Entry Operator	61	20	41
13	Senior Assistant	109	105	4
14	Assistant	167	108	59
15	Junior Assistant	275	164	111
16	Stores Superintendent	10	0	10
17	First Division Storekeeper	13	1	12
18	Second Division Storekeeper	19	6	13
20	Telephone Operator (MR)	6	2	4
21	Special Grade Driver	12	9	3
22	Senior Driver	20	14	6
23	Driver	74	43	31
24	Senior Sanitary Inspector	2	1	1
25	Sanitary Inspector	7	1	6
26	Sanitary Overseer	22	18	4
27	Sanitary Mistry	60	23	37
28	Electrician Grade-I	5	0	5
29	Electrician Grade-II	9	9	
30	Sr. Work Inspector (MR)	6	3	3
31	Work Inspector (MR)	14	0	14
32	Water Analyst	3	0	3
33	Chemist-Grade-1	1	1	
34	Chemist-Grade-2	3	3	
35	Lab-Assistant Grade-1	6	2	4

No.	Category of the Post	Sanctioned strength	In-position Strength	Vacant Positions
36	Lab-Assistant Grade-2	10	5	5
37	Senior Operator	17	17	
38	Operator	45	41	04
39	Senior Water Inspector	31	28	3
40	Water Inspector	150	141	9
41	Meter Reader	360	239	121
42	Senior Jamedhar	2	0	2
43	Jamedhar	4	1	3
44	Senior Dafedar	2	0	2
45	Head Gardener	3	1	2
46	Senior Fitter	60	1	59
47	Fitter	140	100	40
48	Senior Cook	1	1	
	Total	1,935	1,253	682
	GROUP- 'D'			
1	Sr. Attendant	25	16	17
2	Jr. Attendant	105	63	42
3	Sr. Watchman	31	4	27
4	Watchman	6	2	4
5	Sanitary Worker	250	133	117
6	Dafedar	1	0	1
7	Sweeper	50	28	22
8	Gardener	2	0	2
9	Helper	550	351	199
10	Cook	4	1	3
11	Junior Helper	25	6	19
	Total	1,049	604	445

ABSTRACT

1	Group A	207	155	52
2	Group B	309	191	118
3	Group C	1,935	1,253	682
4	Group D	1049	604	445
	Total	3500	2203	1297