Implementation of Wastewater Projects in Southern Asian Countries

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Dohwa Engineering Co.,LTD.

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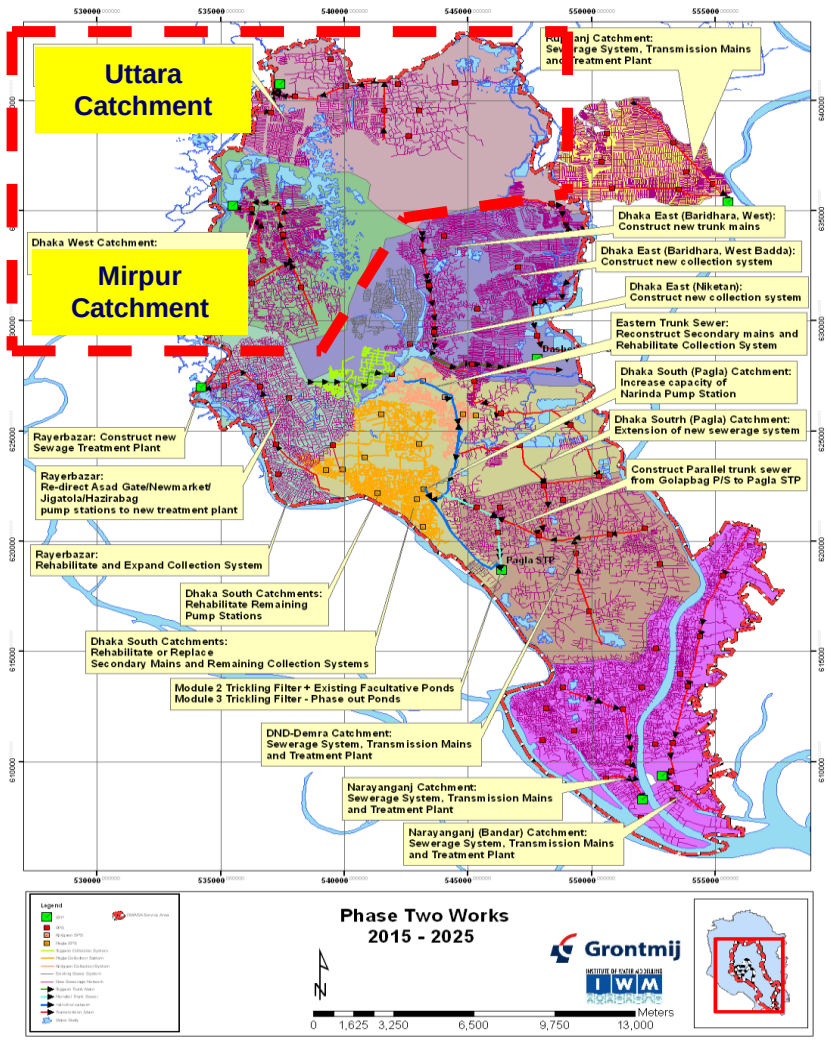
I. Project Overviews

1. Project Area (from Master Plan, 2012)

Catchment	Area (km^2)	Population (million), 2035		Average Flowrates (MLD)
		Total	Served	
Uttara	77.3	2.6	1.6	184
Mirpur	44.2	4.2	2.8	322
Total	121.5	6.8	4.4	506

2. Project Objectives

- Improvement of the sewerage system and on-site sanitary facilities for the Uttara and Mirpur Catchments
- Strengthening the sewerage infrastructure to avoid intrusion of wastewater into water supply lines and to help preventing the drinking water pollution
- Improvement of residents' health, sanitation, environment, and further quality of life by improving on-site sanitation
- Improvement of water quality in urban rivers and tributaries and their ecosystem



Source: Sewerage Master Plan (2012)

II. Target Year and Design Population

1. Target Year

- All the sewerage system plan is targeted on **year 2035 (final target year)** in order to keep consistency with “Sewerage Master Plan, 2012”.

- **As per decision from the Client, it is opted to implement the whole project in a single phase excepting the STPs.**

2. Design Population

- Design population of Uttara and Mirpur catchment were decided based on population projection of each target year from “Growth and Demand Forecast report (Sewage Master Plan)”

	[1)]2011	2020	2025	2030	2035
Uttara Catchment	(682,713)	945,000	**1,325,000**	1,850,000	**2,547,000**
Mirpur Catchment	(1,813,701)	2,864,000	**3,294,000**	3,750,000	**4,211,000**

[1)] As of population in 2011 : Population and Housing Census 2011 Community Report (Dhaka zila, 2012)

III. Framework for Sanitation Service Delivery

1. Classifying the Areas of Sanitation Service Levels

Core Area

: will be served by centralized STP
*Sanitation system:
conventional sewerage system

Transitional Area

: from on-site treatment to conventional sewerage system

On-site Area

: will be served by improved on-site sanitation systems or DEWATS

2. Guideline for Identification of Area in Two Catchments

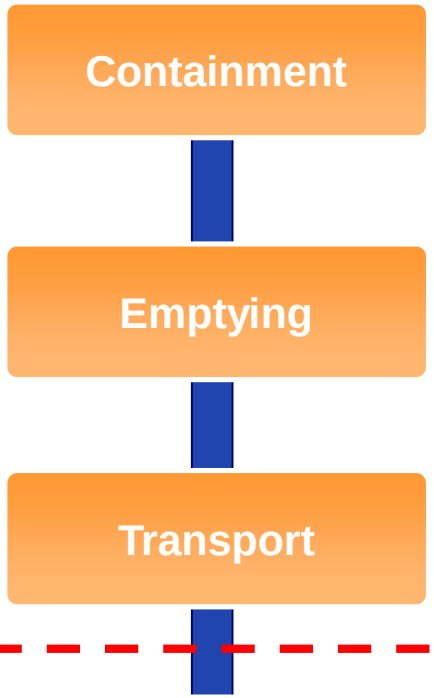
- Projected Population Density, Topographic Conditions
- Level of Urban Development, Projected Per Capita Water Consumption, etc.

Criteria for Selection of DEWATS Area

- By level of existing on-site system and condition of household plumbing;
- By topographic & site conditions for the introduction of DEWATS;
- Areas where those are (1) future development plan exists, (2) floating population is high, and (3) management of the Authority is difficult should be excluded;
- Areas where those are water supply system is in presence and the Client can collect sewerage tariffs, etc.

III. Framework for Sanitation Service Delivery

3. Sanitation Service Chain for Fecal Sludge/Septage Management



Core Area

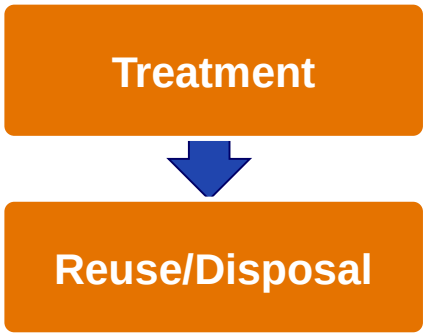
(STP service area)

- Septage from septic tank
- Regular and safe emptying by authorized service provider
- Directly transported to STP site by vehicle

On-site Area

(LICs, On-site, DEWATS)

- A pilot fecal sludge management within selected parts of both catchments
- Strategy and implementation plan for service delivery



- Separate treatment lines for fecal sludge/septage treatment in STP site
- Reuse as bio-solid after treatment or disposed

IV. Categorization of Target Area

1. Uttara Catchment

- **Uttara STP service area is divided into <u>four sub-service areas</u>** based on the local site conditions in order to apply separate sewerage system.
- **On-site area** is where to be served by improved on-site sanitation systems or decentralized collection and treatment.

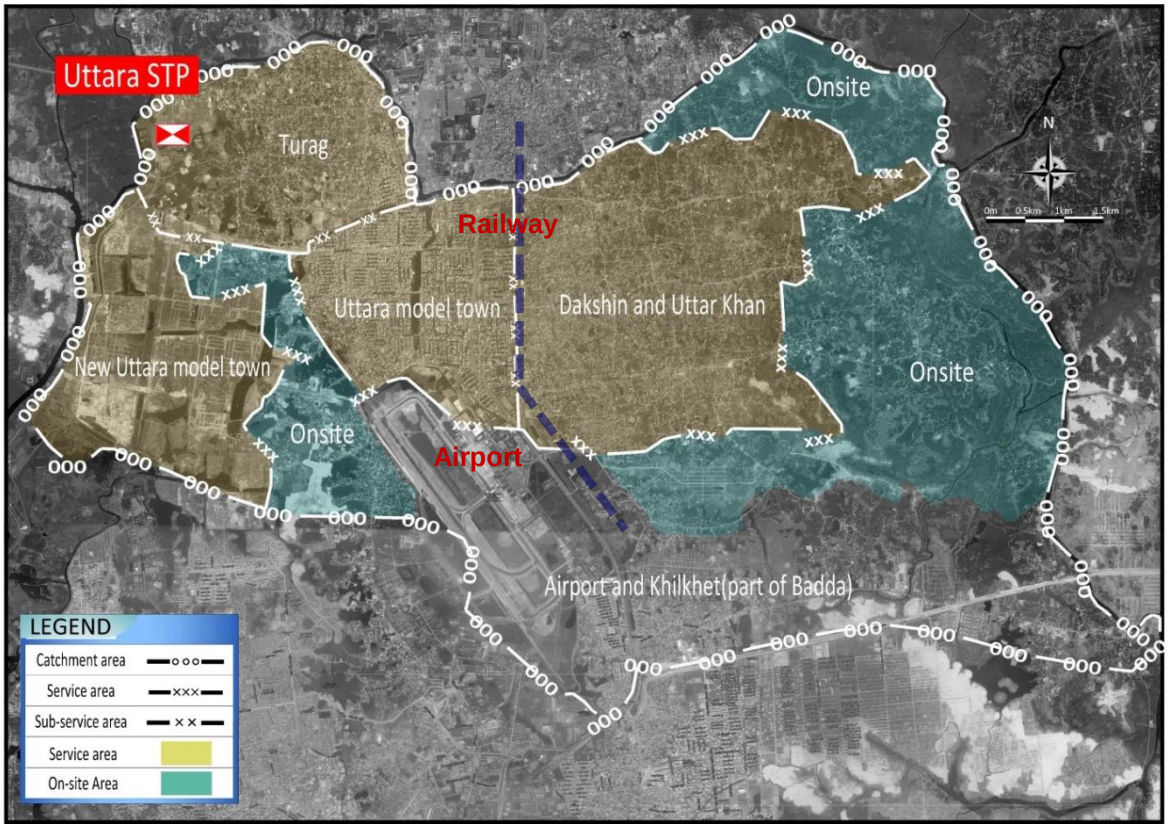
1. STP sub-service areas

- **Uttara Model Town Area**
- **Turag Area**
- **New Uttara Model Town Area**
- **Dakshin and Uttar Khan Area**

2. On-site Areas

Areas where to be served by improved on-site sanitation system or DEWATS

Division of Uttara Sub-service Areas
(Areas will be divided more clearly during the preliminary design phase)



IV. Categorization of Target Area

2. Mirpur Catchment

- **Mirpur STP service area is divided into four sub-service areas** based on local site conditions in order to apply separate sewerage system and its phased implementation plan.
- **On-site area** is where to be served by improved on-site sanitation systems or decentralized collection and treatment.

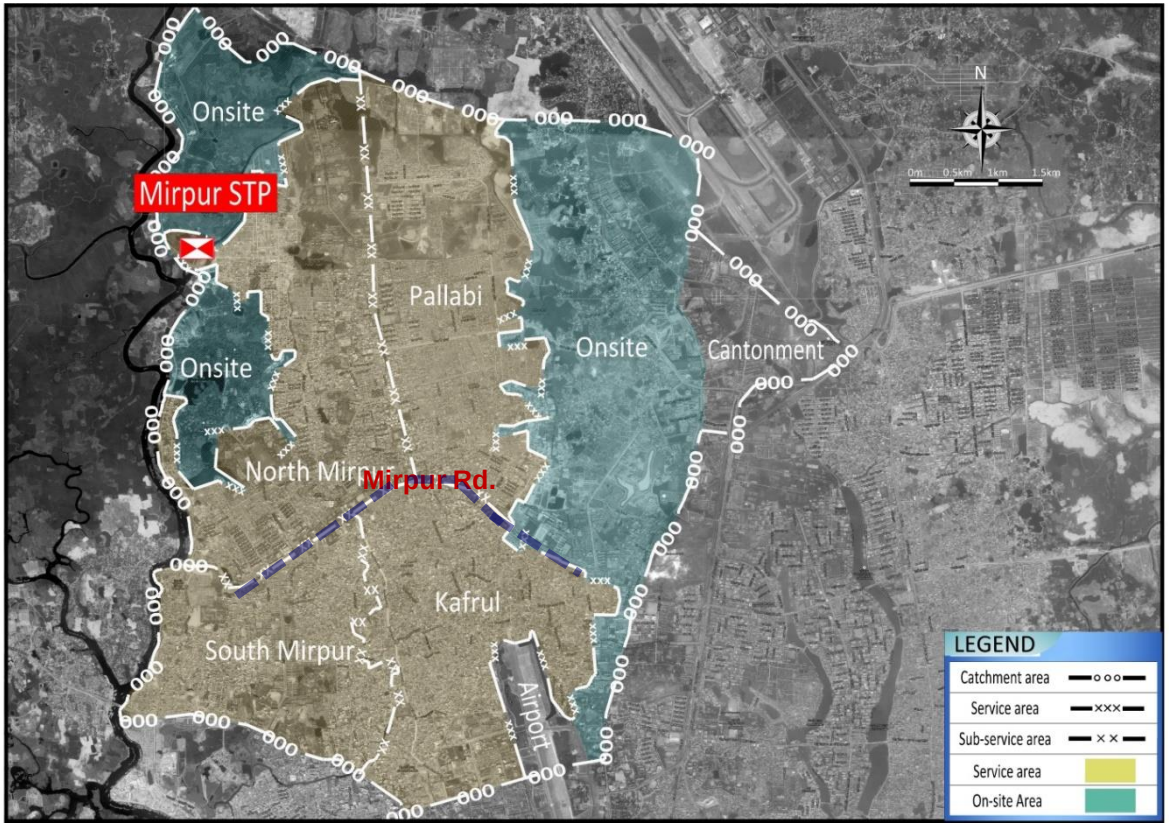
1. STP sub-service areas

- **North Mirpur Area**
- **Pallabi Area**
- **South Mirpur**
- **Kafrul Area**

2. On-site Areas

Areas where to be served by improved on-site sanitation system or DEWATS

Division of Uttara Sub-service Areas
(Areas will be divided more clearly during the preliminary design phase)

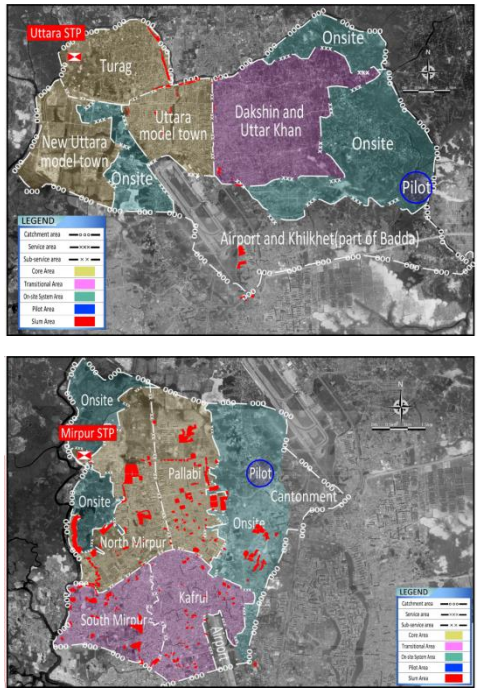


IV. Categorization of Target Area

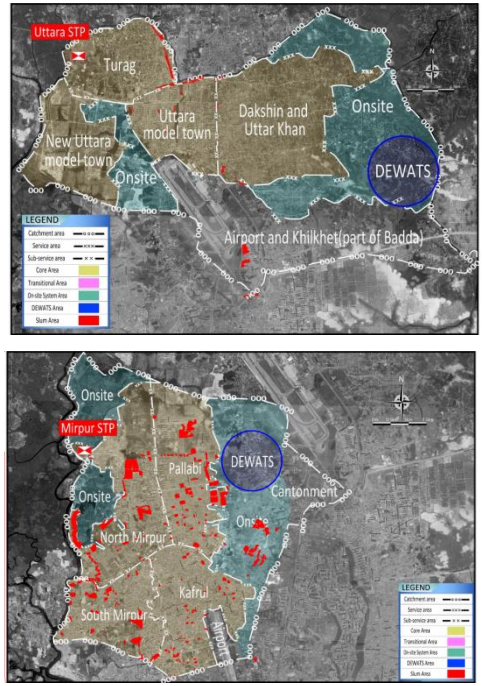
3. Modification of Transitional Area

- The Consultant prepared phase-wise implementation plan for sanitation facilities including sewer network, P/S, and STPs to prevent excessive investment and low O&M efficiencies.
- The Consultant divided into two phases as 1st phase up to 2025, and 2nd phase up to 2035.

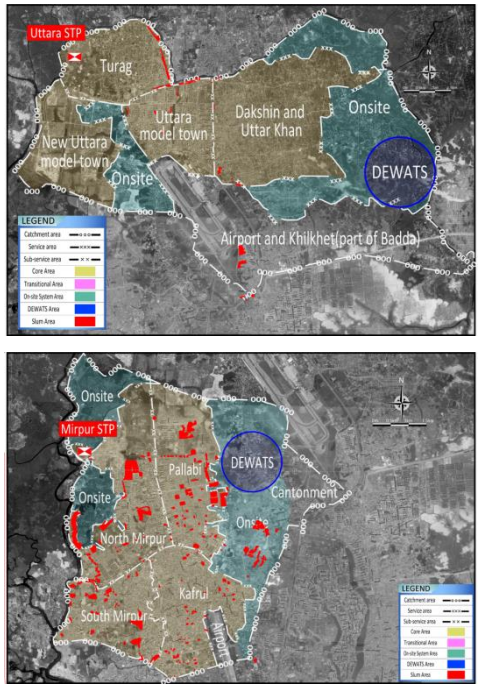
1st Phase: Target year of 2025



2nd Phase: Target year of 2035



Single Phase: Target year of 2035



V. Options for Sanitation Delivery in On-site Areas

1. Population to be Served

The Consultant estimated sewer coverage rate by sub-service area in order to calculate sewer coverage population from population projection in design horizon to reflect characteristic and condition (e.g. rate of water supply connected to households) by each STP sub-service area.

The calculation results for sewer coverage rate for Uttara and Mirpur catchments were 68% and 72%, according to the results, **it is expected that 32% of Uttara catchment and 28% of Mirpur catchment will be serviced by decentralized wastewater collection and treatment, or with improved on-site systems.**

2. Improved On-site Sanitation Systems

- The on-site sanitation system includes a wide range of facilities, such as a basic sanitation facility like a pit latrine, community toilets, a simple sewage treatment system that consists of a septic tank or a soak pit for anaerobic treatment, and advanced treatment facility

- Appropriate options for improved sanitation systems, according to sanitation service chain for fecal sludge / septage management, will be incorporated in interim report #3 based on the results of HH survey and the reviewing of relevant reports.

V. Options for Sanitation Delivery in On-site Areas

3. Decentralized Collection and Treatment

Review of Sewerage Master Plan (2012)

From the review on the Sewerage Master Plan and understanding of context of local areas, introduction of DEWATS shall consider the followings.

- Introduction of DEWATS should be approached by practical guideline reflecting local conditions.
- Cooperation between the relevant authorities and policies for managing the house connection are required.
- Introduction of DEWATS requires pilot testing for the lesson from pilot-scale implementation.

Identification and Evaluation of Options

The considerable items for introducing of DEWATS are as follows.

- Sewage production and treatment capacity in DEWATS areas
- Installation and maintenance of house connection
- Presence of septic tanks in the household
- The area where DWASA can manage O&M and sewerage tariff can be collected. In other words, the place where DWASA can be the management authority
- Period of project implementation

V. Options for Sanitation Delivery in On-site Areas

Classification of Adoptable Area

The Areas where DEWATS can be introduced in Uttara and Mirpur Catchments are as follows.

Areas	Introduction Plan
On-site Area	On-site area will be served by improved on-site sanitation system or decentralized collection a nd treatment. The target area will be selected according to the criteria established by household survey result and site investigation.
Transitional Area	Introduction of conventional sewerage system on the area where planned to be 2nd phase are targeted to 2035 from the completion of construction for sewerage system in 1st phase area. Additionally, DEWATS will be temporary facility during the 1st phase and at the beginning of 2nd phase (2025) in transition area if the conventional sewerage system is introduced in the area. **However, on the meeting regarding the major issues from Interim Report #1, it is opted to implement the whole project in a single phase excepting the STPs.** **As a result, conventional sewerage system will be adopted in this area.**
LICs in Core Area	Considering the characteristic of LICs (high possibility in changes of population, installation and management of house connection, and management capacity of the Client), the Consultant has reviewed “Sewerage Master Plan (2012, WB)”, “Dhaka Low-income Customer Service Improvement Plan”. Combination of installing communal septic tank, discharging supernatant to the adjacent sewer, collection of septage, and separate treatment of septage in the STP is considered to be practical at this stage.

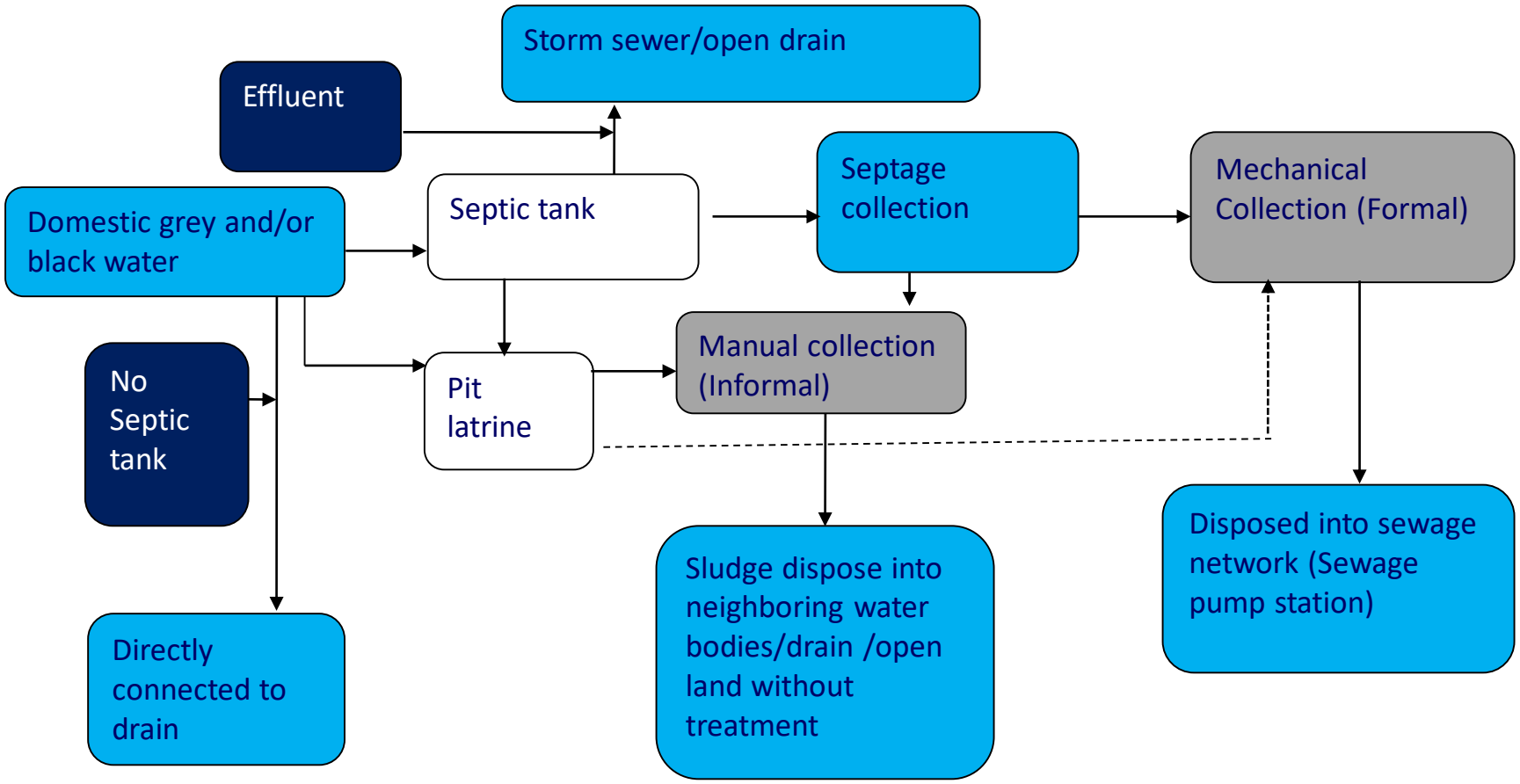
VI. Fecal Sludge Management

1. Objective of FSM Intervention

- Review the existing practices, problems of fecal sludge management
- Develop an action oriented strategy for improved fecal sludge management in the target areas Uttara and Mirpur on pilot basis.
- Improve FS containment installations at household-level
- Improve FS collection and haulage
- Improve FS treatment
- Reuse or disposal of FS or of bio-solids produced during treatment

VI. Fecal Sludge Management

Existing Situation of FSM Service Chain



VI. Fecal Sludge Management

3. Implementation Plan for Improved Fecal Sludge Management

- Legal policy framework on FSM should be developed
- The Client should supervise building construction approval with city government.
- Massive awareness campaign is essential for effective increase in FSM emptying demand.
- The Client will restrict illegal activities on FS connection with storm sewerage/drain.
- The Client takes the lead role in septic tank sludge management (either via own sludge collection vehicles or enter into service agreements with service providers).

VI. Fecal Sludge Management

3. Implementation Plan for Improved Fecal Sludge Management

- Sludge Management Division should be created within the Authority

- The Authority would engage service providers (Contractor) for carrying collection and transport of septic tank sludge to a special facility located at a wastewater treatment plant/transfer station managed and run by the Authority.

- A Performance based License system could be introduced for on-site sanitation chain e.g. collection, transport and on sludge deposited at the treatment plant/transfer station or special arrangement in the sewage pump house.

- All households with septic tanks should pay a septic tank cleaning fee in order to recover costs of septic sludge management.

VI. Fecal Sludge Management

3. Implementation Plan for Improved Fecal Sludge Management

- The Authority may consider a devise card for household septic tank owner where the condition of the septic tank will be recorded on a monthly basis by a FS Inspector/meter reader.

- Entrepreneurs and personnel handling FS during collection, disposal and treatment, should be trained on associated health risks and precaution measures.

- The measures for taking precaution during FS collection should consists of the equipments like gloves, mask, apron, helmet and gumboot.

VI. Fecal Sludge Management

3. Implementation Plan for Improved Fecal Sludge Management

- To create an enabling environment for FS collection, the services should be legal so that entrepreneurs do not face unnecessary harassment during operations.

- For smooth operation of the services, the FS collectors should be under the jurisdiction of the authority.

- Incentive through recognition and rewards, penalties in the form of fine should be introduced to facilitate the proper collection and disposal services

- A sludge management steering committee will be formed from different stakeholders to monitor the overall activities and problem in the area of FSM.

VI. Fecal Sludge Management

3. Implementation Plan for Improved Fecal Sludge Management

- A viable business model will be developed to sustain the improve fecal sludge management service.

VII. Sewer Network Rehabilitation

1. Existing Primary Lines and Remediation Plan

- Hydraulic Analysis of Existing Primary Sewer Network

The Consultant has established a remediation plan for existing primary sewers which directly connected to the interceptors by conducting hydraulic analysis.

Hydraulic Analysis on Dry Season Flow

- Analysis of flow-ability for wastewater generation In 2030

Hydraulic Analysis on Wet Season Flow

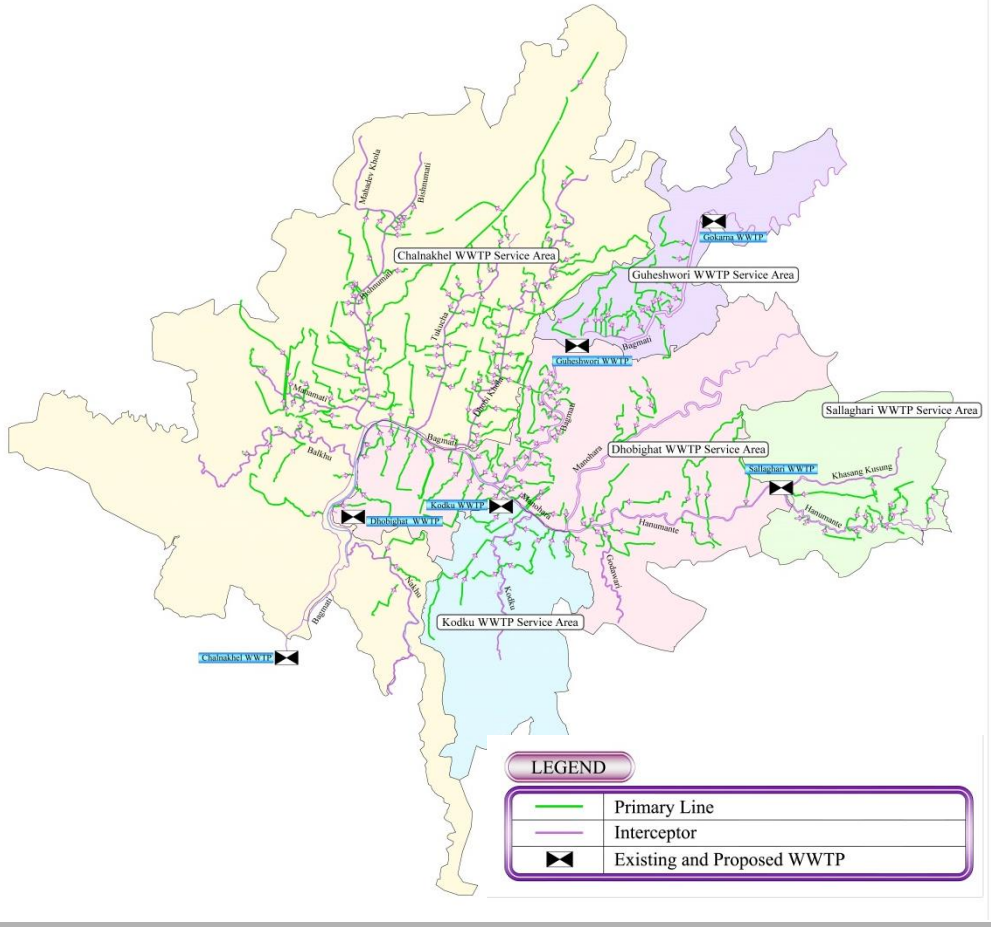
- Analysis of flow-ability for both wastewater and stormwater

Remediation Plan for Frequent Flooding Areas

- Conduct cause analysis and propose improvement plan for flooding areas

Phased Planning for Primary Sewers

- Priority Works
- Phase-wise Works

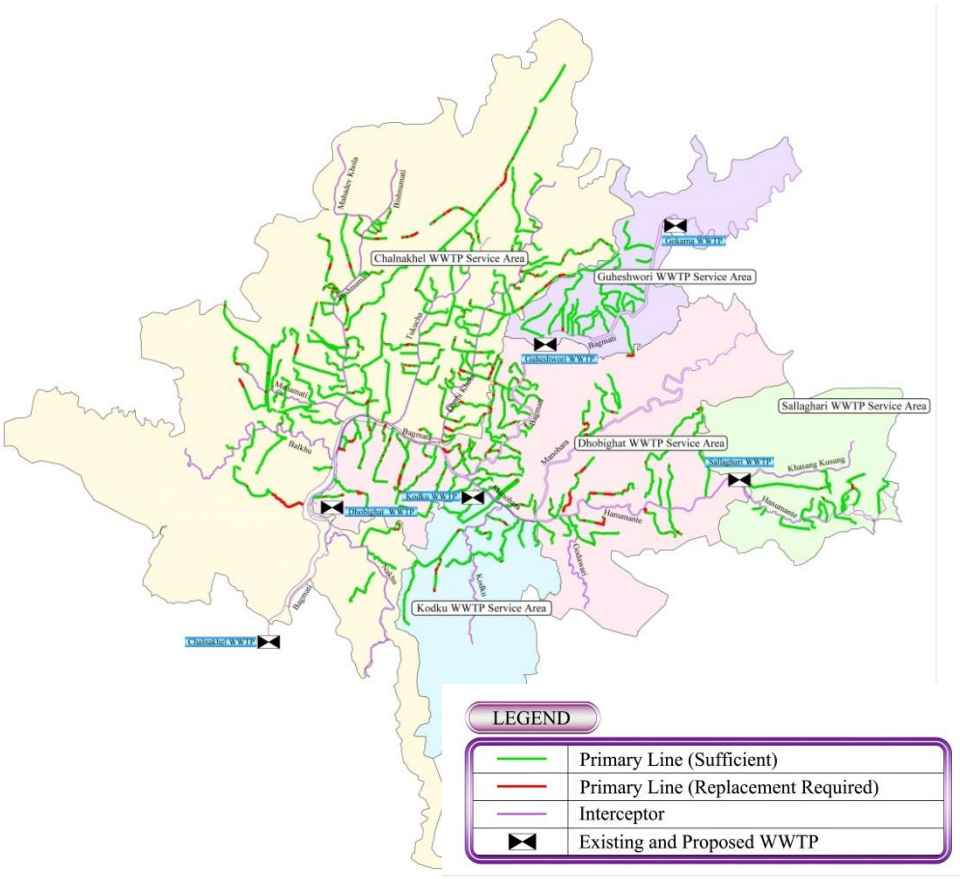


VII. Sewer Network Rehabilitation

2. Hydraulic Analysis in Dry Season (Wastewater generation in 2030 only)

It is estimated that 98.4% at average of existing primary sewer is sufficient to operate at wastewater generation in 2030 → Exiting primary sewer network is capable to discharge wastewater during dry season. However, a planning for remediation work on sewer network is required in the future.

WWTP Service Areas	Length of Existing Primary Lines	Calculation Result	
		Only Sewage	
		OK	Increase Dia.
Sallaghari	13,151m	13,151m (100%)	-
Kodku	14,151m	13,686m (96.7%)	465m (3.3%)
Guheshwori	20,687m	20,586m (99.5%)	101m (0.5%)
Dhobighat	70,168m	69,735m (99.4%)	433m (0.6%)
Chalnakhel	119, 012m	116,212m (97.6%)	2,800m (2.4%)
Total	**237,168m**	**233,370m (98.4%)**	**3,798 (1.6%)**

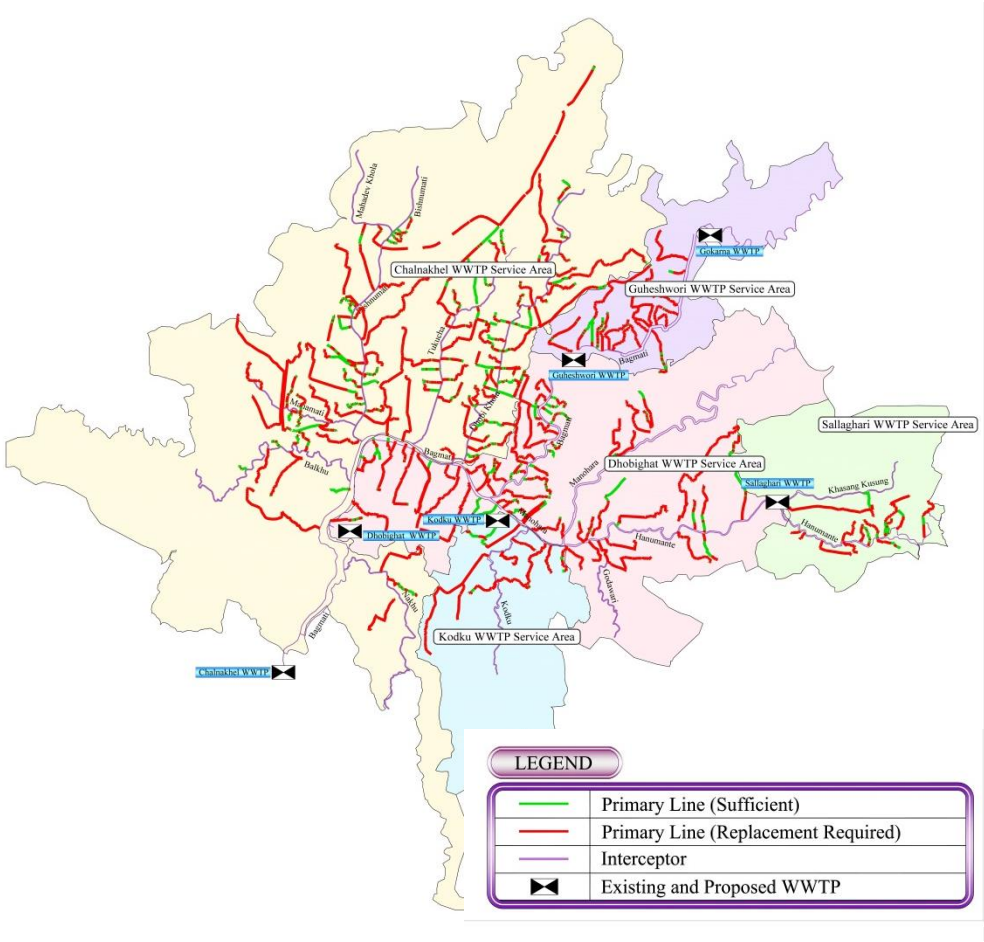


VII. Sewer Network Rehabilitation

3. Hydraulic Analysis in Wet Season (Wastewater generation in 2030 + Stormwater)

It is estimated that 82.1% of existing primary sewer at average is required to be replaced with larger diameter pipe.

WWTP Service Areas	Length of Existing Primary Lines	Calculation Result	
		Wastewater + Storm water	
		OK	Increase Dia.
Sallaghari	13,151m	2,193m (16.7%)	10,958m (83.3%)
Kodku	14,151m	1,280m (9.0%)	12,871m (91.0%)
Guheshwori	20,687m	2,195m (10.6%)	18,492m (89.4%)
Dhobighat	70,168m	12,001m (17.1%)	58,167m (82.9%)
Chalnakhel	119, 012m	24,635m (20.8%)	93,696m (79.2%)
Total	**237,168m**	**43,302m (17.9%)**	**193,901m (82.1%)**

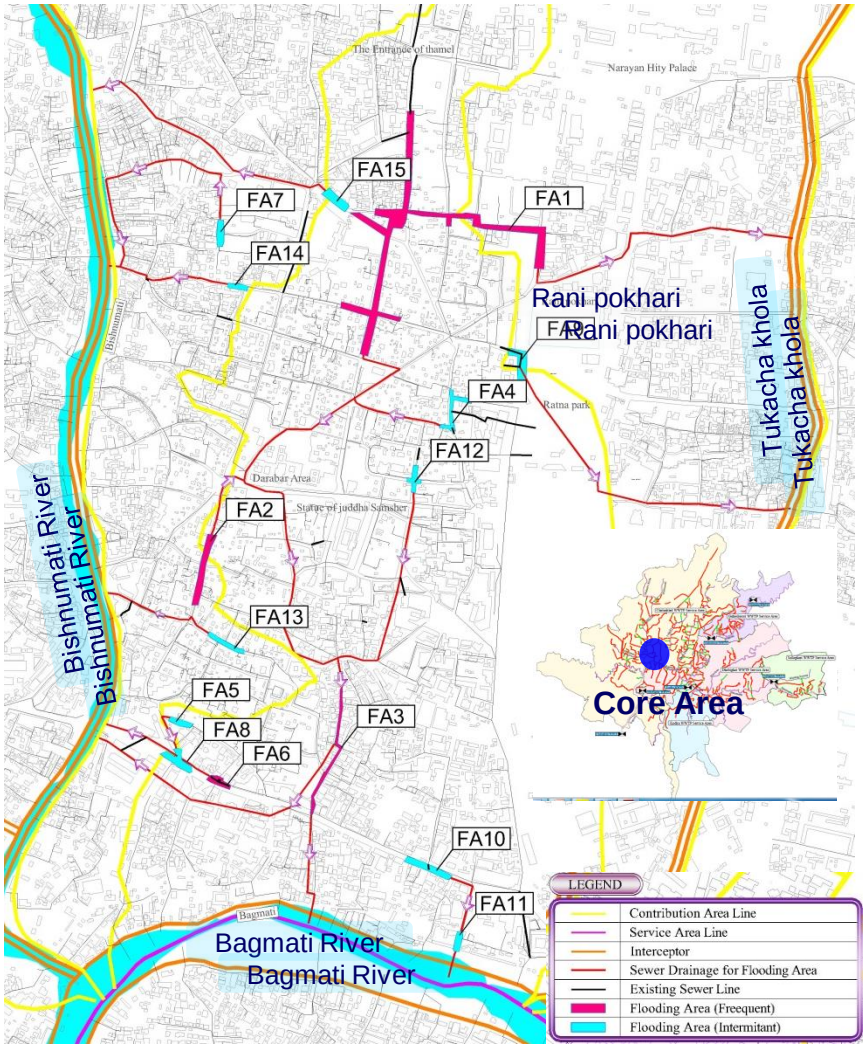


➢ **Quantities required to be replaced**

D	300~1000	1000~1500	1500~2000	Total
L	86.4km	61.7km	46.1km	194.2km

VII. Sewer Network Rehabilitation

4. Cause Analysis of Flooding Areas [Core Area]



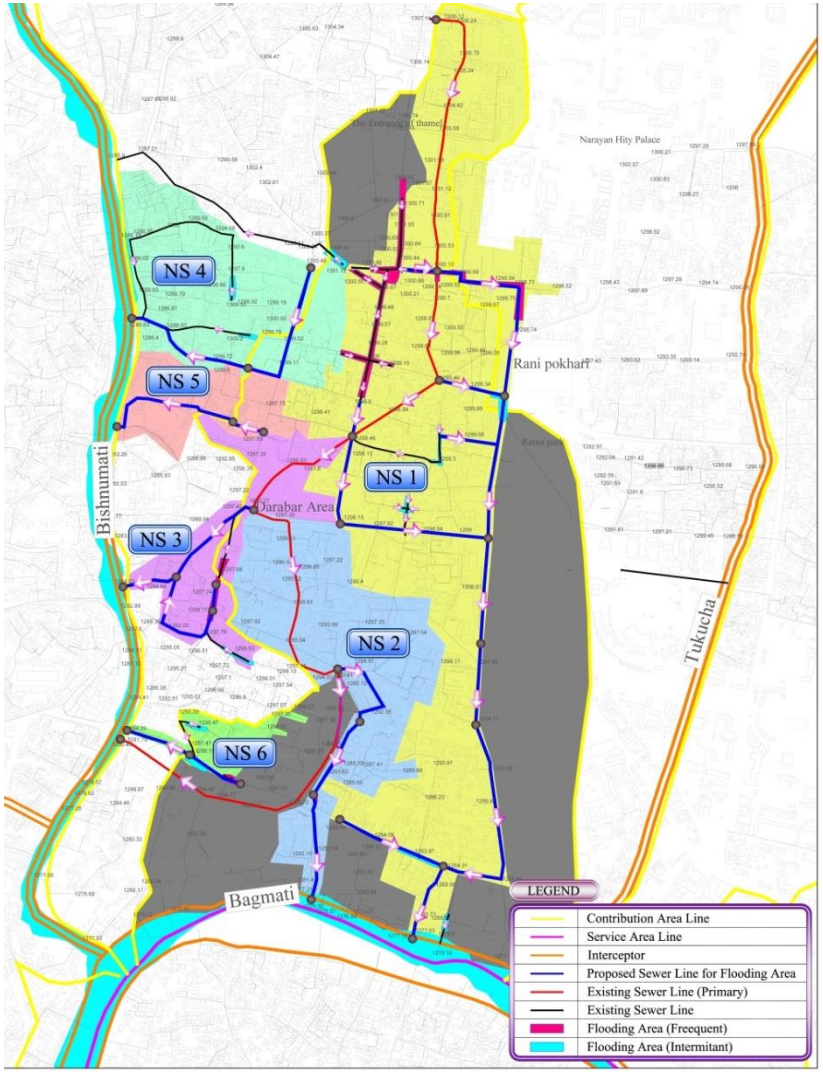
Area	Location	Probable Cause	Site View
FA1	Wards 17, 27 (Thanhity Jyatha Marg, Jyatha Marg, Kantipath, Chandraman Singh Marg)	**Frequent flooding** - Clogging - Insufficient gradient - Small sized drains	
FA2	Wards 20,21,23 (Yogbir Singh Marg.)	**Frequent flooding** - Clogging - Insufficient gradient	
FA3	Ward 21 (Aajad Marg, Suna Gava Marg)	**Frequent flooding** - Small sized drains	
FA6	Ward 4 (Junction of Ganeshman Singh Marg and Gopha Marg)	**Frequent flooding** -MH depth not enough -Insufficient gradient	
Others (FA4 ~ FA15)	Wards 27,24,12,18,17,21	**Intermittent flooding** - Clogging - Insufficient gradient - Small sized drains - Bottle neck etc.	

VII. Sewer Network Rehabilitation

5. Recommendation for Solution of Flooding Areas

1) Remediation of existing sewers in flooding areas by area-wise
2) Construction of new primary lines **(NS1~NS6)**

Area	Location	Remediation of existing sewers in flooding areas
FA1 FA12	Wards 17, 27 Ward 24	• As a result of hydraulic analysis, the existing sewers should be replaced with larger size dia. pipe : - **FA1 :** *D300,450,600mm → D600, 750, 100mm *Length of new sewers : 862m - **FA12 :** *D300,450,600mm → D600, 750, 100mm *Length of new sewers : 141m • Connect to new primary lines proposed by the Consultant
FA3,6,8,9,10,11	Wards 21,4,12, etc.	• Installation of new combined primary lines - FA3 → NS2, FA6 & FA8 → NS6 - FA9 & FA10 & FA11 → NS10
FA2,4,5,7,13,14,15	Wards 20,21,23,24,27,12,18,17	• As a result of hydraulic analysis, the sizes of existing pipes are sufficient - Cleaning or replacement of existing sewers depending on the result of internal inspection - Connect to new primary lines proposed by the Consultant



VIII. Suggestions

1) Land acquisition before the project implementation

→ To prevent design changes during implementations

→ To acquire suitable facility site beforehand

2) Periodic updates for Master Plan (5 year recommended)

→ To keep consistency with urban development plan

→ To prioritize and establish practical project implementation plan

3) Systematic management of Asset Condition Survey and GIS result

→ To make tools for management of facilities and sewer network

→ To use as a data for future projects

→ Periodic updates and comprehensive management of projects within the authority are required

Thank You

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