

## APPENDIX XXI

### Feedback on the draft report received from various organization and our response.

Following is our response to the comments provided by various line departments of NCT of Delhi.

Department: Irrigation and Flood Control CD-XIV

S.No.	As per Terms of Reference	As per Final Report Submitted by IIT Delhi	Reply as per IIT Delhi June 29, 2018
1.	To Formulate Action Plan for implementation of Master Plan in phases.	No Action Plan Provided	<i>Action Plan provided scenario wise: 1. Changing the invert slope. 2. Changing the cross section areas. 3. Connection to the ponds and water bodies.</i>
2.	To prepare feasibility report for the priority projects for the first five year along with further plan cater to the needs of Delhi	Priority projects neither identified nor feasibility report prepared for the 1 <sup>st</sup> five years.	<i>Already mentioned in report. (Refer Recommendation section page no. 115)</i>
3.	Study of the existing drainage system( entire NCT of Delhi	Only basic deficiencies in the existing system such as adverse slope, depth of the drain and point of contraction.	<i>A detailed study was done while formulating the simulation framework. A GIS based framework is in place which can be used for performance evaluation of any drainage network or even a sub-segment of the network.</i>
4.	Improvement/ Rehabilitation/ remodeling of the existing main drain and its tributaries including its design & drawing. The drain from five (5 cusecs) on wards is to be taken into the account for study and remodeling/rehabilitation.	No. Specific rehabilitation & remodeling of the existing drain and point of contraction.	<i>Change in the cross sections of the drains have been provided in the Appendix XI, XII, and XIII. Along with longitudinal profile of the drains.</i>
5.	New drainage facilities/proposals with design and drawing including study of the schemes under	No new drains are proposed.	<i>New Connecting drains have been suggested to connect the water body to drainage network.</i>

	the pipe line/ preparation stage.		
6.	Identification and revival of natural drainage courses, ponds, bawlies etc.	No revival of natural drainage courses, ponds, bawlies etc., and water bodies with the depth of 2m is considered in simulation for recharge/storage of ponds/water bodies.	<i>Appendix VIII, IX, X contains detailed information regarding the water bodies and their connection to the present drainage infrastructure. (Including Identification and revival)</i>
7.	Use of rain water harvesting as envisage in MPD-2021.	No, harvesting proposed in water bodies and parks, however parks upto depth of 1 feet/30 cm considered for storage/recharge.	
8.	Blockage of natural depression and drainage channel which causes choking of drains and flooding of upstream area.	No, such specific report on blockage provided.	<i>Master plan for NCT Delhi has been provided. For the specific report on blockage of natural depression a detailed survey should be carried out by the respective departments before implementation of the recommendations.</i>
9.	Review and designing of Check Dams and depressions to increase ground water table.	No, check dams suggested except park/open ground/ water bodies proposed for storage/recharge ground water table.	<i>The most convenient and cost effective options for enhancing the groundwater table have been suggested. Any other options should be explored after effectively implementing the suggested recommendations first.</i>
10.	Study and suggesting measures to link drainage with ecology and green network by adopting the concept of Bio-drainage.	No such measures suggested.	<i>That has already been captured in scenario 3 (interlinking with water bodies) and scenario 4 (interlinking with parks).</i>
11.	The present system of desilting of drains and suggested deficiencies and measures to improve the same by modern technique.	No mechanism to improve the desilting and techniques on disposal of deslited material suggested	<i>Effective desilting (Pg-101-102) recommendation section.</i>
12.	GSDL will provide data available with them to IIT free of cost. An access point shall be provided in the campus of IIT Delhi for the	Data provided by GSDL.	<i>Land use data of 2021 is still not provided to IIT Delhi.</i>

	duration of the project by IT Department, Govt. of Delhi free of cost.		
13.	Concept of G.I.S. based drainage maps of all the existing and proposed drains on a scale acceptable to the deptt./adopted in DSSDI project of Govt. of Delhi	Data/attributes to adopted concept of GIS based drainage maps provided to GSDL. No new drain is suggested.	<i>New Connecting drains have been suggested to connect the water body to drainage network.</i>
14.	Requirement of Pump House for the areas experiencing drainage congestion, wherever required.	No new pump house suggested.	<i>Already mentioned in Appendix VII</i>
15.	Water bodies, recharge trenches and deepening of drains for recharging and suggesting measures for further improvement.	No, water bodies, recharge trenches and deepening of drains for recharging. Only water bodies and parks are considered for storage and recharge of ground water.	<i>Already considered the natural water bodies as recharge trenches</i>
16.	Sewage being generated at present and likely to be generated and out falling into the storm drains, its impact and steps to check its flow into the storm water drains and alternative measures.	No, such measures suggested.	<i>We have already recommended that no sewage should flow into the storm water drain and vice-versa. DJB has to ensure that no sewage should flow into natural drains as per the NGT order January 2015. Municipalities should ensure that no storm water (Including roof top water) is connected into sewer lines.</i>
17.	To study and suggest methods to prevent disposal of foreign/ garbage into drains and dovetails it with the garbage disposal system in the congested areas wherever unauthorized colonies have come up to the banks of river.	No such methods suggested.	<i>Mentioned in recommendations (Pg-101)</i>
18.	Water holding capacity of the catchment areas and ponds etc. Overall drainage system of unauthorized colonies.	Water bodies with depth of 2m is considered in simulation for storage/recharge only.	<i>In the present study we have considered only the 4 ft. and above drains. If in the unauthorised colonies the said</i>

		Nothing is specifically suggested for unauthorized colonies drainage system.	<i>drains are present then it has been taken care of.</i>
19.	Fixing the service level bench mark/ milestone.	Nothing is suggested in this regard.	<i>Whole drainage network data is being delivered to GSDL. Marking of service level bench mark can be done by GSDL.</i>
20.	To design drainage network, CPHEEO manual on sewerage and sewerage treatment needs to be followed. However other state of art methods of storm water drainage system should also be explored and one should be adopted only with the approval of competent authorities.	IIT Delhi adopted same design parameters with CEEPHO 2 year return period: 79.52mm/hr 5 Year return period : 95.84mm/hr	<i>Intensity Duration Frequency plots are provided for Safdarjung and Palam Station with equations in Chapter 4(Design Parameters) of Main Report.</i>
21.	Interim report of preparation of Master Plan Drainage to be supplied within stipulated time.	Interim report with generalized recommendations received on 04.04.2016 and same was circulated to all the stakeholders on 11.04.2016 for feedback. However the data received from various stakeholders on 12.08.2015 was provided to IIT Delhi for consideration.	
22.	Issue of covering of Storm water drains to be examined.	Issue is not specifically address.	<i>Already recommended in the report for that all the storm water drains should be accessible and open to east inspection and cleaning.</i>

Additional comments received from various line departments have also been provided along with our response in the following table

S.No.	Issue/Feedback	Agency	Response	Resolved
1	Invert Level of drain is shown as zero, which is not feasible in Delhi (p-	INFC CD-XIV	This figure is shows the set of data where Invert Level values were missing. To overcome this problem we	Yes

	27/Figure 2.5.1 of main report)		have generated the missing invert levels using linear interpolation technique. For the reference purpose please refer fig. 2.5- 2 (Pg. 28).	
<b>2</b>	At numerous locations message of Error! Reference source not found, appeared in the report lie p-37/para1/line1, age 96/para/line4 etc.	INFC CD-XIV	Already corrected that error. And provided with the updated version. (Both pdf and word files)	Yes
<b>3</b>	Lawrence road underpass is shown in Trans-Yamuna area (p-43/para 1/line 2).	INFC CD-XIV	Checked and corrected.	Yes
<b>4</b>	Change in cross sections provide is proposed for removing constrictions but for implementation of these recommendations, existing cross sections with proposed cross sections are required.	INFC CD-XIV	We have used existing cross section and on basis of that, changed the cross sections. Just to have uniform cross section along the drain	Yes
<b>5</b>	Surface elevation of Barapullah basin is shown ranging from 14 to 313 metre. Level of 14 metre is not possible in Delhi (p63/para 2/line 4).	INFC CD-XIV	It appears there is a error in DEM provided by GSDL for one specific cell which has been rectified and reported to representative of GSDL.	Yes
<b>6</b>	Figures are repeated in two different basins (Like Fig. 3.1.10, 3.3.9 and 3.2.12 are same).	INFC CD-XIV	The figures using sample segment from the respective basin are been provided	Yes
<b>7</b>	Population densities of various Barapullah sub-basins are taken same as with different districts of Najafgarh sub-basins (p-62 and 87).	INFC CD-XIV	Updated the population densities.	Yes
<b>8</b>	Comparison of flooded junctions i.e. numbers in different scenarios for 2 and 5 years return period rainfall for each basin is not available in report.	INFC CD-XIV	2 Year is present in the report. 5 year we can provide	Yes
<b>9</b>	Proposed invert level of some drains at some locations have discrepancy	INFC CD-XIV	Appropriate rectifications have been carried out.	Yes

	like proposed d/s levels are higher than u/s levels. (P-100/p-138/p-1448/p978/annexure 9 etc.)			
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S.No.	Issue/Feedback	Agency	Response	Resolved
1	Report should strongly recommend Public/ Private premises to be porous.	INTACH	Already suggested	
2	Storm water drains to be soft and unpaved.	INTACH		
3	Hotspot details to be provided in order to come up with specific recommendations.	INTACH		
4	Water bodies are used to store treated waste water.	INTACH		
5	Barapulla water bodies number 203	INTACH		
6	Najafgarh jheel has been considered?	INTACH	Yes	
7	Water body with an area of 329472 sq. mt.	INTACH	Balswa Lake	Yes

S.No.	Issue/Feedback	Agency	Response	Resolved
1	Marked drain are correct with location.	INTACH	Already suggested	
2	Reference point of '0' point is not clear.	INTACH	Starting point of the drain	Yes
3	Shahadra link drain - new IL are mis-matching with slope.	INTACH	Corrected	Yes
4	A sharp drop of 1.5 m in shahadra link drain	INTACH	Site visit should be made by officials. Data provided shows the sharp fall.	Yes

Department: Town and Country Planning Organization

1. The Irrigation and Flood Control Department, Government of Delhi has got Drainage Master Plan for NCT-Delhi prepared by Department of Civil Engineering, Indian Institute of Technology, Delhi. The Master Plan is of great relevance in present scenario of rapid urbanization, unplanned development and encroachments on drains, nallahs and water bodies which leads to waterlogging and urban flooding especially during monsoon. It is a commendable and timely document considering that the last Drainage Master Plan for Delhi was prepared in 1976. The report has divided NCT in three basins in terms of the natural drainage. Based on the available data of the existing drainage infrastructure and other parameters, two types of modeling have been performed (SWAT and SWMM). Design parameters have been worked out, as indicated in chapter four and recommendations have been given in the end, which appear general.

Reply: This work is done in a very systematic manner, starting with the analyses of the existing conditions. Now from this study, a GIS based framework is in place which can be used for performance evaluation of any drainage network or even a sub-segment of the network. Thus, an instrument has become available that can prove to be a boon for the respective departments engaged in planning, design and maintenance of these drainage infrastructure.

2. It appears that at the end of these studies the recommendations need to be more pin-pointed and precise. The facts that are even otherwise known to a planning professional have been given as recommendations at the end of technical report. In fact the report should lead to an actionable plan.

Reply: The recommendations provided in the report are based on the visual inspection and also based on simulation results. Thus, if the recommendations given in the report are achieved, then waterlogging problems at most of the locations will be minimized. Ultimate solutions are deliberately avoided in the wake of the fact that the data used as the basis has not been completely validated by the departments. Therefore, under the circumstances it is advisable to do the implementation in stages after evaluating the efficacy of the implementation side by side. However, the procedures for ensuring that the flooding is reduced to the extent desirable has been elaborately described.

3. The basin wise analyses is good, this should have been used to bring out broad figures of annual discharge of storm water, the capacity of natural and engineered drains, the shortfall and the required gap to be filled and the investments required to do so. Also, the months in which peak discharges are observed can be indicated when the infrastructure undergoes maximum stress and inundation occurs.

Reply: The simulation results are available on sub-hourly, hourly, daily, monthly basis. Therefore, abstraction of the results as per the requirements is possible. But, since urban flooding occurs due to a highly variable rainfall over very short span of time, so in the study we have done the simulation on sub-hourly basis i.e. 15mins.

4. Using the processed datasets, the Storm Water Management Model (SWMM) has been setup in the Drainage Master Plan for each of the drainage basins of Delhi to simulate the inundation depths as well as their spatial locations. The model results have been validated to certain extent through the flooding location data provided by the different agencies like Delhi Traffic police. Various stimulation scenarios based on data provided by departments, cross sections, invert levels, inundation, rejuvenation of water bodies and recharging of parks and play grounds in Drainage Master Plan. The recommendations are based on in-depth study and simulation modeling of the three major drainage basins of Delhi.

Reply: Yes, the study has been conducted very systematically. Firstly, the model has been validated using the existing conditions. Subsequently, a series of scenarios have been generated to identify the successive implementations that should be taken up to reduce the flooding. Each and every scenarios is explained in details for all the three basins in the report.

5. The recommendations provided in Drainage Master Plan can be included in Drainage policy of NCT-Delhi. The recommendations are not basin-design specific. The Drainage Master plan should provide various engineering model designs of storm water drains for ULB Engineers. However this document will be very helpful for ULBs and Sewerage Board in planning and design of storm-water drainage network in NCT Delhi.

Reply: The details of engineering designs of these drains like drains' invert level, its cross-section and gradient are provided basin wise in appendix V, VI, VII.

6. The Drainage Master Plan should be linked to Master Plan 2021 Proposals, land-use policy and development control regulations. It also needs to consider future development proposals.

Reply: The framework is now available which is developed using the land-use data provided by GSDL. The future land-use i.e. 2021 can be integrated in the framework if the same is provided to IIT Delhi.

7. The Drainage Master Plan for Delhi should also consider the National Capital Region (NCR) while analyzing the drainage problem and be in conformity with the Functional plan for Drainage for NCR 2016, since all drainage basins link to the surrounding districts in Haryana and UP.

Reply: In this study, we have already considered the inflow that is coming in from NCR to Delhi city.

8. The Ministry of Housing and Urban Affairs has recently prepared Standard Operating Procedures (SOP) for Urban Flooding, which the Drainage Plan should consider, especially the mitigation procedures to check urban flooding provided in SOP.

Reply: A few of the procedures (as per SOP) have already been recommended in the report and for the other flooding guidelines SOP can be referred.



9. Apart from this, Ministry has issued advisories to adopt provisions of Model Building Bye Laws 2016 regarding rainwater harvesting and drainage.

Reply: We have already included in the report. These laws should be made mandatory in the existing as well as in the upcoming infrastructure.

10. Drainage Plan should also needs to refer Urban and Regional Development Plan Formulation and Implementation (URDPFI) Guidelines published by Ministry which contain provisions for urban drainage, flooding, and rainwater harvesting.

Reply: We have already included in the report. These guidelines should be made mandatory in the existing as well as in the upcoming infrastructure.

11. Drainage Master Plan should also indicate various state-of-art technologies for efficient cleaning/ desilting of drains and holding water bodies. Deployment of state-of-art technologies such as water quality sensors, manhole sensors, and smart water systems that measure water flow and pressure etc. have the potential to significantly improve the storm water drainage systems. Sensor based monitoring of water volumes in storm water drains can help in effective warning systems to prevent damage to life and property.

Reply: It is a nice idea of using sensors for monitoring the quality and quantity of water in the SWD. It can be taken up while implementing the recommendations provided in the report.

12. It has been noticed that most of the covered drains do not have access for desilting. If desilting is not carried out under the covered portion, effectiveness of desilting of rest of the drain is reduced significantly.

Reply: Yes, desilting is the serious issue in Delhi. It is already recommended in the report that all the stormwater drains should be accessible and open to easy inspection and desilting.

13. Large scale mapping of natural drains and water bodies/ wetlands should be done so that drainage can be planned accordingly. Construction and encroachment over natural drains, flood plain, lakes, wetlands and other water bodies should be removed.

Reply: Natural drains and water bodies/ wetlands have already been digitized using GIS (already provided to GSDL) and the mapped drainage are accordingly modelled. Also, in the report, it has already been recommended to remove construction and encroachment areas from the natural drains, lakes, wetlands and other water bodies in the catchments.

14. Non-structural measures may be included as a separate chapter to relieve the problem of covering of SWD which has significant impact on the existing drainage system.

Reply: Yes non-structural measures are important. But it can be taken as separate project. At IIT Delhi, we are setting up flood warning system for NCT of Delhi in collaboration with IMD, using the Doppler Radar data.

15. Drainage legislation empowering Delhi Govt / Parastatals/ ULBs to carry out maintenance of SWD, which is primarily responsible for flooding during rainy season in most of the drainage zones of Delhi.

Reply: Yes the proper and regular maintenance of SWD is very much important in minimizing urban flooding.

16. DMP to specify whether existing network of SWD is sufficient for additional population/ area as per MPD 2021.

Reply: For designing SWD (stormwater Drains), population data is not needed, only land-use data is required. Since the modeling framework is available which is developed using the land-use data provided by GSDL, the future land-use i.e. 2021 can be easily integrated in the framework if the same is provided to IIT Delhi.

17. Hierarchy of drainage network for assigning flood protection standards according to perceived importance of individual drainage system may also be included.

Reply: We have already provided the details information of each drains in terms of flooded volume and duration of flooding.

18. Evaporation/ evapo-transpiration should also be considered while designing SWD.

Reply: In the simulation, antecedent soil moisture conditions has already been incorporated which takes care of evaporation/ evapo-transpiration.

19. Manhole designs for busy roads should be included because covers need to be strong to take the heavy vehicle load.

Reply: It is not the part of TOR (Term of Reference)

20. Foul Sewer and SWD manholes covers should be differentiated by the grid patterns.

Reply: It is a good idea and should be implemented by respective departments.

21. Operation and maintenance of SWD is essential if works are to achieve their design objectives. Clear mention of line departments ward-wise should be included in the form of institutional mechanism chapter.

Reply: In the report, all the drains with their design parameters are provided agency wise, identifying department name, and division's number up-to sub-divisions level.