4 Chapter

Planning, designing and construction of storm water drains

4.1 Planning

Section 9 of the Karnataka Town and Country Planning Act, 1961, stipulates that every planning authority should carry out a survey of the area within its jurisdiction and, prepare and publish a comprehensive development plan (CDP)/revised master plan (RMP) consisting of a series of maps and documents indicating the manner in which the development and improvement of the entire planning area within the jurisdiction of the Planning Authority is to be carried out and regulated. Further, Section 13-D of the Act also provides for revision of the master plan at least once in 10 years from the date on which the master plan had come into force. The plans should indicate areas reserved for parks, play grounds and other recreational uses, public open spaces, public buildings and institutions etc. The Act does not explicitly describe the area preserved as tanks or lakes in the CDP/RMP.

4.1.1 Deficiencies in the Master Plans prepared by BDA

The Bengaluru Development Authority (BDA) prepares master plans. The details of plans brought out by BDA are as shown in the **Table 4.1.**

Table 4.1: Details of plans prepared by BDA

Plan	Identified as	Date of approval	Valid till
First	Outline Development Plan	22-05-1972	11-10-1984
Second	Comprehensive Development Plan	12-10-1984	04-01-1995
Third	Revised Comprehensive Development Plan	05-01-1995	24-06-2007
Fourth	Revised Master Plan	25-06-2007	Till the approval of RMP-2031

Source: Information furnished by BDA

BDA did not have on record the first two development plans prepared for the periods May 1972 to October 1984 and October 1984 to January 1995. In the revised CDP approved in January 1995 and valid till June 2007, there was no consistency in the representation of water bodies which were shown as tanks and also as parks and valleys; and drains (water ways) were not exhibited explicitly. The CDP was, therefore, incomplete and deficient. In the absence of clear data on the width/type of the drains at any stage, encroachment / disruption of flow could not be analysed.

The Revised Master Plan - 2015 for Bengaluru approved in June 2007 and valid till the approval of RMP 2031 was also deficient for the following reasons.

- Though RMP–2015 recognised the importance of having buffer zones[11] for different types of SWDs, it did not classify the drains as required and hence, did not notify 'no development area' along the drains. As a result, the required buffer zone around/along the water bodies/water ways were neither marked nor maintained.

- Though drains were mapped in the RMP-2015, many existing drains and water bodies (as per the Master Plan of SWDs prepared by BBMP) were not shown in the maps published **(Exhibit 4.1)**.

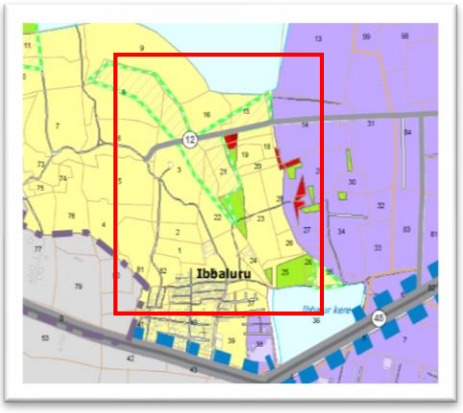
Exhibit 4.1: Illustrative photographs showing drains/water bodies not mapped in RMP-2015 (shown in red rectangles)

Master Plan of SWDs | **RMP-2015**

Shown as a water body

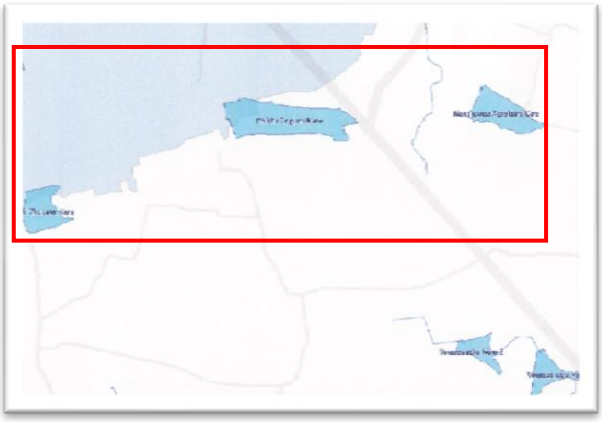
Shown as a park

SWD shown between Bellandur and Ibbalur tanks

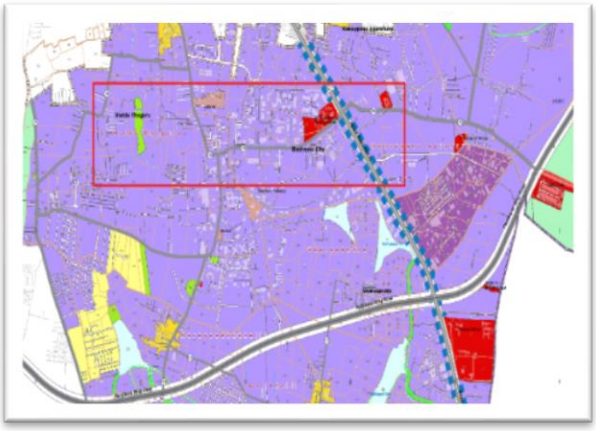


No connectivity between two tanks

[11] Buffer zones are areas of land adjacent to a drain or waterbody which are meant for providing utilities such as power, pipelines for water/oil/gas *etc*., and also to facilitate easy maintenance of drains. The RMP stipulated buffer of 50, 25 and 15 mtrs (measured from the centre of the drain) on either side of primary, secondary and tertiary drains respectively.



Water bodies shown around Thoguru village



No water bodies around Thoguru village

The existing outlet drain (shown in red arrow) from Sankey tank not mapped either in Master Plan of SWDs or RMP-2015

The lapses indicated above facilitated unabated construction along the drains without allowing the required buffer area. Photograph captured during joint inspection showing construction without allowing buffer area along SWDs are shown in **Exhibit 4.2**.

https://youtu.be/sUCfkOnb52k

Absence of buffer zone

Exhibit 4.2: Illustrative photographs showing construction of buildings allowed without buffer area along storm water drains

Bommanahalli Zone

Koramangala Zone

Rajarajeshwarinagar Zone

South Zone (Covered Drain)

West Zone

West Zone

Source: Photographs taken during joint inspections

The State Government accepted the omissions in RMP-2015 and stated (January 2019) that corrective measures were being taken in RMP-2031. In this context, reference is invited to Paragraph 4.6 of the Report on Lakes wherein the change

in status of lake area (residential, roads, agricultural land etc.) in the RMP 2015 when compared to the CDP of 2005 which described the status of lake area as tanks, parks and valleys citing few instances was commented upon. The State Government had accepted (March 2015) the findings and had stated that the error would be rectified in the RMP 2031 which was under preparation. The replies of the Government in both the instances could not be verified as the preparation of RMP 2031 was still under progress.

It is thus apparent that the Government and the authorities concerned have overlooked the importance of water bodies and drains at the time of preparation of the master plans.

4.1.2 Delays in preparation of Comprehensive Development Plans/Master Plans

The Karnataka Town and Country Planning Act, 1961, provided for revision of the CDP/Master plan once every ten years. The timely and periodic revision would assist the Planning authorities to factor in rapid growth and urbanisation of the cities for future expansion and developments in compliance with the zoning regulations besides enabling them to take corrective measures to rectify any errors in the earlier plans.

As can be seen from Table 4.1, the revision of the second and fourth plans were delayed by two years. The fifth plan which was due for revision in 2017 has so far not been done. Though the draft RMP 2031 was published (November 2017) for inviting public comments, the final plan was yet to be notified. Delay in revision of the master plans would result in uncontrolled expansion leading to encroachments of Government lands and zoning violations besides the delay in rectification of the omissions pointed out in the above paragraph.

Recommendation 5: *The State Government/BDA should take immediate action to finalise and notify the revised master plan to prevent encroachments of Government assets such as land, water bodies etc., and rectify the omissions with regard to SWDs.*

4.1.3 Preparation of master plan of drains by BBMP

The master plan prepared by BDA was to be followed by all the authorities for taking up any development work. However, we observed that BBMP got a separate master plan of drains (including the expanded area comprising of City/Town Municipal Councils and 110 villages that was integrated during 2007), water bodies, bridges/culverts, low lying areas, *etc.*, prepared by M/s. STUP Consultants at a cost of ₹3.62 crore during 2010-11[12].

The master plan of drains of BBMP was incomplete as

- it was restricted to identifying only the primary and secondary drains in contradiction of the NDM guidelines which stipulated preparation of comprehensive database of all drains.

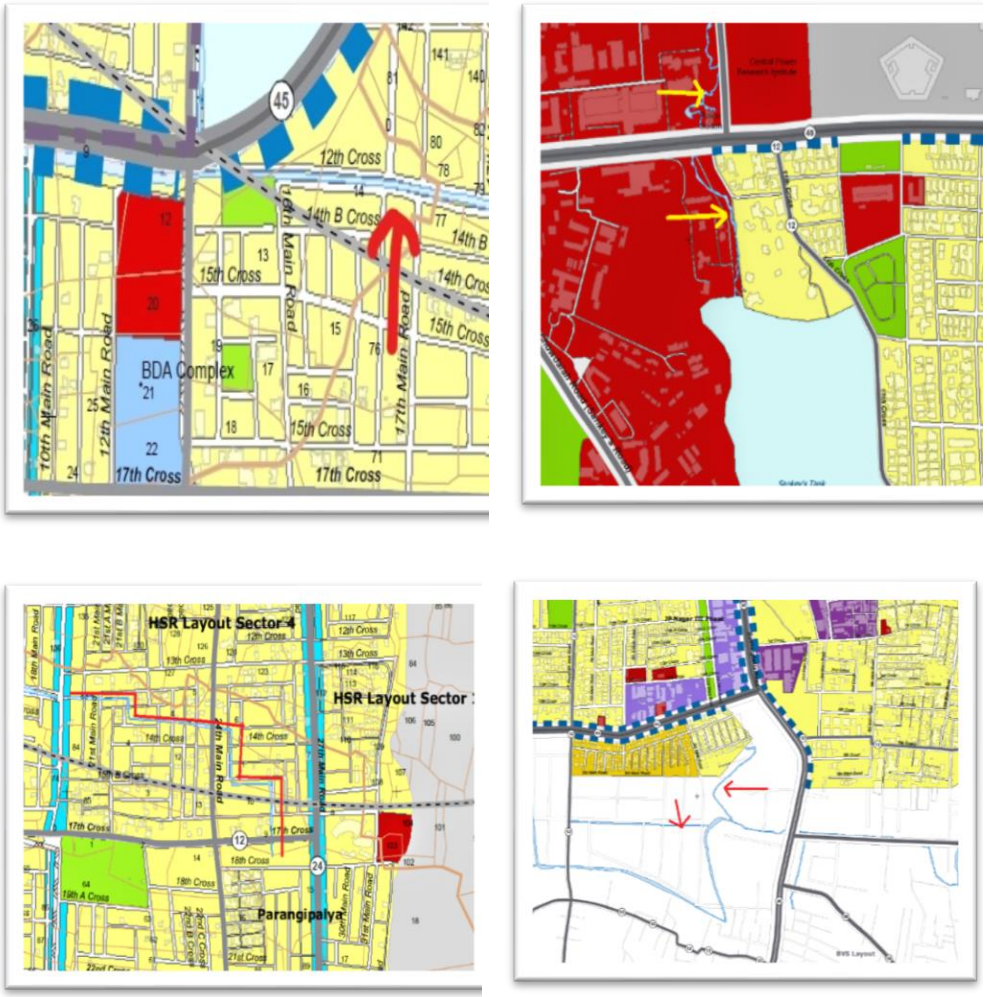
[12] Tendered and entrusted during 2007-08.

https://youtu.be/nNXeci28D-E

Audit trail to trace unmapped drains

- many of the drains shown in RMP-2015 were not mapped in the master plan of drains (**Exhibit 4.3**). Besides, a large number of drains which were in existence but not found in RMP-2015 were also not mapped. This raises questions on the validity and reliability of the database.

Exhibit 4.3: Photographs showing drains identified in RMP-2015 but not exhibted in master plan of drains of BBMP (Arrows show stretches of missing drains)



- the master plan did not provide for buffer zones along the different kind of drains, despite being clearly spelt out in RMP-2015, which was in force.

Further, the records relating to preparation of the master plan of drains containing tender conditions, tendering process, award of contract and payments made to the agency were recorded 'to have been lost' and thus, not furnished to audit. The CE, SWD also did not possess on record the detailed volumes of master plan pertaining to individual zones, except for Yelahanka and Rajarajeshwari Nagar (RR Nagar). Hence, the correctness of the preparation of the master plan by the agency as well as compliance to tender conditions could not be verified.

BBMP did not initiate action to reconcile its master plan with that prepared by BDA. It also did not conduct any physical inspection of the drains to update its master plan and to ensure inclusion of all the drains under its jurisdiction in the RMPs. Significant discrepancies between the two sources of data deprived planners of a single source of truth for planning/development of the city.

The State Government replied (January 2019) that RMP-2015 which was in place at the time of preparing SWD master plan had not captured the drainage networks. The SWD master plan has been shared with BDA and now finds its place in the draft RMP-2031 and the anomalies are getting ironed out.

However, verification of draft RMP-2031 showed that drains shown as primary and secondary in BBMP's map were exhibited as secondary and tertiary in the draft RMP-2031. These discrepancies assume higher significance in light of the judgments of the National Green Tribunal (NGT) enhancing the buffer area[13] along the drains. Moreover, the basis on which BDA identified, classified and exhibited the tertiary drains in the RMP when BBMP, the authority for construction and maintenance of SWD, does not have the data on tertiary drains was not explained.

The State Government accepted (August 2020) that the nomenclature of primary, secondary and tertiary drains in draft RMP-2031 are different from that mentioned in SWD master plan and action would be taken to discuss the issues with BDA for proper reconciliation and corrective measures.

4.1.4 Storm water drain inventory

Paragraph 4.5 of NDM guidelines stipulate that all ULBs/States/UTs shall prepare an inventory of the existing storm water drainage system on a Geographic Information System (GIS) platform. The inventory was to be both watershed based and ward based with clear mapping of the major as well as minor systems. Further each road was supposed to have drains on both sides for collecting storm water which would ultimately lead into primary/secondary SWDs to allow runoff. Hence, the tertiary/road side drains form the major contributor to urban drain runoff. For quantification of runoff in different kinds of drains and their upkeep without allowing for clogging/flooding, the SWD authorities should have on record comprehensive data of different types of roads (length, width, type of surface, perviousness, gradient, *etc*.) collected at regular intervals.

However, the CE, SWD, the authority for construction and designing SWDs thereon, did not possess comprehensive data of different roads and tertiary/surface road side drains within the jurisdiction of BBMP. The lack of comprehensive data on runoff is bound to have an adverse impact on the design, construction and management of drains.

The absence of comprehensive inventory of drains with BBMP and its failure to classify them properly contributed to lack of clarity on critical issues including the extent of buffer zone to be maintained.

[13] Buffer of 50, 35 and 25 mtrs (measured from the edge of the drain) on either side primary, secondary and tertiary drains respectively.

This, in turn, would

- hamper regular maintenance of the drains.
- impact one of the purposes of creating a buffer zone *i.e.*, to provide space for laying of utilities. Audit observed that many utility lines like water pipes, sanitation pipes, electrical, telephone, optical cable, *etc.*, were laid across the drains in many locations obstructing the flow in drains and overflows (**Exhibit 4.4**). The absence of buffer zone also results in encroachments as indicated in Paragraph 5.1.3.

Exhibit 4.4: Photos showing the presence of utility lines in SWDs

Koramangala Zone

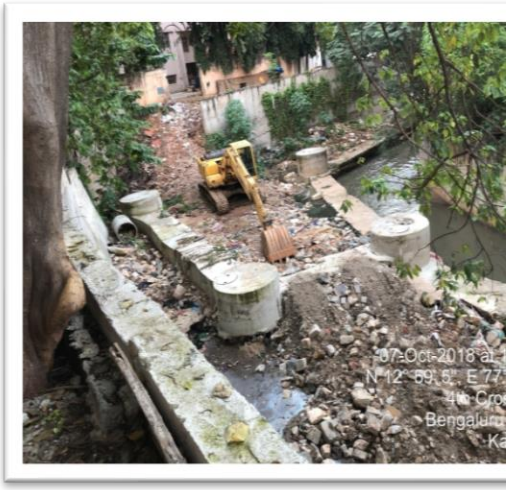
Bommanahalli Zone

NGV campus, Koramangala Zone

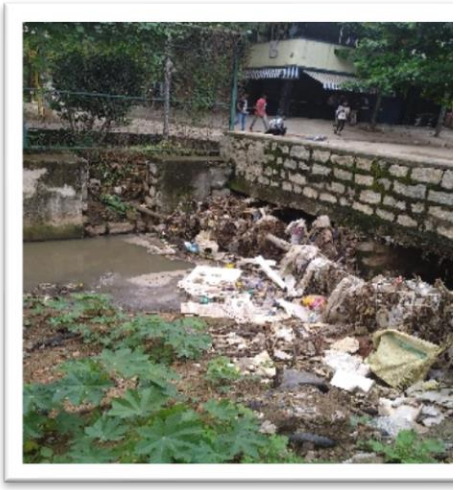
South Zone

https://youtu.be/joRJQi5ElRk

Utility lines blocking flow



West Zone



Bommanahalli Zone

Source: Photographs taken during joint inspections

The State Government replied (August 2020) that action would be taken to compile and document the details of all types of roads and corresponding drains (surface and tertiary drains) under BBMP jurisdiction. However, the data on roads was not made available even as at the end of December 2020.

Audit also observed that the State Government/BBMP had not carried out any evaluation study to ascertain the adequacy/capacity of the existing storm water drainage network in the city.

Recommendation 6: *BBMP should prepare a comprehensive database of SWDs in coordination with parastatal agencies like BDA, BWSSB etc., to serve as a single source for effective planning and management of SWDs.*

4.1.5 Detailed Project Reports for SWDs

A Detailed Project Report (DPR) is a complete document for investment decision-making, approval, planning and implementing the project. It provides details of the basic programme, roles and responsibilities, activities to be carried out, resources required, possible risks and risk mitigation measures. Timeliness of DPRs duly considering the present status and other pre-requisites for each work proposed to be taken up is critical.

4.1.5.1 Preparation of deficient DPRs and consequent non-execution of works (Bengaluru core area)

Audit observed that the BBMP got DPRs prepared (2006-07) for the SWDs under core Bengaluru area[14] through M/s STUP Consultants, Bengaluru, without particular reference to individual works. The DPRs were found to be deficient as indicated in paragraph 4.1.10.1 of the Report of the CAG on Local Bodies for the year ended March 2012 (Report no. 6 of the year 2013 – Government of Karnataka).

[14] As a requirement for obtaining funds under JnNURM scheme.

Summary of deficiencies indicated in Report No. 6 of the year 2013 – Government of Karnataka

- *DPRs did not include the total quantum of land required for the project. Details of land owned by BBMP alongside the SWDs for widening were not available.*
- *The challenges involved in obtaining clearances for shifting of utilities along SWDs from concerned agencies like BWSSB/Bangalore Electricity Supply Company (BESCOM)/Defence/Airport authorities etc., was not brought on record.*
- *The project cost did not have a separate statement on the cost involved in land acquisition, environment compliance cost, cost of surveys and investigations, etc.*
- *The sources for mobilisation of funds of BBMP during the project implementation were not distinctly brought out in the DPRs.*

Subsequently, BBMP got revised DPRs covering the same jurisdictional area prepared (2010-11) through M/s Aarvee Consultants, Hyderabad and the revised DPRs were approved by the State Level Empowered Committee for JnNURM. The CE, SWD did not have on record the copies of revised DPRs, except that of Vrishabhavathi valley. A review of the available DPR revealed the following:

- The major works proposed and taken up (2006-07) were stopped in 2008-09 due to non-availability of sites and poor performance of contractors.
- Works such as construction of detention ponds, wells with pumping arrangements *etc.,* though provided for in the original DPRs were not carried out.
- The revised DPR indicated only the physical and financial progress of works carried out as per the original DPR and the revised cost for carrying out the balance works.
- Bed protection and water recharge arrangement works could not be taken up due to large quantity of sewage flow in SWDs.

Further, as could be seen from the Independent Review and Monitoring Agency (IRMA)[15] inspection reports, the works taken up and executed based on revised DPRs also remained incomplete/abandoned and details of a large number of works were not furnished to IRMA. The reasons cited for abandoning these works were non-availability of work front and poor performance by contractors. Since many of these work files were not available with CE, SWD, the exact location of works could not be ascertained.

The State Government stated (August 2020) that the required width to meet the hydraulic requirements as envisaged could not be procured for want of timely

[15] Appointed by the Central Sanctioning and Monitoring Committee for review of SWD works executed under JnNURM scheme.

revenue records. Hence, due to non-availability of work front, the project could not be implemented as desired. Therefore, BBMP got the revised DPRs prepared based on the availability of land.

The reply substantiates the fact that the original DPRs were prepared without taking into consideration the extent of land required and available with BBMP. Since the revised DPRs were got prepared based on the availability of land, the works of detention ponds, pumping wells *etc.*, were dropped. Further, the non-completion and abandonment of works taken up both under the original DPR and the revised DPR resulted in loss of financial assistance to BBMP and non-recovery of amounts from the contractors as explained below:

◈ *Loss of financial assistance*

Funds were to be released by the Central and State Government under JnNURM in instalments based on the physical and financial progress of the works and submission of Utilisation Certificates (UCs) by BBMP.

As a large number of SWD works taken up under JnNURM were abandoned due to non-availability of sites and poor performance of contractors, Audit observed that BBMP did not submit the required UCs. Consequently, BBMP had to forego financial assistance of ₹83.59 crore as detailed in **Table 4.2.**

Table 4.2: Statement showing the loss of assistance by BBMP

(₹ in crore)

Sl. No.		Total amount to be received	Amount actually received	Loss of assistance
1	Government of India	216.94	158.42	58.52
2	State Government	92.98	67.91	25.07
	Total	**309.92**	**226.33**	**83.59**

Source: Report on the performance of JnNURM

Consequent to the above non-receipt of assistance, BBMP was forced to incur expenditure from its own funds for completion of the works taken up under JnNURM.

The State Government agreed (August 2020) that the loss of assistance under JnNURM scheme was due to non-completion of works and consequent non-utilisation of allocated funds by BBMP within the timeframe.

◈ *Non-recovery of 'risk and cost' amounts from contractors*

SWD works relating to all the four valleys taken up under JnNURM were entrusted under 15 packages to different contractors during 2005-06 at an agreed cost of ₹496.90 crore. The agreements with the contractors provided for termination of contract in case of default by contractor. The works under all these 15 packages were abandoned without completion as discussed above. The Conciliation Committee headed by Special Commissioner (Projects) decided (March 2010) to rescind the contracts without risk and cost and submitted a proposal to the Government. The Government, however, ordered (September 2013) to rescind the contract with 'Risk and Cost' to the contractors.

Audit observed from the records made available that BBMP had calculated ₹35.31 crore as the amount of 'Risk and Cost' to be recovered from the contractors under eight packages[16], but had not recovered any amount even after five years. Similar details in respect of seven other packages[17] were not furnished to audit. This resulted in a loss to BBMP and extension of undue financial benefits to the contractors. The CE, SWD did not furnish any reasons for the failure to enforce recovery proceedings.

The State Government endorsed (January 2019/August 2020) the reply of the Commissioner that letters had already been addressed to contractors intimating rescinding of contracts and immediate action would be taken to trace all the records relating to these packages to calculate the risk and cost amount and to recover the same. Further progress in this regard was not furnished to audit (November 2019/December 2020). The revised reply furnished to audit after a lapse of more than 18 months was similar to the initial reply indicating that serious action was not taken to calculate the risk and cost amount and recover it from the contractors.

◈ *Irregular payments to contractors*

In accordance with the terms and conditions of the contract, in case of failure of the contractor to execute the work, it would be binding on the employer to retain the whole of the contractor's security deposit (including further security deposit) and encash the performance security furnished in the form of bank guarantee and get the work executed at the contractor's risk and cost.

Further, in view of the Government's order (September 2013) to rescind the contract with risk and cost, BBMP had to retain the security deposit and encash the performance security and ensure that no further payments were made to the contractors. Audit sought the details of security deposits collected and recovered from the bills and also the bank guarantees obtained in lieu of performance security in respect of the above packages. The CE, SWD did not furnish these documents for scrutiny and verification.

Audit analysed the pass sheets of the bank accounts pertaining to SWD works in respect of one package as a test-check and observed that ₹1.63 crore was paid to the agency during the period October 2013 to April 2017 for Hebbal-2 package subsequent to the Government's order which was highly irregular and amounted to extension of undue benefits to the contractors.

The State Government endorsed (January 2019/August 2020) the reply of the Commissioner that explanation was called for from the executive engineers and accounts branch for the reasons for releasing payments after the instructions from government and action would be taken on the officers/officials found

[16] Hebbal-2 (₹0.56 crore), Hebbal-3 (₹3.81 crore), Koramangala-1(₹1.20 crore), Koramangala-2 (₹20.30 crore), Koramangala-3 (₹1.06 crore), Vrishabhavathi-2 (₹2.32 crore), Vrishabhavathi-3 (₹0.28 crore) and Vrishabhavthi-5 (₹5.78 crore).

[17] Challaghatta – all three packages, Hebbal – Packages 1 and 4 and Vrishabhavathi – Packages 1 and 4.

guilty. Further progress in this regard was not furnished to audit (December 2020).

Recommendation 7: *The State Government/BBMP should ensure that DPRs prepared are comprehensive and realistic and should include details such as extent and availability of land, the requirement and sources of fund, coordination with other institutions etc.*

Recommendation 8*: BBMP should initiate immediate action to comply with the instructions of the Government for recovery of risk and cost amounts from all the contractors who have violated norms and blacklist persistent violators. It should initiate action against the concerned officers/officials responsible for non-compliance. It should also put in place adequate and resilient financial controls through proper documentation.*

4.1.5.2 Preparation of DPRs through different agencies and deficiencies thereon (Bengaluru agglomeration area)

BBMP invited a single expression of interest for preparation of master plan of drains referred to in Paragraph 4.1.3 and for preparation of DPRs. From the records/information made available, audit observed the following deficiencies/ irregularities in preparation of DPRs and execution of works thereon.

- The scope of the master plan among other things included identifying the drain networks using satellite imagery, terrain modelling and ground verification; preparation of catchment for each drain and preparing uniform guidelines for preparation of DPRs for different zones. Hence, it is imperative to have master plan first on record followed by DPRs for development of drains identified in the master plan. However, single tender was issued including both items with a time period of 28 weeks. Thus, master plan and DPRs were prepared simultaneously.

  Audit observed that guidelines were not prepared and apparently the DPRs were prepared[18] without the guidelines. Moreover, in the absence of basic data of drains, entrusting the work of master plan and DPRs simultaneously renders the DPRs unreliable. The audit observations on non-identification of many existing drains in the master plan (paragraph 4.1.3), raises questions on the completeness of the master plan and the veracity of the DPRs prepared.

- The draft DPRs prepared were reportedly approved (April 2012) by the Technical Advisory Committee put in place for JnNURM scheme. However, Audit could not verify submission of the final DPRs to BBMP by any of the agencies as they were not provided by the CE, SWD. Only longitudinal cross section diagram of drains and cost estimates (submitted during 2013-14 after a delay of more than five years) were available. There is thus, no conclusive proof for the submission of DPRs to BBMP. This

[18] RR Nagar and Byatarayanapura zones – M/s STUP Consultants, Bengaluru; Bommanahalli and Dasarahalli zones – M/s Preethi CAD Consultants; and Mahadevapura zone – M/s TTI Consultants.

conclusion is substantiated by the fact that none of the agencies were paid the full amount as shown in **Table 4.3**.

Table 4.3: Details of payment made to agencies for preparation of DPRs

(₹ in lakh)

Sl. No.	Zone	Agreed amount	Payment made as per available record
1	Rajarajeshwari Nagar	252.92	177.05
2	Byatarayanapura	225.29	214.02
3	Bommanahalli	86.21	60.35
4	Mahadevapura	191.10	152.88
5	Dasarahalli	70.26	Not available

Source: Information furnished by BBMP

- The non-submission of DPRs by agencies was also confirmed by the fact that CE, SWD/BBMP had not submitted/obtained the approval of State Government for the DPRs.
- Further, though DPRs were to be prepared for each individual work duly explaining the scope and requirements, the BBMP entrusted for preparation of DPRs for the entire zone without reference to individual stretch/drain. The cost estimates prepared thereon contained the total length/numbers of various components to be executed and the total cost. However, these were not supported with details for individual works. In the absence of comprehensive DPRs for any of the zones, audit could not cross-verify the financial projections between the master plan and DPRs.
- Besides, documents/records forming part of the DPRs such as Geo-Technical survey, Cost benefit analysis, plans for shifting of utilities interfering with drains, details of encroachment on drains *etc*., that the agencies ought to have submitted, as per tender conditions, were not available with the CE, SWD.
- The BBMP had obtained (2014-15) another set of DPRs for the work of "Remodelling of SWDs, flood mitigation and sewage diversion to improve environmental condition near water bodies in Hulimavu Kere and Madivala Kere Watershed Clusters" under Bommanahalli zone through M/s STUP Consultants at a cost of ₹1.34 crore though the DPR for entire Bommanahalli zone was got prepared through M/s Preethi CAD Consultants during 2013-14. The CE, SWD did not explain the reasons for getting the DPRs prepared through a different agency within the short time period.

  Audit observed that execution of a total of 14 SWD works with an estimated cost of ₹61.21 crore was entrusted (2014-16) to contractors. Though these works were taken up specifically for sewage diversion and to improve environmental condition near water bodies, joint inspection showed that sewage was flowing invariably in all the stretches of drains and was also directly being discharged into Hulimavu and Madivala lakes.

  Thus, failure of the BBMP to prevent the mixing of sewage into water bodies, despite taking up works specifically for the purpose rendered the expenditure of ₹62.86 crore[19] largely unfruitful.

https://youtu.be/mzM_eKXkwbs

Sewage flowing into the lake

[19] ₹1.65 crore on DPRs *plus* ₹61.21 crore on works.

- None of the work files furnished to audit contained a reference to DPRs except for a longitudinal cross-section/strip plan (location map) showing existing and required width for the stretch of the drain.

With the master plan being incomplete and in the absence of guidelines for DPRs, the effectiveness of the DPRs prepared and the impact thereof on the drainage network could not be ascertained.

The State Government replied (August 2020) that the scope of DPRs included carrying out detailed investigations, detailed engineering for structural measures like drains, culverts, preparation of detailed estimates for the works and preparation of tender document and schedules and does not include detention ponds, meeting with different stakeholders like BWSSB, BDA etc., to meet the master plan objectives, non-structural measures. Hence the master plan and DPRs were two distinctive activities and there was no duplication of expenditure. It further stated that few volumes of DPRs pertaining to five zones were not readily traceable and that action would be taken to obtain another complete set of records (both soft and hard copies) from the agencies and preserved in the division.

It is clear from the reply that the scope of DPRs was not comprehensive and hence the DPRs prepared were deficient. The reply was silent on audit observations regarding non-approval of DPRs by the State Government and the unfruitful expenditure of ₹62.86 crore.

◈ *Injudicious payment to an agency under questionable circumstances*

As explained above, copies of DPRs and documentary evidence for completion of assigned tasks were not available with the CE, SWD and the BBMP had foreclosed the contracts for DPRs. Audit observed that the CE, SWD had recorded that the complete set of records relating to tendering, selection of agency, RA bills, payments made *etc*., pertaining to preparation of master plan and DPR for RR Nagar were 'lost' but processed (March 2018) the balance payment of ₹94.93 lakh[20] to M/s STUP consultants based on duplicate documents furnished by the agency. Scrutiny of the file built up based on the duplicate documents revealed the following:

- The agency while preferring the claim (October 2017) for the balance amount had stated that payments due to it could not be processed by BBMP as BBMP had misplaced the files relating to the above works "twice". This is indicative of the serious system deficiencies existing within the SWD division of BBMP. The action taken by the SWD division/BBMP to trace the records or initiate disciplinary action against the officials responsible for such repeated dereliction of duty was not forthcoming. Instead, the files were rebuilt again based on the documents furnished by the agency.
- The Measurement books for these two works were recorded (indicating the details of payments made earlier to the agency) during February and March 2018 and completion certificate issued accordingly. Neither the

[20] ₹19.05 lakh in relation to master plan of drains and ₹75.88 lakh towards DPR of RR Nagar zone

measurement books recording the earlier measurements nor the reasons for delay of more than six years in issuing completion certificate were explained.

- Analysis of the payments showed that the agency was earlier paid during the period from January 2009 to May 2013 and the 5th and pre-final bill was recorded on 29 December 2012. This shows that the work was not completed by January 2012 as recorded during March 2018.
- Further, the earlier payments were made to agency through different zones for different bills (eg.1st and 2nd bills – Byatarayanapura zone; 3rd bill - RR Nagar zone; 5th bill – Bommanahalli zone). In the absence of basic records, the CE, SWD was to reconcile the payments made earlier with the records of the different zones as well as bank records before processing the final claims for payment. However, this was not done.
- The agency had sought extension of time (October 2016) in respect of the DPR for RR Nagar zone. This further indicates that the work was not completed as recorded in the MBs.
- As per the noting seeking approval for payment of the balance amount, it was recorded that the same agency was entrusted with the work of preparation of DPRs under Nagarothana Yojana; no further details regarding tendering, approval thereon was forthcoming.
- The CE, SWD sought approval of the Commissioner, BBMP for payment of final claims recording that the DPRs for six packages under Nagarothana Yojana was prepared from the same agency. This was highly irregular and resulted in misleading the Commissioner as no DPRs were prepared for the package works under Nagarothana Yojana as detailed in Paragraph 4.3.9.
- Balance payments were due to all the three agencies engaged for the preparation of DPRs. However, the CE, SWD accorded approval only for M/s STUP Consultants without bringing on record the complete set of master plan/DPRs. Thus, the payments made were not for the work actually entrusted but for assignments under Nagarothana Yojana.

Since the approval for the master plan and the DPRs was not obtained, completion of the work and submission of final set of documents by the agency was doubtful and the payments made to the agency was injudicious and irregular. Linking two different works which are mutually exclusive raises questions on the circumstances involved in processing the payments and amounts to fraudulent practice.

Neither the BBMP nor the State Government furnished any reply in this regard.

Recommendation 9: *BBMP should maintain all the basic records to ensure proper accounting and comply with the statutory provisions for transparency in implementation and execution of works.*

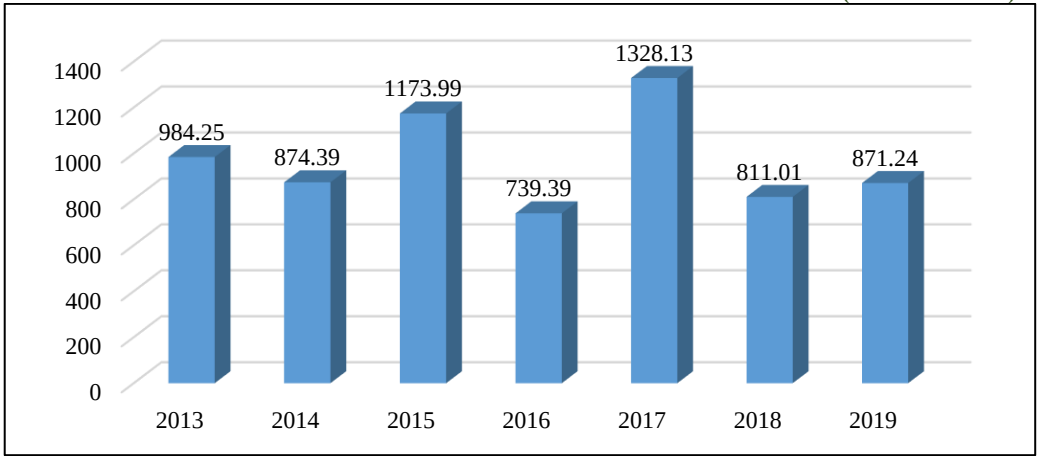
Recommendation 10*: The State Government should conduct a detailed investigation into the issues regarding preparation of incomplete and deficient DPRs, loss of files by SWD division, payments made under questionable circumstances and take appropriate action based on the findings of the investigation.*

4.2 Designing of roads and drains

Analysis of the rainfall data furnished by KSNDMC for the period 2013-2019 showed that the average annual rainfall was about 969 mm during the above period as indicated in **Chart 4.1**.

Chart 4.1: Data on annual rainfall in Bengaluru area between 2013-2019

(in millimeters)



Source: Data furnished by KSNDMC

The increase in built up area and impervious layers due to urbanisation and consequent decrease in vegetation cover compounded the impact of increase in rainfall. Bengaluru faced repeated instances of flooding during the years 2015-18.

Hence, the patterns in rainfall data available with KSNDMC needs to be factored in while designing the roads and drains in order to mitigate the instances of flooding as discussed in subsequent paragraphs. No evidence was forthcoming from the CE, SWD on whether data on actual rainfall in Bengaluru from reliable sources was incorporated in the existing DPRs.

4.2.1 Deficiencies in designing of storm water drains

Paragraph 4.6 of the NDM guidelines stipulates the need for development of an adequate and functioning drainage system based on sound hydrological and hydraulic design principles. Further, as per paragraph 1.1 of IRC guidelines, urban drainage systems need to be designed such that they capture the storm water runoff from the road surface/right-of-way and infiltrate it into the ground. In case there is lack of space for constructing the drainage system, the rainwater runoff should be conveyed along the right-of-way and discharged at the receiving water body, in addition to infiltrating it in the ground at designated locations only.

Hence, a conducive storm water management needs to ensure detention and retention ponds, permeable surfaces and infiltration trenches, surface and sub-surface groundwater recharge, and other source control measures. Developing a SWD design plan is essential to ensure that storm water runoff could be discharged from the catchment area in an efficient and timely manner with ultimate linkage to natural waterways/water bodies.

4.2.1.1 Absence of data on designing of storm water drains

The primary parameters for designing an optimal storm water drainage system are intensity, duration and frequency of rain in the catchment area. The other parameters to be factored in while designing include vegetation, surface/soil permeability and terrain slope. The runoff coefficient of a particular stretch should be calculated based on such data taking into consideration the existing surface drainage infrastructure. The results obtained from the analysis of design parameters are required to be correlated with the site data and used to check the adequacy of the system to cater to the required return period flood discharge.

The master plan of drains considered Central Public Health and Environmental Engineering Organisation (CPHEEO) norms for urban drainage system and rainfall data from Indian Meteorological Department for the period 1976 to 2008 analysed for 15 minutes' peak rainfall duration. Intensity-duration-frequency curves were prepared for one, two and five years return period. Consequently, the DPRs were to indicate the calculations adopted while projecting the specifications for construction/improvements to storm water drainages.

Audit, however, could not ensure whether the methodology and data were adopted uniformly for preparation of these DPRs as CE, SWD did not maintain DPRs for any of the zones. Moreover, the detailed calculation on designing of drains was not forthcoming from any of the work files furnished to audit and hence the veracity of the specifications adopted for remodeling of drains could not be vouched.

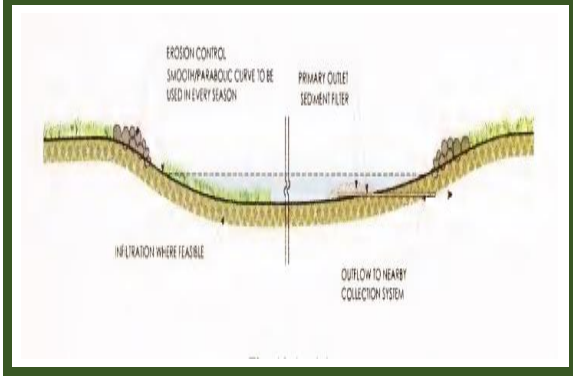
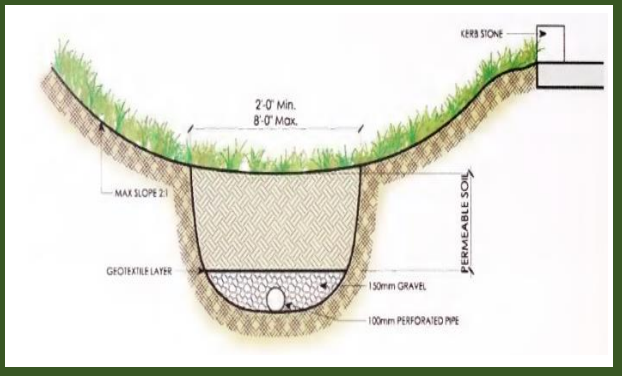
Further, the hydraulic analysis showed in the master plan considered only the rainfall over a period in arriving at the runoff coefficient for drains. This analysis and conclusion thereof for designing of drains would be inappropriate as huge quantum of unassessed sewage flowed in the drains.

4.2.1.2 Non-provision for ground water recharge structures

With a view to conserve the SWD runoff as a ground water recharging method, IRC guidelines suggested infiltration methods like retrofitting the surface roads through different filter layers, providing bore wells in the tertiary and secondary drains, construction of drains with porous layers and filter materials, providing detention ponds and retention system in course of the drains, and rain water harvesting in buildings. Further all possible recharging methods should be adopted before the ultimate disposal of rainwater.

As per paragraph 4.19.1 of NDM Guidelines, urban storm water management systems will include detention and retention facilities to mitigate the negative impact of urbanisation on storm water drainage.

Detention ponds are temporary holding areas for storm water that store peak flows and slowly release them, reducing the demand on treatment facilities during storm events and prevent flooding (Paragraph 10.1(v) of IRC guidelines).

Typical cross-section of a Detention Pond	Typical cross-section of a Retention System
	

Retention facilities are basically extended detention facilities, infiltration basins and swales[21] that could be used for water supply, recreation, pollutant removal, aesthetics and importantly recharging of ground water. In the context of serious depletion of ground water table, these infiltration facilities provide significant water quality benefits and need to be used for the primary benefit of urban areas by providing at one or more locations (Paragraph 10.1(v) of IRC guidelines).

Scrutiny of estimates for SWDs executed by BBMP showed that none of the estimates for construction/improvements to SWDs included the items of providing detention ponds/retention facilities. Besides, works were executed with complete concreting of both the walls and bed of drains, which precluded the infiltration of the storm water and the corresponding recharging of ground water, as evidenced by the data provided by the Central Ground Water Board, which showed decrease in ground water level during the period 2013 to 2018.

The State Government stated (August 2020) that retention/detention ponds, percolation tanks and infiltration structures were not attempted in the pathway of SWDs as large amount of sewage, industrial effluents and other chemical wastes were being let into the SWDs. It further stated that action would be taken in this regard once the discharge of sewage into SWDs is stopped by BWSSB. The reply cannot be accepted as it was the responsibility of the Government to ensure strict compliance to Section 230 of the Karnataka Municipal Corporation Act, 1976 (KMC Act, 1976) and Section 72 of the Bengaluru Water Supply and Sewerage Board Act, 1964 which specifically prohibit laying sewerage lines inside SWDs by authorities for ecological and hygienic environment.

4.2.1.3 Absence of infiltration drains

As per the IRC guidelines, the infiltration of rain water, which is discharged from the pavement surface, should be trapped by construction of infiltration-filter median drains, all along the pavement and the regular drains should be located adjacent to the infiltration drains to facilitate surface water from the pavement entering into the infiltration drains and allow excess water to flow

[21] A swale is a shady spot, or a sunken or marshy place. A swale may be either natural or man-made. Artificial swales are often infiltration basins, designed to manage water runoff, filter pollutants, and increase rainwater infiltration.

into the regular drains. This process was not adopted/ensured by BBMP and drains were constructed without any provision for infiltration drains (Paragraph 10.1(i) of IRC guidelines).

The State Government stated (August 2020) that elaborate detention systems such as rain water harvesting, detention ponds for infiltration and also to minimise flood were proposed in the master plan. However, infiltration inside SWDs are deferred due to presence of sewage in the drain.

4.2.1.4 Construction of roads without proper storm water drainage facility

According to IRC guidelines, while building new roads, storm water facility along the roadside should be mandatory. The type of storm water facility to be used will depend on the street profile or topology. For new constructions, there is far more flexibility for storm water management because the street profile can be designed in a variety of ways.

Audit observed that flooding was a common feature even on newly constructed roads including those constructed under 'Tender Sure[22]' contracts, where the cost of construction of one km of road was ₹10-12 crore as against ₹2 to 3 crore per km of two lane flexible pavement road. This was because such newly constructed roads were dug for repair works by other authorities indicating deficient dewatering/utility lines system. The execution and effectiveness of drainage system on these roads could not be ascertained/established as the drain stretches were completely covered. Audit also observed non-shifting of sanitary and utility lines at few locations. Evidently, storm water drainage system was deficient in these roads. (**Exhibit 4.5**).

Exhibit 4.5: Pictures showing the flooding of newly constructed roads

Scenes like this are common on Cunningham Road, one of the city's first roads to get a TenderSure makeover.

[22] Tender Sure (Specifications for Urban Roads Execution) is a flagship project of BBMP to upgrade the selected main roads in Bengaluru to international standards with uniform standard carriage way width, proper camber and profile as per Indian Road Congress (IRC) guidelines, proper storm water drainage system on both sides of the road to eliminate flowing or ponding of rain water on road, properly designed footpaths, dedicated corridors below footpaths to lay conduits of essential amenities such as electricity, water, sewage, OFC *etc*.

Source: Media reports

The State Government admitted (August 2020) that these requirements and specifications were required to be taken care of during construction of roads and surface drains and stated that action would be taken to discuss the matter with the authorities concerned and to execute works as per IRC provisions and in proper coordination among all to avoid flooding in Bengaluru.

4.2.1.5 Drainage through pumping

Sump tanks with storm water pumping stations were necessary for removal of storm water from road sections, in respect of structures like under-passes, road under bridges, flyovers *etc.*, where road is required to be depressed to get minimum vertical clearance. The storm water accumulated on the pavement was to be channelised to a sump tank and then pumped to the nearest drain; from where it flows by gravity. The sump tanks were also to be used as infiltration tanks by providing open bottom with necessary filtration system (Paragraph 11.1 of IRC guidelines).

The BBMP did not attempt to put in place sump tank systems leading to roads under bridges and flyovers getting inundated during rains (**Exhibit 4.6**).

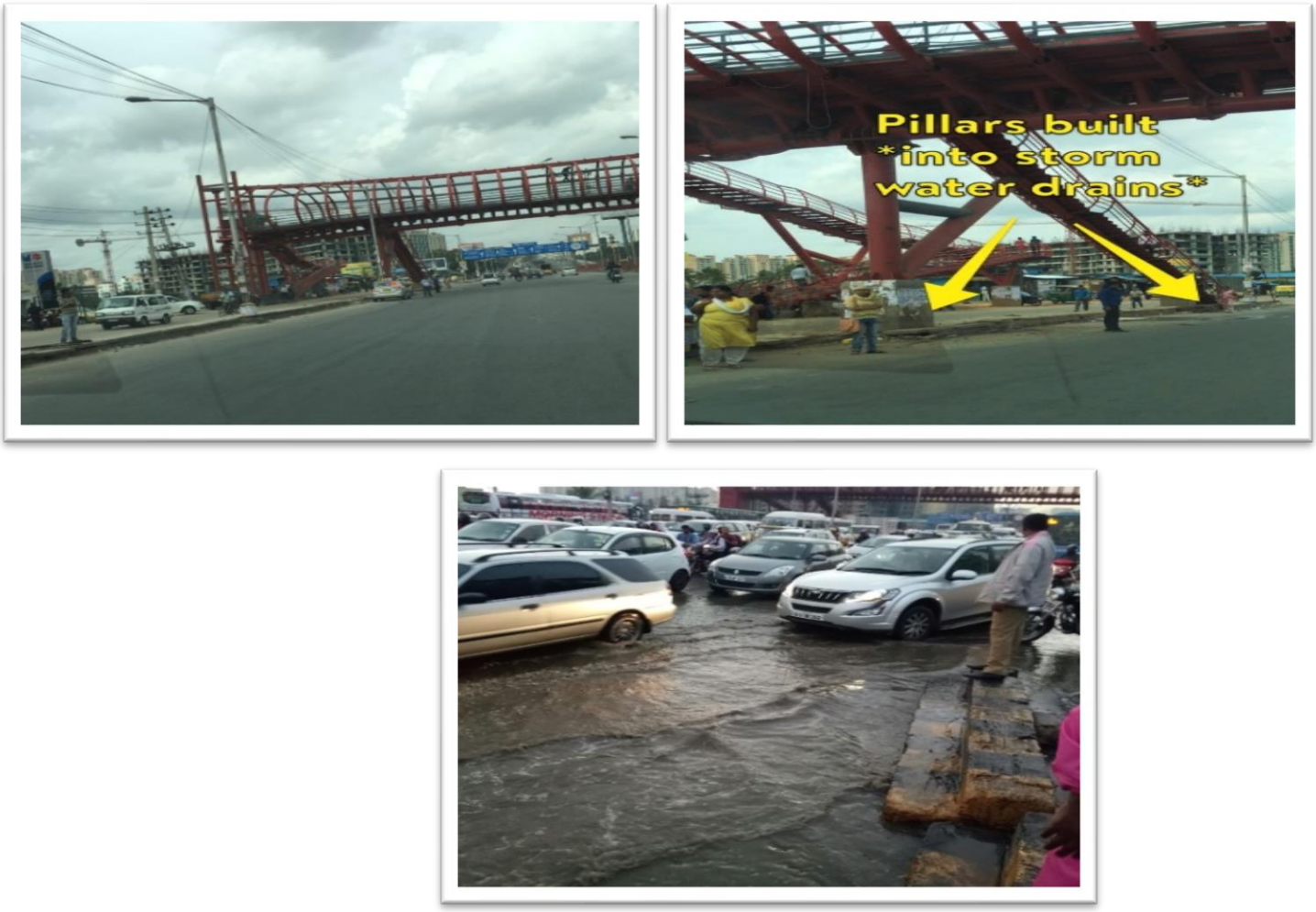
Exhibit 4.6: Photograph showing flooding under flyovers

Source: Media reports

Further as per Paragraph 4.13.2.1 of NDM guidelines, road and rail bridges in cities crossing drains should be designed such that they do not block the flows resulting in backwater effect due to the fact that the piers of roads and railway bridges located in major storm water drains are known to cause backwater effects as much as 1 m high and as far away as 5 km upstream thereby resulting in flooding of the upstream catchments.

Audit noticed construction of pillars for walk over bridge inside SWDs which impacted the proper flow of water leading to flooding as shown in **Exhibit 4.7**.

Exhibit 4.7: Construction of pillars inside SWD and consequent flooding at Outer Ring Road, Bellandur



Sources: Media Photos

The State Government replied (August 2020) that these were the requirements and specifications required to be taken care of during construction of flyovers/ROBs/RUBs and many of the flyovers and underpasses were constructed by BDA also. It further stated action would be taken to discuss the issues with the concerned and to execute works as per IRC provisions and in proper coordination among all to avoid flooding in Bengaluru.

The reply cannot be accepted as construction of wells with pumping facility was provided for in the original DPRs prepared during 2006-07 for core Bengaluru area, which ultimately was not executed and subsequently this was not considered in the revised DPRs for SWDs. Evidently, BBMP failed to consider these requirements while undertaking the works.

Thus, improper design of roads and drains and failure to provide for retention/ detention structures and infiltration drains *etc.*, impaired the ability of the SWD system to handle runoff efficiently.

4.2.1.6 Multiple authorities within BBMP for construction/management of drains leading to lack of coordination

For an efficient SWD system with due discharge of all the runoff into definitive locations, the interconnectivity of all types of drains is essential.

The IRC guidelines specify that urbanisation of any locality and population needs a well-engineered surface and subsurface drainage system. In the present day context of depletion of water table, the storm water drainage should be effectively utilised for ground water recharging. It should be ensured that water from the road flows to the roadside drains through inlets and gratings. As per paragraph 4.13.4.1 of NDM guidelines, inlets should be provided on the roads to drain water to the roadside drains. For effective drainage, this should join the peripheral drains, which in turn should join the main or trunk drain for ultimate discharge to the natural drain or detention facility or retention facility.

https://youtu.be/dewonCFfc1s

Drains without connectivity

BBMP has in place different authorities[23] for construction and maintenance of different types of drains/roads under its jurisdiction. Audit observed from the joint physical inspection of a few drains that BBMP had constructed roads/drains without ensuring that the inlets to drain water from the roads were properly aligned with the roadside drains/underground drains leading to water logging on roads. Evidently, there was lack of coordination among these authorities to ensure proper cambering/ gradient during formation of roads, regular cleaning of bell mouths/kerb vents provided to surface roads as well as proper linkage with SWDs resulting in choking and clogging of water on roads (**Exhibit 4.8 and 4.9**). The tweets of the various stations of traffic department **(Exhibit 4.10)** attribute water logging to choking and blockage of drains.

[23] Storm Water Drains division headed by Chief Engineer; Road Infrastructure division headed by Chief Engineer for arterial and sub-arterial roads, and Zonal Executive Engineers for other types of interior roads/drains.

Exhibit 4.8: Photographs showing unscientific construction of roads/drains – absence of proper gradient/alignment

Koramangala zone

Bommanahalli zone

Source: Photographs taken during joint inspections

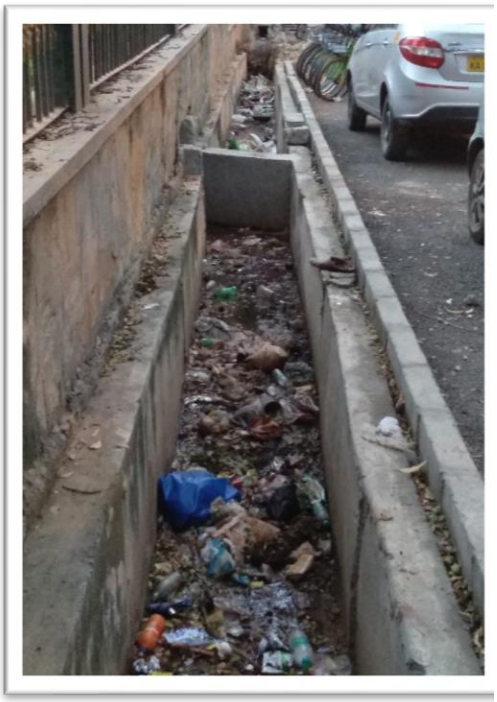
Source: Media reports

Exhibit 4.9: Photographs showing unscientific construction of roads/drains – absence of proper linkage

https://youtu.be/LWP0FfwW3V4

Drains without connectivity

Bommanahalli zone



Koramangala zone

South zone

RR Nagar zone

Source: Photographs taken during joint inspections

Exhibit 4.10: Tweets of various stations of traffic department on water logging due to blockage of drains

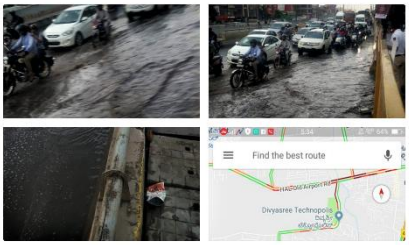
Mico Layout Traffic
@Micolyttraffic

Due to heavy rain, water logging at Bannerghatta main road, between Bangalore Dairy toward Bilekahalli junction, slow moving traffic our staff regulating traffic.

7:31 PM · 16 Mar 18

HSRL TRAFFIC STATION
@hsrltrafficps

Water lagging near eco space and Bellandur and drain blocked by silt and soil drain should be clear by consernd dept as early as possible



5:47 PM · 20 Apr 18

Adugodi Traffic PS
@adugoditraffic1

Due to heavy waterlogging on Bannerghata Rd. between Mico Bande towards Anepalya Jn. Slow traffic movement.

@blrcitytraffic @AddlCPTraffic @DCPTrEastBCP @AcpSe

6:38 PM · 20 Apr 18

Whitefield Traffic
@WhitefieldTrf

Water logging at Whitefield main road near coffee day due to rain. It's due toBlockages of storm water drain it is removed for free flow of traffic @blrcitytraffic @AddlCPTraffic @DCPTrEastBCP @AcpSe

ASHOKNAGAR TRAFFIC BTP
@ashoknagartrfps

Ashoka nagara personnel getting into drains to ease free flow of traffic at Mayo hall junction

CHICKPETE TRAFFIC BTP
@chickpetetrfps

waterlogging at ph underbridge slow moving traffic @blrcitytraffic @AddlCPTraffic @DCPTrWestBCP @BBMPCOMM

5:52 PM · 15 Sep 18 · Twitter for Android

Lack of coordination in ensuring proper construction of roads and interconnectivity of drains and their maintenance could result in frequent flooding of low lying residential localities and water logging on roads affecting vehicular movement in the city. Besides, stagnant water on roads for long hours could result in deteriorating quality of roads and appearance of potholes.

The State Government admitted (August 2020) that major and arterial roads were constructed by Road Infrastructure wing of BBMP and internal roads in residential localities were laid by concerned BBMP wards. In addition, many of the major roads and other infrastructure were also constructed by BDA. It further stated that maintenance of all types of roads and drainages fall under the jurisdiction of concerned BBMP wards and maintenance of SWD lies with SWD division. It also stated that action would be taken to coordinate with all authorities concerned for ensuring proper construction/maintenance of drains and to avoid choking of drains and also to ensure adequate interconnectivity of surface drains with SWDs. The reply justifies the audit contention that there was absence of coordination between the different authorities within BBMP.

Recommendation 11: *BBMP should factor in all parameters such as rainfall pattern, increase in impervious layers, decrease in vegetation etc., while designing and executing roads and drains to increase ground water recharge and prevent flooding. It should ensure strict adherence to the guidelines and norms prescribed for construction of roads/drains.*

4.3 Deficiencies in execution of projects involving remodelling of storm water drains

There are a total of 633 storm water drains (primary and secondary) measuring 842 km under the jurisdiction of BBMP. BBMP had taken up remodelling of 332.02 km of drains up to 2017-18 and maintenance of 308.02 km of drains as indicated in **Table 4.4.**

Table 4.4: Details of various works taken up to 2017-18

Year	Remodelling	Maintenance
	Total length (in km)	**Total length (in km)**
Till 2012-13	53.00	96.00
2013-14	18.12	10.02
2014-15	20.50	15.00
2015-16	22.08	16.00
2016-17	28.30	69.00
2017-18	35.02	102.00
Total	**177.02**	**308.02**
	Nagarothana Yojane	
2016-17 to 2017-18	155.00	NF
Grand Total	**332.02**	**308.02**

Source: Information furnished by CE, SWD NF: Not furnished

While the major component of expenditure for these works were incurred out of JnNURM grants and funds provided by the State Government, the BBMP also funded the works from its own resources.

4.3.1 Absence of action plans and progress reports

BBMP was responsible for remodelling and maintenance of SWDs. However, the CE, SWD did not possess either the action plans for the works approved or the physical and financial progress report of works executed. This was because the CE had not maintained records such as tender register, works register, contractor's ledger etc. Hence, the CE did not furnish the work-wise details in justification of the claims for executing works for the length of 177.02 km. In the absence of details and any kind of identification structures like information boards/pillars, markings *etc.*, audit could not ascertain/identify the actual site/stretch at which these works were reportedly executed, particularly where the drains were fully covered for long stretches and also the correctness of the claims.

The absence of basic records, action plans and progress reports of works could facilitate incorrect reporting of physical and financial achievement besides abandoning of works with substantial expenditure going unnoticed.

While endorsing (August 2020) the reply of the Commissioner that action plans and progress reports were prepared only in respect of works sanctioned under Nagarothana Yojane during 2016-17, the State Government did not clarify the reasons for non-maintenance of essential records for other programmes.

4.3.2 Non-maintenance of Works History Register

The Karnataka Public Works Code provisions stipulate maintenance of Works History Register for undertaking various works. This register was to contain a distinct folio for each drain duly recording the chainage, length of drain covered, improvements executed, period of execution, total expenditure, *etc*. It was to serve as a record for preparation of action plans, undertaking future works and avoiding duplication.

Audit observed that three[24] out of the nine zones had not maintained the prescribed register. The registers maintained in the other six zones were not updated with the progress of work undertaken and were incomplete.

Non-maintenance of Works History Register is fraught with the risk of duplication of works and fraudulent claims going unnoticed, as large number of works were being executed as 'emergency works' without the approval of the action plan. Since works were sanctioned with different nomenclature and without specific reference to exact location, audit could not ascertain whether there were any duplications/fraudulent claims.

The State Government stated (August 2020) that instructions were issued to the concerned EEs to maintain the Works History Register and to update them regularly. However, the updated Works History Registers were not made available to audit for scrutiny (December 2020).

[24] Bengaluru East, Bommanahalli and Koramangala.

4.3.3 Non-availability of 'Completion Plans' and 'As built drawings'

BBMP implements large number of works for repair and remodelling of SWDs. On completion of the entrusted work, the contractors are required to submit the 'As Built Drawings' and 'Completion Plans' clearly showing the actual work done and deviations, if any, from the originally sanctioned specifications/drawings, due to site conditions. Such revised drawings were to be preserved in the SWD division and made use of during subsequent modifications/rectification of SWDs in that location.

These drawings/plans are essential reference materials for subsequent management, as a large number of works are entrusted and executed as 'emergency works' without approval of the action plan and without preparing estimates, proper survey and investigation of work site.

The 'As Built Drawings' and 'Completion Plans' were not forthcoming from the records furnished to audit in respect of any of the zones. Non-availability of 'as built drawings' is fraught with the risk of damage to structures/bed of drains during maintenance, particularly in stretches where drains are covered.

The State Government stated (January 2019/August 2020) that the CE, SWD is insisting and obtaining those drawings and completion plans before issue of completion certificates for the works. However, the drawings and plans were not furnished to audit for verification.

Recommendation 12: *BBMP should prepare action plans, comprehensive project reports, completion plans etc., maintain a works history register and repository of all such records for future use in planning and implementation.*

4.3.4 Execution of SWD works by Zonal Executive Engineers

For all general purposes, BBMP is divided into eight zones having zonal offices each containing an Engineering Division headed by an Executive Engineer. Such Zonal Engineering Divisions are responsible for general maintenance (roads, tertiary/road side drains *etc*.) at wards level under their zones. However, for the purpose of management of storm water drains, BBMP is divided into nine zones (as indicated in Chapter 1) and has a separate division headed by the Chief Engineer who is assisted by the Executive Engineers of these nine zones. Hence, execution and implementation of SWD works were to be carried out by the EEs in-charge of SWD.

The analysis of the the trends and practices in tenders relating to SWDs through the e-procurement portal of Government of Karnataka, however, showed that tenders for 110 SWD works costing ₹38.59 crore were invited and got executed by the Zonal Executive Engineers who were not responsible for SWD works. Audit further observed that 10 works were awarded to a single contractor for a total cost of ₹10.88 crore during February 2018 by the Zonal EE, RR Nagar zone. Allowing multiple authorities to invite tenders and execute SWD works coupled with the absence of basic registers/records, could facilitate duplication of claims for the same works by both the SWD division and regular zonal offices. Hence, this matter needs to be investigated.

The ACS concurred (December 2018) with the audit observation and directed the CE, SWD to ensure implementation of SWD works by SWD division only. The State Government replied (August 2020) that action would be taken to execute the works relating to storm water drains through the SWD division.

4.3.5 Delay in completion of works

It was the responsibility of the employer (respective EEs in general and CE in respect of six package works) to ensure that the works entrusted to contractors were completed within the time limit prescribed in the work order. In the absence of the basic records, audit could not ascertain the total number of works executed for SWDs and adopt any sampling method for selection of work files. Hence, 143 works files (includes 15 files pertaining to works entrusted to Karnataka Rural Infrastructure Development Limited (KRIDL)) that were made available were examined.

Audit observed that in 25 works test-checked, there were delays in completion of works ranging from one month to 33 months. The reasons for the delays and action taken for the delays were, however, not forthcoming from the records made available.

This apart, the BBMP had entrusted 22 SWD related works to KRIDL under clause 4(g) of the KTPP Act, during the period 2013-14 to 2017-18 without inviting tenders treating the works as 'emergency works' and an amount of ₹15.02 crore was paid to KRIDL for these works. However, in six out of 15 test-checked works, audit observed delays in completion ranging from one month to 23 months defeating the objective of entrusting works without calling for tenders. The works that were delayed comprised construction of road bridge, box drains, retaining wall *etc*. The prolonged delay in completion of these works inordinately distressed the pedestrian and vehicular movement. Besides, BBMP's decision to entrust works to KRIDL contravened the recommendations of the Committee on Local Bodies and Panchayat Raj Institutions prohibiting direct entrustment to KRIDL.

The State Government endorsed (August 2020) the reply of the Commissioner that efforts were made by the divisional engineers to complete the work within the date fixed for the completion, but as drains pass through residential areas and main roads, the delay caused in completion are due to problems such as availability of work sites and permission from various other government authorities. Further, works were entrusted to KRIDL directly based on the recommendations and approval of the Government, as the works were of emergent in nature.

It is clear from the reply that the works were taken up without ensuring that the work front was available and free from all encumbrances and administrative hurdles such as coordination with other government authorities for shifting of utility lines *etc.*, highlighting the absence of proper planning before entrustment of work. The reply that works entrusted to KRIDL were of emergent in nature was not justifiable as the delay in completion of the works ranged up to 23 months.

4.3.6 Avoidable expenditure on diversion of water course

The general specifications of tender document/agreement stipulated that the rates included the cost of shoring, coffer dam channels or other incidental servicing necessary for diverting the water and it should be maintained in good working condition till the completion of the structure.

Audit observed that diversion of water course by providing coffer dam was estimated as a separate item and payments were also made to the contractors to the extent of ₹4.10 crore in 115 test-checked works, which was extra contractual and avoidable. In response to a similar observation (Paragraph 4.1.11.4 of Report no. 6 of the year 2013 – Government of Karnataka), the Committee on Local Bodies and Panchayat Raj Institutions had opined that in cases where the original estimates included all items required for construction of coffer dams, incurring expenditure as a separate item was not permitted.

The State Government endorsed (August 2020) the reply of the Commissioner that the item of coffer dam was provided in the estimates and payment made as it was an absolute necessity for diversion of water course during execution of the works of construction of retention walls/bed protection for SWDs as there was continuous flow in all the SWDs throughout the days due to discharge of sewage. The reply of the Commissioner cannot be accepted as water diversion forms part of excavation, and contract conditions prohibit extra payment. Besides, audit also observed that only the available earth/silt in the drain was used for diverting the water course as exhibited (**Exhibit 4.11**) below:

Exhibit 4.11: Instances of available earth/silt used for diverting water course

Source: Photographs taken during field visits

4.3.7 Excess payments on item of backfilling

As per the specifications for Roads and Bridges issued by GOI, Ministry of Road Transport and Highways (MORTH), the cost of excavation for foundations of Roads and Bridges and retaining walls included backfilling the space between the foundation masonry/concrete and the sides of excavation with approved material including its compaction.

Audit observed that the contractors were paid ₹4.41 crore in respect of 62 test-checked works towards the item of backfilling the foundation. Payment for backfilling separately to the contractors was not warranted as the specification in the estimate and the rates quoted by the contractors for excavation for foundation included this item of work. This amounted to extending undue financial benefits to the contractors.

In response to a similar observation (Paragraph 4.1.11.5 of Report no. 6 of the year 2013 – Government of Karnataka), the Committee took a serious view of the excess payments and directed that action be initiated against the concerned Chief Engineer, Executive Engineer and other officers and to recover the loss caused to the exchequer besides blacklisting the contractors. However, no action was taken by BBMP so far.

The State Government endorsed (August 2020) the reply of the Commissioner that the item of backfilling was provided in the estimates for strengthening the structure on abutment side for allowing seepage of water through granular layer into weep holes and action would be taken to restrict the item to provide granular/porous layer only in estimates for retention walls of SWDs. The reply is incorrect as cost of excavation for foundations of Roads and Bridges and the retaining walls includes backfilling.

4.3.8 Payment made without approval of lead chart

As per codal provisions, cost of lead and lift for conveying the material should be paid only after getting the lead chart approved by the competent authority. The lead chart should clearly show the distance from the point of the work to the place of disposal and the nature of land in which the material has been

dumped. In case of private land, it was also necessary to obtain the written consent from the land owner for dumping drain waste in the land.

Audit observed that an amount of ₹9.97 crore had been paid to contractors in respect of 98 test-checked works though the required lead chart was not prepared and approved by the competent authority for transporting the desilted waste from SWDs. In the absence of the approved lead chart, the genuineness of claims and payment towards desilting and conveyance was doubtful.

The State Government stated (August 2020) that the Engineers concerned would be instructed to document the rate analysis and lead chart pertaining to works showing the distance from the place of work and site for disposal. It further stated that works executed by SWD division were generally of emergency nature and due to the shortage of sanctioned strength for putting in place a separate technical wing in the division, few omissions might have crept into the estimates since they were prepared in a hurry. It also stated that a technical wing has been established in the division with a Technical Assistant and subordinate engineers and estimates are being approved duly showing google map lead chart.

It is clear from the reply that the audit objection has been accepted by the Government. The reply is, however, silent on the action taken or proposed to be taken to ascertain the genuineness of the payments made in the absence of lead charts.

Recommendation 13**:** *Since SWD works are identified as emergency works, BBMP should ensure that the works are completed within the prescribed time schedule. It should also consider establishing a separate technical wing for meticulous scrutiny of the estimates to ensure execution of works economically and efficiently.*

Recommendation 14*: The State Government should ensure strict action against the officers/officials responsible for non-compliance with Government instructions and Committee recommendations. Care should be taken to avoid excess/avoidable payments to contractors.*

4.3.9 Improper implementation of SWD works under Nagarothana Yojane

The State Government approved (June 2016) 408 SWD works (remodelling / improvements to existing drains) costing ₹800 crore for implementation under *Nagarothana Yojane* during the period 2016-18. Of these, while 49 works were entrusted individually, the CE, SWD grouped 359 works into six packages as detailed in **Table 4.5**.

Table 4.5: Statement showing the grouping of 408 works

Sl. No.	Group	Number of works	Total cost (₹ in crore)
1	Six package works	359	671.82
2	Emergency maintenance works	19	26.40
3	Essential emergency works	30	101.78
	Total	**408**	**800.00**

Source: Information furnished by CE, SWD

The CE, SWD furnished only the soft copies of the details of progress achieved in these package works to audit. Analysis revealed the following:

(i) The progress report in respect of Package-2 (consisting of 33 works estimated at ₹45.30 crore) submitted to audit by CE, SWD was apparently incorrect as all the works were shown to have been completed with the executed quantities being shown the same as estimated while there were huge variations in financial progress as indicated in **Appendix 4.1**.

(ii) Of the 326 works entrusted under the other five packages which were stipulated for completion between September 2018 and March 2019 (excepting Package-2), 279 works were reported completed and 15 works had not commenced even as of October 2019 due to reasons like non-clearance of encroachments, not obtaining permission for shifting of utilities/traffic diversion, change of location, *etc.*

(iii) While the works under packages 5 and 6 were stated to be completed within the time prescribed, audit observed that the progress of works under Package-1 was extremely tardy as only 50 *per cent* of the works were completed even after lapse of one year from the scheduled date of completion.

(iv) The laxity in execution of works was evident from the fact that 32 works were lingering for periods ranging from six months to one year after the scheduled date of completion for the packages. Details are furnished in **Appendix 4.2**.

Moreover, verification of records disclosed the following irregularities in implementation/execution of works under the different packages.

(a) The State Government had specifically stipulated that BBMP should group these works into different packages costing not less than ₹10.00 crore and obtain technical sanction from the competent authorities in accordance with the KTPP Act and Rules.

The CE, SWD, pooled a total of 359 works into six packages with number of works ranging from 20 to 138 works and estimated cost ranging from ₹45.30 crore to ₹176.95 crore. This had minimised/restricted the scope of bidding and resulted in limited participation of bidders and was, thus, biased as is evident from the fact that there were single bids for Packages 1, 2 and 3 while Package 5 had five bidders. The details of bidders for Packages 4 and 6 were not made available to audit.

(b) The CE did not prepare the DPRs for the execution of works under Nagarothana Yojana despite specific instructions from the Government. The CE replied (August 2020) that DPRs prepared during 2011 were the basis for the works and the same agencies were asked to prepare the tender document by updating the estimate to the current Schedule of Rates (SR) at no extra cost. He further stated that required physical survey and total station survey was conducted by consultant agencies before commencement of work and modifications made to Bill of Quantities (BOQ) specification as per site

conditions. The strip plans prepared earlier by DPR agencies were used for the purpose.

Audit, however, observed that the longitudinal cross-section diagrams based on which the estimates were prepared for the works under core areas of Bengaluru pertained to the year 2005-06 or earlier. The action and reply of the CE, thus, indicates that the estimates were prepared without conducting site inspection and the procedure of preparing estimates was only a mere formality that was being complied with for undertaking the works. The fact that modifications were made to BOQ underlines the relevance of the existing DPRs and the strip plans that were stated to have been used. The reply that tender documents were prepared by updating the estimate to the current SR at no extra cost contradicts the recommendation of the CE for making balance payment to an agency citing execution of this work (Paragraph 4.1.5.2 *ibid*).

(c) The rationale behind pooling of the works was not forthcoming from the records made available to audit. However, pooling of huge number of works spread out across different locations/zones (Package 3 had 86 works to be executed under 9 assembly constituencies and Package 4 contained 138 works spread across 11 assembly constituencies) contributed to delay in completion. This is evident from the fact that Packages 5 and 6, which pertained to RR Nagar zone, were only completed within the timeframe.

(d) The packages were entrusted with a consolidated Schedule-B totalling the quantities from each estimate and payments were also made accordingly. This facilitated the contractors/engineers to execute works without reference to estimated length/quantity for the individual works. Audit observed that while the executed quantity in individual works far exceeded (63 to 587 *per cent*) the estimate, works were declared complete even though the total executed quantity was much less than the estimate (46 to 94 *per cent*). Details are furnished in **Appendix 4.2.**

Substantial variation in length/quantities in respect of works in the packages and limiting the total quantity to Schedule-B quantities undermined the preparation of estimates for individual works and their consequent approval by the competent authorities. This also highlights the disregard to the codal provisions by BBMP authorities.

(e) In the absence of defined drain identification number in the nomenclature of works proposed/executed under packages, audit could not verify whether all the works executed were identified SWDs or drains of other types.

(f) None of the photographs on record, in any package, were taken identifying a ‘fixed photo spot’ clearly showing the status before and after the execution; as a result of which audit could not ensure the genuineness of execution/ completion of works (as works were spread out in various locations and all drains look alike and works are similar in nature). The details of inspections, if any, conducted by the EEs and the inspection reports thereon were not available.

The CE, SWD during the exit conference stated that the package works were nearing completion and would be completed early. Audit, however, observed that works were not completed even as of October 2019. Though the State Government stated (August 2020) that the up-to-date progress of all packages would be furnished to audit, the same was yet to be furnished (December 2020). No specific reply was furnished for the other observations pointed out in audit.

Recommendation 15: *The State Government should conduct an independent verification of the status and quality of all SWD works to ensure their quality and completion.*

4.3.10 Non-implementation of the Master Plan

The verification of available volumes (four out of eleven) of master plan of drains showed that, apart from remodelling of SWDs, the master plan had also proposed works for recharge structures in the drains, intercepting drains, segregation of sewage/ sewerage system from SWDs, removal of bottlenecks, interlinking of drains and lakes to hold flood discharges, etc. However, audit observed that except for remodelling of drains by constructing concrete walls and bridges, none of these recommended items had been incorporated in estimates or executed by BBMP. This defeated the objective of preparation of master plan.

The State Government accepted (August 2020) that BBMP had carried out work of around 15 to 20 *per cent* of the master plan estimates. It further stated on completion of all the works identified in the master plan, flooding problem could be minimised with other benefits such as improved environmental condition, ground water quality and quantity and also the possibility of harnessing rain water at city level as alternate source of water to Bengaluru. The reply, however, did not specify the time frame or the plan of action in this regard.

4.3.11 Non-preparation of storm water drainage manual

A manual/code is intended to define the scope of the administrative and executive functions of the department/organisation. It primarily describes the procedure to be followed by the authorities in dealing with activities concerning planning, design, execution and maintenance of assets created besides maintaining and rendering accounts properly.

The IRC guidelines (paragraph 12.5) provide for a maintenance manual for SWDs, clearly indicating the work to be carried out, the frequency for that work, the equipment and labour to be used and most important, any safety measures and equipment required. Further, the CPHEEO suggest preparation of an action plan for maintenance of SWD to ensure proper functioning of the drains.

Audit noted that BBMP, which is responsible for storm water management was yet to prepare a comprehensive SWD manual to systematically design, execute and maintain the SWD infrastructure of the city. Even the action plan as suggested by CPHEEO was not prepared.

The State Government stated (January 2019) that action would be taken for preparation of maintenance manual for SWDs. No action was, however, taken by the authorities concerned for preparation of manual for SWDs (December 2019). The position remained the same as per the updated reply (August 2020).

Conclusion

Provisions of National Disaster Management guidelines were violated as BBMP did not possess fool-proof data on the total number/length and nature of different types of drains as well as complete master plan of drains. Discrepancies between master plan for the city and master plan of drains regarding mapping of drains and their nomenclature remained unreconciled. BBMP failed to prepare a SWD manual to systematically design, execute and maintain the SWD infrastructure of the city and also did not possess on record the comprehensive DPRs for improvement of SWDs; the DPRs prepared being incomplete and deficient. Many of the works proposed in the master plan of drains were not taken up so far.

Failure to factor in reasons for high intensity rainfall due to rapid urbanisation and non-adherence to the provisions of IRC while designing and construction of roads/drains coupled with improper and delayed execution of works affected free movement of storm water leading to frequent flooding in various parts of the city.

Even though large number of works were abandoned due to poor performance of contractors, the contracts were rescinded without risk and cost and without retaining the security deposit. This led to extension of undue financial benefit to the contractors. BBMP lost financial assistance under JnNURM for storm water drainage due to non-submission of UCs as many of the works taken up were abandoned. The absence of basic records such as action plans, progress reports, works history registers *etc*., was fraught with the risk of incorrect reporting and duplication of works.

Summary of important audit findings

Para number	Audit findings
4.1.1	BDA did not have on record the first two development plans. The third plan was incomplete and deficient. The fourth plan (RMP-2015) which is valid even as of now did not classify the drains in accordance with the buffer zone parameters. Many existing drains and water bodies identified as per the master plan of drains prepared by BBMP were not shown in the RMP.
4.1.2	There were delays in preparation of the Comprehensive Development Plans/Master Plans.

Para number	Audit findings
4.1.3	The master plan prepared by BBMP was incomplete as did not take into consideration the tertiary drains. Many drains shown in RMP and large number of drains which were in existence but not found in RMP were not mapped raising questions on the validity and reliability of the database.
4.1.4	The CE, SWD, did not possess comprehensive data of different roads and tertiary/surface road side drains within the jurisdiction of BBMP. The absence of comprehensive inventory of drains with BBMP and its failure to classify them properly contributed to lack of clarity on critical issues including the extent of buffer zone to be maintained.
4.1.5	The DPRs prepared for Bengaluru core area were deficient. Major works taken up were stopped due to non-availability of land and poor performance of contractors which led to loss of JnNURM assistance, non-recovery of amounts from contractors and irregular payments to contractors. The DPRs for Bengaluru agglomeration area which were prepared without the required guidelines was not made available to audit. Preparation of DPRs without the basic data of drains rendered them unreliable. 14 SWD works estimated to cost of ₹61.21 crore were taken up specifically for sewage diversion and to improve environmental condition near water bodies. The joint inspection showed that sewage was flowing invariably in all the stretches of drains and was also directly being discharged into lakes. This rendered the expenditure largely unfruitful.
4.2.1	In the absence of DPRs, the methodology, data and specifications adopted for remodeling of drains could not be vouched by Audit. Scrutiny of estimates for SWDs executed by BBMP showed that none of the estimates for construction/improvements to SWDs included the items of providing detention ponds/retention facilities and infiltration drains. There was lack of coordination among various authorities within BBMP resulted in absence of proper linkage between roads and SWDs.
4.3.1	Basic records such as tender register, works register, action plans and progress reports were not maintained. The CE did not furnish the work-wise details in justification of the claims for executing works for a length of 177.02 km. Hence, audit could not ascertain/identify the actual site/stretch at which these works were reportedly executed, particularly where the drains were fully covered for long stretches and also the correctness of the claims.
4.3.2/ 4.3.3	Three out of the nine zones had not maintained the prescribed Works History Register and 'As Built Drawings' and 'Completion Plans' were not forthcoming from the records furnished to audit in respect of any of the zones.
4.3.4	The Zonal Executive Engineers, who were not responsible for SWD works, invited tenders for 110 SWD works costing ₹38.59 crore. Allowing multiple authorities to invite tenders and execute SWD works and absence of basic registers/records, could facilitate duplication of

Para number	Audit findings
	claims for the same works by both the SWD division and regular zonal offices.
4.3.6	BBMP estimated diversion of water course by providing coffer dam as a separate item and paid ₹4.10 crore to the contractors in 115 test-checked works, which was extra contractual and avoidable.
4.3.7	Though cost of excavation for foundations of Roads and Bridges and retaining walls included backfilling the space between the foundation masonry/concrete and the sides of excavation with approved material including its compaction, BBMP paid the contractors ₹4.41 crore in respect of 62 test-checked works towards this item resulting in extending undue financial benefits to the contractors.
4.3.8	BBMP paid an amount of ₹9.97 crore to contractors in respect of 98 test-checked works though the required lead chart was not prepared and approved by the competent authority for transporting the desilted waste from SWDs. In the absence of the approved lead chart, the genuineness of claims and payment towards desilting and conveyance was doubtful.
4.3.10	Though the master plan of drains proposed works for recharge structures in the drains, intercepting drains, segregation of sewage/ sewerage system from SWDs, removal of bottlenecks, interlinking of drains and lakes to hold flood discharges, *etc*., audit observed that BBMP had neither incorporated these items in the estimates or executed them except for remodelling of drains by constructing concrete walls and bridges.