CHAPTER–10

FINDINGS AND CONCLUSION

10.1 HIGHLIGHTS OF THE STUDY

In the present study, a comprehensive and holistic attempt is made to appraise the drainage conditions and morphological features of the UBGI based on maps, satellite images and detailed fieldwork. It also aims to identify the past and present behavior of the delta distributaries. This study is significant from the perspective of understanding the degeneration of the distributaries and various processes operating in the upper Ganga Delta. In this chapter, an attempt has been made to synthesize the results obtained during the course of investigations.

10.2 MAJOR FINDINGS

The main findings of the present study are summarized below.

(i) Nested within the structural framework of Bengal Basin, the GBD is enclosed by highlands in the west, north and east with the exception of the 125 km-wide structural lowland of RGG in the north. The development of the GBD started along with the opening of the RGG during the Pliocene–Pleistocene (5.2–0.01 Ma BP), when the Ganga and Brahmaputra along with their tributaries entered the Bengal Basin. The GBD has acquired its present form by throwing successive accretionary lobes toward the east following the Flandrian transgression. The UBGI—the upper portion of the southwestern GBD—is characterized by sediment laden rivers with low discharge capacities, abundance of meander cutoffs, palaeocourses and vertically accreted floodplains (Chapter-2).

(ii) The off-takes of most of the distributaries in the UBGI are clogged up due to sedimentation, which occurred due to shifting course of the Ganga River. The channel shifting of the Ganga occurs within its 12–21 km-wide meander belt through the processes like meander formation and avulsion. The Bhairab and Mathabhanga Off-takes are the only two naturally surviving distributary entrances. Even these two are becoming clogged up now due to active siltation. As its off-take became dissipated, the principal distributary of the UBGI—the Bhagirathi–Hugli—gets its entire headwater supply from the FBP since 1975. The Ichhamati—branch of the Mathabhanga—becomes active only during the monsoon season, when the latter reaches its capacity level. The decay of the distributary off-takes is severe throughout the mapping history (Chapter-3).

(iii) Except the Bhagirathi–Hugli River, all the distributaries of the UBGI are presently suffering from capacity reduction due to the decline of discharge. The feeble courses of these distributaries can primarily be linked to the abandonment of their off-takes. The sinuosity indices of these channels remain almost the same in the last 100 years, indicating lack of changes in their configurations due to channel shifting. Due to its resuscitation by the FBP, the channel capacity of the Bhagirathi–Hugli course has increased in the last few decades and it
has become less sinuous. At present, it is the only distributary which oscillates within its meander belt. While the other distributary channels have gradually become degenerated, the delta development process in the UBGI is mostly governed by the discharge through the Bhagirathi–Hugli course (Chapter-4).

(iv) The courses of the Gobra Nala, Chhota Bhairab, Sialmari, Upper Jalangi, Anjana, Jamuna and Padma are completely abandoned due to the disconnection of their headwaters from the parent rivers. Most of these channels became abandoned prior to the early 20th century. At present, many segments of these palaeocourses, especially the headwaters, are getting merged with the surrounding topography (Chapter-5).

(v) 76% of the meander cutoffs in the UBGI were completed before the mid-19th century. Since the mid-20th century, cutoff formations have only occurred in the artificially augmented Bhagirathi–Hugli. The distributaries were quite active in the past, as revealed from the greater widths of some of the oxbow lakes compared to the widths of the present channels. The maximum dissimilarity between the widths of the oxbow lakes and widths of the nearest channels can be found along the courses of the Jamuna and Upper Ichhamati, indicating severe deterioration of these distributaries. Almost one-third of the oxbow lakes in the UBGI are highly tortuous, pointing toward extremely winding courses in the past (Chapter-6).

(vi) Due to reduced channel capacity, flood appears to be a major problem in the UBGI during the monsoon season and 89% of the study area is susceptible to flood hazard. The most devastating flood in the recent times occurred in September 2000, when the floodwater moved along the palaeocourses, following the embankment breaching on the left (eastern) bank of the Bhagirathi River. 46% of the UBGI was inundated and many areas remained waterlogged for over a month. Even a high intensity flood like this did not cause significant alterations in the channel planform and floodplain morphology. The existing channel configuration and floodplain morphology are the outcomes of slower and less devastating fluvial processes, e.g. vertical accretion in the floodplains during low-magnitude floods (Chapter-7).

(vii) The UBGI can be classified into ten broad genetic morphotypes depending on their formational and locational characteristics. The morphotypes associated with the active distributaries are more responsive to the discharge variability. Whereas, many floodplain features and processes are intervened and modified by human activities (Chapter-8).

(viii) Human encroachments in the UBGI distributaries are increasing with time, which adversely affects the flow characteristics of the decaying distributaries. Although specific management strategies are there for dealing with the hazards like river bank erosion, flood etc., precise plans for controlling human interventions are still overdue. Among the major distributaries, only the Bhagirathi–Hugli has been revived by the FBP, owing to its association with the Kolkata Port. The revival chances of the other distributaries are slim due to various geomorphic and geopolitical causes. It seems that the adaption to the changed condition should be the best long-term solution to the issue of river degeneration (Chapter-9).
10.3 CONCLUDING REMARKS

It is seen from that the distributaries of the UBGI are decaying due to the closure of their off-takes by sedimentation. Most of these rivers have shrunk significantly due to degeneration. Many of the distributaries have already turned into palaeochannels due to siltation in the channel beds and drastic decline of discharge. These irreversible geomorphic changes are connected to the abandonment of the western part of the Ganga Delta. Cyclic changes like meander oscillation are only restricted to the Ganga and its artificially-revived distributary—the Bhagirathi–Hugli. The Bhagirathi–Hugli course is also contributed by the discharge of its western tributaries from the Chhotanagpur Plateau. Due to the capacity reduction of distributaries, the UBGI has become vulnerable to flood hazard during the rainy season. The strategy for managing all these issues must be different but essentially needs to be in tune with the natural changes.

The population density of the UBGI is very high and likely to increase in the near future. Human encroachments are modifying the ecologically sensitive riverine environment at a very brisk pace. Therefore, natural changes and human induced modifications need to be regulated by the government policies, which must be sensitive to the environmental changes and feedback of the inhabitants. It should also be noted that any further scheme like the FBP—principally catering a single distributary—is not feasible due to unfavorable circumstances. In the current socio-political set-up of the densely populated UBGI, the issues of river degeneration and flood hazard can be addressed through participatory management. The inhabitants of the UBGI are quite habituated to living with the floods. Therefore, flood management schemes should be given more importance than the flood prevention policies. Future strategies must be comprehensive and should take into account the alterations that have already been brought into the system by the human agencies and strike a balance between the needs of the people and requirements of the nature.