River basin morphometry is a process of characterization which gives quantitative information about configuration of a basin. The voluminous literature followed by the path breaking works of Horton, opened the gate of its large practical application in hydro-geomorphic investigations and allied disciplines. Since then morphometric parameters are used as one of the basic tools for assessing hydro-geomorphic behaviour of a basin throughout the world. In spite of this development the measurement techniques are not free from subjectivities and ambiguities. These difficulties are imposed mainly by the fragmental nature of the subject, source limitations and subjectivities associated with contemporary techniques of its measurement. With this backdrop, the present study deals with the methodological complexities associated in river morphometric studies. For minimization of ambiguities in river morphometric measurements, this work proposes novel methods, techniques and protocols. It is noteworthy that new methods and protocols are proposed keeping fundamental premises and associated physical principles unimpaired.

This thesis has been arranged into three chapters which are briefly described below-

**Chapter 1 Introduction:** Thorough literature search pertaining methodological difficulties associated with river morphometric studies are done and reported in this chapter. Based on this search, the framework of the research has been set up. The methodical complexities learned are grouped into - drainage measurement, watershed delineation and basin length measurement. The methodology adopted and dataset used are described in this chapter.

**Chapter 2 Result and discussion:** This chapter has been further sub-divided into three major sections one each for three groups of complexities mentioned above.

First section includes difficulties associated with identification and consideration of streams, correct estimation of stream from DEM, inaccessibility of data source and characterization of complex interconnecting streams. Methodical approaches for consideration of streams are outlined for removing ambiguities associated with stream
identification. Pertaining to correct estimation of streams, novel methods of stream estimation from DEM are proposed. The advantages of the proposed methods are that it allows extraction of stream to greater extent at the same time limiting the stream numbers. Therefore, it can be effectively used in controlling the basic drainage characteristics- stream number and length. Another major advantage of this proposed method is that it conserves all possible geometry at given DEM scale. To overcome the difficulties due to inaccessibility of drainage data sources, an approach that uses two (or more) sources, one source for one portion of the basin and another for the rest, is proposed to derive entire geometry of a basin. The proposed approach combines streams consistently addressing the two major constrains- stream and spatial mismatching. In the appraisal of stream characterization in complex interconnecting streams, three complex situations are outlined taking clue witnessed in the study basin. Concurrently, Strahler’s and Shreve’s methods, the two most commonly used methods for stream characterization, are tested in outlined distributary conditions. A set of protocol are suggested that can be considered for conserving the stream characteristics of Strahler’s and Shreve’s classification.

Second section discusses the difficulties associated with watershed boundary delineation. Topographical information in DEM is not sufficient enough for flat terrains to delineate unambiguous water divide. To derive correct watershed boundary, a systematic multi-geo-informational protocol conjointly with sufficient ground survey is suggested in this section.

Third and final section of this chapter speaks about the approximation associated with contemporary method of basin length measurements. To remove this approximation, a numerical approach for basin length measurement is proposed. The method is validated against systematically manually measured basin length. The results clearly show that the numerical method calculates basin length to the finest level which is unattainable with manual measurements.

Chapter 3 Conclusion: This chapter carries concluding remarks and highlights the areas which have future scope of investigation.