

Chapter 1 Introduction

1-1. Purpose

This manual provides assistance for determining potential channel instability and sedimentation effects in flood control projects. It is intended to facilitate consideration of the type and severity of stability and sedimentation problems, the need for and scope of further hydraulic studies to address those problems, and design features to promote channel stability. The concept of channel stability implies that the plan, cross-section, and longitudinal profile of the channel are economically maintainable within tolerable limits over the design life of the project. Causes and forms of instability are discussed in paragraph 3-3.

1-2. Applicability

This manual applies to all HQUSACE elements, major subordinate commands, districts, laboratories, and field operating activities having civil works responsibilities.

1-3. References

Required and related publications are listed in Appendix A.

1-4. Explanation of Terms

Abbreviations used in this manual are explained in the Notation (Appendix D).

1-5. General Approach

The approaches presented in this manual are mainly qualitative and are intended to assist the engineer in the early stages of project formulation to forecast the type and magnitude of channel stability problems. Confidence in the stability of the project design will be enhanced if several different techniques of stability and sedimentation evaluation are employed. Wherever possible, the procedures employed should have been developed under hydraulic and geomorphic conditions similar to those encountered in the project. If procedures appropriate to project conditions do not seem to be available, or if different methods of evaluation do not give similar results, a need for more sophisticated analyses may be indicated. Such analyses might involve quantitative sediment transport studies and numerical modelling of morphologic response, which are not covered in this document. Engineer Manual (EM) 1110-2-4000 suggests three stages

of sediment studies: sediment impact assessment, detailed sedimentation study, and feature design sedimentation study. This manual should be useful in the first stage of the staged sedimentation study, and design guidance documents listed in Appendix A should be used in the second and third stages. The reader should refer to EM 1110-2-4000 for the risks and consequences of using the "staged study" approach.

1-6. Discussion

Adverse effects of flood control modifications on channel stability and sedimentation may be more common than is generally known. Linder (1976) wrote:

"Once disturbed, a stream channel begins an automatic and relentless process that culminates in its reaching a new state of equilibrium with nature....In the past, too many problems...have been handled by modifying the river channels involved without giving thought to the sediment being transported by the water.... Techniques should be employed that consider sediment transport characteristics and stream equilibrium....The ultimate cost of the uncontrolled erosion and excessive downstream sediment deposition that follow traditional channel modification is often far greater than the initial cost of a design that recognizes the influence of sediment transport characteristics on a stream's state of equilibrium."

Channel instability and sedimentation in a flood control project are not always the result of project modifications to the hydrology or channel characteristics. They may also reflect the continuation of pre-existing conditions such as meandering. Potential consequences of channel instability, whether pre-existing or project-induced, include reduction of assumed flood conveyance, loss of land and structures, and excessive requirements for maintenance or rehabilitation.

1-7. Systematic Approach to Channel Stability

Solution of channel stability problems in the planning and design of a flood control project requires the synthesis of field information, analytical procedures, and previous experience in a complex fashion that cannot easily be summarized as a linear sequence of steps. The flowchart shown in Figure 1-1 is intended to convey how data assessment and analysis can be integrated to attack stability problems. Numbers within the diagram blocks indicate subsequent paragraphs in this manual.

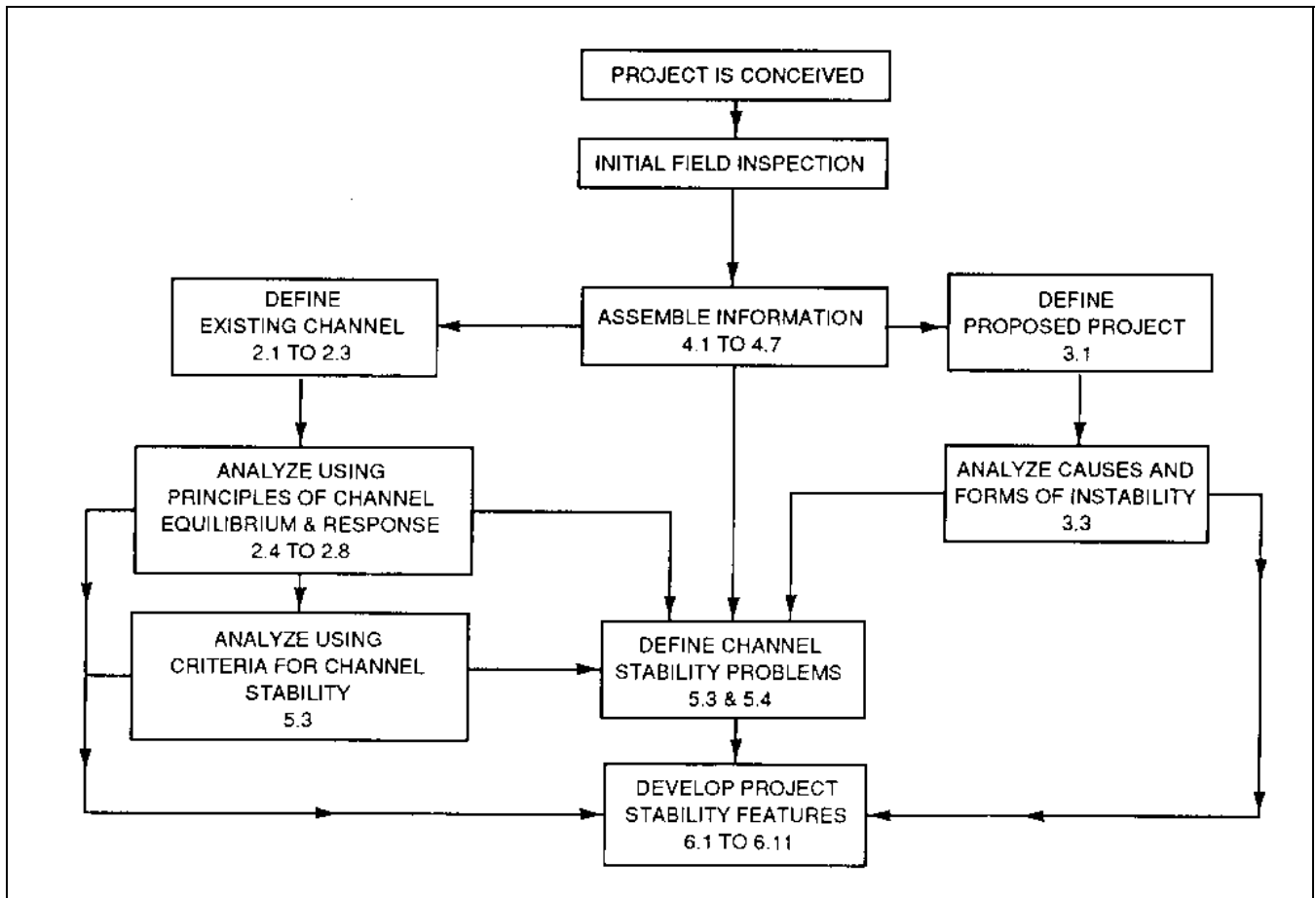


Figure 1-1. Flowchart for systematic approach to channel stability