I. INTRODUCTION

This design manual gives a series of four design procedures for estimating the performance of a wide variety of erosion control structures which are presently used to control sediment from small areas subjected to surface coal mining. The design procedures give quantitative estimates of the sediment reduction achieved by utilizing a type of structure and the amount of sediment passing the structure. The design procedures are suitable for determining if effluent water quality standards can be met by a structure. The procedures can predict sediment yield from a specific site on an event-by-event basis or can be used to predict sediment yield on an average annual basis. This allows personnel to specify structures capable of meeting regulatory requirements for infrequent events such as the 10-year, 24-hour storm. The procedures also predict annual sediment accumulation and maintenance requirements.

The design procedures follow known physical processes which produce or control the yield of sediment from a small catchment. All erosion control structures in this manual are grouped into one of four categories based on the dominant physical process by which they control sediment yield. These categories are:

1. Surface Protection Measures. This group includes mulches, vegetation, and erosion control products such as hydraulic mulch, netting and mulch binders.

2. Mechanical Treatment Measures. This group includes mechanical treatments such as contour furrowing, imprinting, ripping and pitting the soil surface.

3. Diversion and Conveyance Structures. This group includes terraces, diversions and small conveyance channels.

4. Detention and Filtering Structures. This group includes filter fence, permeable and impermeable berms, and vegetative buffer strips.

The water quality objective for the sediment control structures and measures presented in this manual is to limit the volume of settleable solids carried in the runoff to a specified concentration. The maximum area which can be treated and meet the water quality requirement will be a function of several important factors. First, the type of soil and particularly the amount of fine material in the soil has a great deal of influence on the size of the area which can be controlled. Fine soil sizes, called silt, are the

most difficult to control. The allowable size of an area will decrease as the percentage of silt increases in the soil. The second important factor governing the maximum area size is the amount of rainfall for the design storm and the resulting runoff. The allowable size of an area will decrease as the volume of runoff increases. Areas in regions with large design storms or areas with soils having poor infiltration rates will have a smaller allowable size than areas with lower design storm volumes or areas with soils having good infiltration rates. The third set of factors are the shape, slope and roughness of the area. Areas which are wide and have short overland flow lengths will have a larger allowable size than narrow areas with long overland flow lengths. Areas with a steep slope will have a smaller allowable area than areas with a mild slope. Areas with a high surface roughness will have a larger allowable size than areas which are smoother.

The maximum area can be computed directly for various types of treatments with information and procedures presented in this manual. Chapter VIII gives a procedure for determining maximum allowable area based on information presented in Chapters IV, V, VI and VII. The design procedures developed in Chapters IV through VII can be used to predict sediment yield from various sediment control measures for larger areas if this information is required. The procedures can be used to predict sediment yield to sediment ponds.

The physical processes active in small catchments (small area) are discussed in detail in Chapter II. Chapter III gives data requirements and sources of data used in preparing this manual. The manual is self contained in terms of data required to conduct a design of any structure introduced in the manual. If better data are available for a particular mine site, they can be easily incorporated into the design procedures and the designer is encouraged to do so. Chapter III documents numerous references that identify where these data can be located and methods for obtaining them. Chapters IV through VII include the design procedure for each structure group, design information for specific design types, planning considerations, design specifications, and maintenance requirements. Each design procedure chapter contains all worksheets, charts, tables, and nomographs necessary to carry out a design. Also, a complete design example is presented in these chapters. Chapter VIII provides an overview of sediment control structures with a guide toward planning for a cost effective erosion control system. The manual also contains four appendices providing information on procedures by which other

data sources can be used in conjunction with the manual (Appendices A and B), basic equations used in the manual (Appendix C), and 1980 materials costs (Appendix D). A glossary of key terms and phrases used in this manual is given in Appendix E.