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Title: Formation and Evolution of Key Morphological Features of Large Scale Sediment Systems

Topic Area: A1.3. Formation and Evolution of Morphological Features

Objective: The primary objective of this work unit will be to determine, describe, and analyze the primary processes and causal factors for the formation of key sedimentological features in large-scale Corps of Engineers projects in terms of site specific and regional processes of erosion, transport, temporary storage and ultimate deposition. A second objective will be to provide scientifically sound and operationally efficient technologies for integrating this knowledge into methods and strategies for managing sediment at the local and regional scale. Product A1.3.1 of the Regional Sediment Management Program will be provided by this work unit.

Problem: The primary products of soil erosion, sediment transport, temporary sediment storage, and ultimate sediment deposition are the morphological features found within the sediment pathways of the regional systems. These features, such as eroding streambanks, aggrading channels, filling of estuaries, and prograding deltas play an important role in the character and evolution of the hydrologic and sedimentologic system as well as associated ecological and engineering systems. Understanding the formative processes and causative factors for the genesis and evolution of large scale sedimentary features is basic and necessary to the development of methods, procedures, and strategies for managing sediment at the local and regional scales as well as over short-term to long-term time periods. Comprehensive and efficient regional sediment management requires that the existing knowledge of local processes and features be knitted together to form a holistic and systematic understanding of the linkages between them and local and regional causative factors that are responsible for the regional production, transport, storage, and diagenesis of sediment.

This work unit will address the fundamental processes and products of the formation of morphological features within regional sediment systems. Specifically, several large inland riverine systems will be investigated along with several estuarine systems.

Benefits: The focus of the research will be on the development of a scientifically sound understanding of the mechanics and causative factors of the formation of morphological features in large-scale sediment systems over time spans of 5-50 years. The research is intended to mesh with other RSM research foci on smaller systems and sub-systems of the regional system (such as source areas, channels, and estuaries) as well as research on the fundamental mechanics and

dynamics of sediment systems. With the focus on large-scale sediment systems, the results of the proposed work unit will be especially supportive of the development of information, methods, procedures, and strategies for the planning, prioritization, and prosecution of dredging, flood control, and navigation programs in the principal basins for which the Corps has these authorities.

Specifically, the following identified field needs will be addressed by the work unit: 1-B4, 6-B4, 18-B3, 24-C1, 28-A2, 30-B2, 41-C4, 43-B2, 49-B2, 56-B3, 71-B2, 79-A1, 91-E1, and 92-E4.

This work produces new tools and methods for the USACE and nation. It is an integral part of the Regional Sediment Management Research Program, and thus contributes primarily to support of the USACE's navigation, flood/storm damage reduction, and environmental protection and quality missions. It supports all 8 Civil Works strategic goals and 7 of 9 Listening Session objectives identified by HQUSACE as R&D priorities. With companion work units, it employs active technology transfer and insertion.

Work Description: Completion of this proposed work unit will involve the completion of eight sequential but partially overlapping tasks. These tasks are:

1. Synthesis and summarization of existing knowledge of the formation of morphological features in large-scale regional sediment systems that reflect the fundamental nature and character of sediment processes and dynamics.
2. Selection of representative sediment systems for detailed investigations of sediment feature occurrence and genesis. Several large-scale inland and estuarine sediment systems will be selected for investigation. Optimally, the selected systems will contain smaller regional systems selected for field research in other research efforts of the RSM program.
3. Development of existing data bases for the selected research areas. All of the large-scale sediment systems within the Corps authority are characterized by huge data sets for most of the key parameters of investigation. Development of the data sets for use in this research will be coordinated with the efforts and recommendations of the RSM research on Informatics to insure that the data will conform to formats acceptable for other RSM research requirements.
4. Field and office investigations to develop key data sets for combination with existing data. Previous investigations have demonstrated that detailed field investigations and confirmation of existing data will be required to achieve the objectives of the work unit. Because of the scale of the selected systems, the primary effort will be focused on the comprehensive collection and analysis of existing data and the types of data likely to be available to field offices of the Corps.
5. Analysis of natural formative processes and causal factors for sediment morphologies of various scales and types. The key processes responsible

- for the development of large-scale morphological features will be determined and analyzed for the selected systems. Analysis of the processes will focus on the identification of the magnitude, frequency, and duration of processes. The hydrologic, geologic, topographic, climatologic, and human factors that influence and or control these processes will be examined.
6. Analysis of the role of engineering controls on the formation of morphological features. A key aspect of this research will be the investigation of the role of large-scale engineering projects and activities on the development of morphological features in large-scale systems. This task will focus on the response of large-scale systems to modification of natural sediment processes by human actions associated with flood control, navigation, and environmental programs.
 7. Development of formative models for key sedimentological features in large-scale sediment systems. Upon completion of the analysis of processes and their causative factors, as well as the response of the systems to engineering controls, conceptual models for the development and role of the morphological features will be developed for the selected regional systems. Methods and guidance for use of these models in regional sediment management in other systems will be provided.
 8. Completion of a summary report detailing the goals and objectives, methods, data, results, models, and significance to the management of sediment in large systems to achieve economic and ecological sustainability over relatively long time periods.

Products and Schedule:

The primary output of this work unit will be Product A1.3.1, Mechanics of Formation for Morphologic Features, which will contribute ...

Product	Scheduled
1. TN: Formation and Significance of Morphological Features in Large Scale Fluvial Systems	Q4/02
2. TN: Formation and Significance of Morphological Features in Large Scale Estuarine Systems	Q4/02
3. Preliminary data bases	Q2/03
4. TN: Data Requirements and Methods For Analysis of Sediment Morphological Features	Q3/03
5. TR: Regional Sediment Management: Significance Of Morphological Features	Q3/04
6. JP: Factors Influencing the Formation of Large Sedimentary Features in Flood Control and Navigation Channels	Q4/04