D. W. Taylor
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CORPS OF ENGINEERS, U. S. ARMY

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POTAMOLOGY INVESTIGATIONS

REPORT NO. 11-8

MINUTES OF CONFERENCE ON POTAMOLOGY PROGRAM

5 APRIL 1951

WATERWAYS EXPERIMENT STATION

VICKSBURG, MISSISSIPPI

APRIL 1951

POTAMOLOGY INVESTIGATIONS REPORTS

Issued Prior To and Including This Report

Report No.	Title	Date
1-1	Instructions and Outline for Potamology Investigations	November 1947
1-2	Outline of Plans for the Potamology Investigations	December 1947
2-1	Preliminary Flume Tests of Mississippi River Revetment (1st Interim Report)	October 1947
2-2	Preliminary Tests of Mississippi River Dikes, Bank Stabilization Model	June 1950
3-1	Preliminary Laboratory Tests of Sand-Asphalt Revetment	July 1948
* 4-1	Investigation of 110-Volt Echo Sounder	July 1948 (Revised May 1950
5-1	Geological Investigation of Reid Bedford Bend Caving Banks, Mississippi River	July 1947
5-2	Field Investigation of Reid Bedford Bend Revetment, Mississippi River (3 volumes)	June 1948
5-3	Reid Bedford Bend, Mississippi River, Triaxial Tests on Sands	May 1950
5-4	Piezometer Observations at Reid Bedford Bend and Indicated Seepage Forces	May 1950
5-5	Standard Penetration Tests, Reid Bedford Bend, Mississippi River	May 1950
8-1	Hardscrabble Bend, Mississippi River, Revetted Bank Failure, Soils Investigation	June 1950
* 10-1	Preliminary Development of Instruments for the Measurement of Hydraulic Forces Acting in a Turbulent Stream	June 1948
10-2	Turbulence in the Mississippi River	May 1950
* 10-3	Evaluation of Instruments for Turbulence Measurements, 1948-1949	Mar 1951
* 10-4	Evaluation of Instruments for Turbulence Measurements, 1949-1950	April 1951
11-0	Resume of Conference Initiating Potamology Investigations, 11 February 1947	Feb 1947
11-1	Report of Conference on Potamology Investigations 15 March 1948	March 1948
11-2	Report of First Potamology Conference With Hydraulics Consultants, 9-10 December 1948	December 1948
11-3	Minutes of Conference on Soil Studies, Potamology Investigation, 18 April 1949	April 1949
11-4	Report of Second Potamology Conference With Hydraulics Consultants, 23-24 May 1949	May 1949
11-5	Minutes of Conference With Soils Consultants, Stability of Mississippi River Banks, 5-8 October 1949	October 1949
11-6	Report of Conference on Potamology Investigations, 6-7 October 1949 (2 volumes)	April 1951
11-7	Minutes of Conference On Soil Aspects of Potamology Program, 17-18 June 1950	October 1950
11-8	Minutes of Potamology Conference, 5 April 1951	April 1951

* Not of general informational value and hence not distributed

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MINUTES OF CONFERENCE ON

POTAMOLOGY

5 April 1951

1. A conference was held at the Waterways Experiment Station on 5 April 1951 to review the status of the potamology program being conducted by that office and to obtain from the three Districts in the Lower Mississippi Valley Division their comments and discussion of their problems related to the program. Mr. Norman Moore of the Mississippi River Commission acted as Chairman for the meeting. Personnel in attendance from the various offices were as follows:

Mississippi River Commission

Brig. Gen. P. A. Feringa
Mr. N. R. Moore
Mr. C. C. Phillips
Mr. E. J. Williams
Mr. R. H. Haas
Mr. H. E. Weller

Memphis District

Mr. G. W. Miller
Mr. A. C. Michaels
Mr. J. L. Hyde

New Orleans District

Mr. M. Carbonell
Mr. S. E. Worley

Vicksburg District

Capt. W. R. Hylander, Jr.
Mr. G. A. Morris
Mr. R. K. Stewart, Jr.
Mr. F. Bayley, Jr.
Mr. A. C. Williams

Waterways Experiment Station

Col. H. J. Skidmore
Mr. J. B. Tiffany
Mr. G. B. Fenwick
Mr. W. J. Turnbull
Mr. E. B. Lipscomb
Mr. W. G. Shockley
Mr. W. L. McInnis
Mr. E. H. Woodman
Mr. C. B. Patterson

2. General Feringa opened the meeting at 9:00 a.m., stating that the outlook for appropriations during the coming year was not as favorable as formerly and that if funds are to be so short the potamology program would of necessity be reduced a commensurate amount. Accordingly

he felt that the studies should be directed toward immediate and practical results, rather than along the lines of basic research.

3. Mr. Moore introduced Colonel Skidmore, who welcomed the group to the Waterways Experiment Station. Mr. Moore then introduced Mr. Tiffany, who presented a general review of the potamology program since its inception.

General review of the potamology program

4. Mr. Tiffany reviewed the potamology program, beginning with the directive energy experiments in 1932, through the meander studies of the 1940's, and culminating in the formal authorization of the project in 1947. The four basic objectives of the program were quoted as follows:

a. To study the meandering tendencies of the Mississippi River with the view toward development of a model and model operating technique capable of predicting future changes within specific reaches of the Mississippi River.

b. To determine the nature of revetment failures, their causes, and to develop methods of preventing such failures.

c. To study and develop methods of channel stabilization by means other than the use of revetment.

d. To develop and test comprehensive plans for the improvement of specific troublesome reaches of the Mississippi River.

5. Mr. Tiffany then described how the work at the Waterways Experiment Station is organized to accomplish these objectives. The basic responsibility is assigned to the Hydraulics Division, with the Soils Division collaborating on pertinent phases of the work. Coordination has been established with the Division and Districts and eminent consultants in the fields of hydraulics and soil mechanics have been

retained. He briefly outlined the studies that have been and are being performed by the Hydraulics and Soils Divisions as a part of the potamology program and cited related investigations in both fields which did not come under the program but which have contributed valuable information to it. Attention was called to the reports published under the study (listed on the inside front cover of these minutes; reports on the related studies are similarly listed on the inside of the back cover).

6. He pointed out, in summary, that compared to the lack of information at the initiation of the program four years ago a tremendous fund of knowledge has been acquired relative to the basic factors, both hydraulics and soils, influencing the behavior of the river. Investigative tools, both laboratory and field, have been nearly perfected and we are on the threshold of providing specific answers to the many problems.

Meander model study

7. Mr. Lipscomb stated that one major phase of the potamology investigation is the study of the channel meandering of the Mississippi River. The specific objective of this phase is the development of a model, and model operating technique, to use in predicting future bed and bank changes within troublesome reaches of the Mississippi River. Such a study involves reproduction in the model of bed and bank materials subject to erosion, transportation, and deposition in manners similar to those phenomena in the river itself.

8. Mr. Lipscomb pointed out that the results of the last test, which had just been completed, indicate that a satisfactory correlation of model and prototype materials has been accomplished for a relatively short and unstable reach of the Mississippi River. Thus the final goal of this phase of the potamology investigation now has been achieved.

Bank stabilization
model study

9. Mr. Lipscomb stated that the revetment study, another important phase of the potamology investigation, is concerned principally with the behavior and effectiveness of stabilization works. The present study involves the development of a model technique, the investigation of the behavior and effectiveness of various types of revetments and other stabilization measures, and the development and testing of methods of preventing revetment failures. The Reid Bedford Bend reach of the Mississippi River was selected for initial investigation in the model because two major failures and two minor failures of revetment had occurred at this location within four months after completion of construction. A satisfactory verification of the model was attained about a year ago for the prototype bed and bank changes occurring in Reid Bedford Bend between August 1945 and August 1946. The investigation of revetment was suspended temporarily at that time, at the request of the Mississippi River Commission and Vicksburg Engineer District, in order to allow preliminary tests of Miller Bend to be conducted in the flume. It is now proposed to install Reid Bedford Bend again in the model and resume the investigation of revetment and various other means of stabilization.

Hydrographic and
hydraulic surveys

10. Mr. Lipscomb said that hydrographic and hydraulic surveys are being made to determine the nature and causes of partial failures in revetments and to investigate developments leading to such failures. Revetments surveyed include a (then) new unstable revetment (Reid Bedford) a (then) new stable revetment (False Point), and an old stable revetment (Bauxippi-Wyanoke), which could become unstable because of changes in river regimen. Soils surveys are made in conjunction with the hydrographic and hydraulic surveys, to permit correlation of the attacking hydraulic forces and the resisting soils forces. Investigations at the two new revetments have been discontinued because of lack of funds. Reports are being prepared on these studies. Study of the old, stable revetment is being continued. The proposed 1952 F.Y. program provides for surveillance over the latter area by means of limited surveys.

Soils investigations

11. Mr. Shockley summarized the soils investigation phase of the potamology program. He gave a brief description of the sequence of soils deposition in the Mississippi Alluvial Valley and the relationship to the character of the banks of the Mississippi River. Soils investigations have been made at specific sites where revetments have and have not failed. These investigations have led to the following observations regarding the massive failures that have occurred on the river banks: (1) the failures occur in point bar deposits where the top stratum is relatively thin, (2) they are associated with massive deposits of fine

sand and do not penetrate into the underlying coarse sands and gravels, (3) they are characterized by bowl-shaped depressions and very flat slopes after the failure, (4) river stages and seepage forces have little or no direct effect on the initiation of failure. From these and other observations it has been concluded that the failures are flow failures resulting from liquefaction of fine sands.

12. He pointed out that the mechanics of the flow failures were not completely known; neither were the phenomena which actually initiated such failures known, although certain hydraulic factors were suspected. Recent studies have indicated that relatively minor scour at the toe of slope may be an important causative factor in initiating flow slides.

13. Mr. Shockley discussed the methods used in the soils investigation, describing the use of aerial photographs, and the development of undisturbed sand sampling and the cone penetrometer, and various laboratory tests on soils. He showed how the foregoing procedures and techniques were used to detect and evaluate potentially troublesome sites along the river. It was stressed that the knowledge gained in several years' work in the potamology program would permit the soils engineers to make a tentative evaluation of the susceptibility of specific sites to flow failures, but that studies were not far enough advanced to give a complete and final answer to the problem now.

Turbulence studies

14. Mr. Tiffany commented on the importance of turbulence as a basic factor underlying all major changes in the river, including bank caving and massive revetment failures. The study of turbulence is

aimed at relieving the lack of knowledge of pressure and velocity fluctuations caused by turbulence, their magnitude, rate of transmittal, size of area involved, and other factors. Early and more recent attempts to measure these effects were described, including a discussion of the pressure and velocity measuring instruments which were used or developed in the course of the investigation. Graphical results of the measurements were presented, which showed a tendency to cyclic variation of velocities and pressures. The results also indicated almost instantaneous fluctuations in velocity over a considerable depth. The problem of differential pressures which may exist on and affect the stability of revetments and river banks was discussed. In this connection a moving picture of flume tests of revetment being conducted at the St. Anthony Falls Hydraulic Laboratory was shown. Mr. Tiffany pointed out that the information being obtained in this study was of great interest to other Corps of Engineers offices as well as other federal agencies.

Discussion by
District representatives

15. Colonel Skidmore prefaced the discussion of problems by District representatives by calling attention to the fact that to a large extent information has been obtained in the potamology studies which is of direct benefit to those people who are working on the revetment program. He felt that some basic research is essential in order to determine the causes of some of the troublesome phenomena that have been noted. Otherwise, a recommended treatment undertaken without knowing the cause might well be worse than no treatment at all. He cautioned the District

representatives that remedies were expensive and they could not afford to undertake the wrong ones. Therefore, there is a certain minimum amount of information they are obligated to obtain in order to do a satisfactory job.

16. Memphis District. Mr. Michaels stated that the greatest problem on revetments in the Memphis District is associated with instability of the river banks, particularly in the reach below Memphis where there are high velocities and great turbulence. He felt that it was essential to obtain more information on the massive flow slide failures. Their primary concern at this time is how long it will take to get the answers to their revetment problems and how much money it will take to accomplish this end.

17. New Orleans District. Mr. Carbonell said that the New Orleans District did not have revetment problems of the magnitude of the other Districts. He recognized the flow slide at Free Nigger Point and felt that the potamology program was furnishing information which would assist in dealing with problems of this type.

18. Vicksburg District. Mr. Morris felt that it was time to start improving the techniques of revetment placement and to consider the use of new types of revetment, using engineering materials available in the area. It was his opinion that the potamology studies had advanced to the point that concurrent studies of remedial measures could and should be undertaken without waiting for completion of the investigative techniques now under study. Mr. Stewart suggested that the hydraulic models could be put to good use in helping solve certain immediate problems of

river control in the Vicksburg District. The channel meander model might be used to study river migration at Cypress Bend and at Marshall Point, both of which locations appear to be potentially troublesome. The bank stabilization model might be used to study several unstable reaches of the river, such as Ashbrook-Greenville, Worthington-Cracraft, and False Point-Vicksburg on the left bank. He also emphasized the need for study on improvements to the present type of revetment.

ASSOCIATED REPORTS

Study of Materials in Suspension, Mississippi River	Feb 1939
Study of Materials in Transport, Passes of the Mississippi River	Sept 1939
Geological Investigation of the Alluvial Valley of the Lower Mississippi River	Dec 1944
A Laboratory Study of the Meandering of Alluvial Rivers	May 1945
Fine-Grained Alluvial Deposits and Their Effects on Mississippi River Activity	July 1947
Report of Conference on Sand-asphalt Revetment, 12 August 1948	Aug 1948
Geological Investigation of Mississippi River Activity, Memphis, Tenn., to Mouth of Arkansas River	June 1949
Bank Caving Investigations, Morville Revetment, Mississippi River	Sept 1950
Investigation of Free Nigger Point Crevasse, Mississippi River	Dec 1950
Investigation of Mass Placement of Sand Asphalt for Underwater Protection of River Banks	In Preparation