



Environmental Effects of Dredging Technical Notes



The Automated Dredging and Disposal Alternatives Management System (ADDAMS)

Purpose

This technical note describes the current capabilities and availability of the Automated Dredging and Disposal Alternatives Management System (ADDAMS). *This technical note replaces the earlier Technical Note EEDP-06-12, which should be discarded.*

Background

Planning, design, and management of dredging and dredged material disposal projects often require complex or tedious calculations or involve complex decision-making criteria. In addition, the evaluations often must be done for several disposal alternatives or disposal sites. ADDAMS is a personal computer (PC)-based system developed to assist in making such evaluations in a timely manner. ADDAMS contains a collection of computer programs (applications) designed to assist in managing dredging projects. This technical note describes the system, currently available applications, mechanisms for acquiring and running the system, and provisions for revision and expansion.

Additional Information

For additional information regarding ADDAMS, contact the authors of this technical note, Dr. Paul R. Schroeder, (601) 634-3709, or Dr. Michael R. Palermo, (601) 634-3753, or the EEDP program manager, Dr. Robert M. Engler, (601) 634-3624. Points of contact for technical questions relating to various ADDAMS applications are provided in Appendix A of this technical note and on-screen in ADDAMS.

Description of ADDAMS

Objective

The Automated Dredging and Disposal Alternatives Management System (ADDAMS) is an interactive personal computer (PC)-based design and analysis system for dredged material management. ADDAMS is composed of individual modules or applications, each of which has computer programs designed to assist in the evaluation of a specific aspect of a dredging project. The creation of the system was in response to requests by Corps field offices for tools to rapidly evaluate dredged material management alternatives. The objective of the ADDAMS is to provide state-of-the-art computer-based tools that will increase the accuracy, reliability, and cost-effectiveness of Corps dredged material management activities in a timely manner.

Available Applications

Reflecting the nature of dredged material management activities, the applications and their methodologies contained in ADDAMS are richly diverse in sophistication and origin. The contents range from simple algebraic expressions, both theoretical and empirical in origin, to numerically intense algorithms spawned by the increasing power and affordability of computers.

Figure 1 shows the currently available applications of ADDAMS. A summary description of each ADDAMS application, including a listing of capabilities and technical points of contact, is found in Appendix A of this technical note. As applications are updated or new applications are added, Figure 1 and Appendix A will be updated by changes to this technical note.

Documentation and User's Guide

Each ADDAMS application has documentation describing how to run that application, how that application functions, and how it is programmed. This technical note is intended to serve as the user's guide and documentation for the overall ADDAMS system. All files for ADDAMS are provided to users on floppy diskettes. A detailed list of references is provided both in this technical note and directly on-screen within the applications including those concerned with the technical background and theory involved and documentation for the programming as appropriate. Points of contact for each application are also listed directly on the screens for answering questions regarding the respective applications.

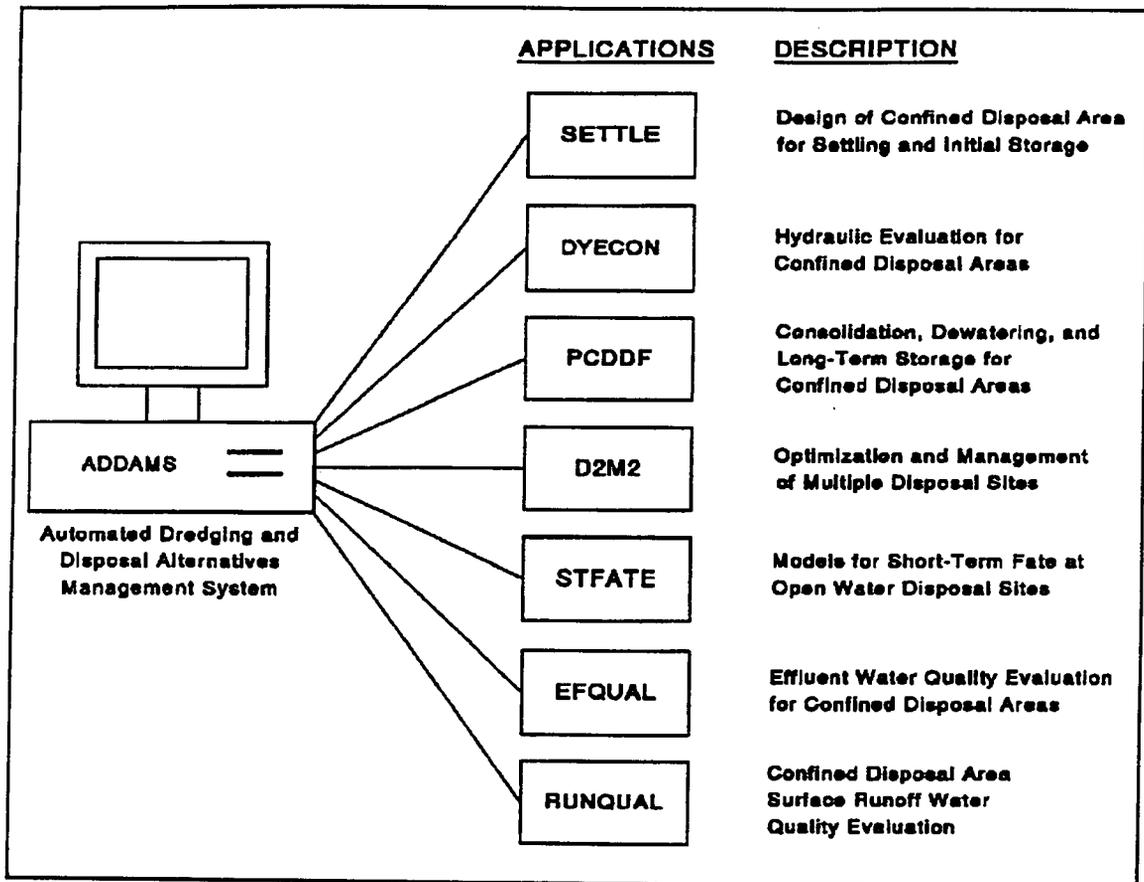


Figure 1. Current applications in ADDAMS

General Instructions

Target Hardware Environment

The strong preference of Corps field offices is for the system to reside in a desktop hardware environment commonly available. The system is therefore designed for a current base of PC-AT (including compatibles) class of personal computers resident at many Corps field offices, though some applications require a less powerful computer and others would be best run on a more powerful computer. Future versions of the various ADDAMS applications are expected to take advantage of the more powerful hardware technologies becoming commonly available, while maintaining some compatibility with lesser hardware. In general, the system requires a math coprocessor, 640 kilobytes of RAM, and a hard disk. In addition, an Enhanced Graphics Adapter (EGA) and color monitor are recommended. ADDAMS applications are written primarily in FORTRAN 77. However, some of the higher level operations and file management operations are written in BASIC, and some of the screen control operations are performed using an assembly language utility program.

Installation and Start-Up

It is recommended that the ADDAMS files be saved in a directory on the hard disk dedicated for the ADDAMS system, for example, C:\ADDAMS. The files are archived on the disks and must be de-archived prior to running the applications. To de-archive the files on each disk, copy the files from the disk onto the hard drive, type README, and follow the instructions. To begin a session, make the ADDAMS directory the current default directory, and type ADDAMS. Menus will then be displayed.

User Interface

ADDAMS employs a menu-driven environment and supports full-screen data entry. Single keystrokes (usually the F1-F10 function keys, number keys, Esc key, cursor keys, and the Enter key) select menu options in the system.

Cursor keys highlight input fields (displayed in reverse video) much like a spreadsheet program. To enter alphanumeric data, the user moves the cursor to the cell of interest using the up or down arrows to move vertically, and the Tab and Shift-Tab keys to move horizontally. The enter key moves forward through the cells. The left and right arrow keys can be used to move the cursor within a selected cell in order to edit the cell's contents. The Backspace key deletes characters in a cell. The space bar inserts spaces in a cell. The Delete and Insert keys, respectively, delete and insert a row of data on a screen of tabular data.

Page Down moves the cursor to the next screen of data entry and the Page Up key moves the cursor to the previous screen of data entry. The End key or Esc key permits the user to quit data entry and exit the application without saving the data. The Home key exits from the current data entry activity screen to the activity selection menu for the application and retains the entered data in memory.

Results from computations are generally displayed in tabular or graphic format on the screen or written to print files or devices.

Applications and File Management

Each ADDAMS application consists of one or more stand-alone computer programs or numerical models to perform a specific analysis. ASCII files hold input data from previous runs and are used to store output of results.

ADDAMS displays an initial menu of applications. Once an application is selected, an activity selection menu will be displayed at several levels for entering and editing data, executing the application, printing the results, performing file operations, and exiting the program.

The File Manager is accessible within each application. The File Manager acts only on data files for the selected application. The File Manager can select, name, or copy files, or display a directory listing the files.

Printing

Opportunities are provided to print a hard copy of input data, output of results, data files, and file directories. The DOS commands Control-Print Screen and Shift-Print Screen can also be used to print, respectively, all information written to the screen or currently on the monitor.

Ending

Normal termination is recommended at all times to avoid data loss. Data entry should be terminated by paging from the data entry screens or hitting the Home key to return to the activity selection menu. Hitting the Esc key or the function key for file operations will save the data, and then the Esc key is used to exit each menu to successively higher menu levels, and ultimately, back to DOS. During execution of a particular application's program, the user must wait until the sometimes lengthy computations are completed before exiting. The program can also be terminated by a Control-Break or by turning off the computer, but these methods of ending are not recommended because loss of data may occur.

Availability of ADDAMS on Diskettes

The ADDAMS system and applications are available on floppy diskettes. A request form for obtaining the ADDAMS diskettes is provided as Appendix B.

Revisions, Updates, and Workshops

The ADDAMS applications will be revised and updated as new technical approaches become available, and new applications will be developed to address additional management needs. Each application is designed as a module so that revisions or the addition of new applications can be easily accomplished. New users are provided with the most current version of each respective application. Version numbers are displayed on-screen for the ADDAMS system and the various applications. Periodically, a new version of the entire system may be required.

Announcements of revisions to specific applications and for the entire system will be published in the Environmental Effects of Dredging Programs' (EEDP) information exchange bulletin. Changes to this technical note will also provide information on new applications. In addition, workshops are held on an as-needed basis to familiarize Corps personnel with use of the ADDAMS system. Requests for additions to the mailing list for the EEDP bulletin or the technical note series and

inquiries regarding the scheduling of ADDAMS workshops should be sent to the following address:

U.S. Army Engineer Waterways Experiment Station
ATTN: CEWES-EP-D
3909 Halls Ferry Road
Vicksburg, MS 39180-6199

Appendix A: Description of ADDAMS Applications

SETTLE Application

Title

Design of Confined Disposal Facilities for Suspended Solids Retention and Initial Storage Requirements (SETTLE)

Description

Confined disposal facilities (CDFs) must be designed to provide both the storage volume required for the dredged solids and the hydraulic retention time for removal of suspended solids from the effluent discharged from the area during hydraulic filling operations. Various settling processes occurring in the CDF control the initial storage during filling, clarification, and effluent suspended solids. Engineer Manual (EM) 1110-2-5027 (Headquarters, U.S. Army Corps of Engineers 1987) provides design guidance for CDFs. This application provides a computer program to assist users in the design of a CDF for solids retention and initial storage in accordance with the design procedures in the EM. Laboratory column settling tests are an integral part of these design procedures, and the data from these tests are required in order to use this application. The SETTLE application analyzes laboratory data from the settling tests and calculates design parameters for CDFs.

Major Capabilities

1. Analyzes laboratory settling test data for zone, flocculent, and compression settling for CDFs.
2. Determines the maximum allowable in situ volume that can be dredged and placed in a CDF with a given available storage volume.
3. Determines the maximum allowable dredge size (or inflow rate) that can be used with a given CDF surface area and ponding volume to obtain clarification and maintain satisfactory retention of suspended solids.
4. Determines the required CDF surface area and volume to accommodate a given dredge size and a given in situ volume to be dredged.
5. Determines the required weir crest length for a given dredge size.

Current Version

3.00 updated July 1993

Points of Contact

Dr. Paul Schroeder, CEWES-EE-A, (601) 634-3709
Dr. Michael Palermo, CEWES-EE-P, (601) 634-3753

Selected References

- Hayes, D. F., and Schroeder, P. R. 1992. "Documentation of the SETTLE Module for ADDAMS: Design of Confined Disposal Facilities for Solids Retention and Initial Storage," *Environmental Effects of Dredging Technical Notes* EEDP-06-18, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Headquarters, U.S. Army Corps of Engineers. 1987. "Confined Disposal of Dredged Material," Engineer Manual 1110-2-5027, Washington, DC.
- Palermo, M. R., Montgomery, R. L., and Poindexter, M. E. 1978. "Guidelines for Designing, Operating, and Managing Dredged Material Disposal Areas," Technical Report DS-78-10, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Thackston, E. L., and Palermo, M. R. 1988. "Refinement and Simplification of Column Settling Tests for Design of Dredged Material Containment Areas," *Environmental Effects of Dredging Technical Notes* EEDP-02-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

PCDDF Application

Title

Evaluation of Primary Consolidation and Desiccation of Dredged Fill for Determining Long-Term Storage Requirements (PCDDF)

Description

This application provides a mathematical model to estimate the storage volume occupied by a layer or layers of dredged material in a confined disposal facility (CDF) as a function of time. Management of CDFs to provide maximum storage capacity is becoming more necessary as both the storage capacity of existing sites and availability of land for new sites decrease. Maximum site capacity is achieved through densification of the dredged material by removal of interstitial water. The volume reduction, and the resulting increase in storage capacity, is obtained through both consolidation and desiccation (drying) of the dredged material. The PCDDF model relies on the results of laboratory consolidation tests to estimate the magnitude and rate of consolidation and on climatic data for estimation of the rates of drying at a given site. The predictive procedures are described in Engineer Manual (EM) 1110-2-5027 (Headquarters, U.S. Army Corps of Engineers 1987).

Major Capabilities

1. Determines the final or ultimate thickness and elevation of multiple lifts of dredged material placed at given time intervals.
2. Determines the time rate of settlement for multiple lifts and therefore the surface elevation of the dredged material fill as a function of time.
3. Determines the water content, void ratio, total and effective stress, and pore pressure for multiple lifts as a function of time.

Current Version

1.2 updated October 1993

Points of Contact

Dr. Paul Schroeder, CEWES-EE-A, (601) 634-3709
Dr. Michael Palermo, CEWES-EE-P, (601) 634-3753

Selected References

Headquarters, U.S. Army Corps of Engineers. 1987. "Confined Disposal of Dredged Material," Engineer Manual 1110-2-5027, Washington, DC.

Poindexter-Rollings, M. E., and Stark, T. D. 1989. "PCDDF89 - Updated Computer Model to Evaluate Consolidation/Desiccation of Soft Soils," *Environmental Effects of Dredging Technical Notes* EEDP-02-10, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Stark, T. D. "Program Documentation and User's Guide: PCDDF89, Primary Consolidation and Desiccation of Dredged Fill," Instruction Report D-91-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

DYECON Application

Title

Determination of Hydraulic Retention Time and Efficiency of Confined Disposal Facilities (DYECON)

Description

This application provides a computer program to determine mean hydraulic retention time and hydraulic efficiency of a confined disposal facility (CDF) from a dye tracer slug test. Determination of retention time of ponded water is an important aspect of CDF design. Dye tracer studies may be undertaken to

provide retention time data for large sites or those with unusual characteristics. Procedures for conducting such dye tracer tests are presented in Engineer Manual (EM) 1110-2-5027 (Headquarters, U.S. Army Corps of Engineers 1987). In the absence of dye tracer data, the hydraulic efficiency can be estimated empirically.

Major Capabilities

1. Determines the theoretical and mean retention times of a CDF and the resulting hydraulic efficiency.
2. Determines the mean and maximum dye concentrations, time of peak dye concentration, and related characteristics of the dye concentration curve.

Current Version

3.00 updated July 1993

Point of Contact

Dr. Paul Schroeder, CEWES-EE-A, (601) 634-3709

Selected References

Hayes, D. F., and Schroeder, P. R. 1992. "Documentation of the DYECON Module for ADDAMS: Determining the Hydraulic Retention and Efficiency of Confined Disposal Facilities," *Environmental Effects of Dredging Technical Notes EEDP-06-17*, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Headquarters, U.S. Army Corps of Engineers. 1987. "Confined Disposal of Dredged Material," Engineer Manual 1110-2-5027, Washington, DC.

D2M2 Application

Title

Optimization of Long-Term Operation and Expansion of Multiple Disposal Sites Incorporating Dredging Sites, Disposal Sites, Transportation Facilities, and Management Restriction (D2M2)

Description

This application provides the Dredged-Material Disposal Management Model (D2M2), developed by the U.S. Army Engineer Hydrologic Engineering Center (HEC), a simulation-optimization model for systematic analysis of long-term operation and expansion of multiple disposal sites. The model provides a means of determining the optimum usage of multiple disposal areas to meet the dredging requirements at multiple dredging sites, for example, along the length of a

navigation channel. D2M2 uses a linear-optimization approach in determining the optimum usage based on input data for dredging volumes, location, frequencies, transportation facilities, and associated costs.

Major Capabilities

1. Determines the optimum usage of multiple disposal sites to meet dredging requirements at multiple dredging locations.
2. Identifies the minimum-net-cost short-term operation policy for a system of disposal sites and dredging areas.
3. Analyzes disposal capacity expansion alternatives and determines the minimum cost disposal site acquisition schedule.

Current Version

3.00 updated October 1989

Points of Contact

Hydrologic Engineering Center, CEHEC, (916) 551-1748
Dr. Paul Schroeder, CEWES-EE-A, (601) 634-3709

Selected References

Ford, D. T. 1984 (Jan). "Dredged-Material Disposal Management Model," *Journal of the Water Resources Planning and Management Division, American Society of Civil Engineers*, Vol 16, No. 1, pp 57-74.

Hydrologic Engineering Center. 1984. "Dredged-Material Disposal Management Model (D2M2) User's Manual," U.S. Army Engineer Water Resources Support Center, Davis, CA.

STFATE Application

Title

Short-Term Fate of Dredged Material Disposal in Open Water (STFATE)

Description

This application provides mathematical modeling of the physical processes determining the short-term fate of dredged material disposed at open-water sites, that is, within the first few hours after disposal. STFATE was developed from the DIFID (Disposal From an Instantaneous Dump) model. In STFATE, the behavior of the material is assumed to be separated into three phases: convective descent,

dynamic collapse, and passive transport-dispersion. The model provides estimates of receiving water concentrations of suspended sediment and dissolved constituent and the initial deposition of material on the bottom. Estimates of water column concentrations are often needed to determine mixing zones; whereas, the initial deposition pattern of material on the bottom is required in long-term sediment transport studies that assess the potential for erosion, transport, and subsequent re-deposition of the material. This model can also serve as a valuable aid in field monitoring programs. STFATE can be used in evaluating water column effects of open-water disposal of dredged material in accordance with section 103 of the Marine Protection, Research, and Sanctuaries Act and section 404(b)(1) of the Clean Water Act.

Major Capabilities

1. Estimates receiving water concentrations of suspended solids, dredged material liquid and suspended phases, and dissolved contaminants as a function of time and location and compares contaminant concentrations with water quality standards.
2. Estimates the percentage of suspended solids deposited on the bottom as a function of time and location and the thickness of deposition.
3. Estimates mixing zone requirements to meet water quality standards.

Current Version

5.00 June 1993

Points of Contact

Dr. Billy Johnson, CEWES-HE, (601) 634-3725
Dr. Paul Schroeder, CEWES-EE-A, (601) 634-3709
Dr. Michael Palermo, CEWES-EE-P, (601) 634-3753

Selected References

- Brandsma, M. G., and Divoky, D. J. 1976 (May). "Development of Models for Prediction of Short-Term Fate of Dredged Material Discharged in the Estuarine Environment," Contract Report D-76-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Johnson, B. H. 1990. "User's Guide for Models of Dredged Material Disposal in Open Water," Technical Report D-90-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

U.S. Environmental Protection Agency/U.S. Army Corps of Engineers. 1991. "Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual," EPA-053/8-91/001, Office of Water, Washington, DC.

U.S. Environmental Protection Agency/U.S. Army Corps of Engineers. 1994. "Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters - Inland Testing Manual (Draft)," Office of Water, Washington, DC.

EFQUAL Application

Title

Analysis of Modified Elutriate Test Results for Prediction of Chemical Effluent Quality and Dilution Requirements for Confined Disposal Facilities (EFQUAL)

Description

This application provides a computer program to analyze the results of modified elutriate tests and predict the chemical quality of effluent discharged from confined disposal facilities (CDFs) during hydraulic filling operations. Such predictions are necessary to evaluate the acceptability of the effluent discharge under section 404 of the Clean Water Act. The effluent may contain both dissolved and particle-associated contaminants. The modified elutriate test was developed for use in predicting both the dissolved and particle-associated concentrations of contaminants in the effluent. Results of the modified elutriate and column settling tests may be used to predict the total concentrations of contaminants for a given set of CDF operational conditions.

Major Capabilities

1. Computes predicted dissolved, particle-associated, and total concentrations of contaminants of the effluent.
2. Compares predicted concentrations with given water quality criteria and standards and determines the required dilution, if any, in a mixing zone to meet the standards.

Current Version

3.00 updated October 1991

Points of Contact

Dr. Michael Palermo, CEWES-EE-P, (601) 634-3753
Dr. Paul Schroeder, CEWES-EE-A, (601) 634-3709

Selected References

- Francingues, N. R., Palermo, M. R., Peddicord, R. K., and Lee, C. R. 1985. "Management Strategy for the Disposal of Dredged Material: Contaminant Testing and Controls," Miscellaneous Paper EL-85-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Lee, C. R., and others. 1991. "General Decisionmaking Framework for Management of Dredged Material: Application to Commencement Bay, Washington," Miscellaneous Paper D-91-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Palermo, M. R. 1985. "Interim Guidance for Predicting Quality of Effluent Discharged from Confined Dredged Material Disposal Areas," *Environmental Effects of Dredging Technical Notes* EEDP-04-1 through 04-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- Palermo, M. R., and Schroeder, P. R. 1991. "Documentation of the EFQUAL Module for ADDAMS: Comparison of Predicted Effluent Water Quality with Standards," *Environmental Effects of Dredging Technical Notes* EEDP-06-13, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

RUNQUAL Application

Title

Comparison of Predicted Runoff Water Quality with Standards (RUNQUAL)

Description

This application provides a computer program to analyze the results of surface runoff quality tests and to predict the chemical quality of the surface runoff discharged from confined disposal facilities (CDFs). Such predictions are necessary to evaluate the acceptability of the surface runoff under section 404 of the Clean Water Act. The surface water runoff may contain both dissolved and particle-associated contaminants. Results of the surface runoff quality tests and the column settling tests may be used to predict the dissolved and total concentrations of contaminants for a given set of CDF operational conditions.

Major Capabilities

1. Computes predicted dissolved and total contaminant concentrations in the surface runoff discharged from a confined disposal site using surface runoff quality test data.
2. Compares predicted surface runoff concentrations with specified water quality standards.

3. Computes required dilutions of surface runoff discharge to meet specified water quality standards, considering background concentrations in the receiving water.

Current Version

1.00 August 1993

Points of Contact

Dr. Charles R. (Dick) Lee, CEWES-ES-F, (601) 634-3585
Dr. Paul Schroeder, CEWES-EE-A, (601) 634-3709

Selected Reference

Schroeder, P. R., Gibson, A. C., and Dardeau, E. A., Jr. 1995. "Documentation of the RUNQUAL Module for ADDAMS: Comparison of Predicted Runoff Water Quality with Standards," *Environmental Effects of Dredging Technical Notes EEDP-06-19*, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Appendix B: Request Form for ADDAMS

Please send the ADDAMS diskettes to:

Name and Title _____
 Mailing Address _____
 and Office Symbol _____

 Telephone Number _____
 Anticipated uses of ADDAMS _____

Requests for ADDAMS must be sent with *formatted* floppy disks. Please circle the applications desired and the number and type of diskettes enclosed.

Requested Modules	Number of diskettes enclosed (all DS)			
	5.25 in. 360 kb	5.25 in. 1.2 Mb	3.5 in. 720 kb	3.5 in. 1.44 Mb
ADDAMS (all modules)	26	14	16	9
ADDAMS DEMO	6	3	3	2
SETTLE	2	1	1	1
DYECON	2	1	1	1
PCDDF	2	1	1	1
D2M2	1	1	1	1
STFATE	10	4	6	3
EFQUAL	1	1	1	1
RUNQUAL	1	1	1	1
EXECUTIVE SHELL	1	1	1	1

Signed _____ Date _____

MAIL THE COMPLETED REQUEST FORM AND FORMATTED DISKETTES TO:

U.S. Army Engineer Waterways Experiment Station
 ATTN: CEWES-IM-DS (Naylor)
 3909 Halls Ferry Road
 Vicksburg, MS 39180-6199