Hydrologic Center Engineering

ADVANCES

in Hydrologic Engineering

Spring 2006

Director's Comments

This edition of the HEC Newsletter is another of our aperiodic quarterly reports – the last one was over a year ago. We will try to do better in this next year. Thus, I will summarize activities this past year or so to bring readers up to date. HEC fielded new versions of its flagship NexGen software products; devoted substantial resources to improving and fielding a new version of the Corps Water Management System (CWMS), and executed a number of important technical assistance projects, including significant technical activities for non-USACE partners in local government agencies and in the international arena. The new System-Wide Water Resources Research Program is expected to yield development of new and exciting products for field office use in the coming years. It should be noted that most of the HEC software products and new methods development is funded from this and the Flood and Coastal Storm Damage Reduction research program.

NexGen Software: At fiscal year end, we were on the verge of releasing the revamped HEC-HMS – version 3.0. Featured is a completely new user interface as well as a host of capability additions and enhancements in evapotranspiration, snowmelt, loss methods, and flow-frequency curve development. The companion GIS utility package (HEC-GeoHMS) is also updated and new features added to coincide with the parallel release with the new HMS version. HEC-RAS version 3.1.3 was released. This version completes the unsteady flow capability, adds several new features including the first release with sediment transport capabilities. The companion GIS utility package (HEC-GeoRAS) has also undergone improvements and was released simultaneously. At fiscal year end, major progress had been made on a new version of HEC-RAS (4.0) that further implements sediment transport, contains the first release for water quality simulations, and includes several other new capabilities. A mid-summer 2006 release is anticipated. The flood damage and risk analysis software package HEC-FDA continues to be improved with progress made in integrating the event program HEC-FIA, nonstructural measures and GIS capabilities into the program. The planned release is late calendar year 2006. HEC-ResSim continues to be improved, being prepared for major new release in FY 2006 with a host of new capabilities. A new version of HEC-DSSVue (with several add-ins) was released (1.2.1); featured also is a new concept for extending capability called 'Plug-ins.' HEC-EFM (ecosystem functions model) is emerging as a valuable link between traditional flow-based watershed analysis and ecosystem response. A release is planned in FY 2006. Another new initiative begun in FY 2004 and carrying through FY 2006 has been coined HEC-WAT, watershed analysis tool. This software will be the integration environment for HEC models, and later program packages developed by others.

Corps Water Management System (CWMS): The CWMS project to modernize the water data system software began in FY 1997, was fielded in its first operational state in 2002/2003, and has undergone substantial improvements. Three subsequent nation-wide updates have occurred. CWMS embodies data acquisition, validation, transformation and management; forecasting, simulation and decision support analysis; and

(Continued on page 8)

IN THIS ISSUE:

Training Program

FY 2007 PROSPECT Training Program *by Dunn*

HEC has submitted our proposed FY 07 PROSPECT training schedule to the Corps' Professional Development Support Center (PDSC). The PDSC, located in Huntsville, AL, will soon be conducting the Corps' annual training survey which will decide which classes will actually be taught. Only the classes that have enough subscriptions will be taught. For your review and use, HEC has provided the proposed FY 07 class list below. If you are interested in one or more of the classes make sure you let the individuals responsible for the training program in your District/ Division know so that they can report your interest to the PDSC.

Not only are we offering the traditional classes given by HEC such as Unsteady Flow Analysis with HEC-RAS, Advanced Applications of HEC-HMS, CWMS Modeling for Real Time Water Management, and the Water and the Watershed, but this year we are proposing to offer two brand new classes, H&H for Dam Safety Studies and Sediment Transport Analysis with HEC-RAS. To help ensure that all these classes will be taught, please sign up early if you are at all interested.

To register for our classes, please contact the appropriate party in your office or contact the USACE Professional Development Support Center (PDSC), Huntsville, AL, http://pdsc.usace.army.mil/. Registration is handled by Training and Operations (CEHR-P-RG). Only those courses with sufficient enrollment to cover training costs are presented. However, there are often spaces available due to drop-outs or partial filling during the initial registration. These vacancies are filled on a first-come basis and are open to non-Corps registration. For current information on stand-by registration, NOTE: the course number, name, date, and location and contact:

USACE Professional Development Support Center (PDSC)
550 Sparkman Drive,
Huntsville, Alabama 35816
Tel: (256) 895-7425 Fax: (256) 895-7465

Course descriptions are provided in the "Purple Book" at the PDSC site http://pdsc.usace.army.mil/Purple_Book.aspx. A short description along with course agendas will also be provided on HEC's website as well. Please note, there is still time to attend this years remaining classes as well which are also listed below.

FY 2006 PROSPECT Training remaining Program
(All Classes located in Davis, CA)

Course #	Course Title	Date
155	CWMS Modeling for Real Time Water Management	Jun 5-9, 06
219	Hydrologic Engineering Applications for GIS	Jul 17-21, 06
164	Water and the Watershed	Aug 14-18, 06

PROPOSED FY 07 PROSPECT Training Program
(All Classes located in Davis, CA)

Course#	Course Title	Proposed Date
164	Water and the Watershed	Nov 13-17, 06
67	Advanced Steady Flow Analysis with HEC-RAS	Dec 4-8, 06
98	Reservoir System Analysis with HEC-ResSim	Jan 22-26, 07
58	Statistical Methods in Hydrology	Feb 26-Mar 2, 07
369	Advanced Applications of HEC-HMS	Mar 19-23, 07
161	Hydrologic Analysis for Ecosystem Restoration	Apr 16-20, 07
320	H&H for Dam Safety Studies	Apr 30-May 4, 07
155	CWMS Modeling for Real-Time Water Management	May 14-18, 07
57	Hydrologic Engineering for Planning	Jun 18-22, 07
219	Hydrologic Engineering Applications for GIS	Jul 16-20, 07
122	Sediment Transport Analysis with HEC-RAS	Aug 20-24, 07
209	Risk Analysis for Flood Damage Reduction Projects	Sep 10-14, 07

Publications

Obtaining HEC Publications *by Baker*

The HEC Publications Catalog is HEC's library of publications that document its computer program, hydrologic engineering and planning analysis procedures, project studies, and seminars. An effort is underway to provide these publications electronically through the HEC web page (www.hec.usace.army.mil). To-date all the IHD Volumes and Training Documents have been placed on the web site, seventy-five percent of the Research Documents and thirty-eight percent of the Computer Program Documentation have been completed, and a few Seminar Proceedings and Technical Papers are available. In the next several months HEC hopes to complete the Research Documents and Seminar Proceedings, and by the end of 2006, have completed this endeavor.

All documents are in Adobe® format (7.0 and later) and are for printing only. To download and view the documents, a user will need to have the latest version of Adobe® Reader (7.0.7) from Adobe® (www.adobe.com). If you have any questions regarding this issue, please contact Ms. Penni Baker (email: penni.r.baker@usace.army.mil) of our office.

Project News

Katrina — IPET *by Gee*

HEC is part of the IPET (Interagency Performance Analysis Task Force) that has been tasked by the Chief of Engineers to provide credible and objective scientific and engineering analyses of the performance of the hurricane protection systems during Hurricane Katrina. The key objective of this study is to understand the behavior of the New Orleans Hurricane Protection System in response to Hurricane Katrina and assist in the application of that knowledge to the development of a more resilient and capable system.

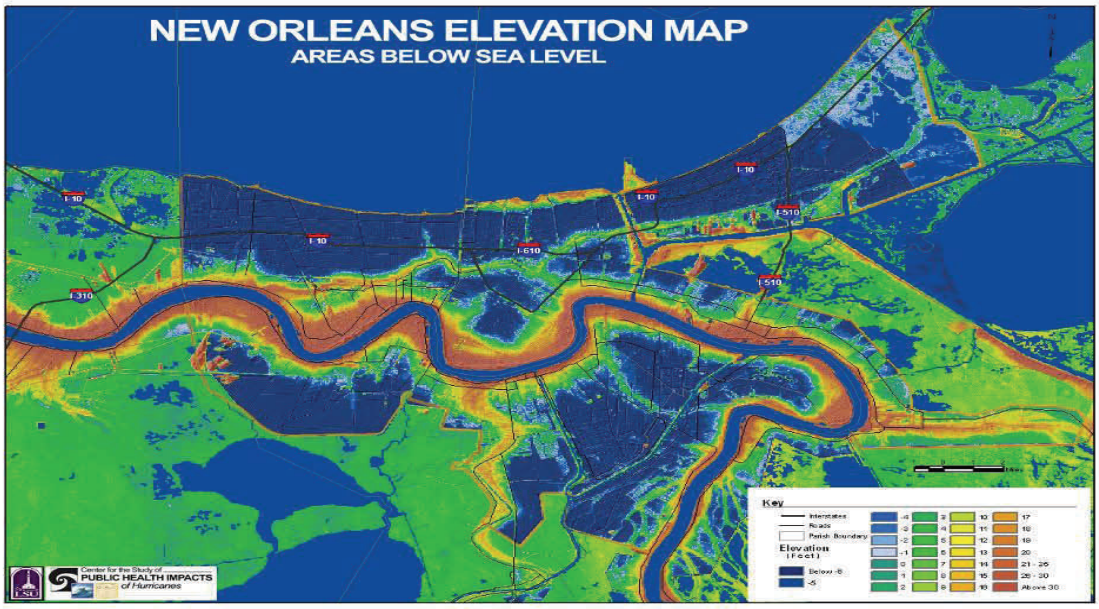
HEC is specifically tasked with analyzing the interior drainage performance of the flood systems for the following Parishes: Jefferson, Orleans, St. Bernard, and Plaquemines. A team of modelers has been assembled that includes the New Orleans Dist., Vicksburg Dist., CTE, Copeland & Dove, ERDC (ADCIRC storm surge modeling), and NWP-HDC (pump station operation forensics).

Reconstitution of the Hurricane Katrina event is being done using HEC-HMS for simulation of the runoff and HEC-RAS for simulation of channel hydraulics. The HEC-RAS modeling includes pump operation details, levee overtopping and breaching and simulation of the impact of storage areas.

HEC-RAS boundary conditions are being obtained from the ADCIRC storm surge model for Lake Ponchartrain and the Gulf of Mexico. Operation of the pumping stations is being modeled based upon the pumping times and capacities as can best be reconstructed for Katrina. Levee overtopping and failure information has been developed from post-flood surveys. NWP-HDC has also developed estimates of the backflows through the pumping stations that contributed to flooding in some areas, particularly Jefferson Parish. All of these details are significant to model development and are described in the HEC-RAS model.

Project News

Katrina — IPET—continued



The modeling utilizes GIS-based data for definition of storage areas, location of external (ADCIRC) boundary conditions, comparison of computational results with observed high water marks, location of levee breaches and mapping of simulated flooded areas.

The models and data for this effort are being prepared for the analysis of the performance of future flood components (e.g., levee elevations and pump station capacities) and impacts of other storm magnitudes. The hypothetical storms to be analyzed with the HEC models will include both rainfall and storm surge parameters.

HEC has been working with Jefferson Parish over the last few years to build RAS models for preparation of FEMA DFIRM products. These models were updated and used for the Katrina event reproductions.

IPET reports can be accessed at https://ipet.wes.army.mil

(Gee, Harris, and Brunner)

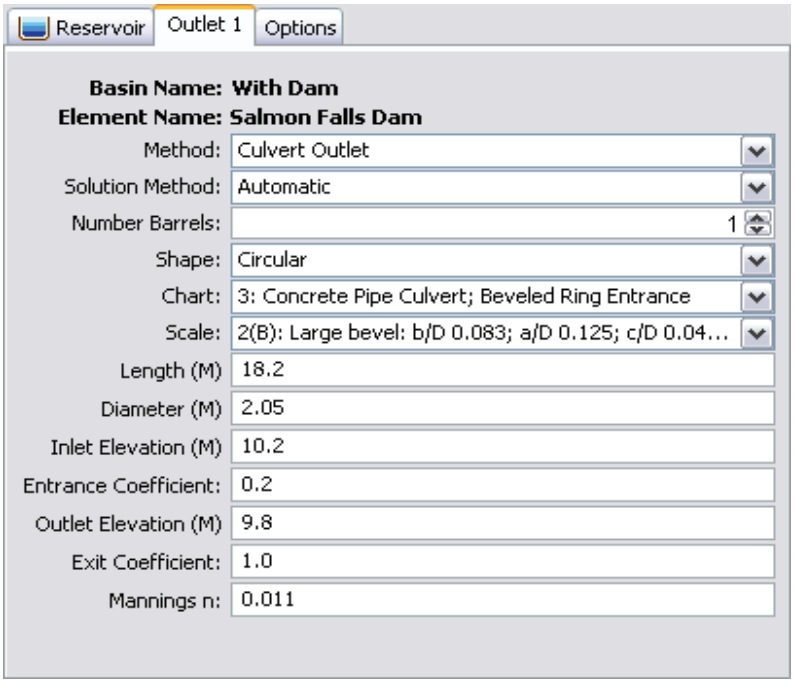
Software News

HEC-HMS Completes Major Upgrade *by Scharffenberg*

The Hydrologic Modeling System (HEC-HMS) provides a wide range of options for simulating watershed hydrology. It can be used in small or large watersheds, for natural or urban conditions. Depending on choices made by the user, it can simulate single storm events or multi-decadal continuous records. The wide range of tools it provides for precipitation, infiltration, surface runoff, baseflow, channel routing, and engineered structures recently received a major upgrade. The upgrade included both new simulation capabilities as well as a fresh user interface.

The first major area of improvements is in the meteorologic model used to compute atmospheric conditions over the watershed. The Priestley-Taylor method for evapotranspiration is now included, both for regular subbasins and for gridded subbasins. This method can be a vast improvement over the previous "monthly average" method that used NOAA evaporation pan data. Priestley-Taylor uses measured solar radiation, temperature, and other information to compute the potential evapotranspiration demand. This allows for both diurnal variation and accounting for cloud cover which was not possible with the monthly average method. The meteorologic model has also been expanded with the temperature index method for tracking the accumulation and melting of a snowpack. The temperature index method uses a degree-day approach where the meltrate (melt volume equals meltrate multiplied by number of degrees above freezing) is computed dynamically based on current precipitation rate, temperature of the snowpack, recent melt history, and other factors. In fact this is the same approach used in the venerable SSARR simulation program. While it is possible to use the full capability of the temperature index method to simulate rain-on-snow events and other complex dynamics, it is also possible to "turn off" certain features and use a much simplified representation of the snowpack.

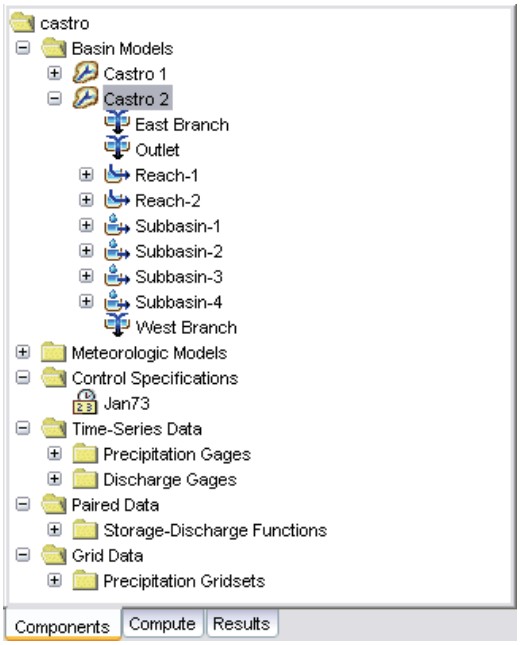
The second major area of improvements is in the reservoir element used to compute outflow from reservoirs and lakes. Low-level outlets can now be represented with a true culvert, or the previous orifice pressure conduit. The culvert feature can represent either inlet or outlet control situations and automatically determines which condition exists. It is ideal for situations where the outlet is not always submerged, contrary to the pressure conduit which must be continuously submerged by a minimum depth. The culvert option offers nine different cross section shapes and the full range of FHWA charts and scales. A figure showing the culvert properties is provided below. A pump has also been added to the array of outlet options. It uses a head-versus-discharge curve to represent pumping power. The program automatically computes the total head against which the pump must work using information specified by the user about the piping and discharge system. Separate elevations are specified for turning the pump on or off. The most common application of the pump capability is for interior flood projects where water collects in a pond on the "dry" side of a levee and must be pumped into the river. Finally, the reservoir has been expanded to include more outlets than in previous versions. You may now include up to a total of 41 outlets separated as up to 10 separate low-level outlets, 10 spillways, 10 overflows, 10 pumps, and optionally a dam failure by overtop or piping modes.



Software News

HEC-HMS Completes Major Upgrade *-continued*

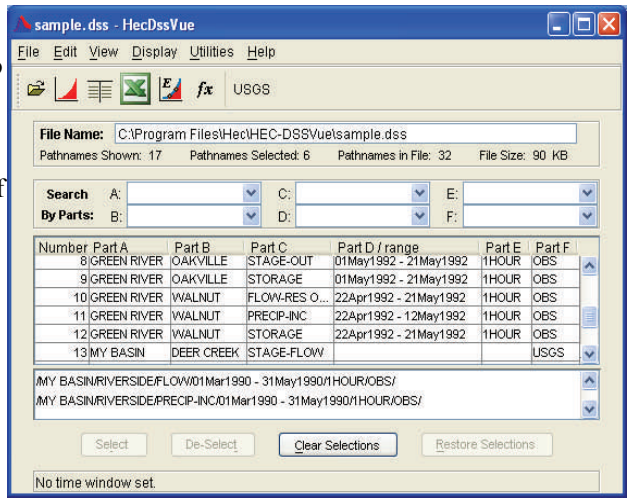
Version 3.0.0 includes a brand new interface. It became necessary to replace the old interface when the tools used to create it were discontinued by the manufacturer. Rather than simply duplicate the old interface using new tools, we took this opportunity to completely redesign it based on feedback sent to us by many users. A primary concern was to make the program faster to use. We did this by requiring less typing at the keyboard and requiring less action with the mouse to accomplish common tasks. Another important consideration was to make it easier to organize and manage all the data that is necessary to do watershed simulation. The new Watershed Explorer organizes all of the data by category and allows easy access for viewing or editing the data. The Watershed Explorer also organizes all of the simulation results and allows you to create custom graphs or tables that combine various results in any way you choose. So far users have been pleased with the new interface and reported it is much easier to get their work done!



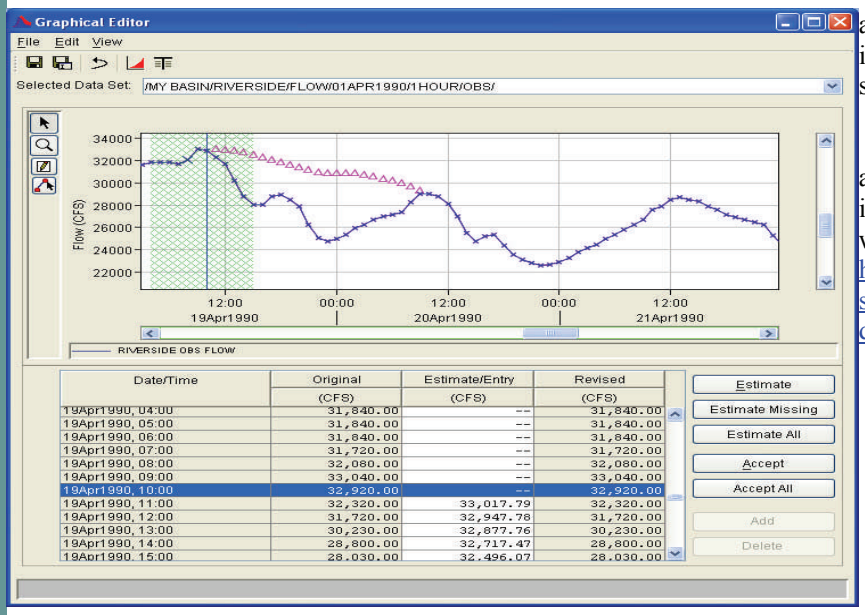
HEC-DSSVue and "Plug-ins" Now Available *by Charley*

Last fall (2005), version 1.2.10 of the program HEC-DSSVue was released. HEC-DSSVue is a Java-based visual utilities program that allows users to plot, tabulate, edit, and manipulate data in a HEC-DSS database file. HEC-DSS is a free database system that the various HEC programs, such as HEC-HMS, HEC-RAS and HEC-ResSim use. The graphics produced by HEC-DSSVue are customizable and can be saved in various formats, including "jpeg" and "png" (portable network graphics), or for printing or copying to the clipboard for inclusion in reports. HEC-DSSVue has over fifty mathematical functions and several utility functions. Included in this version is a graphical editor, which allows users to modify data by drawing new curves or editing it in a table.

This release also included a new capability to use software "plug-ins". An HEC-DSSVue plug-in is a set of Java software that is compiled and put into a Java ".jar" file. By simply placing this file into the HEC-DSSVue\Plugins directory, it is automatically loaded and accessible from the HEC-DSSVue program. The purpose of a plug-in is similar to the jython scripting capability that is available in HEC-DSSVue. However, since plug-ins are written in the Java language, which is used by HEC-DSSVue, there are extended capabilities and controls available.



HEC-DSSVue and "Plug-ins" Now Available - *continued*

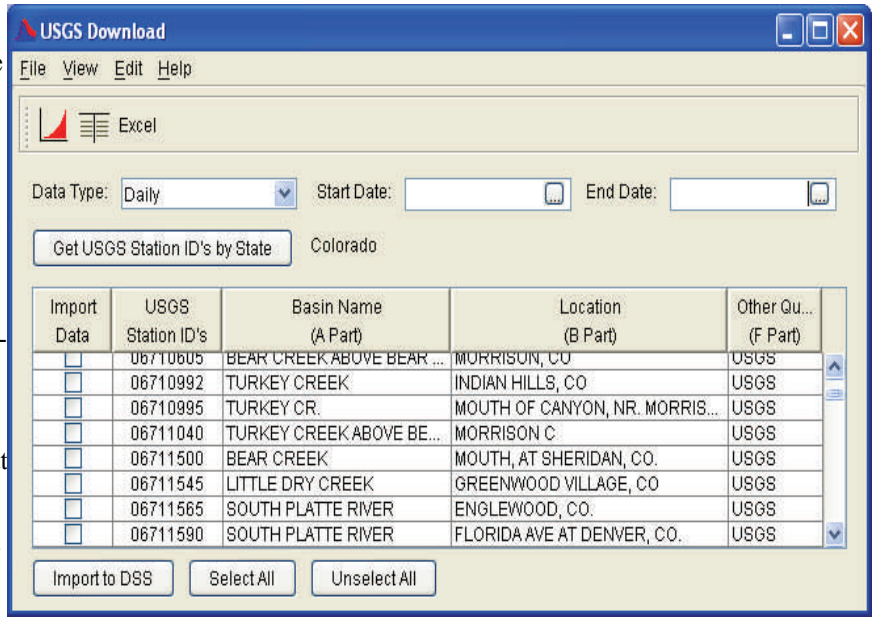


ability to edit data in Excel and import data from Excel spreadsheets.

HEC-DSSVue, the plug-ins and all supporting documentation is available for free from the HEC web site at: http://www.hec.usace.army.mil/software/hec-dss/hecdssvue-dssvue.htm

One plug-in that is now available on HEC's web site is one to retrieve data from the USGS NWIS web site. The plug-in will retrieve and store historical and recent daily flow data, real-time data, which are typically provided on an hourly or 15 minute time interval basis, and annual peak flow and stage data. You can retrieve daily historical data for the period of record or you can provide a time window for the period that you are interested in. Recent daily data, which is generally not verified, is available for a period of up to 730 days prior to the current date. Real-time data is available for up to 31 days prior to the current date. This data is typically provided in hourly or 15 minute intervals, and is also unverified.

Another plug-in that is available from the HEC web site is one to copy data from an HEC-DSS database file directly into Microsoft Excel. It displays an "Excel" button on the toolbar, which will show the data sets that you have selected in an Excel spreadsheet. To use this plug-in after it has been installed, simply select data sets as you normally would for tabulating or plotting and then press the toolbar button labeled "Excel" and this will bring up Microsoft Excel with your data loaded in the sheets. Time series data sets will appear all on the same sheet and paired data sets will each be loaded into separate sheets. No other data types are supported at this time. To "export" the data to Excel, simply save the workbook under a name that you want. Version 1.3 of HEC-DSSVue will have this capability integrated in it, with the



Directors Comments— *continued*

information dissemination. Improvements to the system continue via a field-prioritized betterments program. The major featured improvement for planned 2006 release will be a revamped database structure and interface that greatly facilitates migrations from existing legacy data systems to the CWMS database environment. The new database schema strongly supports local access and customized product development – much sought after by USACE field offices. The funding structure provides for a modest field-directed betterments program. Funding for notable improvements came via a local agency (Lower Colorado River Authority) that has adopted and implemented CWMS for their system in Texas. Information about CWMS and other HEC software is available on the HEC Web site: http://www.hec.usace.army.mil/cwms/.

The Nature Conservancy (TNC) Sustainable Rivers Project: HEC is supporting The Nature Conservancy/USACE Sustainable Rivers Project. This project seeks to leverage the knowledge and skills of TNC and USACE in altering the operation of USACE reservoirs so as to improve the ecosystem sustainability of downstream river reaches. HEC continues the third year of a joint agreement with a number of mutually beneficial activities accomplished or underway. Work initially focused on improving the operation of reservoirs on the Savannah River in Georgia, Ashuelot in New England, and Willamette River in Oregon. Other project rivers continue to be under consideration. Joint training sessions have likewise taken place.

Training: The HEC training program continued at the typical pace of about eleven week-long PROSPECT courses and several field workshops. The courses presented several hydrologic engineering and planning analysis topics including HEC-RAS, HEC-HMS, GIS applications, watershed/river and wetlands restoration courses, and a few advanced courses. Attendance averaged about 25 students per course. The on-site workshops focused on HEC software such as HEC-ResSim, HEC-RAS, HEC-HMS and HEC-DSSVue.

HEC Visiting Scholar: FY 2004 was the first year of the newly established Roy Beard Visiting Scholar program – named after the founding director of HEC. The program seeks to bring scholars from academia, private industry, and other agencies and laboratories for residence at HEC for periods of six months to one year. HEC's first scholar was Mr. Tony Thomas, founder and president of Mobile Boundary Hydraulics. Mr. Thomas provided fresh insight and ideas related to sediment modeling and mentored HEC staff in developing sediment analysis features for HEC-RAS. The second visiting scholar was Dr. Jery Stedinger, Professor from Cornell University. Dr. Stedinger's fields of research and teaching are engineering statistics and flood frequency/risk analysis. Dr. Stedinger arrived in August 2005 and stayed through January 2006. Collaboration on a number of statistics and risk-related topics took place.

Technical Assistance/ Reimbursable Projects: Reimbursable project work was undertaken for Corps field offices as well as HQUSACE, the R&D community, the Federal Emergency Management Agency (FEMA), and other Federal agencies. FY 2005 continued the recent growth in projects with non-Corps, non-Federal organizations. This includes work in Iraq and Afghanistan for USAID and its contractors, and local government agencies. Projects for these clients and settings included the full range of hydrologic engineering and planning analysis technology development and application. Notable projects include historic data reconstruction and water management system modeling of the Tigris and Euphrates in Iraq, and the Helmand Valley in Afghanistan. In the aftermath of Hurricane Katrina, HEC became part of the IPET investigation team with responsibility for modeling and analysis of flooding of five New Orleans area Parishes. Independent Technical Reviews (ITRs) continued for a National Data Quality Act challenge to a southern California stream frequency curve, and spillway design studies for reservoirs in the central valley of California. Improvements were made to the CWMS software system under the sponsorship of the Lower Colorado River Authority, Texas and additions are now underway to HEC-RAS under the sponsorship of the Tampa Bay Water Authority – both Thomas Amendment projects. The total reimbursable project program was about $2.0 million with individual projects ranging from a few thousand dollars to upwards of $500,000. and Gulf Coast area.

Overview 2006: The HEC program for FY2006 has been similar to that of FY2005. New

(Continued on page 10)

Project News

HEC Involvement in Afghanistan *By Needham*

Since mid-2004, HEC, in cooperation with the Corps' Afghanistan Engineering District, has been developing a water management plan for the Helmand River, a basin located in the Helmand Province of Afghanistan. The effort is being funded by the U.S. Agency for International Development, (USAID). HEC is also cooperating with the Afghanistan Ministry of Irrigation, Water Resources and Environment (MIWRE) and the Ministry of Energy and Water (MEW). Through this effort, HEC will develop a water control management plan for the Helmand Valley and help restore water control management institutional capabilities within Afghanistan. The goal is to improve the management of the limited water resources by defining the most efficient balance of water demands between irrigation, power production and other downstream water requirements under current and various future conditions.

The Helmand River Valley, including all tributaries, drains approximately 160,000 km^2 (or 31% of Afghanistan). The Helmand River accounts for 80% of the total Helmand basin runoff, and is estimated to have an average annual yield of 14,000 million m^3. The Helmand River flows in a southwesterly direction for approximately 1,300 km towards the Afghan-Iran border where it enters the Sistan wetlands. The major water control structure along the Helmand River is Kajakai Dam. Kajakai Dam is a 90 m high earth and rock fill embankment dam that was built in the early 1950s. It is located about 100 km northwest of Kandahar and is used for irrigation storage and power production.

The work has been performed in two phases. Phase I has been completed and Phase II is expected to be completed at the end of FY06.

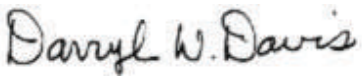
Phase I consisted of data gathering and validation, developing a HEC-ResSim simulation model of Kajakai Reservoir and completing a water budget analysis to illustrate the capacity of the Helmand Basin to provide water for irrigation, power supply, and International treaty requirements. Phase I also included a two-week water management training course in Davis for six Engineers from the Ministry of Energy and Water.

Phase II will focus on refining, enhancing, and expanding the existing simulation modeling, which will be the main tool used to develop a Reservoir Operation Manual for the Kajakai Reservoir. The Arghandab River, a tributary to the Helmand, and a reservoir located on it will be included with the ResSim modeling during this phase. Phase II work will also include analyzing snowpack information obtained from satellite data and USGS Famine Early Warning System (FEWS), so that reservoir operating rules that we develop will account for this information. HEC will team with CREEL for the tasks involving snowpack analysis. Phase II also includes a PMF analysis, which will ensure that the ongoing construction of outlet works on Kajakai Reservoir can pass rare events.

If you want to know more about HEC's work in Afghanistan, contact Jason Needham at Jason.t.needham@usace.army.mil.

Directors Comments— *continued*

versions of the NexGen software packages and companion GIS utility software will be fielded. A new version of CWMS will be prepared for release to Corps offices in FY 2006 that includes much improved stabilized data management features. PROSPECT training is expected to remain high. Civil works R&D funding, important base funding for methods and software development, will likely decrease along with the overall decline of the Corps R&D budget. Software maintenance and support stays the same. CWMS funding was ordered by HQUSACE to be reduced by 10% to meet IT budget targets. International and non-USACE work is expected to continue on the growth path of the past year, with a new project for Iraq that will address water and related land planning at the national level. The New Orleans Katrina-related modeling work will conclude, but additional work is likely given the intense focus on reconstruction in the New Orleans and Gulf Coast area.



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