AGENDA

1. Welcome and Introductions
   Steve Blanchard

2. Review and Approval of Agenda
   Steve Blanchard

3. Approval of Minutes from April 17, 2008 Meeting
   Steve Blanchard

4. Status of Action Items from April 17, 2008 Meeting
   Steve Blanchard

5. Presentation “National Environmental Status and Trends Indicators Project” by Richard Guldin, Director - Quantitative Sciences U.S. Forest Service (Presentation followed by Q&A - total 30 min.)

6. Update on Hydrologic Frequency Analysis Work Group
   Will Thomas

7. Proposal for Federal Agencies to stop using 100-yr flood (T-year) terminology and start using 1-percent (X-percent) terminology
   Will Thomas/Steve Blanchard

8. Update on Satellite Telemetry Interagency Work Group
   Ernest Dreyer

9. Hydrologic and Hydraulic GIS Applications Work Group
   William Merkel

10. Update on Hydrologic Modeling Work Group
    Don Frevert

11. National Hydrologic Information System (HIS) development and SOH effort
    David Goodrich

12. Extreme Storms Task Force
    Tom Nicholson

13. Current Events within Hydrologic Communities
    All
    • NWS Partners Meeting, June 18, 2008 – Gene Stallings

14. Announcements and Q&A on Business Reports from Member Organizations
    All
    • “The SOH CONNECTIONS” Newsletter Editor’s Report
National Research Council’s Committee on Hydrologic Science (COHS) “Research and Applications Needs in Flood Hydrology Science” - Wednesday, October 15 in Washington, DC

15. Plans for Next Meeting in October

Steve Blanchard

16. Plans for July 2009 Meeting in Las Vegas

Steve Blanchard

Adjourn
SUMMARY OF THE MEETING
(Prepared by Mary Greene, OSM)

PARTICIPANTS –
Martin Becker            Defenders of Property Rights (DPR) \( by \) phone
Steve Blanchard         Geological Survey (USGS)
Ted Engman              National Aeronautics and Space Administration (NASA)
Don Frevert             Bureau of Reclamation (BOR)
Mary Greene             Office of Surface Mining (OSM)
Richard Guldin         USFS guest speaker
Steven Haley           American Forest
Claudia Hoeft           Natural Resources Conservation Service (NRCS) \( by \) phone
Victor Hom              National Weather Service (NOAA/NWS)
John Hunter             Army Corps of Engineers (USACE)
Robert Mason            Geological Survey (USGS) \( by \) phone
Bill Merkel             Natural Resources Conservation Service (NRCS)
Tom Nicholson           Nuclear Regulatory Commission (NRC)
Gene Stallings          National Hydrologic Warning Council (NHWC)
Will Thomas             Association of State Floodplain Managers (ASFPM)
Jerry Webb              Army Corps of Engineers (USACE) \( by \) phone
David Wells             Environmental Protection Agency (USEPA)
Max Yuan                Federal Emergency Management Agency (FEMA)
Meeting Highlights

1. Welcome and Introductions
   Steve Blanchard called the meeting to order at 9:06 AM (EST) and welcomed everyone. Each person introduced themselves and their organizational affiliation.

2. Review and Approval of Agenda
   The meeting agenda was approved as listed above.

3. Approval of Minutes from April 17, 2008 Meeting
   The minutes were approved.

4. Status of Action Items from April 17, 2008 Meeting
   Steve Blanchard updated the status of the action items:
   a. Email any additional organization business reports to Mary Greene by Monday May 5 – Completed
   b. Work Group leaders - email a written version of the reports you gave at the meeting to Mary Greene by Monday May 5 so Mary can complete the draft minutes. – Completed
   c. Email suggestions for a Theme for the 2010 Hydrologic Modeling Conference to Don Frevert by Monday May 5. – Completed
   d. Steve will contact Carol regarding integrating the SOH and BOR websites to post the previous hydrologic modeling conference proceedings. – Addressed
   e. Steve will act on the requests from the Extreme Storms Ad Hoc Group to resolve the NOAA/NWS availability for leading the extreme storm update effort. – Addressed
   f. Email SOH Connections Newsletter submissions to Claudia and Mary by Friday May 23 – the next newsletter is scheduled for early June 2008 – Completed

5. Presentation “National Environmental Status and Trends Indicators Project" by Richard Guldin, Director - Quantitative Sciences U.S. Forest Service (Presentation followed by Q&A - total 30 min.) (Presentation Attached)

6. Update on Hydrologic Frequency Analysis Work Group

Hydrologic Frequency Analysis Work Group (HFAWG) report
Will Thomas summarized the status of the testing for the Expected Moments Algorithm (EMA) and Bulletin 17B techniques. He reported that he received more test results from John England, Bureau of Reclamation, on May 5, 2008. These results were more complete but not significantly different from the February results. The results to date indicate large differences in the 100-year flood estimates for the two methods for a few stations with zero flow years and low outliers. John England indicated that the EMA code needed some additional modifications with respect to the new low-outlier test.

Will reported that the data group (Martin Becker, Jerry Coffey, Don Woodward, Beth Faber, Nancy Steinberger and Will Thomas) had a conference call on July 30 to discuss the May
2008 test results. The data group decided it was worthwhile to send an email to the testing group (John England and Tim Cohn, USGS) stressing the following points:

- Finalize the EMA code as soon as possible,
- Make sure the code works on all computer systems that are commonly used in engineering analyses,
- Encourage the testing team to complete the testing proposed in August 2007 within the next few months,
- Comment on the testing results, point out trends and inconsistencies in the results.

The above report prompted the following comments:

- Robert Mason, USGS, acknowledged that Tim Cohn's program and the USGS production program (PeakFQ version 5.2) on their web site are giving different results. He indicated that USGS is working to resolve this issue.
- Steve Blanchard, USGS, mentioned that USGS is going to fund John England to work with Tim Cohn to finalize the EMA code and to complete the EMA testing. This funding would allow John to focus the EMA testing and finalizing the code.
- Jerry Webb, USACE, indicated that people within his agency were asking for copies of Bulletin 17C. Jerry indicated that we should be more cautious in characterizing our progress on updating Bulletin 17B and not give the impression that a new Bulletin 17C is imminent.

7. Proposal for Federal Agencies to stop using 100-yr flood (T-year)
Will Thomas provided the background on the use and concerns of the use of the T-year terminology related to flooding and the Subcommittee considered supporting a recommendation to start using 1-percent (X-percent) terminology exclusively to alleviate this past confusion. Jerry Webb indicated that the Corps of Engineers has done a lot of work regarding communicating flood risk and would try to arrange for Dave Moser, from the Corps, to come and make a presentation at the October SOH meeting. The SOH will table any action on this topic until after hearing from the Corps.

8. Update on Satellite Telemetry Interagency Work Group
Steve Blanchard provided a summary overview for Ernest Dreyer. The major item is that the Wallops Island back-up system is up and running at the USGS Sioux Falls, SD facility.

9. Hydrologic and Hydraulic GIS Applications Work Group
William Merkel provided an update on the activities of the Work Group. The Work Group has been active about 9 months. Two purposes of the work group which are currently active are 1) gathering information on GIS applications in hydrology and hydraulics and 2) information sharing among member federal and non-profit organization members.

Two teleconferences were held since the last meeting of SOH. These were in June and July 2008. At the June teleconference, a demonstration of MapWindow (open source GIS) was conducted using Microsoft Live Meeting. More of these information sharing demonstrations are expected in future teleconferences.
A questionnaire was developed to send to those working in hydrology, hydraulics and GIS to request information on public-domain applications which they may have developed. Concerns were raised by Toni Johnson (now retired) about distributing a questionnaire and the Paperwork Reduction Act regulations. Toni Johnson sent two e-mails and her successor Wendy Norton sent two e-mails to outline the conditions under which the work group could distribute a questionnaire. The main guidelines from these e-mails will be used to distribute the questionnaire, namely 1) non-federal members of the work group will distribute the questionnaire to non-federal individuals and 2) federal agency members will distribute the questionnaire on a limited basis within their own agencies.

Coordination has begun with the Department of Interior EGIM GIS committee whose Chairman is Bob Pierce. A presentation was made on the purposes of the work group at their conference in May 2008. Coordination is planned with Dr. Vijay Singh who maintains a web site with contacts for hydrologic models. Some of the models which are included in his list operate with GIS data.

More coordination with CUAHSI is planned. Dave Goodrich of ARS is a member of the work group and also of CUAHSI. The purpose of coordination is to avoid duplication and perhaps set up a cooperative effort.

The goal for the work group is to prepare a draft report by the end of calendar year 2008 which will contain the status of information gathering and sharing as of that date.

10. Update on Hydrologic Modeling Work Group

Don Frevert reported on the Hydrologic Modeling Work Group activities. Committee met in Denver on June 26th and 27th. All positions on the organizing committee have now been filled. The conference will be held June 27 – July 1, 2010 at Riviera Hotel and Casino in Las Vegas. A pre-meeting of organizing committee will be held on site in July, 2009. The theme of the conference will be “Hydrology and Sedimentation for a Changing Future: Existing and Emerging Issues”. It will be formatted as six concurrent sessions – three on Hydrologic Modeling and three on Sedimentation. Exhibit and Demonstration Sessions will also be offered. A total of 10 short courses will be offered on Sunday and on Thursday afternoon – five in Hydrologic Modeling and five in Sedimentation. The timeline for major events for the organizing committee leading up to the conference is attached. Additionally, the tentative deadlines for authors are as follows:

- The Call for Papers is due to go out in November, 2008
- The deadline for abstracts will be June, 2009
- The conference announcement is due to go out in October, 2009
- Drafts of papers are due in November, 2009
- Final papers will be due in January, 2010

Proceedings from all preceding Hydrologic Modeling conferences (1998, 2002 and 2006) as well as the 1993 workshop on Hydrologic Modeling Needs for the 1990’s can now be
accessed from SOH website. The outstanding efforts of Carol Lewis from USGS were gratefully acknowledged.

The next conference call for the workgroup was scheduled for Thursday, August 7th and was held on schedule. The group will hold its next teleconference on Tuesday, October 21st at 11:00 Eastern time.

11. National Hydrologic Information System (HIS) development and SOH effort  
David Goodrich emailed an update on this development as he is on sabbatical in New Zealand. Dave’s email report is provided below.

- CUAHSI is holding its Biennial Colloquium on Hydrologic Science and Engineering in Boulder, CO, on July 14-16, 2008, and as part of that, the Hydrologic Information System team will present a one-day workshop on CUAHSI HIS on Wednesday July 16. This meeting is open to the public and there is no charge for attendance.

- At this workshop, Version 1.1 of the CUAHSI Observations Data Model will be presented along with a new data loader and toolset for editing and viewing data in this data model. A standardized system for registering new WaterML web services and indexing their data in a national water metadata catalog will also be presented.

- On May 15-16, members of the CUAHSI HIS team (David Maidment, Rick Hooper and Ilya Zaslavsky) met with representatives of EPA Office of Water, US Geological Survey, National Weather Service, National Climatic Data Center, and the OpenGIS Consortium in the EPA Office of Water in Washington DC. The key conclusions that emerged from this meeting were:

  - There is substantial agreement on the necessity for having a national water metadata catalog and a set of web services to search it. The current catalog the CUAHSI HIS team has built at the San Diego Supercomputer Center contains 8.38 million records – each record identifies a particular variable measured at a point observation site by an organization over a specified interval of time. These data series can be regularly or irregularly recorded through time. CUAHSI’s HydroSeek search service operates over this catalog and permits searching for data by location and type across all the organizations whose data are indexed there.

  - It would be useful to form a “water web services community of interest” among representatives of water agencies who would like to share information and participate in the effort to nationally synthesize water observations data.
• While in Washington, the CUAHSI HIS team also met with Chuck Job to discuss the definition of data elements needed for describing well information, as prepared by the ACWI Subcommittee on Groundwater.

• The CUAHSI HIS team is exploring various ways in which its observational data catalog can be viewed and queried against the background of the NHDPlus geographic dataset [http://www.horizon-systems.com/nhdplus/](http://www.horizon-systems.com/nhdplus/) which is based on the National Hydrography Dataset, National Elevation Dataset and National Land Cover Dataset. This will achieve linkage of the data describing water properties and the geographic description of the water features being sampled by the observing gages and sampling sites.

• A Water Resources Interoperability Experiment has been started under the coordination of the OGC Interoperability Institute whose goal is to identify how best to define XML data structures for sharing water resources information. This Experiment will proceed by defining a set of test cases and then trying out alternative data structures for addressing the issues arising from those test cases. Over the past 15 years, the Open GIS Consortium (OGC) has worked with about 400 organizations to define collectively define standards for sharing geographic data. These standards, the Web Mapping Service, Web Coverage Service and Web Feature Service, are now being adopted within the GIS community. WaterML, the XML language that CUAHSI has developed for transmitted time series of water resources data, is presently defined only for simple geographic objects like point observation sites and lat/long boxes. As part of the Interoperability Experiment, a more complete synthesis of water data description in space and time will be attempted, based on WaterML and GML (the Geographic Markup Language) developed by OGC. Individuals wishing to know more about this should contact David Arctur, President of OGCII at darcut@ogcii.org

12. Extreme Storms Task Force

Tom Nicholson summarized the activities of the Task Force using a PowerPoint presentation (attached) and reported the completion of the initial work of this Task Force. Tom Nicholson transmitted a letter from the Extreme Storms Task Force to Steve Blanchard, Chair of the SOH, requesting that the Extreme Storms Work Group be formally established under the SOH. Tom’s letter is attached. Tom also submitted the draft Charge for the Work Group and requested the SOH adopt the Charge to guide the functioning of the Work Group. The Charge is attached.

**Decision:** The SOH unanimously approved the motion to adopt the Charge for the Work Group and established the Extreme Storms Work Group.

**Action:** Steve Blanchard will check with ACWI if there are any other steps required to establish the Work Group within the ACWI structure.
13. Current Events within Hydrologic Communities
   *NWS Partners Meeting, June 18, 2008 – Gene Stallings*
   This meeting was announced.

14. Announcements and Q&A on Business Reports from Member Organizations
   "*The SOH CONNECTIONS* Newsletter Editor’s Report"
   The Subcommittee voted to skip the Mid-summer publication (September 2008) and proceed with a Newsletter in late Fall following the October 2008 meeting as the summer period would not have a large amount of information or activities.

   *National Research Council’s Committee on Hydrologic Science (COHS) “Research and Applications Needs in Flood Hydrology Science” - Wednesday, October 15 in Washington, DC*
   This meeting was announced.

15. Plans for Next Meeting in October
   October 30, 2008 – Washington, DC Main Interior Bldg  from 9 AM to 12 Noon

16. Plans for July 2009 Meeting in Las Vegas
   The Subcommittee supported the plans for this meeting and the subsequent adjusted timing.

17. Action Items:
   - Subcommittee members should submit any additional business reports to Mary Greene for inclusion in the minutes
   - Work Group Chairs should submit written reports to Mary Greene for inclusion in the minutes
   - Steve Blanchard will follow-up on the request to modify the status of the Extreme Storms Task Force to create a work group.
Bureau of Reclamation
The Bureau of Reclamation and the water resources community mourned the loss of former commissioner John Keys who died in an airplane crash on May 30th in Canyonlands National Park. Keys, a long time Reclamation manager and Regional Director, was also an avid pilot. He came out of retirement in 2001 to serve as Commissioner until his retirement in April, 2006. He was widely respected by Reclamation employees and his associates throughout the water resources community.

Reclamation Commissioner Robert Johnson said: “It is difficult to find the right words to convey the sense of loss that I know we all feel. John was part of Reclamation for nearly 40 years. He worked in most of our regions as well as our Denver Office. He was Pacific Northwest Regional Director for over 12 years. He retired from Reclamation only to return to be Commissioner for five more years. He believed in Reclamation and its mission. He believed in what he called "Reclamation people" and "Reclamation people" believed in him.”

FERC Member Report
Midwest Flooding in June, 2008, particularly in Iowa and southern Wisconsin, is being estimated to be in the range of a 500-year event which is unusual. FERC has had no reports of any problems at dams under its jurisdiction. In Cedar Rapids, IA along the Cedar River, one of the worst hit cities for flooding, there is an FERC project in the middle of the downtown area. The Five In One Project is integral with two major highway bridges crossing the Cedar River. The upper bridge is an Interstate highway and the lower bridge is a local city street. The dam had no effect on the flooding levels. The project dam is inundated (headwater = tailwater) at 50,000 cfs and the Cedar River flows have exceeded 90,000 cfs during the flooding event. The river level rose to just below the bridge girders of the lower bridge.

Office of Surface Mining
The Office of Surface, Mining Western Region, recently acquired a Downhole Camera. It is being used by OSM and Western State regulatory and Abandoned Mine Lands programs to investigate the integrity of wells and shafts. Most recently, the TIPS Down-Hole Camera was used to assist a Murder Investigation: OSM Western Region provided training and technical assistance to the Colorado Abandoned Mine Lands office in Grand Junction in the use of the TIPS down-hole camera. The system was used to inspect an abandoned mine shaft for a missing body as requested by the Mesa County, CO Sherriff’s Office on July 26th. The request was made in connection with a high profile homicide investigation that was featured recently on NBC Dateline.
USGS Agency Business Report

**New Associate Director for Water**
Dr. Matthew C. Larsen has been named Associate Director for Water of the U.S. Geological Survey (USGS). In his Associate Director role, Dr. Larsen has programmatic responsibility for all water-related research and activities at the USGS. He will be responsible for water issues relating to flooding, water quality, drought, climate change, and water availability.

Larsen has been the leader of the USGS National Research Program in hydrology in his position of Chief Scientist for Hydrology since 2005.

"Matt has an outstanding record as a research scientist, advancing knowledge of hydrologic and landslide processes in tropical ecosystems. He has worked closely with the National Science Foundation on collaborative efforts in water research and has directed USGS hydrologic research in advancing the understanding of the impacts of climate change on hydrologic systems," said USGS Director Mark Myers.

As USGS Caribbean District Chief, Larsen supervised water resources programs and worked with external partners in Puerto Rico and the U.S. Virgin Islands starting in 2000. That same year he also served as a coordinator and researcher on a USGS international mission that responded to the December 1999 landslide and flashflood disaster in Venezuela.

Larsen was the Luquillo, Puerto Rico, Water, Energy, and Biogeochemical Budget project chief from 1991 to 2000. Prior to that, he was project chief on a USGS study of landslide hazards in eastern Puerto Rico. Larsen began his USGS career in 1977 with the Branch of Pacific and Arctic Marine Geology, Menlo Park, CA. He was a physical science technician and participated in a study of natural hazards to petroleum development in the Northern Bering Sea, Alaska.

Dr. Larsen earned a bachelor's in Geology in 1976 from Antioch College in Yellow Springs, Ohio, and a doctorate in Geography at the University of Colorado-Boulder in 1997. He is also the Chair of the U.S. National Committee for the UNESCO International Hydrological Programme and is the author of 66 scientific reports and journal articles.

**New Duration Hydrographs**
A new tool has been added to the USGS WaterWatch (http://water.usgs.gov/waterwatch/) web data interface for aiding in the assessment of hydrologic drought. This new feature, entitled "Duration Hydrographs," can be accessed using the **Drought Watch** pull-down menu on the main WaterWatch page (http://water.usgs.gov/waterwatch/ ; see the screen shot below).

This new WaterWatch feature will generate a plot for the past two years that depicts the daily maximum, minimum, and 90th, 75th, 25th, and 10th percentiles for the period of record, along with the daily mean flow for each USGS real-time station having at least 20 years of record. At the present time, the algorithm that generates the plots does not differentiate between gage periods having mixed regulated and unregulated flows, although this is a capability that we anticipate adding in the future. For the time being, a cautionary note is included above the hydrograph indicating that, for streams where mixed regulated and unregulated flows exist, the depictions may be inaccurate.
The Duration Hydrographs tool has a flexible interface that enables the user to acquire plots by typing into a search window an 8-digit streamgage station number (or part thereof), a river name, county name, or two-letter state abbreviation. Plots can be generated for 7-, 14-, or 28-day averaging periods, and historical plots are available back to 2004. After entering the station number, river name, county name, or state abbrev, WaterWatch returns the requested duration hydrograph; a table containing the station numbers, station names, drainage areas, and number of years of record; and a Google map depicting the location of the stations. When multiple stations are listed in the table and on the map, users get a duration hydrograph for a station of interest by clicking on the hotlinked station number in the table or the station symbol on the map.
July 18, 2008

Mr. Steve Blanchard  
Chief, Office of Surface Water  
U.S. Geological Survey  
National Center, MS415  
12201 Sunrise Valley Drive  
Reston, VA 20192

SOH Chairman:

As you directed, I have served as Chair of the Task Force on Extreme Storm Events and am reporting on its activities and consensus. The Task Force has completed its draft of a “Charge of Work Group” for the establishment of the “Standing Work Group on Extreme Storm Events” under the Subcommittee on Hydrology (SOH). To date, all agency representatives, save the NOAA/NWS representative who abstained, have voted in the affirmative to forward the enclosed “Charge of Work Group” proposal to SOH for their consideration and vote.

The proposal provides a framework of the scope, membership and procedures for the work group. Most importantly, the proposal provides a detailed technical background on the problem statement, need, and recommended work group tasks with an extensive bibliography. Fundamentally, the Task Force sees a distinct Federal role and responsibility to coordinate studies and databases for reviewing and improving methodologies and data collection techniques used to develop design precipitation estimates of large storm events, up to and including the Probable Maximum Precipitation (PMP). As you directed at the last SOH quarterly meeting, the proposal was revised to include detailed narratives from the six Federal agencies and the National Hydrologic Warning Council identifying their needs and support.

In developing and achieving consensus on the proposal, it is apparent that there is strong interest, across many agencies and organizations that are represented on the SOH, for establishing the Work Group and its activities related to data collection, analysis and documenting extreme storm events. Unfortunately, there is a paucity of resources to conduct the work. For example, data collection and analysis by the U.S. Army Corps of Engineers for their ongoing publication “Storm Rainfall in the United States” has been discontinued, therefore this data is not available. In the short term, the opportunities are to revisit and update a limited number of Hydrometeorological Reports (HMR) for the Southeastern U.S., using NOAA/NWS data bases for extreme storms occurring since those HMR’s were developed. This short-term work is being funded by the U.S. Nuclear Regulatory Commission in cooperation with the Department of Interior’s Bureau of Reclamation. In the long term, all of the HMR’s covering the entire U.S. need to be revisited and updated. Resources to accomplish these efforts will need to be identified and allocated.
As noted in the Federal agencies’ narratives, we recommend that the Work Group be formally approved as soon as possible. We also recommend that the SOH communicate to the Advisory Committee on Water Information (ACWI) on the paucity of resources in the Federal community to address both short-term and long-term needs for estimating extreme storm events. Guidance on estimating extreme storms is needed today to assess dam safety and nuclear facility site assessments. The Work Group could coordinate the technical bases for this guidance.

The Task Force members and I will brief the SOH members at your scheduled July 31, 2008 quarterly meeting on the proposal and our recommendations. I will provide you with slides for that presentation prior to the meeting.

Respectfully submitted;

Thomas J. Nicholson, Senior Technical Advisor
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

Enclosure:
Advisory Committee on Water Information
Subcommittee on Hydrology

Extreme Storm Events Work Group

FINAL
July 24, 2008

Charge of Work Group

I. Sponsorship:
The Extreme Storm Events Work Group (Work Group) is a working group of the Subcommittee on Hydrology (SOH) of the Advisory Committee on Water Information (ACWI).

II. Purpose, applicability, and scope:

A. Purpose. The overall purpose of the Extreme Storm Events Work Group is to coordinate studies and databases for reviewing and improving methodologies and data collection techniques used to develop design precipitation estimates of large storm events up to and including the Probable Maximum Precipitation (PMP). The Work Group will develop a detailed scope of work/plan of study, and determine the necessary funding requirements to update the Catalog of Extreme Storms and Hydrometeorological Reports (HMR) for estimating PMP. The statement of work presented below thoroughly describes the problem and issues that the Work Group should address.

B. Applicability. Extreme storm hydrometeorology studies impact extreme flood estimates and assessments for dams, nuclear power plants, levees, and other high-hazard structures within the United States. Without these studies, engineering planning and design costs will increase due to the need for site-specific studies because generalized approaches are outdated.

C. Scope. The Work Group will promote cooperation among agencies on development of design storm studies and facilitate information transfer amongst the agencies and to the public. The initial effort will be a review of extreme storm event data since 1972, and to update HMR’s for the U.S. east of the 105th Meridian. The Work Group will formulate a detailed plan to cover the remainder of the U.S. with emphasis on resolving uncertainties for PMP estimates in mountainous terrain.

III. Membership:

A. The Work Group shall have open membership from Federal/State agencies, universities, the private sector, and others with expertise in hydrometeorology.

B. During meetings, the Chair will announce and the group will act on new membership applications received at least two weeks prior to the meeting.

C. The Chair and Vice Chair will be selected from among the members. The Chair and the Vice Chair will serve two year terms ending December 31. The Vice Chair will then become Chair, and the members will elect a new Vice Chair to replace the Chair.
Also, the Vice Chair will serve in the absence of the Chair. A special election will be held if either the Chair or Vice Chair terminates their association with the work group before their terms expire.

D. Members are expected to attend, in person or by teleconference, all meetings of the Work Group. If a member does not attend at least 50 percent of the meetings in any calendar year, the Chair may remove the member from the rolls. A member can be reinstated by informing the Chair of their desire to renew their participation in the Work Group.

IV. **Meetings and Procedures:**

A. The Work Group will meet at least two times a year and more frequently as designated by the Chair. The Chair will determine the dates, times, and locations of the meetings in consultation with the members. The Chair will be responsible for announcing meetings 2 months in advance and distributing agendas and information about meetings to all members at least 2 weeks in advance of the meetings.

B. Members of the Work Group will receive no pay, allowances, or benefits from the SOH or the ACWI. All travel expenses will be borne by the individual member organizations.

C. The Work Group will conduct business in an open fashion by discussing and attempting to resolve all issues through consensus and by recognizing the legitimate interests and diverse views of the Work Group members. If complete agreement cannot be reached on a specific issue, then the following procedures will apply:

1. A consensus will exist unless one or more members request a vote.

2. Once a vote is requested, the Chair will poll the voting members. An affirmative vote of a majority of the members present will constitute approval of a motion. Two-thirds of the members will constitute the quorum necessary for a formal vote. Each member except for the Chair may cast one vote. In the event of a tie, the Chair will cast the deciding vote. The chair will record how the votes were cast.

3. The Chair will sign and forward to the Chair of the SOH decisions of the Work Group that are proposed advice, guidance or recommendations intended for implementation. Members may prepare minority reports and provide them to the Chair within 3 weeks of a decision. Such minority reports will be forwarded along with majority reports.

D. Meetings of the Work Group will be open. Each meeting will include time for individuals who are not members to make statements or to have written statements distributed during the meeting.

E. The Chair will prepare and distribute minutes with action items of Work Group meetings to members and to the Chair of SOH.

V. **Termination:**

The Chair of the SOH has the authority to terminate the Work Group in consultation with the SOH. At least 60 days notice must be provided in advance of termination.

VI. **Authority:**
The Work Group reports to the SOH of ACWI that operates under the Federal Advisory Committee Act. The Work Group will be subject to the direction of the SOH and will report activities to the SOH during their quarterly meetings.

**Statement of Work**

**Issue**

Storm-based precipitation is one of the major inputs to rainfall-runoff models, and is the dominant forcing variable that causes extreme floods. Data and methods for estimating extreme storms, up to and including the Probable Maximum Precipitation (PMP), are currently lacking. Currently, there is no mechanism in place within Federal Agencies to routinely collect, analyze, and archive extreme storm data that is useful for estimating extreme floods. In addition, there are no procedures in place to update storm data sets, methodology, and reports that are used to develop generalized PMP estimates. For example, the most recent PMP report was published in 1999 (Corrigan et al., 1999) and used data up to February 1986. Thus, extreme storms that caused major floods such as January 1997 in California, February 1996 in Oregon, January 1995 in Pennsylvania and rainfalls from Hurricanes Andrew (1992), Katrina (2005), Floyd (1999), and the 2008 Mid-West U.S. floods are not well-documented and not part of any storm catalog (e.g., USACE 1945-1973) or data set useful for flood estimation. Improved extreme storm estimates, including exceedance probability estimates of storm properties, can be used for dam safety assessments, nuclear power plant designs and assessments, risk analysis, and understanding extreme flood processes.

**Federal Role and Responsibility**

The basis for extreme storm rainfall estimates and PMP in the United States is depth-area duration (DAD) studies of notable extreme storms (e.g., USACE, 1945-; USWB, 1946). For at least the past 50 years, the U.S. Army Corps of Engineers, Bureau of Reclamation, and National Weather Service (and others) have jointly collaborated in collecting and analyzing storm rainfall data and publishing DAD data. These agencies have also collaborated in developing and improving PMP techniques. Stallings et al. (1986) describe how the cooperative studies evolved. Hansen (1987) provides a review and summary of the PMP methods that are in current use.

Federal agencies have pioneered the development of PMP and its usage for designing and assessing large dams and other structures such as nuclear power plants in the United States. In particular, the Bureau of Reclamation, Corps of Engineers and Tennessee Valley Authority own and operate many of the largest and highest hazard dams in the United States. For example, these include the Columbia River system, Upper and Lower Colorado River systems, the Tennessee Valley system, and many dams on the Missouri River and Ohio Rivers. A Federal role is required in defining and developing extreme storm techniques, up to and including PMP, for assessing these large Federal water projects using PMP and other extreme storms. In addition, the Federal Energy Regulatory Commission has a unique role as the regulatory body of non-Federal dams that produce hydropower in the United States. FERC has adopted PMP and the Probable Maximum Flood (PMF) as the base standard for assessing high-hazard dams that it regulates (FERC, 2001), similar to the Bureau of
Reclamation (Cudworth, 1989) and Corps of Engineers (USACE, 1991). The current Federal
guidelines for dam safety (FEMA, 1998) define PMP and its use.

**Extreme Storm DAD Data**

The DAD data and PMP methods are used to provide "generalized" PMP estimates over large
regions of the United States (Figure 1). The PMP estimates have been published in
Hydrometeorological Reports (HMRs) (Table 1).

![Regional coverages of generalized PMP reports in the United States](http://www.weather.gov/oh/hdsc/studies/pmp.html)

**Figure 1.** Regional coverages of generalized PMP reports in the United States (from NOAA/NWS Website: http://www.weather.gov/oh/hdsc/studies/pmp.html).

**Table 1:** Status summary of Hydrometeorological Reports (focus here is on larger generalized reports; for full listing of all HMR see: http://www.weather.gov/oh/hdsc/studies/pmp.html)

<table>
<thead>
<tr>
<th>HMR No.</th>
<th>Publication Date</th>
<th>Latest Storm Used</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>1977</td>
<td>Sept. 3-7, 1970</td>
<td>see HMR 50 (Hansen and Schwarz, 1981) for</td>
</tr>
</tbody>
</table>
Other than the storms used in the HMRs, little to no storm data have been collected and analyzed for regional or generalized PMP estimates. Some limited extreme storm data have been collected and summarized for some states (e.g. McKee and Doesken, 1997; Lanning-Rush et al., 1998) and by some consultants for site-specific PMP work. However, these data sets have not been analyzed for use in a larger region or for application to multiple structures. The data in Table 1 indicate that there is a definite need for storm data collection. There is also a lack of major storm data within an existing HMR (Figure 2, HMR 55A). There are several limitations noted in the HMRs on providing space-time estimates of PMP, especially within orographic areas. Unlike the procedures in HMR 52 (Hansen et al., 1982), there are no methods for spatially and temporally distributing PMP over a watershed for locations other than the eastern United States.
Figure 2. DAD data considered in developing PMP (HMR 55A), expressed as number of storms per year. Please note the lack of data in the 1960s and post 1978.

Problem Statement and Need

The Hydrometeorological Reports that form the basis for generalized probable maximum precipitation estimates rely on data that does not include the large storms that have occurred in the last 20 to 40 years. This creates a need to supplement these reports with site-specific analyses to incorporate the largest storms that have occurred in a particular region. Site-specific storm studies to date are done typically on an ad-hoc, individual dam or structure basis. The full benefits of these studies are not materialized, because there is no central archive for the documentation, storage, and sharing of extreme storms and related analyses. The extreme storm catalog should be expanded to include recent storms, and the HMRs should be updated to include the latest data.

An updated storm catalog is required to estimate the rainfall magnitude and spatial and temporal storm characteristics for various watersheds throughout the United States. Many agencies are using this information to develop extreme storm rainfall estimates for risk assessment and to determine the maximum flood potential at a particular location. Most of the storm information included in the extreme storm catalog was derived from published sources and supplemented with bucket survey information. Bucket surveys were used to get better definition of the rainfall magnitudes near the storm centers. Budget constraints have eliminated collection of bucket survey data in the past 20-30 years. Recent advances in use of radar reflectivity data should be examined as a source of information to supplement published rainfall data to expand the extreme storm catalog.

Many recent precipitation studies have used computer models to examine extreme storms. The HMRs use storm transposition and maximization techniques for determining generalized PMP estimates. These techniques should be compared against available computer modeling approaches that have been more recently developed. The advantages and disadvantages of each approach should be considered to determine the most appropriate approach for use in estimating extreme floods and to estimate the uncertainty in the estimates (NRC, 1994).

Impacts and Applications

The proposed studies impact extreme flood estimates and assessments for dams, nuclear power plants, levees, and other high-hazard structures within the United States. The investigations also complement ongoing rainfall frequency studies and mapping efforts by the National Weather Service. Without these studies, engineering planning and design costs will increase due to the need for site-specific studies because generalized approaches are outdated.

Work Group Tasks

1. Solicit Work Group membership from Federal and state agencies, universities (e.g. Bill Cotton, Colorado State University; Jim Smith, Princeton), professional organizations (e.g., AMS, ASCE) and others with expertise in hydrometeorology, including consultants (e.g. Mel
2. Perform a literature review. Investigate improvements to methodologies (NRC, 1988; NRC, 1994; NRC, 2005; Cotton et al., 2003) and data collection techniques.

3. Develop a detailed scope of work/plan of study, and determine the necessary funding requirements to accomplish the work. Develop a long term plan to update the extreme storm catalog and HMRs for estimating PMP. Consider use of new technologies for storm analysis and data collection and dissemination. List possible approaches for acquiring funding to implement the plan.

4. Develop a list of individual Federal agency needs.

5. Inform the SOH and ACWI of the present state of Federal funding support, and the need to develop future budget support for long-term cooperative efforts to: maintain extreme storm databases; periodic review and updating of HMR’s and the Catalog of Extreme Storms; development of site-specific studies of PMP and extreme storm event contributions to flooding, and support dam safety and nuclear facility installation evaluations.

6. Consider sponsoring an extreme storm workshop or specialty conference (e.g. at AMS, AGU, ASCE, etc.).

Identification of Federal Agency Needs and Support:

Bureau of Reclamation

Reclamation’s Dam Safety Program mission is “To ensure that Reclamation dams do not present unacceptable risks to people, property, and the environment”. As the owner of over 350 high- or significant-hazard storage dams in the western U.S., Reclamation is committed to providing the public and the environment with adequate protection from the risks that are inherent in collecting and storing large volumes of water. Traditional design and analysis methods have focused on selecting a level of protection based on spillway evaluation flood loadings, which were usually based on the Probable Maximum Flood (PMF). Many factors influence the ultimate magnitude of the PMF hydrograph, but the intensity and duration of the rainfall are the most important. Considerable analysis and discussion of the derivation and application of PMP estimates has taken place in the past. In 1981, Reclamation, the National Weather Service, and the U.S. Army Corps of Engineers adopted a mutually acceptable, uniform definition of the widely used term PMP. The PMP, as defined by these three agencies at that time, is “theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographical location at a certain time of the year.” PMP must always be termed as an estimate because there is no direct means of computing and evaluating the accuracy of the results. Since the mid-1980s, Reclamation has considered that the series of HMRs prepared and updated by the National Weather Service provide the best estimates of PMP potential within the limits of each report. The Bureau of Reclamation uses PMP estimates obtained from the NWS HMRs in order to compute PMFs for dam safety. Reclamation uses the PMF as the upper limit of flood potential at a site for storm durations
defined by the PMP. Because of this, Reclamation has a strong interest in updating extreme storm
data sets and methods used in HMRs, and to assist in updating the HMRs.

Since 1995, Reclamation has used a risk assessment process to determine an appropriate level of
public protection by evaluating a full range of loading conditions and possible dam failure
consequences. This is in contrast to the traditional approach of using upper bound events such as the
PMF, without regard to their likelihood of occurrence and without assessment of their incremental
consequences. The ideal flood inputs required for risk analysis are frequency distributions of peak
flows, volumes, and peak reservoir stages which, for dams with potentially high loss of life, might
extend to very low exceedance probabilities.

In order to make these extreme flood risk estimates, Reclamation has a need for extreme storm
rainfall frequency estimates, including point rainfall frequency, basin-average rainfall depth
frequencies and extreme storm models, up to and including PMP. Much of the applied work in this
area to date is in its infancy as applied to extreme flood and dam safety problems. Reclamation
supports developing an interagency group on extreme storms to help fulfill PMP and extreme storm
probability needs. Some specific areas that are of interest to Reclamation are: updating HMR 49;
developing a coupled radar and extreme storm catalog in the western United States; developing
spatial and temporal storm patterns for PMP in the western U.S. (like HMR 52 for Eastern U.S.);
linking regional L-moments statistical techniques with PMP; and developing and testing space-time
extreme storm probability models and concepts such as stochastic storm transposition.

U.S. Army Corps of Engineers

The US Army Corps of Engineers (USACE) is committed to insuring that its dams can safely pass
the largest meteorological events possible. USACE regulations require the use of the most recent
hydrometeorological studies available for general studies and requires Site Specific studies be
developed for unusual conditions or that are thought to need additional refinement beyond the
general studies to define specific drainage basins.

It is well recognized that large dam construction in the U.S. is not a high priority mission area at this
time. However, USACE is intensely involved in assessing their existing dams for safety and
reliability. To properly convey the hydrologic risk associated with each dam, USACE must first be
able to determine if each dam can safely pass the Probable Maximum Flood (PMF). Many USACE
dams were constructed prior to establishment of Probable Maximum Storm (PMS) data as presented
in Hydrometeorological Reports (HMR). Others were constructed in areas were historic data was
too limited to expect reasonable HMR results. Therefore, these studies must be revisited and
updated as applicable new data becomes available.

The Corps will continue the requirement to use the most accurate and up-to-date HMR studies to
properly evaluate their existing portfolio of over 600 dams or to properly design any new dams.
USACE has historically been dependant on the NWS to provide accurate and unbiased estimate of
PMS through HMR studies as well as Site-Specific Studies since the 1950's. USACE will support
SOH to the extent possible in establishing a work group to insure that interim and long term
measures are taken to complete required extreme event needs in the future. USACE will attempt to
secure personnel and/or funding to support the work group as necessary to at least provide updates or
coverage of the Continental U.S. and it Territories.
Federal Emergency Management Agency

FEMA supports the establishment of the Extreme Storm Events Work Group as part of the Subcommittee on Hydrology (SOH) of the Advisory Committee on Water Information (ACWI). The primary mission of the Federal Emergency Management Agency is to reduce the loss of life and property and protect the Nation from all hazards, including natural disasters, acts of terrorism, and other man-made disasters, by leading and supporting the Nation in a risk-based, comprehensive emergency management system of preparedness, protection, response, recovery, and mitigation. For more than 25 years, the Federal Government has been working to protect Americans from dam failure through the National Dam Safety Program (NDSP). The NDSP, which is led by FEMA, is a partnership of the states, federal agencies, and other stakeholders to encourage individual and community responsibility for dam safety.

As a member of the proposed Extreme Storm Events Work Group, FEMA will participate in reviewing proposed methodologies and data collection techniques used to develop design precipitation estimates of large storm events up to and including the Probable Maximum Precipitation (PMP). Support for research on hydrometeorology related to dam safety is also available from FEMA in a limited capacity, through the NDSP.

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) is responsible for the safety and adequacy of 2523 non-Federal, jurisdictional dams. The Commission, through its dam safety program requires regulated dams to have adequate spillway capacity to pass the project’s Inflow Design Flood (IDF). The IDF is the flood flow above which the incremental increase in flow and water surface elevation due to a failure of a dam or other water impounding structure is no longer considered to present an additional, unacceptable threat to downstream life or property. The PMF is the upper limit of the IDF analysis. Thus the Commission has an interest in any coordinated effort to review extreme storm data and update HMR’s for use in extreme storm development. Currently the engineering profession is developing PMF values for extreme storm events based on outdated storm information. The Commission supports the efforts of the Extreme Storm Events Work Group to promote the cooperation and coordination among agencies to improve methodologies and data collection techniques to develop estimates of large storm events up to and including the Probable Maximum Precipitation (PMP).

U.S. Nuclear Regulatory Commission

To comply with U.S. Nuclear Regulatory Commission (NRC) requirements, applicants for new nuclear plants must demonstrate the ability of their proposed facilities to withstand the Probable Maximum Flood (PMF). This demonstration is scrutinized by the NRC internally and through a public review process. To assist in this effort, the NRC Staff is updating technical guidance on “Design Basis Floods for Nuclear Power Plant Sites” as documented in Regulatory Guide 1.59 (RG 1.59). This guidance provides information for evaluating conditions resulting from the worst site-
related flood probable at a nuclear power plant [e.g., PMF, seismically-induced flood, hurricane, seiche, surge, heavy local precipitation] with attendant wind-generated wave activity. These events and their resulting conditions constitute the design basis flood that safety-related structures, systems, and components identified in NRC regulatory guidance must be designed to withstand.

A key input to the determination of the PMF for a particular reactor site is the Probable Maximum Precipitation (PMP) for the hydrologic unit within which the nuclear power plant is to be located. Many extreme storm events have occurred since the issuance of Revision 2 to RG 1.59 in 1977, and they need to be evaluated in updating regulatory guidance. The NRC Staff needs to review and update its technical bases, specifically NOAA's HydroMeteorological Reports (HMR) for estimating PMP for specified areas, durations and seasonal variations. The NRC Staff intends to support Federal Interagency efforts to update these reports. These updates will provide the technical basis for the NRC to develop guidance for license applicants on acceptable methods and data sources for estimating and using PMP to calculate Probable Maximum Floods.

The NRC has proceeded to begin funding Interagency Agreements with other Federal agencies to acquire the latest knowledge and data on PMP and extreme storm events. Currently these research studies focus on updating HMR 52 since most of the proposed new plants are in the southeastern U.S. This effort should be incorporated into the proposed standing Work Group on Extreme Storm Events of the Subcommittee on Hydrology.

U.S. Geological Survey

The Mission of the U.S. Geological Survey (USGS) is to provide reliable, impartial, timely information that is needed to understand the Nation’s water resources. The USGS maintains a leadership role in the development and application of techniques for analysis of flood frequency, hydrologic and water-quality trends, regionalization, and geomorphologic response. The accurate regional and temporal characterization of extreme precipitation is essential to this work. Precipitation is the starting point for many hydrologic models and analytical tools for the analysis of precipitation intensities and distributions are closely allied with those used in analysis of flood and flow-duration frequencies. Innovations in one sphere can lead to new developments in the other. Hence, the USGS supports the establishment of the Extreme Storm Events Work Group, commits to participating in its advisory and coordination activities, and will aide the development and testing of methods and protocols developed under its purview.

National Hydrologic Warning Council

The National Hydrologic Warning Council (NHWC) has an explicit interest in the activities of the Task Force on Extreme Storm Events. The importance of the use of Probable Maximum Precipitation (PMP) and corresponding Probable Maximum Flood (PMF) estimates in the design of major reservoirs has long been established. NHWC members and affiliates do operate reservoirs. Consequently, we are most interested in the impacts of any proposed changes to design and safety standards for dams. We are also concerned with reducing the potential for injuries, deaths, and property damage caused by floods. One way to accomplish this goal is by effective use of community-based flood warning systems. Our annual conferences afford an opportunity to be aware of all of the latest developments associated with early flood detection and warning systems. The
NHWC maintains a close association with private sector vendors, consultants, and government agencies involved with the business of flood warning systems. However, the NHWC is newly formed and currently unable to support Task Force activities financially.

**Natural Resources Conservation Service**

The United States Department of Agriculture's Natural Resources Conservation Service (NRCS) is active in the construction and rehabilitation of small dams which are or were constructed under various programs administered by the NRCS.

The dam design criteria utilized by NRCS (Technical Release No. 60), specifies use of Probable Maximum Precipitation (PMP) estimates obtained from the National Weather Service's Hydrometeorological Reports (HMRs), or ratios of the PMP storm events, to hydrologically size dams and other hydraulic control structures in order to convey large storm events safely for the protection of property and people living downstream of such dams. The HMRs currently in use were developed in the 1950's and few updates have occurred since that time. Since then, additional large storms have occurred which should be factored into the PMP analysis and technological advancements have occurred which should be incorporated into PMP analysis procedures.

NRCS supports the establishment of an Extreme Storm Events Work Group as part of the Subcommittee on Hydrology (SOH), a subcommittee of the Advisory Committee on Water Information (ACWI). NRCS commits to work group participation; serving as advisors to the work group; and assisting with the assessment and review of data collection techniques and potential methodologies for analyzing PMP.

**Bibliography**


U.S. Army Corps of Engineers (USACE) (1945 - 1973) Storm Rainfall in the United States (ongoing publication). Washington, D.C.


Additional information sources are:

Links to NWS Sites on Precipitation Analyses:

Precipitation Frequency Data Server (PFDS) (http://hdsc.nws.noaa.gov/hdsc/pfds/)

Probable Maximum Precipitation (PMP) Documents
(http://www.nws.noaa.gov/ohd/hdsc/studies/pmp.html)