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Operations and Services
Hydrologic Services Program, NWSPD 10-9

HYDROLOGIC SERVICES PROGRAM MANAGEMENT

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SUMMARY OF REVISIONS: This directive supersedes NWS Instruction 10-901, "Hydrologic Services Program Management," dated March 30, 2005. The following revisions were made to this instruction:

1) Adds sentence at the end of Section 2.2 stating "The OHD Director acts as the NOAA Hydrology Program Manager."
2) Moves old Section 3.1 (WFO/RFC/NCEP Operational Relationship) to the end of Section 2 (Hydrologic Services Program Activities) and renumbers it to 2.9.
3) Changes name of Section 3 to "Interdisciplinary Programs."
4) Renumbers old Section 3.2 (Advanced Hydrologic Prediction Service) to 3.1.
5) Adds new Section 3.2 entitled "Water Resources Information Program."

(Signed) August 29, 2007
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Acting Director, Office of Climate,
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Hydrologic Services Program Management

Table of Contents Page

1. Introduction. National Weather Service (NWS) Policy Directive 10-9 provides the high-level policies for the Hydrologic Services Program. This instruction explains how NWS Policy Directive 10-9 is implemented by providing a more detailed description of headquarters and field office activities required to support and carry out operations of the Hydrologic Services Program.

2. Hydrologic Services Program Activities. The Hydrologic Services Program is managed in accordance with Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), and NWS policies. The Assistant Administrator for Weather Services has final management authority over the Hydrologic Services Program. Under oversight of the Assistant Administrator, several organizational units are responsible for aspects of the Hydrologic Services Program as identified in the following sections. Mission statements for these organizational units are provided in the NOAA Organizational Handbook.

2.1 Office of Climate, Water, and Weather Services. The Office of Climate, Water, and Weather Services (OCWWS) is responsible for a wide variety of activities which support the NWS Hydrologic Services Program. OCWWS accomplishes these responsibilities through functions of its divisions as described in the following sections.

2.1.1 Hydrologic Services Division. In coordination with NWS regions, the OCWWS Hydrologic Services Division (HSD, a.k.a. national HSD) manages the NWS hydrologic services program through the following activities:

a. Outreach - conduct and participate in national-level outreach activities with partners and other users. This includes coordinating issues and activities related to hydrologic services with NWS headquarters offices, Congressional offices, government agencies, and other users.

b. Service requirements - compile and evaluate requirements received through national-level outreach activities and integrate them into national policies, plans, and requirements specifications.

c. Field office requirements – assimilate field office requirements for hydrologic software systems acquired by the regional headquarters and others and provide them to the Office of Hydrologic Development. National HSD also provides appropriate developmental and management entities with requirements for computational hardware, communications, staffing, facilities, and observing systems needed by the Hydrologic Services Program.

d. Service and operations policy - develop and maintain hydrologic service and operations policy through the National Directives System and other mechanisms.

e. Service and operations planning - develop strategic plans for the enhancement and evolution of NWS hydrologic services and operations.

f. Hydrologic systems support services - provide on-call support services for hydro-meteorological forecast systems used in river forecast centers (RFC) and weather forecast offices (WFO).

g. Hydrologic data network services - work with other NWS entities and partners to maintain and expand the data network required for hydrologic forecast and warning services. This includes leading the Integrated Flood Observing and Warning System (IFLOWS) program.

h. Training - Assimilate hydrologic training requirements of field office personnel and ensure development of needed national training. Also assist in the provision of hydrologic services-related training for field office personnel.

i. Hydrologic remote sensing - provide remotely-sensed hydrologic data products used by WFOs, RFCs, National Centers for Environmental Prediction (NCEP), and other partners and users through the National Operational Hydrologic Remote Sensing Center (NOHRSC).

j. National hydrologic information - provide information on national hydrologic conditions through the Hydrologic Information Center.

2.1.2 Meteorological Services Division. The Meteorological Services Division supports the Hydrologic Services Program by managing NWS weather services programs, serving as the primary link between the NWS and weather-sensitive industries, and developing the plans, policies, and procedures for weather operations and services which support hydrologic forecast and warning operations.

2.1.3 Climate Services Division. The Climate Services Division supports the Hydrologic Services Program by developing the plans, policies, and procedures for climate and long-term weather forecasting services. They also oversee long-term forecast services which incorporate hydrologic information such as drought information statements.

2.1.4 Performance and Awareness Division. The Performance and Awareness Division supports the Hydrologic Services Program by conducting verification for river forecasts and flood/flash flood warning products. The Performance and Awareness Division manages the National Precipitation Verification Unit, which is responsible for verification of national quantitative precipitation forecast (QPF) products. The division also supports hazard awareness activities for extreme hydrologic events and manages the service assessment process initiated after events causing substantial loss of life and/or property such as regional floods.

2.1.5 Training Division. The Training Division supports the Hydrologic Services Program by overseeing the annual process of allocating training resources for hydrologic science, operations, and services. The Training Division's branches (NWS Training Center, Warning Decision Training Branch, and the Forecast Decision Training Branch (FDTB) at the Cooperative Program for Operational Meteorology, Education, and Training (COMET)) provide instructional resources covering operational hydrology. Close coordination occurs with COMET, particularly with a dedicated COMET Branch hydrologist developing and providing coursework in hydrologic/hydrometeorologic science.

2.1.6 Observing Systems Division. The Observing Systems Division supports the Hydrologic Services Program by maintaining standards, policies, procedures, and plans for NWS surface and upper air observing services. Many of these observing systems provide data used in hydrologic operations and services.

2.1.7 Operations and Requirements Division. The Operations and Requirements Division supports the Hydrologic Services Program by processing requirements for the NWS systems infrastructure which supports hydrologic operations and ensuring they are addressed.

2.2 Office of Hydrologic Development. The Office of Hydrologic Development (OHD) supports the Hydrologic Services Program by developing and maintaining hydrologic/hydrometeorologic models, systems, and procedures in response to requirements provided by the national HSD. OHD manages the development and implementation of the national web portal providing access to Advanced Hydrologic Prediction Service (AHPS) products and information. OHD maintains the operational system used to provide operational data to NWS field offices –

the Hydrometeorological Automated Data System (HADS). In collaboration with outside research institutions, cooperating agencies, RFCs, WFOs, and NCEP, OHD conducts applied research activities needed to infuse new hydrologic science into the operational hydrologic systems at field offices. OHD roles and responsibilities in managing RFC development are described in directives under NWS Policy Directive 80-7, *River Forecast Center Development Management*. The OHD Director acts as the NOAA Hydrology Program Manager.

2.3 Office of Science and Technology. The Office of Science and Technology (OST) has overall responsibility for plans, programs, and development in NWS science and technology activities. OST plans and develops applications providing observed and forecast information used in hydrologic operations. The Meteorological Development Lab (MDL) within OST develops WFO applications used to produce selected hydrologic watch/warning/advisory products. MDL supports the Model Output Statistics (MOS) software, which provides temperature forecast guidance used as input to RFC hydrologic models. OST also supports the Hydrologic Services Program by ensuring that hydrologic technologies and applications developed by the OHD are integrated into operational NWS systems and by addressing requirements for system upgrades to accommodate hydrologic needs.

2.4 Office of Operational Systems. The Office of Operational Systems (OOS) is responsible for managing NWS operational systems. OOS supports the Hydrologic Services Program by managing NWS observing, forecasting, and dissemination systems required to conduct hydrologic operations and provide services. OOS also manages the acquisition of large-scale systems which host operational hydrologic forecasting systems.

2.5 Regional Headquarters. Each regional headquarters has staff managing a regional hydrology program. Alaska Region provides hydrologic support for the Pacific Region. The regional director is the first-line supervisor of regional division chiefs, RFC hydrologists in charge (HIC) and WFO meteorologists in charge (MIC) and assigns hydrology program responsibilities for the region. Regional hydrology program responsibilities include but are not limited to:

a. Oversight of hydrologic service delivery - monitor and assess the practices, local policies, and performance of the hydrology program at each RFC and WFO in the region. This includes support for service hydrologist program leadership activities.

b. Forecast improvement - direct and support improvements to RFC and WFO hydrologic modeling and forecast operations. This includes supporting hydrometeorological operations such as those for QPF and flash flood as well as overseeing routine WFO/RFC interactions and longer-term collaborative activities.

c. Training - facilitate training activities specific to local field office requirements and hydro-climatologies in the region.

d. Policy/procedure implementation - develop supplements to national directives for the Hydrologic Services Program. Ensure WFO and RFC compliance with regional directions on hydrologic/hydrometeorologic operations and services provided in supplements as well as all applicable national directives.

e. Service, science, and operations planning - develop strategic plans for hydrologic service and science improvements within the region.

f. Outreach - represent NWS, NOAA, and DOC in regional intra-agency, inter-agency, and river basin commission activities. Receive and assimilate service requirements from partners and other users in the region.

g. National requirements - assimilate hydrologic systems and services requirements from WFOs and RFCs, conduct intra-regional coordination, and provide requirements to national HSD per the established process. Coordinate regional data requirements and resolve hydrologic/hydrometeorologic data problems affecting hydrologic operations in the region's WFOs and RFCs.

h. Regional requirements - work with WFOs and RFCs to establish regional requirements (e.g., for data, hardware, etc.) for provision of hydrologic services. Work with other regional staffs to meet these requirements.

i. Information exchange - work with WFOs, RFCs, and other regional headquarters to facilitate the sharing and exchange of information, procedures, software, and related items between field offices and regions.

j. National headquarters interactions - represent Hydrologic Services Program concerns of the regional director and field offices to the NWS headquarters and provide regional input to procedures, plans, proposals, training, and other products developed by NWS headquarters.

k. Service assessment - provide assessments of field office performance during significant hydrologic events to the regional director and/or NOAA/NWS management as appropriate.

Other regional headquarters functions support the hydrology program in areas such as training, observation/data collection, climate, verification, and system operations.

2.6 National Centers for Environmental Prediction. The NCEP collects global meteorological data and uses it to generate a wide variety of environmental guidance information. Individual national centers support the Hydrologic Services Program through activities briefly summarized as follows:

a. NCEP Central Operations executes the numerical analysis and atmospheric forecast models and ensembles of models used in everyday hydrometeorological analysis at RFCs and WFOs.

b. The Hydrometeorological Prediction Center (HPC) produces the forecaster-developed QPF and probabilistic QPF (PQPF) products for all types of weather systems, including tropical systems. These QPF products are used as guidance by RFC forecasters, and after possible editing to account for local hydrometeorological conditions, serve as input to RFC models. The HPC provides gridded QPFs to WFOs, which serve as a starting point for production of QPFs for local use. The HPC also produces other products which assimilate hydrometeorological information on a national basis, including a flood outlook product and a flash flood hazards product.

c. The Environmental Modeling Center develops, maintains, and improves the atmospheric models which produce the graphical and numerical output (e.g., forecast precipitation and temperature) used in short- and medium-term AHPS products.

d. The Climate Prediction Center provides products quantifying how precipitation and temperature is expected to deviate from climatic averages through the long-term forecast period.

e. The Storm Prediction Center produces event-based, short-term rainfall rate forecasts.

f. The Tropical Prediction Center provides official NWS forecasts for the movement and strength of tropical weather systems.

2.7 River Forecast Centers. Each RFC conducts continuous hydrologic modeling of river basins, provides hydrologic forecasts and guidance, and carries out liaison activities with partners. RFCs assimilate hydrologic/hydrometeorologic data and forecasts from multiple sources including the NCEP, WFOs, and other partners, and use this information in real-time hydrologic modeling and forecast operations. Each RFC provides a range of hydrologic forecast and guidance products for one or more major river basins to WFOs and selected water agencies. Each RFC supports multiple WFOs. RFC operations are described in NWS Instruction 10-911, *River Forecast Center Operations* and RFC products and services are described in NWS Instruction 10-912, *River Forecast Center Products Specification*.

2.8 Weather Forecast Offices. Each WFO provides hydrologic forecasts, warnings, and related products to partners and other users for its local area of responsibility. As part of an integrated mode of operations, the entire WFO operational staff participates in hydrologic activities, including issuing routine hydrologic products and collecting and quality controlling the hydrologic/hydrometeorologic data. WFO hydrologic operations are described in NWS Instruction 10-921, *Weather Forecast Office Hydrologic Operations* and WFO hydrologic

products and services are described in NWS Instruction 10-922, *Weather Forecast Office Hydrologic Products Specification*.

2.9 WFO/RFC/NCEP Operational Relationship. Managers at WFOs, RFCs, and the NCEP should encourage operational interactions between their operational staffs while recognizing the uniqueness of each entity's operations. Hydrologic modeling and hydrometeorological data technologies developed by the OHD are vital in supporting these interactions. The goals of these interactions are to further the NWS mission by: (1) integrating interrelated aspects of hydrologic and meteorologic science into WFO, RFC, and NCEP operations; (2) encouraging hydrometeorological collaboration activities between WFOs, RFCs, NCEP, and the OHD; and (3) supporting integrated operations, where appropriate, within field offices.

WFOs, RFCs, NCEP, and OHD should collaborate in the development of hydrometeorological applications such as flash flood models, precipitation processing algorithms, and QPF techniques. They should maximize the routine sharing of support, data, forecasts, and other information and collaborate in the development of procedures to enhance such exchanges.

NWS hydrologic forecasts on the short-term (out to 7 days), medium-term (7 out to 14 days), and long-term (2 weeks out to 3 months or more) time scales are heavily dependent on the effective coupling of hydrologic and meteorologic observations and forecast information from WFOs, RFCs, and NCEP. Quantitative precipitation estimates (QPE) from radar, satellite, and ground-based observations; snowpack information; QPF; temperature forecasts; and forecasts for other hydrometeorological variables serve as critical input to the hydrologic modeling process for all time scales. Extended-range meteorologic forecasts and predictions from global climate models are important input to long-term hydrologic forecasts.

The operational coupling of hydrologic and meteorologic observations and forecasts for all time scales requires effective real-time coordination between the RFCs, WFOs, and NCEP. The RFC hydrometeorological analysis and support (HAS) function is the catalyst for this coordination. However, RFC, WFO, and NCEP managers should ensure this coordination occurs through a team effort of their entire staffs. Key hydrometeorological coordination activities of these three partners can be summarized as follows:

a. NCEP - provision of discussions and related products on current/forecast meteorological conditions and hosting of coordination conference calls during significant weather events.

b. RFCs - production of discussions on current/forecast hydrologic conditions and notification of WFO and NCEP forecasters of important changes in current or forecast streamflow conditions. RFC coordination activities also include supporting WFO site-specific hydrologic modeling operations and providing technical expertise on hydrologic events and other water-related issues.

c. WFOs - notification to RFCs when changing hydrometeorological conditions or special observations indicate the need for updated hydrologic forecasts and when data quality problems have been identified at specific gage locations.

Other joint coordination activities between these partners which managers should encourage include: pre-event conference calls, site visitations, joint training, workshops, collaborative research projects, flood drills, and collaborative preparation of long-term outlooks.

3. Interdisciplinary Programs. The special hydrometeorological relationships and interdisciplinary programs described in this section need the support of all managers participating in the Hydrologic Services Program.

3.1 Advanced Hydrologic Prediction Service. AHPS is a national effort to provide enhanced hydrologic information and products through the infusion of new science and technology. The goal of AHPS is to improve river forecasts and flood warnings nationwide to meet the diverse and evolving needs of partners and other users. While it is a budget initiative with a defined life span and an accompanying set of goals, managers involved in the Hydrologic Services Program should address AHPS as an effort to modernize and energize all aspects of hydrologic services provided to partners and other users.

The AHPS program is managed by the OHD. The AHPS Program Manager in OHD conducts planning, administers the budget, and guides and tracks implementation for the program. National HSD assimilates service, science, and operational requirements for AHPS originating from the NWS field offices and provides prioritized requirements to OHD. National HSD also develops general operations concepts for AHPS as well as other plans for specific AHPS components. Program planning, oversight, and resource allocation for AHPS is provided by the AHPS Review Committee (ARC). The ARC is comprised of representatives from NWS regional headquarters as well as OCWWS, OHD, OST, and NCEP.

3.2 Water Resources Forecasting. The Water Resources Forecasting activity builds on AHPS and other NOAA services and delivers new services at a higher resolution (down to the neighborhood scale) with more information; such as soil moisture, soil temperature, snow pack, and surface runoff volume. It enables NOAA to provide nationally consistent water quantity and quality condition forecasts via: 1) a national digital database which assimilates hydrometeorological data and observations, and 2) a high resolution hydrologic modeling system which brings the current state of science to NWS hydrology.

The national digital database will integrate fresh water resource observations and analysis components such as precipitation estimates, snowpack analysis, and soil moisture data. The goal of this database is to increase the amount, type, and accuracy of water resources information for use within the NOAA and by partners and other users.

The high resolution hydrologic model, known as the Community Hydrologic Prediction System (CHPS), engages NOAA and the external (federal and non-federal) research community in the advancement of water prediction science. CHPS builds on existing modeling capabilities, standard protocols, and open data exchange standards to develop a common suite of tools for

making water predictions. CHPS will facilitate the sharing of data and algorithms between government, university, and private sector research groups. The goal is to use CHPS to develop and infuse new science to produce a new suite of high-resolution forecasts (including estimates of uncertainty) for streamflow, soil moisture, soil temperature, water quality, and many other variables directly related to watershed conditions.

3.3 Flash Flood Program. The NWS Flash Flood Program was originally implemented in 1970. According to Operations Manual Letter 74-8, *Management of the Flash Flood Program*, dated March 21, 1974, the program was implemented "to provide a flood warning service when timely stage forecasts cannot be provided by river forecast centers." This led to a program based largely on watch/warning products for areas (e.g., counties), issued by weather offices and supported by areal RFC products known as flash flood guidance. Because heavy precipitation from convective weather systems is the primary cause of flash floods, and watches and warnings are most often handled on an areal basis like other weather events, a meteorological perspective has historically prevailed in the Flash Flood Program.

Collaborative efforts to improve flash flood guidance, QPF, and QPE have led to more timely areal flash flood products. However, forecasting technologies which improve the site-specificity and information content of warning products are allowing flash flooding to be increasingly addressed from a hydrologic perspective. These technologies include:

a. The Flash Flood Monitoring and Prediction (FFMP) function, which provides the ability to pinpoint individual basins threatened by flash flooding.

b. The Site-Specific Hydrologic Prediction (SSHP) function, which allows products to include stage/flow forecasts for specific locations in small stream basins.

c. Distributed rainfall-runoff models, which allow hydrologic processes to be more realistically simulated in stream basins of all sizes.

AHPS supports these and other technologies used in the Flash Flood Program. National headquarters, regional headquarters, and field offices should account for the increasing role of hydrologic science, technology, and services in determining the support infrastructure for the Flash Flood Program.