NWS-CR-TA-88-30

CRH SSD
AUGUST 1988

CENTRAL REGION TECHNICAL ATTACHMENT 88-30

LOCAL WARNING FLASH FLOOD PROGRAMS

Lawrence L. Longsdorf
North Central River Forecast Center
Minneapolis, Minnesota

Local Warning Flash Flood Programs (LWFFP's) are fairly common within Central Region, yet very few LWFFP's are classified as complete. The best procedure for initiating a community warning plan is to allow the nearest National Weather Service (NWS) field office (i.e., Weather Service Forecast Office (WSFO), Weather Service Office (WSO)) to be the LWFFP coordinator. One problem with this concept is that, in general, communities don't completely understand the importance of establishing and implementing an LWFFP. When the WSFO and/or WSO take an extremely active part in community affairs (such as at Rochester, Minnesota), it may not be necessary to have a complete LWFFP (although it is recommended). Furthermore, using the Rochester WSO as a case in point, multi-LWFFP's operated from a central point seem to provide adequate community flash flood warning capabilities. Unfortunately, in many communities adequate warning response plans do not exist. For a community to provide themselves with a completed operational response plan, it is necessary that they implement the requirements listed in the Memorandum of Understanding (MOU) (National Weather Service, 1985).

Consider a case where an LWFFP was initiated following a flooding episode. Flint, Michigan had a heavy rainfall event in September, 1986 centered over the north side of town. Prior to the storm and resultant flooding, there was little concern over a community LWFFP. The city, because of its involvement in the operation of the water treatment reservoirs, generally believed themselves to be prepared to monitor and respond to a heavy rainfall event. The operation of the Flint reservoir system is based upon river gage data only. After the flooding, the city sought to install a fully automated data collection system to warn themselves in the event of a repeat flood. After reviewing their present flood warning operations and cost of the automated equipment and maintenance, they concluded that a manually-operated system would adequately upgrade their existing system. Thus, the beginning of the first complete LWFFP within the NCRFC's area of responsibility was initiated.

This system (the Flint, Michigan LWFFP) was dedicated during Flash Flood Awareness Week, 1988. The Flint system collects rainfall data from observers, obtains current basin indices from the Flint WSO (Black, 1988), computes average basin rainfall, applies these inputs to flood advisory tables (FAT) furnished by the NCRFC to determine the magnitude of the flood threat. The flash flood warnings are issued internally to the appropriate Flint city departments and law enforcement agencies. Time permitting, city coordination with the Flint WSO is encouraged.

Response to the internal warning is based upon the predetermined community response plan. The entire operational mode of the Flint LWFFP is covered by a MOU between the city and the NWS. As such, the city becomes a partner with the NWS in providing the internal warnings. The NWS continues to issue watches, warnings, and statements to the public, according to the severity of the hydrometeorological threats.

Computation sheets (Appendix) offer the community a method of performing the basic hydrology used to compute rainfall/runoff. When properly used and filed, they become a record on which to update the FAT's. Thus, a complete LWFFP offers a written document on which to base a flash flood warning, the response to the warning and a history upon which to improve the system.

WSFO's and WSO's have found varying degrees of success using LWFFP's associated with local communities. For instance, in Grand Rapids, Michigan, the local emergency service agency is very active. There are four streams where FAT's have been constructed with indices furnished by the NWS. The Grand Rapids emergency agency activates the response plan on the basis of the indices information. Other cities, such as Mahnomen, Minnesota, maintain their system using indices furnished by the NWS through the local WSO. Furthermore, WSFO's such as Des Moines are also active as community coordinators. They assisted the city of Des Moines in switching from a local manually operated system to a fully automated system. The fully automated alert system now coming on line will ensure the continuous flow of hydrologic data to the appropriate agencies.

Throughout the NCRFC's area of responsibility, communities are continually upgrading their LWFFP's to meet the ever present threat of flash flooding. Federal, state and local governments are recognizing the economic benefits of timely warnings and predetermined response plans. Even though the NWS issues public flash flood warnings, the public is demanding adequate response plans to complete LWFFP's.

Acknowledgements

The author acknowledges and thanks Ed May (Service Hydrologist, Des Moines WSFO), Gary Charson (Service Hydrologist, Ann Arbor WSFO), Dean Braatz (HIC, North Central RFC), and Lee Larson (Regional Hydrologist, Central Region) for their review and comments for this technical attachment. Special thanks to Mrs. Kathy Giese for her efforts.

References

Black, L., 1988: MBRFC Method of Computing Flash Flood Indices, Central Region Technical Attachment 88-12. NWS Central Region Scientific Services Division, Kansas City, MO.

Longsdorf, L., and D. Braatz, 1983: A New Approach to Providing Lead Time During a Flash Flood Event. Preprints, Fifth Conference on Hydrometeorology, Amer. Meteor. Soc., Boston, 60-64.

National Weather Service, 1985: Local Flood Warning Systems. National Weather Service Operations Manual Chapter E-12, National Weather Service Office of Hydrology, Silver Spring, MD.

APPENDIX

Flood Estimates Based Upon Rainfall

The plotting map is designed as an aid for determining estimated weighted basin rainfall. The indexes furnished by the NWS should be plotted on the map and routinely updated. As rainfall reports are received, they are compared to the respective flood index to determine whether or not it is necessary to compute the weighted basin rainfall. Estimates of the weighted basin rainfall should not be based upon the maximum rainfall report received. Otherwise, an overforecast of the river stage will be made. When the rainfall amounts exceed the index, they are transferred to the computation sheet along with the time the rainfall began. A sample computation sheet and a flash flood table are furnished for Swartz Creek, Flint, Michigan.

Flash Flood Computation Sheet

Whenever rainfall amounts exceed or are expected to exceed the flood index, collect and record the observed rainfall and the beginning time of rainfall on the flash flood computation sheet. Zero observations should also be recorded. The observed rainfall is then multiplied by the weighting factor to obtain the weighted rainfall. The sum of the weighted rainfall amount gives the weighted basin rainfall. The beginning times of the rainfall are averaged to provide an estimate of time zero.

The next step in this example is to enter the Swartz Creek Flood Advisory Table with the current index along the line marked "flood stage" and move up or down that column to match the weighted basin total as computed. The expected flood crest stage is obtained by reading across to the left. The number of hours from beginning of rainfall as reported by the observer to when the creek will reach flood stage is obtained by reading to the right. The number of hours to the expected crest stage is noted on the top of the table. Record these numbers on the forecast summary table.

FLOOD COMPUTATION WORKSHEET

Swartz Creek

Date__________

Flood Index__________

Observer/Phone	Observed Rainfall	x	Weight Factor	=	Weighted Rainfall	Beginning Time of Rainfall
Swartz Creek	________		.25		________	__________
Bishop Airport	________		.25		________	__________
Mundy Township	________		.50		________	__________
City of Fenton	________		.10		________	__________
Weighted Basin Total					________	__________

Forecast Summary Table

Location	Expected Time to Flood Stage	Crest Forecast	Expected Time of Crest
Swartz Creek	__________	________	________

Location	Actual Time To Flood Stage	Actual Crest Stage	Actual Time of Crest
Swartz Creek	__________	________	________

Permanent File

Whenever the computation sheets are used and flood forecasts are issued, they should become part of a permanent file. This will allow the NWS to update and adjust the tables as necessary.