

NAI How-to Guide for Flood Warning & Response Case Study: Our Lady of Lourdes Hospital's Flood Mitigation and Flood Response Plan

Our Lady of Lourdes Hospital was founded in Binghamton, New York in 1920. The hospital was built on donated land, which was unfortunately located in the Susquehanna River floodplain. In June 2006, the then flood of record inundated the ground floor. As reported by Anne Wolanski, the hospital's risk manager, "I'm walking through the ground floor with boots up to my knees and taking pictures. It was like walking through the Titanic. Just unbelievable."



Our Lady of Lourdes Hospital, September 2011 – Photo by Griffiths Engineering, LLC

As the waters rose and it became clear the hospital would have to evacuate its 150 patients, emergency medical service crews from the area were called in to take everyone to safety. The hospital was out of operation for only 10 days, but that is too long for a critical facility. Damage was estimated at \$20 million. The power plant, emergency generators, fuel tanks and water supply sustained severe damage.

Moving the complex was out of the question, so a mitigation and emergency operations plan was put together and funded with FEMA and state grants, and insurance payments.

Mitigation: Mitigation measures included a \$7 million 1,365-foot-long floodwall built to the 500-year flood elevation, and stop logs at indoor locations in case the floodwall fails or is overtopped. The floodwall has six openings that automatically close with floodgates that rise when flooded. They do not require human intervention or power and remain hidden beneath the entryways, allowing unimpeded access.



The hospital complex, September 2011. The yellow parts of the wall are the floodgates.

– Courtesy of Our Lady of Lourdes Hospital

In September 2011, three months after the wall and floodgate system were completed, Binghamton was hit by Tropical Storm Lee. Floodwaters went 2.7 feet higher than in 2006, and 2,000 buildings in the area were flooded. However, as seen on the previous page, the wall worked. While the riverside parking lots flooded, there was minimal damage to the facility. Elective surgeries were cancelled, but otherwise Our Lady of Lourdes continued to serve the community at full capacity.

Flood Emergency Response Plan: The hospital has had a Flood Emergency Response Plan since 2002. It describes the general situation and overall approach, followed by three pages of a Flood Plan Matrix, which has specific actions to take at different flood levels.

Here are excerpts from the general part. Note the references to what happens at different elevations.

Based on engineering studies, past history and risk assessments guidelines, flood level stages have been determined that will guide the hospital in assessing the need to initiate the Flood Emergency Response Plan (FERP). Those steps include notifying appropriate staff, contacting stand-by services, activating the floodwall gates, activating additional pumps and when essential, preparing for patient evacuation. The existing floodwall will prevent water from entering the hospital or power plant facilities unless the flood exceeds the 500-year flood level (845'). Should the water level exceed 846', the internal flood mitigation system (logs) will provide a secondary method of protection. The logs consist of aluminum beams stored inside the hospital in the maintenance area and may be installed in strategic locations within the ground floor area should the need arise..."

At a minimum of once per year the FERP will be tested through a dry run to test each step of the plan.

<u>Flood Level Stages</u>	100-Year Flood Plain	840' above sea level
	500-Year Flood Plain	845' above sea level
<u>Facility Elevation Levels</u>		
Utility Tunnel		830' above sea level
Seton (Ground)		839' above sea level
Power Plant		841' above sea level
West and Ross Ground Wings		844' above sea level
MOB I Ground		844' above sea level...

Broome County Emergency Operations Center is the most reliable source of information to Lourdes regarding potential flooding. Flood notifications are faxed to administration, facilities and emergency departments at any time during the day or night, as well as direct phone communications when situations warrant immediate communication.

Depending on the particular weather event that may cause flooding, the warning time may vary. Flooding due to excessive rain is likely to afford more lead time to prepare the facility. Ice jams provide much less warning time. However, Lourdes' floodwall provides significant protection for any flood event. The focus of this plan is to address the supplemental actions required, such as: relocation of parking, activation of the floodgates and initiation of the incident command system, should a flood occur...

Essential components to the plan will include:

- 1. Once the National Weather Service issues a flood warning for major local rivers, the FERP will be activated.*
- 2. Notification of the Administrator on Call (AOC), Clinical Manager or the Hospital Safety Officer who may activate the Incident Command Center. Continual communication with Broome county Emergency Operations Center to gauge river levels.*
- 3. If deemed necessary, coordination activities related to alternate parking and transportation for employees, patients and visitors.*
- 4. Closing of all floodgates at the floodwall.*
- 5. If determined necessary, initiate the internal installation of a flood mitigation system (logs) that are designed to protect the Radiation Oncology Laboratory, phone switch, and the bank of five elevators from flooding.*
- 6. Ground floor departments will begin preparations to implement their individual flood plans upon direction from the Incident Commander. Efforts must be made throughout the plan activation to protect equipment, supplies, records, and other vital property as well as patients, visitors and associates...*

The Incident Commander, Director of Facilities Management/Safety Officer, Risk Management and Emergency Preparedness Coordinator are responsible for critiquing the incident within 72 hours, and providing a copy of the critique to the Environment of Care Committee.

Flood Plan Matrix: As noted in the FERP,

The matrix is intended as a guide to decision making as water levels rise. The incident commander and others assuming roles under the Hospital Incident Command System may initiate the various guideline actions as conditions warrant.

Excerpts appear on the next two pages. Note there are three water levels for each action: the elevation at the site and the stage readings at the upstream Washington Street gauge and the downstream Vestal gauge. The Lourdes gauge is above sea level while the Washington Street and Vestal gauges are river-stage gauges.

Flood Plan Matrix Excerpts

Water Level			Status	Objective	Action Guidelines
Lourdes	Washington St.	Vestal			(Any step below can be accelerated depending on the situation, and is dependent upon flood projection information provided by Broome Co Emergency Management and FEMA.)
					NOTE: The implementation of any action is based on the water's elevation and is a judgment call. When to actually implement any of the issues listed is ultimately based on the predicted rate of the rivers rise and height of the crest.
Weather Center Forecast			Advisory		<ol style="list-style-type: none"> 1) Alert the AOC of pending flood condition based on the Weather Service Advisory. 2) During non-business hours the Clinical Manager will be notified and responsible to contact the AOC and Hospital Safety Officer. 3) Begin monitoring river levels by accessing the AHPS section of the NOAA weather website
829'	11.5'	18'			Broome County Office of Emergency Services will notify Lourdes via fax to Administration, ED and Facilities. BCOES will also call Lourdes for immediate notification and direct communication needs.
830'	12.5'	19'			Refer to the "Quick Look" plan to determine when to close the sanitary & storm gates and REMOVE the diverter plugs.
831'	13.0'	20'			Relocate medical waste truck and dumpsters AT 831'....
832'	14.0'	21'	Preparation	Inventory and inspect equipment already in place. Announce Facility Alert level 1.	<ol style="list-style-type: none"> 1) Institute Security Rounds monitor conditions in parking lots C, D and G. Confirm when water starts encroaching into the parking lots. 2) ...set up the Incident Command center in the DePaul Conference Room... 3) Initiate communication between the hospital's Incident Commander and Broome County Emergency Services. Notify UHS of Lourdes' activation of FERP and potential for possible patient evacuation. Send a liaison to the Broome County EOC.
833'	15'	22'	Alert Level	Prepare for flood protection procedures	<ol style="list-style-type: none"> 1) At this elevation, water will be encroaching into the parking lots. Begin the process of evacuating Lots C, D & G.... 4) Place security staff and other support personnel at entrances to guide staff, visitors and patients to alternate parking locations.... 8) In anticipation of need to close the floodgates, verify there is nothing obstructing the gates.

Flood Plan Matrix Excerpts

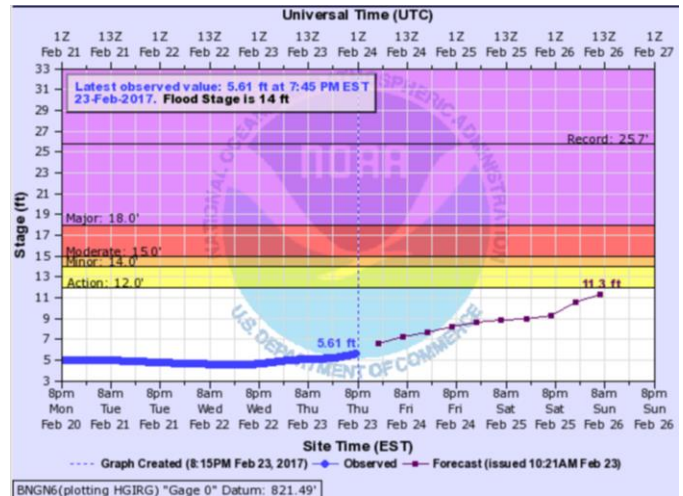
Lourdes	Washington St.	Vestal			
					NOTE: The implementation of any action is based on the waters elevation, it is a judgment call. When to actually implement any of the issues listed is ultimately based on the <u>predicted</u> rate of the rivers rise and height of the crest.
834'	16"	23"			<ul style="list-style-type: none"> 1) Close Floodgates G3, 4, 5, 6, 7, 8 & 9. 2) All back up standby pumps should be in place. 3) Install "logs" at pump house... 4) Palletized sand bags are moved to dry side of wall .
835.49	18'	25'	Flood Stage	...go to Code Green level 2...	<ul style="list-style-type: none"> 4) ...alert the NYSDOH regional office in Syracuse. 5) Have any vehicles left in the lots towed away.
836'	19'	26'		At this level, the water will be at the base of the floodwall behind the ACC building. There is now approximately 6.75 feet (80") of protection remaining.	<ul style="list-style-type: none"> 1) Parking lots C, D, and G should be empty. 2) At approximately 839'-840,' the NYSEG sub station will be at or in danger of flooding. This will trip the sub station, which will cause temporary power loss to the Hospital (until E-gens kick on, Facilities will "warm up" gens set so minimal "blip" will occur). The DePaul pavilion will lose power. Only basic e-power will be on. Order and have portable generator delivered/set up.
838'	21.0'	28'		<p>Final Preparations</p> <p>Discuss and consider the need to go to Facility Alert Level 3</p>	<p>Begin discussions and planning for the installation of the ground floor floodgate (log) system at elevation 842'.</p> <p>Note: If the installation is implemented there should be consideration regarding the implementation of any interim life safety measures. In general, it may take up to 5 hours to install all logs.</p> <p>NOTE: The decision to implement the internal floodgate (log) system should be based on the National Weather Service advisory / warning that the flood stage may exceed the 500 year level, which is at 845'. At 845' the water will be 1' below the floodwall maximum height of 846'.</p>
839'	22'	29'	Severe Stage	Discuss and consider upgrading to Facility Alert Level 4.	<ul style="list-style-type: none"> 1) At this point, floodwaters will be covering all of the rear parking lots, employees and patient alternate transportation should be in place, but all hospital services will be available... 3) Coordinate a group or team and install the ground floor floodgate system along with the portable emergency generator and the ground water sump pump connections out and over the floodwall. 4) Secure and anchor equipment that cannot be moved, raise it 24" off the floor if possible.... 7) Place other contractor and service companies on alert as necessary.

National Weather Service support: The FERP relies on the National Weather Service and its two gauges that are part of the [Advanced Hydrologic Prediction Services](#) system. The Washington Street gauge is the AHPS Binghamton Gauge. It has stages for "Action," "Minor flooding," etc. that are shown in the screenshots from the website below. These stages correspond to different status levels in the Matrix, such as "preparation" at stage 14.

Flood Categories (in feet)	
Major Flood Stage:	18
Moderate Flood Stage:	15
Flood Stage:	14
Action Stage:	12

Historic Crests	
(1)	25.73 ft on 09/08/2011
(2)	25.00 ft on 06/28/2006
(3)	23.50 ft on 03/17/1865
(4)	22.90 ft on 03/18/1936
(5)	21.00 ft on 03/18/1846

[Show More Historic Crests](#)



<https://water.weather.gov/ahps2/hydrograph.php?wfo=bgm&gage=bngn6>

The site also includes information on what happens at the different stages. Here are some examples:

- 25.73 Flood of record. Floodwalls overtop in several areas. Flood devastation in downtown Binghamton extends as far south as Vestal Avenue and as far north as Hawley Street on the east side, and Riverside Drive on the west side. Flood of September 2011.
- 25.6 Maximum height of flood protection walls in downtown Binghamton.
- 25.2 Portions of downtown Binghamton flood including Water Street, Washington Street, Susquehanna Street and Vestal Parkway. Extensive flooding occurs south of Riverside Drive in Binghamton. Upper Court Street has significant flooding on the east side. Flood of June 2006...
- 18 Major Flood Stage...Portions of Route 7 are closed. Lourdes Hospital parking lot floods...
- 14 Flood Stage. Flooding begins along the floodplain outside of the levee protection area. Sandy Beach Park floods...

This gauge's website also has flood inundation maps. The screenshot below shows stage 21.9 at the Washington Street gauge (the green dot in the river).

