

# Missouri River FLOOD CONTROL

The Missouri River is a highly alluvial river modified via reservoir construction under the 1944 Flood Control Act. It is operated by the US Army Corps of Engineers (USACE) to provide for eight authorized purposes under what is referred to as the *Master Manual*. One primary authorized system purpose is *Flood Control*.

## Flood Chronology – Awareness / Concerns

The flood of record for the Missouri River at the United States Geological Survey (USGS) stream gage at Bismarck, N.D., was 27.9 feet. This was associated with an ice jam break upstream from the Bismarck gage in the spring of 1952. The USGS has designated the flood stage at Bismarck to be 14 feet, while a 1% chance event (100-year) is around 17 feet.

Since the Garrison Dam closure that created Lake Sakakawea in 1954, other flood events have created concerns. In 1992, Lake Sakakawea was at a lower elevation, but refilled very quickly in 1993 due to significant rainfalls in Montana. In this instance, the system served its flood control purpose.

In 1997, high summer releases out of the Garrison Dam created a stage of 13.98 feet. In March 2009, a significant ice jam below the confluence of the Heart River and the Missouri River south of Mandan created localized flooding near a 17-foot stage. While not directly controllable by the reservoir system, ice jams are not uncommon.

The historic flood of 2011 was caused by significant rainfall in Montana with the resulting peak stage at Bismarck at 19.3 feet. While the snowpack was above average it melted later than usual. Some claim or perceive this flood was caused

by system mismanagement. This is far from the case. After-action reports noted the USACE successfully managed the event, within the system's capabilities, to prevent even greater impacts <sup>[1][2][3]</sup>.

## Flood Risks

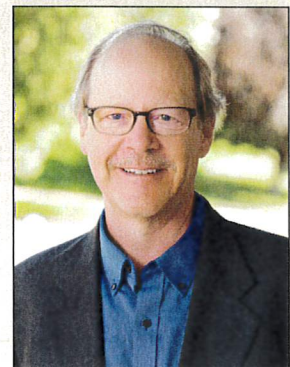
The 1944 Flood Control Act and the reservoirs are designed for “*flood control*” not “*flood prevention*” and are managed as events occur within the system's design capabilities. Subsequently, flood risks remain and continuously change as the floodplain and channel conditions are modified by both man and nature.

The updated hydrologic projections for releases from Garrison Dam <sup>[4]</sup> and downstream yielded increases in the peak flows on various flood events at Bismarck-Mandan.

These flow increases resulted from an expanded period of record including flows occurring after the 1999 Report data through 2012, which now includes the 2011 event and revised tributary inflows.

## Floodplain Mapping

The Federal Emergency Management Agency and the North Dakota Department of Water Resources are currently mapping and/or remapping the Missouri River floodplain from Garrison Dam to the Oahe Reservoir. The preliminary



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hydraulic mapping in Burleigh County provides interesting results given the increased flow rates. The mapping indicates a higher Base Flood Elevation (BFE) at Hogue Island north of Bismarck-Mandan, while a lower BFE south of the I-94 Grant Marsh Bridge. These transitional elevations are a function of the revised flow rates and changing conveyance due to sediment accumulation (aggradation) and remnants of the scour (degradation) that occurred during the 2011 flood.

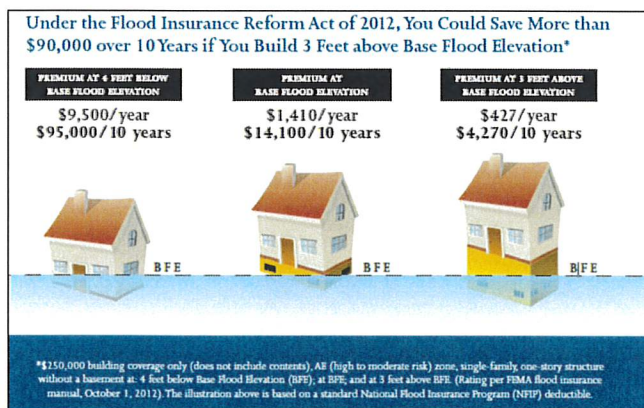
It is important to recognize river conveyance changes with time and is not fixed. The Oahe Delta formation south of Bismarck-Mandan will rebuild and, as the scour impacts dissipate, BFEs will increase again. The state of North Dakota requires construction in the floodplain to have finished floor elevations at least one foot above the BFE. Given the flood risks along the Missouri River, both Bismarck and Mandan require a higher standard of two feet.

Understanding flood risks go well beyond elevating the properties above the BFE. Some elevated properties were not adversely impacted by the 2011 flood waters; however, they were inaccessible creating a significant displacement of residents. In other instances, the residence was elevated, however, the crawl space or basements, along with septic systems were flooded.

After 2011, Burleigh County modified its floodplain ordinance to regulate the 500-year floodplain and not allow basements. This action will significantly reduce the risks for future structures.

## Flood Insurance

While we can manage and reduce risks, it is not practical to prevent flooding. As such, the National Flood Insurance Program (NFIP) is available to assist communities located within the floodplain. The availability of insurance is critical to flood recovery, however, risk mitigation via proactive construction is necessary. The following figure references insurance costs based on the elevation of construction, noting a clear public and private benefit to elevating structures.



Frequency	Garrison Releases 1999 / 2020	@ Bismarck 1999 / 2020
2% / 50-year	68,000 / 80,800	81,500 / 87,500
0.1% / 100-year	76,000 / 98,900	94,000 / 106,600
0.2% / 500-year	90,000 / 156,800	148,000 / 166,900

## Summary

**Flood control is a function of several key elements:**

- Providing reservoir storage to contain projected flood volume and to limit releases.
- Increasing flows associated with an extended period of record and climatological changes.
- Maintaining the river's conveyance capacity, which is adversely impacted by alluvial sediments and floodplain encroachments (i.e., development)

So, which can we control? The *Master Manual* is based on total system storage and control, not just that in North Dakota. The *Master Manual* balances all authorized purposes, and, under high runoff conditions, flood control is the priority. The 2011 after-action reviews indicated lowering reservoir levels to increase storage had little value in flood reduction and created other undesirable impacts. Subsequently, increasing reservoir storage is not reasonably practical. On a related note, revisions to the *Master Manual* that included water conservation measures did not impact peak flows during the 2011 flood event.

Climatological changes are uncontrollable and are addressed as the scientific data determines. The USACE is currently evaluating modifications to the Garrison dam and spillway configuration based on the updated inflow projections on extreme flood events.

Maintaining conveyance capacity within the overbank floodplain is controllable, principally by implementing and actively enforcing floodplain regulations. The conveyance capacity within the channel remains a function of the natural river aggregation and degradation process.

We can all do our part by engaging in discussions to increase awareness and to assist the public in understanding the flood risks and mitigation measures.

- [1] *Post 2011 Flood Event Analysis of Missouri River Mainstem Flood Control Storage*, USACE April 2012
- [2] *Report to Congressional Requesters, Missouri River Flood and Drought*, Government Accounting Office, GAO-14-741 September 2014
- [3] *Missouri River Flood Task Force, After Action Review*, September 10, 2012.
- [4] *Hydrologic Statistics Technical Report*, USACE Northwest Division, Missouri River Basin Water Management Division, Omaha, NE, September 2013.