

MICHIGAN
OCZM GRANT #NA-80-AA-H-CZ157
SUBTASK 4B-1



Coastal Flood Hazards In Michigan

November, 1982

The Great Lakes are a vast and wonderful resource. However, unless the adjacent shoreland is prudently managed, the benefits of locating near the lakes can be offset by the costs associated with natural hazards such as erosion and flooding. This brochure describes the nature of the coastal flooding problem and outlines preventive and remedial actions which can be implemented to minimize the threat of flood damage.

Consider

- Flooding of urbanized areas is currently the most widespread natural hazard in the United States.
- Flooding throughout the nation causes public and private property damage of more than \$3 billion annually.
- Approximately 30 Michigan counties encompassing almost 10% of the state's Great Lakes shoreland and over 45,000 acres of land area are subject to flooding by high levels of the Great Lakes.
- Private and public expenditures due to coastal flooding in Michigan during just one year in the early 1970's exceeded \$55 million.
- **ALTHOUGH FLOODING IS INEVITABLE, SEVERE FLOOD DAMAGE IS AVOIDABLE.**

Nature of the Problem

Surface water bodies offer unique benefits in the areas of transportation, energy, recreation and domestic, commercial and industrial uses. As a result, much human development has historically been linked to lakes and streams. An undesirable side effect of locating in the proximity of these bodies of water is that such areas are often subject to periodic inundation causing losses of life and property.

Flooding is a natural event. Floodplains, the low-lying areas adjacent to lakes and streams, can be viewed as nature's safety valves. Their function is to receive flood water and dissipate its energy. It is only when man infringes on this floodplain with his construction activities that a problem arises and the potential for disaster occurs.

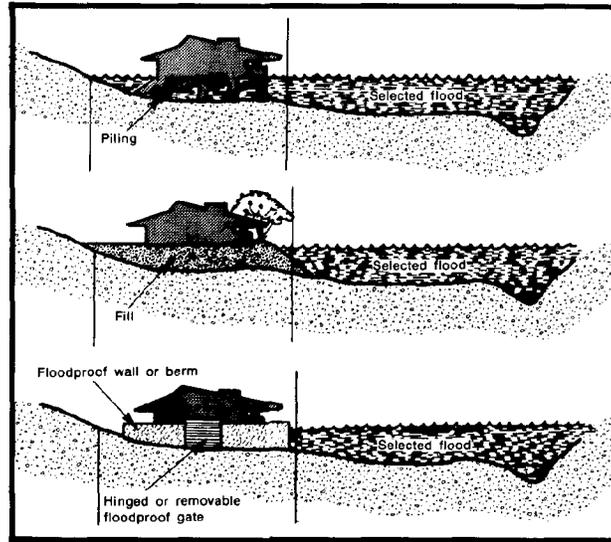
Flooding occurs in areas which are relatively well defined. The most effective means of preventing or minimizing the costs associated with flooding would be to remove existing structures from flood-prone areas and prohibit future development in these identified floodplains. Obviously, however, it is not always practical or possible to eliminate all development from the floodplain so a more comprehensive approach to reducing flood damages is necessary. This comprehensive approach is referred to as floodplain management.

Managing the Floodplain

Planning and management, as a strategy to minimize flooding damages, recognizes that natural and man-made environments need to be carefully integrated. Effective floodplain management programs consist of "structural" and "nonstructural" measures which:

1. physically modify the flood hazard through use of dams, dikes, levees and channel and drainage improvements;
2. moderate the impacts of floods by utilizing flood insurance, flood proofing techniques, warning systems and disaster relief; and
3. reduce the risk of flood damage by regulating and guiding construction in flood-prone areas.

Floodproofing techniques include any and all structural methods used to minimize or prevent flood damage. For a new structure located within the boundaries of a floodplain, the typical floodproofing technique utilized is to elevate the building above the level of the 100-year flood either on earthen fill or piles/stilts. Existing structures can also be elevated, however, this option can be rather costly. Other methods of floodproofing include the construction of low walls or levees around an existing building, installing temporary or permanent closures to openings such as doors or windows which lie below the critical flood elevation, rearranging sensitive and vulnerable items within structures and applying waterproof sealants to existing walls and floors.



NOTE — Courtesy U.S. Army Corps of Engineers.

FLOODPROOFING TECHNIQUES

It is essential that individuals become familiar with the nature of flood hazards in their community and have a good understanding of local, state and federal floodplain management programs, especially if they are considering the purchase and/or occupation of land near a lake or stream.

Coastal Considerations

Most flooding literature deals with riverine flooding problems. Indeed, to the casual observer, the shoreline of the Great Lakes may appear to be relatively stable and it may be difficult to envision the waters of the lakes, driven by nature's fury, overflowing and inundating large areas of low-lying lands. It is all too clear, however, that much of the land adjacent to the Great Lakes, especially along Lake Erie, Lake St. Clair and Saginaw Bay, is subject to periodic flooding which causes significant amounts of damage and destruction. Other areas which are prone to flooding due to high lake levels are found along the St. Clair and Detroit rivers, embayments such as Bay de Noc and drowned river mouths of tributaries to the Great Lakes.

Flooding on the Great Lakes represent a phenomenon unique and distinct from riverine flooding. Great Lakes flood events are a product of various types of lake level fluctuations acting independently or, more commonly, in conjunction with one another.

Lake level variations can be classified as long term, seasonal and short term. Long term variations are largely influenced by trends in precipitation on the Great Lakes and the surrounding basin. Seasonal fluctuations reflect the normal yearly hydrologic cycle of precipitation, evaporation, runoff and ice melt. Together the long term and seasonal influences cause the still water levels of the lakes to rise and fall.



POST THIS IN YOUR HOME

— Preparing for Floods —

1. **Make emergency plans now. Involve your entire family. Have an evacuation route for leaving your house.** When charting your evacuation route, be aware of low road elevations that may be subject to inundation by flood waters.
2. **Get to know the flood warning system in your community. If you receive a civil defense warning, listen to the radio for the latest local information.** Have a battery powered radio and an extra set of fresh batteries.
3. **Know your flood insurance policy.** Make sure it fully covers your structure(s) and their contents.
4. **If there is time, move important items to higher elevations — food, furniture, valuables, legal papers and insurance policies, rugs, first aid kit, appliances, clothing, books, and electric motors and controls.**
5. **Consider keeping basement windows open to keep the indoor and outdoor water levels equal.** This will help prevent basements from collapsing.
6. **Shut off all utilities at the main switches — water, gas, oil, and electric.** Remove switch plates and cover electrical boxes with rubberized tape. Use caution if area is already inundated with water.
7. **Take special precautions with domestic water systems.** If you have a well, seal it to keep out silt and debris.
8. **Regardless of your state of preparedness, when you are advised to evacuate, do so immediately.**

— During the Flood —

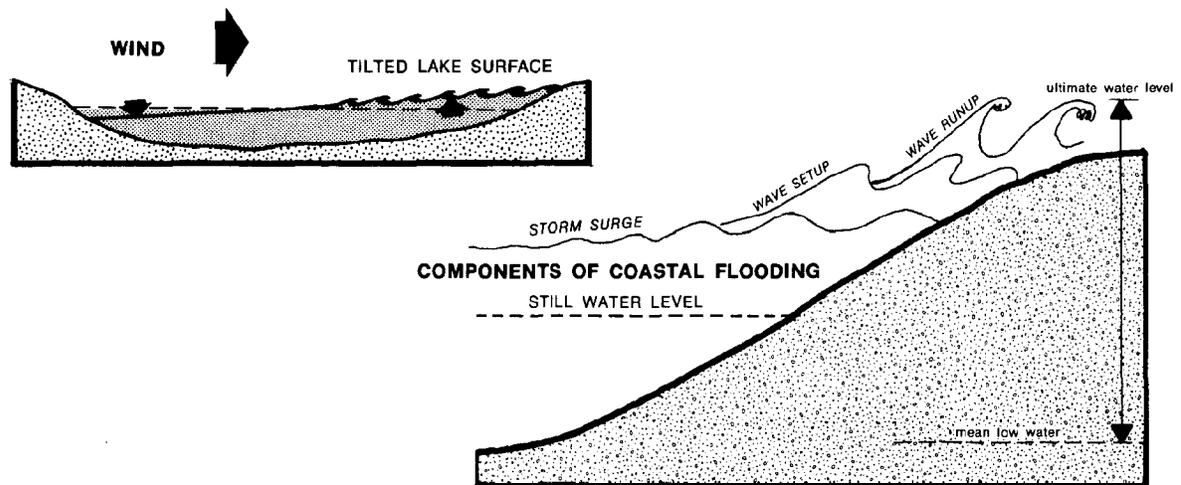
1. **Be sure everyone is safe from the fast flowing flood waters.**
2. **Cooperate fully with local officials.**
3. **Wait until officials assure you that the flood danger is over before reentering any area.**

— After the Flood —

1. **Start clean up as soon as flood waters recede.** Use flashlights, not matches, when entering buildings. Do not use electrical system until it has been checked by a qualified electrician.
2. **Test the plumbing by flushing system with buckets of water.** Have your individual sanitary disposal systems inspected by health officials.
3. **Have your water supply tested by health officials.** Boil or chlorinate emergency drinking water.
4. **Destroy all fresh or frozen food that has been in contact with flood water or has thawed. Do not use it.**
5. **Document all flood related damage, including debris removal and clean up costs.** Photographs are extremely helpful in documenting flood damage for insurance purposes.
6. **Wait until surrounding flood waters are well below the basement floor level before draining your basement.** The additional pressure of saturated soil may cause your basement walls to collapse. Begin pumping in stages — about $\frac{1}{3}$ of the water per day.
7. **Use stoves and heating systems as soon as possible to hasten drying.** Clean, dry and recondition heaters and flues and be sure electric motors are dry before using them.
8. **Delay all permanent repairs until buildings are thoroughly dry.**
9. Consider implementing measures to avoid future flood losses (i.e., floodproofing, elevating or relocating your structure).

Short term fluctuations are caused by winds, waves and changes in barometric pressure. The specific components of short term fluctuations are storm surge, wave setup and wave runup.

Storm surge is actually a tilting of the lake's surface caused by wind acting on the water so that one end of the lake is elevated above the other. Wave setup and runup further increase elevation and result in water being carried onshore. These short term fluctuations act independently of still water level fluctuations and are responsible for most of the flooding which occurs on the Great Lakes. When short term fluctuations are superimposed on long term variations, ultimate water levels of the Great Lakes can be raised ten to 12 feet above average!



Most of Michigan's coastal flood risk areas have been identified and mapped. If you currently own land in a coastal area or if you are considering building or buying near one of the Great Lakes, check with your local government, Michigan's Department of Natural Resources or the Federal Emergency Management Agency to determine if you are in a hazardous area. A special permit may be required for construction in such an area. Also, be aware that most mapping and identification techniques do not account for all of the lake level fluctuations which have been discussed (especially wave runup) so that map boundaries and identified flood elevations might underestimate the actual flood threat. When building, elevating or floodproofing a structure provide yourself with an additional safety buffer over and above that which might be recommended or required by law.

Remember

- Much of the Great Lakes shoreline is subject to flooding.
- Flooding is caused by long term, seasonal and short term lake level variations.
- Many of the coastal flood risk areas have been identified and mapped.
- Coastal flood studies do not always take into account all of the various lake level fluctuations.
- The best way to avoid flood losses is to stay out of the floodplain.
- If you are located in a flood risk area, consider the purchase of flood insurance. (Standard homeowner's policies *do not* cover losses due to flooding.)
- When building, elevating or floodproofing a structure in an identified flood risk area, provide a safety buffer over and above that which is recommended or required.

Definitions

Flooding is a natural part of the earth's hydrologic cycle during which the banks of a stream, lake or other body of water overflow, causing normally dry land to be temporarily inundated (or covered by water).

Floodplains are low-lying areas adjacent to streams or lakes which are subject to flooding. The natural function of the floodplain is to receive floodwater and dissipate its energy.

Floodproofing refers to any structural method utilized to prevent or reduce flood damage to buildings and/or properties.

100-Year Flood is a flood with a 1% chance of occurring in any given year. This is often referred to as the "regulatory" flood since many units of government use a flood of this magnitude as the base for their floodplain management regulations.

Storm Surge is a rise above normal water level on the open coast due to the action of wind stress on the water surface. (Also called *wind setup*.)

Wave Runup is the rush of water up a structure or beach caused by the breaking of a wave.

Wave Setup is the superelevation of the water surface over the storm surge elevation due to onshore transport of the water by wave action alone.

For Additional Information Contact

Your local zoning or building officials.

Michigan Department of Natural Resources
Division of Land Resource Programs
Shorelands Management Unit
P.O. Box 30028
Lansing, MI 48909
517/373-1950

Michigan Department of Natural Resources
Water Management Division
Flood Hazard Regulation
P.O. Box 30028
Lansing, MI 48909
517/373-3930

National Flood Insurance Program
Toll Free Number: 1-800-424-8872

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