

Hazus Floods

Flagged inputs and outputs

April 17, 2013



Natural Resources
Canada

Ressources naturelles
Canada

Canada

Introduction

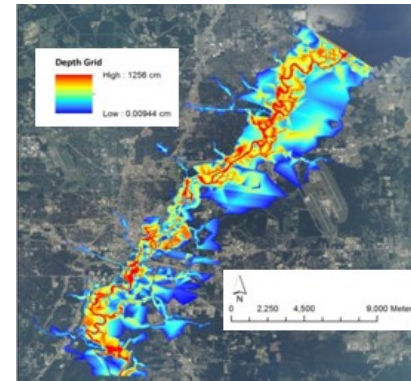
- Provide some key input data and loss-estimate outputs of Hazus flood module
 - From the flood module technical manual
 - hzmf2_1_fl_tm.pdf
 - And a few case studies



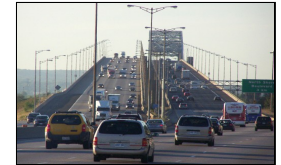
shutterstock · 80024281



Hazus Flood Module Inputs

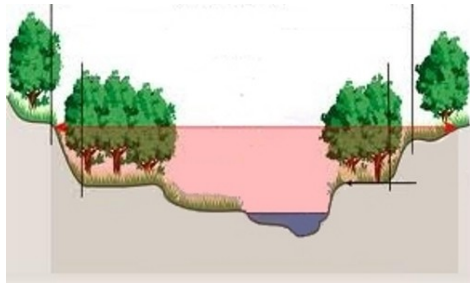


- Part 1: Flood scenario as depth grid
- Part 2: Assets - Building stock
- Part 3: Assets - Infrastructure and other
- Part 4: Assets - Demographics



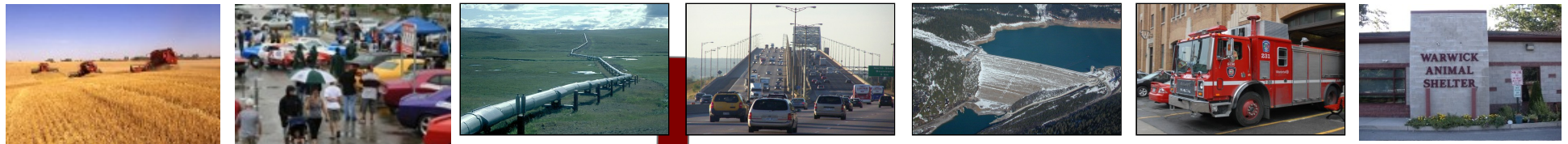
Flood Hazus Run

Flood event
riverine or
coastal



See page 5-1 of the
flood technical
manual

Assets



Direct damage losses



Debris

Economic
losses
direct and
indirect



Shelter requirements

Photo by David Saville, FEMA News Photo

<http://livefrugallivesmart.com/smart-budgeting/>



Flood Scenario

Only as depth grid in Canada

“... flood depth grid is created by subtracting (cell-by-cell) the ground elevation, contained in the DEM grid, from the flood elevation.” for the potential flood of choice (e.g. 1 in 500 yr)

“... backwater areas and (tributaries) are not entirely covered by the grid. Algorithms for analyzing such areas are described in Section 4.2.3.2.9, Nonconveyance Areas.”

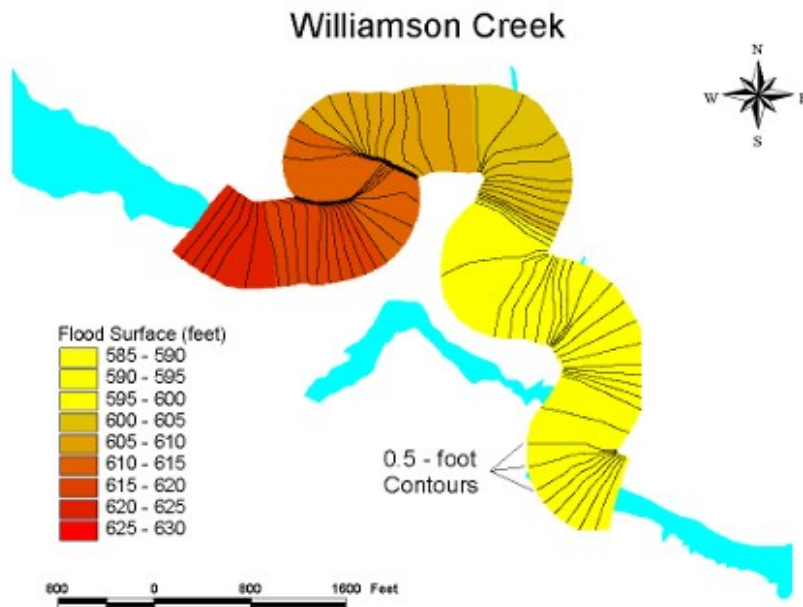
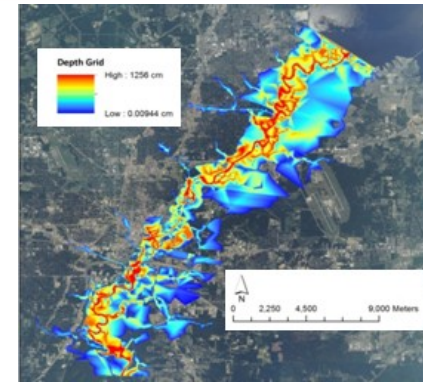


Fig. 4.34

FEMA Hazus flood tech manual, p. 4-48

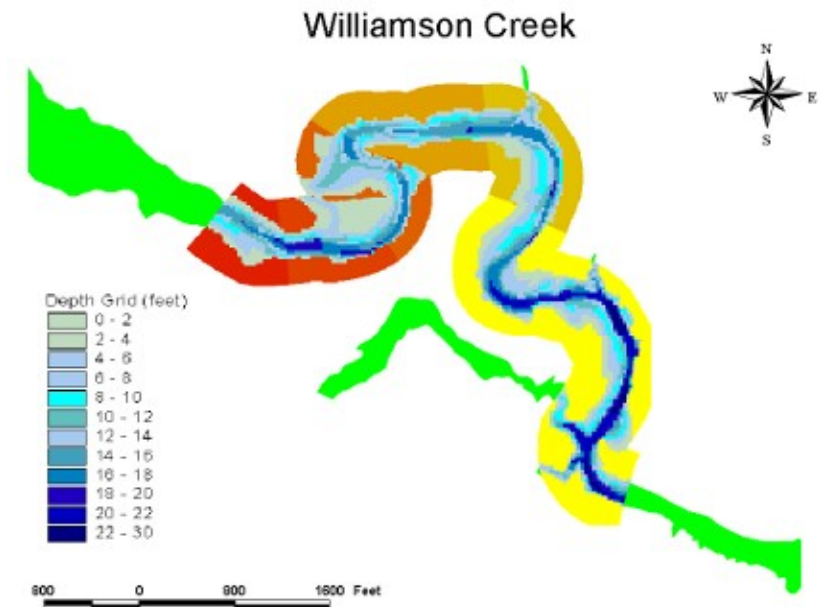
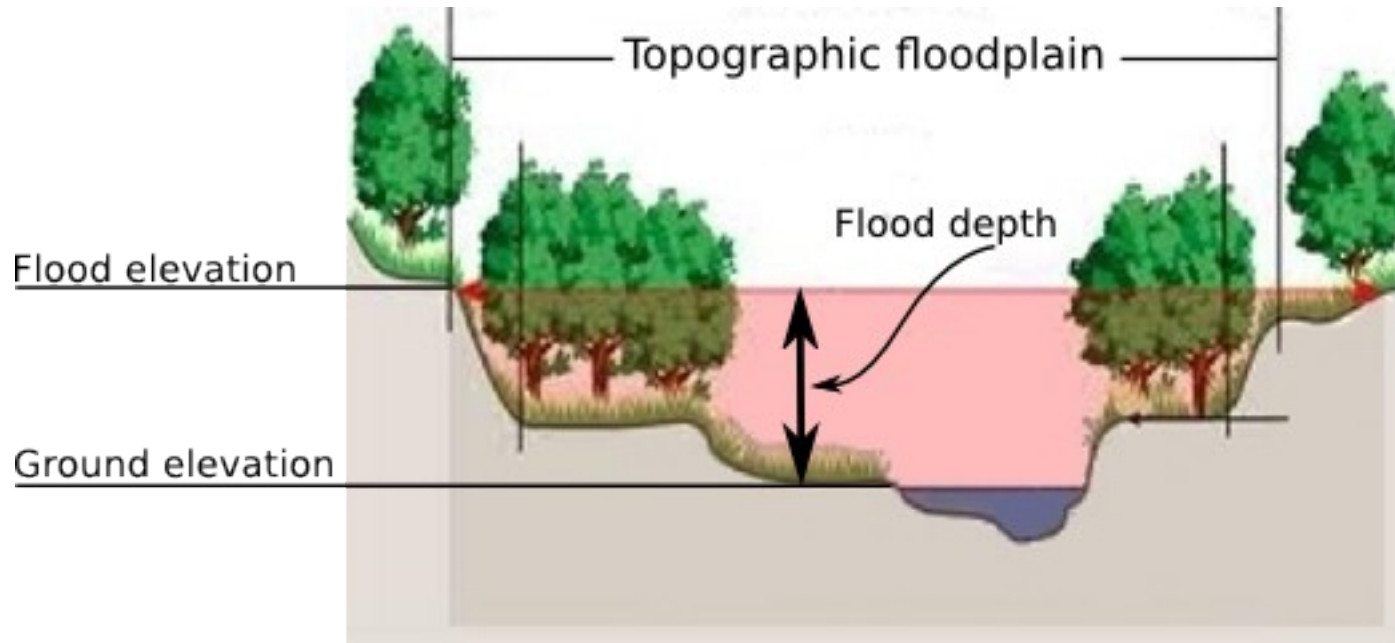
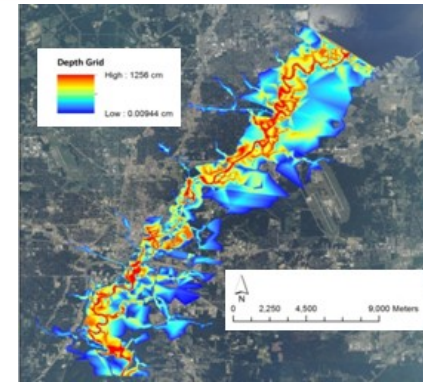


Fig. 4.35



Flood Depth Grid

“... flood depth grid is created by subtracting (cell-by-cell) the ground elevation, contained in the DEM grid, from the flood elevation.”



Modified from http://www.fgmorph.com/fg_3_7.php



Flood Water Flow Velocity

High flood water flow velocity can damage the structural integrity.

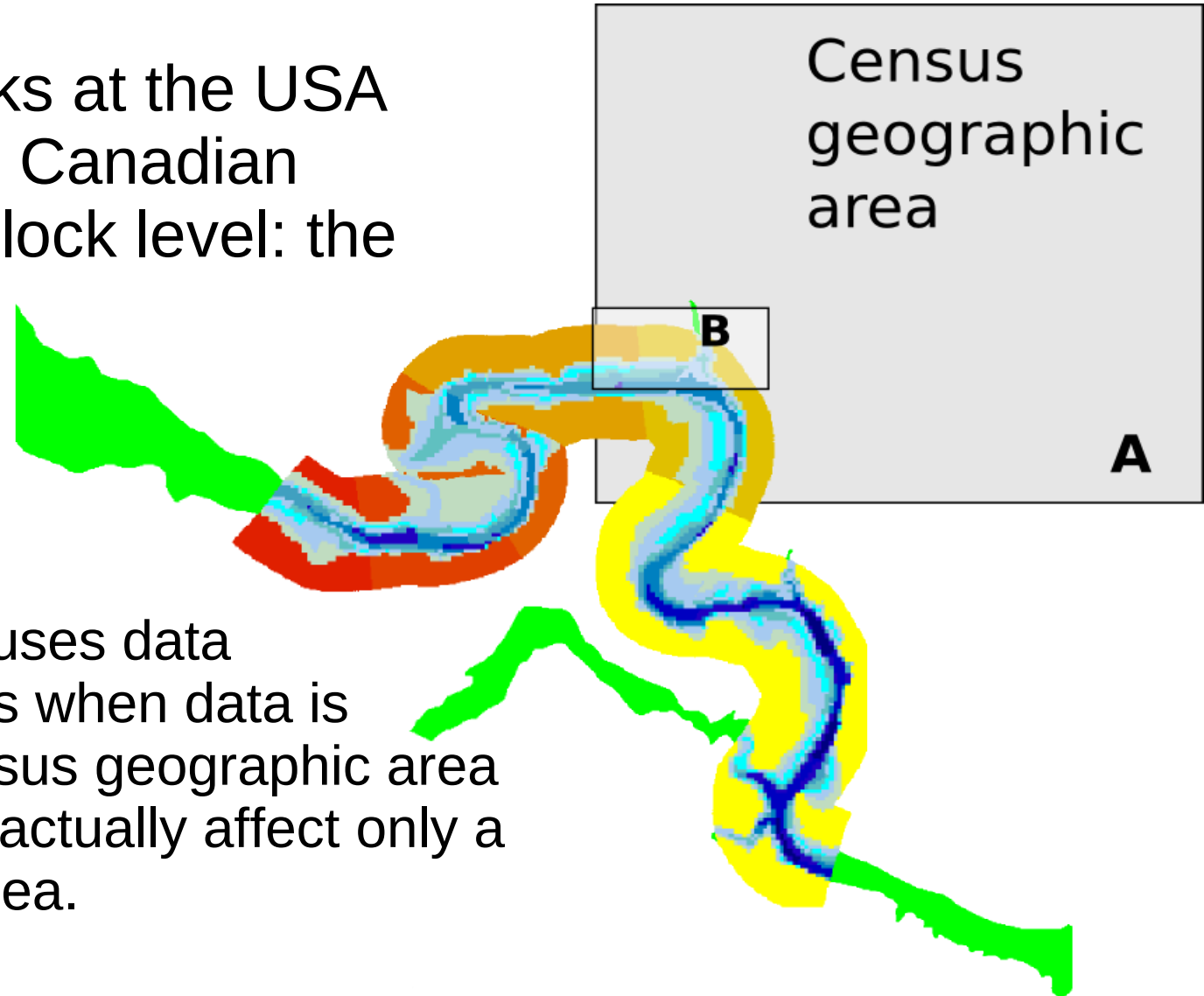
“For application within the Flood Model, it has been assumed that below velocities of 2 feet per second, collapse potential is extremely low and damage is due to inundation only. Further, the “masonry and concrete bearing wall” model is applied to both the concrete and masonry Hazus building types.”

page 5-22 of flood technical manual



Census Blocks

Hazus-floods works at the USA census block or Canadian dissemination block level: the smallest (B).



Anything larger (A) causes data interpretation problems when data is aggregated to the census geographic area and yet the flood may actually affect only a small portion of that area.

Building Attributes for Floods

To estimate building damage, extra data needed are:

Occupancy class (use): 33 classes of which 9 are Residential, 10 are Commercial

Foundation type: specific Hazus code R, L, C, C (for C and R)

First Floor elevation: height of the floor above the ground. Default table for USA

Building construction date: In USA these are related to dates of initiation of successive flood insurance requirements

Rest of the data needed is stock information that comes with Hazus Canada for residential buildings

Location: Latitude & Longitude (point)

Replacement cost (?): dollars

Building type: Wood, Steel, Concrete, Masonry, Mobile home

Square footage, total:

Basements: present or not

Number of stories:



Essential Facility Attributes needed by Hazus



Model building type:

Height:

Basement: yes, no

First floor elevation: elevation of the first floor above the ground

Damage curve: assignment or creation and assignment of the user's own damage function



Lifeline Infrastructure



“... damage to lifeline facilities (identified by) those components (that) are either particularly expensive to replace, or when damaged by floodwaters force an extended closure, thereby removing critical infrastructure from the community and the emergency responders attempting to restore the community.”



Infrastructure Flooding sub-Hazards

- *Inundation – a function of water elevation*
- *Scour/erosion – a function of floodwater velocity and duration.*
- *Debris Impact/Hydraulic Loading – a function of water elevation and velocity*



Infrastructure Attributes

Required:

Class (for each infrastructure entity):

Location: Lat/long for points; geographic location for linear features



Infrastructure not included

Water treatment plant distribution pipelines not in flood plains or on a bridge.

Generation plant transmission systems and vaults

Switching station transmission systems and vaults

Compressor station pipelines not in flood plains or on a bridge and control stations

Refinery pipelines not in flood plains or on a bridge.



Vehicles

Hazus uses formulas for vehicle distribution by building type and roadway to estimate vehicle numbers of cars, light trucks and heavy trucks that may be exposed to flooding.

You can change set parameters of how it calculated damage to vehicles.



Agriculture

Damage to crops depends on when the flood occurs and the duration of flooding (not the depth)

“The user ... provide a date of flooding (calendar) and the Flood Model estimates the losses based on standard durations provided by the USACE of 3-days, 7-days and 14-days.

Losses are estimated based on the area of inundation versus total area of crop land and the subsequent reduction in output, investment, and income.”



Agriculture

“The Flood Model provides a default agriculture product base, which includes the key input requirements for the analysis. These inputs include the crop type, its association with a geographic dataset that locates the crop within non-developed areas within the study region (not census geographic boundaries except for the county / district level), the current market value of the product, and the planting season of the crop as it relates to the time of flooding.”



Agriculture

Alfalfa Hay, Apples, Bahiagrass, Barley, Bromegrass-Alfalfa Hay, Common Bermudagrass, Corn, Corn-Silage, Corn-Sweet, Cotton Lint, Crested Wheatgrass-Alfalfa Hay, Flax, Grain-Sorghum, Grapes-Wine, Grass-Hay, Grass-Clover, Grass-Legume Hay, Improved Bermudagrass, Kentucky Bluegrass, Oats, Oranges, Orchard Grass, Orchard grass-Alfalfa Hay, Peanuts, Pears, Potatoes-Irish, Reed Canarygrass, Rice, Smooth Bromegrass, Soybeans, Sugar Beets, Tall Fescue, Tall Fescue-Ladino, Timothy-Red Clover Hay, Tobacco, Tomatoes, Trefoil-Grass Hay, Watermelons, Wheat, Wheat-Winter



Demographics Inventory

Works in conjunction with occupancy data to determine displaced households, and shelter requirements



People



Shelter requirements



Occupancy Class 1 of XX for floods



Displaced households

Demographics Inventory in the Earthquake Model

Census data used to estimate direct social loss due to

1. Displaced households,
2. Loss of building space that can be occupied



Shelter requirements



Displaced households

Flood Module Outputs

- Available formats: maps, tabular, summary reports
- Building stock loss – structure and contents
- Lifeline damage – bridges, treatment plants
- Shelter requirements
- Indirect economic losses – market sector recovery
- Produced for specific return periods, suites of return periods, or annualized losses
- Can be exported for use with enterprise GIS



Flood Model Casualties

Flood Module
does not estimate injuries or deaths.

Flood module
do estimate number of displaced households and
shelter requirements.



Further information

<http://www.fema.gov/hazus> technical and user manuals

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Hazus User Groups on LinkedIn

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Technical Support

<https://support.hazus.us>

helpdesk@support.hazus.us

Help Desk is available 24/7

1-877-336-2627 during office hours

