



Tools for Determining Base Flood Elevation



Presenter

Michelle Gilbert, CFM
Planner, STARR II/FEMA Region 10 Service Center

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Agenda

Introduction and Housekeeping

Determining a BFE

- When there already is one
 - From the FIRM
 - From the FIS
 - Other sources
- FEMA's Map Service Center
- When there isn't one
 - Methods for A Zones
 - How to get help from FEMA

Questions

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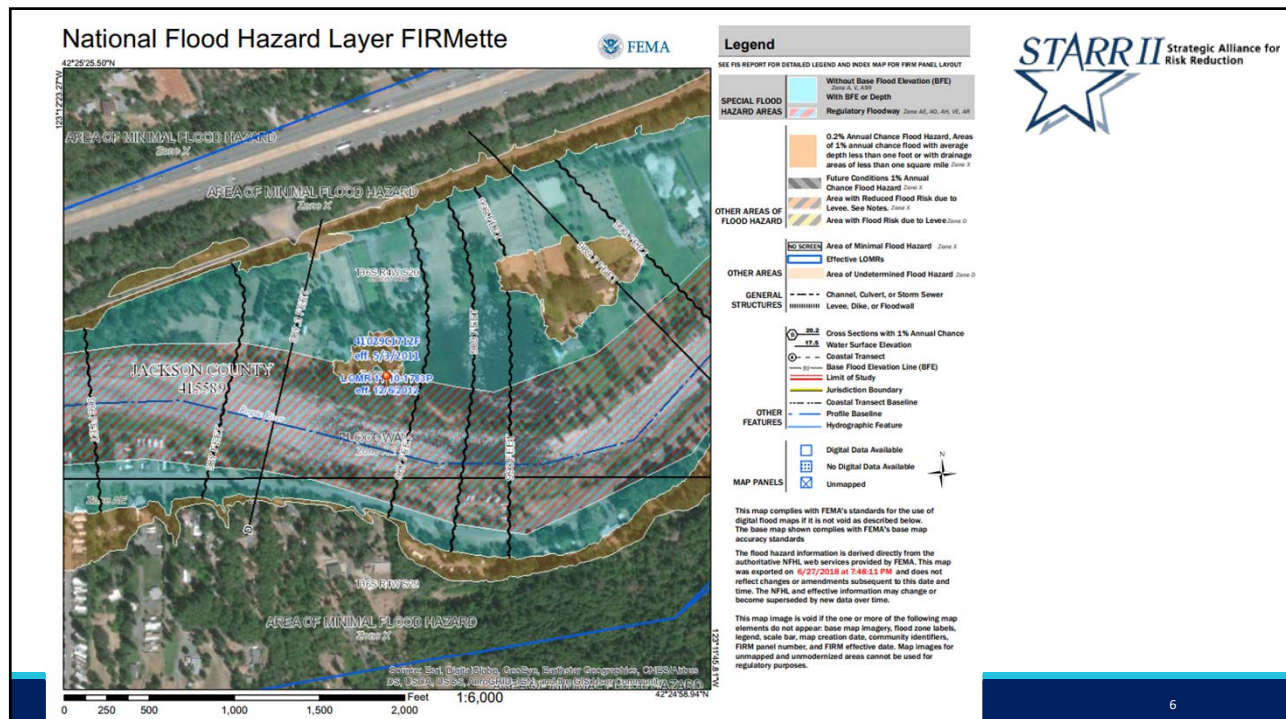
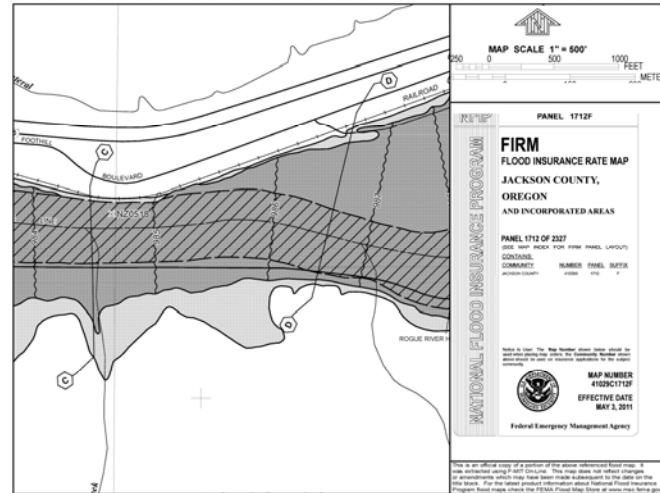


Determining a BFE

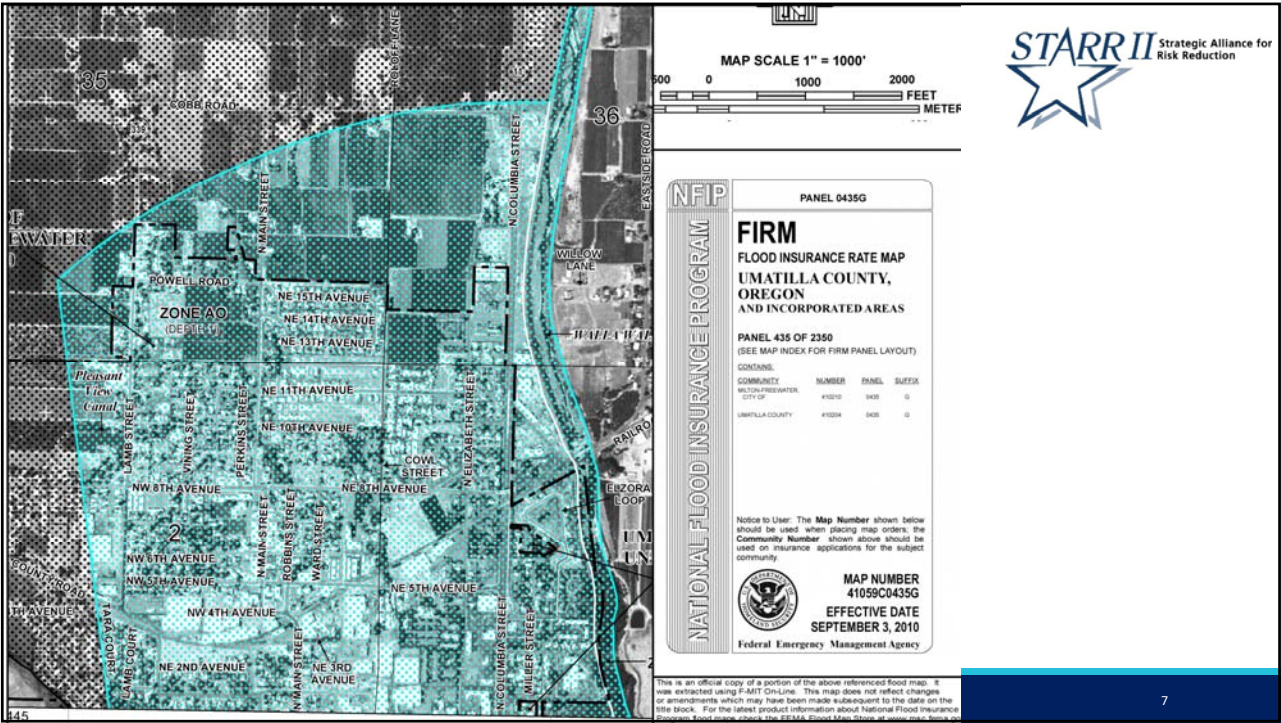
WHEN THERE ALREADY IS ONE...

4

For floodplain management, add 0.4 ft safety factor when using the FIRM alone.



E



Flood Insurance Study (FIS)

Provides background information, including the engineering methods used for the study

Explains how the FIRM was prepared

Provides flood data and tables

- Summary of Discharges
- Floodway data
- Flood Profiles
- Transect Descriptions

Used for determining a BFE at a site for regulatory purposes

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FLOOD INSURANCE STUDY

PIERCE COUNTY, WASHINGTON
UNINCORPORATED AREAS

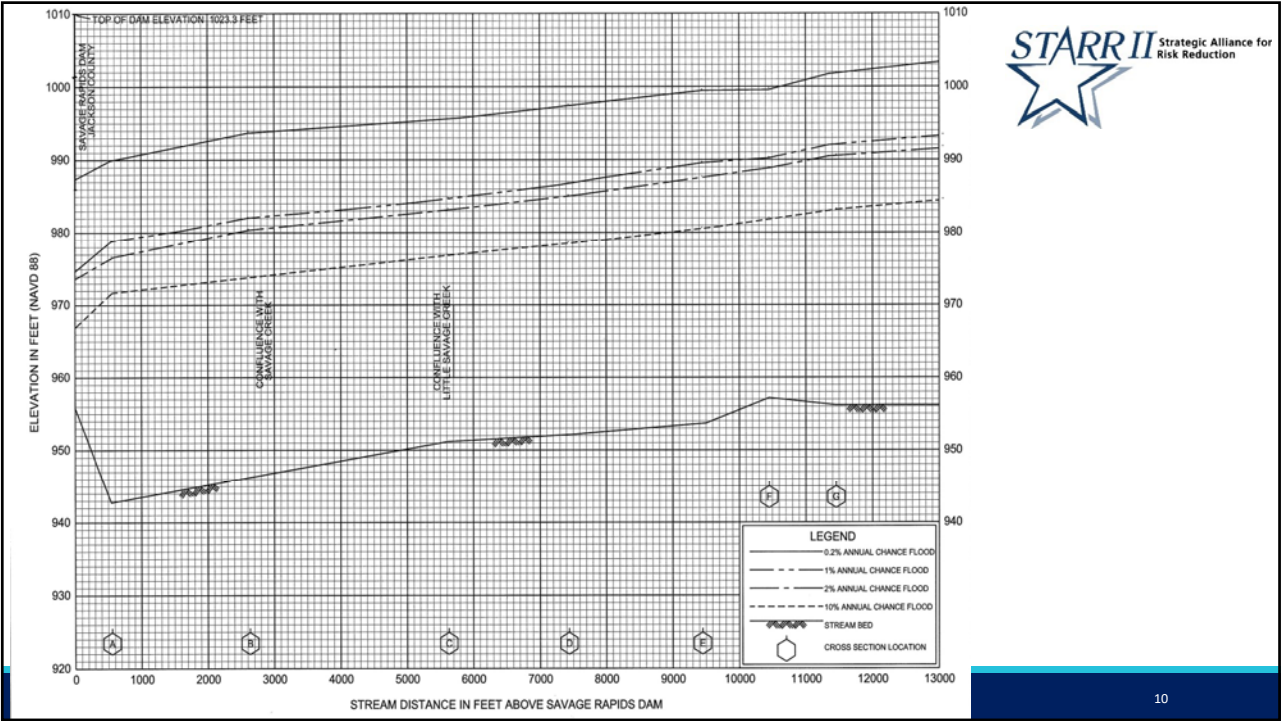
VOLUME 1 OF 2

AUGUST 16, 1987

Federal Emergency Management Agency
COMMUNITY SERVICES DIVISION

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Rogue River								
A	550	441	11440	12.4	978.9	978.9	979.2	0.3
B	2610	550	12553	11.3	982.2	982.2	982.2	0.0
C	5620	476	12585	11.2	984.9	984.9	985.3	0.4
D	7430	495	12671	11.1	986.8	986.8	987.2	0.4
E	9440	500	12538	11.2	989.7	989.7	989.7	0.0
F	10450	500	12171	11.6	990.3	990.3	990.6	0.3
G	11460	693	17653	8.0	992.2	992.2	993.0	0.8
H	13450	700	14230	9.9	993.8	993.8	994.4	0.6
I	15580	750	13414	10.5	996.7	996.7	997.1	0.4
J	16590	750	14068	10.0	998.0	998.0	998.6	0.6
K	17580	700	14433	8.2	1000.1	1000.1	1000.8	0.7
L	18580	600	12817	9.2	1001.1	1001.1	1002.1	1.0
M	19020	487	14285	8.3	1002.7	1002.7	1003.5	0.8
N	19640	477	12929	9.0	1003.0	1003.0	1003.8	0.8
O	21830	473	11106	10.5	1004.4	1004.4	1005.3	0.9
P	23980	344	9870	11.9	1006.5	1006.5	1007.2	0.7
Q	24980	500	11263	10.4	1007.9	1007.9	1008.7	0.8
R	27000	414	10308	11.3	1009.8	1009.8	1010.6	0.8
S	29200	470	10391	11.3	1012.6	1012.6	1013.3	0.7
T	30070	361	8742	13.2	1013.7	1013.7	1014.4	0.7
U	34060	663	14495	7.8	1019.1	1019.1	1020.0	0.9
V	36010	224	10424	10.8	1020.2	1020.2	1021.0	0.8
Feet above Savage Rapids Dam								
Table 5	FEDERAL EMERGENCY MANAGEMENT AGENCY			FLOODWAY DATA				
	JACKSON COUNTY, OR AND INCORPORATED AREAS			ROGUE RIVER				

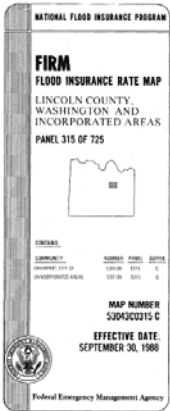
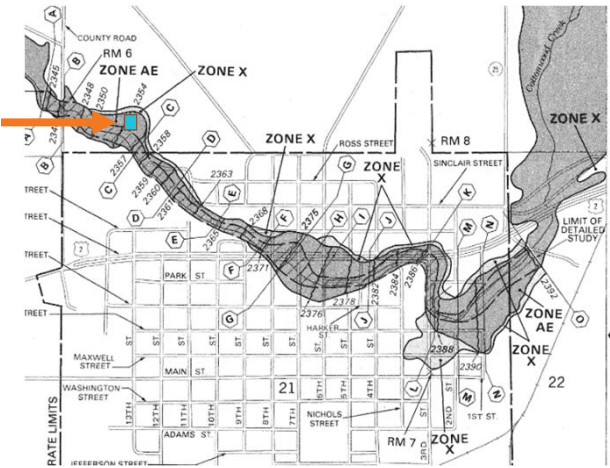


Which one do I use?

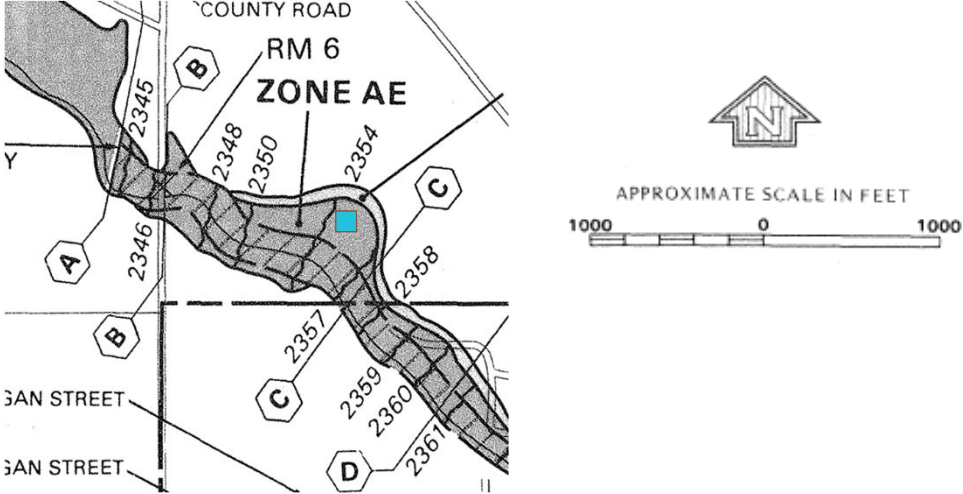


- The FIRM
- For AE Zones, the least accurate source of elevation data, because BFEs are rounded to the nearest whole foot
- The Flood Profile
- When used with the FIRM, accurate to 0.1 foot for sites between cross sections
- Floodway Data Table
- Most accurate source for BFE (to 0.1 foot), but data is only good for sites on or next to a cross section
- Transect Table (V/VE Zones)
- Describes transect locations and provides accurate elevations and regulatory BFE

How to Determine BFE

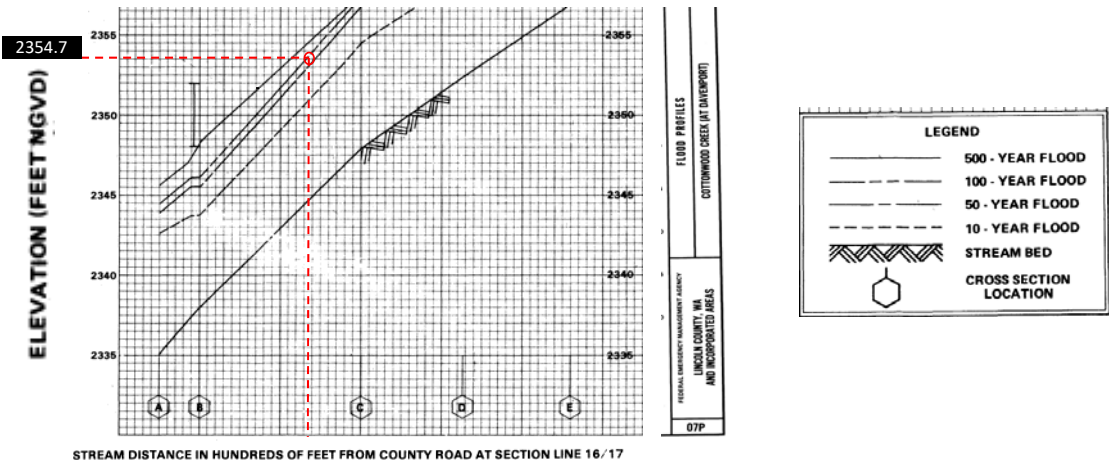


Locate the property on the FIRM in relation to Cross Sections



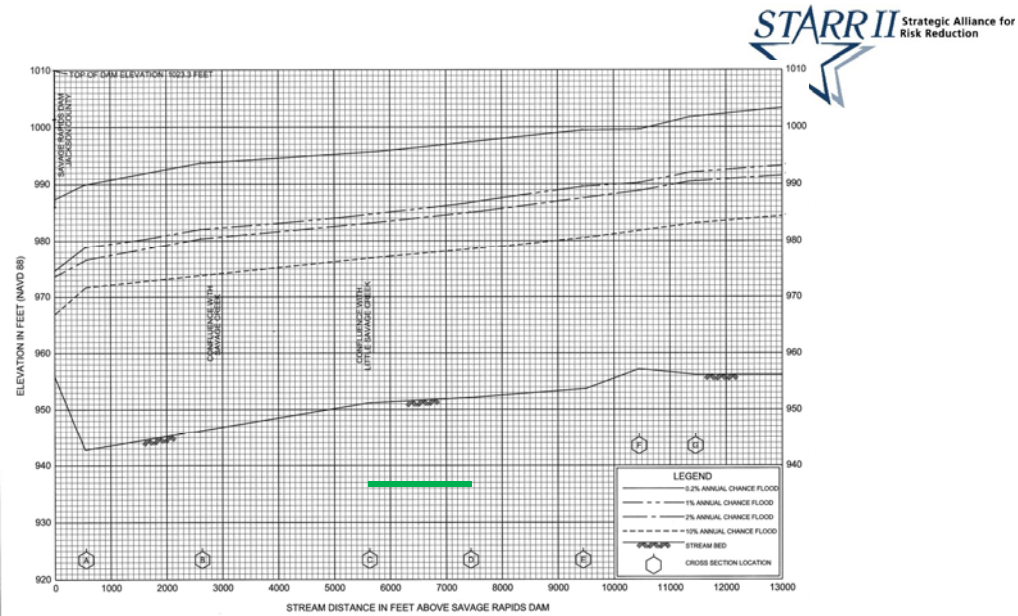
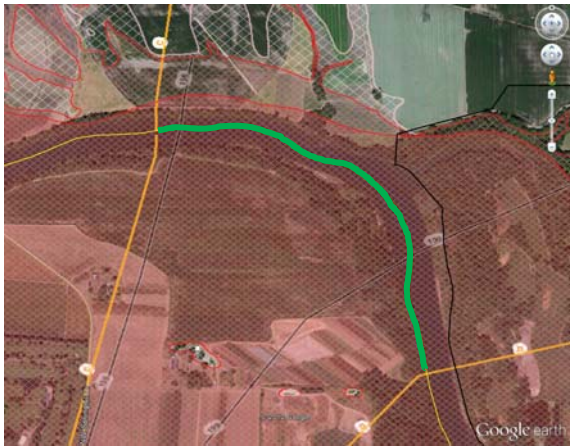
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Locate the property on the FIS Profile



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Follow the center line...



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Strategic Alliance for Risk Reduction



FEMA Map Service Center

Looking for a Flood Map? 

Enter an address, a place, or longitude/latitude coordinates:

Enter an address, a place, or longitude/latitude coordinates:

Search

Looking for more than just a current flood map?

Visit [Search All Products](#) to access the full range of flood risk products for your community.

About Flood Map Service Center

The FEMA Flood Map Service Center (MSC) is the official public source for flood hazard information produced in support of the National Flood Insurance Program (NFIP). Use the MSC to find your official flood map, access a range of other flood hazard products, and take advantage of tools for better understanding flood risk.

https://msc.fema.gov



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FEMA Map Service Center

Search Results—Products for TILLAMOOK, CITY OF

Show ALL Products >

The flood map for the selected area is number **4102020004E**, effective on **04/16/2004** 

DYNAMIC MAP



PRINT MAP
FIRMette

MAP IMAGE



DOWNLOAD
FIRM PANEL

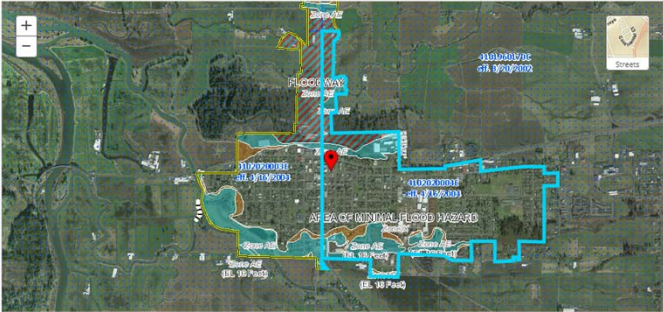
Changes to this FIRM 

Revisions (0)

Amendments (4)

Revalidations (0)

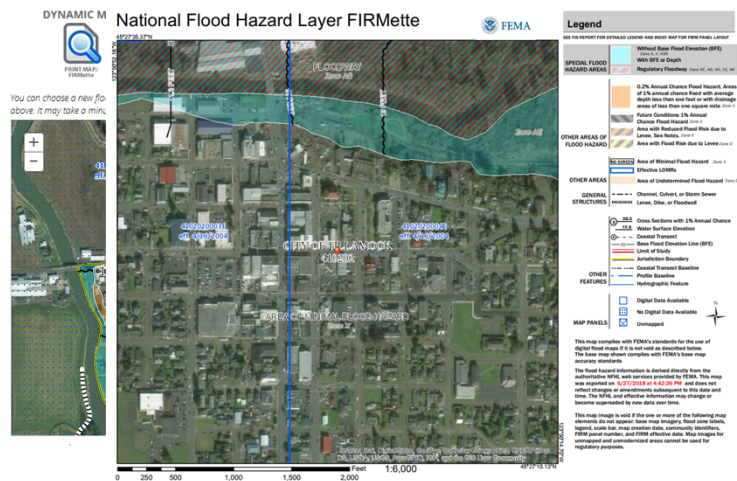
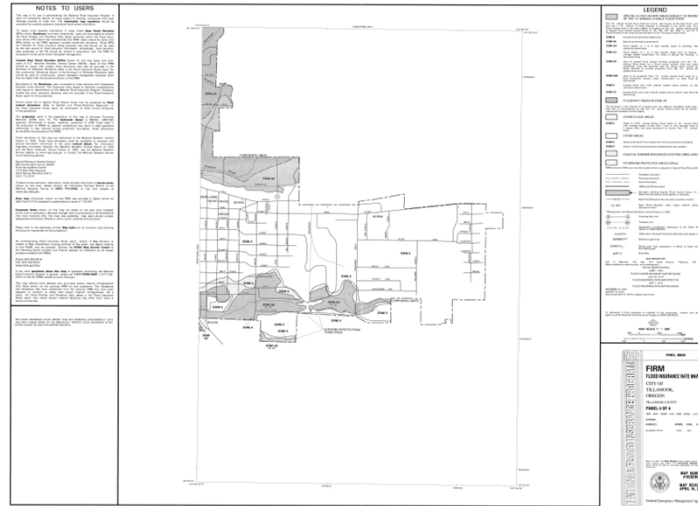
You can choose a new flood map or move the location pin by selecting a different location on the locator map below or by entering a new location in the search field above. It may take a minute or more during peak hours to generate a dynamic FIRMette. NOTE: Please be sure to enable popups for this site.



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Presenter: michelle.gilbert@star-team.com

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FEMA Map Service Center

Search Results—Products for **TILLAMOOK, CITY OF**

Show ALL Products »

The flood map for the selected area is number **4102020004E**, effective on **04/16/2004**

DYNAMIC MAP

PRINT MAP

MAP IMAGE

DOWNLOAD FIRM PANEL

Changes to this FIRM

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FEMA Map Service Center

Search Results for **TILLAMOOK, CITY OF**

Click [subscribe](#) to receive email notifications when products are updated.

Please Note: Searching All Products by county displays all products for all communities within the county. You can refine your search results by specifying your specific jurisdiction location using the drop-down menus above.

Effective Products (18)

FIRM Panels (5)

Please note: Searches often result in many map files listed under a given section. You can determine the Product ID for the individual map panel needed by looking at the Map Index file. The index map files have "IND" within the Product ID and appear at the start of the list. These index files show an overview of a jurisdiction and how it is subdivided into map panels with the Product ID for each panel shown.

Show 100 entries

Showing 1 to 5 of 5 entries

Previous

1

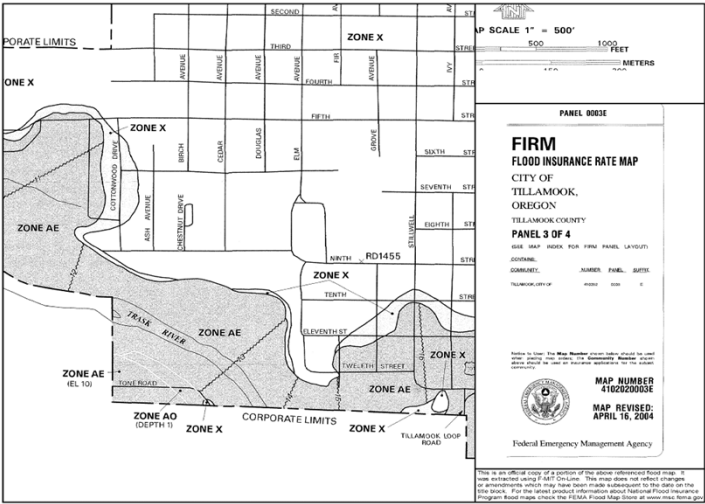
Next

Product ID	Effective Date	LOMC	Size	Download	View
410202IND0A	04/16/2004		1MB		
4102020001E	04/16/2004		1MB		
4102020002E	04/16/2004		1MB		
4102020003E	04/16/2004		1MB		
4102020004E	04/16/2004		1MB		

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Classic FIRMette



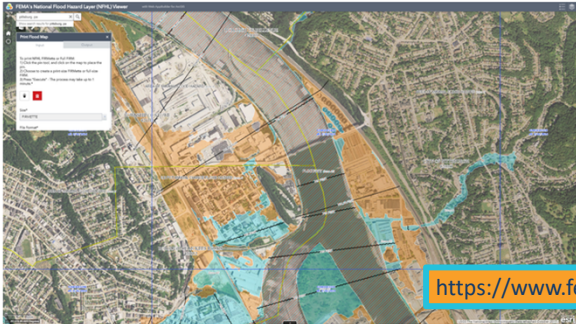
23

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National Flood Hazard Layer (NFHL)

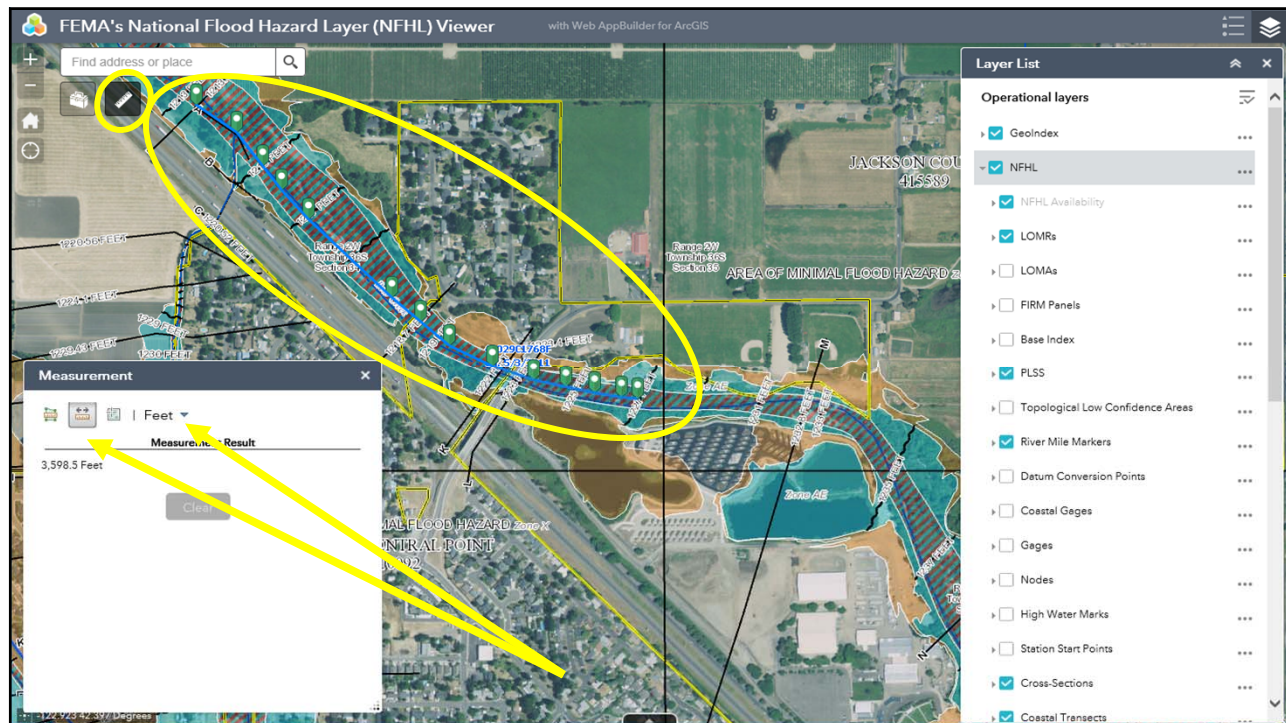
National Flood Hazard Layer (NFHL)

The National Flood Hazard Layer (NFHL) is a database that contains current effective flood hazard mapping data. FEMA's Risk MAP program provides the data so that you can better understand your level of flood risk and type of flooding. The best way for you to access the data is through the [NFHL Viewer](https://www.fema.gov/national-flood-hazard-layer-nfhl).



<https://www.fema.gov/national-flood-hazard-layer-nfhl>

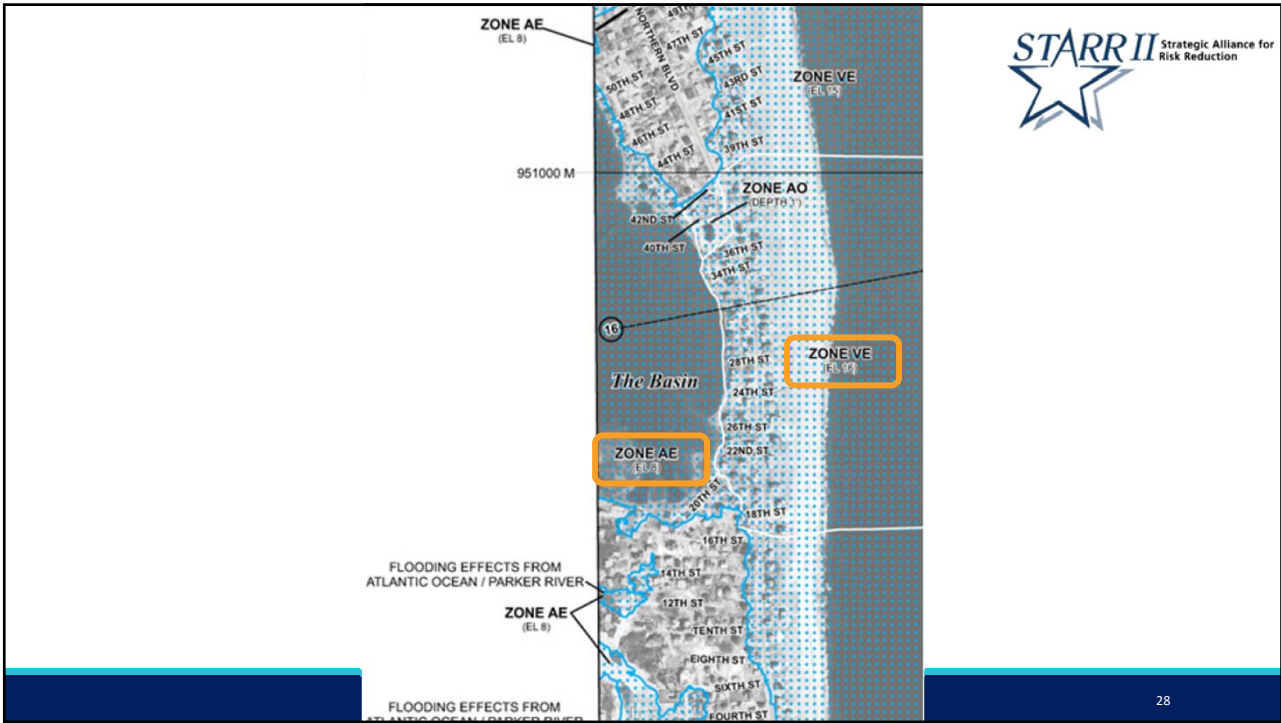
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V/VE Zones



- FIRM depicts the BFE rounded to the nearest whole foot
- FIS may contain transect data with more precise BFE
- If transect data is unavailable in the FIS, add 0.4 to the BFE as a safety factor.



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TABLE 10 - COUNTYWIDE TRANSECT DESCRIPTIONS

ELEVATION (feet NAVD 88¹)

TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER	MAXIMUM 1-PERCENT ANNUAL-CHANCE WAVE CREST ²
14	From Northern Boulevard extending northeast into the Merrimack River approximately 491 feet south of the City of Newburyport corporate limit lines.	8.4	22.0
15	From 98 feet south of Sixty First Street extending east into the Atlantic Ocean approximately 320 feet north of the City of Newburyport corporate limit lines.	8.4	23.0
16	From 1,626 feet south of the Town of Newburyport corporate limit lines extending east to 2,691 feet east of the Town of Newburyport corporate limit lines.	8.4	16.2
17	From 2,613 feet south of the Plum Island Turnpike extending east to .62 miles east of the	8.4	18.7

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Table 9 - Transect Data (continued)

Stillwater Elevations

Transect Number	Flooding Source	Transect Locations	Hazard Mapped	1% Annual Chance (ft NAVD88)	0.2% Annual Chance (ft NAVD88)	1% Annual Total Water Elevations (ft NAVD88)	Shoreline Zone	Shoreline Base Flood Elevation (feet NAVD88)
17	Pacific Ocean (Puget Sound)	At the shoreline of Puget Sound (Eld Inlet), 1200 feet northwest of the intersection of Sunset Beach Drive NW and Biscay Street NW	Overland Wave Propagation	13.4	13.4	17	VE	17
18	Pacific Ocean (Puget Sound)	At the shoreline of Puget Sound (Eld Inlet), 800 feet southwest of the intersection of 58TH Ave NW and Countryside Court NW	Runup	13.3	13.4	19.38	VE	19
19	Pacific Ocean (Puget Sound)	At the shoreline of Puget Sound (Eld Inlet), 800 feet west of the terminus of 64TH Ave NW	Runup	13.3	13.4	21.08	VE	21
20	Pacific Ocean (Puget Sound)	At the shoreline of Puget Sound (Eld Inlet), 270 feet northwest of the terminus of Hidden Cove Lane NW	Runup	13.3	13.3	19.08	VE	19
21	Pacific Ocean (Puget Sound)	At the shoreline of Puget Sound (Budd Inlet), 600 feet northeast of the intersection of 74TH Ave NW and Huckleberry Street NW	Runup	13.3	13.3	18.96	VE	19

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luction

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Where do I find the FIS?

Search Results—Products for TILLAMOOK, CITY OF

Show ALL Products »

The flood map for the selected area is number 4102020004E, effective on 04/16/2004

DYNAMIC MAP

MAP IMAGE

Changes to this FIRM

You can choose a new flood map or move the location pin by selecting a different location on the locator map below or by entering a new location in the search field above. It may take a minute or more during peak hours to generate a dynamic FIRMette. NOTE: Please be sure to enable popups for this site.

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FEMA Flood Map Service Center : Search All Products

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Risk Reduction

Choose one of the three search options below and optionally enter a posting date range.

Jurisdiction

Jurisdiction Name

Product ID

State

Jurisdiction Name or FEMA ID

Product ID

-- Select --

TILLAMOOK, CITY OF

(Ex: Fairfax County-wide or 51059C)

(Ex: Panel Number, LOMC Case Number)

> Filter By Posting Date Range (Optional)

Search Clear All Fields

Search Results for TILLAMOOK, CITY OF

Click [subscribe](#) to receive email notifications when products are updated.

Please Note: Searching All Products by county displays all products for all communities within the county. You can refine your search results by specifying your specific jurisdiction location using the drop-down menus above.

Effective Products (16)

Preliminary Products (0)

Historic Products (2)

Flood Risk Products (0)

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Search Results for TILLAMOOK, CITY OF

Click [subscribe](#) to receive email notifications when products are updated.

Please Note: Searching All Products by county displays all products for all communities within the county. You can refine your search results by specifying your specific jurisdiction location using the drop-down menus above.

Effective Products (16) ?

FIRM Panels (5)

FIS Reports (1)

Product ID	Effective Date	Size	Download
410202V000A	08/20/2002	4MB	

LOMC (8)

NFHL Data-State (1)

NFHL Data-County (1)

Preliminary Products (0) ?

Pending Product (0) ?

Historic Products (2) ?

Flood Risk Products (0) ?

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Map Exercise

PRACTICE FINDING THE BFE FOR THREE DIFFERENT PROPERTY LOCATIONS

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Instructions

Find the BFE to the nearest tenth of a foot for Properties A, B, and C

Use the FIRM and the FIS provided

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Property A

The image shows a Flood Insurance Rate Map (FIRM) for Cook County, Illinois. The map displays various flood zones, including Zone X (shaded gray) and Zone A (unshaded). Two properties are highlighted with red boxes and labels: Property B in the upper left and Property A in the lower right. The map includes a legend, a scale bar, and a table of flood zones. The table lists the flood zone, the corresponding Flood Insurance Rate (FIR), and the Flood Insurance Premium (FIP). The map also includes a title block with the following information:

Flood Zone	Flood Insurance Rate (FIR)	Flood Insurance Premium (FIP)
Zone X	1.00	1.00
Zone A	0.50	0.50

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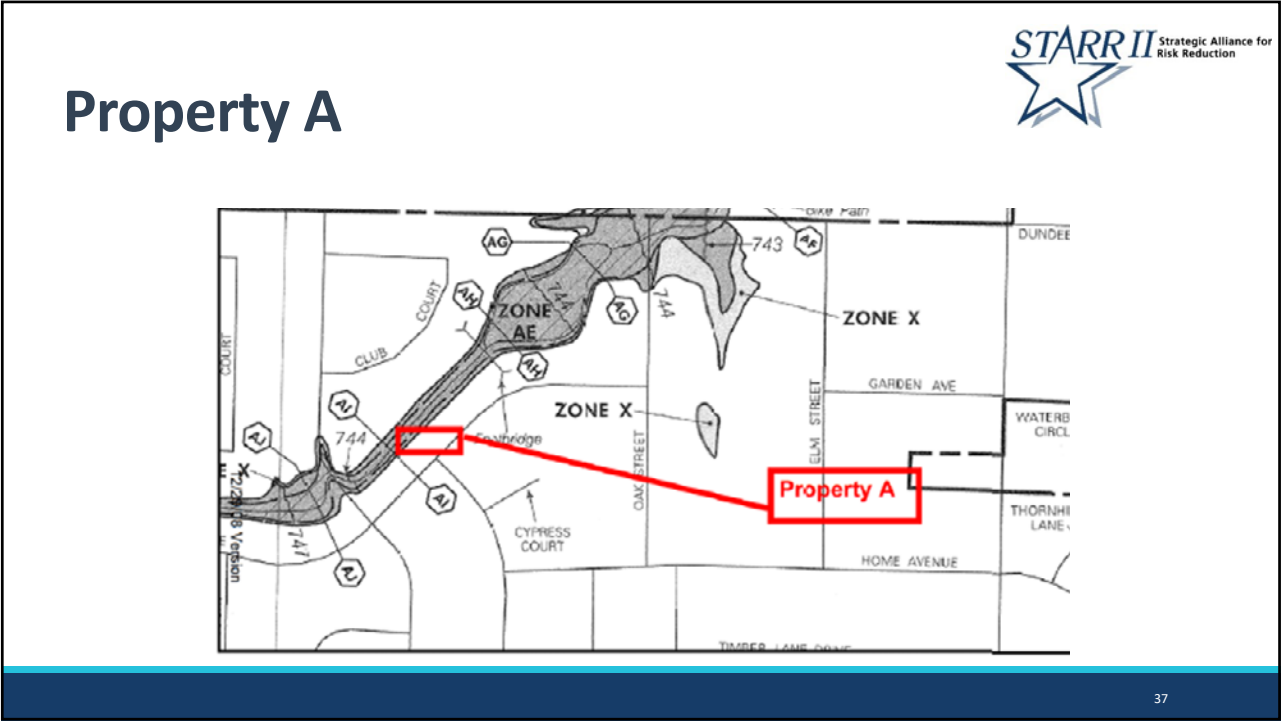


TABLE 19

FLOODING SOURCE		FLOODWAY			1-PERCENT-ANNUAL-CHANCE-FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE (FEET)
Buffalo Creek Tributary A (Cont'd)								
O	12,370 ^a	161	137	2.9	720.1	720.1	720.2	0.1
P	12,420 ^a	200	540	0.7	720.2	720.2	720.2	0.0
Q	12,760 ^a	290	332	1.2	720.8	720.8	720.8	0.0
R	12,850 ^a	279	450	0.9	721.3	721.3	721.4	0.1
S	13,770 ^a	209	239	1.3	722.7	722.7	722.8	0.1
T	13,900 ^a	200	307	1.0	722.9	722.9	722.9	0.0
U	14,400 ^a	44	82	3.9	724.5	724.5	724.6	0.1
V	14,590 ^a	30	53	6.0	725.6	725.6	725.6	0.0
W	14,700 ^a	20	79	3.7	726.7	726.7	726.7	0.0
X	15,110 ^a	38	82	3.6	729.8	729.8	729.9	0.1
Y	15,210 ^a	90	283	1.0	731.3	731.3	731.3	0.0
Z	18,050 ^a	270	195	1.4	739.7	739.7	739.7	0.0
AA	18,552 ^a	103	168	2.8	740.5	740.5	740.5	0.0
AB	19,195 ^a	750	1,035	0.4	740.7	740.7	740.7	0.0
AC	19,350 ^a	508	1,181	0.2	740.7	740.7	740.7	0.0
AD	20,559 ^a	265	634	0.4	741.1	741.1	741.1	0.0
AE	20,854 ^a	80	120	2.0	741.9	741.9	742.0	0.1
AF	20,931 ^a	106	160	1.6	742.2	742.2	742.2	0.0
AG	21,544 ^a	165	1,044	0.1	743.8	743.8	743.9	0.1
AH	21,949 ^a	135	945	0.2	743.9	743.8	743.6	0.1
AI	22,548 ^a	41	201	1.1	744.3	744.3	744.3	0.0

^a Feet above mouth

FEDERAL EMERGENCY MANAGEMENT AGENCY
COOK COUNTY, IL
AND INCORPORATED AREAS

FLOODWAY DATA
BUFFALO CREEK TRIBUTARY A

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Determining BFE

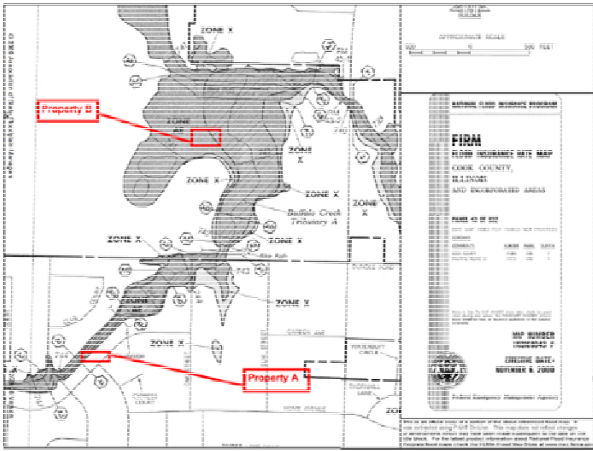
Use a property's most upstream boundary when determining the BFE.

If a property boundary is on or touching the nearest Cross Section line, use the FIS Floodway Data Table to determine the most accurate BFE to the nearest tenth of a foot.

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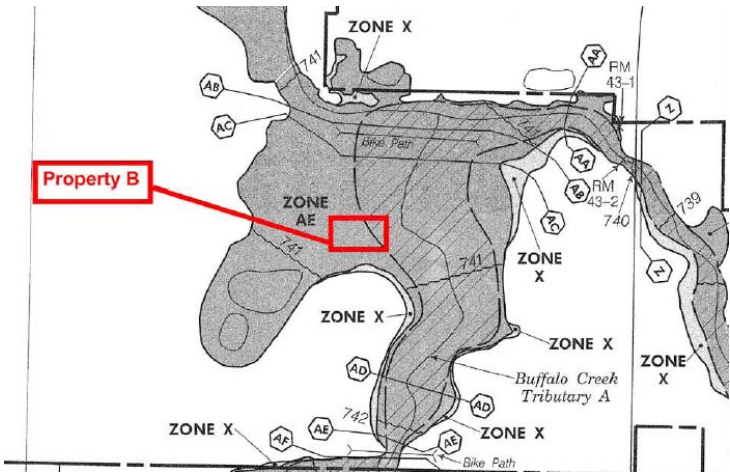
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Property B

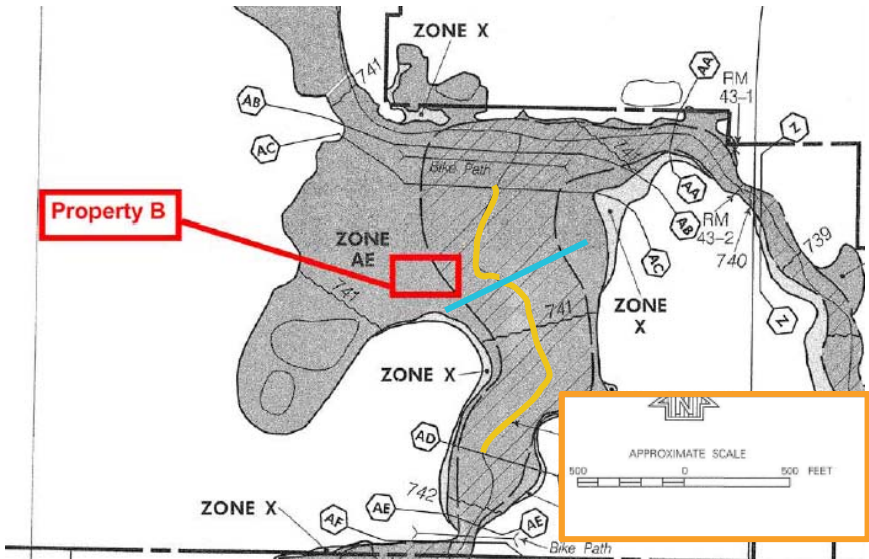


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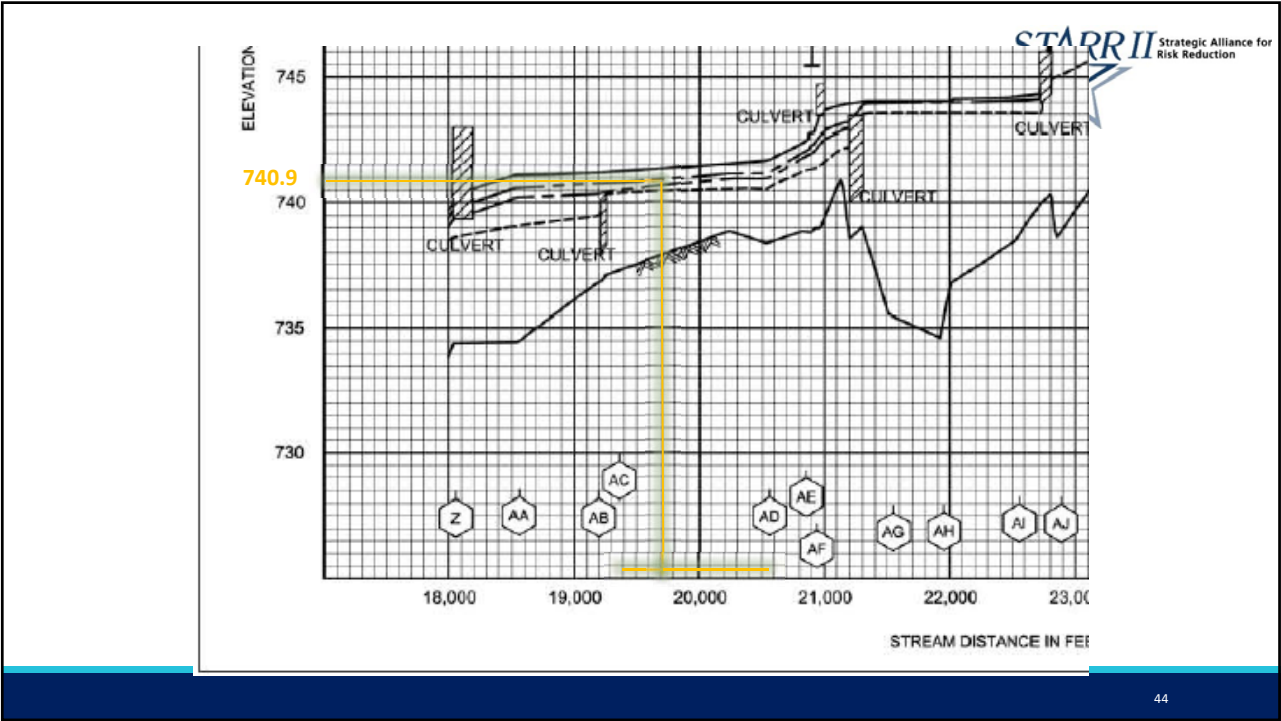
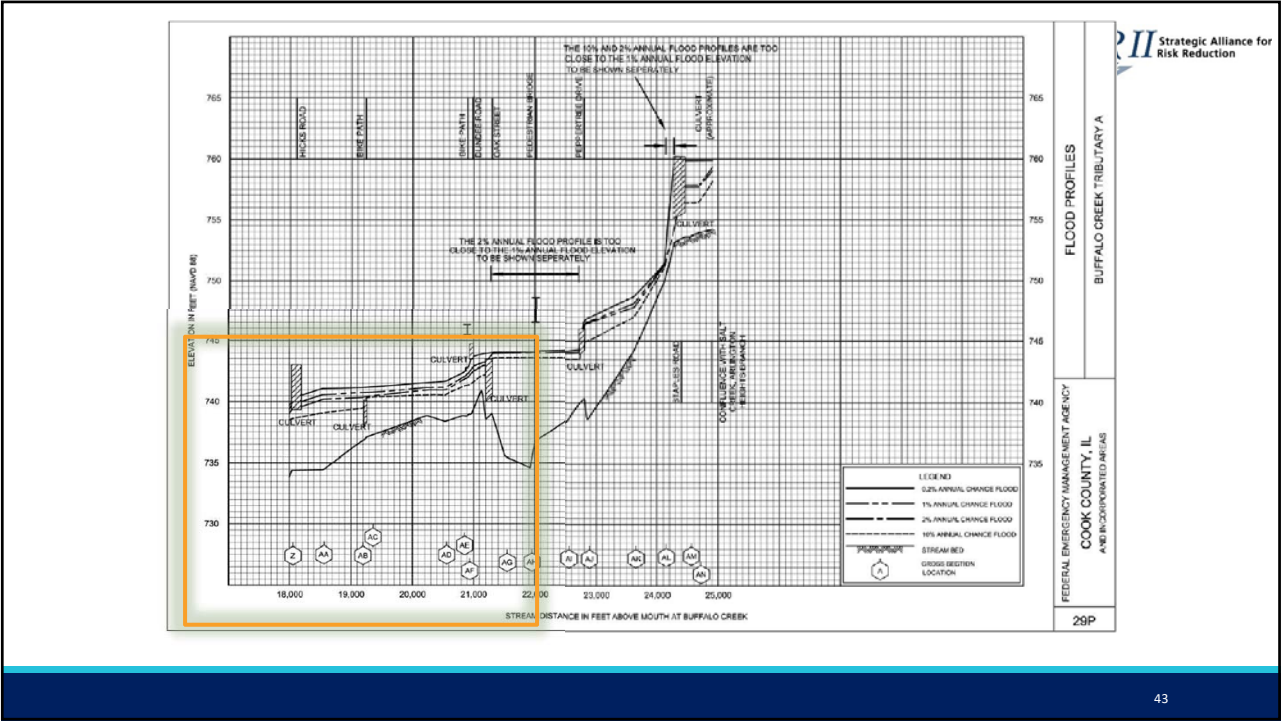
Property B



41



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Property C

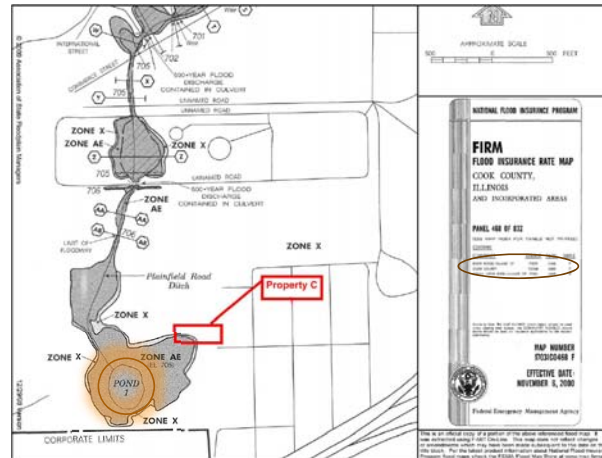


Table 15 – Summary of Stillwater Elevations

Flooding Source and Location	Elevation (feet NAVD 88)			
	10-Percent- Annual-Chance	2-Percent- Annual-Chance	1-Percent- Annual-Chance	0.2-Percent- Annual-Chance
Lake Michigan¹	**	**	564.7	**
City of Chicago				
Willow Higgins Flood Control Reservoir	**	**	641.9	**
City of Des Plaines				
Lake Mary Ann	**	**	634.4	**
Drake Ranch Pond	**	**	631.6	**
Bay Colony Pond	**	**	632.7	**
City of Hickory Hills				
Hickory Hills Reservoir	**	**	623.4	**
Area bounded by 95 th Street to the South, 93 rd Street to the North, and Keen Avenue to the west, along Bailey Deep Slough	**	**	697.8	**
Cook County				
Unincorporated Areas				
Detention Basin, located along an unnamed tributary to Long Run, just Upstream of NW-Cook Road	**	**	686.0	**
Toshly Avenue Reservoir (East Reservoir)	**	**	649.8	**
MWRD Reservoir (West Toshly Avenue FCR)	**	**	653.0	**
Village of Bensenville				
Ponding Area No. 1	653.2	654.4	655.0	**
Village of Burr Ridge				
Pond 1	705.2	705.4	705.5	705.7

** Data not available

¹ Stillwater elevation does not include tide or wave runup.

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BFE's in A Zones?

IS THAT POSSIBLE?

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Best Available Data Sources

- FEMA Map Information Exchange (FMIX)
- State Risk MAP Coordinator
- Preliminary flood insurance study data
- Site specific data generated by developer
- State or local department of transportation
- Natural Resources Conservation Service
- U.S. Army Corps of Engineers, USGS, Forest Service, etc.
- Historical flood of record

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What are your options?

For the elevation certificate or to obtain flood insurance

- Detailed methods

For floodplain management and regulatory purposes

- Simplified methods
- Require elevation above Highest Adjacent Grade by a specified number of feet based on local knowledge of flooding conditions

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Detailed Method

Topography

- Field surveys with cross sections

Hydrology

- Watershed drainage areas, regression equations, formulas, and hydrographs

Hydraulics

- Depths, step-backwater analysis, hydraulic structures

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Quick-2

Assists in the computation of flood water surface elevations in open channels

- Normal depth
- Critical depth
- Step-backwater computations

Appropriate for BFE on a single lot, single cross section

Still available at <https://www.fema.gov/quick-2-version-20>, but designed to run only on Operating Systems (OSs) through Windows 98. FEMA does not plan to upgrade for OSs XP and beyond.

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HEC-RAS

Free USACE software

Accepted by FEMA

1-D and 2-D Hydraulic modeling

- Cross sections
- Flow data
- Topographic/Survey data

(Requires engineering background to interpret results)

PROPRIETARY & CONFIDENTIAL TO STARR II (C) 2015-2016



Simplified Methods

Recorded flood of record

Contour Interpolation

Data Extrapolation

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Contour Interpolation

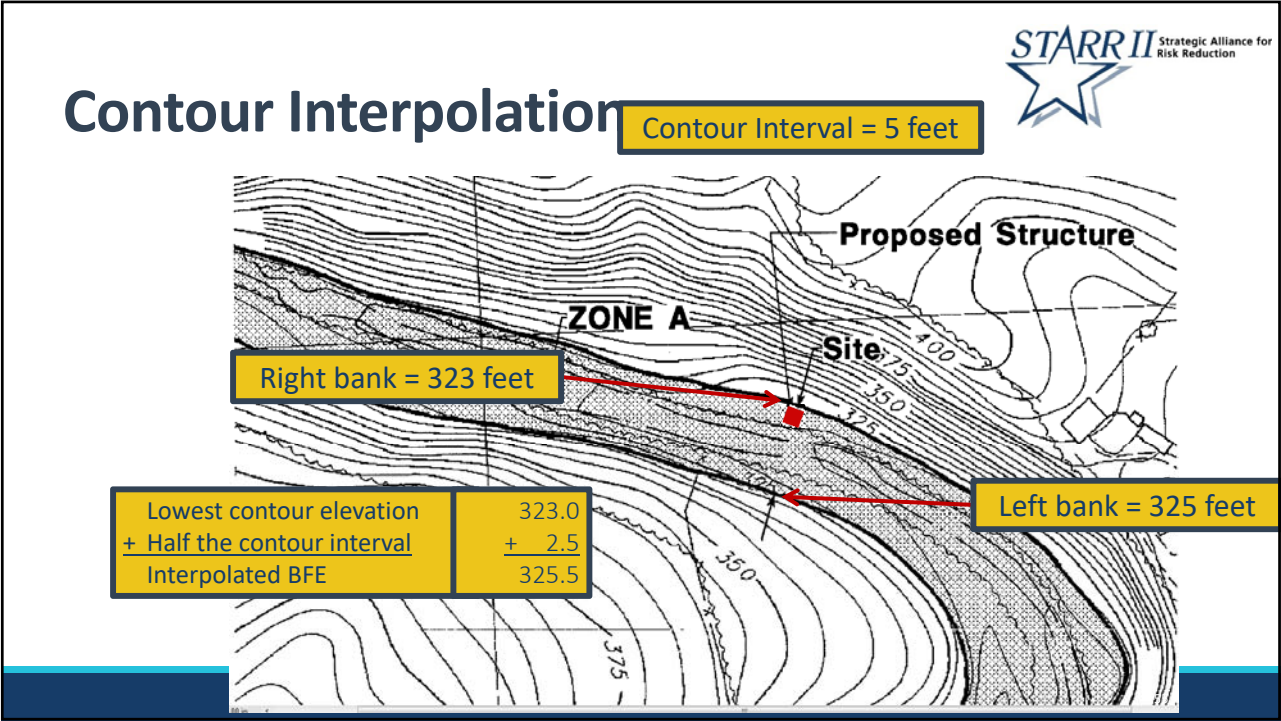
When can you use it?

- Floodplain boundary should generally conform with contour lines
- Water surface elevation (at floodplain boundary) must be within one half of the contour interval on both the right and left overbank lines

If within these accuracy limits

- $BFE = \text{lowest contour elevation} + \text{half the contour interval}$

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Data Extrapolation

For sites that are within 500 feet upstream of a study reach that already has a 1% chance annual flood profile developed

Floodplain and channel bottom slope are relatively similar to the downstream reach

Must be free from backwater effects from downstream hydraulic structures (e.g. bridges, dams, and culverts)

Data Extrapolation

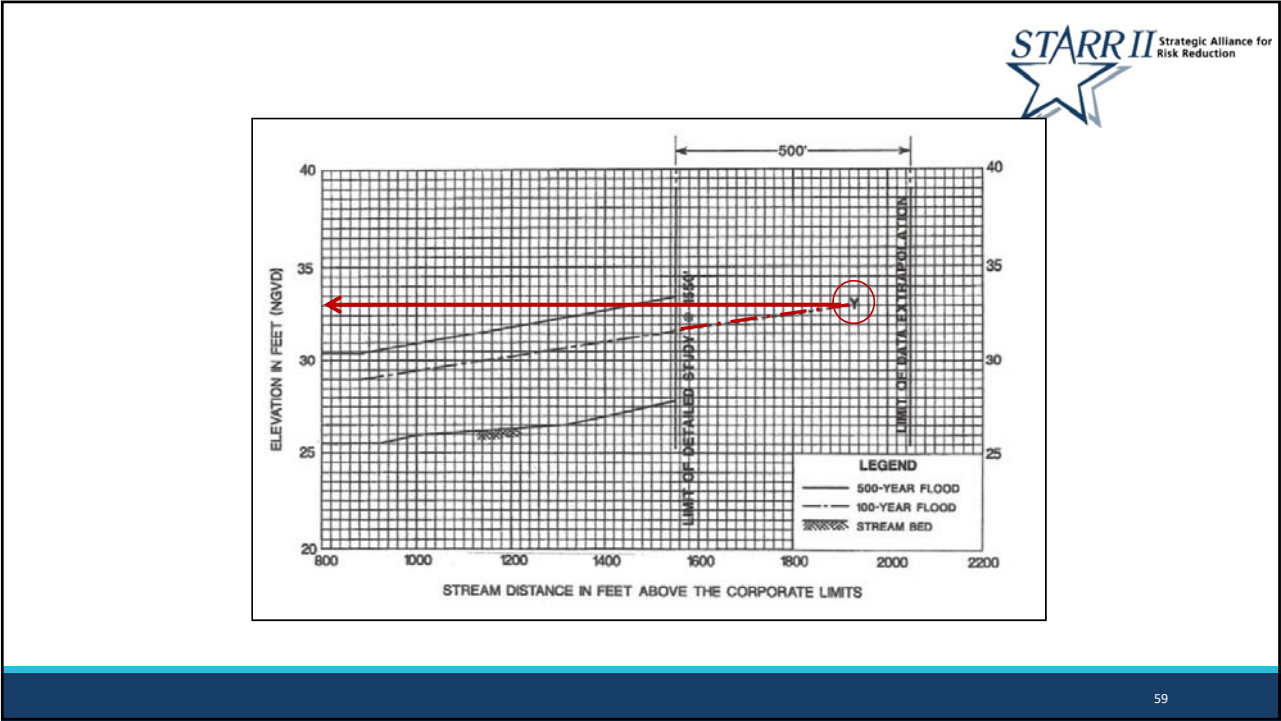
The diagram shows a cross-section of a river channel and its banks. A vertical line on the left is labeled 'CORPORATE LIMITS'. A dashed line represents the 'LIMIT OF DETAILED STUDY'. To the right of this is the 'LIMIT OF DATA EXTRAPOLATION'. The area between the corporate limits and the limit of detailed study is labeled 'ZONE AE'. The area between the limit of detailed study and the limit of data extrapolation is labeled 'ZONE A'. A point 'Z' is marked on the right bank within Zone A, enclosed in a red dashed circle. A point 'Y' is marked on the channel bed within Zone A, enclosed in a yellow circle. Elevation values are indicated along the channel bed: 24, 28, 28, 30, 32. A scale bar at the bottom left indicates '1"=400'.

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Remember the center line?

An aerial photograph from Google Earth showing a river channel. A green line is drawn along the center of the channel, representing the center line. The surrounding area is shaded in brown and red, indicating flood zones. The Google Earth logo is visible in the bottom right corner.

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How to get FEMA to help...

FEMA will determine a BFE when processing MT-1 applications, but the BFE may not be published.

Submit MT-1 case number to the FEMA library as part of an External Data Request for calculations used.

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Questions?

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Ask the Help Desk

RegionXHelpDesk@starr-team.com

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Thank you!

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