

# **Feeling the Flood: Evaluating Thematic Tactile Maps**

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Penn State University  
NACIS 2021

# When we left off....

- Flood Insurance Rate Maps (FIRMS) are complex and important.
- There is no accessible alternative (for most maps).
- Community hazard planning is much more difficult to engage in as a result.

**NOTES TO USERS**

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from boat drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **footcrops** have been determined, users are encouraged to consult the Flood Profiles and Footcrops Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent predicted elevations. Accurately, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

**Coastal Base Flood Elevations** shown on this map apply only landward of 6.0 North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for the jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **footcrops** were computed at cross sections and interpolated between cross sections. The footcrops were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Footcrop widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Massachusetts State Plane Mercator Zone F (NAD 83). The horizontal datum was NAD 83. CGRS 1983 spheroid. Differences in datum, spheroid, projection or UTM zone used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Survey datum of 1929 and the North American Vertical Datum of 1988 visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NDS Information Services  
 NOAA NIMS12  
 National Geodetic Survey  
 2230-3, #9023  
 1318 East-West Highway  
 Silver Spring, Maryland 20910-3282  
 (301) 713-3242

To obtain current elevation, description and/or location information for **beach marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

**Base map** information shown on this FIRM was derived from digital orthophotography. Base map files were provided in digital format by Massachusetts Geographic Information Systems (MassGIS). Ortho imagery was produced at 15 and 30 centimeter resolution. Aerial photography is dated Spring 2008.

The **AE Zone** category has been divided by a **Limit of Moderate Wave Action (LMWA)**. The LMWA represents the approximate landward limit of a 1.0 foot breaking wave. The effects of wave hazards between the VE Zone and the LMWA or between the LMWA and the LMWA for assessment VE Zones are not identified, but are small, but less severe than those in the VE Zone.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the profile baselines, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

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**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the locational printed **Map Index** for an overview map of the county showing the boundaries of map panels, community map repository addresses, and a listing of communities late containing National Flood Insurance Program data for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at <http://www.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

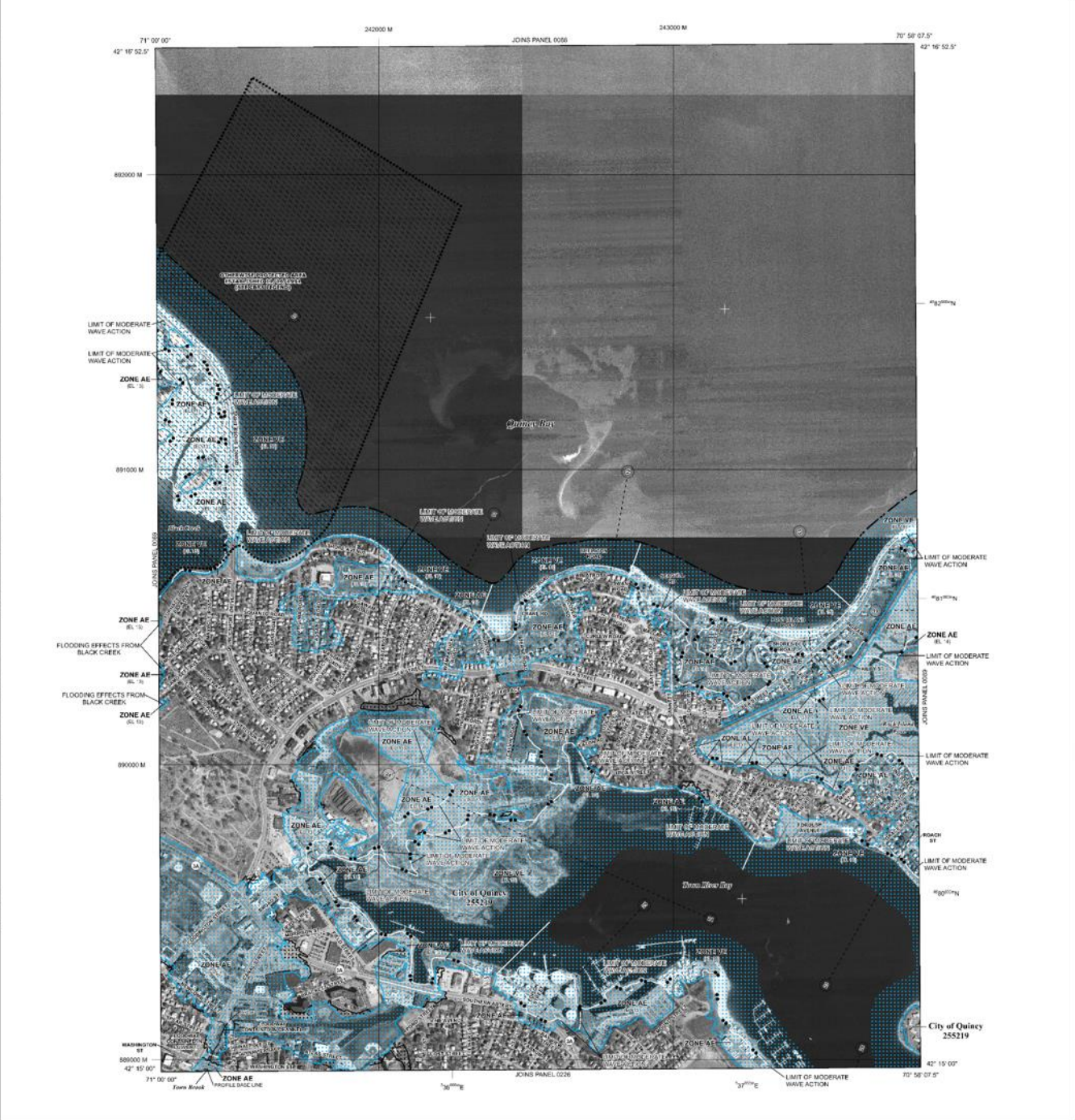
If you have **questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information Assistance (MIA)** at 1-877-FEMA-MAP (1-877-368-2071) or visit the FEMA website at <http://www.fema.gov/about/oa/mia/>.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) LEGEND**

11-16-1991 **Otherwise Protected Area (OPA)**  
 FLOOD INSURANCE NOT AVAILABLE FOR STRUCTURES NEWLY BUILT OR SUBSTANTIALLY IMPROVED ON OR AFTER NOVEMBER 16, 1991 IN DESIGNATED OPAs WITHIN THE CBRS.

Boundaries of the **John H. Chafee Coastal Barrier Resources System (CBRS)** shown on this FIRM were transferred from the official CBRS source map(s) for this area and are depicted on this FIRM for informational purposes only. The official CBRS maps are enacted by Congress via the Coastal Barrier Resources Act, as amended, and maintained by the U.S. Fish and Wildlife Service (FWS). The official CBRS maps were used to determine whether or not an area is located within the CBRS are available for download at <http://www.fws.gov>. For an official determination of whether or not an area is located within the CBRS, or for any questions regarding the CBRS, please contact the FWS field office for this area at 603-223-2541.

Only coastal structures that are certified to provide protection from the 1-percent-annual chance flood are shown on this panel. However, all structures shall be considered for the purpose of coastal flood hazard analysis and mapping are present in the FIRM database in **S\_Gen\_0000**.



**LEGEND**

**SPECIAL FLOOD HAZARD AREAS (SFHA) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD**  
 The 1% annual chance flood (100-year flood) was shown in the base flood in the FIRM that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AO, AH, X, VE, and V. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevations determined.

**ZONE AE** Base Flood Elevations determined.

**ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevation determined.

**ZONE AO** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevation determined. For areas of shallow flooding, water flow also determined.

**ZONE AR** Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently determined. Zone AR areas that the former flood control system is being replaced by a levee for protection from the 1% annual chance or greater flood.

**ZONE ARH** Area to be protected from the 1% annual chance flood by a levee for flood protection under construction; no Base Flood Elevations determined.

**ZONE VE** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevation determined.

**ZONE V** Coastal flood zone with velocity hazard (wave action); Base Flood Elevation determined.

**FLOODWAY AREAS IN ZONE AE**  
 The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without undesirable increases in flood heights.

**OTHER FLOOD AREAS**

**ZONE X** Areas of 1.2% annual chance flood; areas of 2% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; areas protected by levees from 1% annual chance flood.

**OTHER AREAS**

**ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPA)**  
 CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary  
 2% Annual Chance Floodplain Boundary  
 Footcrop Boundary  
 Zone VE Boundary  
 CBRS and OPA Boundary

Boundary shading Special Flood Hazard Areas and boundary shading Special Flood Hazard Areas of adjacent Base Flood Elevation, flood depths, or flood velocities.

Limit of Moderate Wave Action

Limit of Moderate Wave Action coincident with Zone AE

Base Flood Elevation line and value, elevation in feet  
 (E1.987)

Base Flood Elevation values uniform with area, elevation in feet

Referenced to the North American Vertical Datum of 1988

Cross section line  
 Contact line  
 Inlet  
 Bridge

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

490000 M  
 1000-meter Grid; Massachusetts State Plane Mercator Zone F (NAD 83) Lambert Conformal Conic projection  
 1000-meter Universal Transverse Mercator tick values, zone 18N

490000 X  
 Bench mark (see explanation in notes to users section of this FIRM panel)

**MAP REPOSITORY**  
 Refer to Map Repository for map orders

**EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP**  
 AUG 17, 2012

**EFFECTIVE DATE OF REVISIONS TO THIS PANEL**  
 June 9, 2014 - to change Base Flood Elevations and Special Flood Hazard Areas, to change zone designations, to update the effects of wave action, to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision and Letters of Map Change.

For community flood hazard history prior to countywide mapping, refer to the Community Map History files located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-425-6842.

**MAP SCALE 1" = 500'**  
 150 0 150 300 METERS

**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0088F**

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**NORFOLK COUNTY,**  
**MASSACHUSETTS**  
**(ALL JURISDICTIONS)**

**PANEL 88 OF 430**  
**(SEE MAP INDEX FOR FIRM PANEL LAYOUT)**

**CONDITIONS**

COMMUNITY	DATE	SCALE	STATUS
0088F	08/17/12	1"=500'	1

**NOTES:**  
 1. A MAP POLYLINE BOUNDARY OF THE CHANGING AREAS OF THE COMMUNITY RESOURCES SYSTEM (CRS) AND THE COASTAL BARRIER RESOURCES SYSTEM (CBRS) OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY IS SHOWN.

**Notice to User:** The **Map Number** shown below should be used when placing map orders, the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
 25021C0088F  
**MAP REVISED**  
 JUNE 9, 2014

Federal Emergency Management Agency

# National Flood Hazard Layer FIRMeTte



70°59'17"W 42°15'16"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000  
 Basemap: USGS National Map: Orthoimagery; Data refreshed October, 2020

## Legend

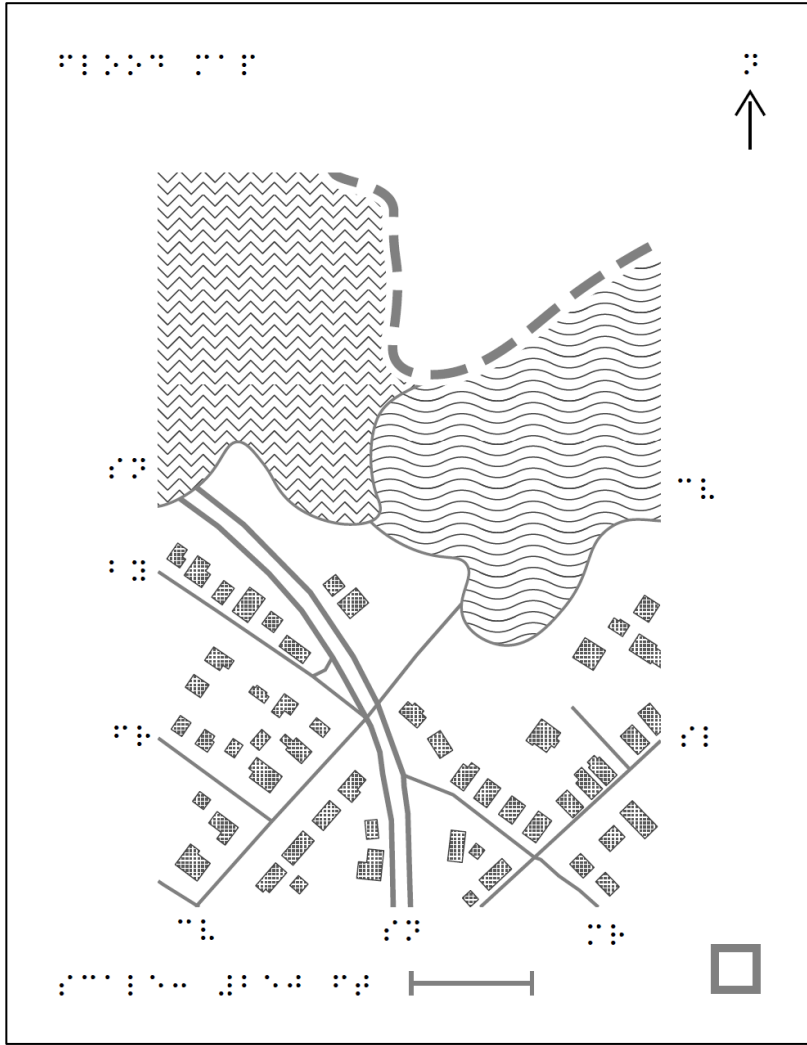
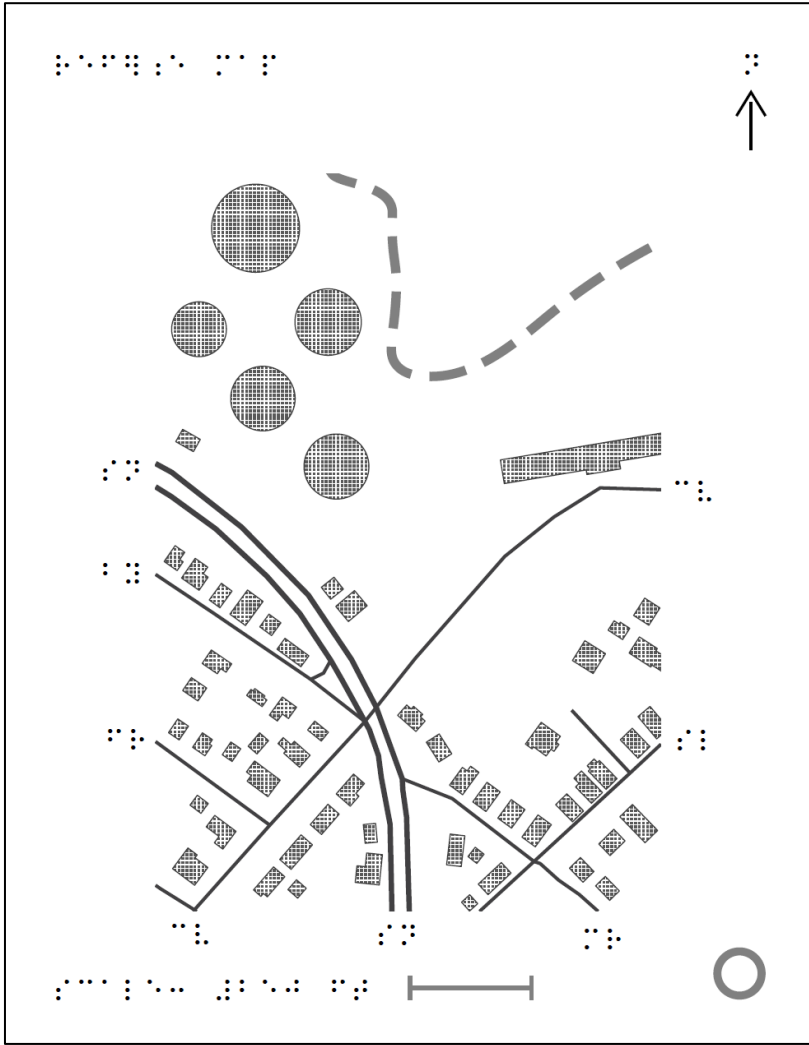
SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

<p><b>SPECIAL FLOOD HAZARD AREAS</b></p>	<p>Without Base Flood Elevation (BFE) Zone A, V, A99</p> <p>With BFE or Depth Zone AE, AO, AH, VE, AR</p> <p>Regulatory Floodway</p>
<p><b>OTHER AREAS OF FLOOD HAZARD</b></p>	<p>0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X</p> <p>Future Conditions 1% Annual Chance Flood Hazard Zone X</p> <p>Area with Reduced Flood Risk due to Levee. See Notes. Zone X</p> <p>Area with Flood Risk due to Levee Zone D</p>
<p><b>OTHER AREAS</b></p>	<p>NO SCREEN Area of Minimal Flood Hazard Zone X</p> <p>Effective LOMRs</p> <p>Area of Undetermined Flood Hazard Zone D</p>
<p><b>GENERAL STRUCTURES</b></p>	<p>Channel, Culvert, or Storm Sewer</p> <p>Levee, Dike, or Floodwall</p>
<p><b>OTHER FEATURES</b></p>	<p>20.2 Cross Sections with 1% Annual Chance Water Surface Elevation</p> <p>17.5 Coastal Transect</p> <p>Base Flood Elevation Line (BFE)</p> <p>Limit of Study</p> <p>Jurisdiction Boundary</p> <p>Coastal Transect Baseline</p> <p>Profile Baseline</p> <p>Hydrographic Feature</p>
<p><b>MAP PANELS</b></p>	<p>Digital Data Available</p> <p>No Digital Data Available</p> <p>Unmapped</p> <p>The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.</p>

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/4/2021 at 8:55 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



Map 1 Legend

	הדרך הראשית
	הדרך השנייה
	הדרך השלישית
	הדרך הרביעית
	האזור המזרחי
	האזור המערבי
	האזור המרכזי

Map 2 Legend

	האזור המזרחי
	האזור המערבי
	האזור המזרחי
	האזור המערבי
	האזור המרכזי

Map 1 Description

המפה מציגת תוכנית של רשת דרכים וצורות גאומטריות. הדרך הראשית היא קו ישר, הדרך השנייה היא קו מקווקו, הדרך השלישית היא קו כפול, והדרך הרביעית היא קו נקודות. האזור המזרחי מיוצג בקווי גלים, האזור המערבי בקווי אופקיים, והאזור המרכזי בקווי רשת. קו מקווקו מוקף את האזור המזרחי. סמל מעגלי ממוקם בפינה הימנית התחתונה.

Map 2 Description

המפה מציגת תוכנית של רשת דרכים וצורות גאומטריות. האזור המזרחי מיוצג בקווי גלים, והאזור המערבי בקווי אופקיים. קו מקווקו מוקף את האזור המזרחי. סמל מרובעי ממוקם בפינה הימנית התחתונה.



# Study goals

- Evaluate existing methods/technologies.
- Assess user confidence with analytical tasks.
- Maintain high accessibility.

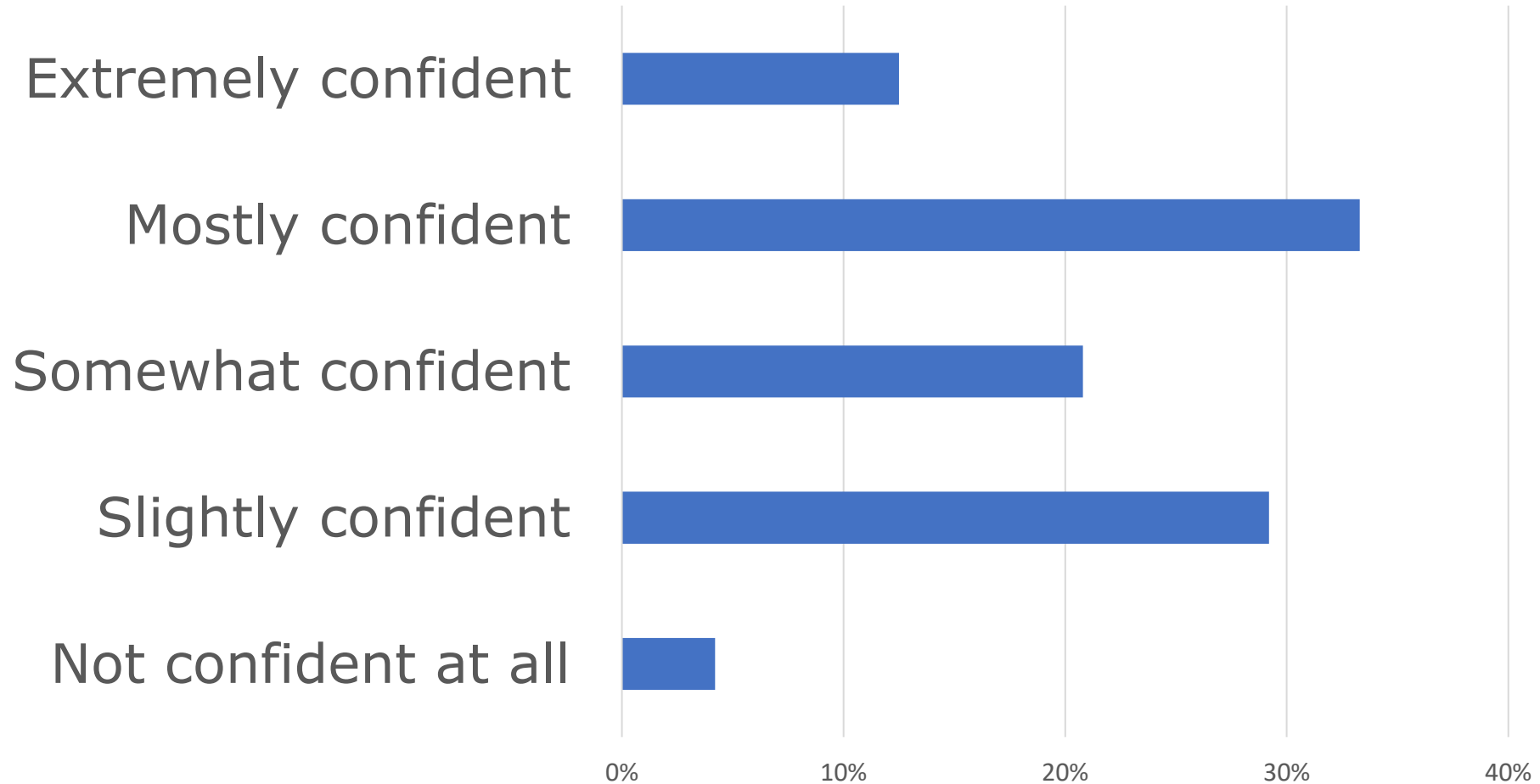
# Study protocol

- Participants were mailed maps showing one of two cities and a survey link.
- Survey asked them to perform hazard planning-related tasks.
- Participants performed tasks / rated quality of maps / rated their confidence using them.



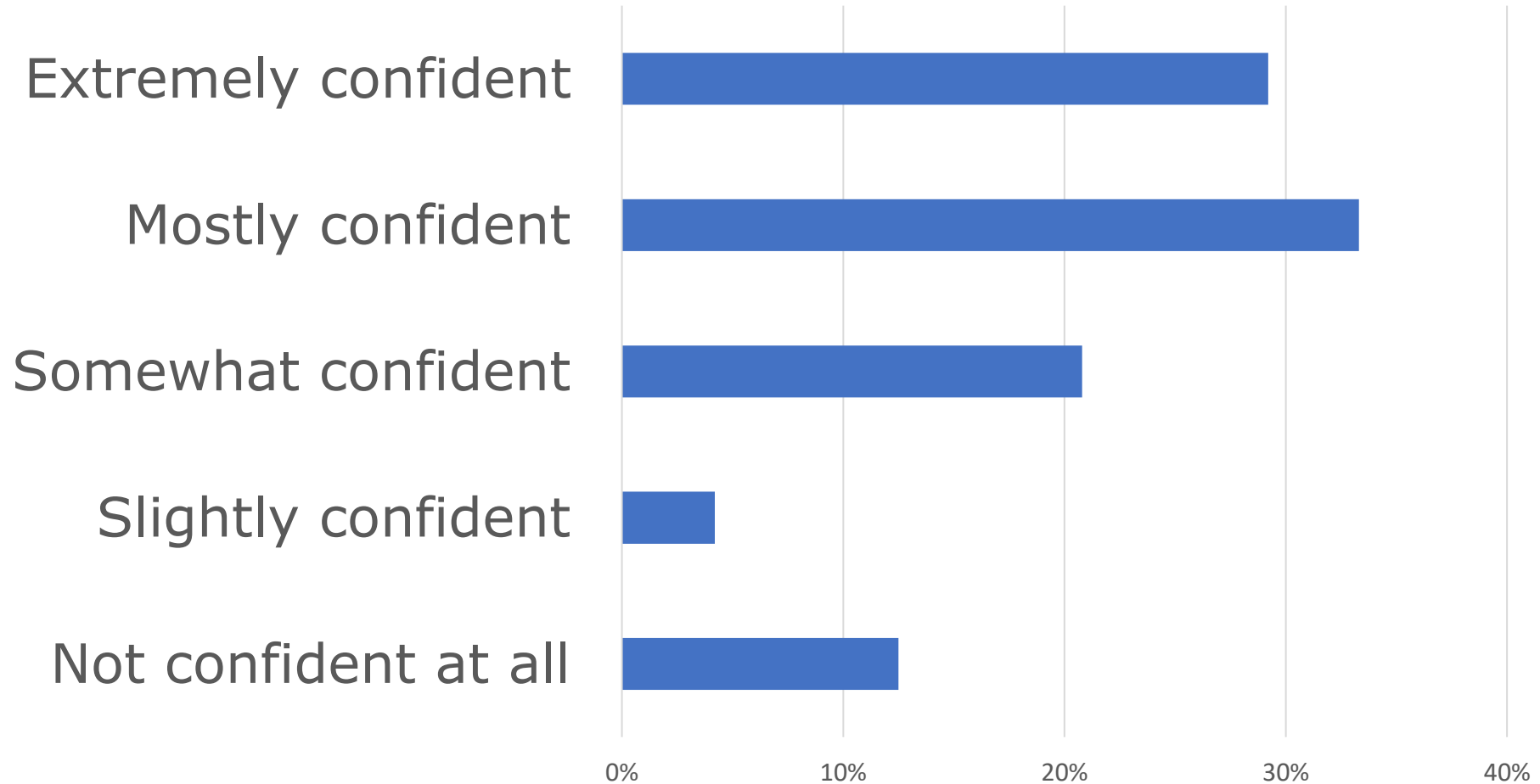
# Initial results

How confident did you feel while using the maps to analyze flood risk?



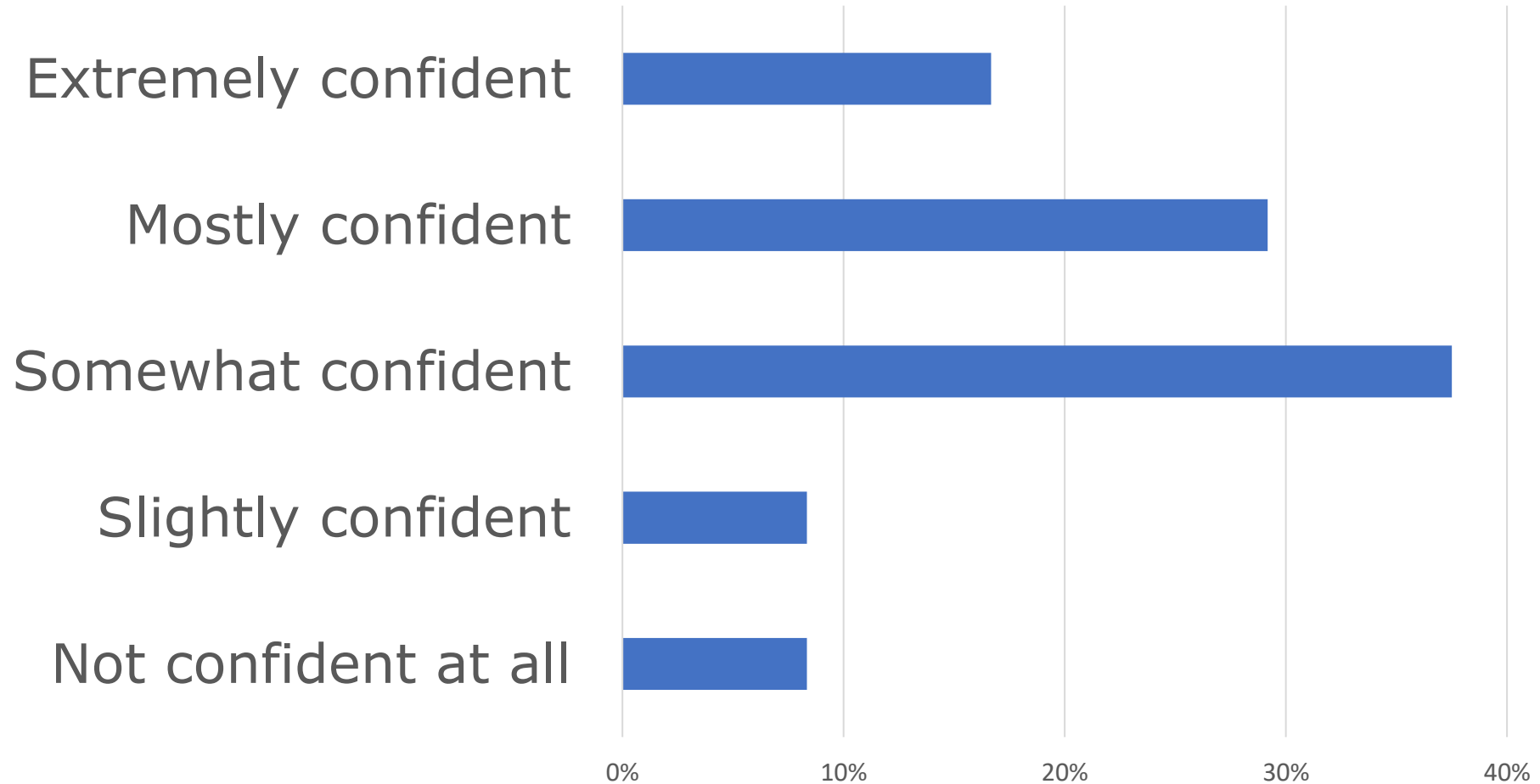
# Initial results

How confident did you feel while learning the meanings of symbols on the maps?



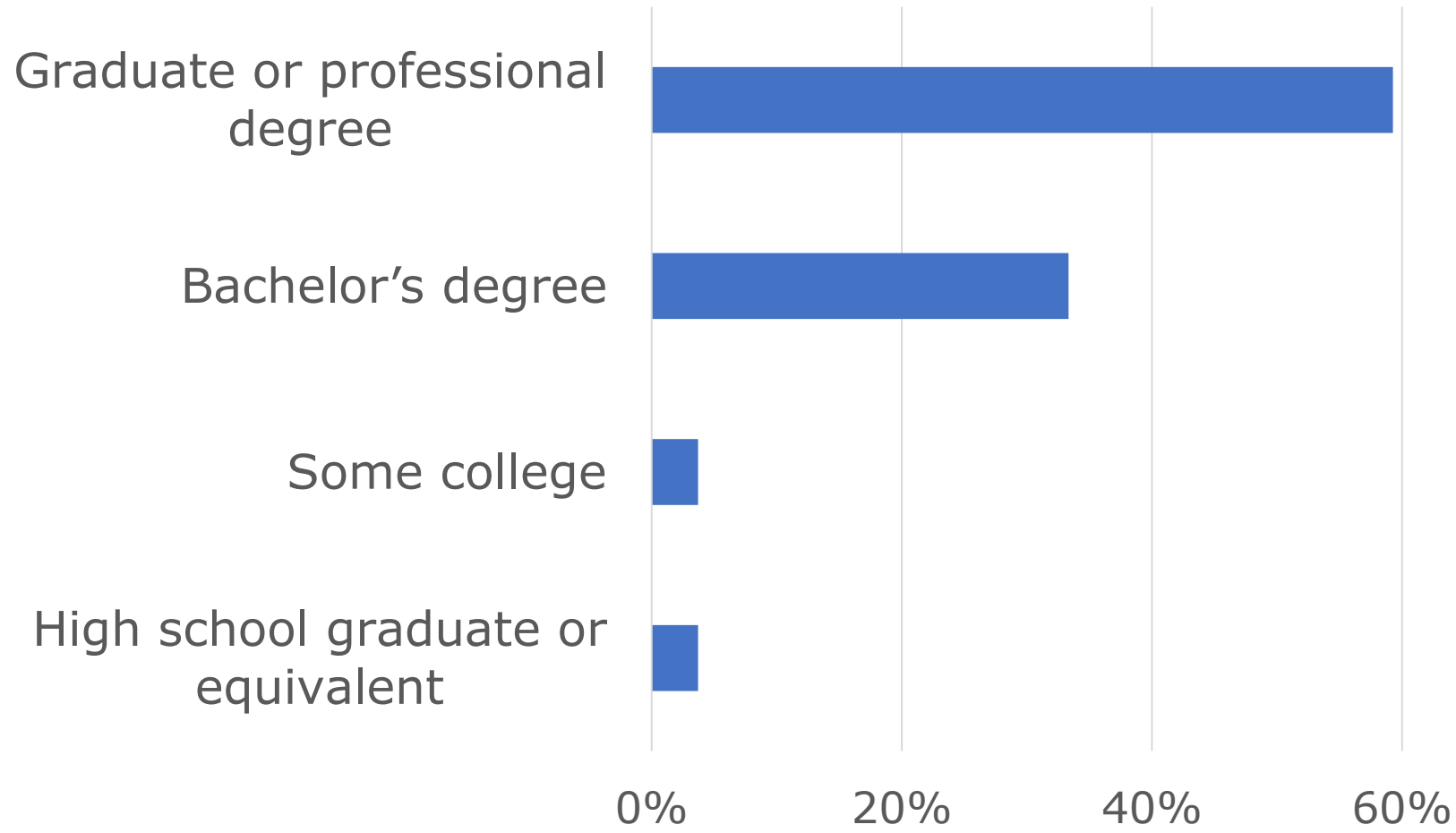
# Initial results

How confident would you be in using similar maps to analyze flood risk in your own community?



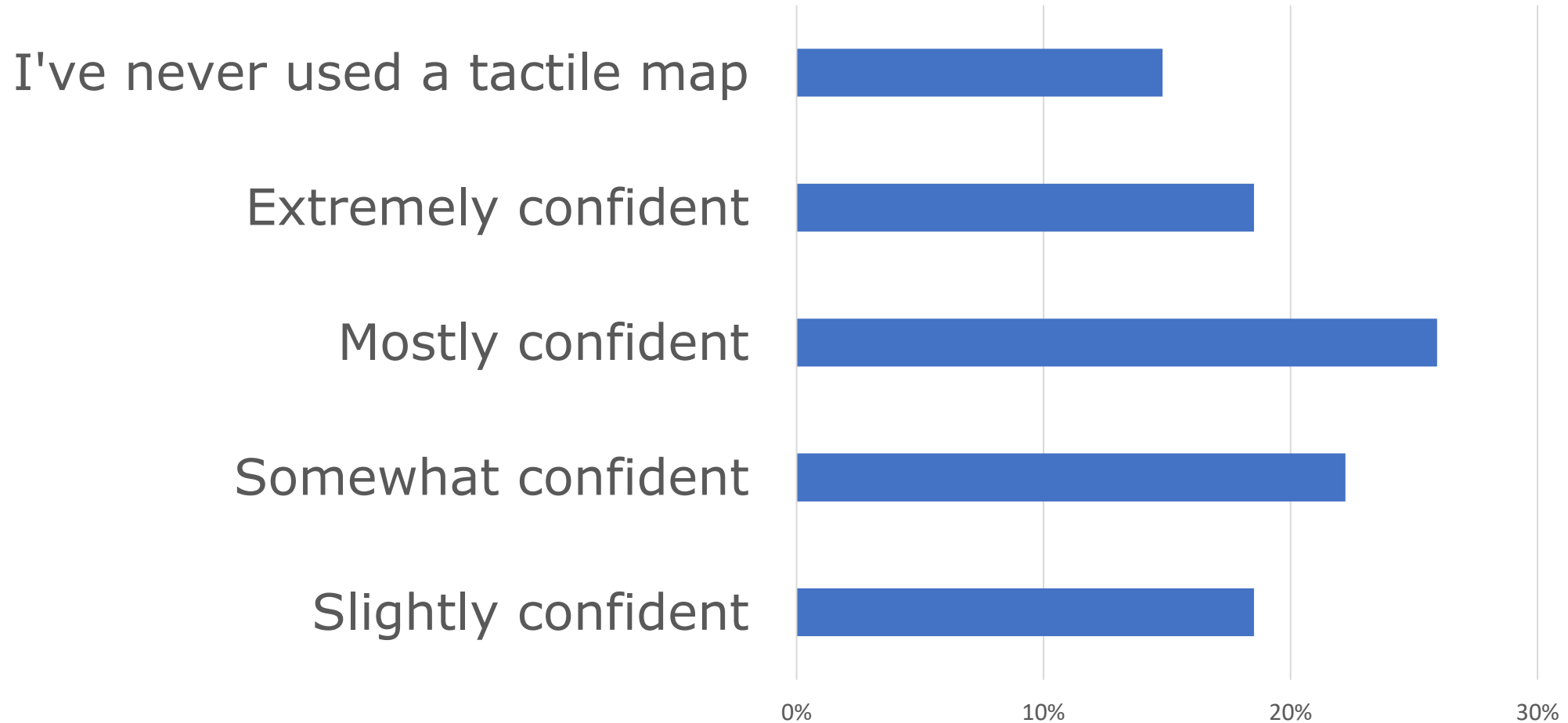
# Contributing factors

Please describe your education:



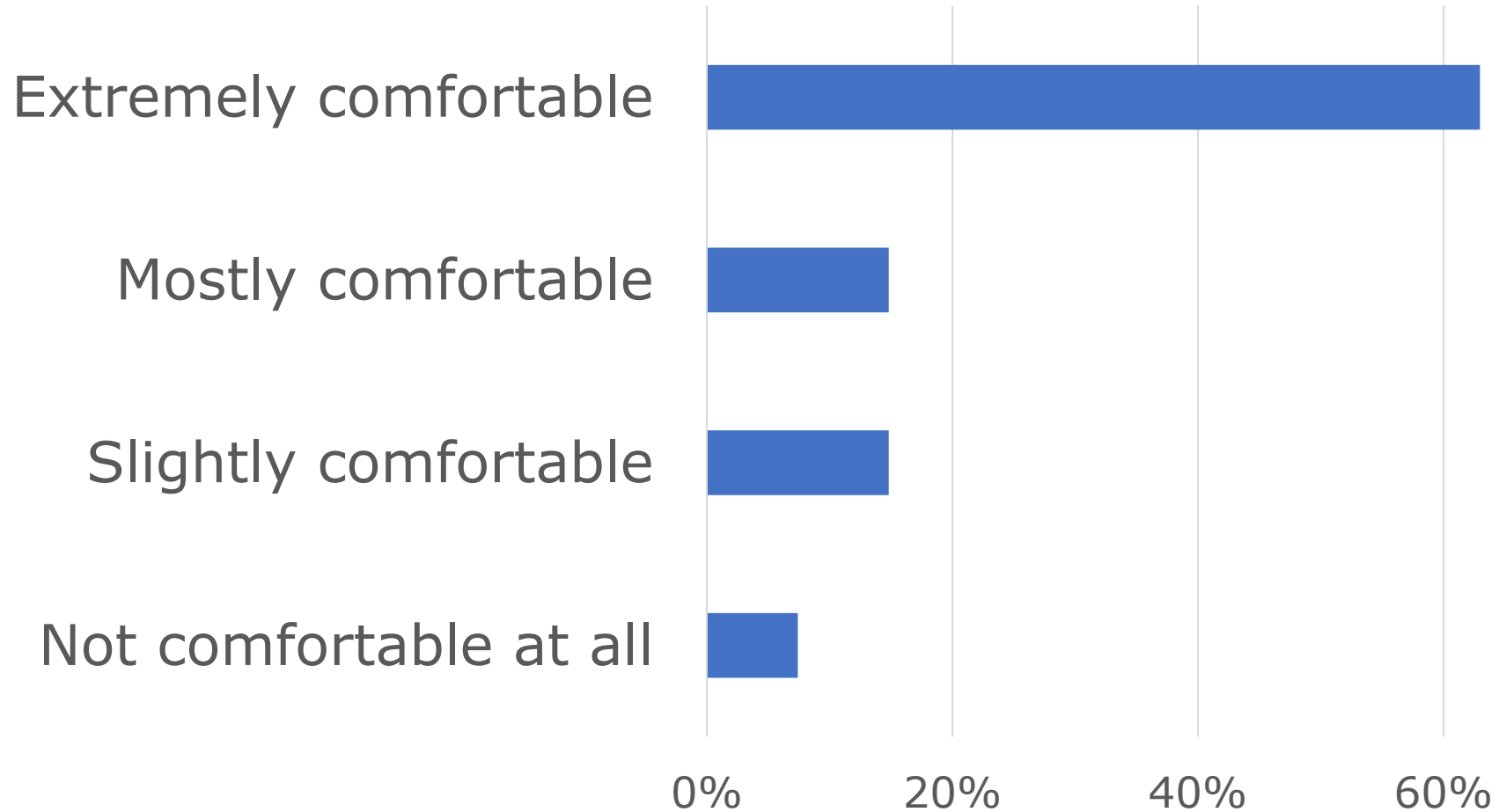
# Contributing factors

How confident do you feel while using tactile maps?



# Contributing factors

How comfortable are you with reading braille?



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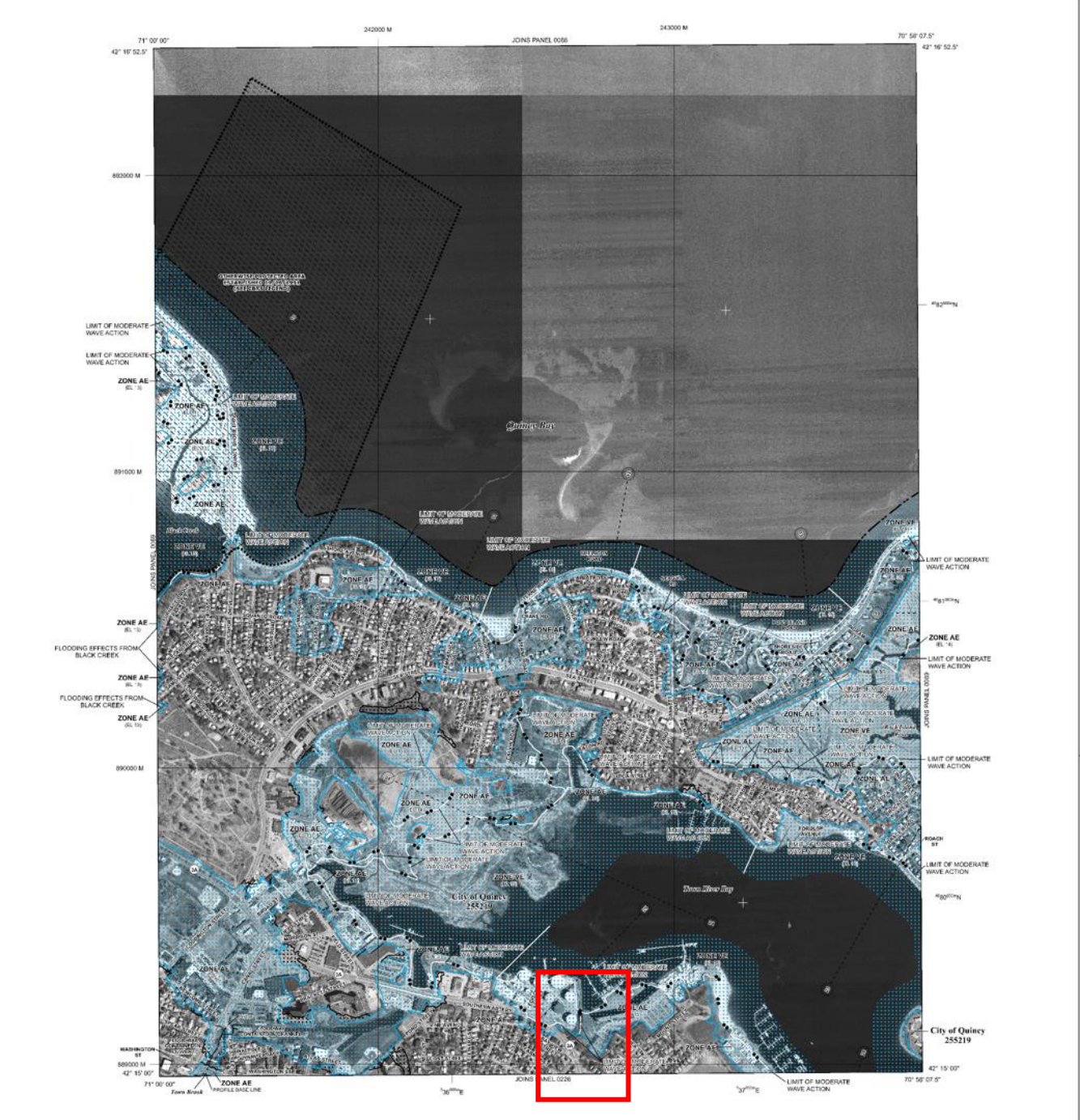
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**LEGEND**

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 The 1% annual chance flood (100-year flood) was derived from the base flood. The flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include zones AE, AE-1, AE-2, AE-3, AE-4, AE-5, and VE. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood.

**ZONE A** No Base Flood Elevation determined.  
**ZONE AE** Base Flood Elevation determined.  
**ZONE AE-1** Flood depths of 1 to 3 feet (usually areas of parking); Base Flood Elevation determined.  
**ZONE AE-2** Flood depths of 1 to 3 feet (usually areas of parking); Base Flood Elevation determined.  
**ZONE AE-3** Special Flood Hazard areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently determined. Zone AE-3 areas that are former flood control systems being retained to provide protection from the 1% annual chance or greater flood.  
**ZONE AE-4** Area to be protected from the 1% annual chance flood by a levee flood protection system under construction; no Base Flood Elevation determined.  
**ZONE AE-5** Coastal flood zone with velocity based (wave action); no Base Flood Elevation determined.  
**ZONE VE** Coastal flood zone with velocity based (wave action); no Base Flood Elevation determined.

**FLOODWAY AREAS IN ZONE AE:**  
 The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without undesirable increases in flood heights.

**OTHER FLOOD AREAS**  
**ZONE X** Areas of 1-2% annual chance flood; areas of 2% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; areas protected by levees from 1% annual chance flood.  
**OTHER AREAS**  
**ZONE X-1** Areas determined to be outside the 0.2% annual chance floodplain.  
**ZONE D** Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**  
**OTHERWISE PROTECTED AREAS (OPA)**  
 CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.  
 1% Annual Chance Floodplain Boundary  
 2% Annual Chance Floodplain Boundary  
 Floodway Boundary  
 Zone D Boundary  
 CBRS and OPA Boundary

**BOUNDARY SHIELDING SPECIAL FLOOD HAZARD AREAS AND BOUNDARY SHIELDING SPECIAL FLOOD HAZARD AREAS OF DIFFERENT BASE FLOOD ELEVATIONS, FLOOD DEPTHS, OR FLOOD VELOCITIES**  
 Limit of Moderate Wave Action  
 Limit of Moderate Wave Action coincident with Zone AE  
 Base Flood Elevation line and value, elevation in feet  
 Base Flood Elevation values uniform with zone, elevation in feet  
 (E1, S67)

**REFERENCES TO THE NORTH AMERICAN VERTICAL DATUM OF 1988**  
 Cross section line  
 Transit line  
 Contact line  
 Bridge  
 Geographic coordinates referenced to the North American Datum of 1988 (NAD 83) Western Hemisphere  
 490000 M  
 1000-meter grid; Massachusetts State Plane Mercator Zone  
 FIPS Zone 2021; Lambert Conformal Conic projection  
 1000-meter Universal Transverse Mercator tick values, zone 20R  
 000000 M  
 1000-meter Universal Transverse Mercator tick values, zone 20R  
 000000 M

**MAP REPERTOIRE**  
 Refer to Map Repository for map titles  
 EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP  
 JAN 17, 2014  
 EFFECTIVE DATE OF REVISIONS TO THIS PANEL  
 June 9, 2014 - to change Base Flood Elevation and Special Flood Hazard Areas, to change zone designations, to update the effects of wave action, to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Change and Coastal Barrier Resources System data  
 For community flood hazard history prior to countywide mapping, refer to the Community Map History files located in the Flood Insurance Study report for the jurisdiction.  
 To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-425-6842

**MAP SCALE 1" = 500'**  
 0 500 1000  
 0 500 1000  
 METERS FEET

**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0088F**

**FIRM**  
**FLOOD INSURANCE RATE MAP**  
**NORFOLK COUNTY,**  
**MASSACHUSETTS**  
**(ALL JURISDICTIONS)**

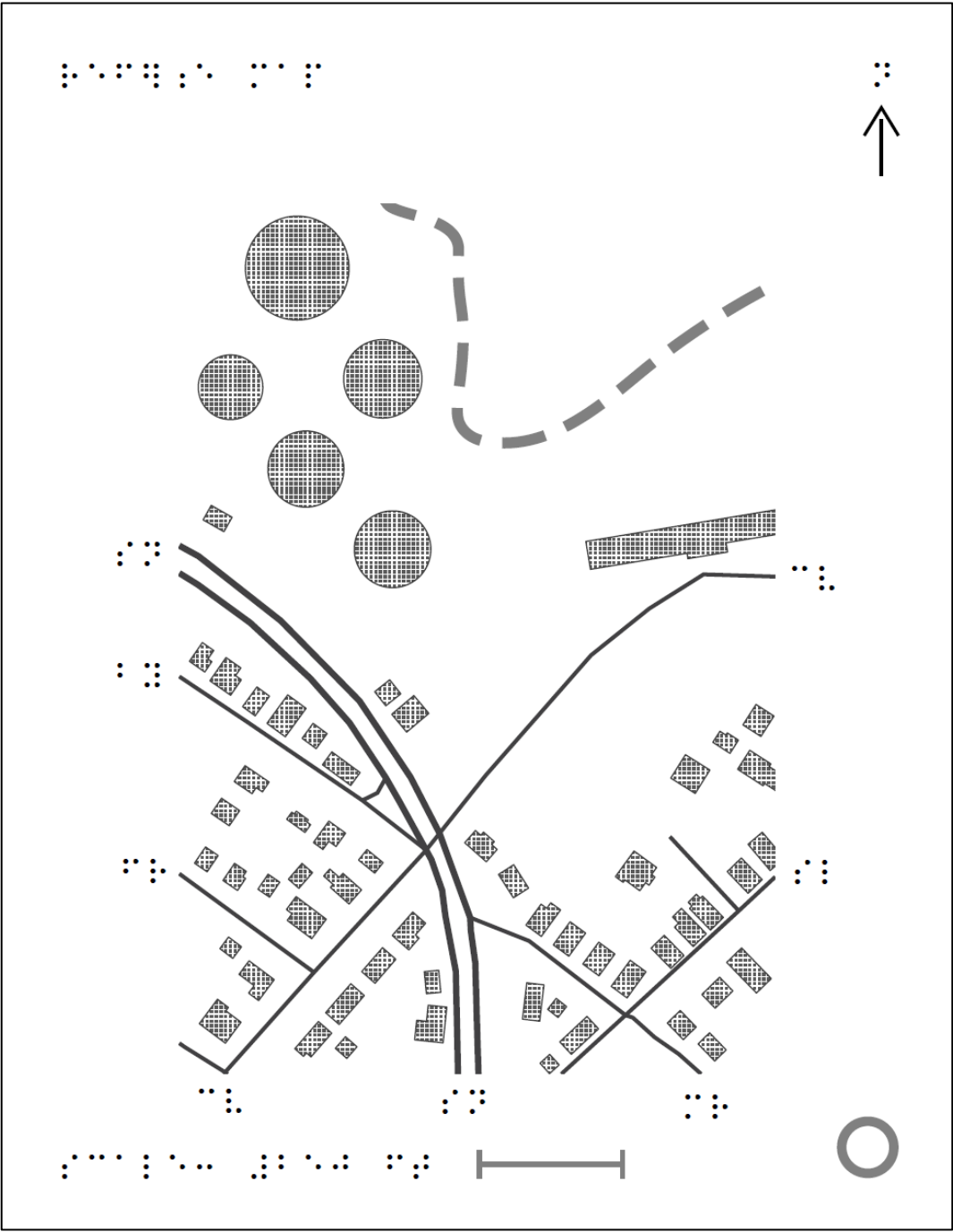
**PANEL 88 OF 430**  
**(SEE MAP INDEX FOR FIRM PANEL LAYOUT)**

**CONDITIONS**  
 COMMUNITY NUMBER 25021C0088F  
 GMAF:107000  
 DATE 06/09/14

**NOTE:**  
 THIS MAP PROVIDES INFORMATION OF THE CHANGING NATURE OF FLOOD HAZARD RESOURCES. IT IS NOT INTENDED TO BE USED AS A BASIS FOR INSURANCE POLICY RENEWALS OR FOR OTHER PURPOSES. THE COMMUNITY NUMBER SHOWN ABOVE IS THE OFFICIAL COMMUNITY NUMBER FOR THIS JURISDICTION.  
 Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject community.

**MAP NUMBER**  
**25021C0088F**  
**MAP REVISED**  
**JUNE 9, 2014**

**Federal Emergency Management Agency**





# **“Soft” findings**

- Very little infrastructure/support for accessible media
- Very little support or education using tactile maps
- Maps of the mundane are meaningful!

# Thank you

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