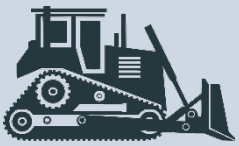
# INFORMED LAND DEVELOPMENT WITH BLE

Engineers and developers benefit from the availability of credible and comprehensive flood hazard information. Datasets showing the location of areas prone to flooding inform site planning decisions, like earthwork/grading, infrastructure location (bridge, culverts, drainage swales and ponds) and other development activities. With flood hazard data communities can make more informed decisions regarding local commercial and residential development activities.

A local permit should be applied for prior to development activities or construction begins near areas determined to be flood prone by the 1% annual chance storm event. Communities are required to permit all development activities to assure that any structure located in the vicinity of a floodplain is done in a manner to assure it is relatively safe from flooding.

Flood risk may be altered by land development activities and the permitting process allows communities to review these alterations prior to construction. Consult the local floodplain manager and building department in your community before making any building or land modifications. Local building and permitting requirements vary by community and are based on local decisions and ordinances. At a minimum, communities will require two engineering models (a) existing conditions and (b) proposed conditions be submitted for review. Local officials use the analysis and information provided by the development community to assess potential change in flood risk due to the project. The review determines the change in water surface elevation within the project area and identifies where adjacent property owners may be affected.

**Flood Insurance Rate Maps (FIRMs).** FIRMs should always be consulted first; the current inventory of FIRMs provides regulatory flood hazard information for approximately 1.3 million of the nation's 4.0+ million miles of stream. The majority of flood zones shown on FIRMs are designated Zone A – depicting areas that are potentially flood prone during larger rain events with a shaded polygon, but not providing a published Base Flood Elevation (BFE). Since a large portion of the nation's streams do not have readily available flood hazard information, it is difficult for individuals, developers and communities to accurately assess and understand the potential for flooding in their area.



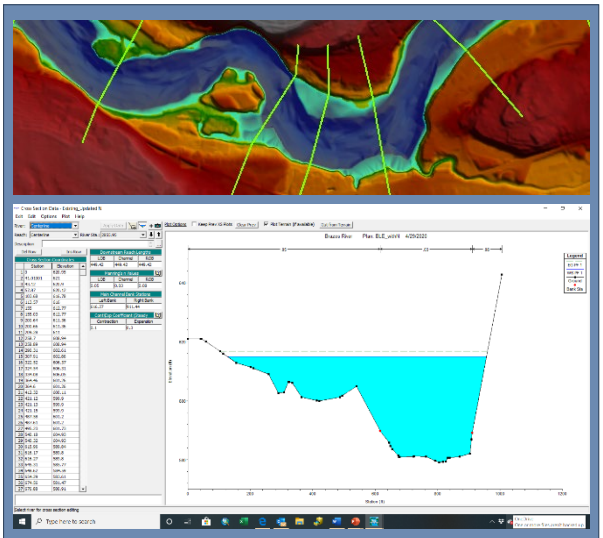
**Development** is defined as any man-made change to improved or unimproved real estate. This includes, but is not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation and drilling operations. Development also includes the storage of equipment or materials in the floodplain.

**BLE provides additional coverage.** Part 60.3 in the Code of Federal Regulations indicates when FIRMs do not provide sufficient data, the community shall "obtain, review and reasonably utilize data available from Federal, State or other sources… pending receipt of data" from FEMA. BLE assessments are performed for watersheds and river basins. Once an assessment is complete, hundreds of engineering models and a range of spatial information in GIS format is made available, expanding the accessibility of additional flood information for use. BLE data provides insight and mappable information to assist local consideration of development alternatives, assess project impacts, and ensure more resilient construction activities. While BLE flood information does not replace data shown on your community's current FIRM panels, the BLE data complements current FIRM Zone A areas and provides additional coverage where streams have not yet been included in the FIRM data coverage, expanding the coverage of available data for community and industry use.

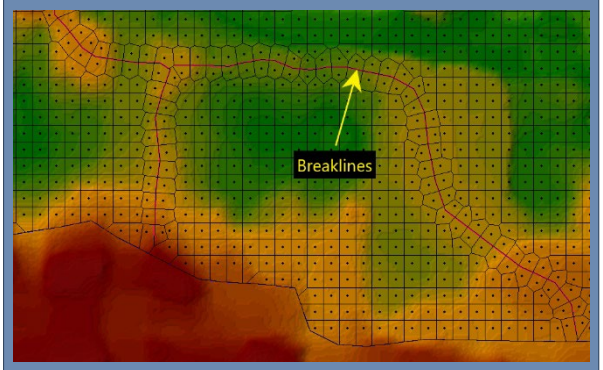
**BLE Models are Scalable.** BLE watershed assessments are built on high resolution ground elevation and use freely available hydraulic modeling software, Hydrologic Engineering Center – River Analysis System (HEC-RAS). The effort results in the preparation of Zone A modeling that may be refined. The BLE models are either

produced using a one-dimensional (1D) or two-dimensional environment. One-dimensional (1D) analysis produces great results where the stream channels are well defined. Two-dimensional (2D) analysis allows better identification of flood prone areas where flooding doesn't necessarily follow a defined channel. These models are easily refined to include site-specific information and can serve as the base model for assessing project impacts, adhering to community development requirements for permitting and preparation of FEMA Letters of Map Change (LOMCs). A few refinement examples are shared below:

- Field survey may be included to better define the stream channel.
- 1D models use a default calculation approach to determine the volume of flow (hydrology) leveraging Regional Regression Equations. The sub-basins used in this analysis are available for further breakdown. The source of land use and impervious area may also be updated with a local dataset.
- 2D model's hydrology is based on readily available data that may benefit from refinement of land use information and hydrologic losses removed from the hydraulic model.
- 1D models can be updated with structures using local as-built or survey information. Overbank and channel spacing and roughness coefficients (Manning's n) may also result in a more refined outcome.
- 2D models benefit from the addition of breaklines to define road embankments and levee features, indicating high points and refining the terrain. Breaklines also define the lowest drainage points, the stream channel.
- 2D models use hydro-connectors to define pathways for flow between grid cells. Using hydro-connectors, culverts may be quickly added to enhance the complexity of modeling and upgrade the results quickly.



**1D analysis** models several cross-sections along a stream reach; these cross-sections are analyzed to determine a water surface elevation.




**2D analysis** models use a gridded surface and a series of breaklines to define the analysis areas.

## Implementing Local Use of BLE Information.

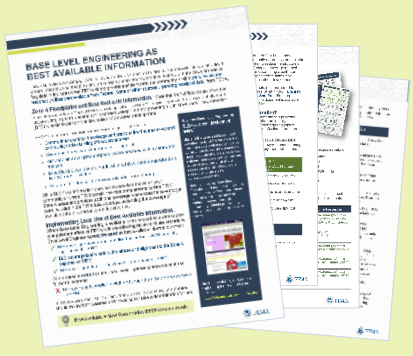
Where Base Level Engineering is available it can be used as a data source to supplement effective FIRMs with the following review and use procedure. Base Level Engineering may be used available information when:

- ✓ BLE coverage shows an area as flood prone that is NOT currently depicted on the FIRM
- ✓ BLE coverage is similar in width, shape and alignment to the Zone A depicted on FIRM
- ✓ BLE coverage is larger than Zone A areas shown on FIRM

Communities **should not** use Base Level Engineering information in the following instances:

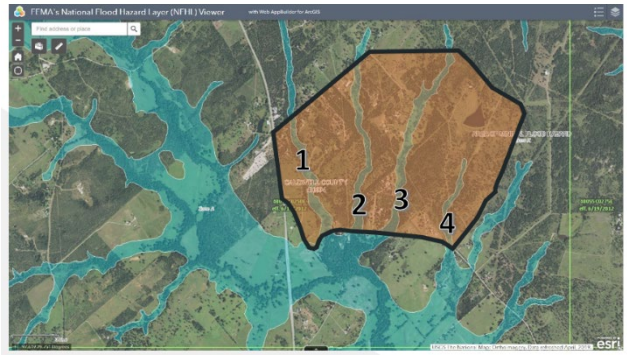
- ✗ BLE coverage is smaller in width and shape than Zone A areas shown on FIRM

In areas where Zone AE is depicted and a BFE is available, communities should review both datasets and modeling to define a Base Flood Elevation.



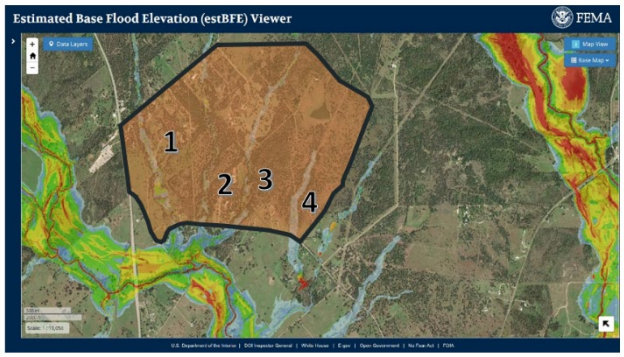

Download **BLE as Available Flood Hazard Information** from the FEMA website,

**Proposed Development & BLE.** As previously stated, the FIRMs and BLE information complement one another; the steps for collection and use of Base Level Engineering data to support local development activities are outlined in the steps below.




**1** The project area should be identified with the National Flood Hazard Layer (NFHL) available at: **www.msc.fema.gov/nfhl.**

The orange polygon in the image to the left identifies the area of a project to be developed, the NFHL flood data identifies four streams that drain the project area from north to south. These flood zones are Zone A; no BFEs are available for local use.




**2** These four streams are also identified as flood prone on the Estimated BFE (estBFE) Viewer, available at: **https://webapps.usgs.gov/infrm/estBFE/**.

The estBFE Viewer provides models and spatial files to download for use. These models are scalable and may be refined by local developers. The Viewer may be used to identify the streams within the project area. Turn on the stream centerlines and stream labels with the blue Data Layers button available at the upper left hand corner.

**3** Local permitting reviews require two model scenarios (a) existing conditions or pre-project and (b) proposed conditions model showing the results of the project. The second model should be created using grading plans and include any stream crossings that will be constructed.

**4** Once permits are received, the proposed conditions modeling should be used to identify the Base Flood Elevations (BFEs) for any structures to be placed in the vicinity of floodplain areas. Consider the use of pier and beam construction where high flood velocities are expected. Consider applying a freeboard of 1 to 2 feet to assure that further watershed development does not affect the structures that are being located throughout the project area.

**5** Once construction activities are completed and an as-built drawing has been assembled, a Letter of Map Revision (LOMR) submittal should be prepared and delivered to assist in the update of the FIRM panels in this project area. This update assures that any floodplain modifications are reflected on the FIRMs.

## QUICK FACTS

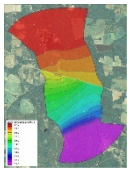
- Communities are responsible for permitting and land development decisions.
- FEMA's LOMR reviews are intended to review the development activities for inclusion into the nation's flood maps after construction has been completed.
- Communities may adopt and use Base Level Engineering as Best Available Information where FIRMs do not indicate a flood zone or have a Zone A with no established BFE.
- Communities and future residents may benefit from the local collection and filing of Elevation Certificates. This activity provides points towards NFIP community participation in the Community Rating System (CRS).
- Communities may require elevation certificates with a determined BFE prior to issuance of a final subdivision plat or certificate of occupancy.

Updated 12/8/21

## Community Uses for of Base Level Engineering Data

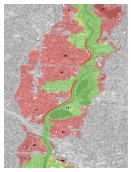
Development and Engineering professionals should ensure that the proposed project is reasonably safe from flooding and that the project considers a design that will both reduce flood losses and limit the impacts on neighboring properties.

The following BLE datasets are available for download; each is coupled with a description of how they may be used by communities:

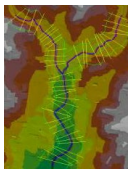


Estimated **Water Surface Elevation Grids** provide estimated Base Flood Elevations (BFEs) for use by developers to ensure new homes are built with the lowest floor above the BFE. Communities may wish to include additional local requirements, like freeboard.

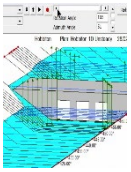
Estimated **Flood Depth Grids** can be used by developers and their team to determine appropriate layout and siting for neighborhoods and subdivisions, as well as the infrastructure that comes with them like streets, parks, open spaces, and utilities. Communities may also leverage these values for local risk communication activities.



The **Vector Geodatabase** is available for download, this includes **floodplains** for the 10%, 1% and 0.2% storm events. These floodplains indicate the areas that are flood prone during each scenario. A 10% event has a 1 in 10 chance of occurring each calendar year, a 1% event has a 1 in 100 chance of occurring each calendar year. The 0.2% chance event is five times less likely to occur than a 1% annual chance event.



The **Vector Geodatabase** model input information – **sub-basin** delineation, **stream centerlines** and analysis **cross-sections**. These files support model refinements that may be undertaken by a land developer or local engineering firm when designing a sub-division layout, determining open space areas or designing a new bridge or culvert crossing.



**Hydraulic (HEC-RAS) Models** are available for download and refinement by communities and/or local development and engineering professionals to determine BFEs. These models may be leveraged to submit local permitting. The models may also be used for FEMA MT-1 (Amendments) and MT-2 (Revisions) submissions.

### Site Specific Reports available through the Estimated BFE Viewer

BLE and the Estimated Base Flood Elevation (EstBFE) Viewer provide a free interactive on-line portal to allow communities to identify site-specific Base Flood Elevations and download engineering models that can be used by the development industry to assess the change in flood prone areas prior to the start of construction activity.

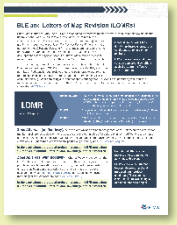
Users can look up Base Flood Elevations and flood depths with an address entry. A free report tool is available for printing, allowing residents to coordinate with community officials prior to any renovation, restoration or recovery efforts.

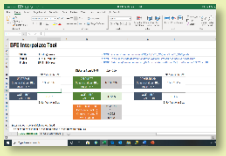

Check for availability of Base Level Engineering information in your vicinity at:

https://webapps.usgs.gov/infrm/estBFE/

Additional BLE resources are available on the FEMA.gov website at: https://go.usa.gov/xsGVe

- BLE and Letters of Map Amendment (LOMAs and LOMR-Fs)
- BLE and Letters of Map Revision (LOMRs and CLOMRs)
- HOW2 Find the right HEC-RAS Model
- HOW2 Find the right Spatial Data
- HOW2 BLE Use Matrix
- HOW2 Determine BFE Outside the Floodplain (1D/2D)
- BFE Interpolate Tool
- Flashcards – BLE Downloads, Vector Geodatabase & LOMAs with BLE

## Additional Community Uses for of BLE Data

BLE datasets provide secondary benefits to communities looking to be more informed and better prepared ahead of flood events. A number of local activities are identified below for community consideration:

**Capital Improvement Program/Project:** BLE data includes a point file (S_AOMI_PT) that may assist local communities in identifying stream crossings (vehicular and utilities) that may require rehabilitation. Culverts designs are usually sized for events smaller than the 1% annual chance storm event. Very frequently, the 4% annual chance event (25-yr) or 0.2% event (50-yr) is used for culvert and bridge design. Culverts and bridges that are undersized can collect debris (trees, limbs and dirt) that will clog the existing structure. Repeated overtopping and or debris build-up can lead to structural failure.

**Local Project Selection/Prioritization:** BLE products assist with prioritization of risk reduction and infrastructure improvement projects. The multiple flood return periods produced for a watershed can identify projects that are at higher risk of repeat and more frequent inundation, project locations that are within the 10% floodplain will likely flood more frequently.

**Evacuation Routes:** BLE data may identify low lying stream crossings that become impassable during larger storm events, locating areas where portions of the community population may not be able to retreat from. These areas may also be impassable by rescue vehicles – review the depth grid information to find these vulnerable areas.

**Critical Facilities Location:** BLE results include information for the 0.2% annual chance event. The areas flood prone during an event of this magnitude are not viable for the location of hospitals, police/fire departments, community shelters, or other critical facilities. Knowing the location of flood prone areas ensures that these public facilities are placed in areas that will not be inundated in larger storms.

**Open Space Planning:** Areas shown as flooding in BLE results along larger streams identify areas that may be great for community acquisition. These flood prone areas are great locations to increase the walkability of a community. Community parks, greenbelts, hike, bike and walking paths have additional benefits to communities, beyond a reduction of flooding.

**Grant Applications:** Several Federal and State mitigation grant funding programs require applicants to provide a flood map and identify a BFE for the project location. When a BFE is not available on the community FIRM, BLE can provide this information. Communities can use the Water Surface Elevations grid and or the site-specific report on the estBFE Viewer.