Flood Risk Report

Town of Superior, Arizona

Report Number 001

04/28/2023

FEMA

RiskMAP
Increasing Resilience Together

Project Area Community List

Community Name
Town of Superior

Preface

The Department of Homeland Security (DHS), Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states, tribes, and local communities with flood risk information and tools that they can use to increase their resilience to flooding and better protect their citizens. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP has transformed traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

This Flood Risk Report (FRR) provides non-regulatory information to help local or tribal officials, floodplain managers, planners, emergency managers, and others better understand their flood risk, take steps to mitigate those risks, and communicate those risks to their citizens and local businesses.

Because flood risk often extends beyond community limits, the FRR provides flood risk data for the entire Flood Risk Project as well as for each individual community. This also emphasizes that flood risk reduction activities may impact areas beyond jurisdictional boundaries.

Flood risk is always changing, and there may be other studies, reports, or sources of information available that provide more comprehensive information. The FRR is not intended to be regulatory or the final authoritative source of all flood risk data in the project area. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

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FLOOD RISK REPORT

1 Introduction

The Flood Risk Report (FRR), Flood Risk Map (FRM), and Flood Risk Datasets (FRD) together form a framework for enhancing a community's ability to manage flood related risk and are intended to augment other established floodplain management tools. Flood risk and corresponding mitigation strategies within the Town of Superior were developed via a planning group made up of FEMA, state, and local staff, and other public and community stakeholders, with local officials taking the lead responsibility for future implementation of identified mitigation opportunities or solutions.

Flooding is a natural part of our world and our communities. Flooding becomes a significant hazard, however, when it intersects with the built environment.

1.1 About Flood Risk

Floods are naturally occurring phenomena that can and do happen almost anywhere. In its most basic form, a flood is an accumulation of water over normally dry areas. Floods become hazardous to people and property when they inundate areas where development has occurred, or where people frequent, causing losses. Mild flood losses such as damage to landscaping or the generation of unwanted debris, may have little impact on people or property. Severe flooding can destroy buildings, ruin crops, and cause critical injuries or death.

Which Picture below shows more flood risk?

Even if you assume that the flood in both pictures was the same probability—let's say a 10-percent- annual-chance of exceedance flood—the consequences in terms of property damage and potential injury as a result of the flood in the bottom picture are much more severe. Therefore, the flood risk in the area shown in the bottom picture is higher.

1.1.1 Calculating Flood Risk

It is not enough to simply identify where flooding may occur. Just because one knows where a flood occurs does not mean they know the **risk** of flooding. The most common method for determining flood risk, also referred to as vulnerability, is to identify the probability of flooding and the consequences of flooding. In other words:

Flood Risk (or Vulnerability) **= Probability x Consequences**; where

Probability = the likelihood of occurrence

Consequences = the estimated impacts associated with the occurrei

The probability of a flood is the likelihood that a flood will occur. The probability of flooding can change based on physical, environmental, and/or contributing engineering factors. Factors affecting the probability that a flood will impact an area range from changing weather patterns or land use to the existence of mitigation projects. The ability to assess the probability of a flood and the level of accuracy for that assessment are also influenced by modeling methodology advancements, better technical knowledge, and longer periods of record for the flooding source in question.

The consequences of a flood are the estimated impacts associated with the flood occurrence. Consequences relate to humans' activities within an area and how a flood impacts the natural and built environments.

1.1.2 Risk MAP Flood Risk Products

Through Risk MAP, FEMA provides communities with updated Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs) that focus on the probability of floods and that show where flooding may occur as well as the calculated 1% annual chance of exceedance flood elevation. FEMA understands that flood risk is dynamic—that flooding does not stop at a line on a map—and as such, provides the following non-regulatory flood risk products:

- Flood Risk Report (FRR): The FRR presents key risk analysis data for the Flood Risk Project.
- Flood Risk Map (FRM): Like the example found in Section 3.3 of this document, the FRM shows a variety of flood risk information in the project area. More information about the data shown on the FRM may be found in Section 2 of this report.
- Flood Risk Database (FRD): The FRD houses the flood risk data developed during the flood risk analysis that can be used and updated by the community. After the Flood Risk Project is complete, this data can be used in many ways to visualize and communicate flood risk within the Flood Risk Project.

The above products provide flood risk information at the Flood Risk Project's community level, which can be particularly useful for mitigation planning and emergency management activities.

Whether or not an area might flood is one consideration. The extent to which it might flood adds a necessary dimension to that understanding.

1.2 Uses of This Report

The goal of this report is to help inform and enable communities and tribes to take action to reduce flood risk. Possible users of this report include:

- Local elected officials
- Floodplain managers
- Community planners
- Emergency managers
- Public works officials
- Other special interests (e.g., watershed conservation groups, environmental awareness organizations, etc.)

State, local, and tribal officials can use the summary information provided in this report, in conjunction with the data in the FRD, to:

- **Update local hazard mitigation plans.** As required by the 2000 Federal Stafford Act, local hazard mitigation plans must be updated at least every five (5) years. Summary information presented in Section 3 of this report and the FRM can be used to identify areas that may need additional focus when updating the

risk assessment section of a local hazard mitigation plan. Information found in Section 4 pertains to the different mitigation techniques and programs and can be used to inform decisions related to the mitigation strategy of local plans.

- **Update community comprehensive plans.** Planners can use flood risk information in the development and/or update of comprehensive plans, future land use maps, and zoning regulations. For example, zoning codes may be changed to better provide for appropriate land uses in high-hazard areas.
- **Update emergency operations and response plans.** Emergency managers can identify low-risk areas for potential evacuation and sheltering and can help first responders avoid areas of high-depth flood water. Risk assessment results may reveal vulnerable areas, facilities, and infrastructure for which planning for continuity of operations plans (COOP), continuity of government (COG) plans, and emergency operations plans (EOP) would be essential.
- **Develop hazard mitigation projects.** Local officials (e.g., planners and public works officials) can use flood risk information to re- evaluate and prioritize mitigation actions in local hazard mitigation plans.
- **Communicate flood risk.** Local officials can use the information in this report to communicate with property owners, business owners, and other citizens about flood risks, changes since the last FIRM, and areas of mitigation interest. The report layout allows community information to be extracted in a fact sheet format.
- **Inform the modification of development standards.** Floodplain managers, planners, and public works officials can use information in this report to support the adjustment of development standards for certain locations. For example, heavily developed areas tend to increase floodwater runoff because paved surfaces cannot absorb water, indicating a need to adopt or revise standards that provide for appropriate stormwater retention.

Vulnerability of infrastructure is another important consideration.

Monsoon rains caused flooding throughout La Paz and Maricopa County, AZ, which lead to a federal disaster declaration on November 5, 2014.

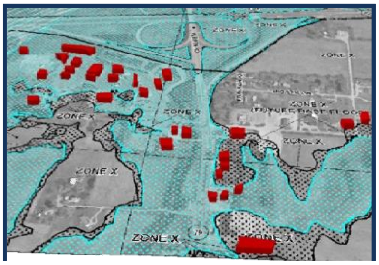
The FRD, FRM, and FRR are "non-regulatory" products. They are available and intended for community use but are neither mandatory nor tied to the regulatory development and insurance requirements of the National Flood Insurance Program (NFIP). They may be used as regulatory products by communities if authorized by state and local enabling authorities.

1.3 Sources of Flood Risk Assessment Data Used

To assess potential community losses, or the consequences portion of the "risk" equation, the following data was collected for analysis and

inclusion in the Flood Risk Project:

- Information about local assets or resources at risk of flooding
- Information about where the risk is most severe
- Hydrologic and hydraulics models developed by the Queen Creek LOMR project
- Hazus estimated flood loss information (described below)
- Locally supplied data (see Section 7 or a description)



FEMA data can be leveraged to identify and measure vulnerability by including local building information (i.e. building type). The examples above show various ways to display flooding intersecting with buildings.

1.4 Related Resources

For a more comprehensive picture of flood risk, FEMA recommends that state and local officials use the information provided in this report in conjunction with other sources of flood risk data, such as those listed below.

- **FIRMs and FISs.** This information indicates area with a specific flood hazards by identifying the limit and extent of the 1-percent-annual-chance floodplain and the 0.2-percent-annual-chance floodplain. FIRMs and FIS reports do not identify all floodplains in the Flood Risk Project area. The FIS Report includes summary information regarding other frequencies of flooding, as well as flood profiles for riverine source of flooding. In rural areas and areas for which flood hazard data are not available, the 1-percent-annual-chance floodplain may not be identified. In addition, the 1-percent-annual-chance floodplain may not be identified for flooding sources with very small drainage areas (less than 1 square mile).
- **Hazus Flood Loss Estimation Reports.** Hazus can be used to generate reports, maps and tables on potential flood damage that can occur based on new/proposed mitigation projects or future development patterns and practices. Hazus can also run specialized risk assessments, such as what happens when a dam or levee fails. Flood risk assessments, such as what happens when a dam or levee fails. Flood risk assessment tools are available through other agencies as well, including the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers (USACE). Other existing watershed reports may have a different focus, such as water quality, but may also contain flood risk and risk assessment information. Section 6 for additional resources.
- **Flood or multi-hazard mitigation plans.** Local hazard mitigation plans include risk assessments that contain flood risk information and mitigation strategies that identify community priorities and actions to reduce flood risk. This report was informed by the existing mitigation plans in the Flood Risk

Project area.

- **FEMA Map Service Center (MSC).** The MSC has useful information, including fly sheets, phone numbers, data, etc. Letter of Map Change are also available through the MSC. The user can view FIRM databases and the National Flood Hazard Layer (NFHL) Database.

2 Flood Risk Analysis

2.1 Overview

Flood hazard identification uses FIRMs and FIS Reports to identify where flooding can occur along with the probability and depth of that flooding. Flood risk assessments is the systematic approach to identifying how flooding impacts the environment. In hazard mitigation planning, flood risk assessments serve as the basis for mitigation strategies and actions by defining the hazard and enabling informed decision making. Fully assessing flood risk requires the following:

- Identifying the flooding sources and determining the flood hazard occurrence probability
- Developing a complete profile of the flood hazard including historical occurrence and previous impacts
- Inventorying assets located in the identified flood hazard area
- Estimating potential future flood losses caused by exposure to the flood hazard area

Flood risk analyses are different methods used in flood risk assessment to help quantify and communicate flood risk. Flood risk analysis can be performed on a large scale (state, community) and on a very small scale (parcel, census block). Advantages of large-scale flood risk analysis, especially at the watershed level, include identifying how actions and development in one community can affect areas up- and downstream. On the parcel or census block level, flood risk analysis can provide actionable data to individual property owners so they can take appropriate mitigation steps.

Flooding impacts non-populated areas too, such as agricultural lands and wildlife habitats.

2.2 Analysis of Risk

The FRR, FRM, and FRD contain a variety of flood risk analysis information to help describe and visualize flood risk within the project area. This Flood Risk Project includes the following elements:

- Water Surface, Flood Depth, and Analysis Grids
- Flood Loss Assessment
- Areas of Mitigation Interest
- Building Analysis

State and Local Hazard Mitigation Plans are required to have a comprehensive all-hazard risk assessment. The flood risk analyses in the FRR, FRM, and FRD can inform the flood hazard portion of a community's or state's risk assessment. Further, data in the FRD can be used to develop information that meets the requirements for risk assessments as it relates to the hazard of flood in hazard mitigation plans.

2.2.1 Flood Depth and Analysis Grids

Grids are FEMA datasets provided in the FRD to better describe the risk of the flood hazard. While the FIRM and FIS Report describe "what" is at risk by identifying the hazard areas, water surface, flood depth, and analysis grids can help define "how bad" the risk is within those identified areas by presenting the data at multiple probabilities.

These grids are intended to be used by communities for additional analysis, enhanced visualization, and communication of flood risks for hazard mitigation planning and emergency management. The "grid" is square pixel of a set size that represents the flood risk data value for the grid. For example, a one-foot flood depth grid represents a location that is 1-foot by 1-foot in plan size with an assigned "flood depth" in feet. Grids provided in the FRD for this project area are all one-foot grids that generally include the following:

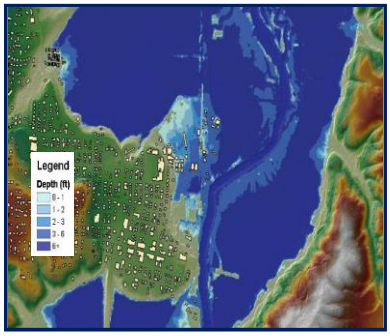
- **Flood Depth Grids**: Flood Depth Grids are created for 10-, 2-, 1-, and 0.2-percent-annual-chance floods through the Flood Risk Project. These grids communicate flood depth as a function of the difference between the calculated water surface elevation and the ground.

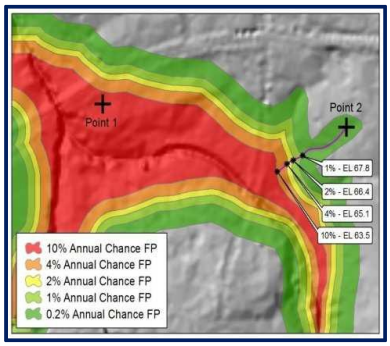
  Depth grids form the basis for refined Hazus loss estimates (as presented in a table in Section 3 of this report) and are used to calculate potential flood losses for display on the FRM and for tabular presentation in this report. Depth grids may also be used for a variety of ad-hoc risk visualization and mitigation initiatives.

- **Percent Annual Chance of Exceedance (ACE) of Flooding Grid:** This is a grid dataset that represents the percent ACE of flooding for a particular grid location. This grid uses the five standard flood frequencies listed above to develop the percent ACE value.

- **Percent Chance of Flooding in a 30-Year Period Grid:** This is a grid dataset that represents the estimated likelihood of flooding at least once within a 30-year period, which is the average lifespan for a home mortgage, for all locations within the extent of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplain.

- **Water Surface Elevation Change Grid**: This dataset provides the ability to see vertical changes in the water surface elevation between the existing FIRM and a revised FIRM. This dataset would be the equivalent of the Changes Since Last Firm (CSLF) dataset, but as a vertical comparative analysis as opposed to a horizontal analysis since last FIRM.





Grid data can make flood mapping more informative. The top image is a flood depth grid showing relative depths of water in a scenario flood event. The bottom image is a percent ACE of flooding grid, which shows inundation areas of various frequency floods.

2.2.2 Estimated Flood Loss Information

Flood loss estimates provided in the FRR were developed using a FEMA' Hazards of the U.S. (Hazus) flood risk assessment tool. Originally developed for earthquake risk assessment, Hazus has evolved into a multi-hazard tool developed and distributed by FEMA that can provide risk assessment loss information for floods, earthquakes, and hurricane winds. Hazus is a nationally accepted, consistent flood risk assessment tool to assist individuals and

communities to create a more accurate picture of flood risk. Some benefits of using Hazus include the following:

- Outputs that can enhance state and local mitigation plans and help screen for cost-effectiveness in FEMA mitigation grant programs
- Analysis refinement through updating inventory data and integrating data produced using other flood models
- Widely available support documents and networks (Hazus Users Groups)

Hazus is a loss estimation methodology developed by FEMA for flood, wind, and earthquake hazards. The methodology and data established by Hazus can also be used to study other hazards.

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Files from the FRD can be imported into Hazus to develop other risk assessment information including:

- Debris generated after a flood event
- Dollar exposure of the agricultural products in a study region
- Utility system exposure in the region
- Vehicle exposure in the study region
- Damages and functionality of lifelines such as highway and rail bridges, potable water, and wastewater facilities

Scenario-Based Flood Loss Estimates:

Scenario-based flood losses have been calculated using Hazus for the 10-, 2-, 1-, and 0.2-percent-annual-chance flood events. In this report, these losses are expressed in dollar amounts and are provided for the Flood Risk Project area only, even though results are shown for the entire watershed and at the local jurisdiction level.

Loss estimates are based on best available data, and the methodologies applied result in an approximation of risk. These estimates should be used to understand relative risk from flood and potential losses.

Uncertainties are inherent in any loss estimation methodology, arising in part from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, demographics, or economic parameters).

Flood loss estimates are provided at the project and community levels for multiple flood frequencies including:

- **Residential Asset Loss**: These include direct building losses (estimated costs to repair or replace the damage caused to the building) for all classes of residential structures including single family, multi-family, manufactured housing, group housing, and nursing homes. This value also includes content losses.
- **Commercial Asset Loss**: These include direct building losses for all classes of commercial buildings including retail,

wholesale, repair, professional services, banks, hospitals, entertainment, and parking facilities. This value also includes content and inventory losses.

- **Other Asset Losses**: These include direct building losses for all classes of commercial buildings including retail, wholesale, repair, professional services, banks, hospitals, entertainment, and parking facilities. This value also includes content and inventory losses.
- **Business Disruption**: This includes the losses associated with the inability to operate a business due to the damage sustained during the flood. Losses include inventory, income, rental income, wage, and direct output losses, as well as relocation costs.
- **Annualized Losses**: Annualized losses are calculated using Hazus by taking losses from multiple events over different frequencies and expressing the long-term average by year. This method factors in historic patterns of frequent smaller floods with infrequent but larger events to provide a balanced presentation of flood damage.

Hazus-estimated loss data can be used in many ways to support local decision making and explanation of flood risk. For mitigation planning purposes, loss data can be used to help meet requirements to develop loss information for the hazard of flood. Also, the FRM can show where flood risk varies by geographic location. For emergency management, Hazus data can help forecast losses based on predicted events, and resources can be assigned accordingly. Loss information can support floodplain management efforts, including those to adopt higher regulatory standards. Also, awareness of exposed essential facilities and infrastructure encourages mitigation actions to protect citizens from service disruption should flooding occur.

Hazus estimated loss data are summarized in the FRR and on the FRM and stored in the FRD

2.2.3 Areas of Mitigation Interest

Many factors contribute to flooding and flood losses. Some are natural, and some are not. In response to these risks, there has been a focus by the federal government, state agencies, and local jurisdictions to mitigate properties against the impacts of flood hazards so that future losses and impacts can be reduced. An area identified as an Area of Mitigation Interest (AoMI) is an important element of defining a more comprehensive picture of flood risk and mitigation activity in a watershed, identifying target areas and potential projects for flood hazard mitigation, encouraging local collaboration, and communicating how various mitigation activities can successfully reduce flood risk.

This report and the FRM include information that focuses on identifying AoMIs that may be contributing (positively or negatively) to flooding and flood losses in the Flood Risk Project. AoMIs are identified through coordination with local stakeholders; through revised hydrologic and hydraulic analyses; by leveraging other studies or previous flood studies; from community mitigation plans, floodplain management plans, and local surveys; and from the mining of federal government databases (e.g., flood claims, disaster grants, and data from other agencies). Below is a list of the types of AoMI that may be identified in this FRR, shown on the FRM, and stored in the FRD:

- **Levees and Major Embankments**

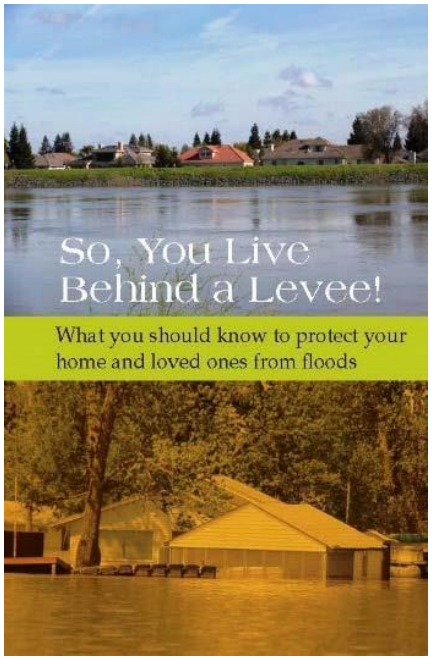
  FEMA defines a levee as “a man-made structure, usually an earthen embankment, designed and constructed in

accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding." Levees are sometimes referred to as dikes. Soil used to construct a levee is compacted to make the levee as strong and stable as possible. To protect against erosion and scouring, levees can be covered with everything from grass and gravel to harder surfaces like stone (riprap), asphalt, or concrete.

Similar to dams, levees have not been regulated in terms of safety and design standards until relatively recently. Many older levees were constructed in a variety of ways, from a farmer piling dirt along a stream to prevent nuisance flooding to levees made out of old mining spoil material. As engineered structures, levees are designed to a certain height and can fail if a flood event is greater than anticipated.

A floodwall is a vertical wall that is built to provide protection from a flood in a similar manner as a levee. Typically made of concrete or steel, floodwalls often are erected in urban locations where there is not enough room for a levee. Floodwalls are sometimes constructed on a levee crown to increase the levee's height.

Most new dams and levees are engineered to a certain design standard. If that design is exceeded, they could be overtopped and fail catastrophically, causing more damage than if the levee was not there in the first place. Few levees anywhere in the nation are built to more than a 1-percent-annual-chance flood protection rating, and the areas behind them are still at some risk for flooding. This threat is called residual risk. In some states, residual risk areas can extend up to 15 miles from a riverbank. Although the probability of flooding may be lower because a levee exists, risk is nonetheless still present. The American Society of Civil Engineers' publication "So, You Live Behind a Levee!" provides an in-depth explanation of levee and residual risk.



For more information about the risks associated with living behind levees, consult the publication "So, You Live Behind a Levee!" published by the American Society of Civil Engineers at http://content.asce.org/ASCELeveeGuide.htm.

Major embankments, on the other hand, are rarely designed with any flood protection level in mind. Railroads, road abutments, canals—especially in the Western United States—are not considered levees or dams and have issues such as unknown construction materials/methods. These embankments are not regulated from a flood risk standpoint.

- **Reasons levees and major embankments are considered AoMIs:**
  - Like dams, many levees in the United States were constructed using unknown techniques and materials. These levees have a higher

failure rate than those that have been designed to today's standards.

- A levee might not provide the flood risk reduction it once did as a result of flood risk changes over time. Flood risk can change due to a number of factors, including increased flood levels due to climate change or better estimates of flooding, development in the watershed increasing flood levels and settlement of the levee or floodwall, and sedimentation in the levee channel. Increased flood levels mean decreased flood protection. The lack of adequate maintenance over time will also reduce the capability of a levee to contain the flood levels for which it was originally designed.
- Given enough time, any levee will eventually be overtopped or damaged by a flood that exceeds the levee's capacity. Still, a widespread public perception of levees is that they will always provide protection. This perception may lead to not taking mitigation actions such as purchasing flood insurance.
- A levee is a system that can fail due to its weakest point, and therefore maintenance is critical. Many levees in the United States are poorly maintained or not maintained at all. Maintenance also includes maintaining the drainage systems behind the levees so they can keep the protected area dry.

Canal levee breaches as a result of Hurricane Katrina in New Orleans in 2005. Note damages can be more extensive due to high velocity flood flows than if the levee was not there.

Levee failure photos from other Pinal County locations (Souce: Pinal County MJHMP 2015)

- **Stream Flow Constriction**

  A stream flow constriction occurs when a human-made structure, such as a culvert or bridge, constricts the flow of a river or stream. The results of this constriction can be increased damage potential to the structure, an increase in velocity of flow through the structure, and the creation of significant ponding or backwater upstream of the structure. Regulatory standards regarding the proper opening size for a structure spanning a river or stream are not consistent and may be non-existent. Some local regulations require structures to pass a volume of water that corresponds to a certain size rain event; however, under sizing, these openings can result in flood damage to the structure itself. After a large flood event, it is not uncommon to have numerous bridges and culverts "washed out."

- **Reasons stream flow constrictions are considered AoMIS:**
    - Stream flow constrictions can back water up on property upstream of the structure if not designed properly.
    - These structures can accelerate the flow through the structure causing downstream erosion if not properly mitigated. This erosion can affect the structure itself, causing undermining and failure.
    - If the constriction is a bridge or culvert, it can get washed out causing an area to become isolated and potentially more difficult to evacuate.
    - Washed-out culverts and associated debris can wash downstream and cause additional constrictions.

Clusters of past flood insurance claims can show where there is a repetitive flood problem.

- **At-Risk Essential Facilities**

  Essential facilities, sometimes called "critical facilities," are those whose impairment during a flood could cause significant problems to individuals or communities. For example, when a community's wastewater treatment is flooded and shut down, not only do contaminants escape and flow into the floodwaters, but backflows of sewage can contaminate basements or other areas of the community. Similarly, when a facility such as a hospital is flooded, it can result in a significant hardship on the community not only during the event but long afterwards as well.

    - **Reasons at-risk essential facilities are considered AoMIs:**
        - Costly and specialized equipment may be damaged and need to be replaced.
        - Impairments to facilities such as fire stations may result in lengthy delays in responding and a focus on evacuating the facility itself.
        - Critical records and information stored at these facilities may be lost.

- **Past Flood Insurance Claims and Individual Assistance/Public Assistance Hotspots**

  Assistance provided after flood events (flood insurance in any event and Individual Assistance [IA] or Public Assistance [PA] after declared disasters) occurs in flood affected areas.

Understanding geographically where this assistance is being provided may indicate unique flood problems.

Flood insurance claims are not always equally distributed in a community. Although estimates indicate that 20 to 50 percent of structures in identified flood hazard areas have flood insurance, clusters of past claims may indicate where there is a flood problem. However, clusters of past claims and/or areas where there are high payments under FEMA's IA or PA Programs may indicate areas of significant flood hazard.

- **Reasons past claim hotspots are considered AoMIs:**
  - A past claim hotspot may reflect an area of recent construction (large numbers of flood insurance policies as a result of a large number of mortgages) and an area where the as-built construction is not in accordance with local floodplain management regulations.
  - Sometimes clusters of past claims occur in subdivisions that were constructed before flood protection standards were in place, places with inadequate stormwater management systems, or in areas that may not have been identified as SFHAs.
  - Clusters of IA or PA claims may indicate areas where high flood insurance coverage or other mitigation actions are needed.

Rooftops, pavements, patios, and driveways contribute to the impervious area in a watershed. This occurs in both urban areas and rural areas being developed.

- **Areas of Significant Land Use Change**

Development, whether it is a 100-lot subdivision or a single lot big box commercial outlet, can result in large amounts of fill and other material being deposited in flood storage areas, thereby increasing flood hazards downstream.

Additionally, when development occurs, hard surfaces such as parking lots, buildings and driveways do not allow water to absorb into the ground, and more of the rainwater becomes runoff flowing directly into streams. As a result, the "peak flow" in a stream after a storm event will be higher and will occur faster. Without careful planning, major land use changes can affect the impervious area of a site and result in a significant increase in flood risk caused by streams that cannot handle the extra storm water runoff.

Sometimes a major land use change may be for planning purposes only. For example, a land use change that rezones land from a classification such as floodplain that restricts development to a zone such as industrial or high density residential could result in significant new infrastructure and

structures in high flood risk areas.

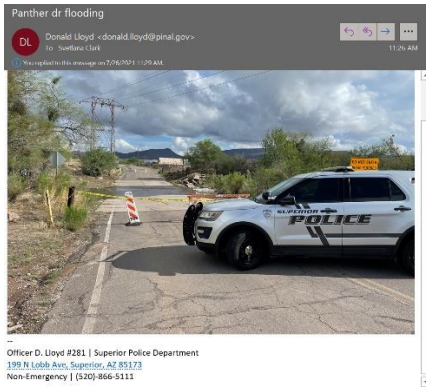
- **Reasons Areas of Significant Land Use Change are considered AoMIs:**
  - Development in areas mapped SFHA reduces flood storage areas, which can make flooding worse at the development site and downstream of it.
  - Impervious surfaces speed up the water flowing in the streams, which can increase erosion and the danger that fast-flowing floodwaters pose to people and buildings.
  - Rezoning flood-prone areas to high densities and/or higher intensity uses can result in more people and property at risk of flooding and flood damage.

When large highways close due to flooding, traffic is detoured causing inconvenience and economic loss.

- **Key Emergency Routes Overtopped During Frequent Flooding Event**

  Roads are not always elevated above estimated flood levels, and present a significant flood risk to motorists during flooding events. When alternate routes are available, risks may be reduced, including risks to life and economic loss.

  - **Reasons overtopped roads are considered AoMIs:**
    - Such areas, when identified, can be accounted for and incorporated into Emergency Action Plans.
    - Roads may be elevated or reinforced to reduce the risk of overtopping during flood events.



At grade roadway crossing separating police and fire access during flood events and requiring emergency resources to manage access.

- **Drainage or Stormwater-Based Flood Hazard Areas, or Areas Not Identified as Flood prone on the FIRM But Known to Be Inundated**

  Flood hazard areas exist everywhere. While FEMA maps many of these, others are not identified. Many of these areas may be located in Communities with existing, older, and often inadequate stormwater management systems or in very rural areas. Other similar areas could be a result complex or unique drainage characteristics. Even though they area not mapped, awareness of these area is important so adequate planning and mitigation actions can be performed.

  - **Reasons drainage or stormwater-based flood hazard areas or unidentified floodprone locations are considered AoMIs:**

- So further investigation of such areas can occur and, based on scientific data, appropriate mitigation actions can result (i.e., land use and building standards).
- To create viable mitigation project applications in order to reduce flood losses.

- **Areas of Mitigation Success**

  Flood mitigation projects are powerful tools to communicate the concepts of mitigation and result in more resilient communities. Multiple agencies have undertaken flood hazard mitigation actions for decades. Both structural measures—those that result in flood control structures—and non-structural measures have been implemented in thousands of communities. An extensive list of mitigation actions can be found in Section 4.

  - **Reasons areas of mitigation success area considered AoMIs:**
    - Mitigation successes identify those areas within the community that have experienced a reduction or elimination of flood risk.
    - Such areas are essential in demonstrating successful loss reduction measures and in educating citizens and officials on available flood hazard mitigation techniques.
    - Avoided losses can be calculated and shown.

Bank erosion allowing floodwaters to threaten residence.

Erosion of road fill along highway near Superior, AZ (ADOT, 2021)

- **Areas of Significant Riverine Erosion**

  Stream channels are shaped by a number of factors, including: degradation, aggradation, general scour, local scour, deposition, and lateral migration. Streams are constantly progressing towards a state of dynamic equilibrium involving water and sediment.

  - Reasons why areas of significant riverine erosion are considered AoMIs:
    - Riverine flood damage assessments generally consider inundation alone
    - Bank erosion caused by within channel flows is not recognized as a significant hazard in Federal floodplain management regulations
    - Riverine erosion can undercut structures and roads, causing instability and possible collapse.

- Approximately one-third of the nation's streams experience severe erosion problems

- **Other**

  Other types of flood risk areas include drainage or stormwater-based flood hazard areas, or areas known to be inundated during storm events.

2.2.4 Building Analysis

The number of buildings that are within inundated areas can provide valuable information about the potential impact of flooding on both the built environment and the people who live or work in the area. By understanding how many buildings are at risk of flooding, it is possible to estimate the potential economic and stoical impact of flood events, such as property damage and loss, displacement of residents or workers, and interruption of critical infrastructure.

Furthermore, counting the number of buildings within inundated areas can help to identify areas where flood risk reduction measures, such as building codes, zoning regulations, or flood control structures, may be needed to minimize the risk of flooding and protect public safety. To that end, number of buildings that are affected by the flood events are examined using the multi-frequency flood depth grids (10-, 2-, 1-, and 0.2-percent ACE flood events) and building footprints.[1]

[1] Microsoft. (n.d.). Building footprints. Retrieved April 10, 2023, from https://www.microsoft.com/en-us/maps/building-footprints

3 Flood Risk Analysis Results

The following pages provide summary flood risk results for the Flood Risk Project as follows:

- **Flood Risk Project Summary:** Within the Flood Risk Project area, summary data for some or all the following datasets are provided for the project area:
  - **Flood Depth and Analysis Grids.** A general discussion of the data provided in the FRD.
  - **Flood Risk Assessment Information.** A loss estimation of potential flood damages using different flood scenarios.
  - **Area of Mitigation Interest.** A description of areas that may require mitigation or additional risk analysis.
- **Flood Risk Map (FRM)**. The FRM presents the Flood Risk Project in map form, displaying:
  - Base data reflecting community boundaries, major roads, and streamlines.
  - Potential loss results from the Hazus modeled flood risk areas.
  - Graphics and text that promote access and usage of additional data available through the FRD, FIRM, and National Flood Hazard Layer and viewers (desktop or FEMA website, etc.).

  This information can be used to assist with Flood Risk Project area identification and community planning as well as for developing mitigation actions within each jurisdiction located within the Flood Risk Project.

The FRM provides a graphical overview of the Flood Risk Project which highlights areas of risk that should be noted, based on potential losses, exposed facilities, etc., based on data found in the FRD. Refer to the data in the FRD to conduct additional analyses.

3.1 Town of Superior Flood Risk Project Area Summary

The Town of Superior is in Pinal County, Arizona and is located approximately 60 miles east of Phoenix and 40 miles west of Globe, Arizona. As shown in Figure 3-1, the Town of Superior is situated within the Middle Gila HUC-8 watershed (HUC-8 Code is 15050100). The town has a population of about 2,700 and covers an area of approximately 2.0 square miles according to the 2020 Census data. The main flooding source impacting the Town of Superior is Queen Creek Wash which is a tributary of the Gila River and is fed by runoff from approximately a 14.5 square mile watershed in the nearby Superstition Mountains. During periods of heavy rainfall, these washes can become a raging torrent, posing a significant flood risk to the town. There are also multiple small tributaries that convey local runoff through the town and can also be source of flood risk.

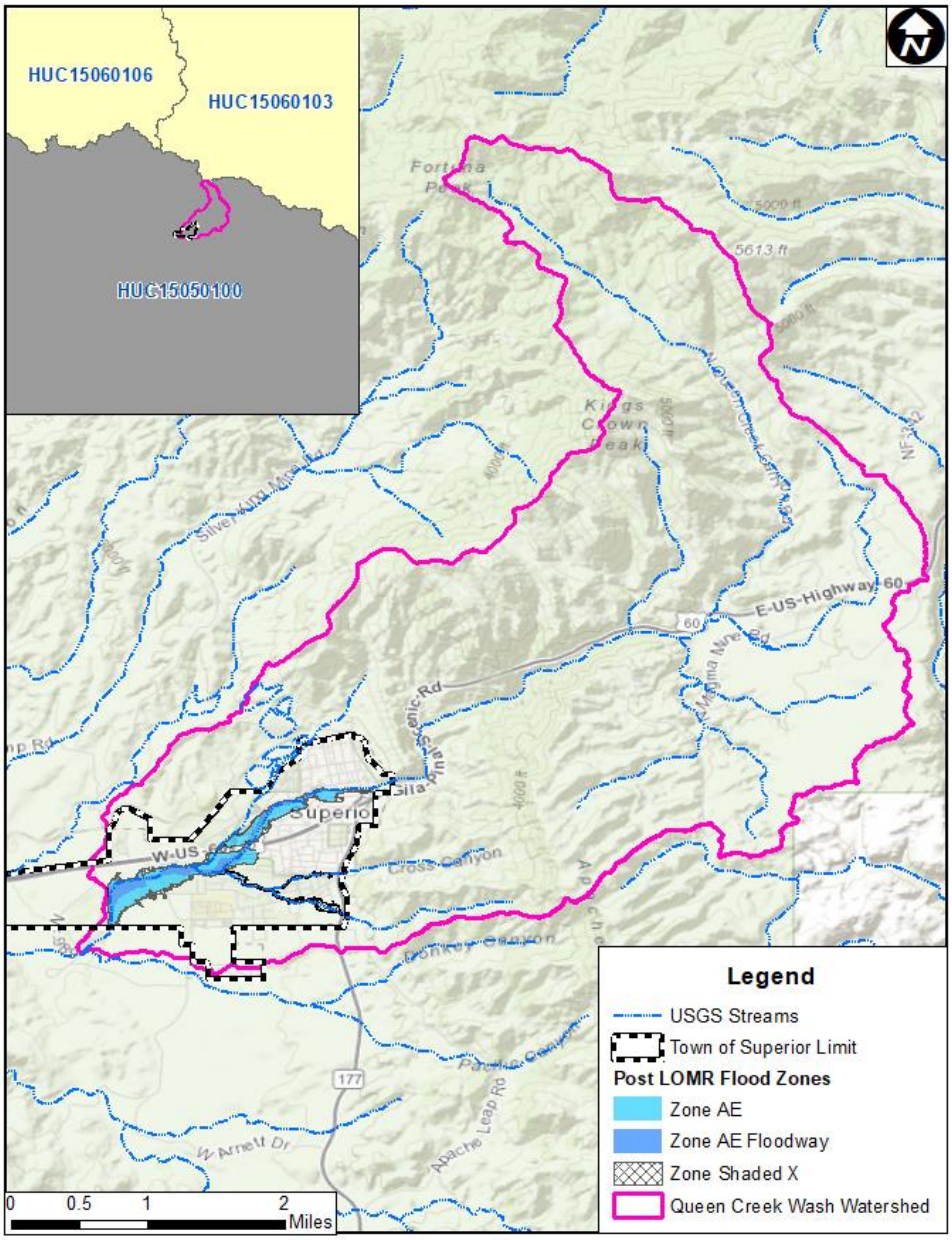


Figure 3-1. Vicinity Map

3.1.1 Overview

Community Name	CID	Total Community Population	% of Population in Study Area	Total Community Land Area (sq mi)	% of Land Area in Study Area	NFIP	CRS Rating	Mitigation Plan
Town of Superior	040119	2,837	100	1.95	100%	Y	NA	N

Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

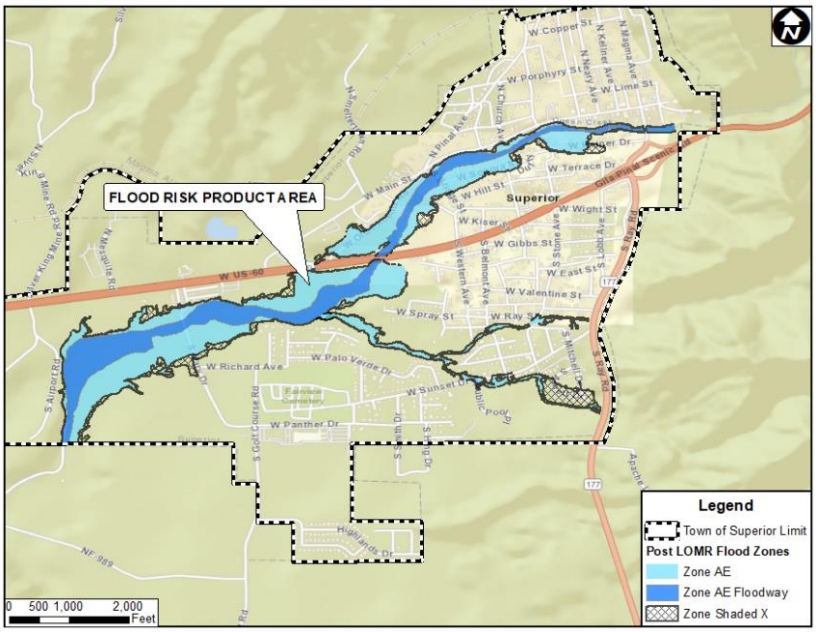


Figure 3-2. Flood Risk Project area map

3.1.2 Flood Risk Datasets

As a part of this FRP, flood risk datasets were created for inclusion in the FRD. Those datasets are summarized for this Flood Risk Project below:

- **Flood Depth and Analysis Grids**
  - Section 2 of this FRR provides general information regarding the development of and potential uses for the flood depth and analysis grid data. Each data set is briefly described below and maps showing the results in graphical format are included following the text. See the FRD for the detailed depth and analysis grid data:
    - Multi-frequency flood depth grids (10-, 2-, 1-, and 0.2-percent ACE flood events) – Figure 3-3 through Figure 3-6
    - Percent ACE of flooding grids – Figure 3-7
    - Percent chance of flooding over a 30-year period grids – Figure 3-8
    - Water surface elevation grids (10-, 2-, 1-, and 0.2-percent ACE flood events) – Figure 3-9 through Figure 3-12
  - Additional information and data layers provided within the FRD can be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

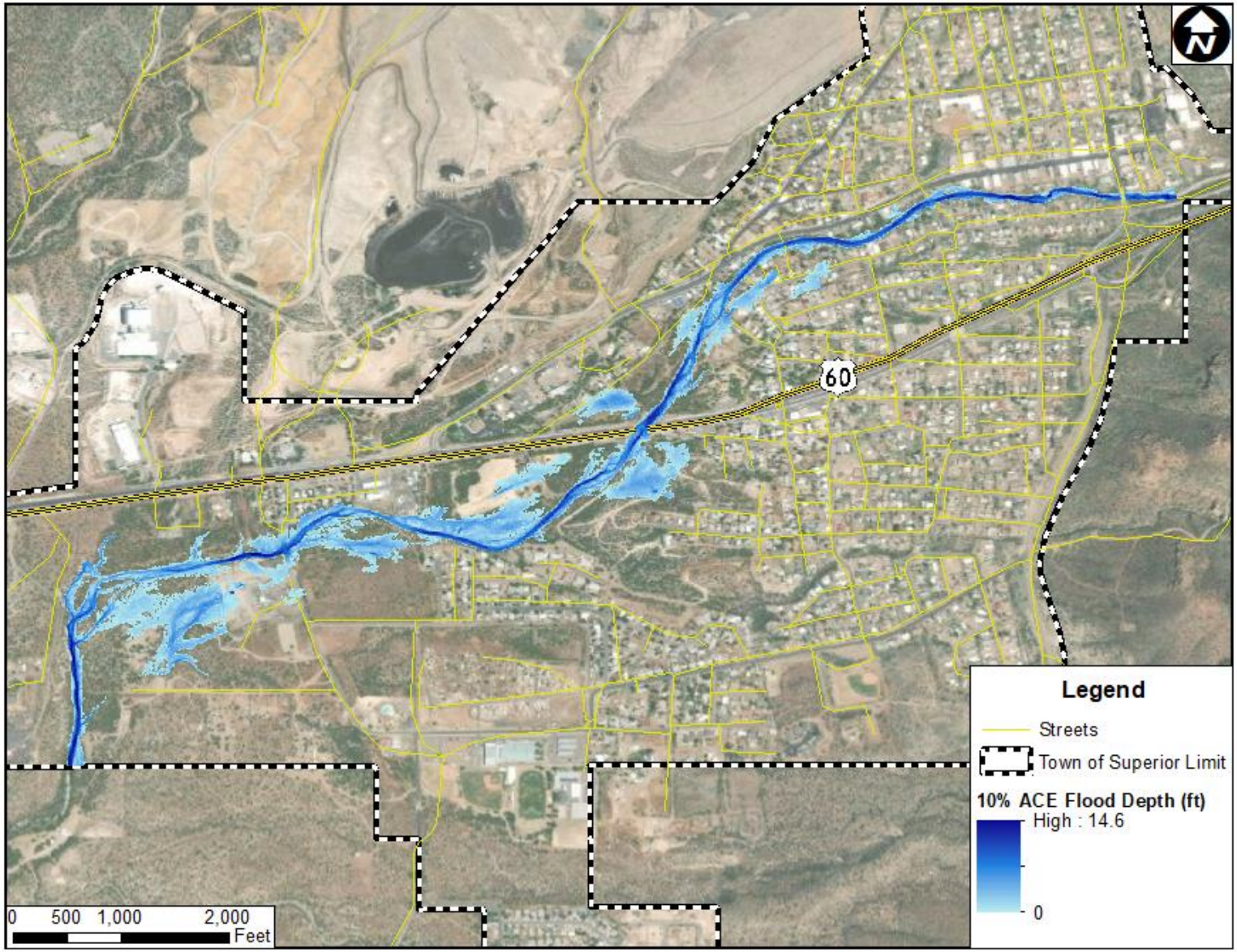


Figure 3-3. 10% ACE Flood Depths

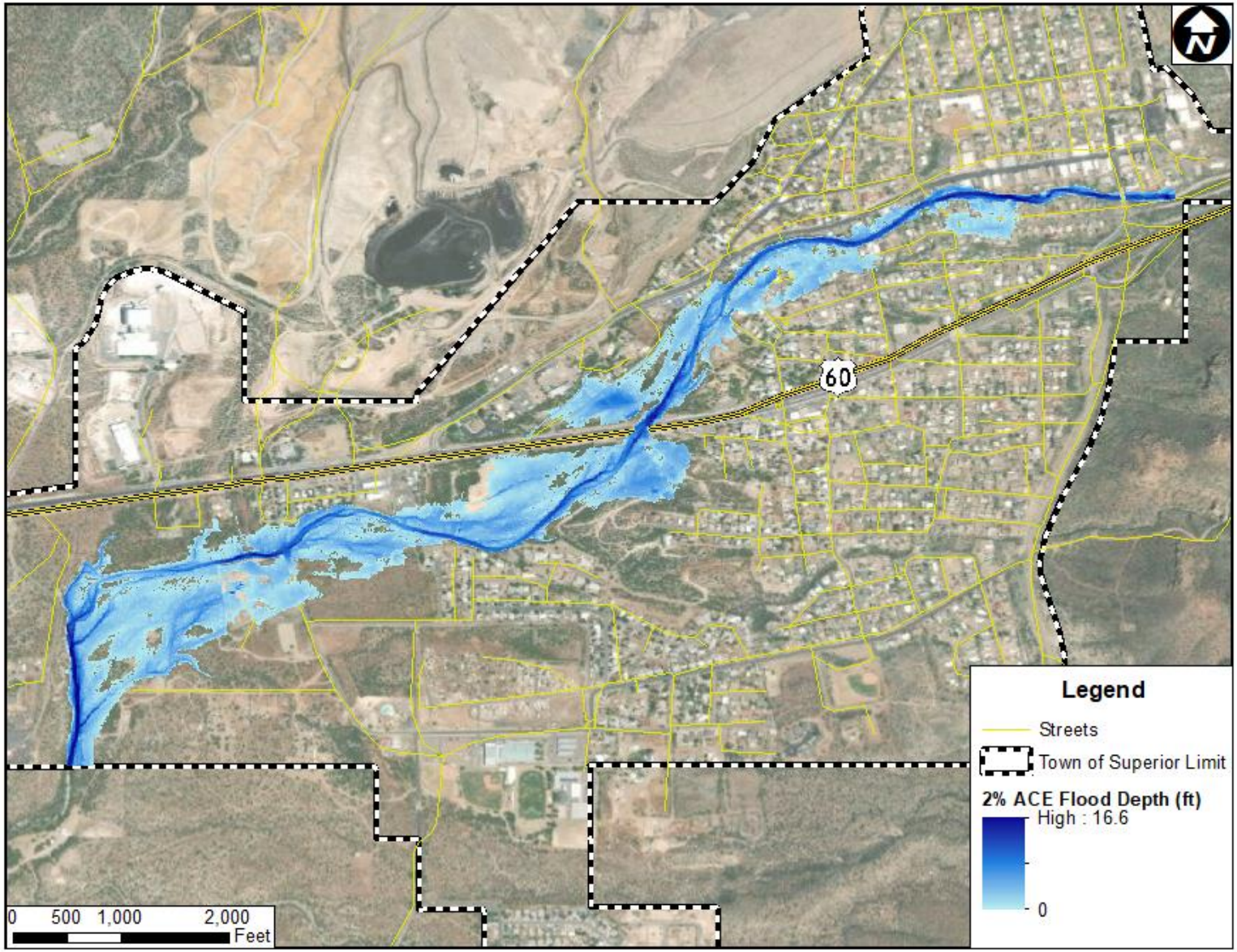


Figure 3-4. 2% ACE Flood Depth

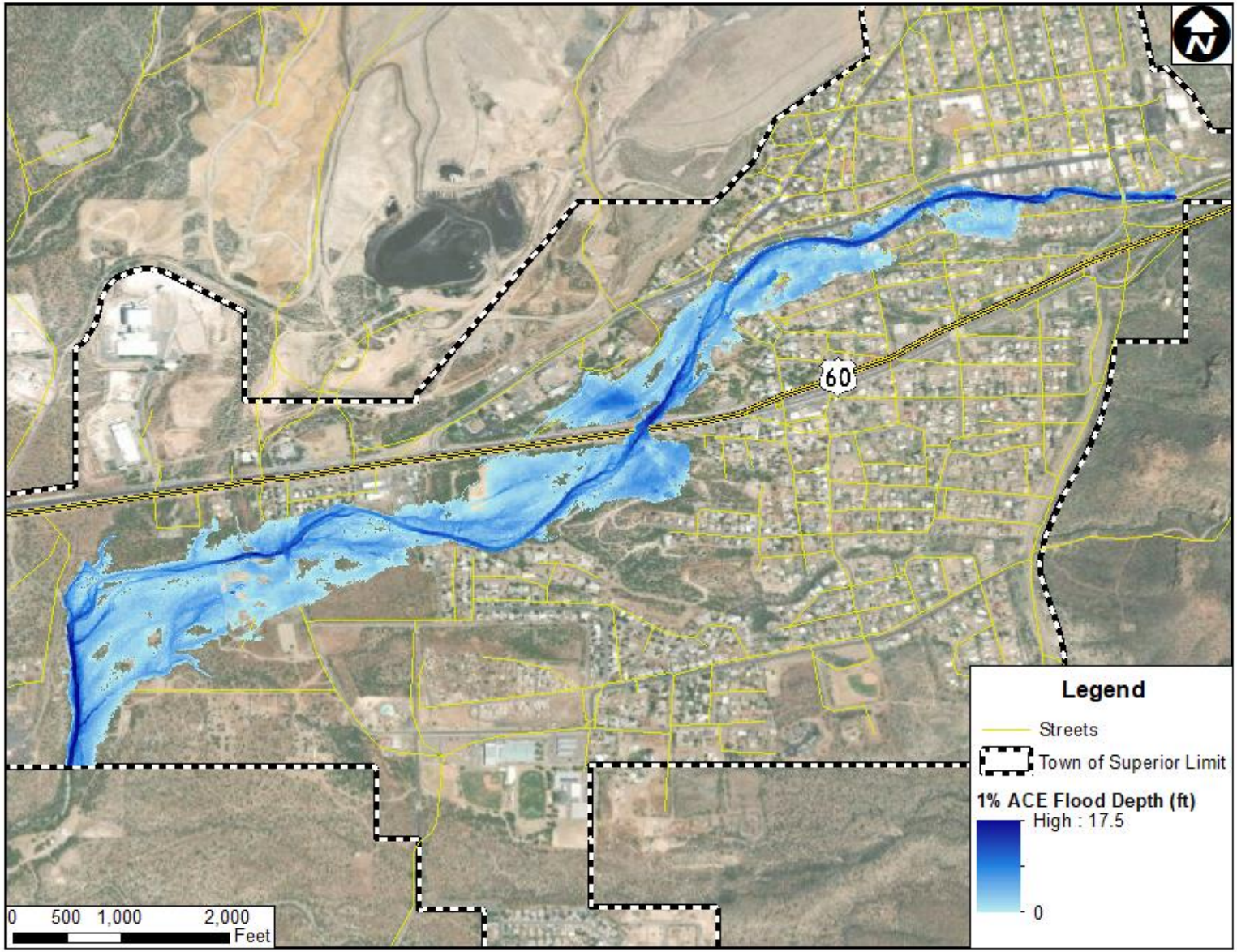


Figure 3-5. 1% ACE Flood Depth

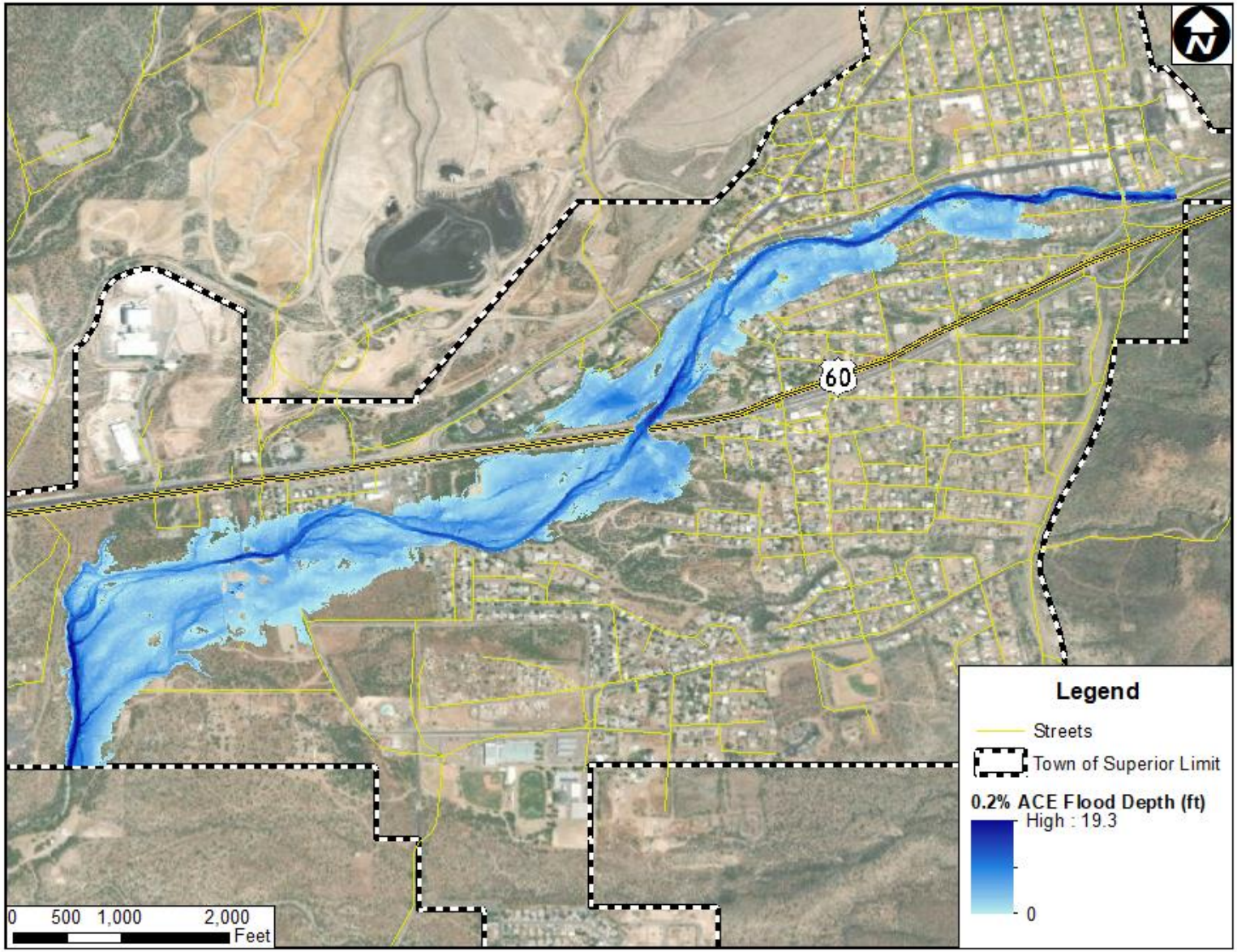


Figure 3-6. 0.2% ACE Flood Depth

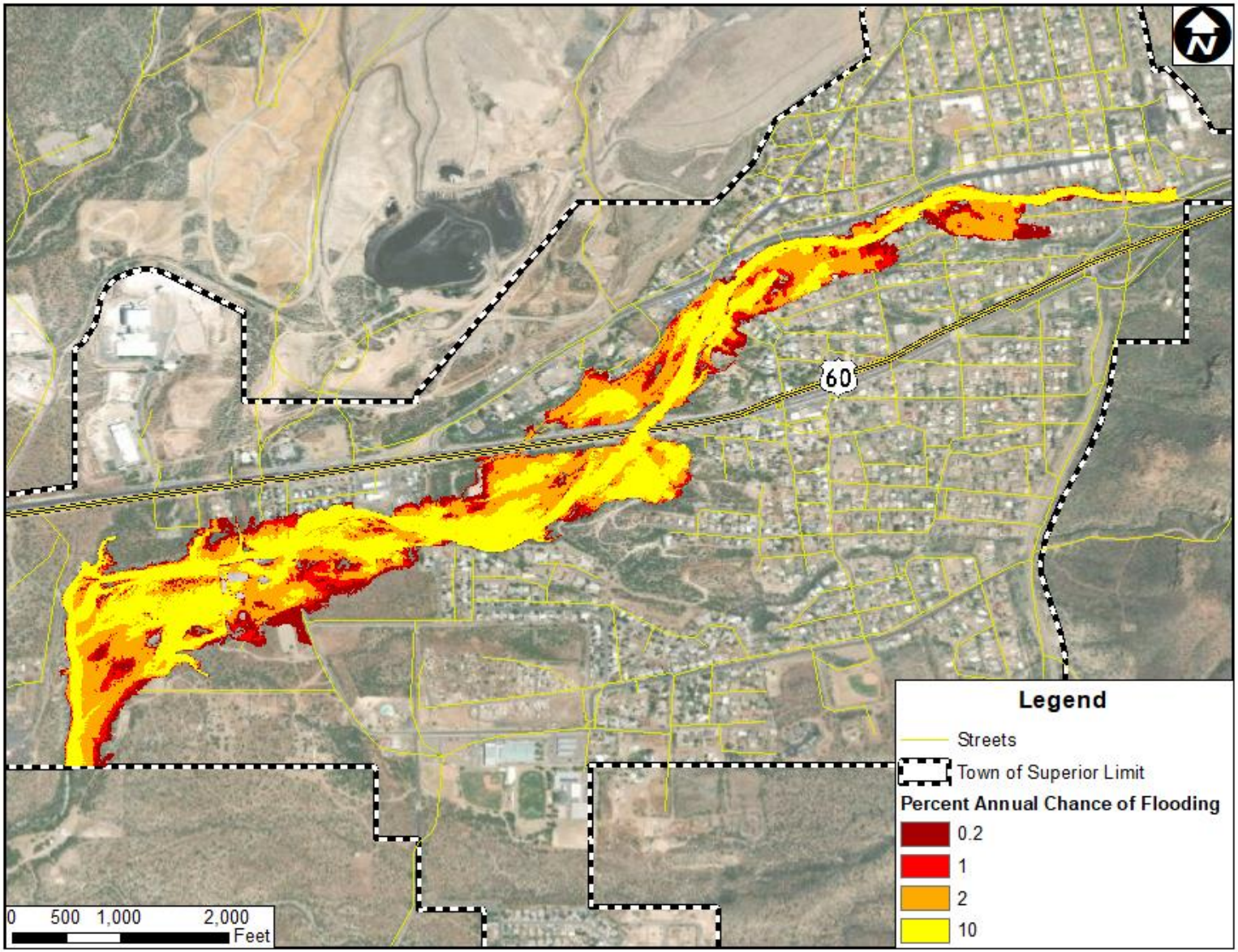


Figure 3-7. Percent Annual Chance of Flooding

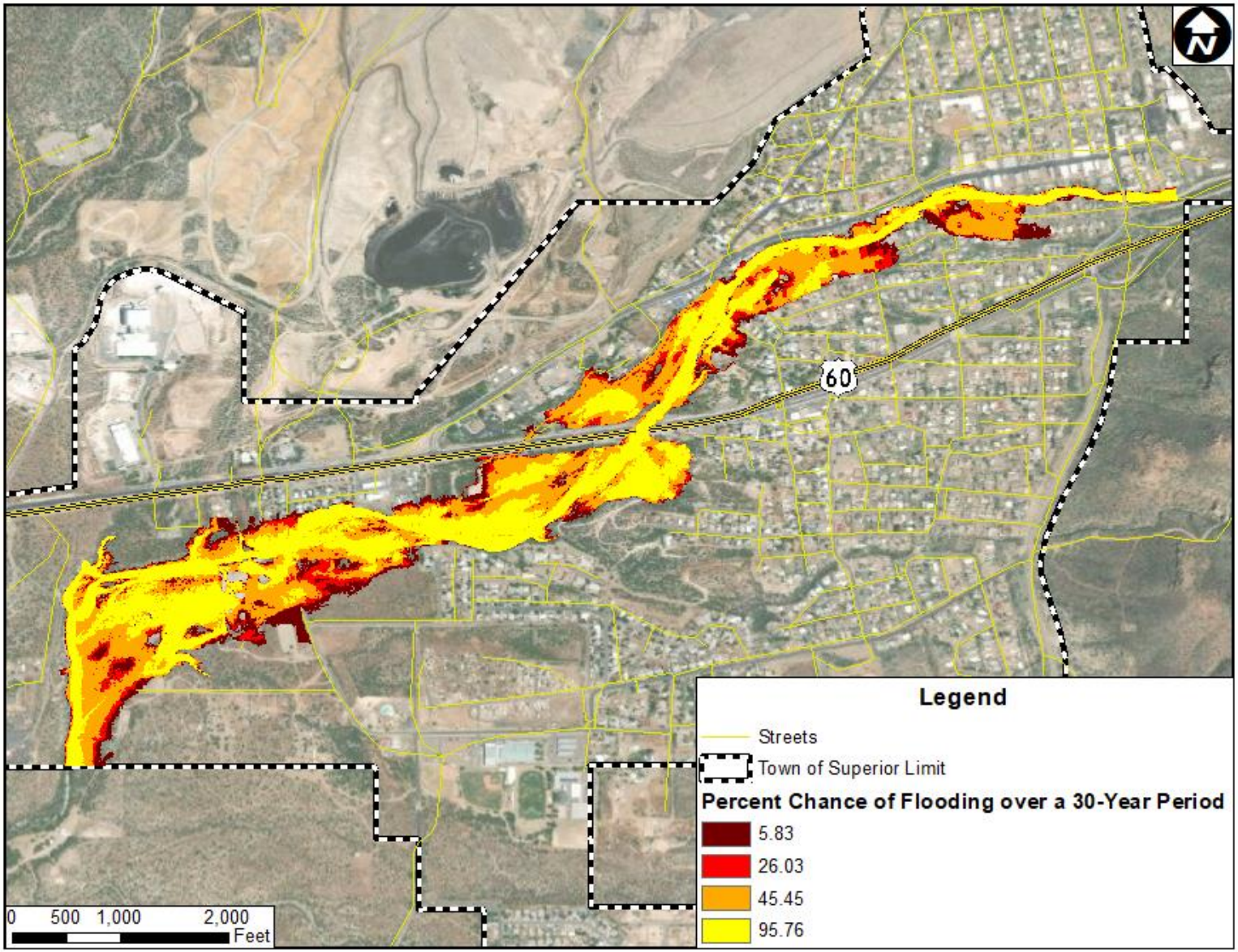


Figure 3-8. Percent Chance of Flooding Over a 30-Year Period

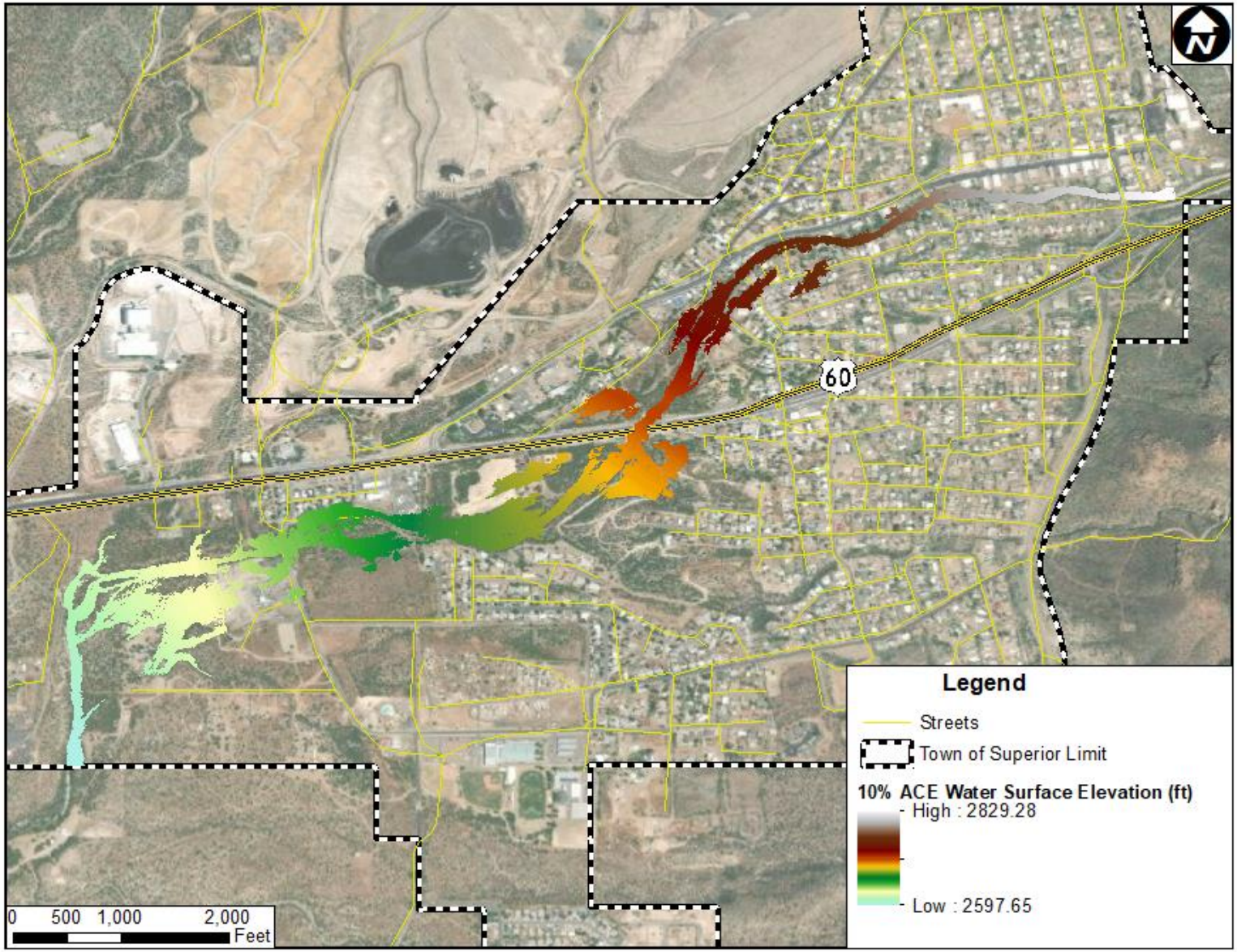


Figure 3-9. 10% ACE Water Surface Elevation

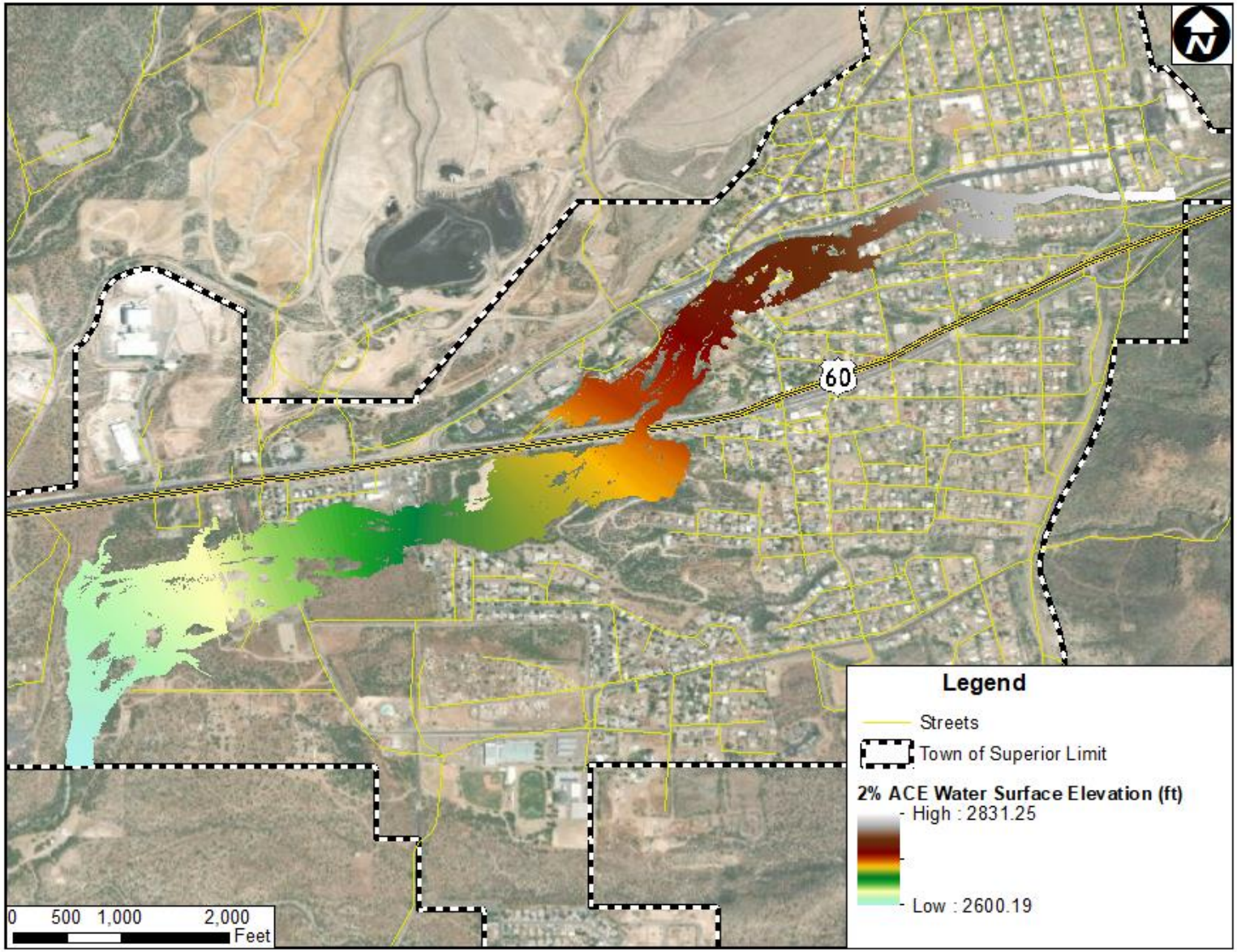


Figure 3-10. 2% ACE Water Surface Elevation

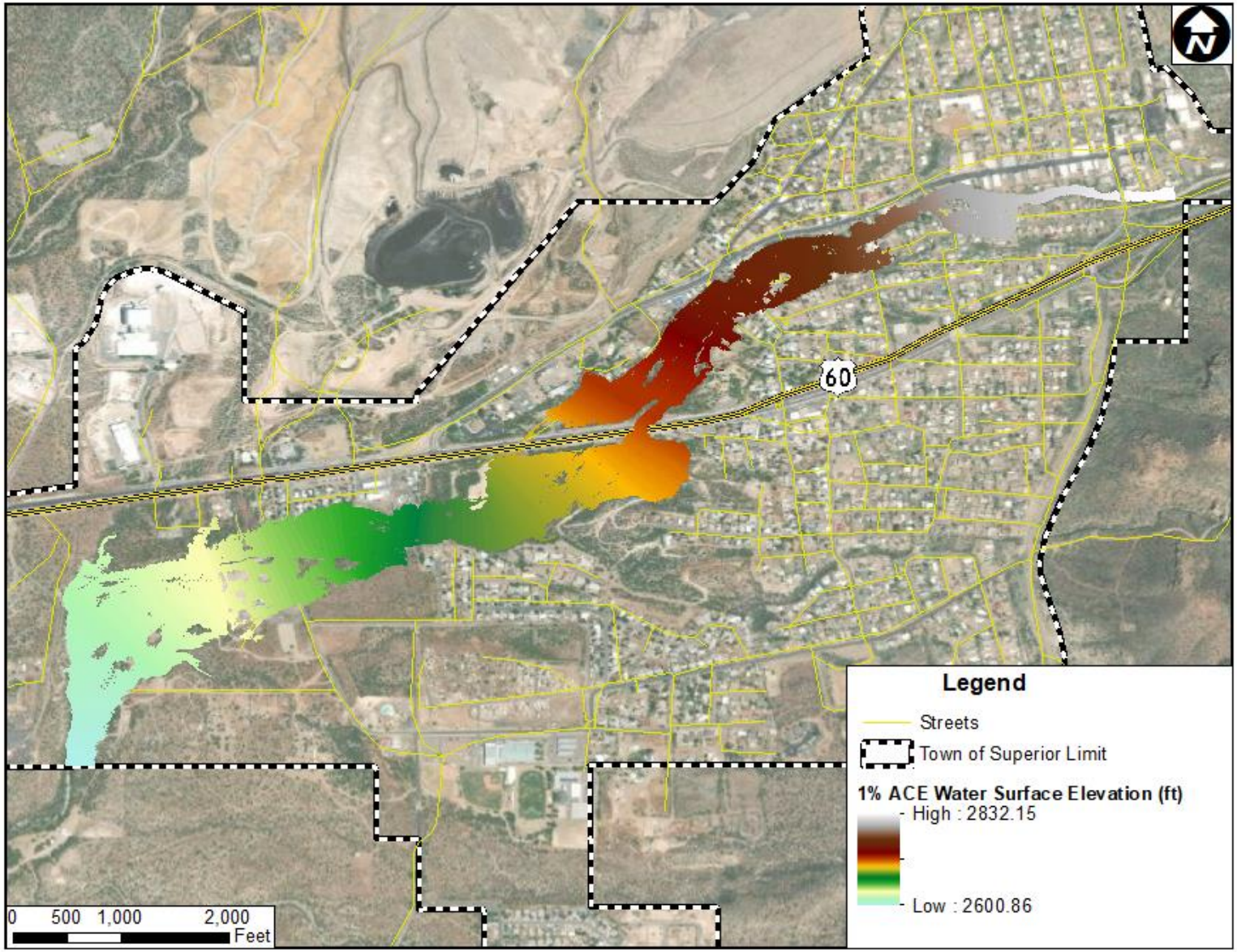


Figure 3-11. 1% ACE Water Surface Elevation

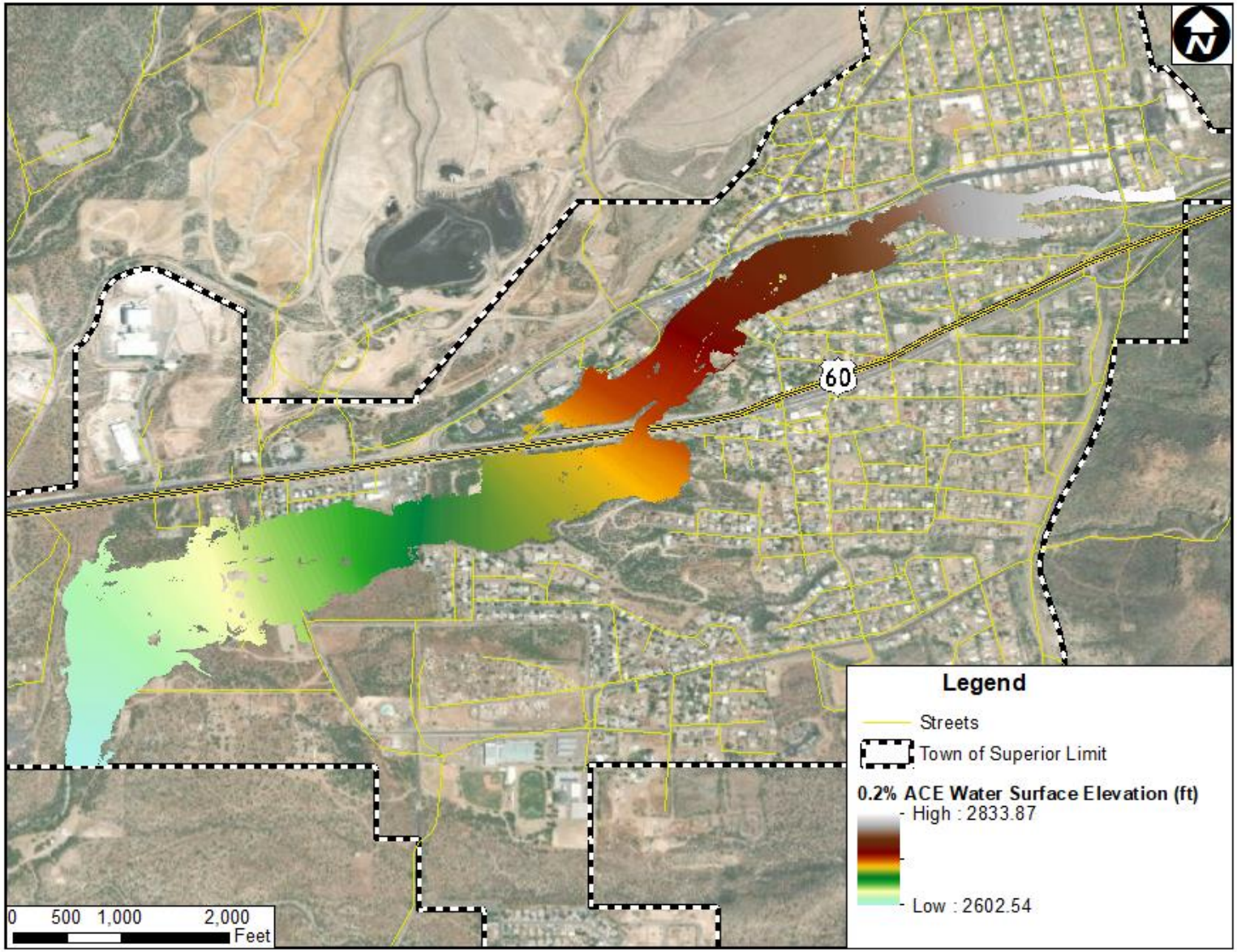


Figure 3-12. 0.2% ACE Water Surface Elevation

- **Hazus Estimated Loss Information**
    - The flood loss estimates discussed in Section 2.2.2 and analyzed using FEMA's Hazus program for the Flood Risk Project area are summarized in Table 3-2. Potential losses were estimated as well as potential loss ratios for multiple scenarios. Additional information and data layers provided within the FRD can be used to further evaluate potential losses and areas where they are likely to occur.
- **Areas of Mitigation Interest**
    - Section 2.2.3 of the FRR provides more information regarding AoMI, how they are defined for this analysis, and potential mitigation actions that could be considered for each type. The Table 3-1 below summarizes the number and type of AoMI identified by the team and stakeholders for this Flood Risk Project. It is noted that a couple of the AoMIs (AoMI ID 6 and 7) are located outside of the FRD area, but within the town limits and known to be problem areas by the town.

Table 3-1. AoMIs by Type

Type of Mitigation Interest	Number of Areas	Data Source
Stream Flow Constriction	2	Stakeholders meeting note and flood depth grids for 1% annual-chance
Other Flood Risk Areas	5	Stakeholders meeting note and flood depth grids for 1% annual-chance

Table 3-2. Hazus estimated flood loss estimates

			Estimated Potential Losses for Flood Event Scenarios									
	Total Inventory		10% ACE (10-yr)		2% ACE (50-yr)		1% ACE (100-yr)		0.2% ACE (500-yr)		Annualized ($/year)	
	Estimated Value	% of Total	Dollar Losses	Loss Ratio[1]	Dollar Losses	Loss Ratio[2]	Dollar Losses[1]	Loss Ratio[2]	Dollar Losses[1]	Loss Ratio[2]	Dollar Losses[1]	Loss Ratio[2]
Residential Building/Contents	201,664,000	87%	880,000	0%	1,840,000	1%	2,370,000	1%	3,150,000	2%	61,200	N/A
Commercial Building/Contents	11,976,000	5%	250,000	2%	450,000	4%	560,000	5%	780,000	7%	136,456	N/A
Other Building/Contents	17,785,000	8%	210,000	1%	380,000	2%	470,000	3%	600,000	3%	66,450	N/A
Total Building/Contents[3]	231,425,000	100%	1,340,000	1%	2,670,000	1%	3,400,000	1%	4,530,000	2%	49,320	N/A
Business Disruption	N/A	N/A	700,000	N/A	1,770,000	N/A	2,090,000	N/A	2,490,000	N/A	42,060	N/A
TOTAL[4]	462,850,000	N/A	3,380,000	N/A	7,110,000	N/A	8,890,000	N/A	11,550,000	N/A	355,486	N/A

Note: Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

[1]Loss ratio = Dollar Losses / Estimated Value.

[2]Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

[3]Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

[4]Total Loss = Total Building/Contents + Business Disruption

Loss Ratios rounded to nearest integer percent.

3.1.3 Flood Risk Results

Table 3-3 below list all the identified AoMI. The map and database show essential facilities not known to be in a defined flood risk area. For specific locations and more information, refer to the database.

Table 3-3. Detailed Summary of AoMI in Town of Superior

AoMI ID in Database	AoMI Type	Description
1	Other Flood Risk Areas	Flood over South Panther Drive
2	Streamflow Constriction	Pedestrian bridge and utility line over Queen Creek Wash
3	Other Flood Risk Areas	Local flooding due to breakout
4	Other Flood Risk Areas	Breakout causing flooding upstream of Queen Creek Bridge
5	Other Flood Risk Areas	Breakout causing flooding downstream of Queen Creek Bridge
6	Streamflow Constriction	A house in the floodplain, and culvert installed under the house. It is located outside of the FRD area
7	Other Flood Risk Areas	Breakout causing flooding in the residential area. It is located outside of the FRD area

3.2 Building Analysis

The results of the building analysis is summarized in Table 3-4, and Figure 3-13 through Figure 3-16.

Table 3-4. A Summary of Building Analysis

Number of Buildings			
10 % ACE Flood Event	**2% ACE Flood Event**	**1% ACE Flood Event**	**0.2% ACE Flood Event**
32	73	84	99

Note: buildings/structures that have size less than 600 square feet are either shed or movable structures and are excluded for this analysis

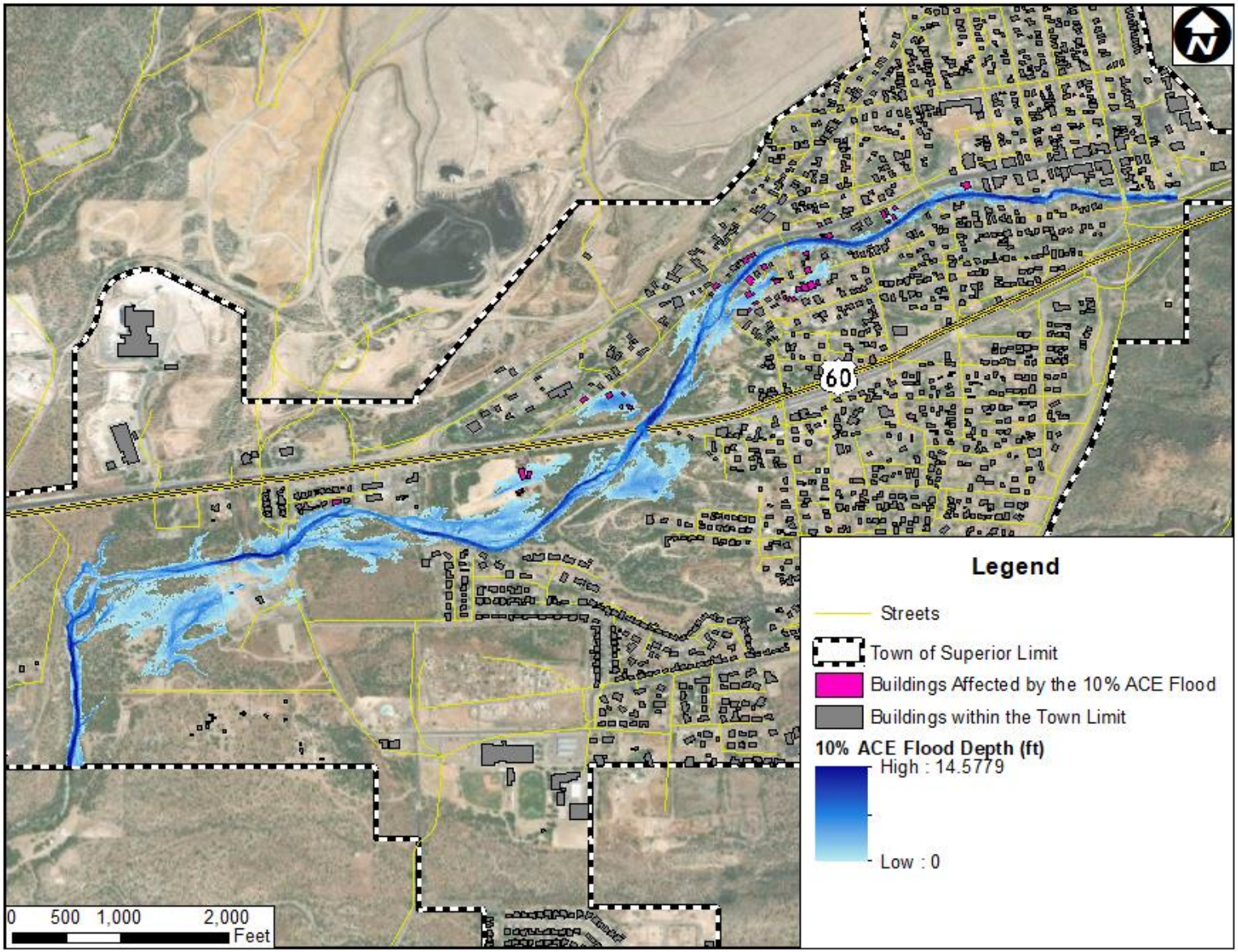


Figure 3-13. Buildings Affected by 10% ACE Flood

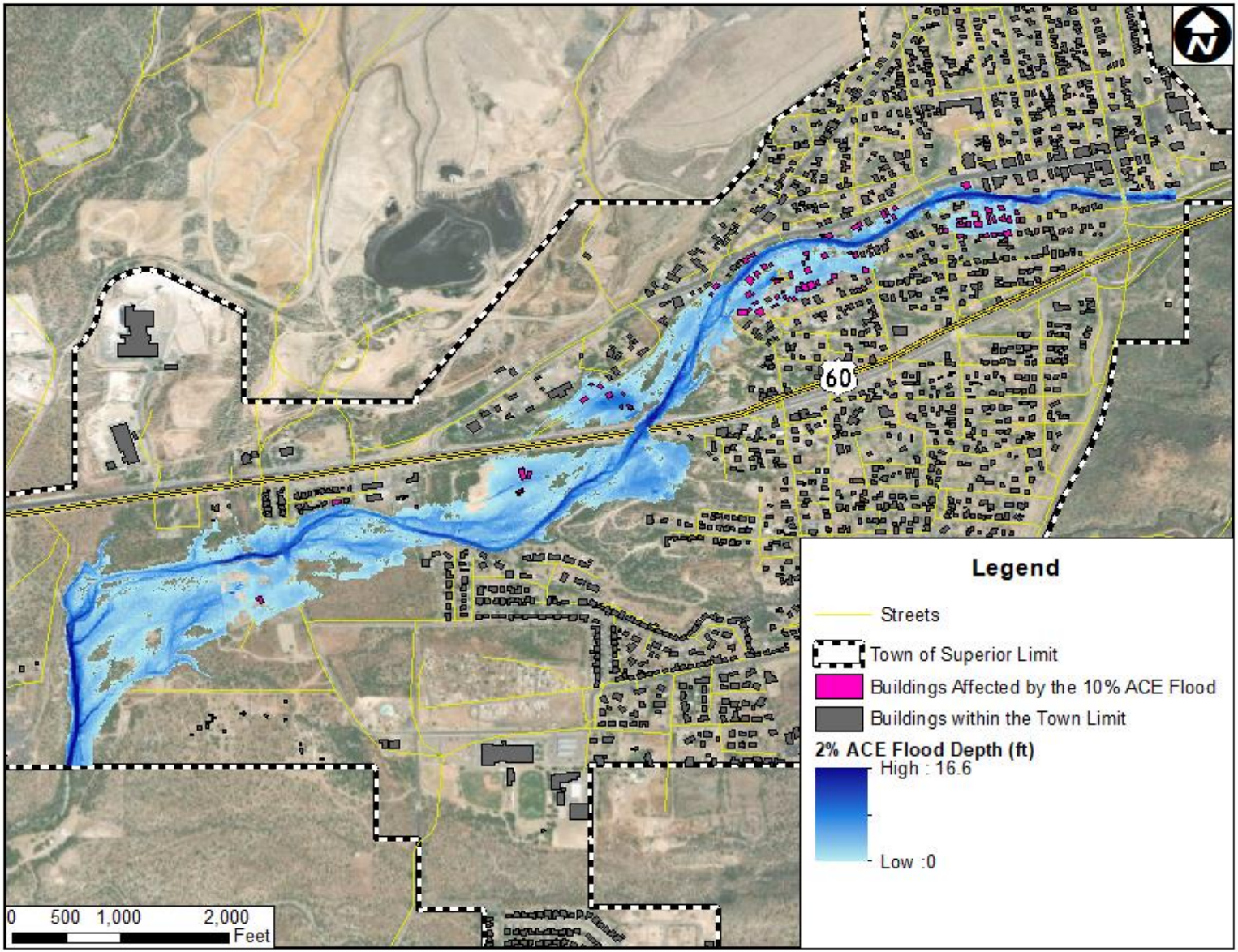


Figure 3-14. Buildings Affected by 2% ACE Flood

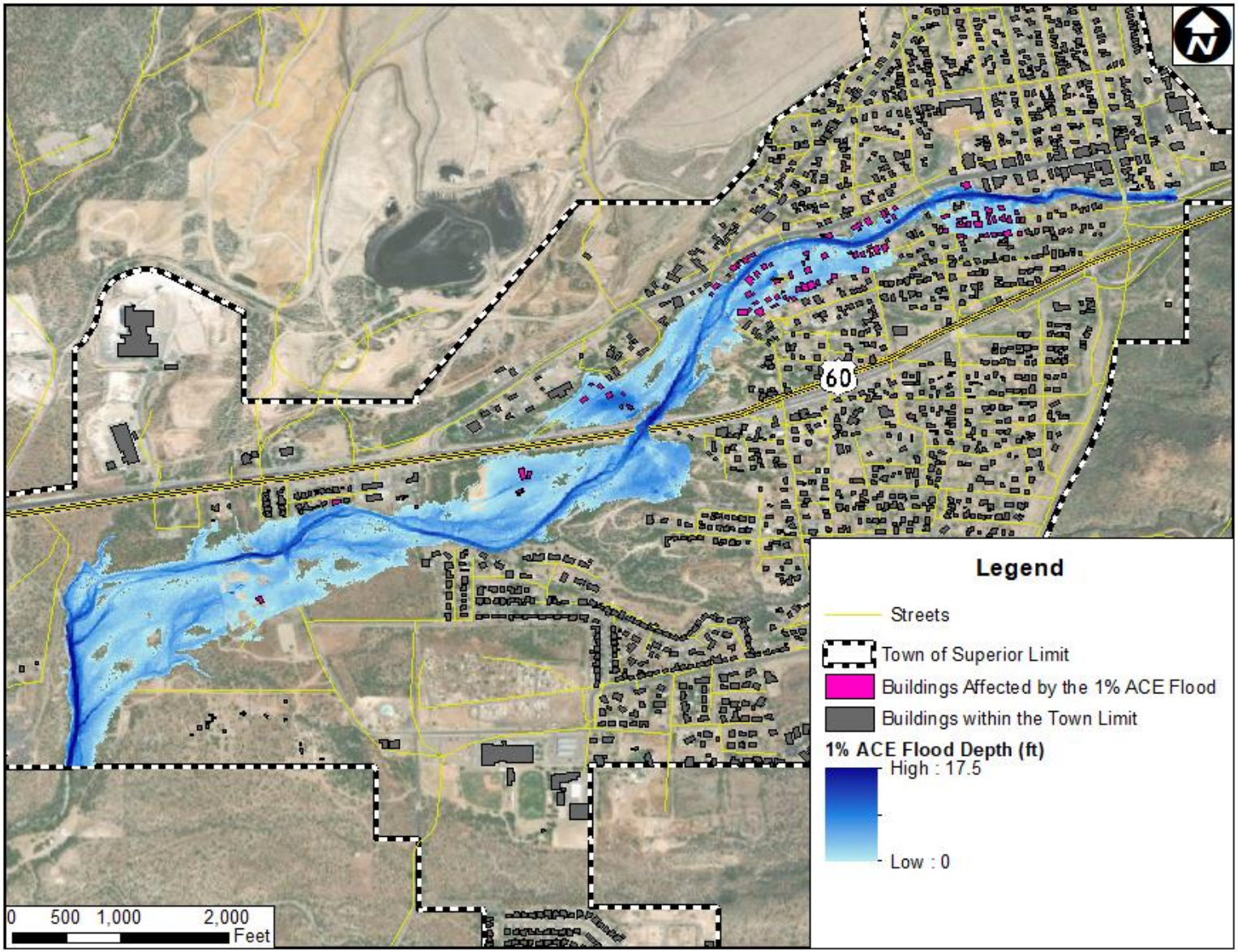


Figure 3-15. Buildings Affected by 1% ACE Flood

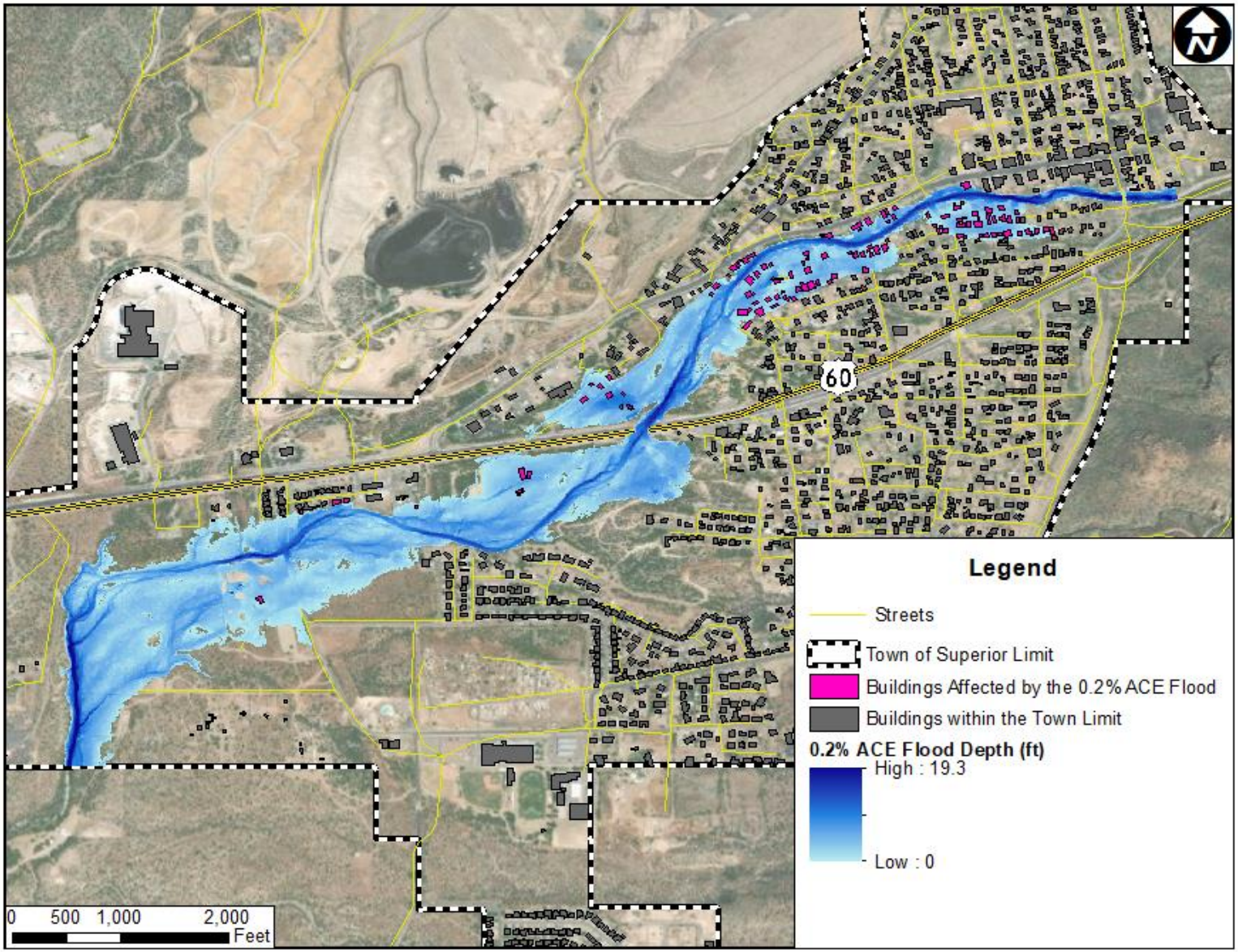
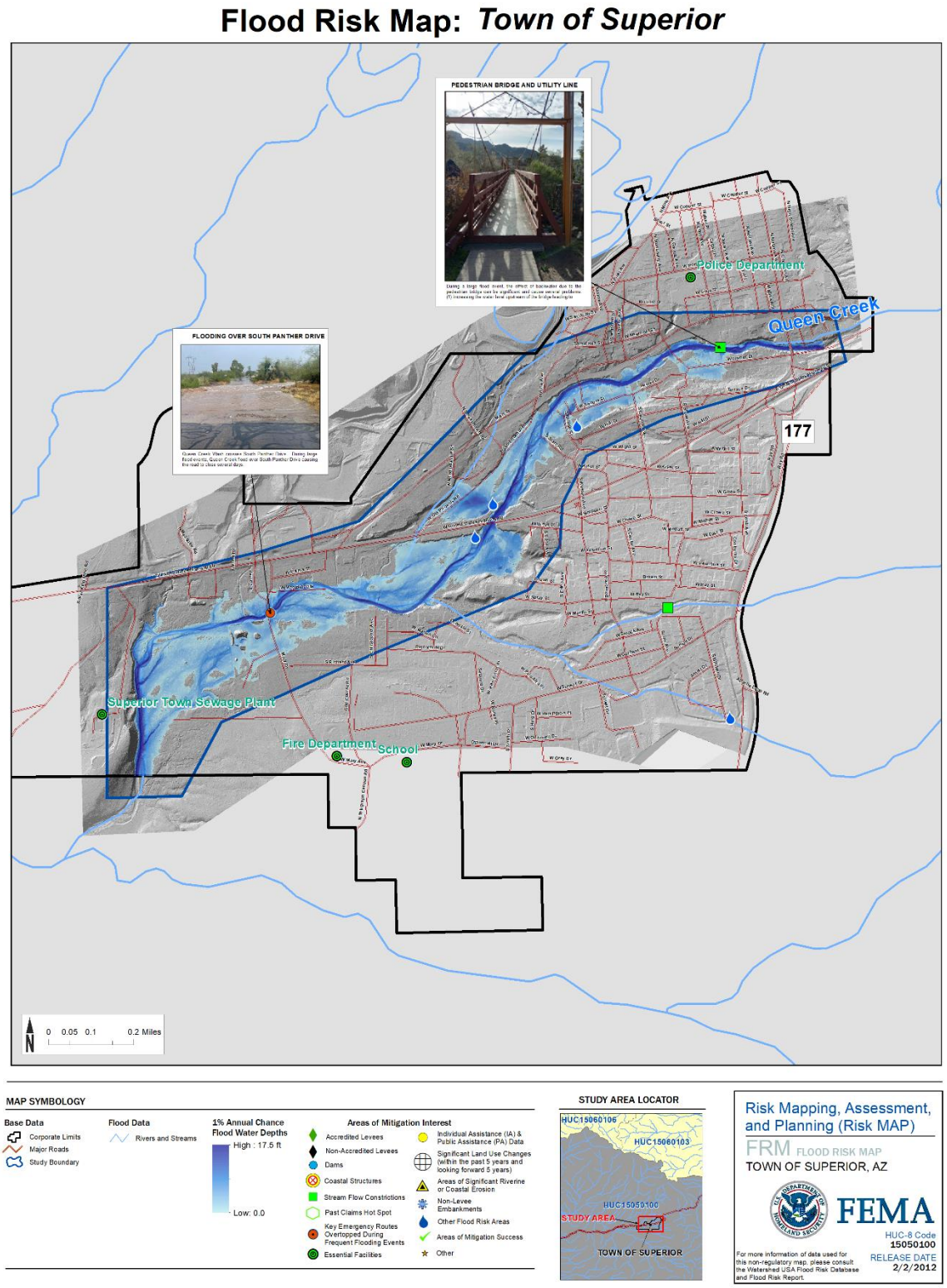


Figure 3-16. Buildings Affected by 0.2% ACE Flood

3.3 Flood Risk Map

A reduced version of the Flood Risk Map for this Flood Risk Project is shown to the right. The full-sized version is available within the FRD.



4 Actions to Reduce Flood Risk

In order to fully leverage the FRD and Flood Risk Products created for this FRP, local stakeholders should consider many different flood risk mitigation tactics, including, but not limited the items shown in the sub-sections below.

4.1 Types of Mitigation Actions

Mitigation provides a critical foundation on which to reduce loss of life and property by avoiding or lessening the impact of hazard events. This creates safer communities and facilitates resiliency by enabling communities to return to normal function as quickly as possible after a hazard event. Once a community understands its flood risk, it is in a better position to identify potential mitigation actions that can reduce the risk to its people and property.

The mitigation plan requirements in 44 CFR Part 201 encourage communities to understand their vulnerability to hazards and take actions to minimize vulnerability and promote resilience. Flood mitigation actions generally fall into the following categories:

4.1.1 Preventive Measures

Preventative measures are intended to keep flood hazards from getting worse. They can reduce future vulnerability to flooding, especially in areas where development has not yet occurred or where capital improvements have not been substantial. Examples include:

Comprehensive land use planning.

- Zoning regulations
- Subdivision regulations
- Open space preservation
- Building codes
- Floodplain development regulations
- Stormwater management
- Purchase development rights or conservation easements
- Participation in the NFIP Community Rating System (CRS)

4.1.2 Property Protection Measures

Property protection measures protect existing buildings by modifying the building to withstand floods, or by removing buildings from hazardous locations. Examples include:

- Building relocation
- Acquisition and clearance

Before Mitigation and After Mitigation

Communities will need to prioritize projects as part of the planning process. FEMA can then help route federal mitigation dollars to fund these projects.

- Building elevation
- Barrier installation
- Building retrofit

4.1.3 Natural Resource Protection Activities

Natural resource protection activities reduce the impact of floods by preserving or restoring natural areas such as floodplains, wetlands, and dunes and their natural functions. Examples include:

- Wetland protection
- Habitat protection
- Erosion and sedimentation control
- Best management practices (BMP)
- Prevention of stream dumping activities (anti-litter campaigns)
- Improved forestry practices such as reforesting or selective timbering (extraction)

4.1.4 Structural Mitigation Projects

Structural mitigation projects lessen the impact of floods by modifying the environmental natural progression of the flooding event. Structural protection such as upgrading dams/levees for already existing development and critical facilities may be a realistic alternative. However, citizens should be made aware of their residual risk. Examples include:

- Reservoir, retention, and basins
- Levees and floodwalls
- Channel modifications
- Channel maintenance

4.1.5 Public Education and Awareness Activities

Public education and awareness activities advise residents, business owners, potential property buyers, and visitors about floods, hazardous areas, and mitigation techniques they can use to reduce the flood risk to themselves and their property. Examples include:

Readily available and readable updated maps.

- Outreach projects
- Libraries
- Technical assistance
- Real estate disclosure
- Environmental education
- Risk information via the nightly news.

NFIP's CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from community actions meeting the three goals of the CRS: to reduce flood losses, to facilitate accurate insurance rating, and to promote the awareness of flood insurance.

For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount. (A Class 10 is not participating in the CRS and receives no discount.)

4.1.6 Emergency Service Measures

Although not typically considered a mitigation technique, emergency service measures minimize the impact of flooding on people and property. These are actions commonly taken immediately prior to, during, or in response to a hazard event. Examples include:

- Hazard warning system
- Emergency response plan
- COOP and COG planning
- Critical facilities protection
- Health and safety maintenance
- Post flood recovery planning

For more information regarding hazard mitigation techniques, best practices, and potential grant funding sources, visit www.fema.gov or contact your local floodplain manager, emergency manager, or State Hazard Mitigation Officer.

In Section 3, specific AoMIs were identified. Table 4-1 below identifies possible mitigation actions for each AoMi to consider.

Table 4-1. Mitigation Actions for Areas of Mitigation Interest

AoMI	Possible Actions to Reduce Flood Risk
Other Flood Risk Areas – Structure in Floodway	**Education** **Relocation** **Acquisition** **Elevation** **Flood Response plan** **Flood Proofing**
Other Flood Risk Areas – Roadway Flooding	**Capital Improvement Projects** **Barricade/Road Closure Plan** **Creation of Alternate Routes**
Other Flood Risk Areas – Breakout	**Capital Improvement Projects** **New Engineering Analysis**

Refer to FEMA Mitigation Planning How To Guide #3 (FEMA 386-3) "Developing the Mitigation Plan - Identifying Mitigation Actions and Implementation Strategies" for more information on how to identify specific mitigation actions to address hazard risk in your community.

4.2 Identifying specific Actions for Your Community

As many mitigation actions are possible to lessen the impact of floods, how can a community decide which ones are appropriate to implement? There are many ways to identify specific actions most appropriate for a community. Some factors to consider may include the following:

- **Site characteristics**. Does the site present unique challenges (e.g., significant slopes or erosion potential)?
- **Flood characteristics**. Are the flood waters affecting the site fast or slow moving? Is there debris associated with the flow? How deep is the flooding?
- **Social acceptance**. Will the mitigation action be acceptable to the public? Does it cause social or cultural problems?
- **Technical feasibility**. Is the mitigation action technically feasible (e.g., making a building watertight to a reasonable

FEMA in collaboration with the American Planning Association has released the publication, "Integrating Hazard Mitigation into Local Planning." This guide explains how hazard mitigation can be incorporated into several different types of local planning programs. For more information go to www.planning.org. or http://www.fema.gov/library.

depth)?

- **Administrative feasibility**. Is there administrative capability to implement the mitigation action?
- **Legal**. Does the mitigation action meet all applicable codes, regulations, and laws? Public officials may have a legal responsibility to act and inform citizens if a known hazard has been identified.
- **Economic**. Is the mitigation action affordable? Is it eligible under grant or other funding programs? Can it be completed within existing budgets?
- **Environmental**. Does the mitigation action cause adverse impacts on the environment or can they be mitigated? Is it the most appropriate action among the possible alternatives?

Your local Hazard Mitigation Plan is a valuable place to identify and prioritize possible mitigation actions. The plan includes a mitigation strategy with mitigation actions that were developed through a public and open process. You can then add to or modify those actions based on what is learned during the course of the Risk MAP project and the information provided within this FRR.

Communities can link hazard mitigation plans and actions to the right FEMA grant programs to fund flood risk reduction. More information about FEMA HMA programs can be found at http://www.fema.gov/government/grant/ hma/index.shtm.

4.3 Mitigation Programs and Assistance

Not all mitigation activities require funding (e.g., local policy actions such as strengthening a flood damage prevention ordinance), and those that do are not limited to outside funding sources (e.g., inclusion in local capital improvements plan, etc.). For those mitigation actions that require assistance through funding or technical expertise, several state and federal agencies have flood hazard mitigation grant programs and offer technical assistance. These programs may be funded at different levels over time or may be activated under special circumstances such as after a presidential disaster declaration.

4.3.1 FEMA Mitigation Programs and Assistance

FEMA awards many mitigation grants each year to states and communities to undertake mitigation projects to prevent future loss of life and property resulting from hazard impacts, including flooding. The FEMA Hazard Mitigation Assistance (HMA) programs provide grants for mitigation through the programs listed in Table 4.2.

The HMGP and PDM programs offer funding for mitigation planning and project activities that address multiple natural hazard events. The FMA, RFC, and SRL programs focus funding efforts on reducing claims against the NFIP. Funding under the HMA programs is subject to availability of annual appropriations, and HMGP funding is also subject to the amount of FEMA disaster recovery assistance provided under a presidential major disaster declaration.

Table 4-2. FEMA Hazard Mitigation Assistance Programs

Mitigation Grant Program	Authorization	Purpose
Hazard Mitigation Grant Program (HMGP)	Robert T. Stafford Disaster Relief and Emergency Assistance Act	Activated after a presidential disaster declaration; provides funds on a sliding scale formula based on a percentage of the total federal assistance for a disaster for long-term mitigation measures to reduce vulnerability to natural hazards
Flood Mitigation Assistance (FMA)	National Flood Insurance Reform Act	Reduce or eliminate claims against the NFIP
Pre-Disaster Mitigation (PDM)	Disaster Mitigation Act	National competitive program focused on mitigation project and planning activities that address multiple natural hazards
Repetitive Flood Claims (RFC)	Bunning-Bereuter-Blumenauer Flood Insurance Reform Act	Reduce flood claims against the NFIP through flood mitigation; properties must be currently NFIP insured and have had at least one NFIP claim
Severe Repetitive Loss (SRL)	Bunning-Bereuter-Blumenauer Flood Insurance Reform Act	Reduce or eliminate the long-term risk of flood damage to SRL residential structures currently insured under the NFIP

FEMA's HMA grants are awarded to eligible states, tribes, and territories (applicant) that, in turn, provide subgrants to local governments and communities (sub-applicant). The applicant selects and prioritizes sub-applications developed and submitted to them by sub-applicants and submits them to FEMA for funding consideration. Prospective sub-applicants should consult the office designated as their applicant for further information regarding specific program and application requirements. Contact information for the FEMA Regional Offices and State Hazard Mitigation Officers (SHMO) is available on the FEMA website (www.fema.gov).

The Silver Jackets program, active in several states, is a partnership of USACE, FEMA, and state agencies. The Silver Jackets program provides a state-based strategy for an interagency approach to planning and implementing measures for risk reduction.

4.3.2 Additional Mitigation Programs and Assistance

Several additional agencies including USACE, Natural Resource Conservation Service (NRCS), U.S. Geological Survey (USGS), and others have specialists on staff and can offer further information on flood hazard mitigation. The State NFIP Coordinator and SHMO are state-level sources of information and assistance, which vary among different states.

5 Acronyms and Definitions

5.1 Acronyms

A

AAL	Average Annualized Loss
ACE	Annual Chance of Exceedance
ALR	Annualized Loss Ratio
AoMI	Areas of Mitigation Interest

B

BCA	Benefit-Cost Analysis
BFE	Base Flood Elevation
BMP	Best Management Practices

C

CFR	Code of Federal Regulations
COG	Continuity of Government Plan
COOP	Continuity of Operations Plan
CRS	Community Rating System
CSLF	Changes Since Last FIRM

D

DHS	Department of Homeland Security DMA 2000 Disaster Mitigation Act of 2000

E

EOP	Emergency Operations Plan

F

FEMA	Federal Emergency Management Agency FIRM Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FRD	Flood Risk Database
FRM	Flood Risk Map
FRR	Flood Risk Report
FY	Fiscal Year

G

GIS	Geographic Information System

H

HMA	Hazard Mitigation Assistance HMGP Hazard Mitigation Grant Program

I

IA	Individual Assistance

N

NFIA	National Flood Insurance Act

NFIP	National Flood Insurance Program NRCS Natural Resource Conservation Service

P

PA	Public Assistance
PDM	Pre-Disaster Mitigation

R

RFC	Repetitive Flood Claims
Risk MAP	Mapping, Assessment, and Planning

S

SFHA	Special Flood Hazard Area
SHMO	State Hazard Mitigation Officer
SRL	Severe Repetitive Loss

U

USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

5.2 Definitions

0.2-percent ACE flood – The flood elevation that has a 0.2-percent chance of being equaled or exceeded each year. Sometimes referred to as the 500-year flood.

1-percent ACE flood – The flood elevation that has a 1-percent chance of being equaled or exceeded each year. Sometimes referred to as the 100-year flood.

Annualized Loss Ratio (ALR) – Expresses the annualized loss as a fraction of the value of the local inventory (total value/annualized loss).

Average Annualized Loss (AAL) – The estimated long-term weighted average value of losses to property in any single year in a specified geographic area.

Base Flood Elevation (BFE) – Elevation of the 1-percent-annual-chance flood. This elevation is the basis of the insurance and floodplain management requirements of the NFIP.

Berm – A small levee, typically built from earth.

Cfs – Cubic feet per second, the unit by which discharges are measured (a cubic foot of water is about 7.5 gallons).

Consequence (of flood) – The estimated damages associated with a given flood occurrence.

Crest – The peak stage or elevation reached or expected to be reached by the floodwaters of a specific flood at a given location.

Dam – An artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water.

Design flood event – The greater of the following two flood events: (1) the base flood, affecting those areas identified as SFHAs on a community's FIRM; or (2) the flood corresponding to the area designated as a flood hazard area on a community's flood hazard map or otherwise legally designated.

Erosion – Process by which floodwaters lower the ground surface in an area by removing upper layers of soil.

Essential facilities – Facilities that, if damaged, would present an immediate threat to life, public health, and safety. As categorized in Hazus, essential facilities include hospitals, emergency operations centers, police stations, fire stations, and schools.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters or (2) the unusual and rapid accumulation or runoff of surface waters from any source.

Flood Insurance Rate Map (FIRM) – An official map of a community, on which FEMA has delineated both the SFHAs and the risk premium zones applicable to the community. See also Digital Flood Insurance Rate Map.

Flood Insurance Study (FIS) Report – Contains an examination, evaluation, and determination of the flood hazards of a community, and if appropriate, the corresponding water-surface elevations.

Flood risk – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. Sometimes referred to as flood vulnerability.

Flood vulnerability – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. Sometimes referred to as flood risk.

Floodborne debris impact – Floodwater moving at a moderate or high velocity can carry floodborne debris that can impact buildings and damage walls and foundations.

Floodwall – A long, narrow concrete or masonry wall built to protect land from flooding.

Floodway (regulatory) – The channel of a river or other watercourse and that portion of the adjacent floodplain that must remain unobstructed to permit passage of the base flood without cumulatively increasing the water surface elevation more than a designated height (usually 1 foot).

Floodway fringe – The portion of the SFHA that is outside of the floodway.

Freeboard – A factor of safety usually expressed in feet above a flood level for purposes of flood plain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed (44CFR§59.1).

Hazus – A GIS-based risk assessment methodology and software application created by FEMA and the National Institute of Building Sciences for analyzing potential losses from floods, hurricane winds and surge, and earthquakes.

High velocity flow – Typically comprised of floodwaters moving faster than 5 feet per second.

Levee – A human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding. (44CFR§59.1).

Loss ratio – Expresses loss as a fraction of the value of the local inventory (total value/loss).

Mudflow – Mudslide (i.e., mudflow) describes a condition where there is a river, flow or inundation of liquid mud down a hillside usually as a result of a dual condition of loss of brush cover, and the subsequent accumulation of water on the ground preceded by a period of unusually heavy or sustained rain. A mudslide (i.e., mudflow) may occur as a distinct phenomenon while a landslide is in progress, and will be recognized as such by the Administrator only if the mudflow, and not the landslide, is the proximate cause of damage that occurs. (44CFR§59.1)

Probability (of flood) – The likelihood that a flood will occur in a given area.

Risk MAP – Risk Mapping, Assessment, and Planning, a FEMA strategy to work collaboratively with state, local, and tribal entities to deliver quality flood data that increases public awareness and leads to action that reduces risk to life and property.

Riverine – Of or produced by a river. Riverine floodplains have readily identifiable channels.

Special Flood Hazard Area (SFHA) – Portion of the floodplain subject to inundation by the 1-percent- annual or base flood.

Stafford Act – Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988; amended the Disaster Relief Act of 1974, PL 93-288. This Act constitutes the statutory authority for most federal disaster response activities especially as they pertain to FEMA and FEMA programs.

Stillwater –Projected elevation that flood waters would assume, referenced to National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or other datum, in the absence of waves resulting from wind or seismic effects.

Stream Flow Constrictions – A point where a human-made structure constricts the flow of a river or stream.

6 Additional Resources

ASCE 7 – National design standard issued by the American Society of Civil Engineers (ASCE), *Minimum Design Loads for Buildings and Other Structures*, which gives current requirements for dead, live, soil, flood, wind, snow, rain, ice, and earthquake loads, and their combinations, suitable for inclusion in building codes and other documents.

ASCE 24-05 – National design standard issued by the ASCE, *Flood Resistant Design and Construction*, which outlines the requirements for flood resistant design and construction of structures in flood hazard areas. National Flood Insurance Program (NFIP), Federal Emergency Management Agency (FEMA), www.floodsmart.gov

FEMA, www.fema.gov

ASCE, 2010. *So, You Live Behind a Levee!* Reston, VA.

FEMA Publications – available at www.fema.gov

FEMA, 1985. *Manufactured Home Installation in Flood Hazard Areas*, FEMA 85. Washington, DC, September 1985.

FEMA and the American Red Cross, 1992. *Repairing Your Flooded Home*, FEMA 234/ARC 4476. Washington, DC, August 1992.

FEMA, 1996. *Addressing Your Community's Flood Problems*, FEMA 309. Washington, DC, June 1996.

FEMA, 1998. *Homeowner's Guide to Retrofitting*, FEMA 312. Washington, DC, June 1998.

FEMA, 1999. *Protecting Building Utilities from Flood Damage*, FEMA 348. Washington, DC, November 1999.

FEMA, 1999. Riverine Erosion Hazard Areas Mapping Feasibility Study. Washington, DC, September 1999.

FEMA, 2003. *Interim Guidance for State and Local Officials - Increased Cost of Compliance Coverage*, FEMA 301. Washington, DC, September 2003.

FEMA, 2000. *Above the Flood: Elevating Your Floodprone House,* FEMA 347. Washington, DC, May 2000.

FEMA, 2001. *Understanding Your Risks: Identifying Hazards and Estimating Losses*, FEMA 386-2. Washington, DC, August 2001.

FEMA, 2002a. *Getting Started: Building Support for Mitigation Planning*, FEMA 386-1. Washington, DC, September 2002.

FEMA, 2002b. *Integrating Manmade Hazards into Mitigation Planning*, FEMA 386-7. Washington, DC, September 2002.

FEMA, 2003a. *Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies*, FEMA 386-3. Washington, DC, April 2003.

FEMA, 2003b. *Bringing the Plan to Life: Implementing the Hazard Mitigation Plan*, FEMA 386-4. Washington, DC, August 2003.

7 Data Used to Develop Flood Risk Products

GIS basemap and other information was acquired from the following sources:

- Pinal County
    1. Depth grids generated using the hydraulics model of Queen Creek Wash from the recent LOMR
    2. Pinal County Multi-Jurisdictional Hazard Mitigation Plan
- Resolution Copper Mine
    1. Topographic data
- Town of Superior
    1. Flood pictures
    2. Pictures of structures in the floodway
- Microsoft
    1. Building footprints

Mitigation plans and AoMI information were acquired from local community input. All data acquired is included in the Appendices as an electronic attachment.