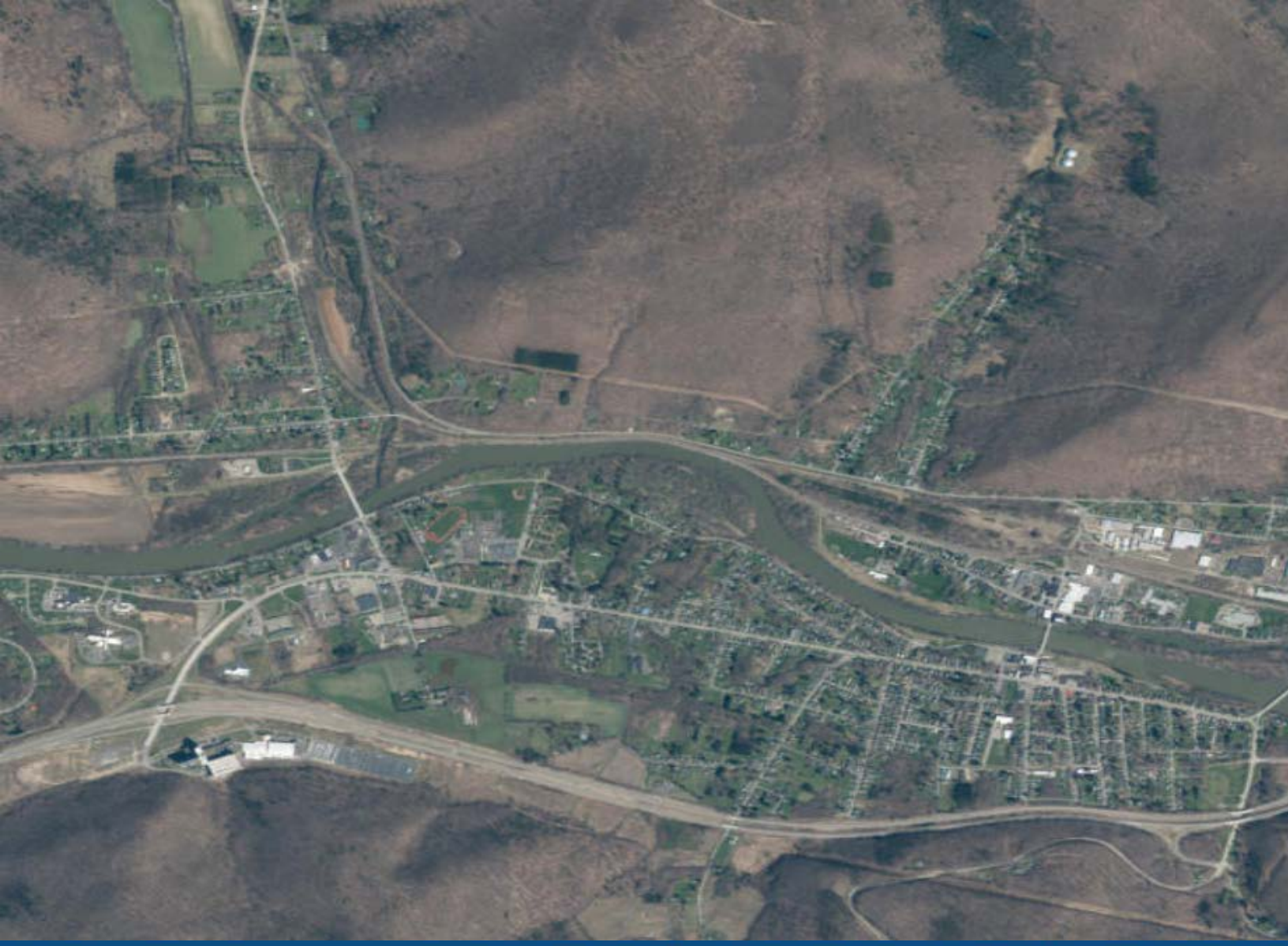

Levee Analysis and Mapping Plan
Salamanca Local Flood Protection Project

The Seneca Nation of Indians Allegany Territory and
the City of Salamanca, Cattaraugus County, New York

August 2020

FEMA

RiskMAP
Increasing Resilience Together

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Acronyms

BFE	Base Flood Elevation
BLE	Base Level Engineering
CERC	Community Engagement and Risk Communication
CFR	Code of Federal Regulations
DEM	Digital Elevation Model
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
LiDAR	Light Detection and Ranging
LLPT	Local Levee Partnership Team
LOMR	Letter of Map Revision
NFIP	National Flood Insurance Program
NLD	National Levee Database
NRCS	Natural Resources Conservation Service
NYSDEC	New York State Department of Environmental Conservation
O&M	Operations and Maintenance
PTS	Production and Technical Services
SFHA	Special Flood Hazard Area
STARR II	Strategic Alliance for Risk Reduction
USACE	U.S. Army Corps of Engineers

Definitions

The terms below have been used in this document. Additional terms are provided in FEMA's *Guidance for Flood Risk Analysis and Mapping, Levees* (November 2019) in the Glossary. This guidance document is available from the FEMA Library.

Base Flood Elevation (BFE) – The elevation of a flood having a 1-percent chance of being equaled or exceeded in any given year.

Levee Reach Analysis and Mapping Procedures – Levee mapping procedures for non-accredited levees, which include Sound Reach, Freeboard Deficient, Overtopping Analysis, Structural-Based Inundation, and Natural Valley. Details on these approaches can be found in FEMA's *Guidance for Flood Risk Analysis and Mapping, Levees*.

Leveed Area* – A spatial feature in the National Levee Database defined by the lands from which flood water is excluded by the Levee System.

Leve Impacted Area (for base flood)* – The area landward of a levee system that would be inundated by the corresponding base flood if the flood hazard reduction effect of the levee system is not considered. Often, this area will be identified by applying the Natural Valley Procedure for the levee system.

Levee Reach* – Any continuous section of a levee system to which a single analysis and mapping procedure may be applied.

Levee System* – A flood hazard-reduction system that consists of one or more levee segments and other features, such as floodwalls and pump stations, which are interconnected and necessary to ensure exclusion of the design flood from the associated hydraulically independent leveed area, and which are constructed and operated in accordance with sound engineering practices.

Local Levee Partnership Team (LLPT)* – A work group that FEMA can facilitate when a levee system will be analyzed by levee analysis and mapping procedures for non-accredited levees. The primary function of this group is to share information/data and identify options based on stakeholder roles and knowledge.

National Levee Database (NLD)* – A database developed by the U.S. Army Corps of Engineers (USACE) in cooperation with FEMA, which is a dynamic, searchable inventory of information for all levee systems in the Nation. The NLD contains information to facilitate and link activities, such as flood risk communication, levee system evaluation for the NFIP, levee system inspections, floodplain management, and risk assessments.

Natural Valley Procedure* – Non-accredited levee procedure that can be applied to all non-accredited levee reaches. The Natural Valley Procedure is used in two ways: first landward of the entire levee system to determine the outer limits of any levee impacted Zone D areas, and second as a potential procedure applied to individual levee reaches to determine the SFHA on the landward side of the levee reach. Several factors are considered when determining whether to use the Natural Valley Procedure to determine the SFHA:

- The levee reach does not significantly obstruct the flow of water; Data necessary for more complex methods is not and will not be available in the near term; or

- The community (or tribal entity, when appropriate) provides feedback that it is the acceptable procedure to use. For riverine levee systems, the Natural Valley Procedure reflects the levee geometry in the hydraulic model but allows water to flow on either side of the levee.

Non-Accredited Levee System* – A levee system that does not meet the requirements at Title 44, Chapter 1, Section 65.10 of the Code of Federal Regulations (44 CFR 65.10), *Mapping of Areas Protected by Levee Systems*, and is not shown on a FIRM as reducing base flood hazards.

Special Flood Hazard Area (SFHA) - An area having special flood, mudflow or flood-related erosion hazards and shown on a Flood Hazard Boundary Map (FHBM) or a Flood Insurance Rate Map (FIRM) Zone A, AO, A1-A30, AE, A99, AH, AR, AR/A, AR/AE, AR/AH, AR/AO, AR/A1-A30, V1-V30, VE or V.

Zone A – An area inundated by 1-percent-annual-chance flooding, for which no BFEs have been published.

Zone D – Area of possible but undetermined flood hazard.

*Term description from FEMA's *Guidance for Flood Risk Analysis and Mapping, Levees*

Executive Summary

The Salamanca Local Flood Protection Project (Salamanca LFPP) was designed and built by the U.S. Army Corps of Engineers, Pittsburgh District (USACE) to reduce flood risk in the City of Salamanca, Cattaraugus County, New York. The boundaries of the City of Salamanca lie mostly within the area of the Seneca Nation of Indians Allegany Territory. The Salamanca LFPP includes three levee systems. These levee systems are located along the Allegheny River. One of the levee systems is also along Little Valley Creek.

The Federal Emergency Management Agency (FEMA) identifies flood risk and maps flood hazards. The flood risk for the 1-percent-annual-chance flood (base flood) is discussed in the Flood Insurance Study (FIS) report. The flood hazards are mapped on the Flood Insurance Rate Maps (FIRMs). One levee system of the Salamanca LFPP, the Right Bank West Salamanca levee of the Salamanca LFPP is shown on the effective FIRM as reducing the base flood hazard. Two other levee systems of the Salamanca LFPP, the Right Bank Allegheny Levee system and Left Bank Allegheny Levee system, do not appear to reduce the base flood hazard; however, they may reduce flood hazards for smaller more frequent flood events. The effective FIRM panels for the City of Salamanca, Cattaraugus County are dated April 17, 1978. These FIRMs are the regulatory flood insurance maps.

FEMA Region II plans to modernize the FIS report and FIRM panels for Cattaraugus County, New York. These updates will replace the local-based FIS report and FIRMs with digital data for the county. Early flood risk identification and outreach related to levee systems is important. As part of the update process, FEMA Region II is proactively engaging the Seneca Nation of Indians Allegany Territory and the City of Salamanca, Cattaraugus County.

In 2013, FEMA issued a document titled *Analysis and Mapping Procedures for Non-Accredited Levee Systems New Approach*. The procedures described in this document introduced additional options to analyze and map flood hazards for non-accredited levee systems. These procedures also feature more interactive stakeholder engagement.

In June 2019, FEMA Region II partnered with Tribal, local, regional, state, and federal levee stakeholders to form a Local Levee Partnership Team (LLPT) with the Seneca Nation of Indians Allegany Territory, the City of Salamanca, Cattaraugus County and the Town of Salamanca, Cattaraugus County. The LLPT coordinated to find potential analysis and mapping procedures to be applied to local levee systems. This involved collecting and evaluating available data, completing an initial data analysis, and identifying mapping needs.

This levee plan summarizes that information. The plan outlines potential options to identify the flood hazard behind the levee on future FIRMs. It also identifies additional data collection needs.

For future FIRM panels to show the three Salamanca LFPP levee systems as reducing the base flood hazard, certified levee data compliant with Title 44, Code of Federal Regulations, Chapter I, Part 65, Section 10 (44 CFR §65.10) will need to be provided to FEMA. FEMA will check the certified levee data for completeness. If the levee certification data is found to be complete, the levee system(s) can be mapped as accredited on the FIRM

If the levee system(s) are not compliant with the minimum requirements of 44 CFR §65.10, flood hazards behind the levee system(s) may be evaluated using the Analysis and Mapping Procedures for

non-accredited levees. This may also require certified levee data that complies with 44 CFR §65.10 and the requirements of the levee reach analysis procedure being considered.

Certified levee data may be submitted to FEMA at any time. The certified levee data should be based on the effective study data. Updated certification data would be required if the effective study data is changed. Qualified entities seeking accreditation can submit data to FEMA using the Letter of Map Revision (LOMR) process.

A restudy of the flood risk of the Allegheny River and Little Valley Creek is anticipated in the future. The restudy may supersede the effective flood risk study. The qualified entity seeking accreditation should coordinate with FEMA Region II prior to preparing certified levee data.

If FEMA does not receive certified levee data or if the data is incomplete, the levee system will not be accredited. Future FIRMs would depict flood hazard for the levee system based on the Analysis and Mapping Procedures for Non-accredited Levees.

1 Introduction

Under FEMA's prior levee flood hazard mapping approach, a levee system that did not meet the National Flood Insurance Program (NFIP) requirements (44 CFR §65.10) was analyzed and mapped as if the levee system had no effect on flooding during the base flood. This was known as the "without levee" approach.

Stakeholders expressed concern about the "without levee" approach. Members of both the U.S. House of Representatives and the Senate echoed this concern and asked FEMA to consider discontinuing the "without levee" approach. FEMA used current modeling techniques to refine its analysis of the flood hazard reduction provided by non-accredited levee systems. This process, known as the "Analysis and Mapping Procedures for Non-Accredited Levee Systems," recognizes the uncertainty associated with hazard identification for levee-impacted areas by providing multiple procedures for defining flood hazards.

This approach is being applied to the levee systems along the Allegheny River near Main Street and along the Allegheny River and Little Valley Creek near Center Street. These three levee systems are part of the Salamanca LFPP. The Analysis and Mapping Procedures for Non-Accredited Levee Systems activities were initiated by FEMA; its Production and Technical Services (PTS) provider, Strategic Alliance for Risk Reduction II (STARR II); and its Community Engagement and Risk Communication (CERC) provider (*Resilience Action Partners*).

Flood hazards change over time. Conditions within a watershed may also change. Therefore, FEMA periodically assesses the need to update the flood hazard information shown on the effective FIRMs. FEMA funded a Base Level Engineering (BLE) project for the Upper Allegheny River Watershed to help inform future flood risk mapping projects.

The Upper Allegheny River Watershed BLE includes the Seneca Nation of Indians Allegany Territory and the Seneca Nation of Indians Oil Springs Territory (see Figure 1). It also includes the City of Salamanca, Cattaraugus County. The BLE project includes the Allegheny River and Little Valley Creek, which affect the Salamanca LFPP. This BLE project provided flood risk datasets, including flood hazard data for the Allegheny River and Little Valley Creek. The results of the BLE project were leveraged for the initial data analysis, discussed in Sections 4 and 5 of this plan. The results of the BLE project can also be used to expand risk awareness discussions.

When a stream with a levee system is restudied, the flood risk associated with the levee system should be reevaluated. FEMA reviews the available information for the levee system to determine the appropriate mapping procedures to apply to the levee-impacted areas landward of the levee. In this case, if the Allegheny River and Little Valley Creek are restudied, the levee systems in the Seneca Nation of Indians Allegany Territory and the City of Salamanca, Cattaraugus County will be reevaluated. FEMA leveraged the BLE project to develop a first-pass estimate of the potential base flood hazard associated with the levee systems along the Allegheny River and Little Valley Creek.

This levee plan is the result of collaboration between FEMA, the Seneca Nation of Indians Allegany Territory, the City of Salamanca, Cattaraugus County, the New York State Department of Environmental Conservation (NYSDEC), Cattaraugus County, USACE, and other stakeholders. The plan summarizes stakeholder coordination, initial data analysis, and potential options for depicting the flood hazard for the levee systems on a future FIRM.

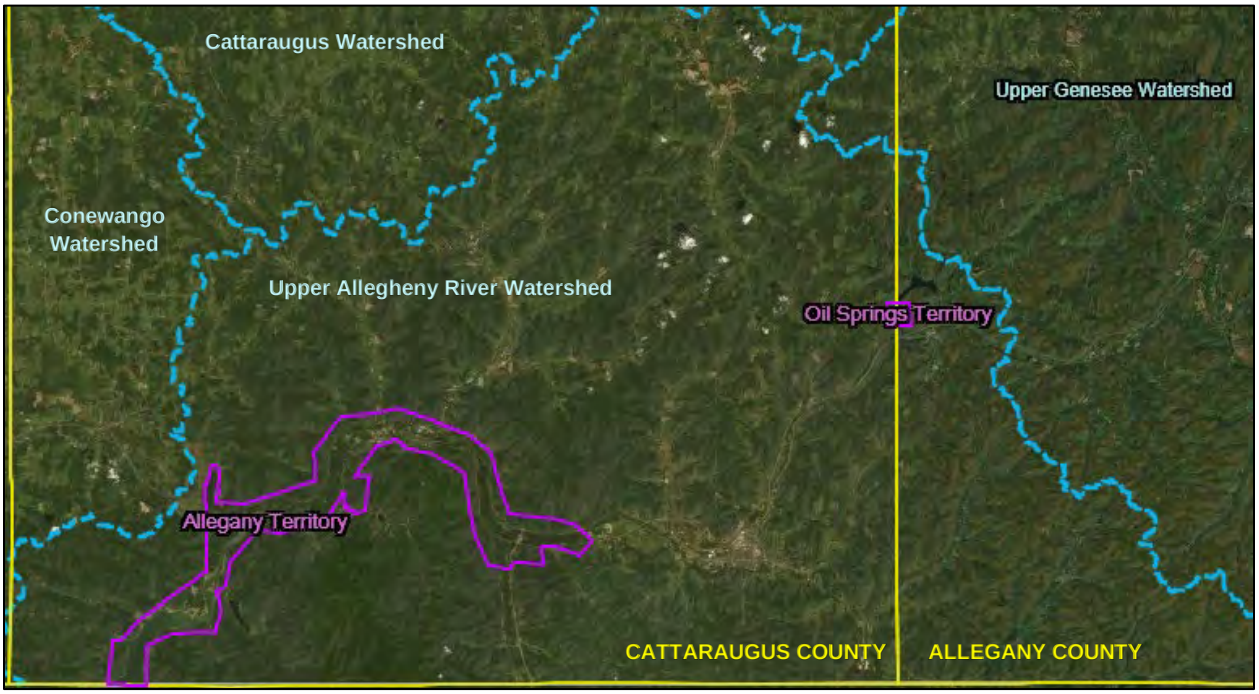

Figure 1: Seneca Nation of Indians Territory Within the Upper Allegheny River Watershed BLE Project Boundary

2 Levee System Descriptions

2.1 Salamanca Local Flood Protection Project (LFPP)

The Allegheny River flows through the Seneca Nation of Indians Allegany Territory and the City of Salamanca, Cattaraugus County from east to west for approximately 5 miles. Little Valley Creek flows from north to south through the Town of Salamanca before entering the Seneca Nation of Indians Allegany Territory and the City of Salamanca, Cattaraugus County on the west side, near Forest Street. Little Valley Creek continues south until its confluence with the Allegheny River just upstream of the State Route (SR)-353 bridge.

USACE originally designed the Salamanca LFPP to reduce flood risk in the City of Salamanca, Cattaraugus County. The project includes three levee systems with identifiers (IDs) in the USACE (NLD). These levee system are referenced as the Right Bank West Salamanca, Right Bank Allegheny River, and Left Bank Allegheny River levee systems and are included in Table 1. All three levee systems are along the Allegheny River; however, the Right Bank West Salamanca Levee System also has a reach along Little Valley Creek. Construction was completed in 1971.

The three levee systems of the Salamanca LFPP have multiple stakeholders with different roles in supporting the levee system. USACE is the Federal stakeholder and NYSDEC is the non-Federal sponsor. The Seneca Nation of Indians Allegheny Territory includes the levee systems and much of the City of Salamanca, Cattaraugus County. The Operations and Maintenance (O&M) of these levee systems is the subject of ongoing discussions between federal, state, and Seneca Nation of Indians Allegany Territory authorities.

The three levee systems of the Salamanca LFPP include concrete flood walls, steel sheet pile walls, and earthen levees. Each levee system includes an interceptor storm sewer pumping station and ancillary facilities to pump interior drainage and river seepage back to the Allegheny River.

More information about the levee systems is provided in Table 1 and the levee system alignments are shown in Figure 1.

Table 1. Levee System Summary

Levee System Name	Levee System ID	County	Community	Approximate Total Length of Levee System (ft)	Approximate # of Structures Affected
Right Bank West Salamanca	4905000017[1]	Cattaraugus	City of Salamanca, Cattaraugus County, New York	4,700[1]	92[1]
Left Bank Allegheny River	4905000016[1]	Cattaraugus	City of Salamanca, Cattaraugus County, New York	2,750[1]	49[1]
Right Bank Allegheny River	4905000015[1]	Cattaraugus	City of Salamanca, Cattaraugus County, New York	3,900[1]	30[1]

[1] Data from NLD

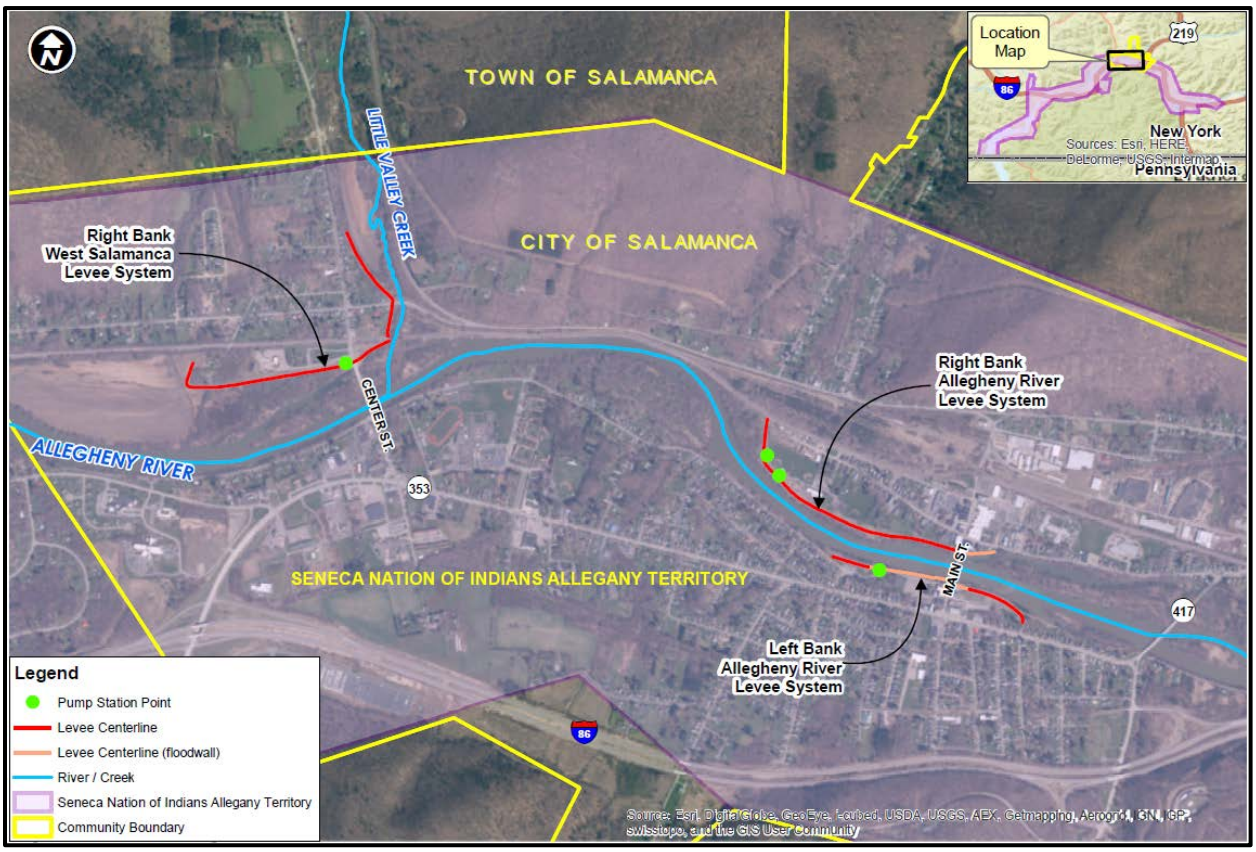

Figure 2: Location Map

2.2 Community NFIP and FIS History

Table 2 summarizes the NFIP participation and FIS report history of the Seneca Nation of Indians and the City of Salamanca, Cattaraugus County.

Table 2. Community Map History

Community Name	Participating in the NFIP?	Initial Identification	Flood Hazard Boundary Map Revision Date(s)	FIRM Effective Date
Seneca Nation of Indians	Yes	January 27, 1978	N/A	September 30, 1988
City of Salamanca	Yes	October 17, 1977	N/A	April 17, 1978

The effective FIRM panel for the City of Salamanca, Cattaraugus County dated April 17, 1978, shows the approximate levee system alignments for the Right Bank West Salamanca and the Right Bank and Left Bank Allegheny River Levee systems. These three levee systems are mapped as reducing flood hazards to varying degrees.

2.3 Upper Allegheny River Watershed BLE

FEMA funded a large-scale BLE project for the Upper Allegheny River Watershed, which includes the Allegheny River and Little Valley Creek in the Seneca Nation of Indians, Allegany Territory and the City of Salamanca, Cattaraugus County. This BLE project is intended to inform future flood hazard mapping updates within the watershed.

BLE is an automated riverine hydrologic and hydraulic (H&H) modeling approach that provides communities with a baseline understanding of their flood risk. It is produced to support the assessment and maintenance of the national flood hazard inventory. The BLE project provides updated information for a large area, with a limited level of detail. The resulting flood risk dataset can be used to initiate flood risk awareness discussions. FEMA will release the final report for the Upper Allegheny River Watershed BLE project to the public when it is complete.

2.4 Future Detailed Study

The effective studies for the Allegheny River and Little Valley Creek are detailed studies that identify Special Flood Hazard Areas (SFHAs) using numbered A zones such as A10. Numbered A zones have published BFEs and can have floodways. A detailed (enhanced) study includes updated H&H analysis. The detailed hydraulic analysis may include ground surveys, additional information about stream crossings - such as bridges, and more manipulation of models than the leveraged hydraulic analysis from the BLE project. The analysis for a BLE project is based on more limited information than a detailed study includes. It cannot replace a detailed study because a replacement study would have to produce at least the same level of output shown on the current FIRMs.

In the future, FEMA may fund a detailed study of the Allegheny River and Little Valley Creek. That detailed study would supersede the effective FIS report and FIRMs when it becomes effective.

3 Stakeholder Engagement and Data Collection

3.1 Local Levee Partnership Team

The LLPT is a group of levee stakeholders who provide FEMA with data and information on local levee conditions. They also share feedback on the procedures for analyzing and mapping the levee reach. The stakeholders who participated in the LLPT for this project are listed in Table 3.

Table 3. LLPT Participants

LLPT Member	Contact Information
Michael Smith	Mayor, City of Salamanca, Cattaraugus County 716-945-3110; gtaylor@salmun.com
Rob Carpenter	Director, Department of Public Works, City of Salamanca, Cattaraugus County 716-945-4680; rcarpenter@salmun.com
Nick Bocharski	Fire Department, City of Salamanca, Cattaraugus County 716-945-3113; nbocharski@salmun.com
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Mark Burr	Engineering Director, Cattaraugus County Department of Public Works mcburr@cattco.org
Kimberly Merrill	Cattaraugus County Department of Public Works kamerrill@cattco.org
Mike Gates	Director, Emergency Management, Seneca Nation of Indians 716-244-0820; mike.gates@sni.org
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Gregory Stagg	NYSDEC 716-998-1389; Gregory.Stagg@dec.ny.gov
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LLPT Member	Contact Information
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Nick Mueller	STARR II, FEMA Technical Support Provider, Technical Lead 513-842-8239; nick.mueller@stantec.com
Trevor Cone	STARR II, FEMA Region II Regional Service Center
	646-490-3929; trevor.cone@stantec.com
Stephanie Nurre	STARR II, FEMA Technical Support Provider, Project Manager 312-262-2284; stephanie.nurre@stantec.com
Matt Kroneberger	*Resilience Action Partners*, Outreach Provider 212-237-6373; matt.kroneberger@ogilvy.com

3.2 Data Collection

Through the stakeholder coordination and data collection process, FEMA asked the LLPT for any available data, information, and documentation associated with the levee systems.

Table 4 provides a summary of the data and documentation collected during the stakeholder coordination and data collection process. The data is included in Appendix D.

Table 4. Data Collection Summary

Data Type	Associated Levee System(s)	Data Description	Source	Date Developed or Obtained
Effective Flood Insurance Study	Right Bank West Salamanca, Right Bank Allegheny River, Left Bank Allegheny River	Cattaraugus County, City of Salamanca, New York, FEMA January 1978	FEMA Map Service Center	1978
BLE Project, Upper Allegheny River Watershed	Right Bank West Salamanca, Right Bank Allegheny River, Left Bank Allegheny River	BLE Upper Allegheny River Engineering Analysis (HEC-RAS)	STARR II	2019 (Obtained)
Topography	Right Bank West Salamanca, Right Bank Allegheny River, Left Bank Allegheny River	Topographic LiDAR, FEMA 2-Meter Digital Elevation Model (DEM)	New York State GIS Clearinghouse	2019 (Obtained)
Topography	Right Bank West Salamanca, Right Bank Allegheny River, Left Bank Allegheny River	Top of Levee Elevations	USACE NLD	2020 (Obtained)
Bridge Data	Right Bank West Salamanca	State Route 353 Bridge Geometry from Plans and HEC-RAS Model	New York State Department of Transportation (NYSDOT)	2020
Hydrologic Data	Right Bank West Salamanca, Right Bank Allegheny River, Left Bank Allegheny River	Streamstats Web Application, Magnitude and Frequency of Floods in New York, USGS 2006-5112	USGS	2020
Documentation	Right Bank West Salamanca, Right Bank Allegheny River, Left Bank Allegheny River	Local Cooperation Agreement between the City of Salamanca and New York State	NYSDEC	1965

3.3 LLPT Meeting 1

A FEMA project team met with levee stakeholders at the first LLPT meeting on September 25, 2019. The meeting was held at the Olean Municipal Building. The overall intent of the meeting was to gain local insight on the status of the levee systems and confirm the stakeholders who would like to take part in the LLPT. The meeting also discussed the data available for the levee systems and introduced the Analysis and Mapping Procedures for Non-Accredited Levee Systems. More details about the LLPT Meeting 1 are in Appendix A.

3.4 LLPT Meeting 2

LLPT Meeting 2, for FEMA's project team and levee stakeholders was held via webinar on June 8, 2020. The meeting built upon the discussions in LLPT Meeting 1. The FEMA project team also updated the LLPT on the progress of data collection and the initial data analysis. The potential flood hazard areas from the Natural Valley Procedure were shared with the stakeholders. Additionally, the LLPT discussed future map updates and potential options for identifying and mapping the levee flood hazard on future FIRMs. More details about the LLPT Meeting 2 are in Appendix A.

3.5 LLPT Meeting 3

The FEMA project team held a webinar for LLPT Meeting 3 with levee stakeholders on July 15, 2020. The meeting built on the discussions from LLPT Meeting 2. The FEMA project team discussed this draft Levee Analysis and Mapping Plan and shared an overview of the mapping update process. More details about the LLPT Meeting 3 are included in Appendix A.

4 Initial Data Analysis

4.1 Understanding Existing Conditions

The effective hydraulic studies for the Allegheny River and Little Valley Creek were developed using the HEC-2 hydraulic modeling program. These HEC-2 models for the Allegheny River and Little Valley Creek are no longer available. The HEC-2 hydraulic modeling program is also not used for new studies.

The Upper Allegheny River Watershed BLE project used the USACE HEC-RAS hydraulic modeling program for stream analysis. The HEC-RAS hydraulic models for the Allegheny River and Little Valley Creek were leveraged to conduct the initial data analysis of the levee systems. The initial data analysis provided a first-pass estimate of the potential BFEs and inundation areas associated with the levee systems.

The Right Bank West Salamanca levee system is shown as providing flood risk reduction from the base flood on the effective FIRMs. The Right Bank and Left Bank Allegheny River levee systems do not appear to reduce the base flood hazard; however, they may reduce flood hazards for smaller more frequent flood events.

4.2 Hydrologic and Hydraulic Analyses

The Upper Allegheny River Watershed BLE project was leveraged as the baseline conditions for the initial data analysis. The BLE project included the following methodology:

- Topographic data processing of publicly available Light Detection and Ranging (LiDAR);
- Hydrologic analysis using gridded input parameters, rural regression equations, and gage analysis, if applicable;
- Basin-wide hydraulic analysis (HEC-RAS) and generation of approximate floodplain mapping; and
- Structure data based on the National Bridge Inventory.

As part of the initial data analysis, STARR II modified the BLE project's HEC-RAS hydraulic models for the Allegheny River and Little Valley Creek. The modifications included estimating the channel geometry and adding channel manning's roughness values. The SR-353 bridge geometry in the Allegheny River model was updated using as-built plans and HEC-RAS model geometry provided by NYSDOT. The railroad bridge crossing Little Valley Creek near its confluence with the Allegheny River was added to the hydraulic model. The railroad bridge length and width were estimated based on measurements from aerial imagery. Elevations of the bridge deck were estimated based on LiDAR elevations at the abutments. Bridge deck thickness was assumed based on the bridge span. This analysis is referred to as the "modified BLE model" in this levee plan.

The modified BLE model was updated to reflect the "with levee" condition. This "with levee" modified BLE model does not allow flow on the landside of the levee system for estimated levee crests elevated above the base flood. The "with levee" condition may produce higher water surface elevations than the traditional Natural Valley Procedure, which allows flow on either side of the levee. The "with levee" condition is used to estimate the BFEs on the levee system's riverside and is used for estimating minimum freeboard requirements. Additional details regarding the modified BLE model can be found in the profile comparison exhibits and technical memorandum in Appendix E.

The BLE project's flood hazard information has a lower resolution than the effective studies of the Allegheny River and Little Valley Creek; therefore, the BLE project cannot be incorporated as effective data. Only future detailed studies would supersede the currently effective information. The results of the initial data analysis for the Allegheny River and Little Valley Creek are non-regulatory; however, they help inform users of potential flood risk and the scope of future detailed analyses. These results should not be used for regulatory activities. If a restudy is funded in the future, FEMA will reengage the community throughout the restudy and mapping process.

4.3 Computation of Freeboard

The base flood profile of the Allegheny River and Little Valley Creek, from the "with levee" modified BLE model, were used to estimate minimum freeboard, per the requirements of 44 CFR §65.10 (b)(1)(i), which include:

- "... a minimum freeboard of three feet above the water-surface level of the base flood."
- "An additional one foot above the minimum is required within 100 feet on either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted."
- "An additional one-half foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee, is also required."

The base flood profile of the Allegheny River and Little Valley Creek were plotted against the levee crest elevations to estimate if the levee crest met minimum freeboard requirements.

The levee crest elevations for the Right Bank West Salamanca and the Right Bank and Left Bank Allegheny River levee systems came from the USACE NLD data. The approximate freeboard comparison exhibits are provided in Appendix B. The exhibits show that each levee system may be freeboard deficient and not meet the minimum freeboard requirements of 44 CFR §65.10 (b)(1)(i).

It should be noted that the freeboard comparison was performed using the first-pass data from the "with levee" modified BLE model. The results of the first-pass analysis do not supersede those of the effective FIS report, FIRM, and applicable LOMRs for the Allegheny River or Little Valley Creek; they are intended for discussion and risk awareness purposes and to inform future detailed studies.

A future detailed study of Allegheny River and Little Valley Creek may change the BFE, which would revise minimum freeboard requirements. Additionally, the levee crest elevations for the freeboard comparison are based on available levee crest elevation data from the NLD. A future field survey of the levee crest, which would be the responsibility of the levee sponsor if they choose to do so, may produce results different from this freeboard comparison. A field survey of the levee crest would facilitate the future application of an appropriate levee analysis and mapping procedure.

4.4 Potential Levee Reach Analysis Procedures

One component of the Analysis and Mapping Procedures for Non-accredited Levees is to define appropriate segmentation of levee systems and reaches to identify potential mapping approaches for each reach, based on available data and conditions.

A levee system is a hydraulically independent flood hazard-reduction system that consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering principles. A levee reach is any continuous section of a levee system to which a single reach analysis procedure may be applied. Based on the available data and the initial data analysis, the Right Bank West Salamanca, Right Bank Allegheny River, and Left Bank Allegheny River levee systems are being considered separate reaches.

Potential reach analysis procedures are described in FEMA's *Guidance for Flood Risk Analysis and Mapping, Levees*. The procedures include Sound Reach, Freeboard Deficient, Overtopping, Structural-Based Inundation, and Natural Valley procedures. These procedures may be assigned for separately defined levee reaches of an entire system.

Each procedure requires the use of different components of data from 44 CFR §65.10. A high-level summary of the data available for the Right Bank West Salamanca and the Right and Left Bank Allegheny River Levee systems is shown in Table 5. A checklist of the levee certification data required under 44 CFR §65.10 is provided in Appendix C.

Table 5. Levee Data Summary

Levee Data Description	Levee Reach Analysis Procedure					Levee System Data Collected		
	Sound Reach	Freeboard Deficient	Overtopping	Structural-Based Inundation	Natural Valley	Right Bank West Salamanca Levee System	Right Bank Allegheny River Levee System	Left Bank Allegheny River Levee System
Levee Crest Information	Required[2], BFE + Freeboard Less than Levee Crest	Required[2], BFE Less than Levee Crest	Required[2]	Required[2]		NLD levee crest data	NLD levee crest data	NLD levee crest data
O&M Plan, Emergency Action Plan	Required[2]	Required[2]	Required[2]	Recommended		No	No	No
Certified As-Built Plans	Required[2]	Required[2]	Required[2]			No	No	No
Structural Design Requirements[3]	Required[2]	Required[2]	Required[2]			No	No	No
Inspection Plan/ Inspection Reports	Required[2]	Required[2]	Required[2]	Recommended		No	No	No
Evaluation of overtopping Erosion Potential			Required[2]			No	No	No

[2] Data required from levee stakeholder.

[3] Structural design requirements include freeboard, closures, embankment protection, embankment and foundation stability analyses, settlement analyses, and interior drainage. These requirements are according to 44 CFR §65.10(b). A checklist of the levee certification data required under 44 CFR §65.10 is provided in Appendix C.

The zones mapped landward of the levee also vary. The Sound Reach and Freeboard Deficient procedures may result in mapping the flood risk as Zone D. Overtopping and Structural-Based Inundation procedures may result in a combination of a landward SFHA and Zone D. The Natural Valley procedure results in a landward SFHA. Interior drainage may also be mapped as SFHAs if it is shown to be the dominant source of flooding for an area.

5 Potential Analysis Methods

A brief description of the various methods available to study the Salamanca LFPP levee systems, based on FEMA guidance, are presented below. A brief evaluation of the appropriateness of each procedure is presented; it focuses primarily on the data available including the BFEs from the "with levee" modified BLE model. The appropriateness of each procedure may change based on future levee data and the results of detailed studies of the Allegheny River and Little Valley Creek.

5.1 Sound Reach

A Sound Reach is a continuous reach of a levee system that has been designed, constructed, and maintained to withstand the flood hazards posed by a base flood. Sound Reaches differ from an accredited levee system because they are a part of a levee system that cannot meet accreditation requirements.

Based on the initial data analysis, each levee system is being considered a separate reach. The Sound Reach analysis would not apply. If the entire levee system meets the requirements of 44 CFR §65.10, it may be considered for accreditation.

5.2 Freeboard Deficient

The Freeboard Deficient Procedure can be applied if the levee crest is above the BFE but does not meet minimum freeboard requirements. A Freeboard Deficient Reach must meet structural requirements, O&M, and inspection standards.

As with the Sound Reach Procedure, no reach-specific modeling is required for a Freeboard Deficient Reach. However, SFHAs from the system-wide interior drainage analysis, and/or adjacent levee reaches, may still be delineated landward of Freeboard Deficient Reaches.

Based on the initial data analysis, the levee crest elevations for the Right Bank West Salamanca and the Right Bank and Left Bank Allegheny River Levee systems are above the BFE; therefore, the Freeboard Deficient Procedure may apply.

5.3 Overtopping

The Overtopping Procedure can be considered when the BFE is above the levee crest for a reach but the levee is designed to withstand the forces of overtopping. The levee sponsor must provide technical justification that the base flood event will not cause structural failure. In addition to the structural standards established in 44 CFR §65.10, more detailed structural analysis may be required to justify the levee system's ability to sustain the impact of a base flood overtopping the

levee. As with the Sound Reach and Freeboard Deficient Reach procedures, an O&M Plan and documentation of inspection are required.

For an Overtopping Reach, technical analyses are performed to determine the volume of water that will overtop the levee during the base flood event. This volume of water is used to establish the inundation area of the SFHA on the landside of the levee system.

Based on initial data analysis, the Right Bank West Salamanca and the Right Bank and Left Bank Allegheny River Levee systems may not be overtopped by floodwater at the BFE for the Allegheny River or Little Valley Creek. Once detailed analyses of the Allegheny River and Little Valley Creek are available, the freeboard estimate of the levee systems should be updated. If the levee systems are overtopped and the additional data listed in Table 5 is provided, the Overtopping Analysis may be performed. As these levee systems may not have been designed to be overtopped, the overtopping analysis may not be applicable without redesign and construction.

5.4 Structural-Based Inundation

In some instances, levee systems have reaches with either known structural deficiencies or unknown structural integrity (a common occurrence for older levee systems). Levee systems with structural integrity issues may provide some flood risk reduction by impeding conveyance to some degree.

It is not possible to predict the exact location of a levee breach. This procedure neither predicts the probability of failure at any breach location, nor provides a specific determination or evaluation of the overall levee system performance. It also does not require a determination of the potential failure mechanism. The procedure results in the development of a reach-specific SFHA that might occur from potential breaches along a specific levee system during the base flood. To determine this SFHA, FEMA will consider possible locations of system breaches, geometry, and failure duration. Known structural deficiencies can be used to help guide the location of the theoretical breaches for Structural-Based Inundation areas.

Once detailed analysis of the Allegheny River and Little Valley Creek are available, the freeboard estimate of the levee systems can be updated. If the levee systems are not significantly overtopped by either the Allegheny River or Little Valley Creek, FEMA may perform the Structural-Based Inundation Analysis.

General practice is to perform such breach scenarios using a two-dimensional model. This may provide information that some areas within a certain radius from any levee breach will be subject to greater forces due to localized flood velocity increases in breach scenarios. Areas near levees are at greater risk due to this velocity increase.

5.5 Natural Valley Procedure

FEMA evaluates the Natural Valley Procedure for all levee systems to estimate the area that would be affected if the levee system does not reduce flood risk due to the base flood. FEMA refers to this area as the “levee impacted area”.

The modified BLE model considers the levee as reducing the flood risk from the base flood. The base flood inundation associated with the Natural Valley Procedure was estimated by extending the "with levee" modified BLE model BFEs landward of the levee into the levee-impacted area. This may produce a more conservative (larger) inundation area than the traditional Natural Valley Procedure; however, for the first-pass estimate it is an appropriate level of detail.

The results of the Natural Valley Procedure and the estimated inundation mapping are shown in Figure 3 and Figure 4 for levee systems along the Allegheny River and Little Valley Creek.

For a more detailed description of the potential analysis methodologies, please refer to FEMA's *Guidance for Flood Risk Analysis and Mapping, Levees*.

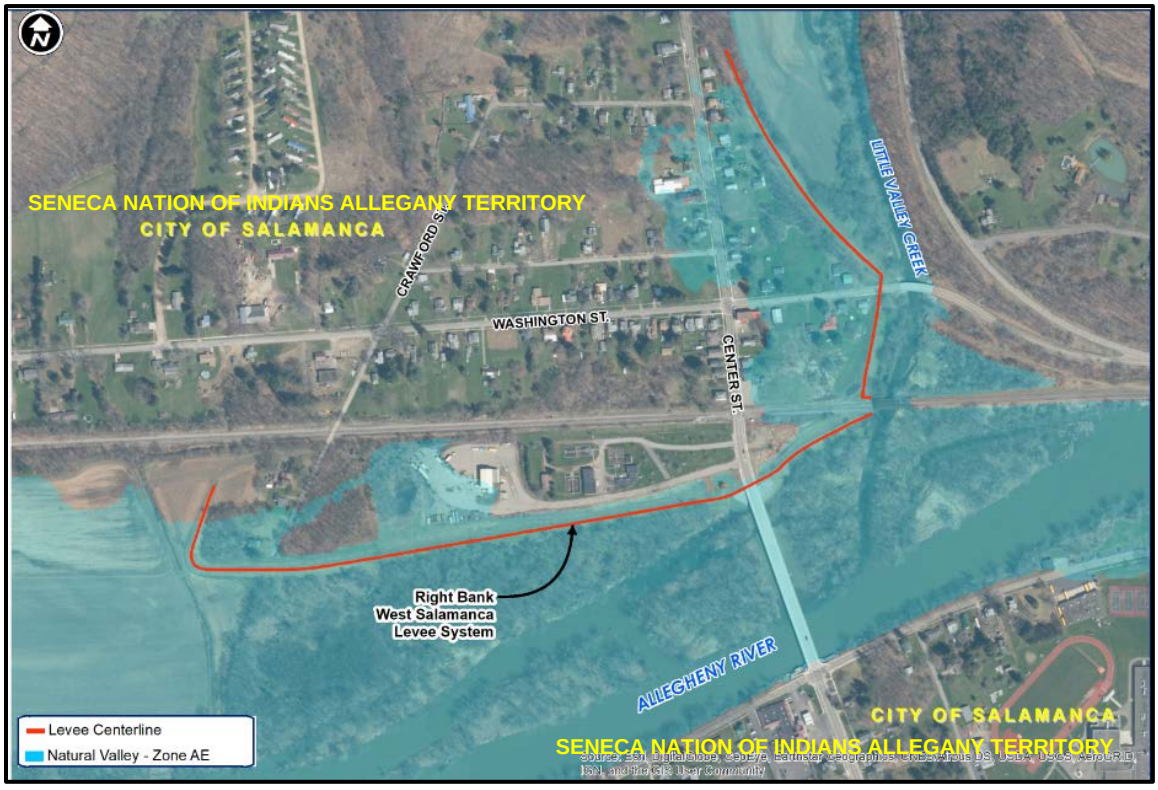

Figure 3: Natural Valley Procedure, Right Bank West Salamanca Levee System

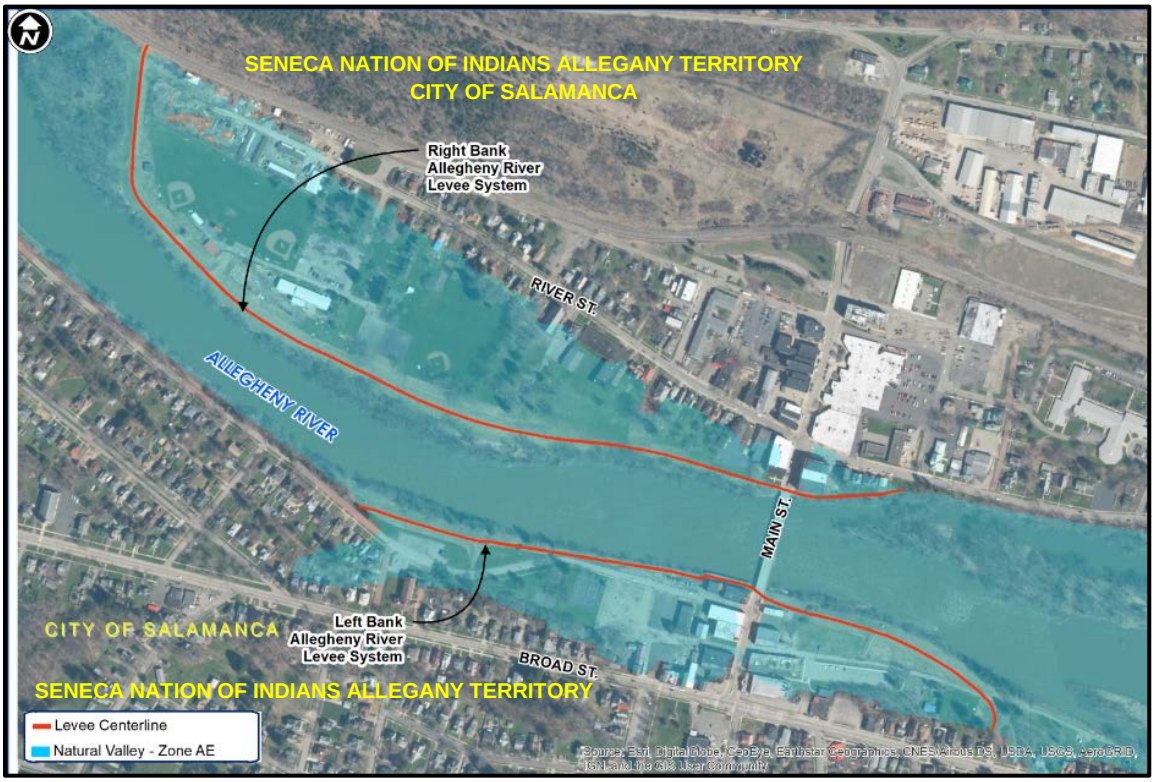

Figure 4: Natural Valley Procedure, Right Bank and Left Bank Allegheny River Levee Systems

6 Path Forward and Next Steps

The information in this levee plan provides the community with a tool it can use for planning and to increase flood risk awareness. This levee plan will also facilitate scoping of a flood mapping project. FEMA has not funded a mapping project at this time. A mapping project will require additional data collection, information gathering, levee owner coordination, detailed hydraulic analysis, and due process. The timetable for a potential project has not been determined as of the completion of this study; however, initiation of a mapping project is anticipated within the next few years.

Members of the LLPT will be included in future outreach to determine what, if any, changes have taken place with respect to existing or future conditions that may have an impact on the findings of the Analysis and Mapping Procedures for Non-Accredited Levee Systems summarized in this plan.

For future mapping to show the Right Bank West Salamanca and the Right Bank and Left Bank Allegheny River levee systems as reducing the flood hazard during the base flood, certified levee data compliant with 44 CFR §65.10 must be provided to FEMA.

If the levee systems cannot meet the minimum requirements of 44 CFR §65.10, the flood hazard behind the levee systems may be mapped using a Levee Reach Analysis Procedure from the Analysis and Mapping Procedures for Non-accredited Levees. Certified levee data that complies with 44 CFR §65.10 and the Levee Reach Analysis Procedure being requested would be required for the Sound Reach, Freeboard Deficient, and Overtopping Procedures. The resulting flood risk on the landside of the levee system may be shown as a composite of Zone D and Zone AE SFHAs.

A certified data package may be incorporated into future mapping if FEMA receives it and confirms that it meets the requirements of 44 CFR §65.10 before the end of the 90-day appeals period after the Preliminary FIRM is released. It is important to note that this data may also be submitted at any time using the LOMR process. If no data or incomplete levee certification data is provided, the levee system would be shown as non-accredited.

7 References

Esri: *World Imagery*, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, date last accessed: June 2020

FEMA: *Flood Insurance Study*, City of Salamanca, New York, Cattaraugus County, October 1977

FEMA: *Analysis and Mapping Procedures for Non-Accredited Levee Systems*, July 2013

FEMA: *Guidance for Flood Risk Analysis and Mapping, Base levee Engineering (BLE) Analyses and Mapping*, February 2018

FEMA: *Guidance for Flood Risk Analysis and Mapping, Levees*, November 2019

New York State GIS Clearinghouse, FEMA 2-Meter Digital Elevation Model (DEM), Available at: https://gis.ny.gov/elevation/

USACE, National Levee Database (https://levees.sec.usace.army.mil/#/), 2020

STARR II: *Base Level Engineering Analysis, Region II Upper Allegheny River Watershed (HUC8-05010001) MIP Case No. 19-02-0035S Deliverable*, November 30, 2019

Appendix A

Stakeholder Engagement - LLPT Meeting Information

Appendix B

Freeboard Profile Comparison

Appendix C

Levee Accreditation Checklist

Appendix D

Collected Data

(Digital data provided via FTP)

Appendix E

Initial Data Analysis

(Digital data provided via FTP)