



# City of Arcadia Floodplain Management Plan

Prepared for  
City of Arcadia

February 2018



Barr Engineering, Co.  
4300 MarketPointe Drive, Suite 200  
Minneapolis, MN 55435  
952.832.2600  
[www.barr.com](http://www.barr.com)

Davy Engineering, Co.  
115 6<sup>th</sup> Street South  
La Crosse, WI 54601  
608.782.3130  
[www.davyengineering.com](http://www.davyengineering.com)

# City of Arcadia Floodplain Management Plan

February 2018

## Contents

Executive Summary.....	8
1.0 Introduction .....	11
1.1 Description of the area.....	11
1.2 Purpose of the FMP .....	12
1.2.1 Federal Floodplain Management Guidance.....	14
2.0 Floodplain Hazard Assessment .....	16
2.1 Flooding History.....	17
2.2 Flood Hazards .....	18
2.2.1 Trempealeau River .....	18
2.2.2 Myers Valley Creek.....	20
2.2.3 Turton Creek.....	22
2.2.4 Interior Flooding .....	22
2.2.5 Land Use and Building Data.....	24
2.2.6 Development Trends.....	25
2.2.7 Development Constraints .....	25
2.2.8 Critical Facilities.....	26
2.3 Future Conditions Flows .....	28
3.0 FMP Development Process .....	30
3.1 Arcadia Planning Committee .....	30
3.2 Stakeholder Engagement Process .....	30
3.3 FMP Revision and Update Process .....	31
3.4 Long-Term Communication Plan .....	31
4.0 Goals and Objectives.....	34
4.1 Goal 1 – Collaborative Approach .....	34
4.2 Goal 2 – Reduce Risk and Mitigate Impacts.....	34
4.3 Goal 3 – Improve Understanding of Flood Risk .....	34
4.4 Goal 4 – Balance Development Goals and Floodplain Ecology.....	35
4.5 Goal 5 – Protect and Preserve the Natural Floodplain .....	35
5.0 Strategies and Tools.....	36

5.1	Strategy 1: Modifying Human Susceptibility to Flood Hazards .....	37
5.2	Strategy 2: Modifying the Impact of Flooding .....	39
5.3	Strategy 3: Preserving and Restoring the Environmental Quality of Floodplains .....	40
5.4	Strategy 4: Modifying Floodwaters.....	41
6.0	Action Plan .....	42
6.1	Emergency Operations Actions.....	42
6.1.1	Review and Update Emergency Operations Plans (EOPs).....	43
6.1.2	Develop Flood Warning System .....	43
6.1.3	Develop Flood Risk Maps.....	43
6.1.4	Develop flood inundation map library.....	44
6.2	Mitigation Actions .....	44
6.2.1	Interior Drainage Improvements .....	45
6.2.2	Evaluation of Repetitive Loss Structures .....	45
6.2.3	USACE Feasibility Study .....	46
6.2.4	Evaluation Impact of Dam Removal on Orion Lane .....	47
6.2.5	Transformer by the Main Wastewater Lift Station .....	47
6.3	Policy and Administrative Actions.....	48
6.3.1	Adopt the Arcadia FMP .....	48
6.3.2	Update City Website to Host Floodplain Information .....	49
6.3.3	Develop a Funding Strategy to Mitigate Community Flood Risk .....	49
6.3.4	Join the Community Rating System (CRS).....	50
6.3.5	Create Downtown Business and Resident Registry .....	50
6.3.6	Develop Stormwater Management Plan.....	51
6.3.7	Review and Update Zoning Code.....	51
6.3.8	Digitize Documents and Records.....	52
6.3.9	Evaluate Potential for a Local Stormwater Ordinance .....	52
6.3.10	Improve Land Management Practices .....	52
6.3.11	Regional Watershed Management Policy .....	53
7.0	References .....	54
8.0	Definitions.....	57
Appendices		59
Appendix A.	Tools: Detailed Discussion .....	60
A.1	Tools for Strategy 1: Modifying Human Susceptibility to Flood Hazards .....	61
A.1.1	Development Policies and Land-Use Regulations .....	61

A.1.2	Flood Warning Systems .....	62
A.1.3	Emergency Operations Plans .....	64
A.1.4	Elevation of Buildings .....	66
A.1.5	Relocation of Buildings .....	66
A.1.6	Wet Floodproofing .....	66
A.1.7	Dry Floodproofing.....	67
A.1.8	Berms and Floodwalls for Buildings.....	68
A.1.9	Fill or Conversion of a Basement for Buildings.....	68
A.1.10	Acquisition of Buildings .....	69
A.2	Tools for Strategy 2: Modifying the Impact of Flooding.....	70
A.2.1	Information and Education.....	70
A.2.2	Flood Insurance.....	71
A.2.3	Community Rating System .....	72
A.2.4	Tax Adjustments and Rebates or Grants.....	72
A.2.5	Disaster Assistance and Emergency Relief Funding .....	73
A.2.6	Post-Flood Recovery Processes .....	73
A.2.7	Place High Water Mark Signs in Public Places.....	74
A.3	Tools for Strategy 3: Preserving and Restoring the Environmental Quality of Floodplains .....	75
A.3.1	Erosion and Sediment Control .....	75
A.3.2	Water Quality Enhancement .....	75
A.3.3	Wetland Protection and Restoration .....	75
A.3.4	Assess Natural and Beneficial Functions of Floodplains.....	76
A.3.5	Enhancement of Recreation and Educational Opportunities.....	76
A.3.6	Preservation of Cultural Resources.....	77
A.4	Tools for Strategy 4: Modifying Floodwaters .....	78
A.4.1	Dams and Reservoirs.....	78
A.4.2	Stormwater Detention Basins .....	78
A.4.3	Levees and Floodwalls .....	79
A.4.4	Bridge Modifications .....	79
A.4.5	Landforms.....	80
A.4.6	Channel Alterations, Diversions, and Bypasses .....	80
A.4.7	Pump Stations.....	81

## List of Tables

Table ES-1	Advisable Strategies and Tools for Reducing Flood Risk for the Community .....	10
Table ES-2	High Priority Actions and Timeline for Completion .....	10
Table 2-1	Arcadia Flooding History and Source .....	17
Table 3-1	Record of Public and Planning Committee Meetings .....	31
Table 5-1	Tools Matrix for Strategy 1: Modifying Human Susceptibility to Food Hazards .....	38
Table 5-2	Tools Matrix for Strategy 2: Modifying the Impact of Flooding.....	39
Table 5-3	Tools Matrix for Strategy 3: Preserving and Restoring the Environmental Quality of Floodplains .....	40
Table 5-4	Tools Matrix for Strategy 4: Modifying Floodwaters .....	41
Table 6-1	Emergency Operations Actions .....	42
Table 6-2	Mitigation Actions .....	44
Table 6-3	Policy and Administrative Actions.....	48

## List of Figures

Figure 1-1	Location of the Study Area.....	11
Figure 1-2	Sustainable Flood Risk Management Cycle.....	13
Figure 1-3	Driving Down Flood Risks Requires a Range of Tools Applied Across Jurisdictions.....	13
Figure 2-1	Study Area.....	16
Figure 2-2	Area of Concern for Flooding from Interior Areas.....	23
Figure 2-3	Critical Facilities Location Map .....	27

## List of Appendices

Appendix A	Tools: Detailed Discussion
------------	----------------------------

## Certifications

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly licensed professional engineer under the laws of the State of Wisconsin and a certified floodplain manager with the American Association of State Floodplain Managers.



---

Joseph J. Waln  
PE #: 39967-006  
CFM #: 31388

February 16, 2018

---

Date



---

Daniel Cook, Davy Engineering Co.  
PE #: 23120-6  
CFM #: US-09-04456

February 16, 2018

---

Date

## Acronyms

<b>Acronym</b>	<b>Description</b>
AHPS	Advanced Hydrologic Prediction Service
BMPs	Best Management Practices
cfs	Cubic feet per second
CRS	Community Rating System
DNR	Department of Natural Resources
EOP	Emergency Operations Plan
FEMA	Federal Emergency Management Agency
FFIM	Flood Forecast Inundation Mapping
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FMP	Floodplain Management Plan
HMGP	Hazard Mitigation Grant Program
ISO	Insurance Services Office
MRRPC	Mississippi River Regional Planning Commission
MVC	Myers Valley Creek
NPDES	National Pollutant Discharge Elimination System
NFIP	National Flood Insurance Program
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
TC	Turton Creek
TID	Tax Increment District
TR	Trempealeau River
USACE	United States Army Corps of Engineers
WRDA	Water Resources Development Act

# Executive Summary

## Floodplain Management Plan

The City of Arcadia’s floodplain management plan (FMP) defines a coordinated approach to managing the floodplain and reducing flood risk for the community. The FMP defines the problems, establishes the goals for flood risk reduction, describes available strategies and tools, and documents the action plan for implementation. The city’s FMP is a living document for the city and other stakeholders to use to track progress toward meeting flood risk reduction goals and to update as conditions change and identified actions are completed.



## Hazard Assessment

Flooding has been an issue for the City of Arcadia for decades. Much of the city’s original downtown is in the Federal Emergency Management Agency (FEMA) 100-year floodplain. Critical infrastructure in the downtown area includes Ashley Furniture’s manufacturing facility, Pilgrim’s Pride office, the Police Station, City Hall, Fire Station, Electric Utility, Main Lift Station, and an elementary school. There are numerous other businesses and residents that are also at risk of being flooded.

Major flood events have occurred at least 14 times in past 100 years. Flooding can be caused by the Trempealeau River, Turton Creek, and Myers Valley Creek, and from surface runoff within the city. The two most recent major flood events were in 2010 and 2017 and caused millions of dollars in damages to the city and its largest employer, Ashley Furniture.

The city has an existing levee along the south bank of Turton Creek and the east bank of the Trempealeau River, but it has overtopped on multiple occasions. In addition to being too short and low, the existing levee system has deficiencies that affect its reliability as a flood barrier. The deficiencies are discussed in section 2.2.

The city typically has several hours of advance warning of flooding on the Trempealeau River. The USGS currently maintains a stream gage at Arcadia that sometimes has National Weather Service (NWS) forecasted flood elevation information. The Turton Creek and Myers Valley Creek watersheds are smaller and produce flashier flood events that leave little advance warning time for the community.

Flooding from surface runoff within the city, commonly called interior flooding, has increased over the last several decades for several reasons. Development in the community increases impervious areas, which means less water is soaking into the ground and more runs off the landscape. The region has seen larger and more intense storm events over the past 60 years. Much of the original downtown area is in the floodplain and the water table is as close as 5 feet below the ground surface. The city’s storm sewer

---

infrastructure, including its lift stations, does not have the capacity to convey all this extra water and there is little detention between the storm sewer and the pumps.

### **Analysis/Evaluation**

Because of repeated flooding in the City of Arcadia, the U.S. Army Corps of Engineers (USACE) has conducted multiple studies to help the city mitigate its flood risk dating back to the 1950s. In 1956 the USACE and the city funded an emergency repair of 2,580 feet of the levee. This section was along the Trempealeau River from the east side of Main Street to the confluence of Turton Creek at the railroad crossing of Turton Creek. The levee upstream of the railroad bridge existed but was not damaged by the 1956 flood. The levee top was elevated to 731.5 above mean sea level at Main Street and 733.0 at the upstream end (USACE 1956). Elevations are based on the National Geodetic Vertical Datum 1929 (NGVD 29).

Subsequent studies showed economic justification to improve and extend the levees in Arcadia, but local funding was not available to match the federal funds (USACE 1960 and 1965). The USACE reported in 1985 that the "emergency levees" built in 1956 "were constructed without the benefit of detailed engineering design and construction procedures and, as such, have the risk of failure." In 1988, the USACE did a reconnaissance report that concluded that a feasibility study was justified (USACE 1988). Again, local funding was not available for the feasibility study. During the reconnaissance report efforts (USACE 1988), the Federal Emergency Management Administration (FEMA) also studied the floodplain of the Trempealeau River. Subsequent assistance from the USACE has included periodic inspections of the existing levee systems along Turton Creek and the Trempealeau River.

The USACE is currently completing a feasibility study for a flood risk management project that would potentially construct a more robust levee system. This system would meet FEMA standards for levee accreditation and significantly reduce flood risk for the community.

Managing flood risks is a shared responsibility of local government, county, state, and federal entities. This FMP identifies additional tools the community can use to lower its flood risk and defines actions the community will take to implement the tools with the greatest potential to economically reduce its flood risk.

Various tools for reducing flood risk were evaluated by community stakeholders to identify those that would be most effective for the City of Arcadia. The tools are categorized into four strategies. Table ES-1 lists the tools associated with each strategy that community members found advisable. Additional tools were found to need further evaluation to determine if the plan should include them as actions to pursue in the future. These tools are documented in Section 5.0 and Appendix A of the report.

### **Action Plan**

Section 6 of the FMP defines specific actions that the community and other stakeholders will take to reduce flood risk for the City of Arcadia. Table ES-2 lists the highest priority actions for the city and provides a timeline for completion over the next 5 years and beyond.

**Table ES-1 Advisable Strategies and Tools for Reducing Flood Risk for the Community**

<b>Strategy 1</b> Modifying Human Susceptibility to Flood Hazards	<b>Strategy 2</b> Modifying the Impact of Flooding	<b>Strategy 3</b> Preserving and Restoring the Environmental Quality of Floodplains	<b>Strategy 4</b> Modifying Floodwaters
Development Policies and Land-Use Regulations	Information and Education	Erosion and Sediment Control	Stormwater Detention Basins
Flood Warning Systems	Flood Insurance	Water Quality Enhancement	Levees and Floodwalls
Emergency Operations Plans	Community Rating System	Wetland Protection and Restoration	Pump Stations
Wet Floodproofing/ Dry Floodproofing	Post-Flood Recovery Processes	Assess Natural and Beneficial Functions of Floodplains	
Berms and Floodwalls for Buildings	Place High Water Mark Signs in Public Places		
Acquisition of Buildings			

**Table ES-2 High Priority Actions and Timeline for Completion**

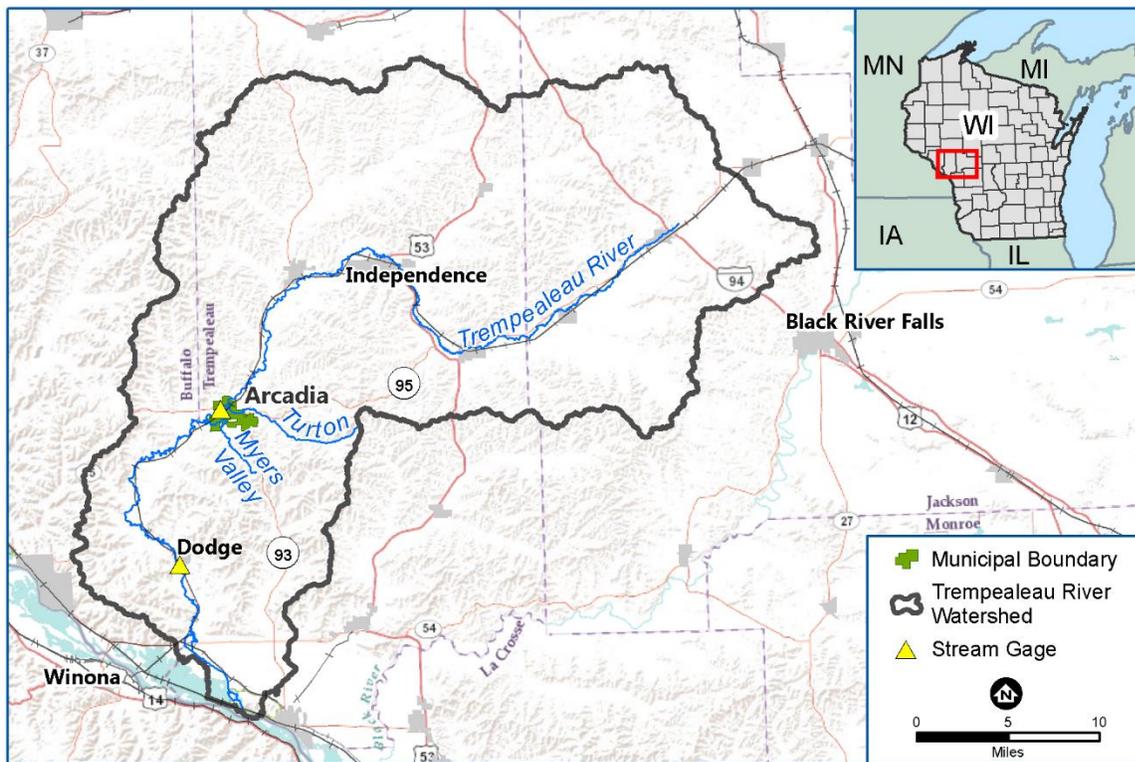
<b>High Priority Actions</b>	<b>Category</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>beyond</b>
Adopt the Arcadia FMP	Policy/Admin	100%					
Review and update Emergency Operations Plans (annually)	Emergency Operations	100%	100%	100%	100%	100%	
Interior drainage improvements	Mitigation	25%	50%	100%			
Complete USACE feasibility study	Mitigation	75%	100%				
Implement city flood control project	Mitigation		10%	25%	50%	100%	
Develop early warning system	Emergency Operations	30%	60%	90%	100%		
Create downtown business and resident registry	Policy/Admin	100%					
Digitize documents and records	Policy/Admin	40%	80%	100%			
Join the Community Rating System (CRS)	Policy/Admin	75%	100%				
Evaluation of repetitive loss structures	Mitigation	25%	50%	100%			
Improve land management practices	Policy/Admin	10%	20%	30%	40%	50%	100%
Regional watershed management policy	Policy/Admin	10%	20%	30%	40%	50%	100%

# 1.0 Introduction

A floodplain management plan (FMP) defines a coordinated approach to managing the floodplain and reducing flood risk. The FMP includes important historical details, objectives, and an action plan about the activities and features that help manage flood risks. The City of Arcadia’s FMP is a living document for the city and other stakeholders to use to manage flood hazards for the community. Managing flood risks is a shared responsibility of the local government entities, the state, and federal agencies.

## 1.1 Description of the area

The City of Arcadia is in Trempealeau County, Wisconsin. Flooding sources for the City of Arcadia include the Trempealeau River, Turton Creek, and Myers Valley Creek, as well as interior flooding within the city limits. Figure 1-1 shows the location of the City of Arcadia within the Trempealeau River watershed.



**Figure 1-1 Location of the Study Area**

The Trempealeau River watershed is tributary to the Mississippi River. It includes areas of Buffalo, Jackson, and Trempealeau counties. The watershed area comprises approximately 560 square miles at the City of Arcadia and 733 square miles at the confluence with the Mississippi River. The Turton Creek watershed area comprises approximately 23.5 square miles that drain from east to west to the Trempealeau River on the north side of the City of Arcadia. Most of this area is upstream of the CN Railroad. The Myers Valley Creek watershed comprises approximately 6.3 square miles that drain northwest to the Trempealeau River. Within the city limits the drainage is primarily from east to west on the south side. The Myers Valley Creek confluence was originally at the south side of downtown, near Furniture Way, where it drained toward the

---

railroad and crossed under the railroad 2,200 feet west of Harrison Street. The confluence has twice been moved south as the city has grown.

Approximately 50 percent of the Trempealeau River watershed is composed of cultivated crops and 40 percent is covered by forest. The Turton Creek and Myers Valley Creek subwatersheds have similar land use distribution with Myers Valley Creek having slightly more urbanization. Soils in the watershed are generally sand, with an average soil permeability of 10 to 20 inches per hour. Less than 1 percent of the watershed is open water (Stream Stats 2017).

There are two major reservoirs in the Trempealeau River watershed upstream of the City of Arcadia. The first is a small reservoir on Elk Creek in the City of Independence called Bugle Lake. It has only limited flood storage capacity for small flood events. Bugle Lake is about 1,000 feet upstream of the Elk Creek confluence with the Trempealeau River. The second reservoir is on the Trempealeau River in the City of Blair forming Henry Lake (Dam Key Sequence Number 312), which has a tributary area of 175 square miles. There is limited flood storage behind Henry Lake Dam and it is far enough upstream that it has minimal impact on peak flood flows at Arcadia.

Downtown Arcadia has long been susceptible to flooding. Multiple projects have been implemented to reduce the flood risk. Recently, the Myers Valley Creek channel was relocated to address flooding issues.

There is an uncertified levee along the south bank of Turton Creek, starting at Oak Street and extending west to the Trempealeau River confluence. This levee then continues along the south bank of the Trempealeau River approximately 1,500 feet downstream of Main Street. In late 2016, the U.S. Army Corps of Engineers (USACE) initiated a feasibility study that is expected to be completed in 2019. See Section 2.0 for more details about floodplain hazards.

## 1.2 Purpose of the FMP

The purpose of an FMP is to provide guidance that a community or a coalition of governing entities may follow to improve resilience to flooding. "Resiliency" is improved by minimizing or mitigating the cumulative effects of development within the floodplain and impacts on areas adjacent to the floodplain. Resiliency means the community, as a whole, can quickly recover from floods because it is able to lessen or avoid the impacts of flooding to their economy and to the lives of community members. The FMP attempts to lessen the damaging effects of floods, maintain and enhance natural floodplain values, and assist in making effective use of water and related land resources within the floodplain. This FMP seeks to provide benefits to all government levels and the public by:

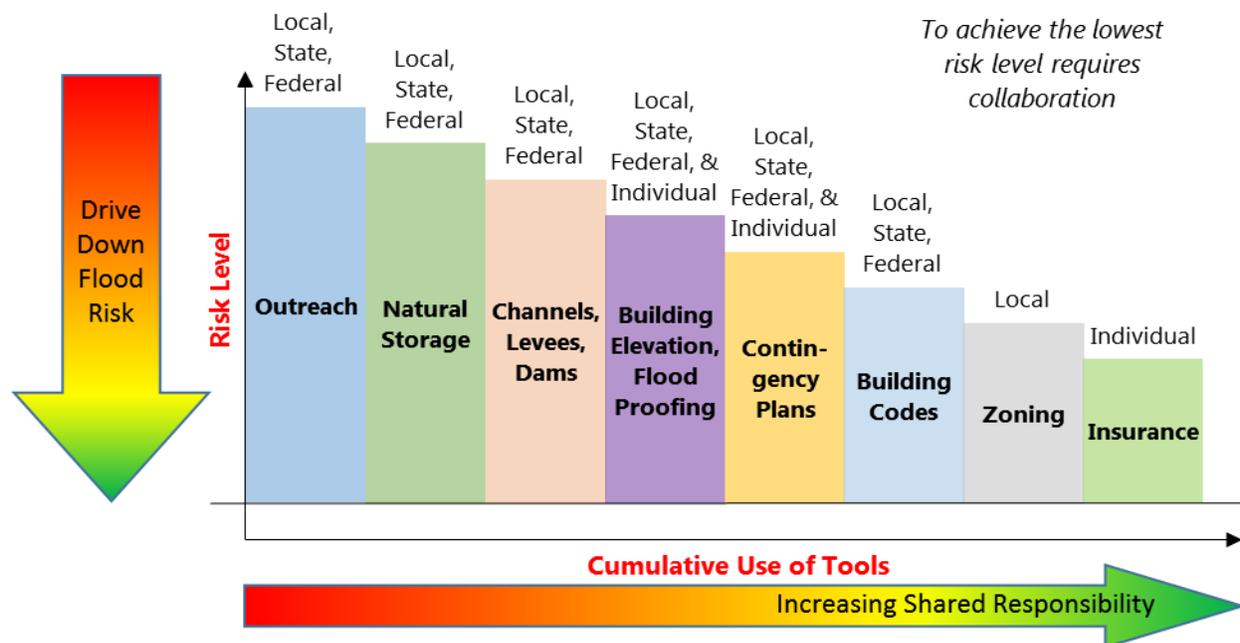
1. Reducing loss of life, injury, and hardship due to floods.
2. Reducing flood damages.
3. Reducing public expenditures for construction of additional flood damage reduction measures, emergency response actions, and post-disaster assistance.
4. Preserving and enhancing natural floodplain functions for fish and wildlife habitat, along with their attendant benefits of groundwater recharge, moderation of floods, water quality improvement, and reduced erosion and sedimentation.

This FMP also attempts to balance potential benefits obtained from the use of the floodplain with the potential losses arising from such use. The comprehensive nature of such a plan stresses consideration of the full range of large and small measures potentially useful in achieving its objectives. The strategies contained in this FMP were developed to closely follow the 1994 Unified National Program for Floodplain Management and to be compatible with the National Flood Insurance Program’s Community Rating System.

Effective management of both floodplains and floodwaters can break the “damage, rebuild, and repeat” cycle. A dedicated effort allows the government to break this cycle and create a sustainable flood risk management cycle (see Figure 1-2) and a resilient community. The most difficult challenge is determining which of the strategies and tools for reducing flood risks are most appropriate. Figure 1-3 illustrates that lower levels of risk require increasing involvement from the community. Flood risk management is a shared responsibility; therefore, a variety of stakeholders must be involved in the decision-making process.



**Figure 1-2 Sustainable Flood Risk Management Cycle**



**Figure 1-3 Driving Down Flood Risks Requires a Range of Tools Applied Across Jurisdictions**

Flood risk management is a constant effort and requires staff dedicated to the work. The work includes building features that manage floodwaters and performing a variety of floodplain management activities. FMPs are a shared planning methodology that documents a community's approach to reducing flood risks. This plan reflects management decisions reached with consideration of significant analytical data and stakeholder input. This FMP is intended to be a living document promoting continued consideration of flood hazards related to land use and water resources in the floodplain over time. The life of this FMP may overlap the careers of many different people in the communities, including professional staff. The FMP serves to document a publicly supported flood risk management approach for the long-term benefit of a community.

#### **DRIVING DOWN FLOOD RISKS**

*Floodplain management plans are a shared planning methodology that can drive down flood risks.*

### **1.2.1 Federal Floodplain Management Guidance**

The city has prepared this FMP in consultation with local and state officials and in accordance with federal standards originating from Executive Order 11988, which began unified floodplain management in 1977. The standards are consistent with Public Law 104-303 of the Water Resources Development Act (WRDA) of 1996, which amends Section 402 of the WRDA of 1986 (also see 33 U.S.C. 701b;12;100 Stat. 4133). Below is an excerpt from the federal requirement. The city intends to have the USACE review this FMP during this planning phase.

#### *SECTION 202 (c) OF WRDA 1996*

#### *FLOODPLAIN MANAGEMENT PLANS*

#### *c) Floodplain Management Plans.*

*(1) In general. Section 402 of such Act (33 U.S.C. 701b 12; 100 Stat. 4133) is amended to read as follows:*

#### *SEC. 402. FLOODPLAIN MANAGEMENT REQUIREMENTS.*

*a) Compliance With Floodplain Management and Insurance Programs. –Before construction of any project for local flood protection, or any project for hurricane or storm damage reduction, that involves Federal assistance from the Secretary, the non-Federal interest shall agree to participate in and comply with applicable Federal floodplain management and flood insurance programs.*

*b) Floodplain Management Plans. –Within 1 year after the date of signing a project cooperation agreement for construction of a project to which subsection a) applies, the non-Federal interest shall prepare a floodplain management plan designed to reduce the impacts of future flood events in the project area. Such plan shall be implemented by the non-Federal interest not later than 1 year after completion of construction of the project.*

c) *Guidelines.* –

*(1) In general.* –*Within 6 months after the date of the enactment of this subsection, the Secretary shall develop guidelines for preparation of floodplain management plans by non-Federal interests under subsection b). Such guidelines shall address potential measures, practices, and policies to reduce loss of life, injuries, damages to property and facilities, public expenditures, and other adverse impacts associated with flooding and to preserve and enhance natural floodplain values.*

*(2) Limitation on statutory construction.* –*Nothing on this subsection shall be construed to confer any regulatory authority upon the Secretary or the Director of the Federal Emergency Management Agency.*

*d) Technical Support.* –*The Secretary may provide technical support to a non-Federal interest for a project to which subsection a) applies for the development and implementation of plans prepared under subsection b).*

*(2) Applicability.* –*The amendment made by paragraph (1) shall apply to any project or separable element thereof with respect to which the Secretary and the non-Federal interest have not entered into a project cooperation agreement on or before the date of the enactment of this Act.*

This FMP complies with USACE planning guidance for FMPs (USACE Policy Guidance Letter 52). Consistency with this USACE guidance is required when a cost-share construction project using USACE funding is proposed for flood risk management projects. The USACE and the City of Arcadia have a feasibility cost-share agreement for conducting a Section 205 feasibility study for a flood risk management project for the City of Arcadia. Preparation of this FMP is part of the city's cost share. An FMP is required if a USACE-funded project results from the feasibility study. This FMP also meets the minimum standards for two Federal Emergency Management Agency (FEMA) programs. The first is Section 510 of the Community Rating System (CRS), as described in the CRS Coordinator's Manual (FEMA, FIA-15). Secondly, the FMP complements the State of Wisconsin Hazard Mitigation Plan, which is reviewed by FEMA Region V.

## 2.0 Floodplain Hazard Assessment

This section of the floodplain management plan (FMP) documents the assessment of flood hazards for the City of Arcadia, such as loss of life, property damage, and environmental impacts. The flood hazard assessment documents the flooding history and anticipated future flood flows and evaluates the flood hazards from the four primary flooding sources for the community. These flooding sources are the Trempealeau River, Myers Valley Creek, Turton Creek, and surface runoff from the interior area behind the city's existing levee system. Figure 2-1 is an overview map of the study area that shows the three riverine systems, the Federal Emergency Management Agency (FEMA) floodplain, and other important features.

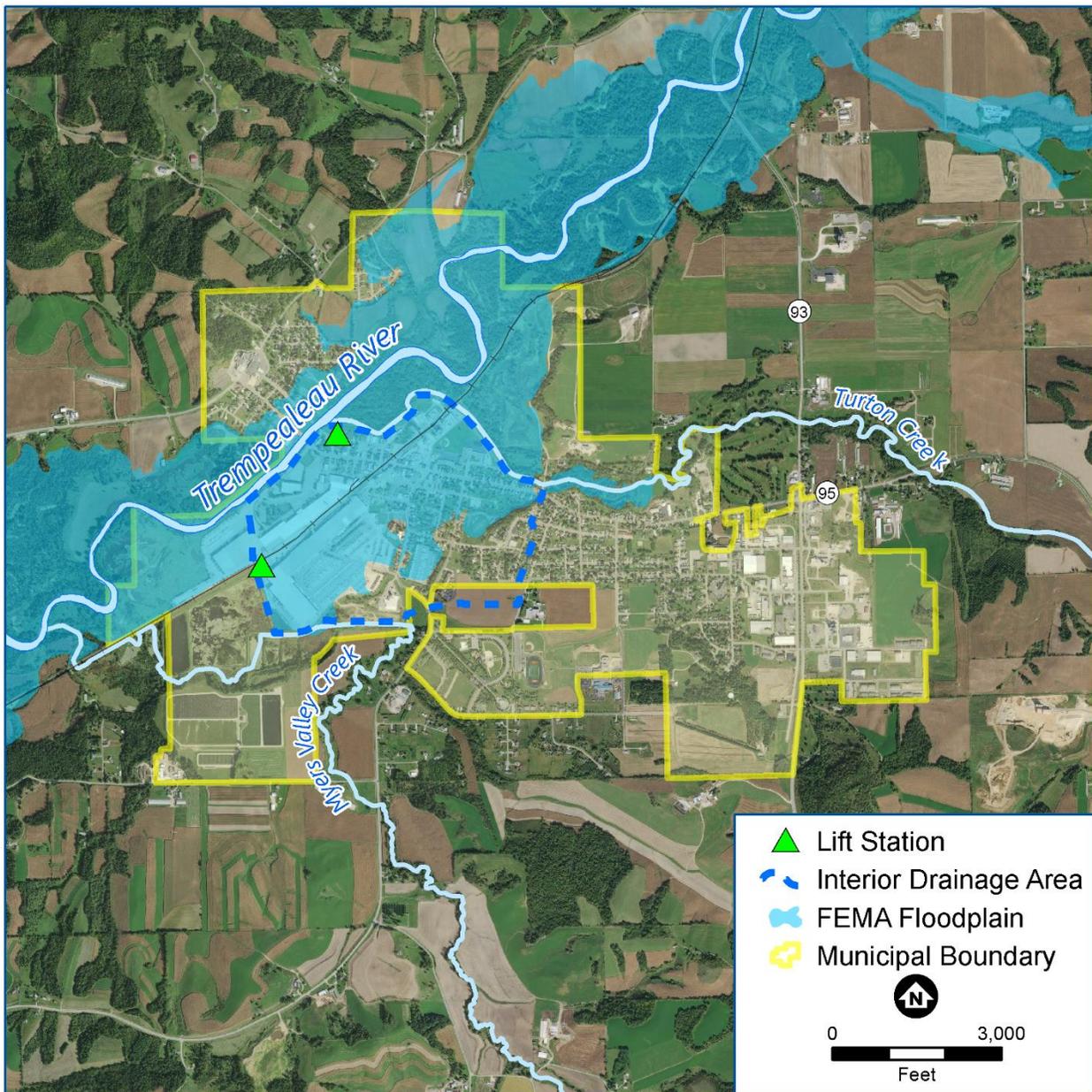


Figure 2-1 Study Area

## 2.1 Flooding History

The City of Arcadia has had a long history of flooding. Table 2-1 provides a list of major flood events that have occurred. Prior to 2010, the source of flooding was recorded as the Trempealeau River, though not fully documented. Subsequently, the source of flooding was more often questioned and documented.

**Table 2-1 Arcadia Flooding History and Source**

Month	Year	Name of Water Body	Estimated Probability of Occurrence in Each Year <sup>(1)</sup> (Gage Reading in cfs) <sup>(2)</sup>
March	1919	Trempealeau River	3% (11,000 at Dodge) <sup>(2 &amp; 4)</sup>
April	1934	Trempealeau River	12% (8,600 at Dodge) <sup>(2)</sup>
April	1947	Trempealeau River	28% (5,410 at Dodge) <sup>(3 &amp; 4)</sup>
June 21	1954	Trempealeau River	25% (5,710 at Dodge) <sup>(4)</sup>
October	1954	Trempealeau River	5% (10,400 at Dodge) <sup>(3)</sup>
April 4	1956	Trempealeau River	3% (12,900) <sup>(6)</sup> and 0.7% (17,400) <sup>(4)</sup> at Dodge
March	1961	Trempealeau River	<10% (7,840) <sup>(5)</sup> and 4% (11,100) <sup>(4)</sup> at Dodge
April	1965	Trempealeau River	8% (9,740) <sup>(3)</sup>
March	1967	Trempealeau River	10% (8,340) <sup>(3)</sup>
August	1975	Trempealeau River	1% (12,000 USACE 2017) <sup>(5)</sup>
September 18	1992	Trempealeau River	6% (8230) <sup>(4)</sup> at Dodge
September 23	2010	Myers Valley Creek (MVC) and Trempealeau River (TR)	1% for MVC and 7%+ 8% TR (9,040) <sup>(4)</sup> at Dodge
May	2017	MVC and TR	Ungauged and high not collected
July 20	2017	Trempealeau River, Turton Creek (TC), MVC	8% TR 9,260 July 20 and 9% 8,730 May 18, 0.5% TC, 1% MVC

Notes:

- (1) The values are estimated from the USACE Annual Peak Discharge Frequency Analysis Tables that are in the *Draft CAP Section 205 Feasibility Study Trempealeau River at Arcadia Hydrology Study and Report*. August 2017
- (2) USGS Gauge Readings, reported in USACE *Draft Reconnaissance Report Flood Control, Trempealeau River at Arcadia, Wisconsin*. 1988 p11
- (3) The flooding of 1947 was before a levee was constructed and before Myers Valley Creek was relocated. Therefore, this event is included.
- (4) USGS, Gage at Dodge [https://nwis.waterdata.usgs.gov/nwis/peak?site\\_no=05379500&agency\\_cd=USGS&format=html](https://nwis.waterdata.usgs.gov/nwis/peak?site_no=05379500&agency_cd=USGS&format=html), November 10, 2017
- (5) USGS, Gage at Arcadia Provisional Data [https://waterdata.usgs.gov/nwis/uv?site\\_no=05379400](https://waterdata.usgs.gov/nwis/uv?site_no=05379400) November 10, 2017
- (6) USGS, Gage at Dodge [https://waterdata.usgs.gov/nwis/dv?cb\\_00060=on&format=html&site\\_no=05379500&referred\\_module=sw&period=&begin\\_date=1956-01-02&end\\_date=1956-12-26](https://waterdata.usgs.gov/nwis/dv?cb_00060=on&format=html&site_no=05379500&referred_module=sw&period=&begin_date=1956-01-02&end_date=1956-12-26) November 28, 2017

---

## 2.2 Flood Hazards

The lower part of the City of Arcadia is at the confluence of two creeks with the Trempealeau River. The confluence of Myers Valley Creek with the Trempealeau River was within the city but now is south of the city limits. The Turton Creek confluence with the Trempealeau River is on the north side of the City of Arcadia. The Trempealeau River and Turton Creek have mapped floodplains that are part of the National Flood Insurance Program (FIP). All three water bodies have levee on one side. See Figure 2-1. The city has approximately 280 structures in the 1-percent-annual-chance floodplain with a combined assessed value of nearly \$32 million, as reported in the Multi-Hazard Mitigation Plan 2012–2016 for Trempealeau County prepared by the Mississippi River Regional Planning Commission (MRRPC 2012). The assessed value within the floodplain of Arcadia is over 50% of the assessed value of properties in the entire county floodplain (\$63 Million).

A levee was constructed prior to 1956 along the Trempealeau River at the Turton Creek confluence. In 1956 the levee was reconstructed or improved from Main Street upstream to within a few hundred feet west of the railroad where a levee existed. These levees do not meet current U.S. Army Corps of Engineers (USACE) design standards, nor FEMA criteria for levee accreditation. The city completed a geotechnical investigation of the existing levee and studied the feasibility of a floodwall in 2013 (American Engineering Testing, Inc. 2013). The conclusion of the geotechnical investigation was “it should be feasible to modify the existing dikes by widening and or raising the dikes after careful analyses for stability, settlement, and seepage.” Concerns about the existing earthen levee include the fact that there are utilities in the levee, portions of the levee are too low, the soil used is inconsistent, and the levee was placed on organic material. The utilities in the levee are along Turton Creek and along the Trempealeau River south of Main Street. The organic material is a lesser concern because the levee has been in-place long enough for the organic subbase to be consolidated. If the USACE Section 205 project is approved it is likely that these levees will be removed and replaced with a levee system built to USACE standards. The preliminary assessment by the USACE is that this levee must be removed and replaced (USACE 2017 Draft CAP).

The levee along Myers Valley Creek was constructed in 1993, the first time the creek was relocated. In 2003 the levee was reviewed for consistency of material and the probability of consolidation of the soils below the base of the levee. The conclusion was that the levee would settle 6 inches over time. Additional height was added to the levee in 2004–2006 to compensate for that settlement. The 2016 project that relocated Myers Valley Creek also checked the height of the levee and designed the conveyance so the levee would meet minimum FEMA freeboard criteria of 3 feet. History has shown that this levee does not seep. The levee protected the city from flooding during the two flood events in 2017. The city is discussing providing certification to FEMA documenting that the levee meets FEMA design standards. The city should consider having the City Engineer do this.

### 2.2.1 Trempealeau River

The Trempealeau River passes through the City of Arcadia flowing from northeast to southwest. There is limited development on the north bank of the river in or adjacent to the floodplain. There is an uncertified levee on the southeast (left bank) for about 1,500 feet downstream of Main Street. The south bank of the river includes most of the City of Arcadia’s downtown and the Ashley Furniture facility corporate

---

headquarters and manufacturing plant. The River Street bridge and the Main Street bridge cross the river. Turton Creek discharges into the Trempealeau River upstream of the two bridges. Myers Valley Creek discharges into the river downstream near the west city limits.

### **2.2.1.1 Flood Risk**

Large flood events on the Trempealeau River have the potential to cause significant damage to the City of Arcadia. The frequency of flooding of the Trempealeau River will likely increase over time for the reasons mentioned in Section 2.3.

Long-time residents indicate that the channel through the City of Arcadia is accumulating sediment. To counter this, the city owned and operated their own dredge in the 1950s. Dredging was discontinued due to problems with spoil disposal. A reduced conveyance capacity caused by sediment accumulation in the channel will tend to push flood waters out into the overbanks more frequently and during smaller flows. This could be further exacerbated if the hydrology of the watershed changes such that larger flows happen more frequently. The accumulation of sediment in the channel has not been documented. The USACE collected four cross sections of the channel in August 2017. This could be initial data to start documentation of channel bottom elevations that may document sediment levels.

There are two upstream reservoirs in the Trempealeau River watershed, but they do not provide significant reduction of flood flows at Arcadia. There is a small reservoir on Elk Creek called Bugle Lake that is upstream in the City of Independence. Elk Creek is tributary to the Trempealeau River. The dam has 113 square miles of tributary area (20% of the Trempealeau River watershed upstream of the city) and can store flood water for small events. However, it has insufficient storage capacity to mitigate large events on Elk Creek. The spillway for the Bugle Lake dam has the capacity to pass 11,900 cubic feet per second (cfs) safely (DNR Dam Safety Search Bugle), which is much more than the 2-percent-annual-chance of exceedance (50-year) event for the Trempealeau River at Arcadia and more than the 1-percent-annual-chance of exceedance (100-year) event for the river at the City of Independence.

Few of the tributaries to the Trempealeau River have modeled floodplains. Development in the tributary watersheds is likely to increase the peak runoff due to increased impervious area and reduced flood storage from fill in the floodplain. In addition, as development occurs in the floodplain outside the floodway, the storage along the Trempealeau River is reduced and may cause increases in flood elevations along the river downstream of the development.

### **2.2.1.2 Flood Data**

The Trempealeau River has a FEMA-mapped floodplain and floodway. The 1-percent-annual-chance of exceedance (100-year) flood peak discharge in the FEMA flood insurance study (FIS) is 14,430 cfs at the City of Arcadia (FEMA 2011). The hydrology for the FEMA FIS was developed using procedures outlined in Bulletin No. 17B (USGS 1982) and the Flood Flow Frequency Analysis computer program (USACE 1982). The hydrologic analysis used data from the USGS gage at Arcadia (No. 05379400) with a period of record of 1961–1977, 2002–2004, and 2014–2015.

---

As part of the Section 205 study, the USACE developed updated hydrologic models in 2017 for the Trempealeau River using data from the USGS gage at Arcadia (No. 05379400) and the USGS gage at Dodge (No. 05379500) with a period of record of 1914–1919 and 1935–2015 (USACE 2017). The 1-percent-annual-chance of exceedance (100-year) flood peak discharge in the Section 205 feasibility study is 15,450 cfs at the City of Arcadia. The city should note that the USGS data used in the analyses did not include the July 2017 flooding event.

The USACE analysis (USACE 2017) of the 1-percent-annual-chance of exceedance flood found the River Street bridge and the Main Street bridge are restrictions that increase the flood profile 1.7-feet upstream of the bridges. The Section 205 study considered the possibility of removing or modifying bridges, but cost is an issue.

### **2.2.1.3 Recent Flood History**

As described in Table 2-1, the Trempealeau River has experienced flooding every decade since records have been kept. The flooding in this area recedes within a few days after precipitation stops.

The highest recorded flow after the levee was constructed along the river was in 1975 when the flow was equivalent to the 1-percent-annual-chance of exceedance flood. Floods can occur from spring snowmelt events and summer rainfall events. Most of the recent flood events have been summer rainfall events. The internal drainage infrastructure has been improved since then with construction of two stormwater pump stations and the addition of backflow valves on some of the storm sewers that discharge to the river.

The 2010 flooding on the Trempealeau River was approximately a 7-percent-annual-chance of exceedance event and nearly overtopped the levee, so sandbags were added to the top. It appears that the flooding sources for the east side of the river were Myers Valley Creek (2-percent-annual-chance of exceedance), Turton Creek, and internal drainage. The city has aerial photos of the flooding on September 23, 2010. There was no gage on the river in Arcadia during this event.

Myers Valley Creek was the major source of the flooding in 2010. Debris and lack of open area at a private driveway bridge restricted flow and caused overflow near Washington Street.

The levee on the east bank of the Trempealeau River prevented flooding of that side of the city during the 2017 flood. See Turton Creek (Section 2.2.3) for the major source of flooding for this event.

## **2.2.2 Myers Valley Creek**

Myers Valley Creek drains north to the Trempealeau River with its confluence at the south side of the city. The confluence was moved southwest several thousand feet when a new bridge was constructed at the railroad in 1994. Myers Valley Creek does not have a mapped floodplain and is misspelled “Meyers” on the USGS quadrangle maps, FEMA maps, and in the Wisconsin Department of Natural Resources (WDNR) database.

In its original alignment, the creek drained under the railroad 2,200 feet southwest of the railroad’s intersection with Harrison Street. The creek has been relocated two times. The first time was in 1994 when

---

the creek was relocated downstream of Washington Street. The confluence was moved 3,800 feet downstream and a new bridge was constructed at the railroad. A berm was constructed on the city side of the creek at that time. Some of the berm was placed over the existing hydric soil. After soil investigation of the existing berm in 2004, the berm was modified. The berm modifications occurred from 2004 to 2006. In addition to mitigating issues with hydric soils beneath the berm, the construction raised the berm a few feet above the predicted flood elevation and provided a maintenance road on top of the levee.

The second relocation occurred in 2016 to prevent flood waters from overtopping the creek at South Washington Street and Furniture Way.

The south side of the city, south of Wilson Avenue, drains to Myers Valley Creek. The developed area is generally south of Wilson Avenue, west of Fairfield Avenue, and drains west toward Saint Joseph Avenue and South Washington Street.

Myers Valley Creek south of the city drains from south to north from County Road G.

### **2.2.2.1 Flood Risk**

Myers Valley Creek has been a source of flooding for many years. In 2016, the city relocated the creek a second time after 5 years of alternatives analyses and permit applications. This relocation avoids the bottle neck at the private driveway bridge, greatly reducing the probability of flooding from the creek.

The private driveway bridge that provided access to a business at the curve in the 600 block of South Washington Street was too low and the bridge opening too small. The 2016 relocation bypassed the private bridge. The 2004 levee is now estimated to have 3 feet of freeboard.

There is a dam south of Orion Lane and Reit Lane that the Wisconsin DNR has reported to be in poor repair. The outlet is an 8- by 4-foot cast-in-place box culvert that has cracks large enough to cause piping. The dam is in the Town of Arcadia. There is concern that if this dam is removed, peak flows on Myers Valley Creek could be higher.

### **2.2.2.2 Flood Data**

A *Myers Valley Creek Flood Study* was completed by Davy Engineering in 2012 and updated in 2013. The study was again updated in 2016 for the 2016 Myers Valley Creek Relocation project. No flood map has been produced for this watershed.

### **2.2.2.3 Recent Flood History**

Myers Valley Creek was a major cause of downtown flooding in 2010. Previously, the source of flooding was not documented in Arcadia and there may have been past flood events caused by Myers Valley Creek.

The July 20, 2017, flood nearly overtopped the levee at Myers Valley Creek. This may have been from a flood wave caused when the backwater created by a partially clogged agriculture fence moved down the

---

relocated channel after the fence failed. This rainfall was approximately a 0.5-percent-annual-chance of exceedance event. Floods occur from summer rainfall events.

### **2.2.3 Turton Creek**

Turton Creek is a larger tributary to the Trempealeau River than Myers Valley Creek and drains west along what originally was the north side of the city. The city constructed a levee along its south (left) bank downstream of Oak Street. The FEMA floodplain map incorrectly shows that the 1-percent-annual-chance flood can pass under the Oak Street bridge without overtopping the roadway. Oak Street has overtopped twice since 2009. Once at flows less than the 1-percent-annual-chance flood.

#### **2.2.3.1 Flood Risk**

The draft USACE hydrologic analyses for Turton Creek estimated an increase in the peak flow for the 1-percent-annual-chance event (USACE 2017). Future mapping of the Turton Creek floodplain should account for this revised hydrology. Floods occur from summer rainfall events.

The railroad bridge over Turton Creek was perceived to be a constriction problem, but the hydraulic analyses by the USACE in 2017 noted that while the bridge affects low flows, tailwater from the Trempealeau River controls water surface elevations during larger flood events.

Oak Street overtopped north of the bridge in 2010 and 2017. The bridge has limited conveyance capacity. In 2010, the downstream half of the road was washed out and repaired. The whole width of the road was washed out in 2017. Alternatives for this area are being considered in the USACE Section 205 study.

#### **2.2.3.2 Flood Data**

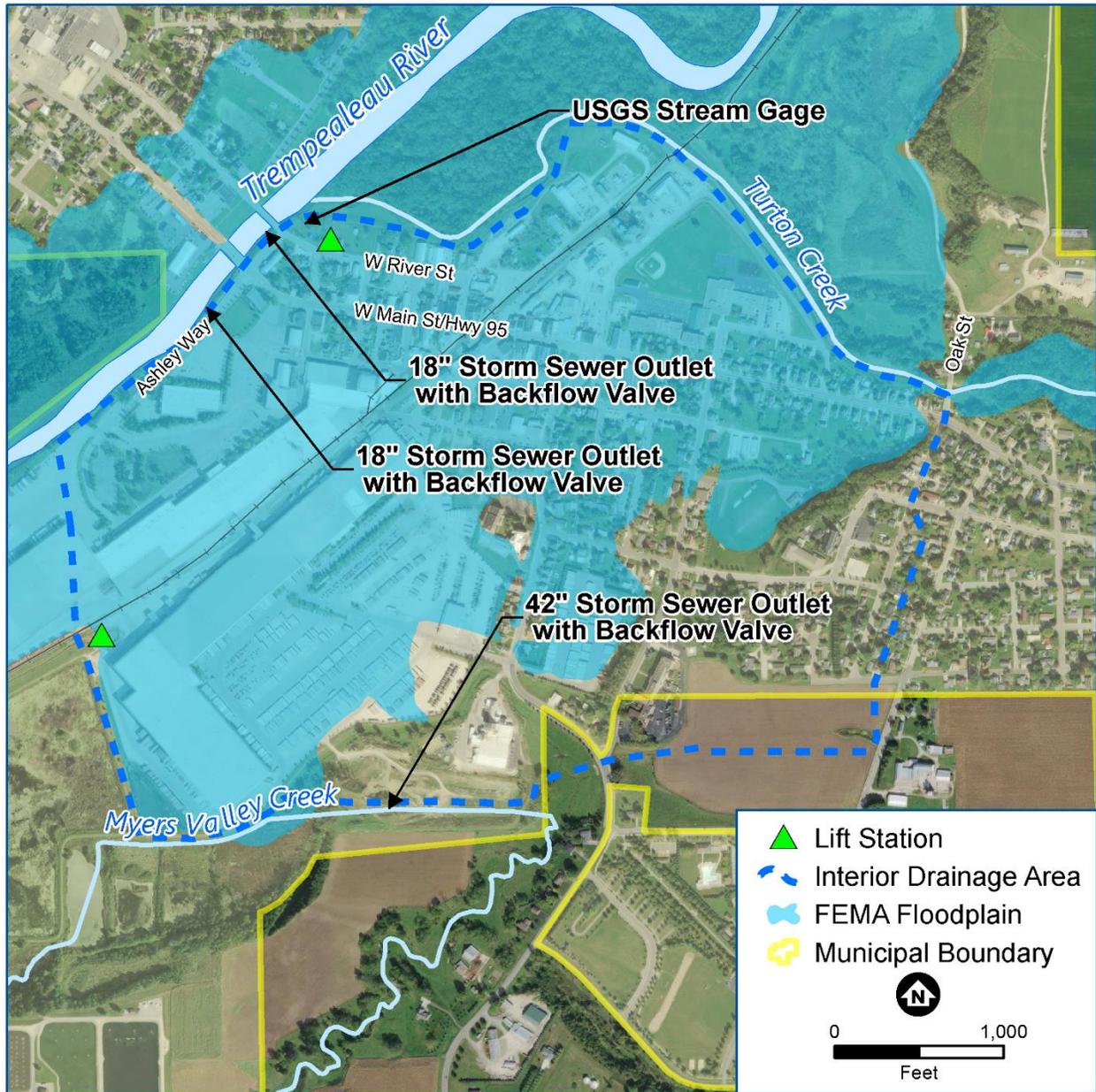
During most years the levee on the south side of Turton Creek protects the city; however, it is not high enough and it may seep. The levee was raised over the last decade to reduce the frequency of overtopping. The levee was overtopped just downstream of Oak Street in the July 2010 and 2017 events. The existing flood maps do not reflect the improvements made to the levee between 2010 and 2015. The levee is not constructed properly or high enough to meet FEMA criteria for certification.

#### **2.2.3.3 Recent Flood History**

The Turton Creek levee overtopped in July 2010 and July 2017.

### **2.2.4 Interior Flooding**

The internal drainage area has the potential to flood if water becomes trapped behind levees meant to keep flood waters from the river and creeks from flooding the city. The interior drainage area consists of the downtown area southeast of the river levee, south of the Turton Creek levee, and north of the Myers Valley Creek levee. The area is generally west of Oak Street. This area drains to storm sewers which convey stormwater to pumps or directly to the waterways. The largest lift station is complemented by a detention basin built to treat stormwater. The area prone to interior flooding behind existing levees is shown in Figure 2-2.



**Figure 2-2 Area of Concern for Flooding from Interior Areas**

### 2.2.4.1 Flood Risk

Existing storm sewer pipes do not have the capacity to convey runoff from large storm events. Sediment has accumulated in some of the storm sewer pipes, which reduces conveyance capacity. Factors that could be affecting sediment buildup include minimal sediment capture from runoff within the city and insufficient grade on the sewer pipes for larger flows to flush sediment out of the pipes.

---

The two stormwater pumping stations have minimal storage reservoirs and limited pump capacities and are only intended to help drain local runoff, not large flood events. The downstream segments of the storm sewer system are generally flat and collect sediment. Parts of the system have sumps in manholes to facilitate cleaning.

The velocity in the storm sewer is limited by the downstream pump capacity. In addition to the flat slopes, the pump capacity limits the conveyance capacity of the system. The lower velocity causes sediment accumulation which further reduces the sewer capacity.

#### **2.2.4.2 Flood Data**

Interior flooding that lasts for days has been caused by creeks overtopping levees. Flooding from interior runoff happens frequently, but for short durations.

#### **2.2.4.3 Recent Flood History**

When the river or creeks flood, the internal area has flooding. The worst flood is caused when the levees overtop. The internal flooding is caused by lack of conveyance, storage, and/or pump capacity. The internal drainage infrastructure cannot meet the demand if a levee overtops.

The intersection of Main Street and Saint Joseph Avenue floods after an intense 1-inch rain. This intersection and the three intersections that drain to it are drained by a 10-inch storm sewer from Main Street to 250 feet south of Cleveland Street. South Washington Street, McKinley Street, Harrison Street, and Cleveland Street are the lowest streets in the city.

In recent years, Ashley Furniture has acquired property and expanded into residential areas, which has reduced the number of residential properties that experience flooding. New Ashley structures are flood proofed to 2 feet above the base flood elevation.

### **2.2.5 Land Use and Building Data**

The land use is industrial, commercial, institutional, and residential. The homes on the southeast bank of the Trempealeau River in the downtown area were constructed during or before the 1930s. The southeast bank of the river is significantly more developed and includes the Ashley Furniture facility and the downtown business district. The east bank portion of the city has hydric soils that typically flood frequently as it includes the original confluences of the Turton Creek and Myers Valley Creek.

On the south side of Turton Creek, protected by uncertified levees, land use ranges from residential (near Oak Street) to commercial and industrial (near the railroad bridge). Arcadia Elementary School is along the creek between the Oak Street and railroad bridges. The Arcadia School District intends to move the elementary school when funding is available.

The city limits along the north bank of the river are mostly urban with the following developments: commercial, residential, and a park. Agricultural development is upstream and downstream of the city. The city also has open space on the northwest bank. Ashley Furniture has designated some open space in the downstream portion of their property on the left bank.

---

Most of the Myers Valley Creek watershed is agriculture. The urban area contains the high school and middle school, Memorial Park, and single-family residences.

There is limited development on the north side of Turton Creek in the conveyance area. Upstream of Oak Street the creek passes through the Arcadia Country Club golf course.

### **2.2.6 Development Trends**

Ashley Furniture, Pilgrim's Pride (formerly known as Golden Plump Poultry), and other industries have expanded significantly in Arcadia. Developments have followed the city floodplain ordinance with the first floor above the flood elevation. Developments that replace existing building(s) have been constructed at the flood protection elevation (2 feet above the base flood elevation). Further development in the downtown area is limited due to flood risk.

Most of the development projected for the Myers Valley Creek watershed will drain to the creek upstream of the 2016 diversion levee. The school district is considering additions at the Middle School and High School campus. Low-density residential development is planned for the upper reaches of Myers Valley Creek.

There is the potential for future development north of Turton Creek and west of Highway 93. The city would like to add a road through this area to connect the downtown area to State Highway 93, north of Arcadia. Construction of a new road and creek crossing would need to take flood risk from Turton Creek into consideration. Oak Street is currently the primary access point for the area north of Turton Creek. Oak Street frequently overtops on the north side of the Oak Street bridge and the roadway washed out during the July 2010 and 2017 floods.

There is a tax increment district (TID) southeast of State Highways 93 and 95 that has promoted development. The city constructed a regional detention basin for this TID 4. There is also an active sand mine in the west part of the TID that fronts Thompson Valley Road. These areas drain to Turton Creek. The detention basins constructed for the industrial expansion south of Main Street and west of South Washington Street were to meet stormwater quality requirements, although they may have minor benefits for the internal drainage area.

### **2.2.7 Development Constraints**

The FEMA regulatory floodway and floodplain for the Trempealeau River and Turton Creek is the main development constraint for both the north and south banks of the Trempealeau River. The floodplain area must also meet the requirements of the Wisconsin Administrative Rule 116 and the City Floodplain Ordinance. The levees along Turton Creek and Trempealeau River are currently not certifiable with FEMA, meaning that the FEMA floodplain is mapped on the landside of the levee and any associated flood insurance requirements apply. No development may occur in FEMA's regulatory floodway. Development in the flood fringe requires at least 2 feet of freeboard above the regulatory flood elevation, which is 4 to 8 feet above existing ground in many locations.

---

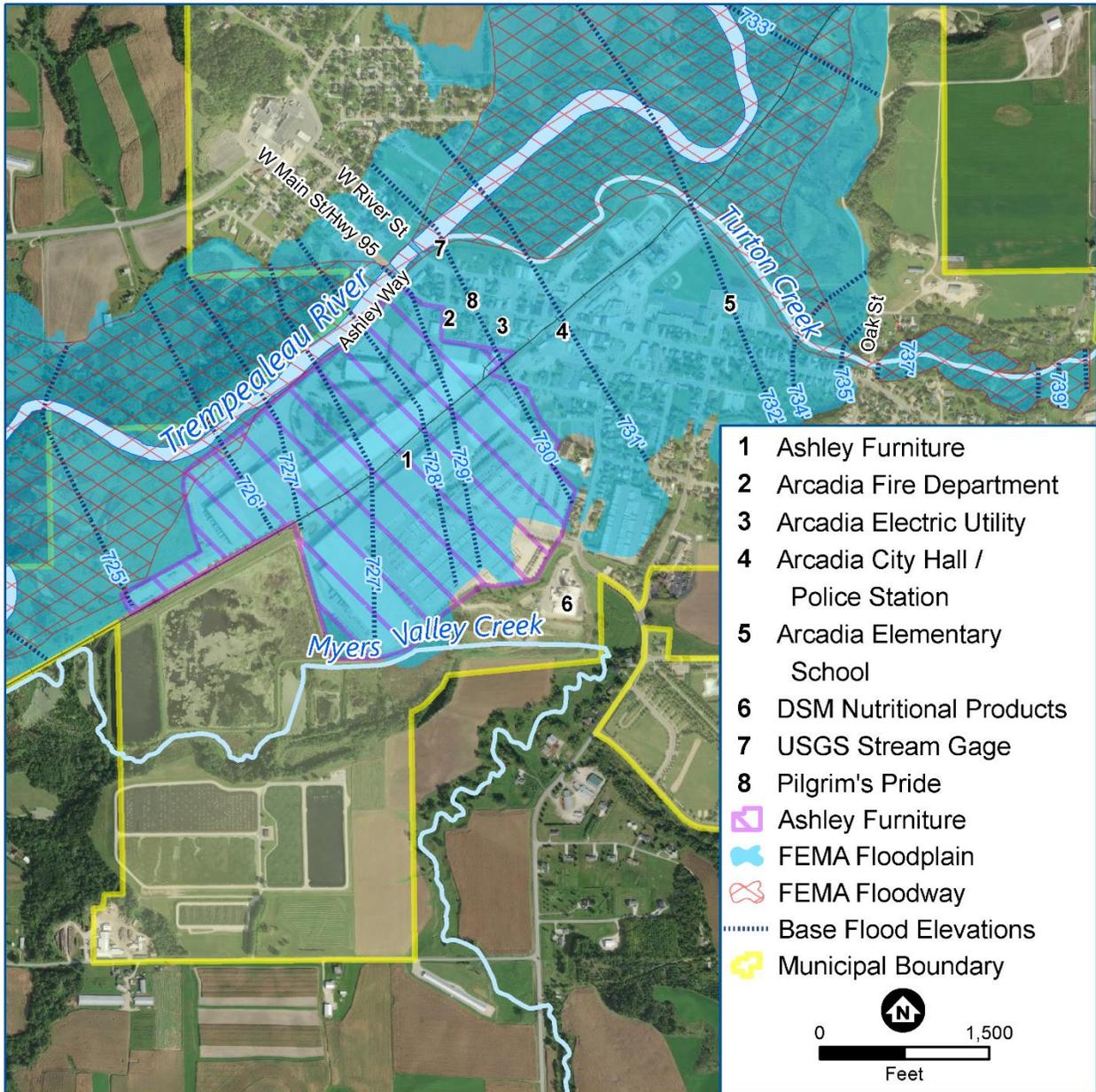
The only access to the north of Turton Creek between State Highway 93 and the Trempealeau River is Oak Street.

The draft USACE Section 205 study has a hydrology section that in 2017 estimated higher flows for Turton Creek than were used by FEMA to map the regulatory floodplain. This is consistent with changes in precipitation trends published in NOAA Atlas 14, Volume 8 (NWS 2013). This means the Turton Creek regulatory floodplain will likely be expanded in the future.

New development generally increases impervious surface within a watershed. Developments in areas tributary to Myers Valley Creek and interior areas behind existing and future levees will need to account for the additional stormwater runoff through detention, retention, or modifications to the interior drainage system. Failure to manage the increase in surface runoff from development could increase the flood risk of other properties in the watershed.

### **2.2.8 Critical Facilities**

The City of Arcadia has several critical facilities in the 1-percent-annual-chance floodplain, which varies between elevation 725 and 732 (NAVD 88). Figure 2-3 shows the location of Arcadia's critical facilities in relation to the regulatory floodplain.



**Figure 2-3 Critical Facilities Location Map**

- Ashley Furniture is the largest manufacturer in Trempealeau County. The facility is substantially behind the levee along the river and drained by internal drainage. The first floor of Ashley Furniture was constructed to elevation 729.5. The base flood elevation ranges from 725 to 729 (NAVD 88) near the Ashley facility.
- City Hall and the Police Station are at 203 West Main Street. The lowest adjacent ground elevation is about 2 to 3 feet below the base flood elevation of 731.

- 
- The Fire Station is at 521 West Main Street. The lowest adjacent ground elevation is 5 feet below the base flood elevation of 730.
  - Arcadia Municipal Electric is at 115 Jackson Street. The lowest adjacent ground elevation is more than 5 feet below the base flood elevation of 730.
  - The Main Lift Station for the sanitary sewer system is constructed above the estimated flood elevation except for the electric transformer. The access to the station with the portable generator is difficult during flooding and power is inconsistent.
  - Arcadia Elementary School is in the floodplain of Turton Creek and the Trempealeau River, where the base flood elevation is 732.
  - Pilgrim's Pride has their main office at 502 West Main Street and a storage facility on North Green Bay Avenue. The ground elevation of this land is as low as 726, which is about 5 feet below the base flood elevation of 731.

The lowest adjacent ground elevations listed above were taken from the 2016 LIDAR and are accurate to plus or minus 1 foot.

Some critical facilities are outside of the regulatory floodplain.

- The city's Wastewater Treatment Lagoon is in the Myers Valley Creek watershed and is over 30 feet above the creek.
- The new high school and middle school are mostly in the Myers Valley Creek watershed, but a portion of the schools is in the Turton Creek watershed. The buildings are dozens of feet above the base flood elevation.

## 2.3 Future Conditions Flows

The flood hazard area and the community's flood risk will change over time.

- Future development may increase the impervious areas in the city and surrounding watershed, which could result in higher peak flow rates in rivers, streams, and storm sewer systems.
- Natural processes may alter the location and morphology of river channels.
- Erosion within the watershed may contribute to the buildup of sediment in flat, slow-moving reaches of the Trempealeau River channel.
- Stormwater infrastructure may alter local hydrology. Storm sewer systems often cause precipitation to move off the landscape and into local water bodies quicker. Detention basins can reduce peak runoff rates but tend to cause higher sustained flow rates over time. This can lead to channel erosion problems.

- 
- Flood protection measures may be implemented that limit risk to some areas. Preventing floodwater from reaching one part of the floodplain usually means there are impacts to other areas adjacent to the floodplain.

Estimates of future hydrologic conditions are necessary to identify flood risk reduction measures and activities capable of providing long-term benefits. Regional precipitation data published in NOAA Atlas 14, Volume 8 (NWS 2013) found increases in storm intensity and precipitation depth relative to the older Technical Paper No. 40 (TP-40) precipitation data (SCS 1961). Hydrologic modeling of Atlas 14 vs. TP-40 for streams and rivers in the region calculated flow increases of 50 to 100 percent for 1-percent-annual-chance exceedance floods because more rainfall over a shorter time results in greater runoff. Flood risk reduction measures implemented today should evaluate how those measures will perform should the trend of larger, more intense precipitation events continue for this hydrologic region.

Measures or activities implemented in the near term may alter future hydrology. Future-condition flood models and stream flow models could be designed to account for a range of potential changes in the watershed. For example, the effect of providing detention in the watershed could be compared to no detention. The ongoing USACE feasibility study evaluated the potential for upstream storage at two locations and determined that the proposed detention alternatives provided minimal peak-flow reduction. Preliminary results from September 2017 found that regional detention on Turton Creek would not reduce flooding in Arcadia. Perhaps storage in other parts of the Trempealeau River watershed could provide greater flood mitigation benefits to Arcadia and other communities along the river.

---

## 3.0 FMP Development Process

This section will describe how the floodplain management plan (FMP) was developed, the roles and responsibilities of the project cooperators, public engagement activities, and expectations for future engagement and communication.

### 3.1 Arcadia Planning Committee

This FMP was developed in response to a request from the U.S. Army Corps of Engineers (USACE). The plan is needed for the city to be eligible for a federally funded flood risk reduction project. In response to this request, the City of Arcadia established the Arcadia Planning Committee (Planning Committee). The Planning Committee includes key stakeholders from the city: Arcadia Police, Arcadia Fire Department, Arcadia Municipal Electrical Utility, Arcadia Street Department, Arcadia Water and Wastewater Utility, County Land Management Department, Town of Trempealeau, Town of Arcadia, Wisconsin Department of Natural Resources (WDNR) and Trempealeau County.

The Planning Committee was heavily involved in the development of the FMP. The Planning Committee met several times, developing the FMP through critical discussion and review of draft plan sections. The Planning Committee will remain in place during implementation of this FMP, serving roles described in Section 3.3 and the Action Plan (see Section 6.0).

### 3.2 Stakeholder Engagement Process

Stakeholder engagement and cooperation is critical to developing an FMP that has value to the community. Input from residents, businesses, and city administrative staff is critical to identifying the problems, challenges, opportunities, issues, objectives, and constraints surrounding flood risk management in Arcadia. Throughout the development of this FMP, the city has sought stakeholder input and engagement through the following efforts:

- Development of the Policy Committee and its continued roles
- Public meetings
- Public notices and requests for public input
- Website postings and solicitation of feedback

The USACE and City of Arcadia jointly hosted a community meeting to kick-off the public engagement process on December 22, 2016. Following the public kick-off meeting, the Policy Committee met several times during the development of the draft FMP to review available information, assess strategies and tools to address problem areas, and develop an action plan supported by stakeholders.

The city used feedback received from the public and Planning Committee participants in identifying preferred strategies and tools (see Section 5.0) and prioritizing the proposed action plan (see Section 6.0). Following development of the draft FMP, the city will hold additional community capacity meetings to solicit feedback on the draft plan and proposed implementation strategies. A summary of meetings and public engagement activities is presented in Table 3-1.

**Table 3-1 Record of Public and Planning Committee Meetings**

Meeting Name	Location	Date
USACE Workshop	Arcadia, WI	December 22, 2016
Planning Committee	Arcadia, WI	March 9, 2017
Planning Committee	Arcadia, WI	April 6, 2017
Planning Committee	Arcadia, WI	August 16 2017
Planning Committee	Arcadia, WI	September 28, 2017
Planning Committee	Arcadia, WI	January 4, 2018
Public Involvement (public hearing at City Council meeting)	Arcadia, WI	February 5, 2018
City Council Resolution	Arcadia, WI	February 19, 2018

### 3.3 FMP Revision and Update Process

This FMP is intended to be a living document. The action plan described in Section 6.0 includes ongoing and future tasks. Results of completed tasks, additional data, and stakeholder feedback may prompt alteration of the action plan to promote increased flood risk benefits or more efficient use of resources.

As a living document, the stakeholder engagement process will not end with the publication of this plan. The Planning Committee will meet annually to assess the implementation of this FMP. The Community Rating System (CRS) requires the city to annually evaluate its progress toward implementing the projects and programs in the plan, to complete an area analysis or natural floodplain functions plan, and to submit a report of these evaluations with its annual CRS recertification (CRS Coordinator’s Manual 511). During this assessment the Planning Committee will:

- Review the status of the action plan (see Section 6.0).
- Consider recommendations for FMP updates provided by the city and/or its consulting engineer.
- Consider recommendations for updates or other input provided by stakeholders.
- Determine whether additional stakeholder input (e.g., public notice or public meeting) is necessary prior to updating the FMP.
- Solicit feedback from FMP stakeholders regarding more significant changes to the FMP.

Following updates to the FMP document, the revised document will be made available on the city’s website.

### 3.4 Long-Term Communication Plan

The long-term communication plan defines the roles and responsibilities of the community for managing its flood risk reduction measures. It also provides an organizational structure and processes that will be followed to ensure that local, state, and federal investments in flood risk reduction are well maintained

into the future. The members of the Planning Committee are listed below. Each action item in Section 6 is assigned to one of these committee members for implementation.

Planning Committee	Responsibility
Bill Chang, <i>City Administrator</i> <a href="mailto:cityadmin@cityofarcadiawi.com">cityadmin@cityofarcadiawi.com</a>	Committee Chair Zoning Administrator, Public Information
Rob Reichwein, <i>Mayor</i> <a href="mailto:mayor@cityofarcadiawi.com">mayor@cityofarcadiawi.com</a>	Mayor
Dan Schreiner, <i>Emergency Management Director</i> <a href="mailto:schreinerd@tremplounty.com">schreinerd@tremplounty.com</a>	County Emergency Management Director
Rollie Conrad, <i>Operations Superintendent</i> <a href="mailto:streets@centurytel.net">streets@centurytel.net</a>	Maintaining stormwater facilities
Diana Anderson, <i>Police Chief</i> 715-538-4351 (non-emergency) <a href="mailto:ChiefAnderson@cityofarcadiawi.com">ChiefAnderson@cityofarcadiawi.com</a>	Flood warning first contact
Tim Putz, <i>Superintendent - Electric Utility</i> <a href="mailto:electricsupt@cityofarcadiawi.com">electricsupt@cityofarcadiawi.com</a>	Providing electric power
Gary Skroch, <i>Superintendent - Water and Wastewater Utility</i> <a href="mailto:rkdwater@triwest.net">rkdwater@triwest.net</a>	Water supply and distribution, sanitary sewer collection, wastewater treatment
Mark Stephenson, <i>Dam Safety Engineer</i> <a href="mailto:mark.stephenson@wiscionsin.gov">mark.stephenson@wiscionsin.gov</a>	WDNR Liaison
Darrek Orwig, <i>Economic Development and Tourism Coordinator</i> <a href="mailto:DarrekO@tremplounty.com">DarrekO@tremplounty.com</a>	Trempealeau County Land Management
Joe Feltes, <i>Council President and Firefighter</i> <a href="mailto:ward1b@cityofarcadiawi.com">ward1b@cityofarcadiawi.com</a>	Council President
Jon Schultz, <i>Environmental &amp; Land Use Committee</i> <a href="mailto:jon.w.schultz77@gmail.com">jon.w.schultz77@gmail.com</a>	Trempealeau County Board District 5
Barb Tock, <i>Town President</i> <a href="mailto:townofarcadia@outlook.com">townofarcadia@outlook.com</a>	Town of Arcadia

Representatives from the public, as defined in the CRS Coordinator’s Manual, need to be added to the Planning Committee. The public needs to review the plan. The goal is that the public understands the flood risk, assists with outreach, and distributes Federal Emergency Management Agency (FEMA) pamphlets.

The City Council should adopt the initial plan by resolution to show support of this effort and understanding of the actions. The Council should be notified of updates to the plan.

The City Administrator should review the actions monthly, as should the owner of each action, and should report on the status of each action to the committee. The report can show cumulative actions since the

---

last plan revision. This report will provide a list of items that are changed in the plan. When the annual update of the plan is done, the City Administrator should prepare a summary of changes to the plan and make it available to the public.

As portions of actions are completed, new actions should be added with reasonable deadlines. For example, when flood inundation mapping is completed, a new action item would be to inform the public of that information and how the map can be used to reduce their flood risk. As another example, as policy actions are completed, an action for the following year would be to amend the plan to monitor the benefits and drawbacks of the policy.

The plan should be shared via several different modes. The public should be informed of the plan in several ways, such as a hard copy at the public library, school library, and at public meetings, as well as a PDF download from the city's website. The CRS Coordinator's Manual has example public outreach projects and programs provided in Section 330. Having FEMA publications at the library and promoting flood insurance are two specific ways of keeping the public informed about flood risk.

As this plan is implemented the flood risk to the community will be reduced and so will the flood insurance rates. The reduction in flood risk often causes apathy towards the effort that reduced the flood risk. The CRS provides suggestions and lists public information topics that can prevent this from happening. For example, the city could install high water mark signs in public places. The reduction in flood insurance cost via CRS is based on reduced flood risk for the community.

### **Monthly Activities**

- City Administrator reviews progress on action items and provides summary to planning committee.

### **Quarterly Activities**

- Planning Committee meets to discuss progress on action items quarterly.

### **Annual Activities**

- Planning Committee meets in early November for an annual review of overall plan and develops recommendations for changes.
- City Administrator creates summary list of changes made to plan in December of each year.
- Summary of changes is presented to the City Council in January of each year.
- Summary of changes posted with the revised plan on the city website in January.
- Table-top exercise for emergency action preparedness.

---

## 4.0 Goals and Objectives

Goals and objectives related to managing flood risks for the City of Arcadia are presented in this section. These goals and objectives are based on the outcomes of the Planning Committee meetings and public engagement efforts documenting the consensus of stakeholders. Future modifications to this floodplain management plan (FMP) will be assessed relative to these goals. The Planning Committee will periodically assess these goals to determine if revisions are necessary due to changing needs and desires.

These goals were developed to guide planning and decision making regarding the strategies and tools discussed in Section 5.0 and Appendix A.

### 4.1 Goal 1 – Collaborative Approach

Develop a collaborative, multi-jurisdictional approach to manage the floodplains and address flood risks and concerns along the Trempealeau River and its tributaries in and around the City of Arcadia. The multi-jurisdictional approach should encompass public stakeholders and local, state, and federal agencies.

- 1.1. *Objective:* **Establish an organizational framework** to facilitate ongoing collaboration, coordination, and discussion of floodplain management issues and activities.
- 1.2. *Objective:* **Adopt and implement an updated City of Arcadia FMP.**

### 4.2 Goal 2 – Reduce Risk and Mitigate Impacts

Reduce the risk and mitigate the impact of flooding of the Trempealeau River and its tributaries within and adjacent to the City of Arcadia to protect life and property.

- 2.1. *Objective:* **Reduce risk to life, property, and the economy** to acceptable levels identified by the community and policy makers.
- 2.2. *Objective:* **Identify and mitigate damage in repetitive loss areas.**
- 2.3. *Objective:* **Revise floodplain, zoning, and subdivision policies and regulations** to better prepare for and protect against flooding.
- 2.4. *Objective:* **Identify and understand unique flood risks** associated with the Trempealeau River and its tributaries.

### 4.3 Goal 3 – Improve Understanding of Flood Risk

Improve the public's understanding of flooding risks along the Trempealeau River and its tributaries and the impacts of those risks on residents, property owners, businesses, and infrastructure.

- 3.1. *Objective:* **Develop and implement early warning systems** in the Trempealeau River watershed and expand these to include the National Weather Service models and regional warning systems (if available) as well as text messages, other internet-based systems (i.e. Twitter, Facebook), and area media outlets (e.g., radio and television).

- 3.2. *Objective:* **Coordinate the emergency preparedness and evacuation plan** with federal, state, and local public officials and business partners (e.g., radio and television stations) for residents and property owners within the floodplain.
- 3.3. *Objective:* **Develop a range of educational and informational tools** to inform the public, elected officials, and interested parties (i.e., realtors, property owners, tenants, and developers) of the flood risks and the unique characteristics of the local waterways (Trempealeau, Turton, and Myers Valley) and internal drainage to promote floodplain stewardship and connection to the riparian environments.

#### 4.4 Goal 4 – Balance Development Goals and Floodplain Ecology

Balance the land development goals in the local watersheds and City of Arcadia with the ecological and hydrologic functions of the natural floodplains along the river.

- 4.1. *Objective:* **Implement appropriate best management practices (BMPs)** for water quality for new and redeveloped public and private projects.
- 4.2. *Objective:* **Encourage BMPs to promote water quality** related to agricultural practices through appropriate incentives and/or regulations.
- 4.3. *Objective:* **Implement appropriate policies and regulations** that incorporate the established floodplain boundary and address needs of existing properties.
- 4.4. *Objective:* **Identify and preserve undeveloped land** critical to the integrity and maintenance of the various flood controls and protection of infrastructure in the City of Arcadia.

#### 4.5 Goal 5 – Protect and Preserve the Natural Floodplain

Protect and preserve the natural environment of the riparian corridor to enhance habitat connectivity, water quality, erosion and sediment management, streambank and channel stabilization, and provide compatible recreation opportunities.

- 5.1. *Objective:* **Implement appropriate BMPs, regulations, and guidelines** to stabilize channel and stream banks, protect wildlife and habitat, conserve open space, and re-establish riparian corridors.
- 5.2. *Objective:* Research, plan for, and implement ways to **restore the natural functions of floodplains**, including the storage capacity, when appropriate.
- 5.3. *Objective:* **Identify compatible recreation opportunities** in the floodplain along the local waterways.

## 5.0 Strategies and Tools

The Planning Committee considered a long list of strategies and tools that could address the flood risk for the City of Arcadia. This section summarizes the inclusion or rejection of those tools (the tools are described in greater detail in Appendix A). The City of Arcadia Floodplain Management Plan (FMP) categorizes the list of strategies and tools as follows:

1. Modifying human susceptibility to flood hazards
2. Modifying the impact of flooding on individuals and the community
3. Preserving and restoring the natural resources and functions of floodplains
4. Modifying floodwaters

These four categories of strategies and tools were created by the Federal Interagency Floodplain Management Task Force during the formation of a Unified National Program for Floodplain Management (1994, p 9. [https://www.fema.gov/media-library-data/20130726-1733-25045-0814/unp\\_floodplain\\_mgmt\\_1994.pdf](https://www.fema.gov/media-library-data/20130726-1733-25045-0814/unp_floodplain_mgmt_1994.pdf)). The four categories and corresponding tools are the “measures” referred to by flood risk management professionals. The terminology is very deliberate, as it leads to the eventual action items in the FMP. More detailed descriptions of the four categories are included in their respective subsections. This terminology serves to clarify the measures that fall under the category of either an “activity” or a “feature.”

- **Activity** – An activity is an effort by the city, county, or partnering state and federal agencies to study, inform, or react to a flood risk. Examples of an activity could be an informational outreach program, an updated study of a flood-prone area, or an emergency action plan.
- **Feature** – A feature is an actual construction project on a property or properties that an individual, the city, county, or partnering agencies can perform. Features can include major civic works projects such as levees, or smaller “flood risk adaptive measures,” such as elevating an existing home or business. The smaller features are typically called “nonstructural measures,” which originates from Federal Emergency Management Agency (FEMA) policy. This plan will refer to these types of features as “**flood risk adaptive measures.**”

Stakeholder support and the implementation feasibility for each tool may vary, and consensus regarding successful tools will be established over time. The Planning Committee evaluated and designated each of the possible tools as either **Advisable**, **Not Advisable**, or **Further Evaluation Needed**. These designations for the tool are included in the FMP to help document the decision history of chosen activities for the action plan.

This decision history is an important part of the FMP, as the city’s unique story is made up of a risk assessment followed by years of decisions about how to manage floodwaters and the floodplain. The specific terms also help improve public involvement and can be applied to specific reaches of a river or a

---

tributary. Since the public needs to be involved in defining their individual acceptable level of risk, these terms facilitate buy-in and get the community focused on the action items identified later in this plan. These action items eventually lead to more effective hazard mitigation by the city, the counties, and state and federal agencies—all partners sharing the responsibility of reducing the risks of flooding and other natural disasters.

This input-based approach allows an FMP to be established and work on realizing the goals of the plan to begin. Communities can work on annual revisions to the FMP and update evaluations on the tools' effectiveness.

Over a period of several years, consensus will be established and a collaborative approach to building projects can be done, effectively leveraging the invested infrastructure dollars in the city and county. This can facilitate implementation of various tools in the Action Plan (see Section 6.0).

## 5.1 Strategy 1: Modifying Human Susceptibility to Flood Hazards

This strategy and set of tools relates to measures directed toward managing the floodplain. These measures include specific activities and features. Activities include land-use regulations, public redevelopment policies, flood warning systems, and flood emergency preparedness plans (including emergency action plans and flood-fighting plans). Features include floodproofing buildings in the floodplain, constructing berms and floodwalls for buildings, increasing building elevations, filling basements, acquisition of buildings (for demolition), and relocation of buildings. This deliberate terminology, distinguishing between activities and features, will help the reader understand that FMPs, emergency action plans, flood fighting plans, and hazard mitigation plans are not the same.

Should funding become available, groupings of structures in each impacted area may be conceptualized to create a list of potential projects. Groupings for the relocation or acquisition of buildings (tools 5 and 10 in Table 5-1) have similar impact and benefits as the groupings of tools 4, 6, 7, 8, and 9 in Table 5-1. The latter set of tools has to do with elevating or floodproofing, while the first two provide open space. Groupings may be tied to subdivisions or neighborhoods, types of flood risk (considering flood depth, velocity, rate-of-rise, duration of inundation, and population at risk). Groupings may also be tied to the type of structure and common elements, which may lead to a more effective construction contract.

The tools related to this strategy are described in greater detail in Appendix Section A.1.

**Table 5-1 Tools Matrix for Strategy 1: Modifying Human Susceptibility to Food Hazards**

Tools	Advisable	Further Evaluation Needed	Not Advisable
A.1.1 Development Policies and Land-Use Regulations limit the types of development that can occur in high flood risk areas	X	X	
A.1.2 Flood Warning Systems measures used to communicate the anticipated timing and extent of a flood event so people can take steps to protect themselves and their property	X		
A.1.2.1 Flood Forecasting Inundation Map shows inundation extents for a given river stage		X	
A.1.2.2 Warning Dissemination: Flood Warning Lights and Sirens audible and visual warnings during a flood		X	
A.1.2.3 Warning Dissemination: Multimedia use of multiple communication methods to reach public	X		
A.1.3 Emergency Operations Plans define the steps the community will take to prepare for, respond to, and mitigate against flood risk	X		
A.1.4 Elevation of Buildings raising a structure to reduce the chance of flood damage to the structure		X	
A.1.5 Relocation of Buildings moving a building to higher ground so it is less likely to flood		X	
A.1.6 Wet Floodproofing measures that allow floodwaters to enter the structure without significantly damaging the structure or its contents	X		
A.1.7 Dry Floodproofing sealing the walls of a structure with water-proofing compounds, impermeable sheeting, or other materials and using closures for covering and sealing openings from floodwaters	X		
A.1.8 Berms and Floodwalls for Buildings construction of compacted soil berms and/or installation of constructed walls to prevent flood waters from reaching structures	X		
A.1.9 Fill or Conversion of a Basement for Buildings filling in the existing basement or converting the basement space to an uninhabitable crawl space		X	
A.1.10 Acquisition of Buildings buying the property and removing the structure either by demolition or relocation	X		

## 5.2 Strategy 2: Modifying the Impact of Flooding

This strategy and set of tools affects the impact of flooding through six specific activities listed in Table 5-2. The objective of this strategy is to limit the severity of impacts from a flood event. These tools are described in greater detail in Appendix Section A.2.

**Table 5-2 Tools Matrix for Strategy 2: Modifying the Impact of Flooding**

Tools	Advisable	Further Evaluation Needed	Not Advisable
A.2.1 Information and Education raise awareness of local flood risk so individuals and groups can act in ways that reduce their flood risk	X		
A.2.2 Flood Insurance an insured property contributes to the larger risk pool and is eligible for some level of reimbursement for flood damage	X		
A.2.3 Community Rating System program that awards communities that take steps to reduce their flood risk by giving discounts for flood insurance premiums	X		
A.2.4 Tax Adjustments and Rebates or Grants used to incentivize the establishment of more open space and/or encourage the construction and renovations of homes and businesses that are better protected from the risk of flooding		X	
A.2.5 Disaster Assistance and Emergency Relief post-disaster funds are available to some communities, contingent on the inclusion of flood hazard information in the County's Hazard Mitigation Plan		X	
A.2.6 Post-Flood Recovery Processes steps the community goes through after a flood to learn from what happened so future damages can be avoided or mitigated	X		
A.2.7 Place High Water Mark Signs in Public Places high water mark signs in the community can be powerful tools for raising and maintaining local awareness of flood risk.	X		

## 5.3 Strategy 3: Preserving and Restoring the Environmental Quality of Floodplains

This strategy and set of tools preserves the natural function and environmental quality of the floodplain. Tools specific to this strategy are listed in Table 5-3.

This is a secondary strategy to be considered within the context of the community's other floodplain management efforts. For example, purchase of land in the floodplain for conservation can allow the application of one or more of these tools. The tools related to this strategy are described in greater detail in Appendix Section A.3.

**Table 5-3 Tools Matrix for Strategy 3: Preserving and Restoring the Environmental Quality of Floodplains**

Tools	Advisable	Further Evaluation Needed	Not Advisable
A.3.1 Erosion and Sediment Control reducing erosion from within the city and in the upstream watershed will reduce the sediment load on local streams and rivers	X		
A.3.2 Water Quality Enhancement incorporating water quality treatment of stormwater runoff into new and re-development plans will help improve water quality in local streams and rivers	X		
A.3.3 Wetland Protection and Restoration wetlands play an important role in reducing sediment and pollutants in streams and rivers, and can help reduce the severity of flooding by storing water in the floodplain	X		
A.3.4 Assess Natural and Beneficial Functions of Floodplains natural and beneficial functions of floodplains have the capacity to provide goods and services of value to society	X		
A.3.5 Enhancement of Recreation and Educational Opportunities rivers and streams can provide a variety of recreational and educational opportunities for the community		X	
A.3.6 Preservation of Cultural Resources the watershed has culturally significant artifacts from Native American tribes and early European settlers		X	

## 5.4 Strategy 4: Modifying Floodwaters

This strategy and set of tools focuses on modifying the quantity, rate, and routing of floodwaters using the features listed in Table 5-4.

Communities have long considered structural features to bring acceptable solutions for flood hazards. Several of these features are currently in place along the Trempealeau River, including the Arcadia levee system. The tools related to this strategy are described in greater detail in Appendix Section A.4.

**Table 5-4 Tools Matrix for Strategy 4: Modifying Floodwaters**

Tools	Advisable	Further Evaluation Needed	Not Advisable
A.4.1 Dams and Reservoirs may reduce the risk of flooding by detaining floodwaters and reducing peak flow rates experienced downstream		X	
A.4.2 Stormwater Detention Basins slow the downstream movement of stormwater runoff, reducing peak flood flows	X		
A.4.3 Levees and Floodwalls structures designed to hold floodwaters outside the protected area located within the levee and/or floodwall perimeter	X		
A.4.4 Bridge Modifications can reduce or eliminate restrictions in the floodplain that cause higher upstream flood elevations		X	
A.4.5 Landforms small berms that are less substantial than levees or floodwalls, but help manage flows and reduce the risk of adverse impacts		X	
A.4.6 Channel Alterations, Diversions, and Bypasses reduce the risk of flooding by diverting floodwaters around areas or structures that might otherwise be damaged		X	
A.4.7 Pump Stations transfer water collected on the protected side of levees and floodwalls to a location outside of the protected area	X		

## 6.0 Action Plan

The action plan was developed to implement the floodplain management plan (FMP) through recommendations developed and collected throughout the public input process. Possible strategies and tools of the action plan were evaluated for their relationship to the goals and objectives of the FMP and the feasibility to complete the action.

The planning committee for the Arcadia FMP developed the following detailed action plan and schedule for implementation of the community's selected strategies and tools.

Action items in the action plan have been grouped into the following categories.

- **Emergency Operations Actions** – These are planning actions to better understand flood risk and put systems in place to effectively respond to flood events when they occur.
- **Mitigation Actions** – These are the study and implementation of physical changes to the floodplain designed to mitigate or prevent floods from causing damage to the community.
- **Policy Actions** – These are administrative actions taken by the city that reduce the community's flood risk.

### 6.1 Emergency Operations Actions

This section provides the detailed explanation of emergency operations actions that will be taken.

**Table 6-1 Emergency Operations Actions**

Actions	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Complete by
1. Review and update Emergency Operations Plans (EOPs)			X			Annual review
2. Develop early warning system	X	X	X			Dec 2019
3. Develop flood risk maps			X	X	X	Dec 2019
4. Develop flood inundation map library			X	X	X	Dec 2020

Goal 1 – Collaborative Approach

Goal 2 – Reduce Risk and Mitigate Impacts

Goal 3 – Improve Understanding of Flood Risk

Goal 4 – Balance Development Goals and Floodplain Ecology

Goal 5 – Protect and Preserve the Natural Floodplain

### 6.1.1 Review and Update Emergency Operations Plans (EOPs)

<i>Action</i>	EOPs are currently updated after a response to an emergency. The city will begin reviewing and updating EOPs annually, as well as after emergencies. This will help keep the plan current, especially contact names and phone numbers. It will also help staff remain familiar with the details of the plan. The annual review and update of the EOPs will happen concurrently with the annual review and update of the FMP.
<i>Owner</i>	Police Chief
<i>Timeline</i>	Complete by June 2019 Annual review and update at same time as FMP.
<i>Tools</i>	A.1.3 Emergency Operations Plans

### 6.1.2 Develop Flood Warning System

<i>Action</i>	Trempealeau County will be reevaluating “ <b>CODE RED</b> ” program in 2018 with the intention of implementing a similar program in 2019. Currently, the county sends out emergency alerts to select city staff. The city will work with the county to expand the number of people who receive this notification to include department heads, especially the Operations Department, Water and Wastewater Utility, and Electric Utility.
<i>Owner</i>	Chief of Police and Trempealeau County Emergency Government Director
<i>Timeline</i>	Already started Complete in 2019
<i>Tools</i>	A.1.2 Flood Warning Systems

### 6.1.3 Develop Flood Risk Maps

<i>Action</i>	Use the hydraulic and hydrologic models developed by the U.S. Army Corps of Engineers (USACE) to create flood risk maps for the community. Flood risk maps can show information like flood depth during specific events or percent chance of being inundated within the span of a 30-year mortgage.
<i>Owner</i>	City Administrator
<i>Timeline</i>	Start by February 2019 Complete by Dec 2019

<i>Tools</i>	A.1.2.1 Flood Forecasting Inundation Map A.1.3 Emergency Operations Plans A.1.4 Elevation of Buildings A.2.1 Information and Education
--------------	---

#### 6.1.4 Develop flood inundation map library

<i>Action</i>	Use the hydraulic and hydrologic models developed by the USACE to create a series of static flood inundation maps at 1-foot stage intervals for the Trempealeau River, Turton Creek, and Myers Valley Creek. Maps should be developed in accordance with National Weather Service (NWS) guidelines so the community has the option of publishing some or all of the maps on the NWS flood forecasting website. This action uses the same data as 6.1.3 with different output.
<i>Owner</i>	City Administrator
<i>Timeline</i>	Start by February 2019 Complete by December 2020
<i>Tools</i>	A.1.2.1 Flood Forecasting Inundation Map A.2.1 Information and Education

## 6.2 Mitigation Actions

This section provides the detailed explanation of the flood risk mitigation actions that will be taken.

**Table 6-2 Mitigation Actions**

Actions	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Timeline Complete by
1. Interior drainage improvements	X	X		X		June 2019
2. Evaluation of repetitive loss structures		X	X			Sept 2020
3. Complete USACE feasibility study	X	X	X	X	X	Nov 2019
4. Evaluation impact of dam removal south of Orion Lane	X	X	X			July 2018
5. Transformer by the main waste water lift station	X	X		X		Nov 2019

Goal 1 – Collaborative Approach

Goal 2 – Reduce Risk and Mitigate Impacts

Goal 3 – Improve Understanding of Flood Risk

Goal 4 – Balance Development Goals and Floodplain Ecology

Goal 5 – Protect and Preserve the Natural Floodplain

### 6.2.1 Interior Drainage Improvements

<i>Action</i>	Evaluate the preliminary hydrology by the USACE, prepare preliminary alternatives with cost estimates, and select preferred alternatives. Implement preferred alternative by creating construction document.
<i>Owner</i>	City Administrator assisted by the Operations Superintendent
<i>Timeline</i>	Start by February 2018 Complete by June 2019
<i>Tools</i>	A.4.2 Stormwater Detention Basins A.4.7 Pump Stations

### 6.2.2 Evaluation of Repetitive Loss Structures

<i>Action</i>	<p>Evaluate the potential to mitigate flood risk to the community by addressing structures that have been flooded multiple times. The first step would be to identify repetitive loss structures in the community. The next step would be a feasibility analysis to develop recommendations for how to reduce the risk of future flooding. Common methods for mitigating flood risk for a repetitive loss structure are 1) elevate the structure, 2) relocate the structure, 3) purchase the structure, or 4) floodproofing. The evaluation of repetitive loss structures will need to take into consideration the historic significance of some structures in areas prone to flooding.</p> <p>Consider application to Municipal Flood Control Grant Program. Applications available, March 15, 2018. Other funding after a disaster are Federal Emergency Management Agency (FEMA) Hazard Mitigation Grants and Community Development Block Grant (CDBG) Emergency Assistance grants. The CDBG Home Rehabilitation also provides funding for homeowner rehabilitation. Work with Wisconsin Department of Emergency Management to develop a buy-out strategy.</p>
<i>Owner</i>	City Administrator
<i>Timeline</i>	Start by Jan. 2018 Complete by Sept 2020
<i>Tools</i>	A.1.4 Elevation of Buildings A.1.5 Relocation of Buildings A.1.7 Dry Floodproofing A.1.10 Acquisition of Buildings A.2.1 Information and Education

### 6.2.3 USACE Feasibility Study

<i>Action</i>	<p>The USACE is in the process of completing a Section 205 feasibility study evaluating potential flood risk mitigation actions for the City of Arcadia. The USACE held a planning workshop in December 2016. The USACE will work with the City of Arcadia to identify a locally preferred plan. A draft feasibility study report is expected in February 2019. The final feasibility study report is expected in September 2019. During the writing of the feasibility study the USACE has initiated an expedited process that starts design before the study is completed.</p> <p>The feasibility study is evaluating several potential structural flood mitigation measures. The items under consideration are listed below, by location.</p> <p><b>Turton Creek—Oak Street Bridge to Trempealeau River</b></p> <ol style="list-style-type: none"><li>1. No action</li><li>2. Raise levee along south bank of Turton Creek</li><li>3. Raise railroad bridge (2.2% grade limit)</li><li>4. Buy out structures south of Turton Creek</li><li>5. Construct floodwall along south bank of Turton Creek</li><li>6. Create upstream storage—gravel pit by Trempealeau River</li><li>7. Create upstream storage—old mill by Turton Creek</li><li>8. Open Turton Creek bridge at Oak Street</li><li>9. Reroute Turton Creek at Oak Street, around the house that becomes an island</li><li>10. Reroute/notch/overflow on Turton Creek at Oak Street and purchase homes north of Oak Street</li><li>11. Remove Oak Street, purchase property north of Oak Street, and provide access to north side off STH 93</li></ol> <p><b>Trempealeau River—Junction with Turton Creek to High Ground Tie-In Downstream</b></p> <ol style="list-style-type: none"><li>1. No action</li><li>2. Raise levee along the east bank of the Trempealeau River</li><li>3. Construct flood wall along the east bank of the Trempealeau River</li><li>4. Buy out properties on the north side of the Trempealeau River near the floodway</li><li>5. Flood protection on the northwest side of the Trempealeau River</li></ol> <p><b>Other Miscellaneous Measures</b></p> <ol style="list-style-type: none"><li>1. Detention ponds or chambers to slow peak within stormwater pipe system</li><li>2. Identify Phase 2 of Myers Valley Creek design (Davy Engineering) and check how CAP authority relates to an existing city improvement plan</li></ol>
---------------	---

	<ol style="list-style-type: none"> <li>3. Remove utility lines from levees wherever practical</li> <li>4. Study local drainage plan to ensure that it is sufficient</li> <li>5. Construct a sheet pile wall along the east bank of the Trempealeau River for seepage cutoff</li> <li>6. Consider interior flood control for any proposed flood risk reduction project</li> </ol> <p>The FMP will need to be updated based on the outcome of the feasibility study.</p>
<i>Owner</i>	City Administrator USACE
<i>Timeline</i>	Start December 2016 Complete by November 2019
<i>Tools</i>	A.4.3 Levees and Floodwalls A.4.6 Channel Alterations, Diversions, and Bypasses A.4.7 Pump Stations

#### 6.2.4 Evaluation Impact of Dam Removal on Orion Lane

<i>Action</i>	Evaluate the potential flood risk to the community if the dam south of Orion Lane in Arcadia Township is removed
<i>Owner</i>	City Administrator
<i>Timeline</i>	Start by February 2018 Complete by July 2018
<i>Tools</i>	A.4.1 Dams and Reservoirs A.4.6 Channel Alterations, Diversions, and Bypasses

#### 6.2.5 Transformer by the Main Wastewater Lift Station

<i>Action</i>	Elevate the transformer near the main wastewater lift station within the Ashley complex on Ashley Way
<i>Owner</i>	Superintendents of Water and Wastewater Utility and Electric Utility
<i>Timeline</i>	Start by June 2018 Complete by November 2019
<i>Tools</i>	A.1.4 Elevation of Buildings

## 6.3 Policy and Administrative Actions

This section provides a detailed explanation of the FMP action items.

**Table 6-3 Policy and Administrative Actions**

Actions	Goal 1	Goal 2	Goal 3	Goal 4	Goal 5	Complete by
1. Adopt the Arcadia FMP	X					July 2018
2. Update city website to host FMP		X	X			Jan 2018
3. Develop a funding strategy to mitigate community flood risk		X				May 2018
4. Join the Community Rating System (CRS)		X	X	X	X	Jun 2019
5. Create downtown business and resident registry		X				Dec 2018
6. Develop stormwater management plan		X	X			Sept 2019
7. Review and update zoning code (floodplain, shore land-wetland)		X	X	X	X	Dec 2019
8. Digitize documents and records		X				Dec 2020
9. Evaluate potential for a local stormwater ordinance		X	X	X	X	Dec 2021
10. Improve land management practices	X	X	X			Dec 2027
11. Regional watershed management policy	X	X	X	X	X	Dec 2027

Goal 1 – Collaborative Approach

Goal 2 – Reduce Risk and Mitigate Impacts

Goal 3 – Improve Understanding of Flood Risk

Goal 4 – Balance Development Goals and Floodplain Ecology

Goal 5 – Protect and Preserve the Natural Floodplain

### 6.3.1 Adopt the Arcadia FMP

<i>Action</i>	City Council to officially adopt this FMP. Plan adoption will involve: <ul style="list-style-type: none"> <li>• A period for public review and comment.</li> <li>• Public involvement meeting where the plan contents are presented at a City Council meeting.</li> <li>• Vote by the City Council to adopt the plan.</li> </ul>
<i>Owner</i>	City Administrator
<i>Timeline</i>	Already started Complete by February 2018
<i>Tools</i>	A.2.1 Information and Education

### 6.3.2 Update City Website to Host Floodplain Information

<i>Action</i>	Create a page on the city website to host the FMP and other floodplain related files such as the floodplain maps. Add flood risk map when completed (6.1.3). Add flood warnings.
<i>Owner</i>	City Administrator
<i>Timeline</i>	Already started Complete by February 2018. Update annually.
<i>Tools</i>	A.2.1 Information and Education

### 6.3.3 Develop a Funding Strategy to Mitigate Community Flood Risk

<i>Action</i>	<p>Several federal programs are available to help mitigate the flood risk in the area and may be applicable to this measure.</p> <p>For each mitigation area, off-the-shelf projects should include groupings of structures which may be tied to subdivisions, types of flood risk (considering flood depth, velocity, rate-of-rise, and duration of inundation), and population at risk. Groupings may also be tied to the type of structure and common elements, as this may lead to a more effective construction contract. This approach could assist in developing a prioritization list and increase the benefit-to-cost ratio to meet federal grant program requirements. By evaluating this tool for specific properties and developing a prioritized list of projects, these projects can be mobilized when the next round of hazard mitigation funds become available. The funding cycle for Municipal Flood Control Grant Awards, administered by the Wisconsin Department of Natural Resources (WDNR), is the first quarter of even-numbered years.</p> <p>Currently, FEMA administers the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, and the Pre-Disaster Mitigation (PDM) Program. HMGP assists in implementing long-term hazard mitigation measures following a major disaster. PDM provides funds for hazard mitigation planning and projects on an annual basis. FMA provides funds for projects to reduce or eliminate risk of flood damage to buildings that are insured under the National Flood Insurance Program (NFIP) on an annual basis. More information is at FEMA.</p>
<i>Owner</i>	City Administrator
<i>Timeline</i>	Already started Complete by May 2018
<i>Tools</i>	A.2.4 Tax Adjustments and Rebates or Grants

### 6.3.4 Join the Community Rating System (CRS)

<i>Action</i>	<p>To join the CRS the City of Arcadia will do the following:</p> <ul style="list-style-type: none"> <li>• Complete the CRS Community Self Assessment. <a href="http://crselfassessment.us/">http://crselfassessment.us/</a></li> <li>• Submit an Application Letter of Interest &amp; CRS Quick Check <a href="http://crsresources.org/quick-check/">http://crsresources.org/quick-check/</a></li> <li>• Submit documentation to the Insurance Services Office, Inc. (ISO) showing that the community is implementing activities that warrant at least 500 points.</li> </ul> <p>Participation in the CRS will be in accordance with the <i>2017 CRS Coordinators Manual</i> <a href="http://crsresources.org/manual/">http://crsresources.org/manual/</a></p> <p>The city will work with the Wisconsin ISO/CRS Specialist to obtain credit for CRS activities. <a href="http://crsresources.org/100-2/">http://crsresources.org/100-2/</a></p> <p>Lou Ann Patellaro Phone: 708-634-3040 Cell: 954-651-5021 <a href="mailto:lpatellaro@iso.com">lpatellaro@iso.com</a></p>
<i>Owner</i>	City Administrator
<i>Timeline</i>	Start by February 2018 Complete by June 2019
<i>Tools</i>	A.2.3 Community Rating System

### 6.3.5 Create Downtown Business and Resident Registry

<i>Action</i>	The City of Arcadia will develop a registry of businesses and residents in the downtown area that are susceptible to flooding. This registry will be used to provide quicker notification of property owners during flood emergencies.
<i>Owner</i>	City Administrator
<i>Timeline</i>	Already started Complete by December 2018
<i>Tools</i>	A.1.2 Flood Warning Systems A.1.3 Emergency Operations Plans A.2.1 Information and Education

### 6.3.6 Develop Stormwater Management Plan

<i>Action</i>	Create a hydrologic and hydraulic model of the existing storm drainage systems. Identify upgrades that could be made to the system that would provide the most benefit for the capital investment. Update the city's capital improvement plan to budget for system improvements over time. Consider changing conditions due to future development and potentially changing climate.
<i>Owner</i>	City Administrator and Operations Department Superintendent
<i>Timeline</i>	Start by June 2018 Complete by September 2019
<i>Tools</i>	A.1.1 Development Policies and Land-Use Regulations A.3.1 Erosion and Sediment Control A.3.2 Water Quality Enhancement

### 6.3.7 Review and Update Zoning Code

<i>Action</i>	Review existing zoning code and identify changes that would reduce flood risk to the community as well as meet other city objectives. Areas to be reviewed include: <ul style="list-style-type: none"> <li>• Design standards for downtown area.</li> <li>• Greenery and vegetative buffer requirements.</li> <li>• Floodplain/compatible with community floodplain ordinance.</li> <li>• Parking restrictions such as no parking on grass especially between sidewalk and curb.</li> <li>• Gravel parking lots.</li> <li>• Population density control through districting.</li> <li>• Shoreland/wetland zoning.</li> </ul>
<i>Owner</i>	City Administrator
<i>Timeline</i>	Already started Complete by December 2019
<i>Tools</i>	A.1.1 Development Policies and Land-Use Regulations A.3.1 Erosion and Sediment Control A.3.2 Water Quality Enhancement

### 6.3.8 Digitize Documents and Records

<i>Action</i>	The city is in the process of digitizing paper records. Hard copies of documents can be lost or damaged in a flood event. Digitizing records so that the data can be securely stored and backed up offsite will mitigate this risk.
<i>Owner</i>	City Clerk-Treasurer
<i>Timeline</i>	Already started Complete by December 2020
<i>Tools</i>	A.2.3 Community Rating System

### 6.3.9 Evaluate Potential for a Local Stormwater Ordinance

<i>Action</i>	Study whether a local stormwater ordinance would effectively achieve goals in this FMP and other city goals.  Does a stormwater ordinance make sense for a community this size?  How would a stormwater ordinance be funded?
<i>Owner</i>	City Administrator
<i>Timeline</i>	Start by February 2019 Complete by December 2021
<i>Tools</i>	A.1.1 Development Policies and Land-Use Regulations

### 6.3.10 Improve Land Management Practices

<i>Action</i>	Work with the county and state to improve land management practices to reduce runoff and the amount of pollutants washed into waterways.
<i>Owner</i>	City Administrator
<i>Timeline</i>	Start by February 2019 Complete by 2027
<i>Tools</i>	A.1.1 Development Policies and Land-Use Regulations A.3.3 Wetland Protection and Restoration A.3.1 Erosion and Sediment Control A.3.2 Water Quality Enhancement

### 6.3.11 Regional Watershed Management Policy

<i>Action</i>	Work with county, state, and other towns to develop a management policy for the Trempealeau River watershed.
<i>Owner</i>	City Administrator Trempealeau County, Buffalo County, and Town of Arcadia
<i>Timeline</i>	Start by February 2019 Complete by December 2027
<i>Tools</i>	A.1.1 Development Policies and Land-Use Regulations A.3.3 Wetland Protection and Restoration A.3.1 Erosion and Sediment Control A.3.2 Water Quality Enhancement

---

## 7.0 References

- American Society of Civil Engineers (ASCE). CodeMaster - Flood Resistant Design, Standards and Codes Institute, 2016.
- Association of State Floodplain Managers (ASFPM). Addressing Your Community's Flood Problems, A Guide for Elected Officials, 1996.
- Association of State Floodplain Managers (ASFPM). Using Multi-Objective Management to Reduce Flood Losses in Your Watershed, 1996.
- City of Manhattan, Kansas. Big Blue and Kansas River Floodplain Management Plan. Online: <https://cityofmhk.com/2798/Big-Blue-River-Floodplain-Management-Pla>. Accessed: October 18, 2017.
- Federal Emergency Management Agency (FEMA), Federal Interagency Floodplain Management Task Force. A Unified National Program for Floodplain Management, 1994.
- Federal Emergency Management Agency (FEMA), Federal Interagency Floodplain Management Task Force, 1996. Protecting Floodplain Resources: A Guidebook for Communities, June 1996.
- Federal Emergency Management Agency (FEMA). CRS Credit for Outreach Projects, National Flood Insurance Program Community Rating System (CRS), 2006.
- Federal Emergency Management Agency (FEMA). Example Plans, National Flood Insurance Program Community Rating System (CRS), September 2007.
- Federal Emergency Management Agency (FEMA). High Water Mark Initiative. <https://www.fema.gov/high-water-mark-initiative>. Accessed: January 8, 2018.
- Federal Emergency Management Agency (FEMA). Openings in Foundation Walls and Walls of Enclosures. *Technical Bulletin 1*, August 2008.
- Federal Emergency Management Agency (FEMA). Trempealeau County, Wisconsin, Flood Insurance Study, April 2011.
- Federal Emergency Management Agency (FEMA). Local Mitigation Planning Handbook, March 2013.
- Federal Emergency Management Agency (FEMA). Coordinator's Manual, National Flood Insurance Program Community Rating System (CRS), FIA,15/2017. OMB No. 1660,0022. Expires March 31, 2020. Online version: <http://crsresources.org/manual/>. Accessed: October 18, 2017.
- Federal Emergency Management Agency (FEMA). Hazard Mitigation Grant Program, <https://www.fema.gov/hazard-mitigation-grant-program>. Accessed: October 18, 2017.

---

National Research Council. *Levees and the National Flood Insurance Program: Improving Policies and Practices*, 2013.

National Weather Service (NWS). National Oceanic and Atmospheric Administration (NOAA) Atlas 14, *Precipitation-Frequency Atlas of the United States, Volume 8*. Silver Springs, Maryland, 2013. [https://hdsc.nws.noaa.gov/hdsc/pfds/pfds\\_map\\_cont.html](https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html). Accessed: January 8, 2018.

Short Elliot Hendrickson (SEH). *Summary Letter Report, Trempealeau River Hydraulic Analysis*, April 2013.

Soil Conservation Service (SCS). *Technical Paper No. 40 Rainfall Frequency Atlas of the United States*, May 1961.

U.S. Army Corps of Engineers (USACE). *Operation and Maintenance Manual, Levee Repair Project Trempealeau River at Arcadia, Wisconsin*, 1956.

U.S. Army Corps of Engineers (USACE). *Draft Detailed Project Report for Flood Control on Trempealeau River at Arcadia, Wisconsin*. 1960.

U.S. Army Corps of Engineers (USACE). *Review Survey Report on Trempealeau River, Wisconsin for Flood Control*, 1965.

U.S. Army Corp of Engineers (USACE), Hydrologic Engineering Center (HEC). *Flood Flow Frequency Analysis, 723-X6-L7550*, Davis California, February 1982.

U.S. Army Corps of Engineers (USACE). *Condition Survey Report, Non-federal Levees. Trempealeau River at Arcadia, Wisconsin*, 1985.

U.S. Army Corps of Engineers (USACE). *Draft Reconnaissance Report Flood Control, Trempealeau River at Arcadia, Wisconsin*, 1988.

U.S. Army Corps of Engineers (USACE). *Policy Guidance Letter No. 52, Floodplain Management Plans*, 8 December 1997.

U.S. Army Corps of Engineers (USACE). *Inspection of Levee by Corps*, September 22, 2004.

U.S. Army Corps of Engineers (USACE). *Periodic Inspection Report for the American Recovery and Reinvestment Act of 2009 Trempealeau River at Acadia, Wisconsin Flood Control District*. 2010

U.S. Army Corps of Engineers, St. Paul District (USACE). *Supplemental Nonstructural Assessment for the Fargo-Moorhead Metro Feasibility Study*, July 2011.

U.S. Army Corps of Engineers (USACE), Institute for Water Resources. *From Flood Damage Reduction to Flood Risk Management: Implications for U.S. Army Corps of Engineers Policy and Programs*, May 2014.

- 
- U.S. Army Corps of Engineers (USACE), Saint Paul District. Draft CAP Section 205 Feasibility Study Trempealeau River at Arcadia Hydrology Study and Report. August 2017
- U.S. Geological Survey (USGS), Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, 1982. *Bulletin No. 17B*, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.
- U.S. Environmental Protection Agency (EPA). Urban Waters Initiative. <https://www.epa.gov/urbanwaters>. Accessed: October 18, 2017.
- U.S. Environmental Protection Agency (EPA). Wetlands Protection and Restoration. <https://www.epa.gov/wetlands>. Accessed October 18, 2017.
- United States Water Resources Council. Floodplain Management Handbook, September 1981 (U.S. Government Printing Office) <https://catalog.hathitrust.org/Record/003141338>. Accessed: October 18, 2017.

---

## 8.0 Definitions

The following terms help provide consistency in conducting the work associated with this living document.

**Best Management Practices (BMPs)** – Measures intended to provide an on-the-ground, practical solution to diffuse pollution problems from all sources and sectors. These are technology- and education-based requirements in federal stormwater regulations that call for the implementation of controls to reduce the discharge of pollutants in municipal stormwater systems to the maximum extent practicable.

**Community Based Floodplain** – A floodplain modeled using hydrological and hydraulic data, information, and knowledge to predict current and/or future flood risks for an area.

**Comprehensive Plan** – A plan, including recommendations for new and operating projects, primarily for U.S. Army Corps of Engineers (USACE) implementation, but in coordination with other agency efforts and focusing on one or more USACE mission areas in Civil Works.

**Geographic Information Systems (GIS)** – A database of points, lines, shapes, and a set of attributes that are geospatially referenced and enable quality communication of the interrelationships of the data via visual aids, such as maps.

**Ecosystem Restoration** – The practice of restoring degraded significant ecosystem structural function and dynamic processes to a less degraded more natural condition; to improve or re-establish structural components and functions of natural areas; to mimic, as closely as possible, conditions that would occur in the area in the absence of human changes to landscape and hydrology.

**Feasibility Study** – For the USACE, this is a study lasting less than 3 years when adequately funded; it uses a specific six-step planning process to form projects with alternatives that are acceptable to the local and federal government to solve a problem. Also synonymous with Feasibility Planning Study.

**Flood Risk Management** – The shared practice among local communities and state and federal agencies of flood damage reduction that includes and extends beyond structural measures to 1) include the proper management of all parts of watersheds to address flooding, 2) address opportunities for wider, shared, programmatic approaches and multipurpose flood damage reduction projects, and 3) better clarify the level of risk associated with flood damage reduction measures.

**Non-Structural Measures** – Measures that do not include physical or constructed components but rely solely on policies, maintenance practices, or management activities.

**Risk Communication** – Integrating effective communication of risk and reliability concepts, alternatives, levels of risk, and the associated consequences to the public and other stakeholders.

**Stakeholders** – Those that have a stake in the outcome of a project and can provide vital input on issues that affect data, possible alternatives, and implementation actions of a project. Stakeholders include

---

sponsors, constituents, residents, businesses, groups, agencies, cities, non-profit organizations, and others.

**Structural Measures** – Measures that include physical alterations or constructed components as part of an alternative or plan.

**Water Quality** – A measure of the suitability of water for specific uses based on chemical, biological, and physical characteristics. These characteristics are compared to standards and guidelines to determine if the water meets designated uses. Water quality is affected by both natural processes and human activities, and a healthy environment supports a diverse community of organisms and protects public health.

**Watershed** – The area that collects and conveys rainfall to a common point along a stream or river; synonymous with basin.

---

# Appendices

---

## Appendix A. Tools: Detailed Discussion

The Planning Committee considered a long list of strategies and tools that could address the flood risk for the City of Arcadia. This section serves to describe the reasons for inclusion or rejection of those tools. The City of Arcadia Floodplain Management Plan (FMP) categorizes the list of strategies and tools as follows:

Strategy 1: Modifying human susceptibility to flood hazards

Strategy 2: Modifying the impact of flooding on individuals and the community

Strategy 3: Preserving and restoring the natural resources and functions of floodplains

Strategy 4: Modifying floodwaters

These four categories of strategies and tools were created by the Federal Interagency Floodplain Management Task Force during the formation of a Unified National Program for Floodplain Management (1994, p 9. [https://www.fema.gov/media-library-data/20130726-1733-25045-0814/unp\\_floodplain\\_mgmt\\_1994.pdf](https://www.fema.gov/media-library-data/20130726-1733-25045-0814/unp_floodplain_mgmt_1994.pdf)).

The following section describes the available tools in greater detail and is organized according to the four strategies listed above. The following tools have been classified as "Advisable," "Not Advisable," or "Further Evaluation Needed," as described in Section 5.0.

## A.1 Tools for Strategy 1: Modifying Human Susceptibility to Flood Hazards

### A.1.1 Development Policies and Land-Use Regulations

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

The City of Arcadia has a local floodplain ordinance. The Planning Committee discussed the potential application of local and regional development policies and land-use regulations to address flooding and other issues within the watershed. Topics that are addressed through the *Model Floodplain Ordinance* policy changes include:

- Prohibiting development in the floodway.
- Limiting development in the 1-percent-annual-chance floodplain

Topics that could be addressed through policy changes include:

- Prohibiting and/or limiting:
  - Development in historical flood areas.
  - Development in future-conditions floodplain. (Floodplains show conditions at the time of the hydraulic analyses so they become outdated. Future conditions incorporate updated hydraulic modeling. Arcadia’s floodplain model is from the 1980s.)
  - Repair/improvements of existing structures in the floodplain.
- Establishing more protective floodplain regulations (e.g., higher minimum building elevations, compensatory storage)
- Limiting repair/improvements of existing structures in the floodplain (more than the existing ordinance).
- Establishing Comprehensive Plan policies identifying appropriate development/redevelopment areas outside of the floodplain.
- Revising land-use practices to reduce runoff and reduce development in the floodplain
- Developing waterway buffers that reduce erosion. This is already part of Administrative Rule NR 151 for developments 1 acre or more.
- Developing stormwater retention and detention requirements for development and redevelopment

The city’s floodplain ordinance can be more restrictive than the “model floodplain ordinance.” But, unless the county adopts similar standards, this may put additional burden on builders within the city limits.

This tool covers development policies, performance standards, and land-use regulations. Development policies can be found in the Comprehensive Plan for the city. These policies guide the community’s decisions of where new development or redevelopment should occur. Some of the above policy changes

are listed as a “Flood Hazard Mitigation Idea” in the Trempealeau County Multi-Hazard Mitigation Plan prepared by the Mississippi River Regional Planning Commission (MRRPC 2012 p3-17 and 3-18).

Land-use regulations can be used to implement a wide variety of site and building requirements, restrictions, and prohibitions to protect new and existing developments. The National Flood Insurance Program (NFIP) and the State of Wisconsin have established a minimum standard of floodplain regulations. These minimum standards are incorporated in the Standard Model Floodplain Ordinance written by the Wisconsin Department of Natural Resources (WDNR). Some of these minimum standards may not appropriately protect a community like Arcadia and the surrounding areas in Trempealeau County. Floodplain ordinances are sometimes incorporated in the zoning portion of a City Code. Stormwater detention is usually a separate ordinance for most Wisconsin communities. Overland flow route standards and buffer standards are usually incorporated in the Stormwater Ordinance.

This tool is readily acceptable as an effective measure to protect existing homes, businesses, and new developments from flooding. This tool is **advisable** to be included in the Action Plan of the floodplain management plan (FMP) to invoke changes to development practices within the city of Arcadia to better protect existing and future development from flood damages.

Land-use practices in the upstream watershed **need further evaluation**. There are known erosion and sedimentation issues. Agricultural practices can have a big effect on the sediment load in streams and rivers. Bank stabilization, stream buffer requirements, and reducing the amount of area used for row crops are potential methods for reducing sediment load in streams. Instituting these land-use practices will require collaboration with stakeholders outside of the City of Arcadia.

### A.1.2 Flood Warning Systems

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

Flood warning systems are a flood risk adaptive measure and are categorized as both an activity and a feature. Flood warning systems include several components and are usually part of a process included in an Emergency Response Plan. Components of a flood warning system include the following:

- Flood threat recognition system
- Flood warning dissemination system
- Emergency response actions (as documented in an Emergency Operations Plan [EOP], see section A.1.3)

Because a flood warning system is interrelated with an EOP, the tool is not an independent element. Maintaining the system and integrating it with the emergency action plan is an on-going activity. This is a “Flood Hazard Mitigation Idea” in the County’s Multi-Hazard Mitigation Plan (MRRPC 2012 p3-18).

### A.1.2.1 Flood Forecasting Inundation Map

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

The City of Arcadia could invest in the development of Flood Forecast Inundation Mapping (FFIM). These are inundation maps, created ahead of time, that represent the flooding extents at different stages of a given stream or river. The National Weather Service publishes forecasted river levels at the USGS stream gage for the Trempealeau River at Arcadia. The National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service (NWS) has created Advanced Hydrologic Prediction Service (AHPS) web pages for the Trempealeau River at Arcadia:

<http://water.weather.gov/ahps2/hydrograph.php?gage=arcw3&wfo=arx>. Used in conjunction with FFIM developed for the Trempealeau River, these forecasts can give the community hours of advance warning of the expected level of inundation. Similar maps could be developed for Myers Valley Creek and Turton Creek, and gages may be needed on these creeks. While there are not stream gages on these streams, there could be other means of developing a forecasted stage based on anticipated precipitation depths in the weather forecast. If FFIM is developed for Arcadia, the mapping should be tied to emergency action plans that define specific response tasks triggered by a forecasted stage for the river and/or forecasted rainfall. This is a "Flood Hazard Mitigation Idea" in the County's Multi-Hazard Mitigation Plan (MRRPC 2012 p3-18). This tool needs to be coordinated with tool 5.2.1.

### A.1.2.2 Warning Dissemination: Flood Warning Lights and Sirens

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

A flood risk communication tool can notify the public of dangerous conditions. For example, flood warning lights on roadways can notify travelers of high water on roadways and can prevent motorists from being trapped in moving water or worse, drowning, by warning of the dangers and the need to turn around.

### A.1.2.3 Warning Dissemination: Multimedia

<b>Advisable</b>	Further Evaluation Needed	Not Advisable
------------------	---------------------------	---------------

As a flood risk communication tool, multimedia approaches such as instant messaging and short message services (SMS) have advanced considerably, although other traditional means, such as radio and television, are also still relevant. An objective noted during public involvement work with the Planning Committee was to use public warning systems via multimedia outlets. Pre-identified roles could be established to present daily status updates channeled through the local television and radio stations, text messages, and social media outlets such as Twitter and Facebook. Another **advisable** step is to formalize public media engagement through documentation in the emergency action plan. This may include predefined messages that correspond to action stages based on the Trempealeau River gage at Arcadia.

### A.1.3 Emergency Operations Plans

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

An EOP for flooding defines the steps a community will take to prepare for, respond to, and mitigate against flood risk. Information included in the EOP includes:

- Flood risk management.
- Emergency communications.
- Emergency response.
- After-event actions.
- Flood risk adaptive measures.

These topics are discussed in greater detail in the following sections.

Developing an EOP is an **advisable** activity to create a prepared and resilient community in the face of the flood risk along the Trempealeau River. These plans need to complement the county EOP and the Wisconsin Emergency Response Plan (Wisconsin Department of Military Affairs, Division of Emergency Management). These plans should be periodically practiced and vetted via table-top exercises and small-scale simulated drills to ensure the variety of plans are up-to-date and accurate. This is a “Flood Hazard Mitigation Idea” in the County’s Multi-Hazard Mitigation Plan (MRRPC 2012 p3-18).

**Flood Risk Management:** Flood risk management is an element of every Emergency Operation Plan and correlates necessary actions based on flood risk as identified by elevations on the Trempealeau River, Myers Valley Creek, and Turton Creek. Emergency Managers for Arcadia and Trempealeau County can outline when certain actions should be initiated, including communication and response activities.

Trempealeau County is part of the Regional V Hazard Mitigation Plan. This plan support functions rather than individual hazards for planning and guidance during an event. The EOP includes planning and guidance measures to be implemented in response to hazards that may compromise county functions (e.g., Sheriff, Fire, Highway, Public Health, Social Services, American Red Cross), but does not specifically address different hazard types (e.g., flooding).

**Emergency Communication:** In an emergency it is important to communicate key information to the public. Emergency communication should describe the event, discuss the risks, and explain appropriate actions to be taken. An emergency is often chaotic and communicating necessary information is not always done adequately. An emergency communication guide can identify roles and responsibilities, templates, and suggested media outlets. This would promote the timely release of effective information and reduce the duplication of messages and/or limit conflicting messages from different sources.

Trempealeau County is working to implement a “Code Red” system that would provide emergency notifications such as storm warnings, road closures, and other emergency information via text message, telephone call, or email. Once adopted, this system needs to be promoted so it reaches a broader

---

audience and provides timely emergency notification. After the city incorporates department heads into this system, residents and businesses that are in the floodplain should be added.

**Emergency Response:** Trempealeau County has an EOP. During a flood event, Emergency Managers for Arcadia and Trempealeau County will initiate response activities based on the extent of the emergency. The EOP may specify the actions and responsible parties. Emergency response actions may include the following:

- Activation of an Emergency Operation Center
- Activation of outdoor warning sirens
- Mobilization of emergency personnel
- Road closures
- Evacuation of impacted areas

**After-Event Action Plans:** It is recommended that EOPs include guidance for completing after-event actions, including (but not limited to) the following:

- Damage assessment
- Debris clean up and material disposal
- Recovery communications
- Economic recovery

### **Flood Risk Adaptive Measure**

Flood risk adaptive measures are construction projects and/or operational actions that can be taken to lessen the likelihood of damages from flooding. Careful consideration needs to be made before selecting the appropriate flood risk adaptive measure. Items to consider are:

- The probability/frequency of flooding.
- The depth of flood waters.
- The velocity of flood waters.
- The duration of the flood event.
- The cost of the construction project or actions.
- The financial benefits from the measures taken, including:
  - Reduction in flood insurance costs.
  - Reduction in structural and content damage costs.

### A.1.4 Elevation of Buildings

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

This flood risk adaptive measure lifts an existing building to a higher elevation to reduce flood risk (e.g., greater than the elevation of the 1-percent-annual-chance flood). This measure may be implemented in several ways. The most common approach in this region is to elevate a building on earthen fill material. In some cases, the structure may be elevated on piles, pillars, or columns. The criteria for elevating buildings is in the Federal Emergency Management Agency (FEMA) Bulletin 10-01. This is a "Flood Hazard Mitigation Idea" in the County's Multi-Hazard Mitigation Plan (MRRPC 2012 p3-17).

Elevation of buildings may create an island within the floodplain, resulting in access challenges. Considering the type of flood risk for the Trempealeau River and Turton Creek, the island effect could last for a day or two and disrupt the ability to evacuate the elevated building or the ability of emergency service personnel to reach the building during a flood event.

This tool is generally accepted as a mitigation option for new and existing structures at risk of flooding. Further research and evaluations are required to understand better the cost and engineering aspects of the tool for the variety of structures in the Trempealeau River floodplain.

### A.1.5 Relocation of Buildings

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

This flood risk adaptive measure includes physically moving the at-risk structure out of the floodplain area. In some cases, relocation of a structure can occur on the same property where it is currently located. In other situations, relocating the structure outside the floodplain requires moving the structure entirely away from the property. When the structure is moved away from the property, the land is typically purchased and future development is restricted or prohibited. There is funding for this tool with WDNR competitive application. See Action Plan section. This is a "Flood Hazard Mitigation Idea" in the County's Multi-Hazard Mitigation Plan (MRRPC 2012 p3-17).

Further evaluation is needed to assess the feasibility of this measure to address risk in the floodplain in Arcadia. Additional research and evaluations are required to better understand cost-engineering aspects of the tool for the variety of structures in the Arcadia floodplain. Opportunities exist to study this tool in a comprehensive manner to create a list of projects that would be prioritized and ready to submit for federal or state grant funding.

### A.1.6 Wet Floodproofing

<b>Advisable</b>	Further Evaluation Needed	Not Advisable
------------------	---------------------------	---------------

Wet floodproofing includes measures applied to a structure and/or its contents to prevent or minimize damage by allowing floodwaters to enter the structure. Applied as a stand-alone measure, all construction materials and finishing materials need to be water resistant and all utilities must be elevated above the flood protection elevation (i.e., 2 feet above the base flood elevation). Wet floodproofing is generally

advisable for commercial and industrial structures and residential accessory structures when combined with a flood warning and EOP. This measure is generally not applicable to deep flood waters and/or high-velocity flows. The floodwaters within the levees are generally low velocity unless the levee is overtopped. This is a “Flood Hazard Mitigation Idea” in the County’s Multi-Hazard Mitigation Plan (MRRPC 2012 p3-17).

Due to the structural and health risks associated with allowing flood waters to inundate a dwelling, wet floodproofing is generally not advisable for residential homes. One exception is the use of engineered openings in an elevated or “crawl space” foundation of a home to allow flood waters to enter the elevated foundation and equalize the hydrostatic pressure of the flood waters, reducing the risk of damage to the foundation.

FEMA requirements (FEMA, August 1993, Technical Bulletin 7-93) and local floodplain regulations (city ordinance and Wisconsin Administrative Code NR 116.16) require permits and oversight by local officials for installation of wet floodproofing measures. Wet floodproofing measures could reduce the cost of flood insurance premiums for a structure if installed appropriately. Property owners wishing to utilize this method should contact their local Floodplain Administrator.

### A.1.7 Dry Floodproofing

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

Dry floodproofing includes measures involving sealing the walls of a structure with water-proofing compounds, impermeable sheeting, or other materials and using closures for covering and sealing openings from floodwaters.

This tool is applicable for commercial and industrial structures and can be used in residential homes in specific circumstances, such as when flood waters are not anticipated to be deep or move at fast speeds. This tool reduces flood risk but is not recognized by the NFIP for any flood insurance premium rate reduction when applied to a residential structure. Commercial and industrial structures can use this tool and realize reduced flood insurance premiums. Sump pumps and foundation drain pipe systems should be installed as part of the measure. FEMA requirements (FEMA, Technical Bulletin 10-01) and local floodplain regulations (city ordinance and Wisconsin Administrative Code NR 116.16) require permits and oversight by local officials for installation of wet floodproofing measures. This is a “Flood Hazard Mitigation Idea” in the County’s Multi-Hazard Mitigation Plan (MRRPC 2012 p3-17).

Dry flood proofing for residential structures would be an acceptable application for homes on the outer fringe of the area of the base flood and/or within the 0.2%-percent-annual-chance floodplain (500-year floodplain). These areas are generally impacted by shallow, low-velocity floodwaters that cause damage to flooring, HVAC, and other utility equipment low to the floor. Most residential basements are not constructed to withstand hydrostatic pressures and relief valves or wall openings may be necessary to prevent collapse.

### A.1.8 Berms and Floodwalls for Buildings

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

This measure includes the construction of compacted soil berms and/or installation of constructed walls to prevent flood waters from reaching structures. This flood adaptive measure is applicable on a small-scale basis to reduce the frequency of flooding. These measures can be placed at doors, around a single structure, or around a small group of structures. As a flood-adaptive measure, berms and floodwalls should be constructed to no higher than 6 feet above grade and generally cannot cause a restriction that would raise the elevation of the floodwaters.

Berms and floodwalls for buildings would be a tool for a small number of the homeowners in the Arcadia floodplains and are advisable in circumstances where construction of the berm or floodwall does not adversely impact adjacent properties or raise floodwaters. This tool requires a significant engineering effort to ensure it will not adversely impact adjacent properties and is designed to withstand the forces of floodwaters. Also, space constraints between structures can be a significant issue, requiring floodwalls instead of berms to be installed, which may be more expensive.

An engineering study is needed to help individuals understand the estimated cost and benefits to implement berms or floodwalls. Berms and floodwalls would not eliminate floodplain regulation and flood insurance requirements. To eliminate the need for flood insurance and floodplain regulations, the berm or floodwall would need to be substantially built to the level of a major civic works project, such as a levee, which would generally not be financially feasible for most property owners and neighborhoods.

### A.1.9 Fill or Conversion of a Basement for Buildings

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

This nonstructural technique consists of filling in the existing basement or converting the basement space to an uninhabitable crawl space, without elevating the remainder of the structure. The measure is applicable only if the first floor of the structure is above grade and higher than the base flood elevation. In addition to filling in an existing basement, property owners may also consider placing an addition onto the structure above the base flood elevation to compensate for the lost living space. Use of the former basement area for storage is discouraged because of the possibility of the space being converted back to living space. This measure may be particularly effective for some of the downtown commercial structures.

As this measure results in the reduction of living space, property owners may be reluctant to pursue this measure. However, it remains an acceptable tool to minimize the risk of flooding and can substantially decrease the cost of flood insurance. This tool is listed as “further evaluation needed” to better understand its cost and property owner interest.

### A.1.10 Acquisition of Buildings

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

This flood adaptive measure consists of buying the structure. The parcel of land also needs to be purchased to use most state and federal grants. The structure is either demolished or sold and relocated to a site outside of the 1-percent-annual-chance floodplain. The purchased land is then converted to passive open space, used for parking, recreational purposes, or allowed to be reclaimed by the river or floodplain. This measure could include the development of adequate and comparable home sites outside of the floodplain to provide locations where displaced persons may build new homes within an established community. This the first “Flood Hazard Mitigation Idea” in the County’s Multi-Hazard Mitigation Plan (MRRPC 2012 p3-17).

The feasibility of this tool will depend heavily on a funding mechanism. Federal, state, and local resources exist. The most likely funding sources are federal grants from Housing and Urban Development, FEMA, the U.S. Army Corps of Engineers (USACE), and state grants from the Municipal Flood Control Grant via WDNR. With these funding sources, the purchased land within the floodplain must remain undeveloped in perpetuity or could be used for recreation, such as a playing field, environmental enhancement, ecosystem restoration, or a combination of these. Concept projects should be studied and developed with consideration of multiple land-use opportunities. The creation of open space, public involvement processes, and other similar activities could provide eligible credit for the communities in the FEMA Community Rating System.

## A.2 Tools for Strategy 2: Modifying the Impact of Flooding

### A.2.1 Information and Education

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

A primary purpose of the floodplain management plan (FMP) is communicating flood risks and increasing the public understanding of flood hazards. City and county officials should, through a variety of methods and media, further inform residents, business owners, and the public of the flood risks for the community.

The city and county possess flood risk information available for the public in the form of Federal Emergency Management Agency (FEMA) flood insurance studies, local flood studies, as well as “non-regulatory” flood maps provided with these studies, and other flood risk efforts. Providing this information, or at least advertising that this information is available to the public, is an effective educational tool.

**Flood Risk Mapping:** The standard way for a community to express the risk of flooding is through the FEMA flood insurance rate maps (FIRMs). These maps show the area anticipated to be inundated in an event with a 1% and 0.2% probability of occurring in any year (also referred to as the 100-year event and 500-year event respectively) and the floodway. In addition to traditional paper floodplain maps, this information is made available digitally for web maps through FEMA at: <https://msc.fema.gov/portal> and at the Wisconsin Department of Natural Resources (WDNR) Water Surface Data Viewer. It can be located by searching this title on the internet and clicking on “floodplain.” These maps are in Appendix A. These maps are based on pre-1970s hydrology and gage data which is outdated. Therefore, the city realizes that the current flood elevations may be higher than mapped in the FIRMs.

In addition to the FEMA floodplain maps, other information on flooding in the area, such as historic floodplain maps, localized flood studies, and “non-regulatory” flood maps, may be provided to the residents, businesses, and property owners in an easy-to-acquire manner. This may include information about depth and/or velocity of floodwaters, inundation areas correlated to percent probability of flooding, or other information. These maps provide valuable information for flood preparedness to the impacted resident or business owner, as well as to city and county officials. The city and county should look to expand these map products and share them with the residents and business owners, where available.

The National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service (NWS) have created Advanced Hydrologic Prediction Service (AHPS) web pages for the Trempealeau River at Arcadia: <http://water.weather.gov/ahps2/hydrograph.php?gage=arcw3&wfo=arx>. The AHPS webpage includes information about current and predicted river stage and narrative explanation about extent of flooding corresponding to varying river stages. When stage-inundation mapping is developed for the City of Arcadia, it may be linked to predicted river stage at the AHPS website to provide predicted flooding extents. Such information would allow residents, business owners, and community emergency planners to develop contingency plans before flood events. This tool requires coordination with tool A.1.2 Flood Warning Systems.

During major flood events, the NWS will also provide a forecast of stages, which is valuable information to those needing to know the anticipated peak flood stage. Projecting the various stages of the river will provide several hours of advance warning for emergency management personnel and impacted residents and business owners.

**Information to Prepare and Recover:** Several state and federal agencies, such as the WDNR, American Red Cross, FEMA, and the National Flood Insurance Program, have prepared pamphlets, books, webpages, and other informational pieces on how to prevent, prepare for, and recover from a flood event. Officials from the city and county should continue to collect, review, and maintain a library of information to assist residents with these topics. This information should be readily available to residents and business owners via the city and county websites and local library.

Newsletters, newspaper advertisements, press releases, notices on utility bills and other government notices, social media, the city website, and direct mailings may also be used to actively communicate this information.

During the distribution of preventative, preparedness, and recovery messages, it is recommended to actively address identified vulnerable population groups such as the elderly, non-English speaking residents, and transient renters. Specialized information techniques are advisable to inform these vulnerable populations. Providing the information in multiple languages is also advisable.

### A.2.2 Flood Insurance

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

Trempealeau County and the City of Arcadia participate in the National Flood Insurance Program (NFIP) administered by FEMA. The NFIP is like most other types of insurance; however, it is controlled by the federal government and managed by FEMA. Through community participation in the NFIP, flood insurance is available to home and business owners and tenants of the properties. If an insurable structure is in a floodplain (1-percent-annual-chance of exceedance in any year) and a federally backed loan is involved, flood insurance is mandatory. For properties not in a floodplain in any year or when federally backed loans are not involved, flood insurance is optional.

Similar to other types of insurance, flood insurance transfers the financial risk of flood impacts to a broader population. This tool is considered effective in mitigating the impact of flooding and contributes to establishing a resilient community. Depending on the disaster and the situations, funds may become available through insurance claims, low-interest loans, or grants to recover from a flood event and to mitigate against future flood risks. It is the individual property owner’s responsibility to manage flood risks by having flood insurance that will cover damages. Therefore, this evaluation lists this tool as advisable for affected property owners.

### A.2.3 Community Rating System

<b>Advisable</b>	Further Evaluation Needed	Not Advisable
------------------	---------------------------	---------------

The Community Rating System (CRS) is a national program through FEMA and the NFIP that evaluates a community’s floodplain management efforts and rewards those efforts with reductions in National Flood Insurance premiums. The extent of those reductions is based on the community’s floodplain management performance. Trempealeau County and the City of Arcadia are not, yet, participants of CRS. To get the reduced premiums, a variety of proactive steps are necessary. This FMP can improve the community’s performance in the program and increase the premium discounts. Other activities, such as additional floodplain regulations, dedication of open space in the floodplain, and increased communication of flood risk can also qualify for insurance premium discounts. Several manuals on this topic are listed in the Reference section of this FMP.

### A.2.4 Tax Adjustments and Rebates or Grants

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

Tax adjustments, tax rebates, or municipal grants are potential tools to incentivize the establishment of more open space and/or encourage the construction and renovations of homes and businesses that are better protected from the risk of flooding. Most of the property along the Trempealeau River and its tributary creeks is privately owned. As a result, the tax adjustment strategy may be effective.

Open space along a stream provides an area for stormwater runoff and for flood waters to flow unobstructed by structures, preserving floodplain function. A tax incentive program could provide a property tax reduction in exchange for the dedication of the open space area through conservation and drainage easements.

Tax rebates or credits or cost-share agreements could be made available to home and business owners for a portion of the cost of materials and labor to build a new structure to a higher degree of flood protection than is required or to renovate an existing structure to mitigate the flood risk. The City of La Crosse started a cost-share program in 2016 for home owners that can remove their homes or lots from the floodplain using a FEMA Letter of Map Amendment or a Letter of Map Amendment – Fill.

More research is needed to determine if this tool would be a substantial benefit to both the property owners and the community and what mechanisms would be needed to make these tax adjustment and tax rebate programs successful. Part of this research is in the action plan as there are funding sources for the cost-share tool.

This could be partially funded by Municipal Flood Control Grant administered by the WDNR. Hazard Mitigation Grants and disaster assistance are also funding sources.

### A.2.5 Disaster Assistance and Emergency Relief Funding

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

The County’s Multi-Hazard Mitigation Plan (MRRPC 2012) supplements the state’s hazard mitigation plan and creates the opportunity to use emergency relief funds and hazard mitigation grants when they become available through a Presidential Disaster Declaration or other avenues from the state of Wisconsin and other federal agencies. These funds can address property owners’ needs after an event and reduce or remove the impacts of the flood hazards. The funding programs available are the Pre-Disaster Mitigation Program, Flood Mitigation Assistance Program, and the Hazard Mitigation Grant Program.

The U.S. Army Corps of Engineers (USACE) floodplain analysis for the city is a start at providing more data. An internal drainage study will provide the city with an opportunity to improve internal drainage and make information available so local emergency planners, responders, and impacted residents and business owners can receive accurate and timely information and devise specific planning efforts for flood events.

### A.2.6 Post-Flood Recovery Processes

<b>Advisable</b>	Further Evaluation Needed	Not Advisable
------------------	---------------------------	---------------

The City of Arcadia and Trempealeau County have significant training and experience in post-flood events. Both the Arcadia Building Codes and the Floodplain Regulations for the city and the county require homes and businesses impacted by flood waters to be inspected to ensure they are habitable and meet all regulations and standards. This is the first “Flood Hazard Mitigation Idea” in the County’s Multi-Hazard Mitigation Plan (MRRPC 2012 p3-18).

It is advisable that the regulatory entities along the Trempealeau River and the creeks continue to inspect damaged homes and businesses after flood events to ensure they comply with all regulations. In addition, the city should become a repository of post-flood disaster information on flood safety, clean up, and mitigation options for impacted property owners and their tenants.

Arcadia and Trempealeau County officials should also focus their post-flood recovery efforts on long-term needs for neighborhoods and/or the region. These efforts could include economic recovery and infrastructure recovery plans. A significant portion of the region’s commercial and industrial use is located along the river. Likewise, the sanitary sewer service for a substantial portion of the city and rural areas is located along these rivers. Fortunately, the existing Arcadia levee system provides some protection for many of these regionally vital amenities. However, any levee system does not eliminate the risk of flooding and contingency plans should be in place if the worst-case scenario occurs.

## A.2.7 Place High Water Mark Signs in Public Places

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

As memories of past flood events fade, the sense of urgency within the community to remain vigilant and prepared can wane. High water mark (HWM) signs create permanent reminders of how high flood waters reached during historic flood events.

As part of the National Flood Insurance Program (NFIP), FEMA’s HWM initiative is a community-based awareness program that increases local communities’ awareness of flood risk and encourages action to mitigate that risk. Participating communities post HWM signs in prominent places, hold a high-profile launch event to unveil the signs, conduct ongoing education to build local awareness of flood risk, and complete mitigation actions to build community resilience against future flooding. More information about the HWM initiative is available on the FEMA website: <https://www.fema.gov/high-water-mark-initiative>.

## A.3 Tools for Strategy 3: Preserving and Restoring the Environmental Quality of Floodplains

### A.3.1 Erosion and Sediment Control

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

The Environmental Protection Agency's National Pollutant Discharge Elimination System (NPDES) program is designed to mitigate the negative impacts of stormwater runoff entering downstream water bodies. As part of the NPDES program, the state requires permits for construction projects that will disturb 1 acre or more of ground. Permit applications must address minimal stormwater management and construction site erosion and sediment control measures. The city could adopt best management practices (BMPs) for construction sites applicable to sites smaller than 1 acre to prevent sediment from reaching the stormwater system.

The state of Wisconsin and Trempealeau County have adopted riparian buffer regulations for areas outside municipal limits requiring vegetated buffers extending 75 feet from the ordinary high-water level of streams and lakes (*Wisconsin Rules NR 115.05 Wisconsin Administrative Rule*). The state of Wisconsin also protects water resources with Wisconsin Administrative Rule NR 151.125.

The city will discuss policies and procedures for post-construction stormwater BMPs, including structural and non-structural measures intended to provide for long-term water quality improvement, for individual lots and/or entire subdivisions. However, if only the city implements these strategies without participation by the county, the cost for development in the city will be higher than in other communities and in the unincorporated parts of the county.

### A.3.2 Water Quality Enhancement

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

As described above in Section A.3.1, the state has plans, policies, and regulations in place that address water quality issues. These include pre- and post-construction erosion and stormwater BMPs and riparian buffer regulations. Partnerships with local groups, non-profit agencies, and/or the Wisconsin Extension Service may provide opportunities for collaboration. Programs at the University of Wisconsin-Eau Claire, University of Wisconsin-Black River Falls, and the University of Wisconsin-La Crosse may assist government entities in developing educational programs and provide private property owners with technical assistance to address water quality concerns. Other opportunities to implement water quality improvement measures should be pursued when considering and implementing floodplain management activities.

### A.3.3 Wetland Protection and Restoration

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

Wetlands are important role because they reduce the amount of sediment and other pollutants that enter a stream channel, provide stormwater runoff routing and detention, and can reduce flood waters in small-

intensity storms. The city has several mapped wetlands within the city limits. Most of downtown was built on wetlands. There are several wetlands within the watersheds of the Trempealeau River, Myers Valley Creek, and Turton Creek. Federal and state regulations dictate the protection of wetlands and promote avoidance, minimizing fill, or mitigation of wetlands. The continued protection of established wetlands in the city and county is a priority of all entities and should be considered in all floodplain management activities.

Where feasible, the restoration of wetlands should be considered in flood risk mitigation measures along the Trempealeau River and its tributaries. Wetland restoration may provide opportunities to restore natural floodplain functions and/or increase floodplain storage volume. Increases in storage volume can reduce the height of flooding downtown.

### A.3.4 Assess Natural and Beneficial Functions of Floodplains

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

Floodplains have the capacity to provide goods and services of value to society. Assessing their natural and beneficial functions is the process of identifying and quantifying the value a natural floodplain adds. Completing an assessment involves reviewing topographic information, flood inundation mapping, aerial imagery, soils maps, wetland maps, threatened and endangered species, invasive species, wildlife corridors, and other ecological characteristics of the study area.

Understanding the natural and beneficial functions of the floodplain allows a community to consider the value of those functions in relation to other community priorities.

### A.3.5 Enhancement of Recreation and Educational Opportunities

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

A variety of recreation amenities exist along the Trempealeau River and its tributaries, including Rudy Klink Deer Park along the Trempealeau River, Memorial Park above Myers Valley Creek, and the Arcadia Country Club adjacent to Turton Creek. Protection of these and other recreational facilities is a primary goal of floodplain management activities. In addition, floodplain management activities may provide opportunities to enhance or further develop recreational and educational facilities. For example, levee systems and easements provide opportunities for trails and habitat corridors.

The enhancement or expansion of recreational areas along the Trempealeau River and its tributaries could also preserve more open space in the floodplains. This will assist in preventing erosion, improve water quality, and potentially reduce flooding in the tributaries. Such improvements could include an educational component to describe a variety of functions and topics related to natural and cultural resources found in the watersheds. It is recommended that the city and county consider further evaluation of options for enhancing recreational areas and opportunities as part of floodplain management activities. Further steps could include a study to identify possible locations, easements, and funding sources.

### A.3.6 Preservation of Cultural Resources

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

The Trempealeau River watershed includes resources of cultural significance. Artifacts of Native American tribes and early European settlers can be found in the watershed. This watershed also contains buildings and infrastructure representative of the area’s past trapping and timber economies. The City of Arcadia has had some Native American artifacts in the southwest part of the city. The Wisconsin State Historic Preservation Office maintains a database of historical sites within the state and reviews proposed projects to promote the preservation of cultural resources. The City of Arcadia has also adopted an ordinance governing historic preservation (Ordinance 179, City Code Chapter 230 [<http://ecode360.com/29346372>]). As structural projects are proposed that are related to this Floodplain Management Plan (FMP), cultural resources must be considered and protected when discovered.

## A.4 Tools for Strategy 4: Modifying Floodwaters

### A.4.1 Dams and Reservoirs

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

Dams and reservoirs may reduce the risk of flooding by detaining floodwaters and reducing peak flow rates downstream. The nearest dam located upstream of Arcadia is the Bugle Lake Dam in Independence on Elk Creek. The nearest dam on the Trempealeau River is in Blair, approximately 25 miles upstream of Arcadia. Constructed in 1919, the dam creates a small lake upstream known as Henry Lake. Neither dam is for flood control; both are now used for recreation.

The small size of Lake Henry limits the ability of the dam to mitigate high flows on the Trempealeau River to provide significant benefit to Arcadia. Future evaluation should consider the impact of changes in dam operation on lake water levels, water quality, sedimentation rate, recreational use, and other factors.

### A.4.2 Stormwater Detention Basins

<b>Advisable</b>	Further Evaluation Needed	Not Advisable
------------------	---------------------------	---------------

Stormwater detention facilities slow the downstream movement of stormwater runoff, reducing peak flows. The City of Arcadia development regulations require new subdivision, redevelopment, and infill projects that are 1.0 acres or larger to meet stormwater discharge rate performance standards. These performance standards are sometimes met through construction of stormwater detention basins. The zoning ordinance requires a Stormwater Management Plan for conditional uses, commercial district, and nonmetallic mining. Other developments could be required to provide a Stormwater Management Plan, but minimum requirements need to be defined.

Detention structures may be undesirable near a stream and/or in the floodplain because the release of the stormwater from the detention basin could coincide with stormwater flowing into the area from upstream, possibly worsening the flood risks. The most appropriate location for stormwater detention structures is in the middle and upper reaches of watershed.

Few stormwater detention basins exist in the Trempealeau River Watershed. In areas outside the floodplain, stormwater detention basins have proven to be beneficial in decreasing the risk of flooding as well as improving sedimentation control.

Because of the dynamics of the Trempealeau River it is unlikely that stormwater detention basins will significantly reduce flood risks along the main stem of the river. However, these basins can decrease localized flooding, reduce the size of stormwater pump stations, allow the storm sewers to convey upstream developed flow, lessen the flood risk, and improve sediment and erosion control. This is an advisable tool when opportunities allow.

### A.4.3 Levees and Floodwalls

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

Levees and floodwalls are structures designed to hold floodwaters outside the protected area located within the levee and/or floodwall perimeter. The design of these structures requires significant engineering effort. Levees and floodwalls could reduce or eliminate the cost of flood insurance premiums for protected structures if the levee is certified by the Federal Emergency Management Agency (FEMA). The levees in Arcadia were not engineered before construction and are not certified.

The existing Arcadia levee system on the Trempealeau River was constructed in the 1950s by the city. This levee started at Cleveland Street and ended at Oak Street. A portion of the levee failed and was repaired in 1956 by the U.S. Army Corps of Engineers (USACE) and built to elevation 731.5 to 733 downstream to upstream. Since the completion of the levee system, the City of Arcadia has maintained the structure and its accessory systems. The levee system protects a portion of the city’s downtown area on the east bank of the Trempealeau River as well as residential areas south of Turton Creek.

Currently, the city is cooperating with the USACE to perform a feasibility study to evaluate structural flood risk reduction options, including expansion or modification of the levee. Further study will help identify where the levee could feasibly be routed and identify potential impacts to property owners. The feasibility study is scheduled to be completed in 2019.

With the completion of the USACE feasibility report, federal funding may be requested for a design and construction project. A recommended step is for the city to begin budgeting dollars towards the city’s share of the cost of property acquisition and construction. Due to the concurrent development of this Floodplain Management Plan (FMP) and the USACE levee feasibility study, later evaluation is needed to determine if this tool is advisable.

### A.4.4 Bridge Modifications

Advisable	Further Evaluation Needed	Not Advisable
-----------	---------------------------	---------------

Bridges and culverts tend to create restrictions that increase flood elevations upstream and can be expensive to replace if they are washed out by a large flood event. Raising or removing these structures can be one tool for reducing upstream flood elevations. However, removing restrictions upstream can sometimes result in higher flows downstream.

The City of Arcadia has several bridges that potentially exacerbate flooding problems. The Main Street and River Street bridges restrict flow on the Trempealeau River during flood events, which causes higher water surface elevations upstream of those bridges. One option to consider would be to remove the River Street bridge and raise the Main Street bridge.

The railroad bridge over Turton Creek is prone to clogging. The USACE feasibility study is evaluating whether there is a benefit to raising the railroad bridge.

Oak Street north of the bridge has washed out on several occasions, most recently in July 2017. The USACE feasibility study is evaluating whether there are options to modify or remove the bridge and how that would affect flood hazards along Turton Creek.

#### A.4.5 Landforms

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

The City of Arcadia and Trempealeau County recognize that some areas of the Trempealeau River floodplain may benefit from structural measures that are less substantial than a levee, but could direct floodwaters away from structures. A landform or training dikes have been used in situations around the country to better manage flows and reduce the risk of adverse impacts to land owners.

Landforms and training dikes may require less effort to implement than levees or floodwalls (due to fewer requirements for USACE and/or FEMA certification). However, hydrologic analyses of floodwaters (e.g., flood depths, flow velocities) are necessary to determine structure placement, design requirements, and affected properties. Use of this type of tool may be evaluated in the City of Arcadia and USACE levee feasibility study. Further evaluation is needed to assess whether landforms are advisable to address flooding adjacent to the Trempealeau River and its tributaries.

#### A.4.6 Channel Alterations, Diversions, and Bypasses

Advisable	<b>Further Evaluation Needed</b>	Not Advisable
-----------	----------------------------------	---------------

Channel alterations, diversions, and bypasses reduce the risk of flooding by diverting floodwaters around areas or structures that might otherwise be damaged. Channel alterations may include removing restrictions to allow floodwaters to move more freely, reducing flooding upstream of the restriction through measures including, but not limited to:

- Channel widening.
- Channel deepening.
- Altering channel roughness.

Channel crossings such as bridges are common areas of restriction. An important recommendation is to keep a well-maintained channel that limits the potential for restriction and obstructions caused by debris. Trees represent the highest vegetative restriction to the flood flows. The bridge's structural members will also be a place for flood borne debris to catch, causing an increase in flooding as well as damages to the bridge. The action of debris management could be a collaborative effort by the City of Arcadia and Trempealeau County and could be described in detail as part of a future emergency action plan.

In 1988, the USACE recommended the replacement of the Main Street bridge with a longer span and larger waterway opening and the removal of the River Street bridge.

Diversions and bypasses may be used to convey a portion of floodwaters around areas of higher flood risk or reduced hydraulic capacity. The feasibility of diversions and bypasses as a flood risk reduction tool

depends on the local hydrologic and hydraulic conditions present during flooding events, availability of land for channel construction, and other factors.

#### **A.4.7 Pump Stations**

<b>Advisable</b>	Further Evaluation Needed	Not Advisable
------------------	---------------------------	---------------

Pump stations are used to transfer water collected on the protected side of levees, floodwalls, and other flood risk reduction measures out of the protected area. Water may be pumped back into the floodplain, to the floodway or the main channel of the adjacent river, or to an alternate downstream location. Pump stations are often permanent structures; pump stations may also be mounted to portable trailers that may be transported on-site during flood conditions.

The City of Arcadia has a main pump station and three smaller pump stations installed for local drainage. These pump stations were not installed as part of the levee system. The pumps for the main pump station were installed at a shallow depth with little adjacent storage, which limits their ability to handle peak runoff events. If the USACE feasibility study results in a flood risk reduction project for the City of Arcadia, an interior drainage design must be developed that would consider modifications to the existing pump station or construction of a new pump station and installation of storage and conveyance to manage interior flooding.