City of Reading Recreation Trail and Flood Control Plan

Phase 1 Conceptual Plan and Trail Route

MILL CREEK WATERSHED COUNCIL OF COMMUNITIES

READING

Prepared by
Amec Foster Wheeler, Inc. and
Human Nature
Final Draft
July 31, 2017

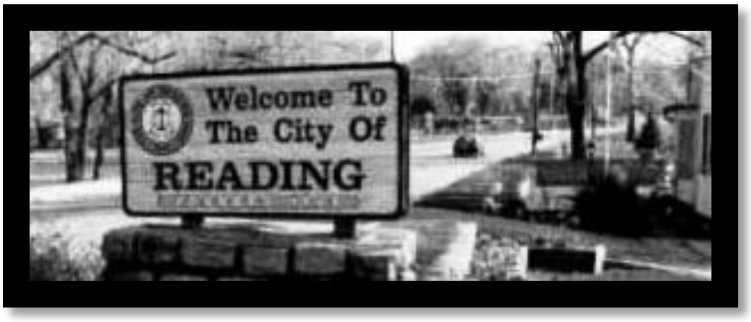
HUMAN NATURE

amec foster wheeler

Table of Contents

1.0 PROJECT BACKGROUND AND SCOPE

History



The City of Reading was founded on the banks of the Mill Creek in 1794 when Abraham Voorhees built a log cabin. The community continued to grow and in 1830 the population had reached two hundred, with forty five houses, five taverns, two general stores, two wagon shops, two blacksmith shops, two tailors, three shoemakers, a cooperage, and a tannery (City of Reading Webpage, 2016). Many of these businesses relied on an abundance of water in order to exist. Just as the abundance of water was a blessing, flooding has been a burden.

The Mill Creek is a prominent feature within the City, and flooding from the Mill Creek is an issue that has plagued the city of Reading since its founding. This problem continues to grow as the upper watershed of the Mill Creek develops and rainwater runs off of the roofs and parking lots of the new development. Flooding impacts Reading residents by destroying property, imperilling lives, decreasing property values, requiring costly insurance and decreasing the quality of life.

Along with the identified need to address flooding issues, momentum is also growing to form a regional network of bicycle and pedestrian trails, and the Mill Creek corridor has been identified by Tri-State Trails as an important regional trail corridor. Segments of the Mill Creek Greenway Trail have already been completed in the City of Cincinnati and more are planned.

The City of Reading, in partnership with the Mill Creek Watershed Council of Communities, was awarded Community Development Block Grant funds to prepare a concept plan to address flood risk reduction and recreation trail opportunities in Reading's Mill Creek Valley. Since these two issues are so closely linked, they were considered together as part of the same planning effort. This document is the result of the planning activity.

This report summarizes the steps that were taken to assess the existing conditions and to develop recommendations to reduce flooding and to improve recreation in the Mill Creek Greenway Corridor. The plan identifies opportunities for targeted improvements to address flood risk, while also identifying a preliminary corridor for the Mill Creek Greenway Trail through the area.


2001 Flood

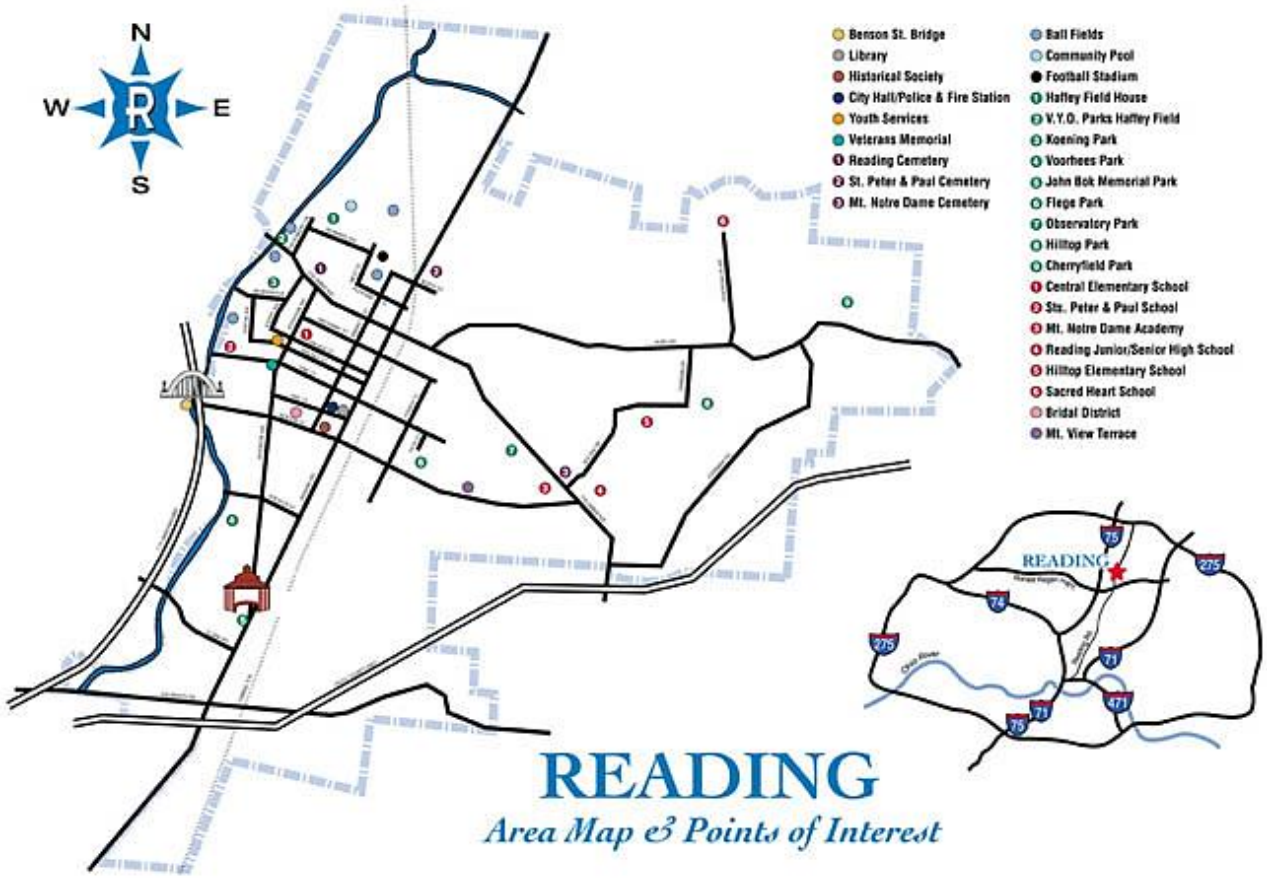


Figure 1:
The City of Reading is founded on the banks of the Mill Creek, which represents the majority of its western border. Reading is bounded by Evendale to the north, Lockland to the west, Sycamore Township, Cincinnati and Amberley Village to the South.

There are a number of corridors the traverse the city of Reading including I-75 to the west, Reading Road through the center, and the Ronald Reagan Cross County highway to the South. The Mill Creek corridor represents another major north-south corridor, which is filled with utility lines.

Issues associated with the Mill Creek that impact the City of Reading and its residents can be divided up into the following categories:

- Flooding
- Erosion
- Failing Infrastructure
- Log Jams
- Water Quality/Health Issues
- Aesthetics
- Brownfield Sites
- Lower Property Values
- Marginal Land Use
- Trash

Project Background

Many Reading households and businesses have been remapped within the 100-year (1% annual chance of occurrence) flood plain as a result of the issuance of revised FEMA Flood Insurance Rate Maps (FIRMs) in 2004 and 2010. This has resulted in significant flood insurance premium increases for residents and businesses, negatively impacting their financial sustainability and property values. At the same time, the Mill Creek Greenway Trail continues to expand in the City of Cincinnati, and the Village of Evendale has recently completed a bike and pedestrian master plan. The City of Reading will be a crucial corridor in this nascent regional trails network.

These two issues, which are presenting themselves at the same time, provide a unique opportunity to create a plan that will guide the City's response. Therefore, the City of Reading, in partnership with the Mill Creek Watershed Council of Communities, applied for and was awarded $20,000 in Community Development Block Grant funds to conduct a coarse- level planning analysis to address two issues:

- Recreation Trail Planning: Identifying the most feasible route for the Mill Creek Greenway Trail and opportunities for connecting trails within the City of Reading. Evaluate trail impacts to City parks and private properties.
- Flood Storage Opportunities: Identifying opportunities for creating flood storage areas on City-owned properties with the goal of removing Reading residences and businesses from the 100-year floodplain.

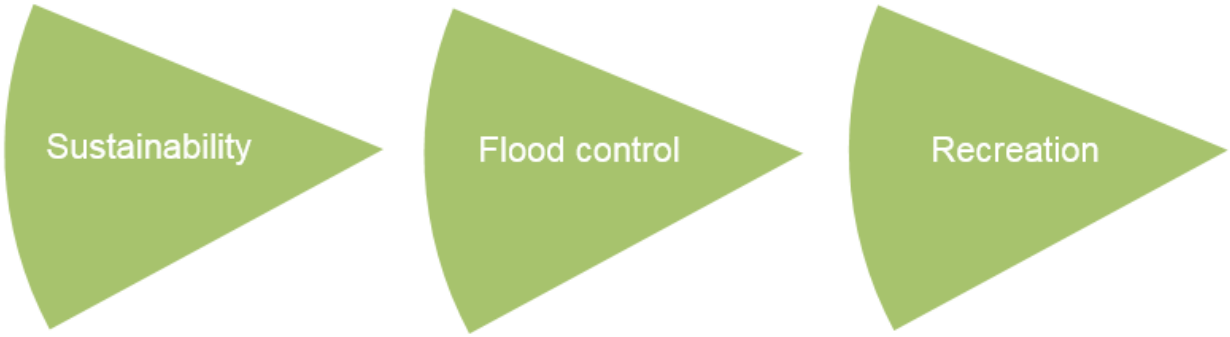
Flooding repeatedly impacts City assets and recreation areas, requiring costly cleanup and reducing available amenities for residents

Specific Project Scope and Goals

This work is a preliminary step in a larger process with the goal of ultimately generating a direct positive impact on the bottom lines of Reading residents and business in the form of reduced flood insurance premiums, improved recreational opportunities for City residents, and completion of a crucial connectivity link in the regional trails network.

The scope of this document is a concept- level study outlining the most feasible route for the Mill Creek Greenway Trail and opportunities for connecting trails within the City of Reading, and identification of opportunities for creating flood storage areas on City-owned properties with the goal of removing Reading residences and businesses from the 100-year floodplain.

It is intended to provide a solid planning foundation that will give the City the opportunity to leverage further grant funding for detailed engineering studies and implementation to address both the floodplain and recreation issues.



2.0 EXISTING CONDITIONS

The existing conditions along the Mill Creek are significantly variable, ranging from urbanized residential to industrial and commercial. Conditions include:

Deteriorating Infrastructure
Creek migration affects utilities and infrastructure. Flow impacts bridges, electric transmission lines, sewer lines, stormwater outlets, water lines, gas lines, CSO/SSO outlets which are costly to maintain or replace.

- Log Jams
- Water Quality/Health Issues
- Aesthetics
- Property Values
- Industrial Materials Storage
- Trash and Debris
- Park Connections
- Residential Land Use

Current statistics:

- 84 flood insurance policies
- Total cost $91,392 or a little over $1000 per structure per year
- Required for Home Loans by Lenders
- Affects property value and sales
- The County has estimated the value of property in the floodplain at $77 Million
- Approximately 227 homes and 39 businesses in the floodplain
- Only 32% of homes and businesses are insured in Reading

The impacts of a major flood would be staggering and would likely affect those least capable of dealing with the consequences such as finding an alternative place to live, loss of home furnishings, loss of records, loss of personal items, memorabilia, and other economic hardships. Many of the impacted are likely to be uninsured renters and senior citizens that own their homes.

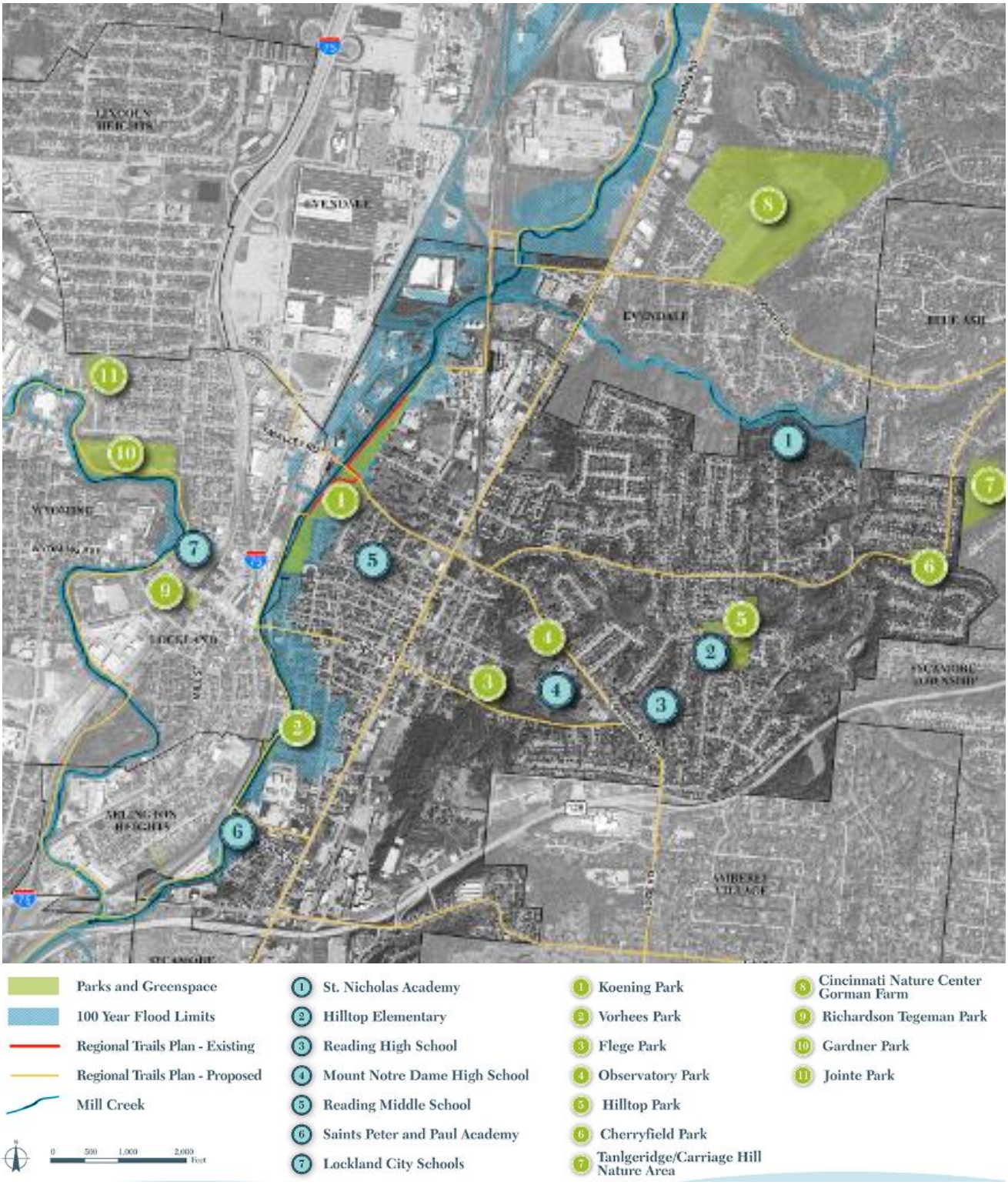


Figure 2: Map of existing study conditions and public spaces

3.0 FLOOD CONTROL

Introduction

The majority of flooding initially originated from two sources in Reading: backwater flooding from the Ohio River and flooding from runoff in the Mill Creek watershed upstream of the city. Historically, the Ohio River would change elevation as much as 60 feet, backing water all the way up the Mill Creek valley. The Corps of Engineers constructed a myriad of reservoirs throughout the Ohio River watershed to alleviate some of this flooding and completed the Mill Creek Barrier Dam in 1945 to prevent Ohio River flooding from entering the Mill Creek valley.

To protect Reading from flooding from runoff in the Mill Creek watershed throughout the early 1800s, fill was added to raise land to prevent flooding. For the most part, this has not been enough to elevate development above the 100-year floodplain. In the 1950's the Corps of Engineers constructed a dam on the West Fork Mill Creek creating Winton Lake and Sharon Lake on Sharon Creek to control a portion of the Mill Creek watershed. The dam was constructed in time to reduce the flooding impacts from the flood of 1959, but there was still millions of dollars in damage and 40 families were forced from their homes in Reading (ODNR 1959). A dam was also constructed across the Mill Creek at the mouth to the Ohio River to prevent the Ohio River from flooding out the valley.

Today, flooding can result in basements filled with mixed stormwater and sewage due to combined sewers and a sudden storm event. More common these days are storm events with higher intensity rainfall inundation in a shorter duration.

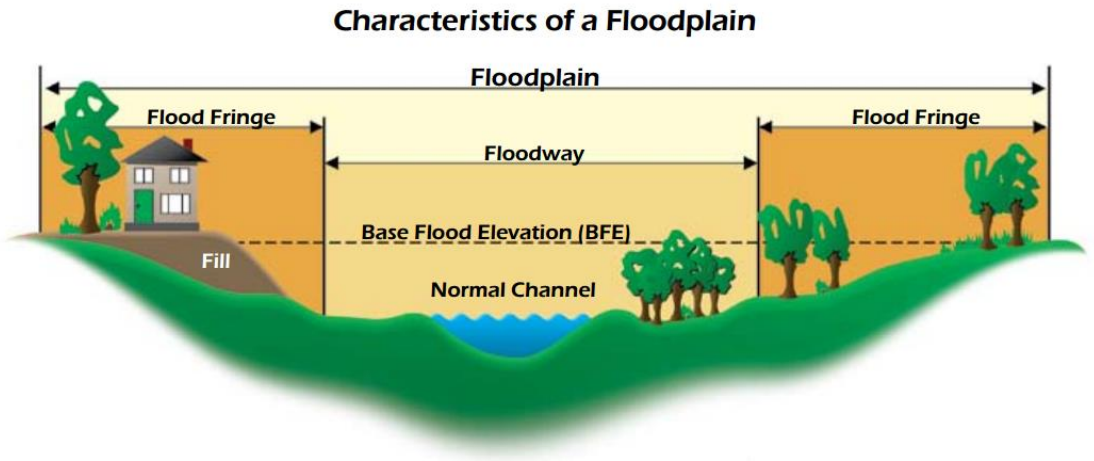


Figure 3:
Image Source: NFIP Guidebook, 5th Edition, FEMA Region 10

FEMA Vocabulary:

Base Flood – the 100-year (1% annual chance) flood.
Base Flood Elevation (BFE) – the elevation which the Base Flood is expected to reach.
100-Year Floodplain – The area inundated by the Base Flood.
Floodway – The channel and overbank areas that carry the bulk of the Base Flood downstream and must be left unobstructed.
Flood Fringe – The area outside of the floodway in the floodplain, subject to inundation by the base flood but with low velocity flow.

Existing Hydrologic and Hydraulic Models and Mapping

Effective Flood Hazard Models and Mapping Background

Flood hazards in the City of Reading and Hamilton were first studied and mapped by FEMA as part of the National Flood Insurance Program (NFIP) in the 1980s. Individual cities and unincorporated portions of counties were studied separately in the early years of the NFIP program, and the first effective Flood Insurance Study (FIS) reports and Flood Insurance Rate Maps (FIRM) became effective for the City of Reading in 1986. The surrounding municipalities and the unincorporated part of Harrison County all had published FIS and FIRMS become effective between 1980 and 1986.

The FIS and FIRMs were extensively revised effective May 17, 2004, as part of a nationwide effort to publish combined studies covering entire counties and to update maps using new digital mapping technologies as digital FIRMS (DFIRM). The new countywide FIS and DIFIRMS covered The City of Reading and surrounding jurisdictions with seamless flood hazard mapping, floodway data tables, and stream profiles for all studied streams in the county. As part of the countrywide report, new hydrologic and hydraulic analyses for Mill Creek was taken from the General Re-evaluation Report (GRR) ongoing study that was being performed by the USACE St. Louis District for the Mill Creek Valley Conservation District.

Further revisions to the FIS and DFIRMs became effective in 2010, and the current effective materials became effective on February 16, 2012. These recent revisions carried over the revised hydrology and hydraulics from the 2004 publications. These are the current effective NFIP flood hazard products covering the City of Reading.

The floodplain delineated on the DFIRMs from the effective model results extends over a large area of overbank area in Reading, including several developed areas. The most significant areas of overbank flooding shown on the DFIRMs are, from the downstream end of Mill Creek in Reading at Galbraith Road to the upstream end near the intersection of Reading Road and Cooper Road:

- The residential and commercial heart of Reading east of the creek from Clark Rd to Columbia Ave.
- Industrial area along Cavett Drive west of Creek.
- Dow Chemical plant east of the creek on West St.

Reading Hydraulic Model Review

The effective HEC-RAS hydraulic model was obtained by request from the FEMA data library and run in HEC-RAS to duplicate the published results. The reach of the model running through or adjacent to the City of Reading is from Galbraith Drive, between the cross-sections (XS) labeled as AP and AQ on the FIS profile and DFIRM to a point upstream of XS BE, near the intersection of Reading Road and Cooper Road.

There are no obvious constriction locations visible from the FIS profile and review of the HEC-RAS profile. If an existing bridge or other structure was undersized and causing backup of floodwater into the overbank, the HEC-RAS flood profile would show an abrupt increase in the calculated water surface elevation on the profile. The profile shows a gradual WSEL slope throughout the reach in Reading, with no bridges or other areas where the 100-year WSEL rises suddenly. So, there is no single bridge or constriction that could be removed or improved that would lower the floodplain elevation through the city.

Most of the bridges through the city are at a high enough elevation that the 100-year flood passes under them without contacting the low chord of the bridge deck. The only bridges that the 100-year water surface elevation overtops or comes close to overtopping are the two bridges on the Dow site. 100-year does reach the low chord at the Columbia Street bridge, but the calculated water surface profile shows that this is not a significant constriction. All others bridges pass the 100-year flow below the low chord, even if there is flow over the approach roadway in the overbanks at some bridges.

The cross-sections in the model are approximate, and very simplified. They appear to be based on survey or detailed mapping in the channel, but are approximated with very few data points on the overbanks. This is not unusual for large-scale mapping projects for flood insurance studies, but can be improved for a more accurate model and mapping.

4.0 RECREATION TRAIL

There are a number of existing parks along the Mill Creek, with no connectivity or ability to conveniently walk or bike between them. The recreation trail will:

- Improve and expand the greenway trail
- Provide amenities, educational and alternate transportation opportunities
- Be a linear extension of the parks
- Connect to other proposed trail segments
- Connect the community to the parks
- Work with the Mill Creek Restoration Project

From Greenway Plan:

Reading Greenway

The Voorheestown Bicentennial Trail is a multi-purpose trail that is conceptually planned to travel along the banks of the Mill Creek throughout the City of Reading. The existing trail, phase one, extends along the east bank of the Mill Creek through the northern portion of the City. Phase one is just under one mile in length traveling from the Veterans Memorial Stadium, north towards Evendale, then loops back south along the creek bank where it terminates after passing through Koenig Park.

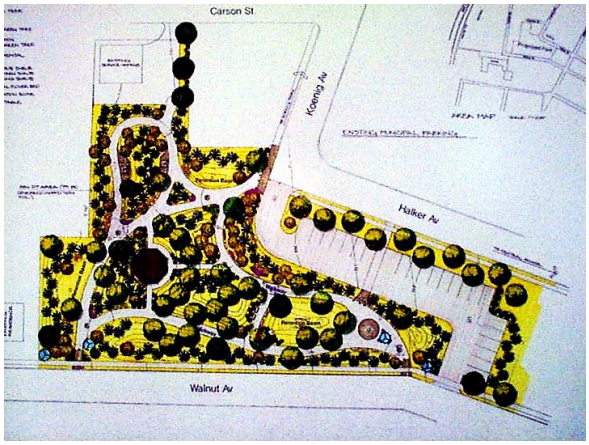


Figure 4: An illustration of the proposed Greenway/Quiet Park in Reading. (Drawing provided by City of Reading)

Phase one passes through the majority of the recreation facilities located in the valley of the City. The second phase of this trail extension is planned to extend the trail south from Koenig Park to Voorhees Park, near the southern end of the City. The overall length would be extended by 0.9 mile and would link all the parks and recreation facilities in the valley of this Mill Creek community. Furthermore, this extension would continue to broaden the interest and future development of the long envisioned recreation trail that will become an instrumental part of the Mill Creek Greenway project.

The multi-use trail is envisioned as a 12-foot wide, asphalt paved trail featuring, where appropriate, trail head signage, stop signs, crosswalks, trash cans, bike racks, rest stations, educational signage, landscaping, informational kiosks, restroom facilities and emergency telephones. The possibility exists in one area of the trail for development of a boardwalk trail tread allowing users a better view of the Mill Creek.

Committed and Potential Partners

American Discovery Trail, Archdiocese of Cincinnati, Army Corps of Engineers, Bike Pac, City of Reading, Hoechst Marion Roussel, Local businesses, Millcreek Valley Conservancy District, Mill Creek Watershed Council, Metropolitan Sewer District, Municipal Road Fund, National Association of Service and Conservation Corp., National Tree Trust, Ohio Department of Natural Resources, Ohio EPA, Ohio Historical Society, Ohio-Kentucky Regional Council of Governments, Property owners, Reading Board of Education, Reading Boy Scouts, Reading Chamber of Commerce, Reading Flower and Garden Club, Reading Girl Scouts, Reading Historical Society, Reading IGA, Reading Kiwanis Club, Reading Seniors, Rumpke, Sierra Club, Southern Ohio Chamber Alliance, South Western Ohio Trails Association, State Capital Improvement Project, Village of Evendale, and Village of Lockland

Greenway/Quiet Park, Reading

The "Greenway/Quiet Park" project is located on the site of the demolished water plant in Reading. The north border of this site is Halker, the south border is Walnut, the west border is Fenton and the east border is Jefferson. The project is .9 miles southwest of the Pristine Superfund site also located in Reading. The proposed project will be restoring to its natural state, the same amount of "green earth" that Pristine destroyed. Plans include a nature trail throughout the greenway. Future plans call for connecting this nature trail to the Voorheestown Bicentennial Trail and a future greenway being planned along the entire length of the Mill Creek. The close proximity to the Pristine site adds to the impact felt as the public will be kept aware of the devastation that took place and the site will provide a real life laboratory to show how long it takes and how difficult it is to reclaim what has been destroyed. The effort to restore the site, which is only 1000' from the Mill Creek, culminated in a project to create a Greenway/Quiet Park. The park will be landscaped to provide many trees, flowers, shrubs, walkways, benches, an environmental gazebo, a water feature, and will be dedicated to the preservation of the environment, especially our ground and surface water.

Committed and Potential Partners

Committed: Reading Community Schools, Reading Senior Citizens Club, Reading Historical Society, Reading Boy Scouts, The Garden Club of Reading, OKI Regional Council of Governments, Reading Bridal Council, The Mill Creek Watershed Council, Mill Creek Restoration Project, Rivers Unlimited, Hamilton County Environmental Action Commission, Reading Chamber of Commerce, Hoechst Marion Roussel. Potential: Archdiocese of Cincinnati, local businesses, Cincinnati Park Board, Cincinnati Recreation Commission, Cincinnati Water Works, Cinergy, Metropolitan Sewer District, National Tree Trust, Ohio Department of Natural Resources, Ohio EPA, Ohio Historical Society, Property owners, Reading Kiwanis, Rumpke, Sierra Club, Southern Ohio Chamber Alliance, Southwestern Ohio Trails Association, State Capital Improvement Project.

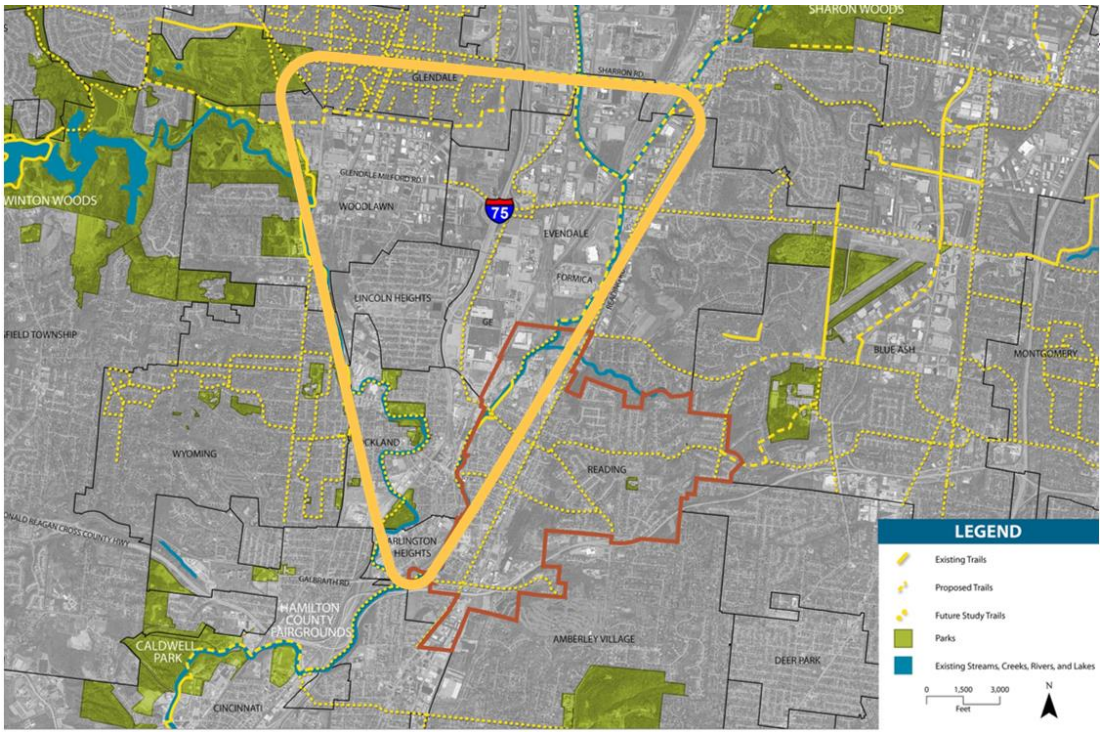


Figure 5: An illustration of existing and planned trails in the Mill Creek Corridor

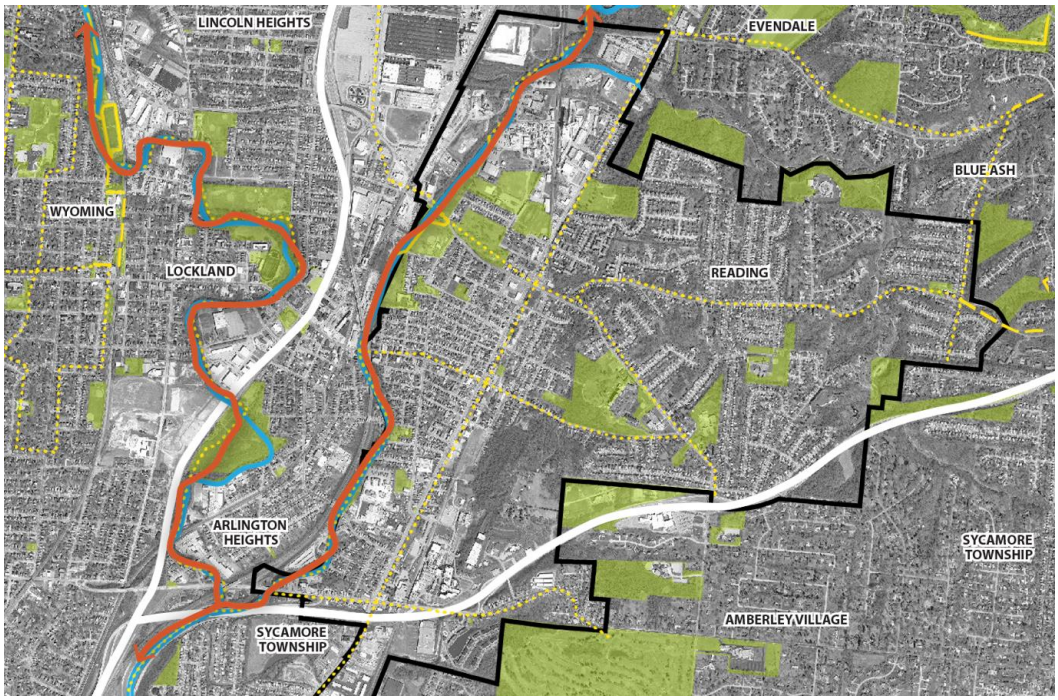


Figure 6: Potential linear greenway trail route

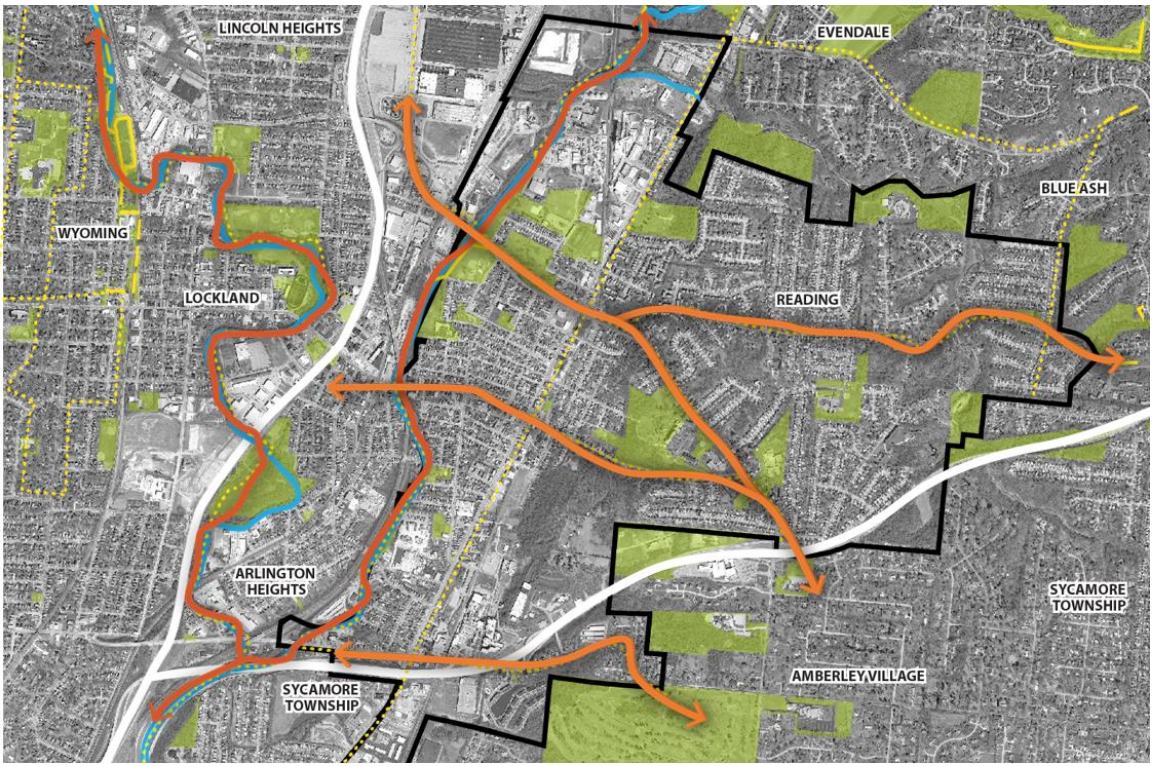


Figure 7: Future East-West connections through Reading

5.0 OVERALL RECOMMENDATIONS

In the world of conveying water and reducing flooding impacts, there are a limited number of measures that can be implemented. Often, a combination of these measures are used based upon a review of the land use impacts, environmental constraints, cost, funding source, and benefits to name but a few of the factors affecting selection.

The first step is to engage a consultant to implement more detailed hydraulic modelling to investigate the potential impact of the hydraulic model improvement recommendations noted. This will create a baseline that can be followed with analysing and implementing stream and structural improvements as a step by step process to evaluate the cost/benefit ratio of each recommendation. The recommended stream and structural improvements include:

1. Storage creation

   One of the easiest ways to reduce flooding is to create flood storage. Storing the water reduces the amount of flow in the channel, which in turn lowers the flow elevation, which reduces flooding in those areas that matter. Obviously, this storage must occur upstream or adjacent to where the flooding problem is located for it to have a beneficial effect. Areas identified with the potential for development of additional storage include:

   a. GE Aviation
   b. Barrett Paving- remove asphalt and possibly add storage
   c. Parks- may alter current use
   d. Drainage Company
   e. Brownfields

2. Increase channel size
   a. Over as much of the entire length as possible
3. Provide a two stage channel
   a. Over as much of the entire length as possible
   b. Will create bench for flood storage, riparian restoration and greenway trail
4. Increase flow efficiency through stream modifications
   a. Incorporate in-stream structures to create non-turbulent flow
   b. Create hydraulic jumps at bridges
   c. Create riffles at sewer crossings
5. Remove or modify constrictions
   a. Railroad bridge
   b. Bridge at Cincinnati Barrel
   c. Benson Street bridge

6. Berms or walls
    a. Establish minimum of 2 feet of freeboard
    b. Confirm potential site locations through modelling
7. Flood proofing
    a. Identify homes and businesses that are only slightly in the floodplain and can be cost-effectively retrofitted
8. Home demolition
    a. Identify homes that are firmly in the floodplain that have flooded repeatedly
    b. Identify homes in floodplain that are blighted.
9. Upper watershed retention
    a. Increase and improve retention in upper watershed as a possible long term solution
    b. Increase storage and decrease discharge in Sharon Lake.

The next step is to investigate and pursue available funding sources and grants to support the implementation including those listed below:

1. FEMA
2. Clean Ohio
3. MSDGC
4. WRRSP
5. Port of Cincinnati

SPECIFICS:

Hydraulic Model Improvement Recommendations

Areas with appropriate conditions for potential flood mitigation and improvement were developed and analyzed through review of:

- FEMA Floodplain Model
- Existing Plans
- Existing Land Use
- CAGIS Topography mapping
- Infrastructure
- Input at Public Meeting

Several updates could be made to the effective model to improve its representation of the flood risk in the City of Reading. These changes would be only in the detail and quality of the data in the model, and do not anticipate any physical changes to the stream, overbanks, or watershed.

Firstly, new cross-section data could be substituted into the model. GIS elevation data layers could be used to extract new cross-sections in the same locations as the existing cross-sections. The channel data and bridge geometries could be retained from the effective model if no better data is available.

Secondly, there are several bridges where the topography indicates that some flow bypasses the bridge opening by flowing in the overbank area, but the overbank area is not included or is blocked in the cross-section geometry. This forces all the flow in the calculation to go through the bridge opening, when in reality some passes over the roadway beside the bridge. This may result in a higher calculated floodplain elevation upstream of these bridges than is appropriate. The Koehler Avenue, Columbia Avenue, and small bridges on the Dow industrial site are modeled with this overbank flow not accounted for. Updating the cross-section geometry with more updated elevation data would address this issue and result in more accurate calculations at these bridges.

Modeling this improved, complete geometry of the overbank areas with connected flow paths defined would result in a more accurate model, and could result in changes to the calculated flood profile. The improvements may result in the calculated water surface elevations going down or up from the existing mapped profile, but would at least more accurately define the overbank developed areas that are flooded in the calculated 100-year event.

A third change that could be made to the existing model could lower the 100-year flood elevation profile, and would remove some areas from the mapped floodplain. One of the elements of a hydraulic model is a factor representing roughness or resistance to flow in the channel and overbanks. The factor used in HEC-RAS calculation is the Manning's roughness coefficient, commonly referred to as the n value. Different types of ground cover and stream type are represented by different values, and the higher the n the more restriction to flow. The n value seems to be set very high based on observations of the stream. It varies a lot from cross-section to cross-section where the land cover is similar. It is possible the values were set through calibration of the model against known events, but the FIS report does not go into that level of detail about the assumptions used in the model. Preliminary sensitivity testing of the effective model shows that lowering the n values throughout the reach to more directly approximate the observed land cover type lowers the 100-year elevation approximately 1.5 feet throughout the reach through Reading. This would bring the calculated flood elevation profile out of the developed overbanks in some areas, and reduce the number of buildings mapped in the floodplain. It is important to note this would not actually reduce the real flood risk at any location, just the modeled approximation of it. Figure 1 shows a plot of the calculated flood profile through Reading, with the existing effective model 100-year profile shown as a blue line with triangles at calculated points, and the preliminary revised profile with revised n values as the blue line below it

All of these changes would require a FEMA map revision to become effective and change the delineated flood hazards areas on the DFIRMs. This would require approval and sign off from the floodplain administrator and FEMA review and concurrence through the Letter of Map Revision (LOMR) process.

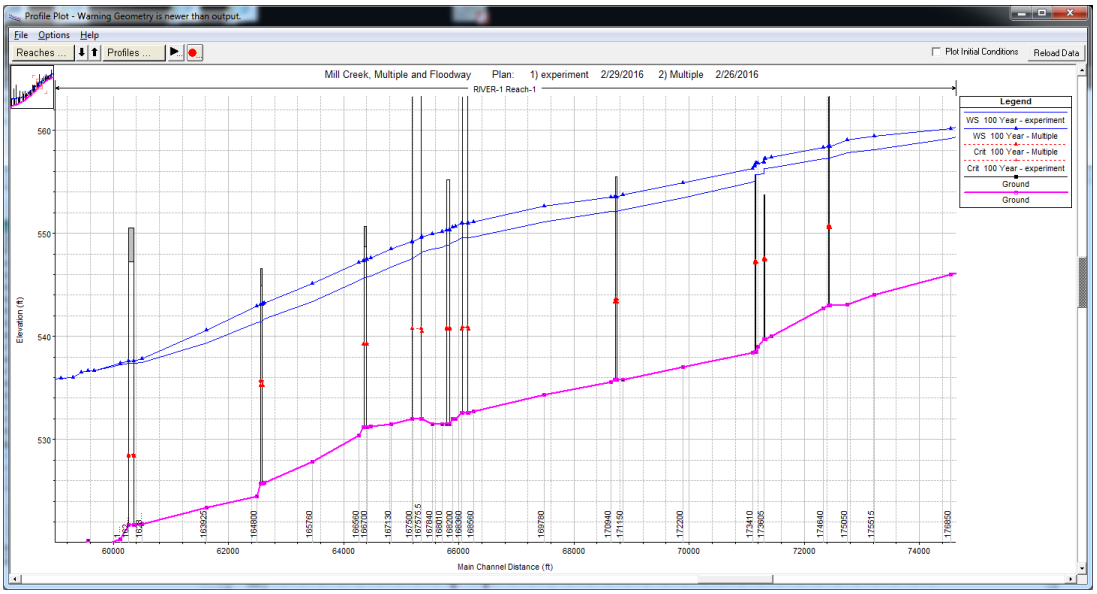


Figure 8: Example HEC-RAS 100-year profile

Stream and Structural Improvement Recommendations

Opportunities that are appropriate for the banks of the Mill Creek in Reading include:

Stream restoration
Floodplain creation
Brownfield clean-up
Economic redevelopment
Community revitalization
Greenway trail rRecreation
Water quality improvement
Bridge Modification

As described in the previous section, there is no existing structure or localized stream reach that was found to cause significant increases in the 100-year flood profile. That said, the bridges on the Dow site are overtopped in the 100-year event, and removing or rebuilding them at a higher elevation with more capacity could have a small impact on flooding upstream.

One method to reduce flooding is modification of the floodplain so that certain areas are designed to flood, while protecting other areas that are considered more valuable. Currently, the opposite of this is occurring. The floodplain is being filled in materials with very little value and it is changing the location and elevation of flooding. An example of this is the storage of asphalt waiting to be recycled. This area on the west bank of the Mill Creek occurs entirely in the floodplain. The enforcement of floodplain regulations would alleviate this immediate problem with flooding.

Floodplain Storage

There are numerous areas where the floodplain can be lowered by cutting out a wide floodplain bench capable of storing water and conveying it slowly downstream. An example of this is the Twin Creek Preserve built upstream in Sharonville. This park located at the confluence of the East Fork of the Mill Creek, Beaver Creek, and the main stem of the Mill Creek was subject to annual inundation that severely impacted adjacent businesses. The construction of a 5 acre wetland and floodplain benches resulted in a 1 foot drop in the 100 year floodplain elevation. The projects impact on smaller storm events is even more dramatic. Besides reducing the flood elevation, the park provides for active and passive recreation.

An area that has obvious potential for flood storage that everyone drives past every day is the floodplain located along Reading Road in front of the Formica facility. This parcel is located in Evendale, but for the use as an example, it has many of the attributes that we look for at other locations. These attributes include:

- Hydraulically connected to the Mill Creek (immediately adjacent)
- Large parcel size
- Parcel is unoccupied
- There are few utilities located on the parcel

The goal is to remove soil from an area such as this and to create an area that stores flood water and slowly releases it after the event. A portion of the water percolated into the ground, a portion evaporates, a portion is taken up by vegetation (especially trees) and is transpired into the atmosphere, and a portion flows back into the Mill Creek when the water elevation recedes. The use of this land is important so that it does not become orphan land which attracts dumping and neglect. The best use of flood storage areas is for recreation. The frequency of flooding in Reading is at its highest in spring, and decreases through summer and fall. Baseball and football fields can be designed to withstand periodic flooding. Greenway trails, picnic areas, and forested parks are especially suitable for inundation.

There are numerous locations in Reading that could be used to store floodwater. The best and largest area occurs at the location where the Mill Creek enters Reading. The property located behind GE Aviation meets all of the design criteria and is the single largest location. Only a portion of this parcel is located in Reading.

GE Aviation Lagoons

- Large parcel of underutilized land
- Majority of area above 100 year floodplain
- Excellent potential for flood storage at beginning of Reading reach of Mill Creek
- Other plans are being developed for this area
- Floodplain creation could be compatible use

The location of Barrett Paving Materials, is currently in use storing asphalt in the floodplain. While not meeting all of criteria for an ideal site, the removal of floodplain fill from the current location would reduce a liability for flooding. The further removal of material would result in flood storage and be an asset to the city for flood reduction. Of key consideration to the City is the impact that could occur to Barrett Paving if floodplain regulations were enforced and if the company chose to relocate.

.

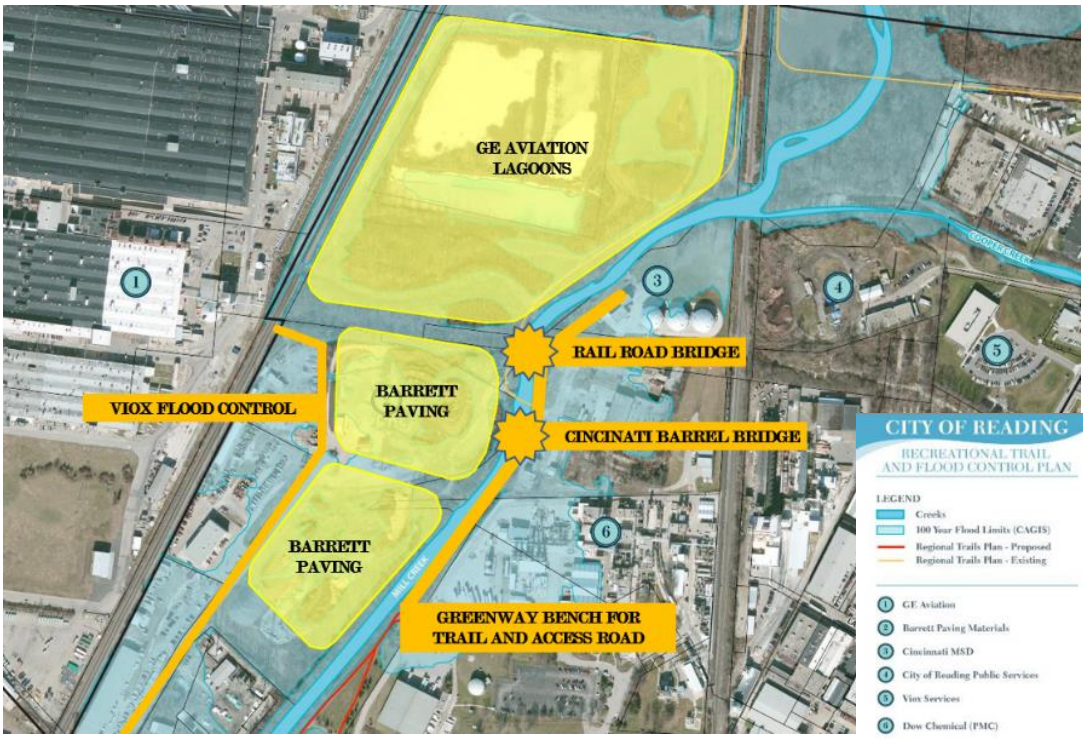


Figure 9: Floodplain Storage and Structures

The series of parks; Haffey Field, Koenig Park, and Saints Peter and Paul Church all fit portions of the criteria for flood storage. The use of these parks for increased floodplain storage would disrupt access and function during the modification and would require some reconfiguration of the parks to maximize active recreation areas. These parks are already affected by flooding and the modifications would generally increase the frequency of flooding and floodwater storage, but could potentially contain the flooding to less used, and better controlled areas. Modifications to the parks would include realigning fields, grading with a slight slope to encourage drainage, installation of more porous soils, installation of field tile and French drains, and flood proofing infrastructure such as restrooms. Using these methods, the parks would also drain much more quickly and damage to the facilities would be minimized.

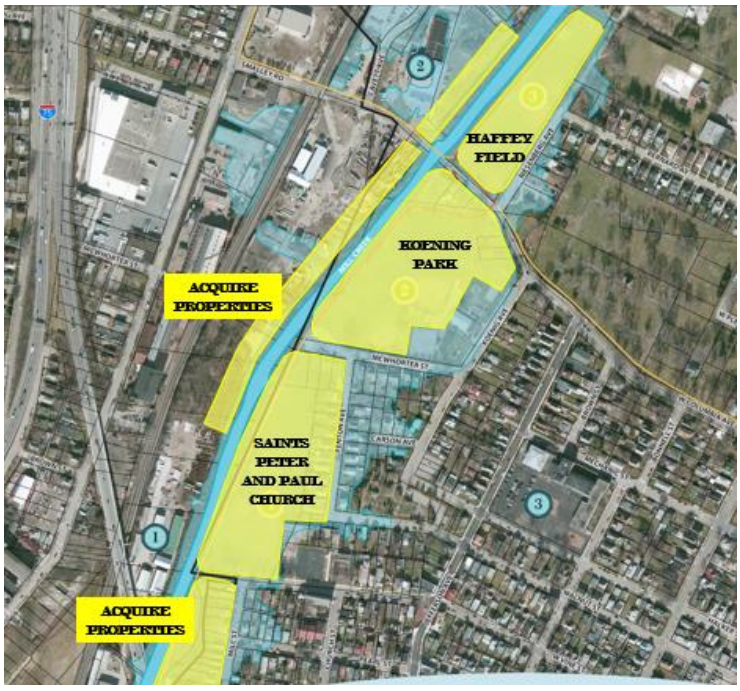
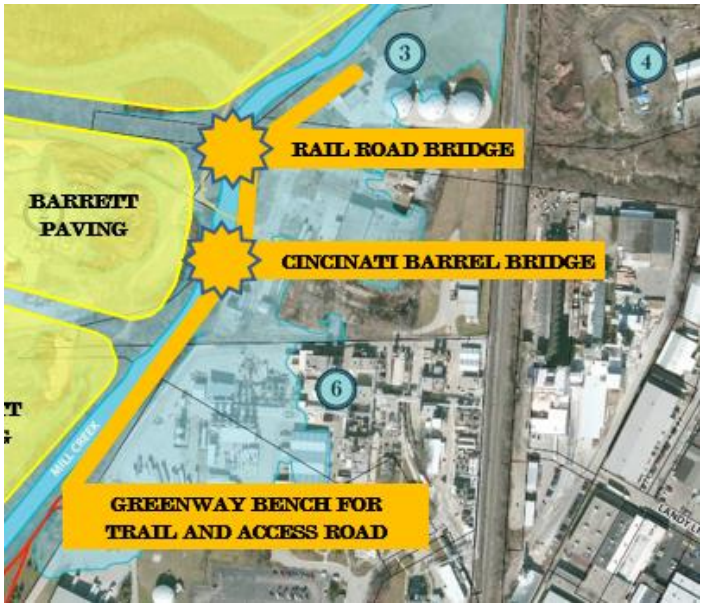


Figure 10: Floodplain Storage - Parks

Of lesser value, but worth consideration is the parcel of land located downstream from the West Columbia Road Bridge on the west bank of the Mill Creek. This is a brownfield site used on occasion to park semi-trailers. A long buffer of floodplain storage under the Duke transmission lines would increase both storage and flow conveyance.

Once past Saints Peter and Paul School, the opportunities for floodplain storage simply do not exist due to density of existing development.

Floodplain Bench/Greenway Trail



This concept calls for the installation of a bench on one or both sides of the stream to provide both flood storage and conveyance. This bench can serve multiple purposes including a greenway trail that can be used for recreation, utility maintenance and stream management. The banks of the Mill Creek would be excavated to provide a bench as wide as possible that would vary in width based upon constraints. This bench would be subject to yearly seasonal flooding. The installation of this bench would be challenging but very beneficial in the long term. In many ways, the city would just be recreating something that likely existed hundreds of years and was filled in with development. The installation of this bench would require the taking of land from businesses, residences, and parks. The width could range from as little as 20 feet to as much as 200 feet depending on fit and impact to businesses.

An asphalt road would be installed for bicycling, MSDGC and Duke Energy vehicles, Reading vehicles and police. The bench would have trees where utility lines are not present and shrubs and grassland where they are. This bench would connect all of the parks creating a long lineal park within the limits of Reading and would be consistent with the long term Greenway Trail Plan for the Mill Creek. When storms occur, the trail would be closed and the floodplain bench would then be flooded for a period of time, usually a few hours, but as much as a few days for periods of extended precipitation. The trails and bench would be designed so that flooding causes no damage and only minimal maintenance. Amenities on the bench could include educational signage, benches, exercise stations, overlooks, and other features that enhance the recreational value of this floodplain feature. There is a similar greenway trail located downstream that Caldwell Park that was installed by MSDGC.

Starting at the upstream terminus, the bench would begin somewhere at or near the MSDGC storage tanks and proceed downstream along the both sides of the Mill Creek. The trail would be located only on the east side. Proceeding downstream along the east side of the Mill Creek are a series of industrial parcels in various stages of abandonment and reuse. This bench would likely require the removal of the abandoned railroad bridge and the private bridge that is currently used by MSDGC. These bridges show only small hydraulic inefficiencies, but in fact log jams represent a continual risk to the community and a continual maintenance requirement to the city. Creating a large bench and a buffer zone could allow a new access

road to be constructed from Riesenberg Avenue. There are probably some brownfield/contamination issues that will need to studied and addressed.

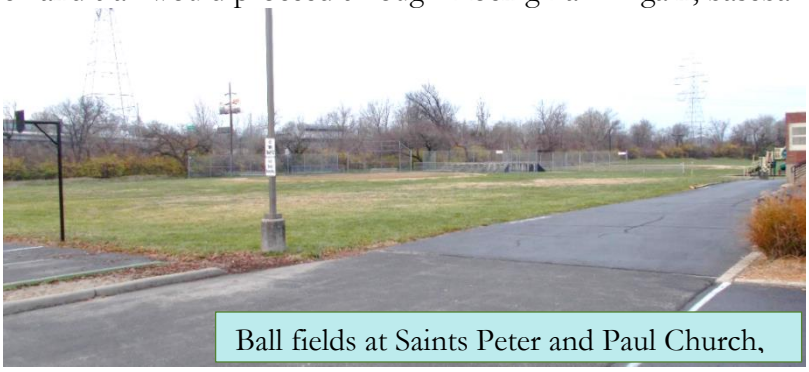
Proceeding downstream, the bench would be constructed at Haffey Field. This would not be much of a change since the Bill Elfers Fitness Improvement Trail is located here. The berm would be removed and a bench would be installed. Depending on the size of the bench, there could be a negative impact on the baseball fields that are wedged into this park. These diamonds may need to be reconfigured or under the concept of a linear park, they might be moved to one of the other parks downstream and perhaps soccer fields moved upstream to this location where the fit is more accommodating.

The bench on the west side would begin on GE Aviation property and progress downstream onto property owner by Barrett Paving. This bench would constrict how much and how close they could pile asphalt next to the Mill Creek. This bench would proceed downstream directly under Duke Energy transmission lines to the property of Discount Drainage Supplies and Valley Metal Works. The bench would affect storage and parking, although both could be designed into the bench.

Both benches terminate at the West Columbia Avenue/Smalley Road Bridge. A method to get traffic from the trail across this busy road would be needed.

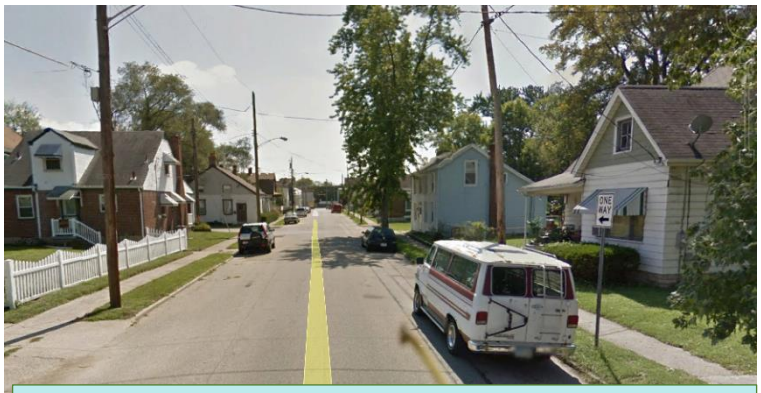
Downstream of the West Columbia Avenue/Smalley Road Bridge the bench on the west side would be located on a previously disturbed brownfield used periodically for parking trucks and trailers. The majority of the bench area would be under Duke Energy transmission lines and the bench would have to avoid the transmission towers. This bench would proceed to Mueller Roofing and terminate due to dense development right to the banks.

On the east side of the Mill Creek the bench and trail would proceed through Koenig Park. Again, baseball fields could be affected by the design and require reconfiguration. The bench and trail would impact the end of McWhorter Avenue, which could serve as a trailhead. The bench and trail would then proceed downstream at the Saints Peter and Paul recreational field. Again, baseball fields would be impacted by the bench, but could be reconfigured to allow for the coexistence of both.



Ball fields at Saints Peter and Paul Church,

Approaching West Vine Street, the bench would impact parking spaces at Saints Peter and Paul School. At this current time, this school is not in service. On the other side of west Vine Street are a row of homes located on Mill Street. All of these homes are located in the floodplain. Key to the floodplain bench/greenway trail is the acquisition and demolition of certain homes located immediately adjacent to the creek. These houses are relatively small, inexpensive and many appear to be rental properties. Many show evidence of deferred maintenance and there are many vacant lots. The creation of the floodplain bench would require the taking of these properties. Mill Street is the first location that houses are encountered, but going



Mill Street View, houses to the right would be acquired.

downstream more homes are encountered and this location will set the precedent for the acquisition of residential properties.

It is recommended that the creek side of Mill Road become a strip park/greenway parcel. The properties would be voluntarily acquired by the city using FEMA, Clean Ohio, or other source of money as the units became available. Once the buildings are acquired, the buildings would be demolished, a large bench up to Mill Street installed, and a trail, landscaping and amenities added. This would reduce flooding in the adjacent parcels and increase all of the surrounding property values.

Parking lot at Benson Avenue

At Pike Street, the building would also be removed at the end to accommodate the bench. The end of Pike Street would become a trailhead. The trail would then cross past Pike Street onto a parking lot located between businesses on Benson Street and the interstate. The trail would transition to the grade of the parking lot and would be located partially on the lot and partially under the interstate. A method to cross Benson Street would need to be installed.

Wachendorf Avenue, houses on the left would be acquired.

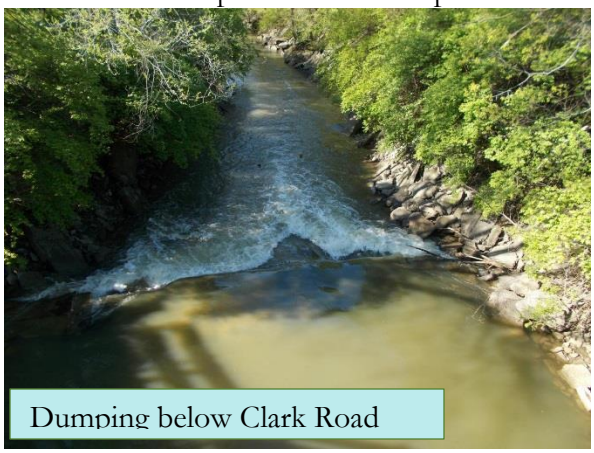
The bench would begin again downstream of the Benson Street Bridge. The bench and trail would require the row of houses located along Wachendorf Street to be acquired. Property acquisition and design would occur in much the same manner as Mill Street. This bench would proceed downstream to Bradley Avenue where another trailhead would occur. There is one residential property at the end of Bradley that would be have to be acquired.

Select residential houses would need to be acquired and demolished along Elm Court, Elm Street and Elm Lane. Elm Street would have a trailhead. The bench and trail would proceed downstream to Koehler Avenue requiring the acquisition of another house adjacent to the bridge. The trail would need to cross Koehler Avenue at grade and proceed into Vorhees Park where the bench would be reestablished. At this point the trail will have connected 4 major parks creating a linear park that can access 4 major parks with using major streets.

Mason Dixon Intermodal

The bench and trail would proceed downstream requiring the taking of houses at the end of Southern and Gebert Avenues. Trailheads could also occur at these locations. The bench and trail would then require the taking of a portion of the Mason Dixon Intermodal Parking Lot and continue to Clark Road.

It should be noted that on the west bank of the Mill Creek at Clark Road, there is a private access road. The banks of the Mill Creek have been covered with large quantities of dumped concrete slabs. It appears to be a continual process and is most likely not permitted. Notification to the Corps of Engineers would likely result in the removal of all or some of this material at the expense of the dumper.



Dumping below Clark Road

Downstream of Clark Road is some very dense development. There is a potential to install a smaller bench and trail behind some of the newer development and behind Hertz Equipment Rental.

Potential Private Property Improvements

Viox Services:

- Install berm or wall around facility and flood proof.
- Changes at Barrett Paving may affect floodplain at this location.
- Redraw floodplain map
- Similar to General Mills and Ford upstream

Valley Metal Works / Discount Drainage Supply:

- Cut floodplain bench behind buildings
- Plant bench with native trees and shrubs
- Costs to acquire industrial land

West Bank above Mueller Roofing

- Cut floodplain bench
- Install native vegetation
- Cost to acquire industrial land

Schweitzer Construction / About Space

- Modify channel to increase size and slope
- Install rock cross vanes
- Install riffle at sewer crossing
- Prevent filling in channel
- Install bench and greenway trail.

In-Stream Measures

The Mill Creek has been very disturbed through Reading with sewers, filling, dumping, bridges, utility lines, to name but a few. This section addresses the creek, specifically the channel, the banks, and the structures in the stream.

As a part of all floodplain benching, work will be performed in the channel to achieve a proper cross sectional area. This would include the removal of log jams, piles of debris, and other refuse. Trees overhanging the creek would be removed before they fall in. The goal is to achieve a stable channel that will convey water more efficiently through the city.

Once the channel is cleared, the banks would be restored using bioengineering. Bioengineering is the use of common engineering materials (ex. Riprap or rock) and native riparian vegetation to provide a bank treatment that grows stronger over time. The vegetation will help to prevent invasive plants like honeysuckle and tree of heaven from chocking the Mill Creek.

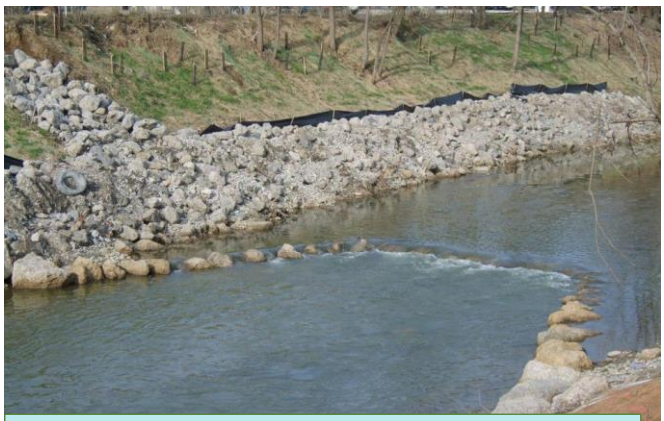
-

Riffle installed at a sewer downstream from Reading on the Mill Creek Bridge

The final measure is instream structures. There are 2 types, ones that control the elevation of the stream and ones that control the direction of flow. Both of these measures can be used to make the water flow more smoothly to increase channel capacity and to decrease erosion. Currently, the elevation of the Mill Creek is controlled by MSDGC by sewer crossings. These sewer crossings act as dams and sewers that cross the stream diagonally redirect the direction of flow. Bridges also constrict the flow of the creek and define the channel dimensions.

Riffles will be installed at all sewer crossings to stabilize the stream and direct the flow down the center of the channel. Rock cross vanes will be installed to direct the flow and increase the velocity under bridges. Both riffles and cross vanes have been installed both upstream and down from Reading and have greatly improved flow and stability.

Redirecting flow is important when the creek bends to tightly to accommodate infrastructure. A J hook vane is installed which moves the water away from the banks and into the center of the channel.



Rock cross vane located downstream from Reading on the Mill Creek

J hook vane located downstream from Reading on the Mill Creek

Floodplain Modeling and Letter of Map Revision

Once all of the measures that can be done to modify the Mill Creek have been performed, a floodplain model will need to be performed to determine the new floodplain footprint. A Letter of Map Revision (LOMR) would be submitted to FEMA to redefine the floodplain and to remove buildings that are no longer in the floodplain. At this time, no more flood insurance will be required

Bridge Structures

Railroad Bridge and Sewer Manhole

- Bridge no longer in use
- Pier in center of stream creates log jams
- Remove bridge, pier, and abutments
- Modify sewer manhole
- Reconnect stream to floodplain

Queen City Bridge

- Bridge piers create log jams
- Remove bridge and connect stream to floodplain
- Create a frontage road on east side of Mill Creek

Flood proofing

Undoubtedly, some structures are going to remain in the floodplain. A flood proofing study would need to be performed to determine if the building or business can be flood proofed. Flood proofing can be as simple as installing glass block windows in the basement and an anti-backup valve on the sewer. It could also be as complicated as raising the elevation of the building. One business on Benson Avenue went through this process and has saved a considerable amount of money on insurance. FEMA has a formal program to perform a flood proofing study and funds to implement. There is also a program to pay for flood proofing through FEMA. If buildings cannot be flood proofed, they could be relocated, demolished, or continue to pay flood insurance.

A more significant physical change that would reduce the flood hazard on the developed overbank areas would be to excavate a shelf along one or both banks of the stream. This shelf would provide additional flow area in the stream without impacting the low flow conditions in the stream bed. Detailed design and modeling could indicate what areas benefit the most from adding this type of additional conveyance, and if any of the existing bridges would then act as constrictions to flow and may require improvements.

6.0 NEXT STEPS

Next Steps/Recommendations

1. Initiate modelling activities described in Section 5 to identify potential gains from submitting a request through the Letter of Map Revision (LOMR) process.
2. Apply for grants to support further studies, brownfield clean up and economic redevelopment.
3. Seek out matching funds from local stakeholders, foundations, and agencies.
4. Acquire identified properties as they become available.
5. Develop a long range plan to construct the project incrementally based on available funding. The plan should identify and prioritize proposed improvements based on potential positive impacts and related costs

The typical procedure for completing a flood damage assessment for PL-566 watershed projects includes the following steps:

1. Inventory properties in the floodplain, including urban and residential land.
2. Develop a project beneficiary profile and assess the economic and social conditions of the area.
3. Interview business owners and develop damage curves for commercial properties.
4. Interview residents and develop damage curves for residential properties.
5. Interview public officials and develop damage curves for roads, utilities, and public properties.
6. Determine present condition baseline of other economic impacts such as water quality, water supply, or recreation impacts.