



City of Muscatine Comprehensive Plan

Chapter 4: Geographical and Environmental Conditions



Geographical and Environmental Conditions—Synopsis

Chapter 4 contains two major components. The first is a comprehensive review of the existing environmental and geographical conditions. These factors have shaped Muscatine, as one of the driving factors of the existing land use pattern. To understand how and where land use patterns in the Muscatine area might change in the future it is necessary to understand the limitations and opportunities imposed by environmental and geographical conditions. They include naturally occurring environmental and geographical conditions such as slope, watershed boundaries, flood plains, soil type, and wetlands; and man-made conditions including water quality regulations, air quality regulations, and regulatory flood plains.

The second component of this chapter contains the goals, which are intended to improve the environmental quality of Muscatine, making it a better place to live and do business. The goals were developed through a process of extensive input from the public and community stakeholders.

Specific existing environmental and geographical conditions analyzed include:

- Influence of Geographical and Environmental Conditions
- Topography
- Flood Prone Areas
- Forthcoming Revisions to Flood Zones
- Soil Characteristics
- Wetlands
- Sewer Separation
- Leaking Underground Storage Tanks
- Air Quality



Figure 1: Muscatine Riverfront and Mad Creek



Introduction

The layout and land use pattern of Muscatine is greatly influenced by geographical and environmental conditions. An understanding of how Muscatine has developed and will continue to develop in the future is not possible without examining these factors and how either encourage or inhibit differing land use. These factors include both the natural geographic features of the Muscatine area and man-made environmental conditions.

The layout and land use pattern of Muscatine is greatly influenced by the topography of the area. Much of the Muscatine area is dissected with numerous creeks and small streams that lay at the bottom of deep ravines. Avoidance of these ravines has significantly shaped the layout of Muscatine and will continue to do so as the area continues to develop.

From Muscatine's beginning in the 1830's as a river trading post the Mississippi River is the dominate and most important geographic feature. Nearly all the industrial activities that Muscatine was initially built on; most notably the lumber mills and then pearl button factories were made possible by direct access to the Mississippi River. The Mississippi River continues to play a vital role in supporting industry in Muscatine. Currently there are 12 river terminals, 10 in active use and two that are not being currently used, in the Muscatine area. Over the past 30 years the Mississippi River has acquired another role in community beyond its traditional one of supporting commerce and industry, that consists of 46 individual projects costing over \$18 million have transformed 29 acres stretching along two miles of the Mississippi River into an amenity rich, publicly owned recreational space.

All low-lying areas created by the Mississippi River and the many small tributaries in the Muscatine Area have historically been subject to periodic flooding. Construction of flood control structures, such as levees, has dramatically reduced the risks of flooding in many of these lying areas. However flood control structures have not removed all risk of flooding in the Muscatine. Many low-lying areas remain at risk of flooding. The Federal Emergency Management Agency has designated these areas, which are subject to 1% annual risk of being flooded, Special Flood Hazard Areas, they are also known as the 100-year floodplain or Flood Zone A. These areas are subject to additional land use regulations that are designed to prevent and minimize damage from flooding. Additionally many of these low-lying areas are also wetlands that are subject to federal and state regulations regarding land use.

Muscatine is one of the oldest communities in Iowa and has been a manufacturing hub for nearly as long. This means a significant portion of infrastructure in Muscatine predates current environmental regulations. Two of the largest single construction projects in the history of Muscatine, the City of Muscatine's \$50 million West Hill Sewer Separation Project, and Grain Processing Corporation with a \$100 investment in that will significantly reduce emissions, broke ground in 2011 and, upon completion, both are intended to, rectify violations of federal environmental regulations.

Topography

The layout and land use pattern of Muscatine is greatly influenced by the topography of the area. Future land use in Muscatine will continue to be shaped by the topography of the area. Property located within the planning area of the City of Muscatine Comprehensive Plan contains two landform regions; the Southern Iowa Drift Plain and the Mississippi Alluvial Plain.

The majority of the planning area is contained within the Southern Iowa Drift Plain, a landform created by ice sheets that extended south into Missouri over 500,000 years ago by amassing clays and unconsolidated sands and gravels over existing bedrock as the ice advanced and then retreated. The deposits were carved by deepening episodes

of stream erosion so that only a horizon line of hill summits marks the once-continuous glacial plain. This area is heavily dissected by numerous creeks, small streams, and ravines.

The highest points in the portion of the planning area part of the Southern Iowa Drift Plain region are found along the very flat crest separating the Mississippi River and Cedar River watersheds which roughly corresponds with the northern extent of the planning area, see Figure 2. From this crest there is a very gentle slope towards the Mississippi River. This slope culminates in steep bluffs which overlook the Mississippi River or downriver from the former mouth of the Muscatine Slough, (see Figure 4 on page 4-6), overlooking the semi-circular valley, located in the Mississippi Alluvial Plain landform region, as the Muscatine Island.

The portion of the planning area located in the Southern Iowa Drift Plain is drained by numerous creeks and small streams, the largest of these being Mad Creek. Most of these streams are associated with ravines. These ravines which heavily dissected this portion of the planning area can reach in some places depths of 125 to 150 feet and have slopes that greatly exceed 15%. These ravines are major impediments to development and avoidance of them has greatly influence the street network and development pattern in the Muscatine area. Figure 4 on page 4-6, which depicts all areas with a slope greater than 15%, illustrates how development and the street network have occurred in a manner that avoids the areas of excessively steep terrain. Future development in the drift plain almost certainly will continue this pattern of avoiding these areas with significant slope.

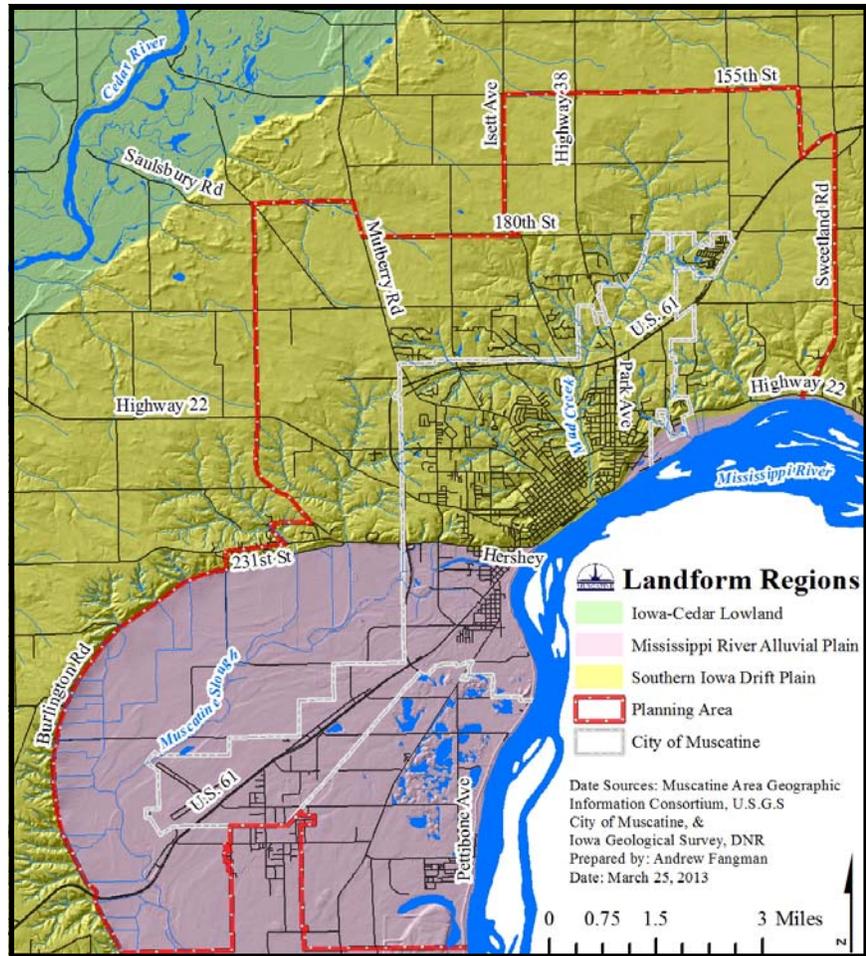


Figure 2: Landform Regions



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Many of the larger streams and creeks, most notably Mad Creek, have created floodplains where a risk of flooding is created by locally heavy storms, backwater from the Mississippi River, or more often a combination of both. Figures 15 through 22 on pages 4-19 through 4-26 illustrates the location of Federal Emergency Management Agency designated floodplains within the planning area.

The southern portion of the planning area that is located in the Mississippi Alluvial Plain landform region. The region is a broad semi-circular valley 19 miles long roughly bounded by the Mississippi River and steep bluffs running along Hershey Avenue and then Burlington Road, and is known as “Muscatine Island.” At the time of European settlement this area was a true island, separated from the rest of the area by the Mississippi River and the Muscatine Slough. Originally Muscatine Slough branched off the Mississippi River immediately south of the intersection of Hershey Avenue and Mississippi Drive, then flowed in a large arc to and reentered the Mississippi River approximately two miles north of Toolesboro in Louisiana County. Relatively early in the history of Muscatine the northern end of the Muscatine Slough was filled in.

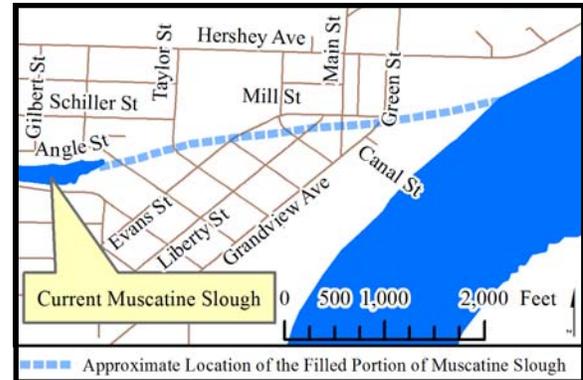


Figure 3: Filled in Portion of Muscatine Slough

All of the Mississippi Alluvial Plain that makes up Muscatine Island is located within the floodplain of the Mississippi River. Construction of flood control structures has removed threat of flooding from the Mississippi River, however as illustrated in , portions of Muscatine Island remain classified by the of Federal Emergency Management Agency as within the 100 year floodplain due because of internal drainage issues. (Figures 13 through 22 on pages 4-19 through 4-23) Frequent inundation by the flooding Mississippi River and the river periodically shifting course across this area has left an extremely flat landscape covered with thick layer of sand and gravel deposits.

While the sandy soil in this area can be classified as excessively drained with a low water-holding capacity, it is especially suited to fruit and vegetable growing. For this reason development in this area was based around fruit and vegetable farming among the crops that have been farmed in this area are sweet corn, squash, cabbage, potatoes, sweet potatoes, green beans, and tomatoes, but the area is perhaps best known for its sweet, juicy melons. Heinz which has operated a facility in Muscatine for nearly 120 years was attracted to area by the produce grown on Muscatine Island. The thick and sandy nature of the soil in the area combined with a high water table has given Muscatine a reliable source high quality source of potable water that requires only minimal treatment. Muscatine Power and Water obtains its water from wells in this area. The large gravel deposits in this area have creating extensive sand and gravel mining operations along Pettibone Avenue.

All of these Muscatine areas ultimately drain into the Mississippi River, however there are several smaller watersheds within the planning area that drain to the Mississippi River along a different route. Watersheds are important to developments in that storm and sanitary sewers can only cross watershed boundaries by making use of pumping stations. Figure 5 on page 4-7 depicts watershed boundaries in the Muscatine area. These watershed boundaries are also depicted on the more detailed topographic maps contained on pages 4-8 through 4-15.



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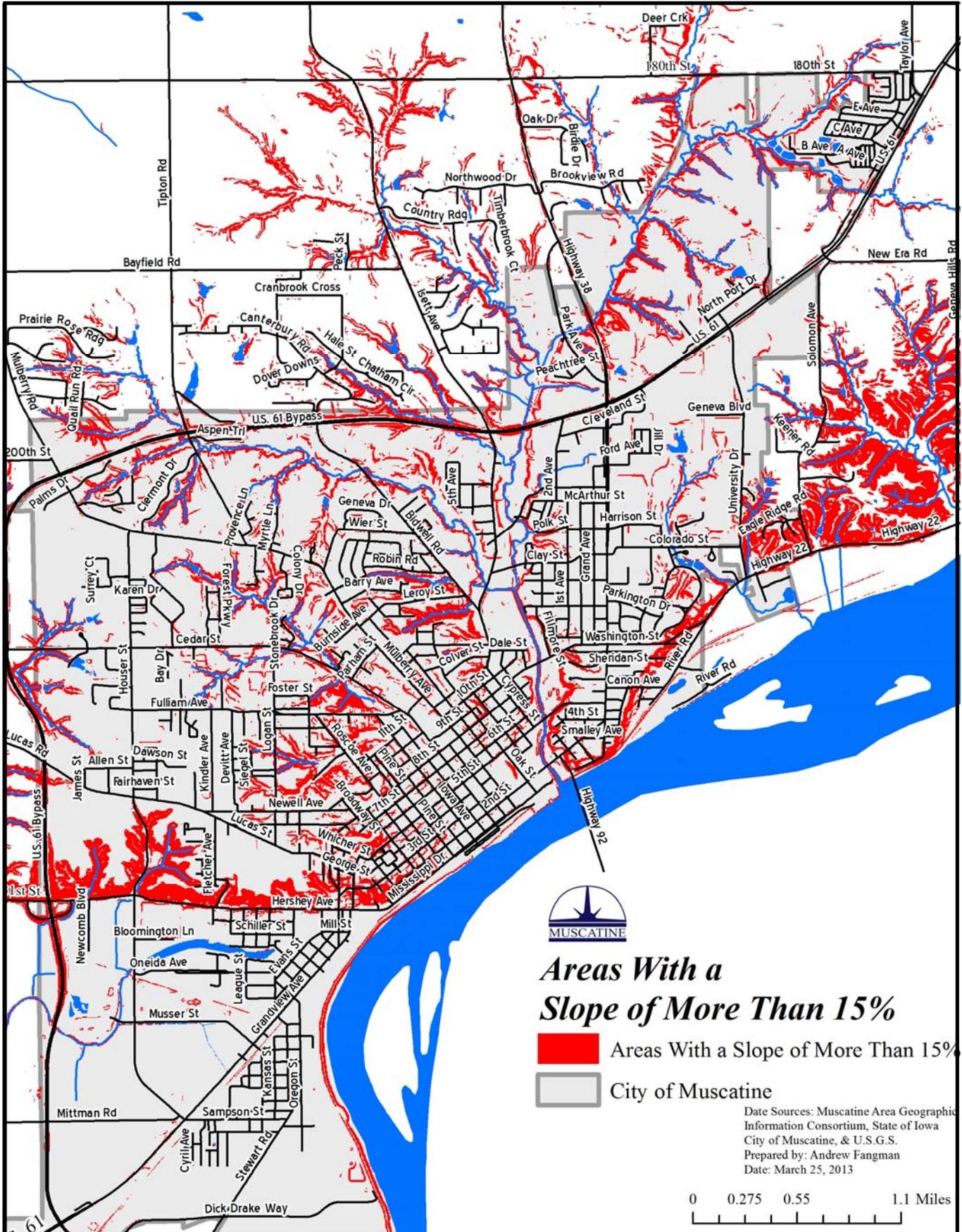


Figure 4: Areas With a Slope of More Than 15%



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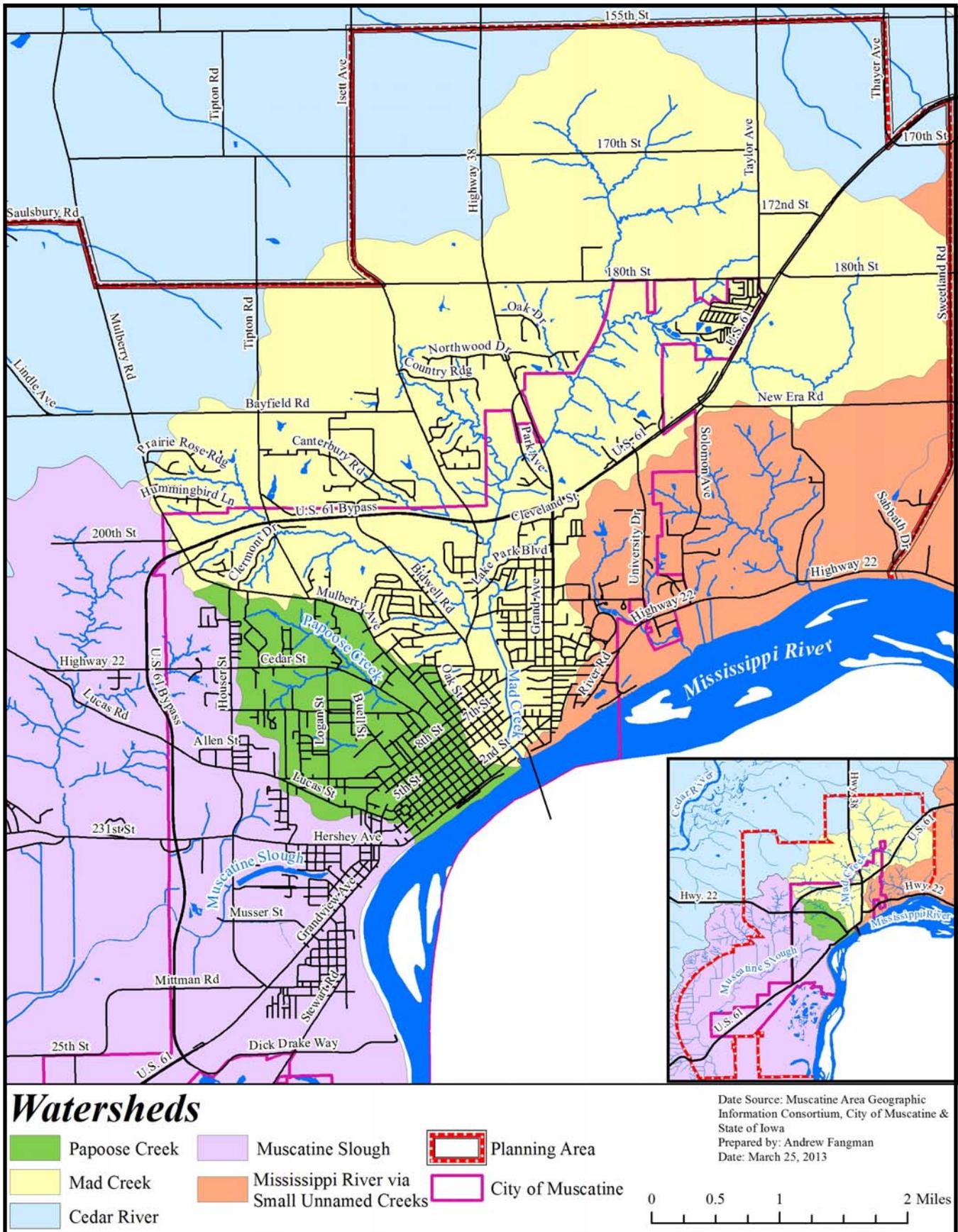


Figure 5: Watersheds



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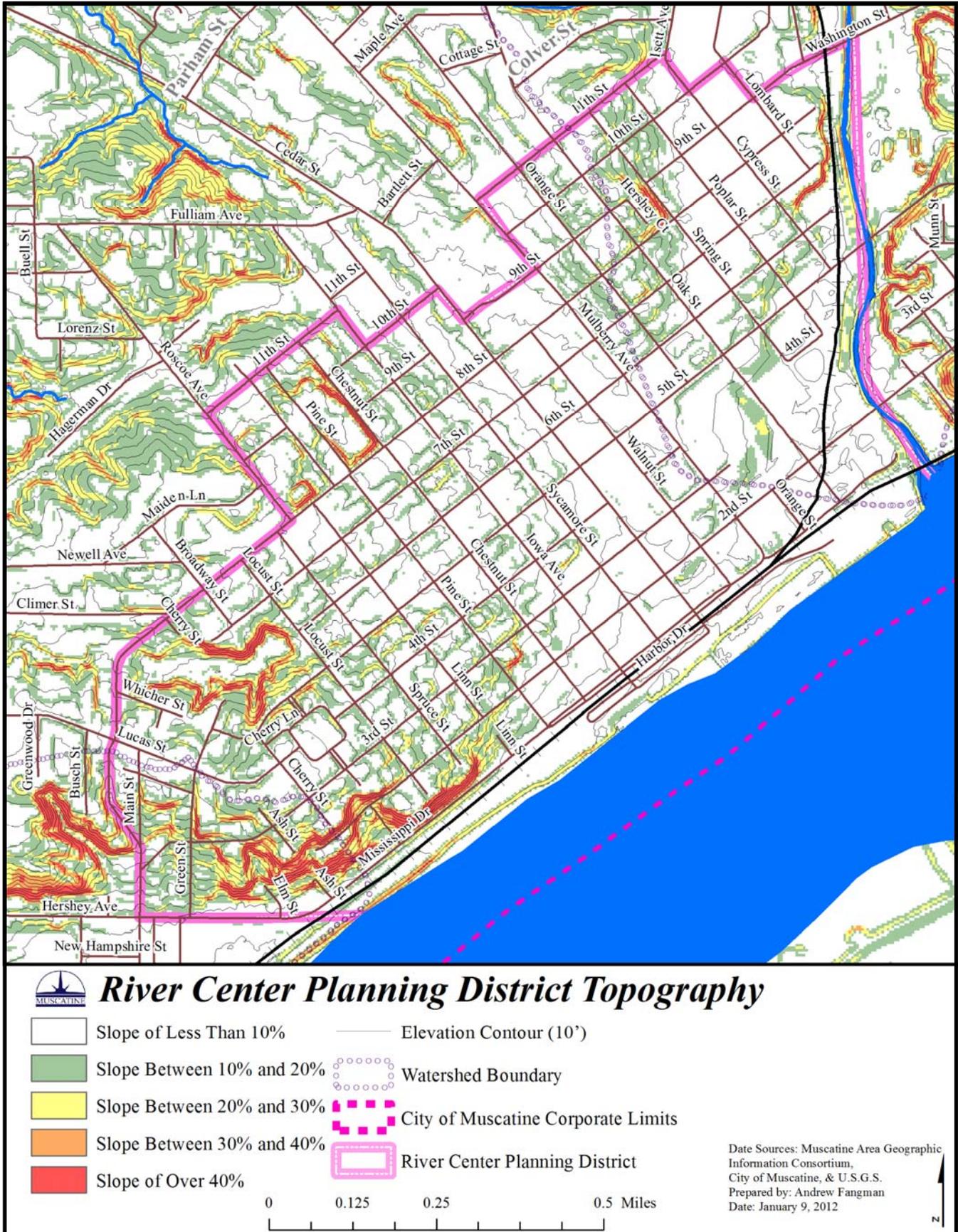


Figure 6: River Center Planning District Topography



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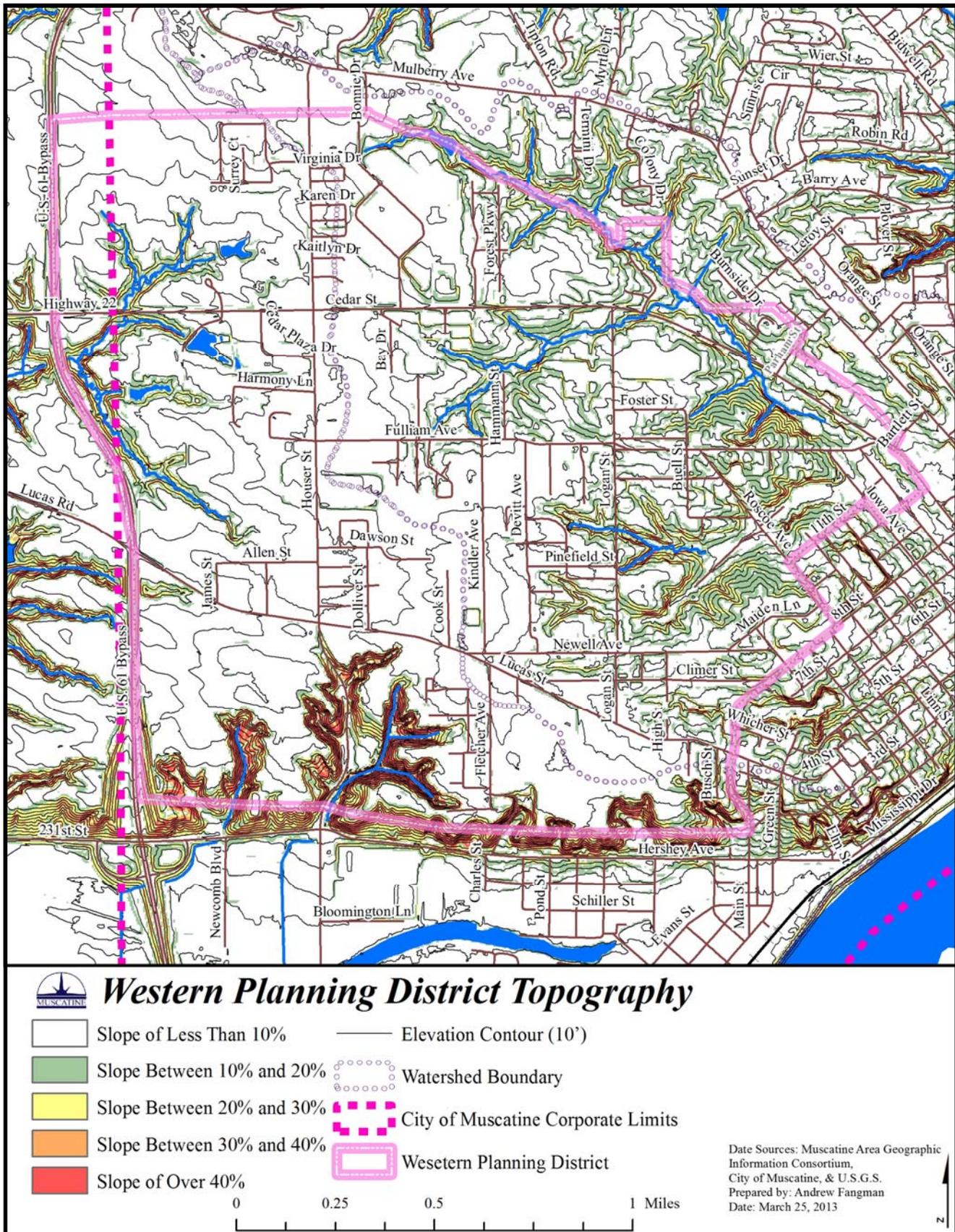


Figure 7: Western Planning District Topography



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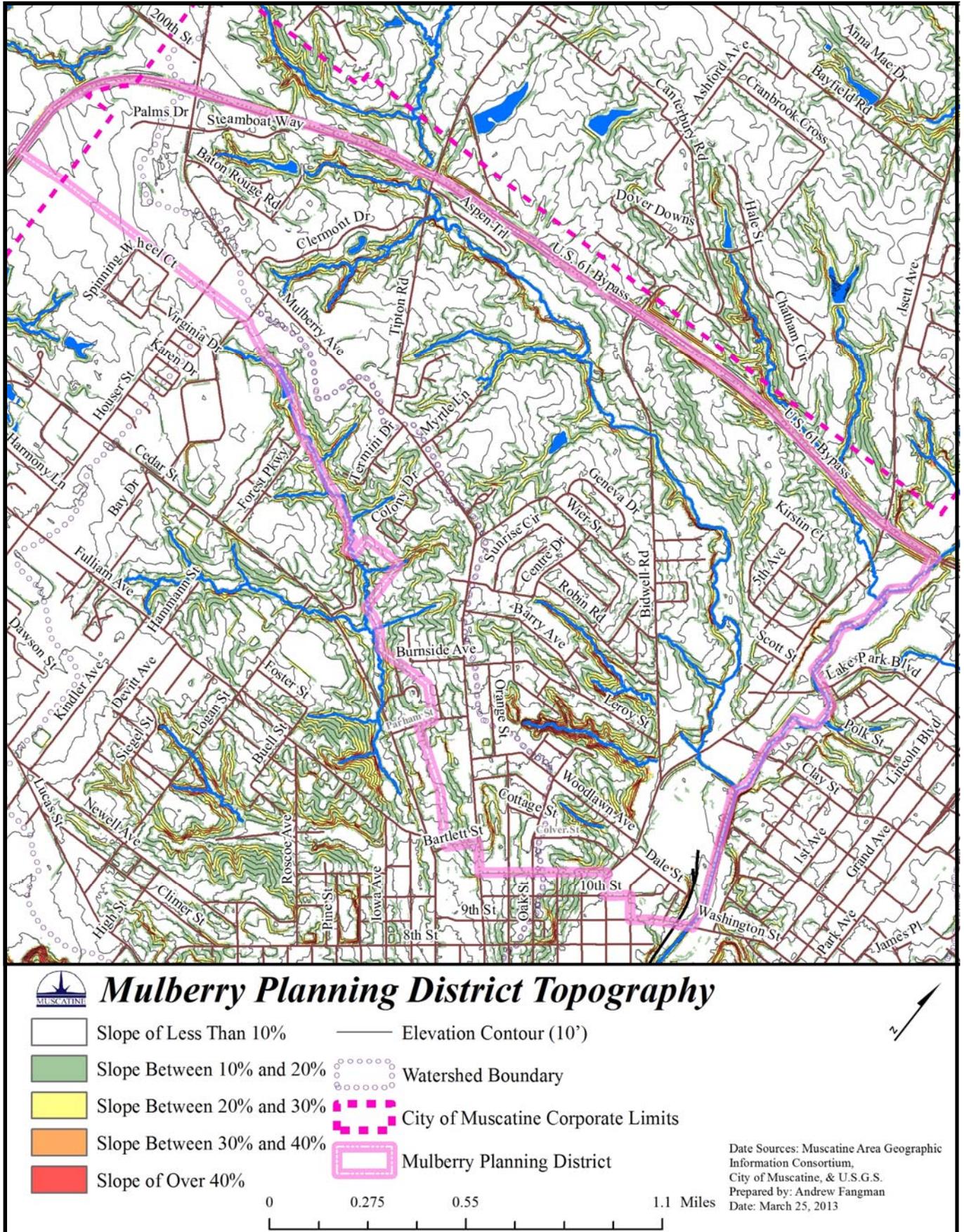


Figure 8: Mulberry Planning District Topography



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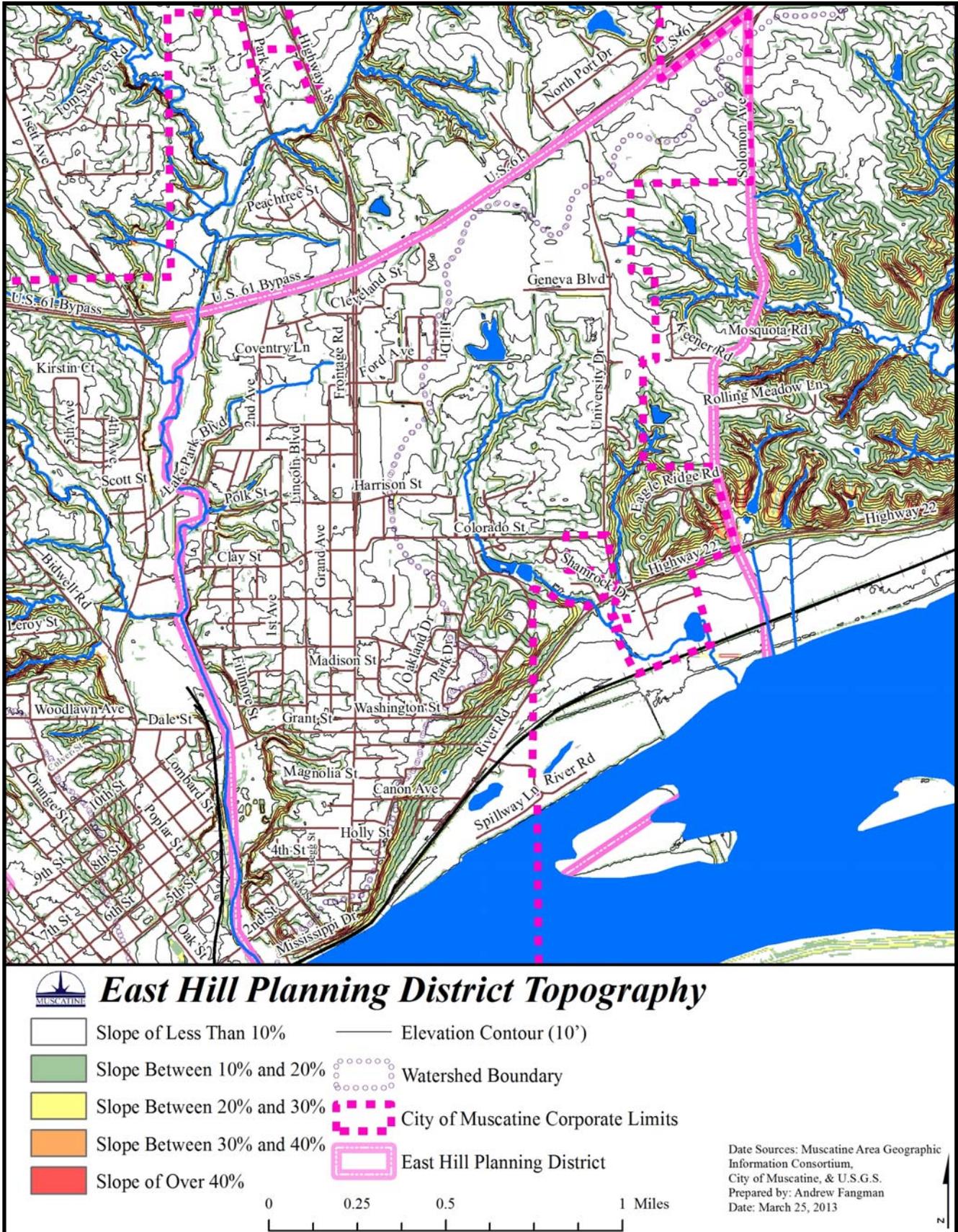


Figure 9: East Hill Planning District Topography



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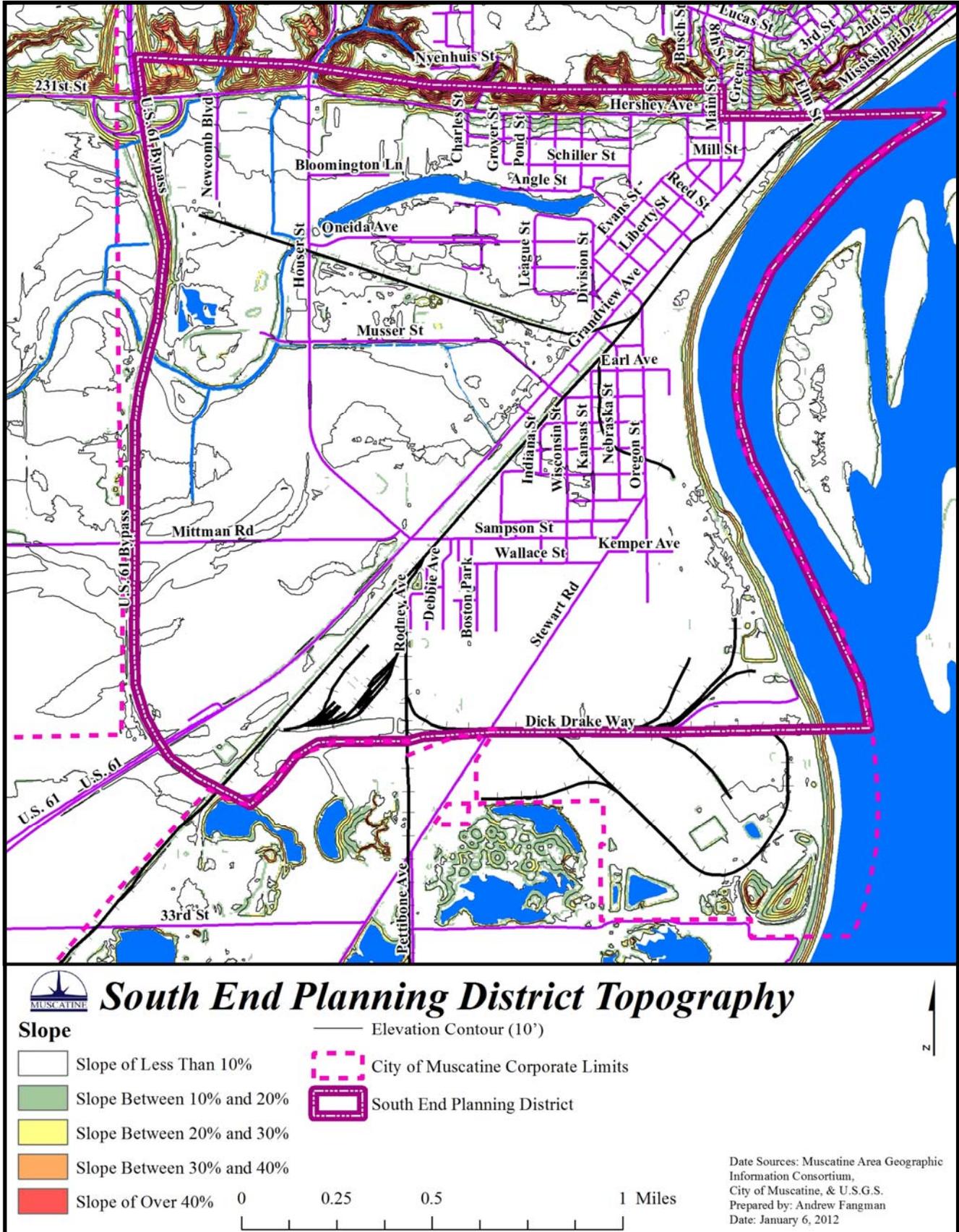


Figure 10: South End Planning District Topography



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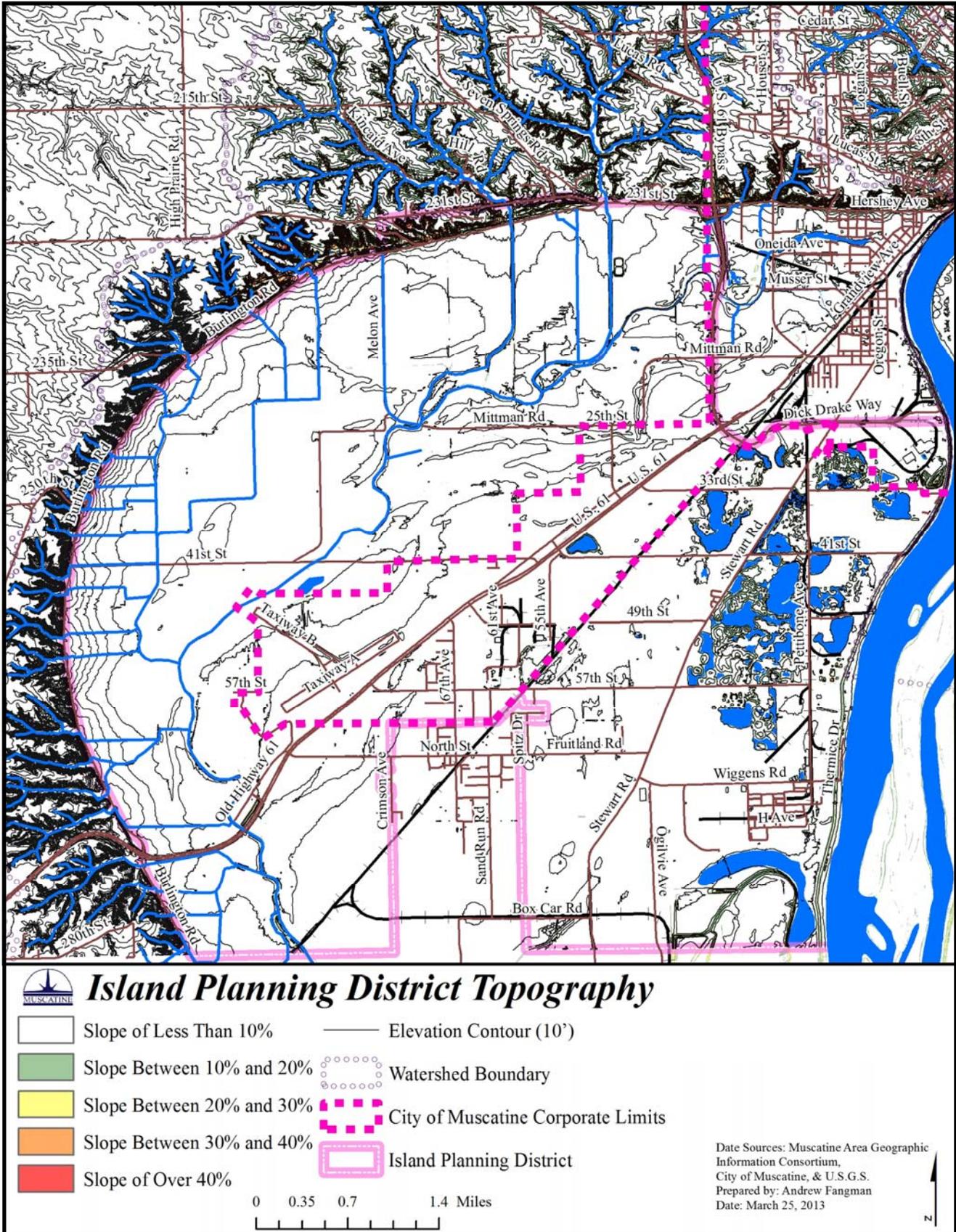


Figure 11: Island Planning District Topography



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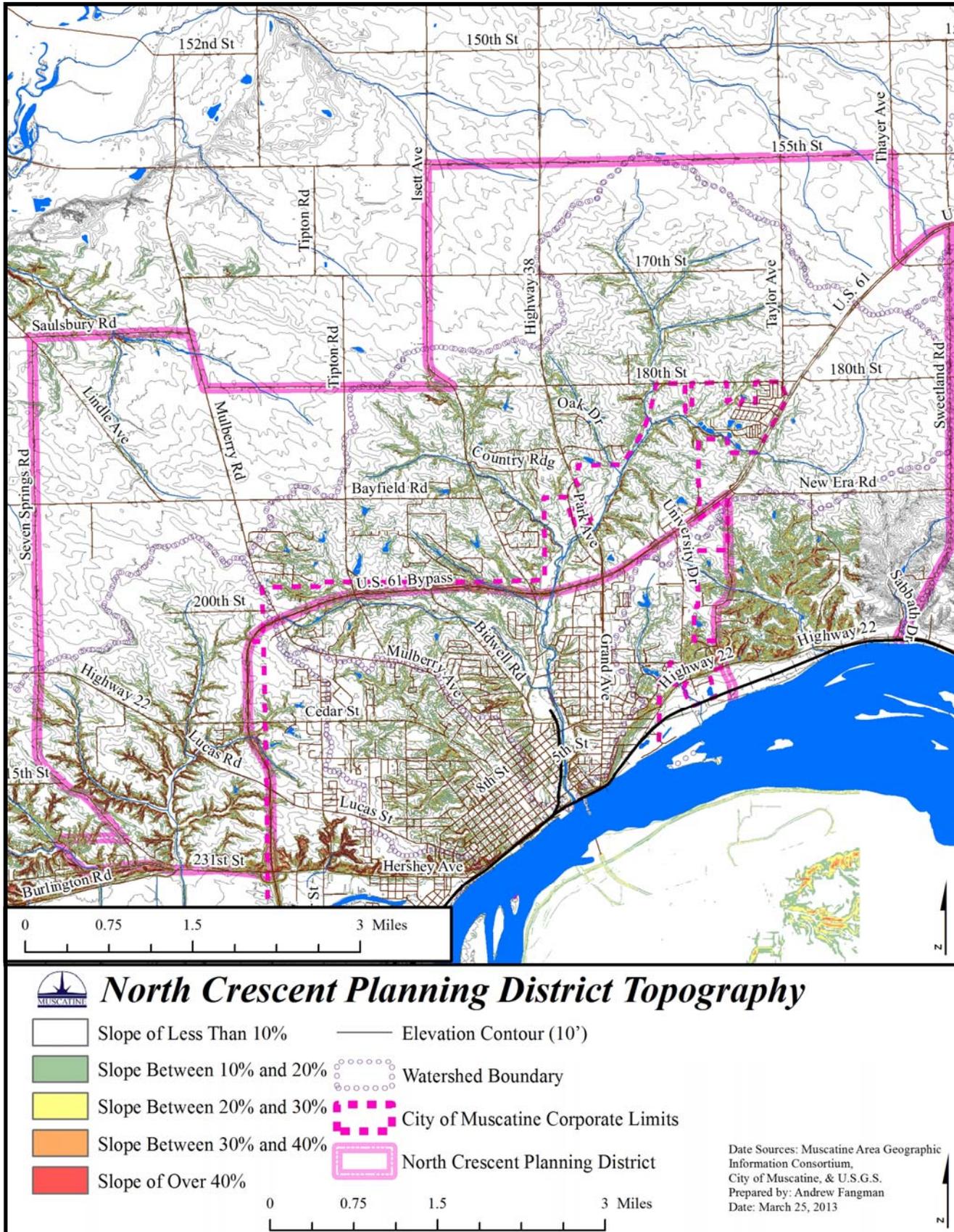


Figure 12: North Crescent Planning District Topography



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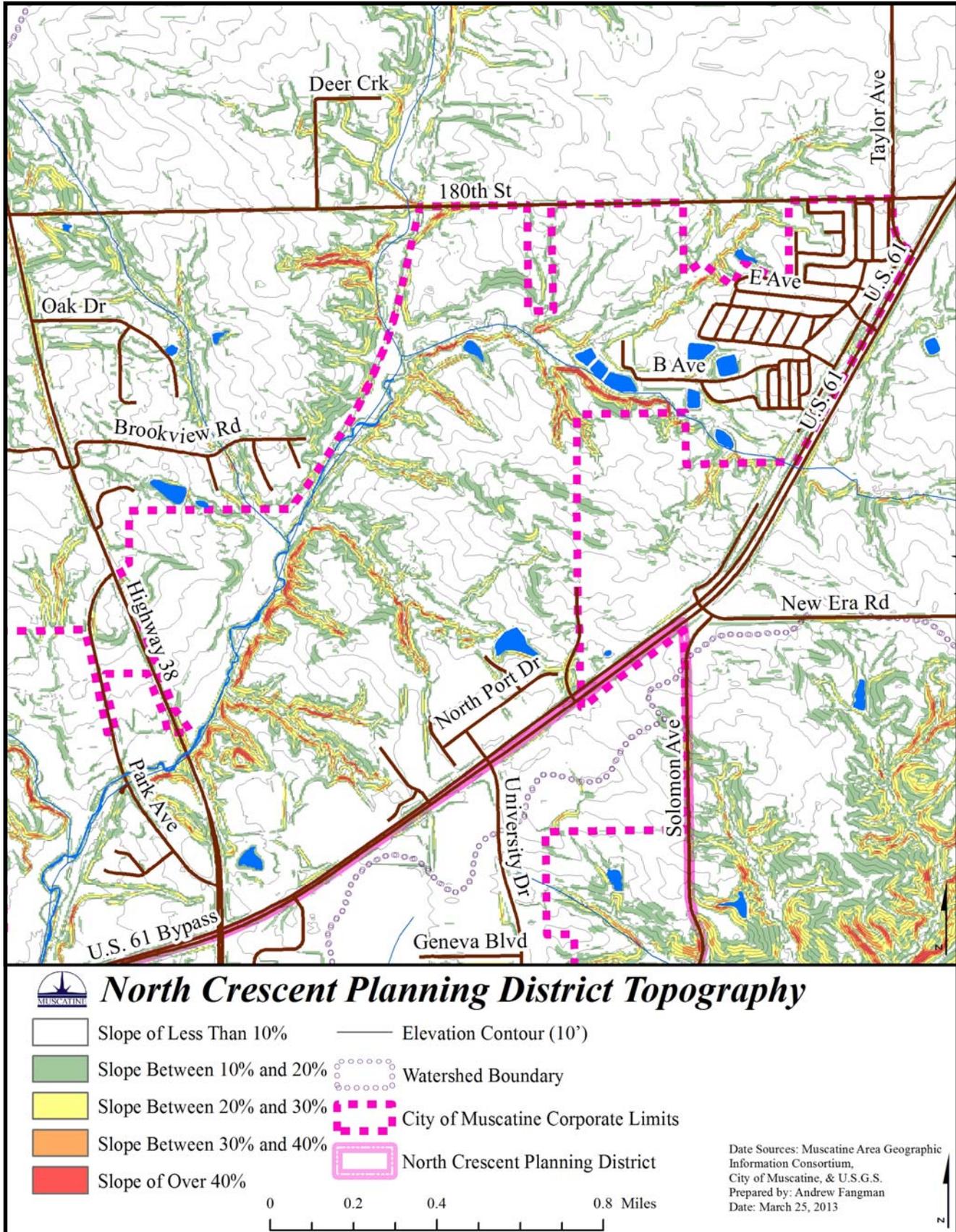


Figure 13: North Crescent Planning District Topography (Upper Mad Creel Area)



Flood Prone Areas

The City of Muscatine has adopted floodplain management regulations that were most recently updated in June of 2011. These regulate the use of land in those areas of the City which are subject to predictable inundations at frequent intervals to assure that flood carrying capacity within the altered or relocated portion of any watercourse is maintained. Such land use controls are necessary to qualify property owners for flood insurance under the National Flood Insurance Act of 1968.

These regulations, while permitting reasonable economic and social use of such properties, help protect health, safety, and general welfare and reduce financial burdens imposed on the community, governmental units, and its individuals caused by frequent and periodic floods. The set of maps on the following pages depict the Flood Insurance Rate Map (FIRM) for Muscatine County, for the City of Muscatine.

Areas classified as “Zone AE or Zone A”, commonly known as the 100-year flood plain on the Flood Insurance Rate Map (FIRM) for Muscatine County are placed in Flood Plain Zoning District. This zoning district functions as an overlay zoning district; areas located in it must comply with all restrictions and regulations and associated with the Flood Plain Zoning District as well as all applicable restrictions and regulations contained within the underlying zoning district and all applicable Federal or State law (including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334). Additionally, no development within a flood plain shall affect the capacity or conveyance of the channel or floodway of any tributary to the main stream, drainage ditch or any other drainage facility or system.

There are two categories of uses allowed in the Flood Plain Zoning District, permissive and conditional. Following is a summary of these types of uses, this summary is intended for informational purposes only, no change in land use in these areas should be undertaken without first consulting the City Code of Muscatine, Iowa.

Uses classified as permissive are allowed without any additional permitting requirements provided that such uses are permitted in the underlying zoning district. The following are permissive uses provided that such uses and types of activities do not entail any man-made changes to improved or unimproved real estate, including but not limited to buildings or other structures (including the placement of factory built buildings), mining, dredging, filling, grading, paving, excavation, or drilling operations.

- Open recreational uses such as golf courses, picnic grounds, boat launching ramps, swimming areas, parks, wildlife and nature preserves, and trails.
- Agricultural uses.
- Marinas.
- Industrial-commercial uses such as loading areas, parking areas, airport landing strips.
- For residential districts, area within the Flood Plain District may be used for computing lot area requirements and may, therefore, be used for yard and park areas.
- Storage yard for materials and equipment not subject to removal or major damage by flood waters.



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New construction or substantial improvements including the placement of factory-built buildings may be permitted if the underlying zoning district allows for the use and a conditional use permit is obtained. Conditional use permits are reviewed by the City to determine if all requirements contained within the City Code are met and that all necessary permits have been received as required by Federal or State law.

It is the responsibility of the applicant to obtain the appropriate topographic data, engineering studies, or other studies needed to make the determination if the proposed use qualifies for a conditional use permit. Some of the most important standards that must be met for conditional use permit to be issued include, but are not limited to, the following:

- Any proposed new construction or substantial improvements, including the placement of factory built building must be constructed using methods and practices that shall minimize flood damage and use construction materials and equipment that are resistant to flood damage.
- All new construction or substantial improvements of residential structures located in the flood plain shall have the lowest floor (including basement) elevated one foot above the level of a 100 year flood (base flood elevation).
- Factory-built homes, including those placed in existing factory-built home parks or subdivisions, shall be elevated on a permanent foundation such that the lowest floor of the structures is a minimum of one foot above the level of a 100-year flood (base flood elevation).
- All new and substantially improved residential and nonresidential structures with fully enclosed areas below the "lowest floor" (not including basements) that are subject to flooding shall be designed to allow for the entry and exit of flood waters.
- Utilities are required to be located and constructed to minimize or eliminate flood damage to the system and the risk associated with such flood damaged or impaired systems.



Figure 14: Floodwaters Covering Mississippi Drive



Areas shown as Floodway on the Flood Insurance Rate Map are placed in the Flood Channel (Floodway) Zoning District. This zoning district functions as an overlay zoning district, areas located in it must comply with all restrictions and regulations and regulations associated with Flood Channel (Floodway) Zoning District as well as all applicable restrictions and regulations contained within the underlying zoning district and all applicable Federal or State laws (including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334). No use shall affect the capacity or conveyance of the channel or floodway of any tributary to the main stream, drainage ditch, or any other drainage facility or system.

The following open space uses shall be permitted within the Flood Channel (Floodway) District to the extent that they are not prohibited by the underlying zoning district and provided that they do not require structures, placement of factory built buildings, fill, other obstructions, excavation, alteration of a watercourse, or storage of materials or equipment.

- Open recreational uses such as golf courses, picnic grounds, boat launching ramps, swimming areas, parks, wildlife and nature preserves, and trails.
- Agricultural uses.
- Marinas.
- Industrial-commercial uses such as loading areas, parking areas, airport landing strips.

Any use that includes structures, placement of factory built buildings, fill, other obstructions, excavation, alteration of a watercourse, or storage of materials or equipment requires a conditional use permit. No structure (temporary or permanent), fill (including fill for roads and levees), deposit, obstruction, storage of materials or equipment, or other uses shall be permitted which acting alone or in combination with existing or proposed uses affects unless it has been demonstrated in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood.

For any such use, review is conducted by the Iowa Department of Natural Resources to determine if the proposed use would increase flood levels within the community during the occurrence of the base flood. Where topographic data, engineering studies, or other studies are needed by the appropriate City agency and/or Iowa Department of Natural Resources to determine the effects of flooding on a structure and/or the effects of the structure on the flow of water, the applicant shall submit such data or studies. All such data shall be prepared by technically qualified persons.



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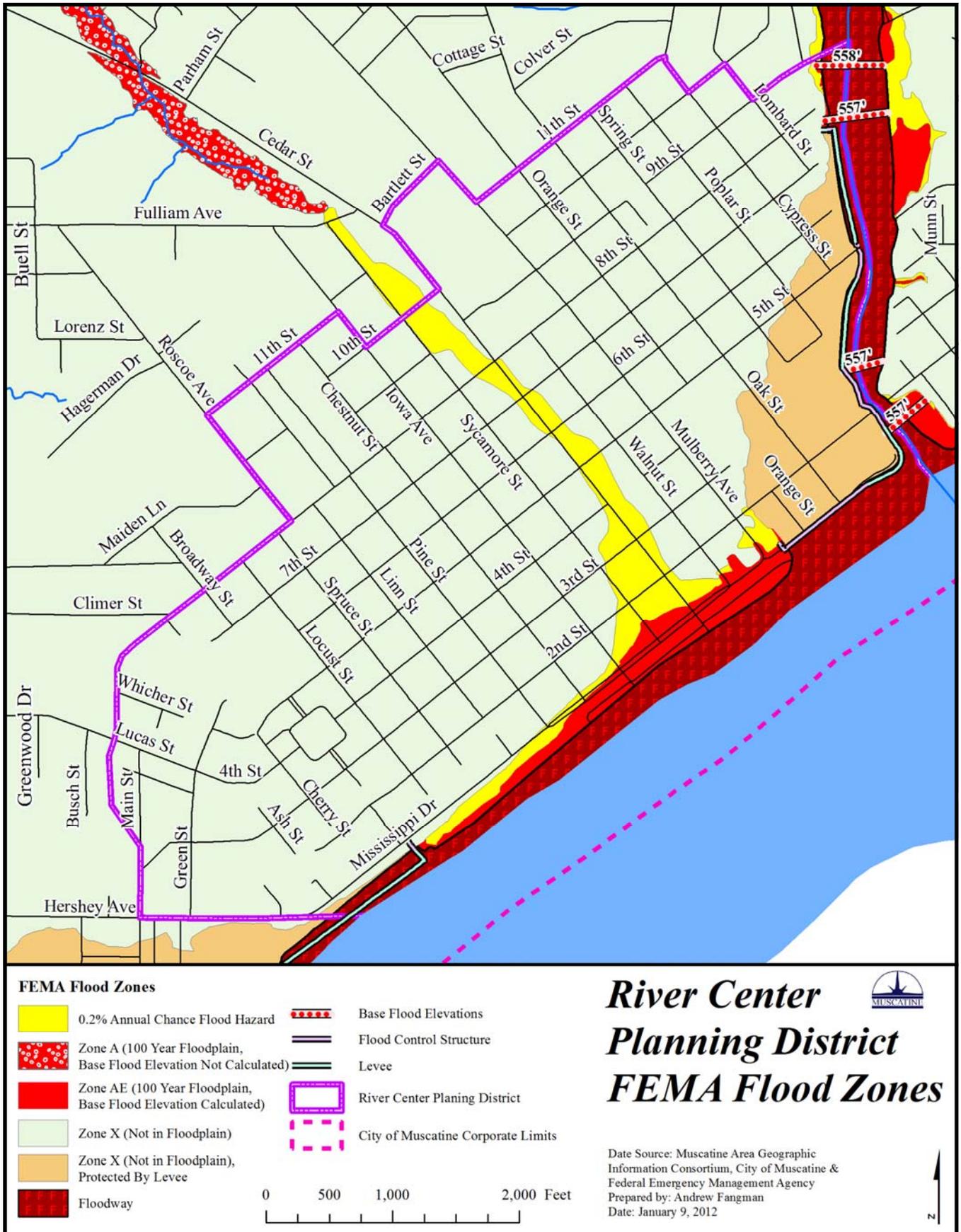


Figure 15: River Center Planning District Flood Zones



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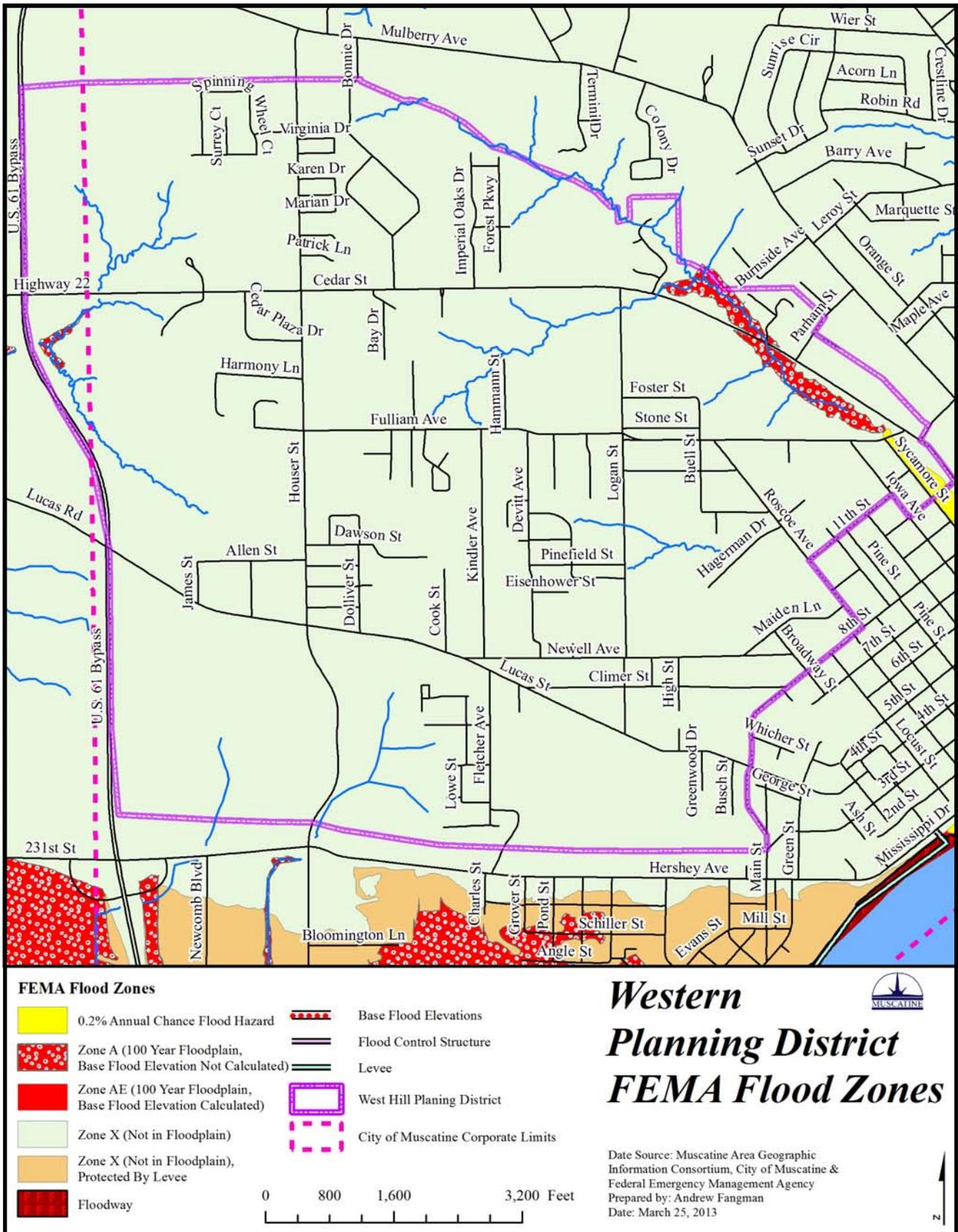


Figure 16: Western Planning District Flood Zones



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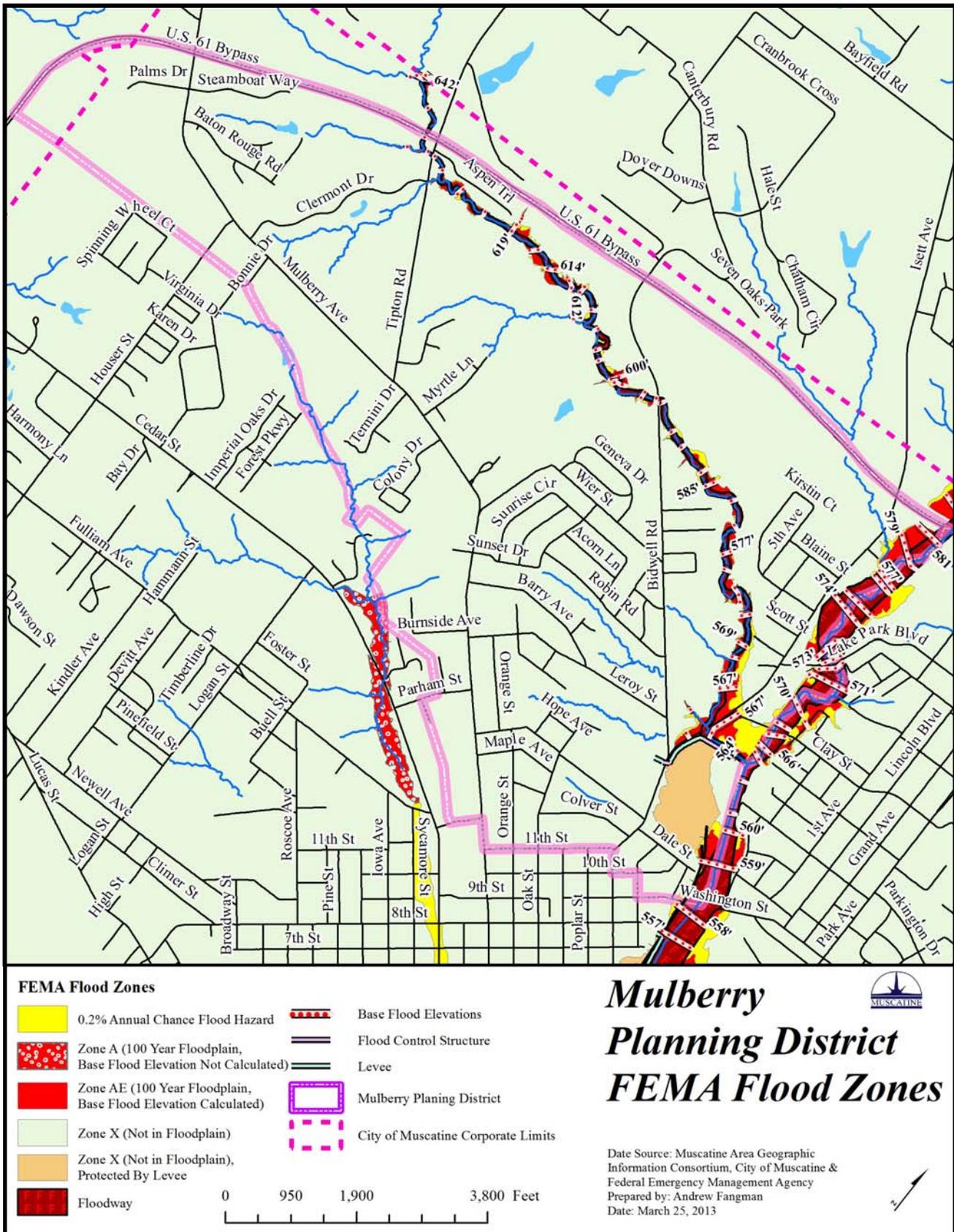


Figure 17: Mulberry Planning District Flood Zones



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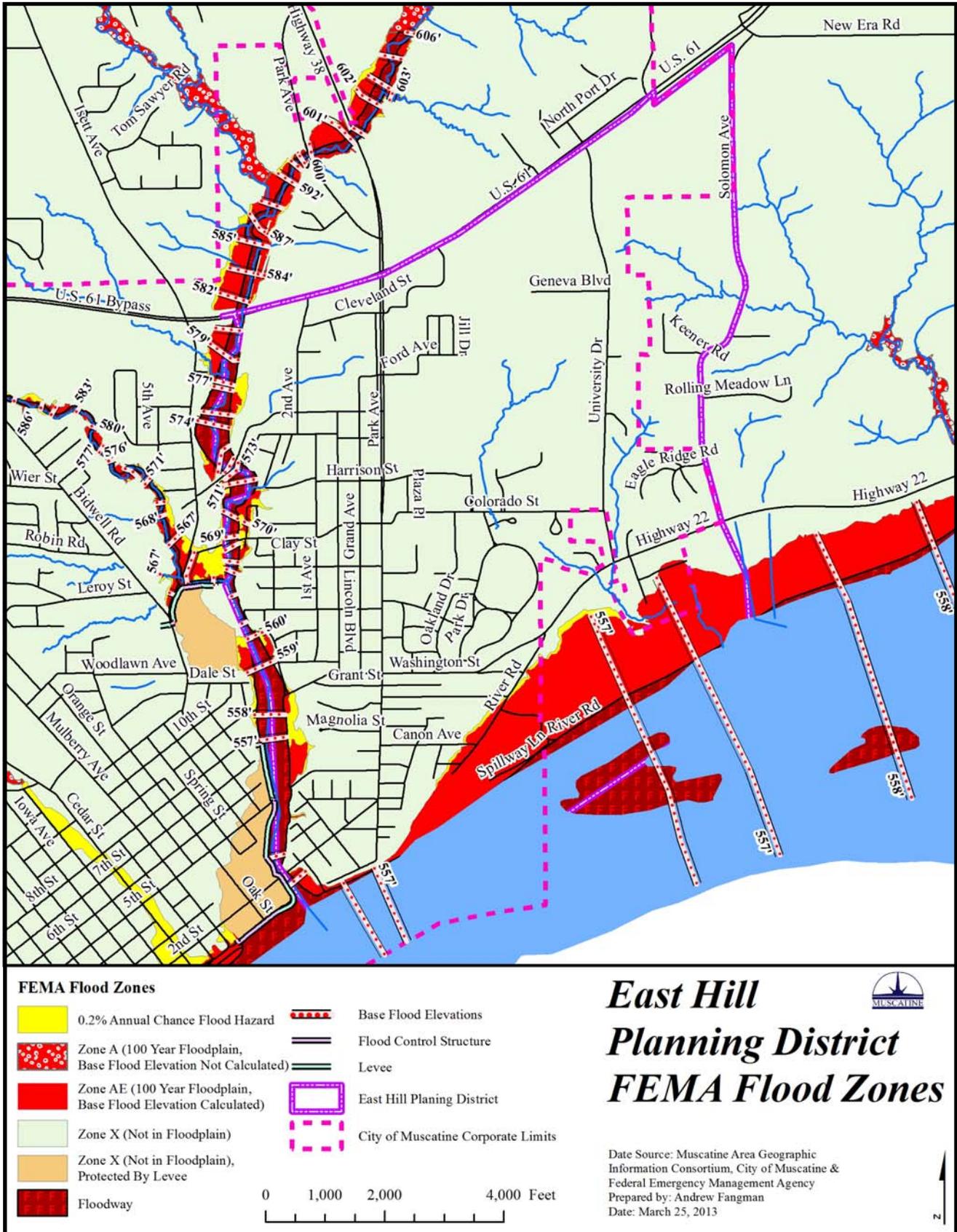


Figure 18: East Hill Planning District Flood Zones



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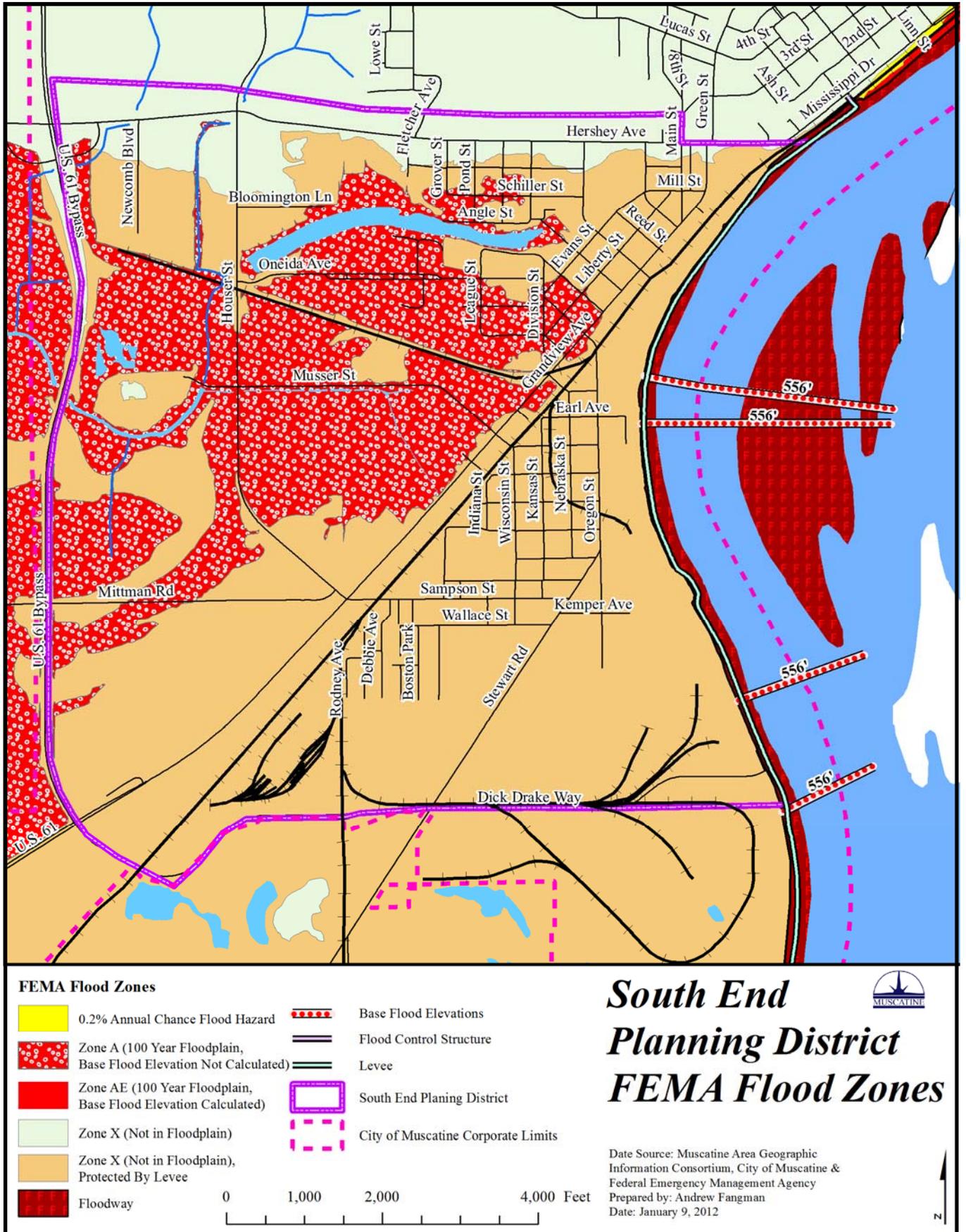


Figure 19: South End Planning District Flood Zones



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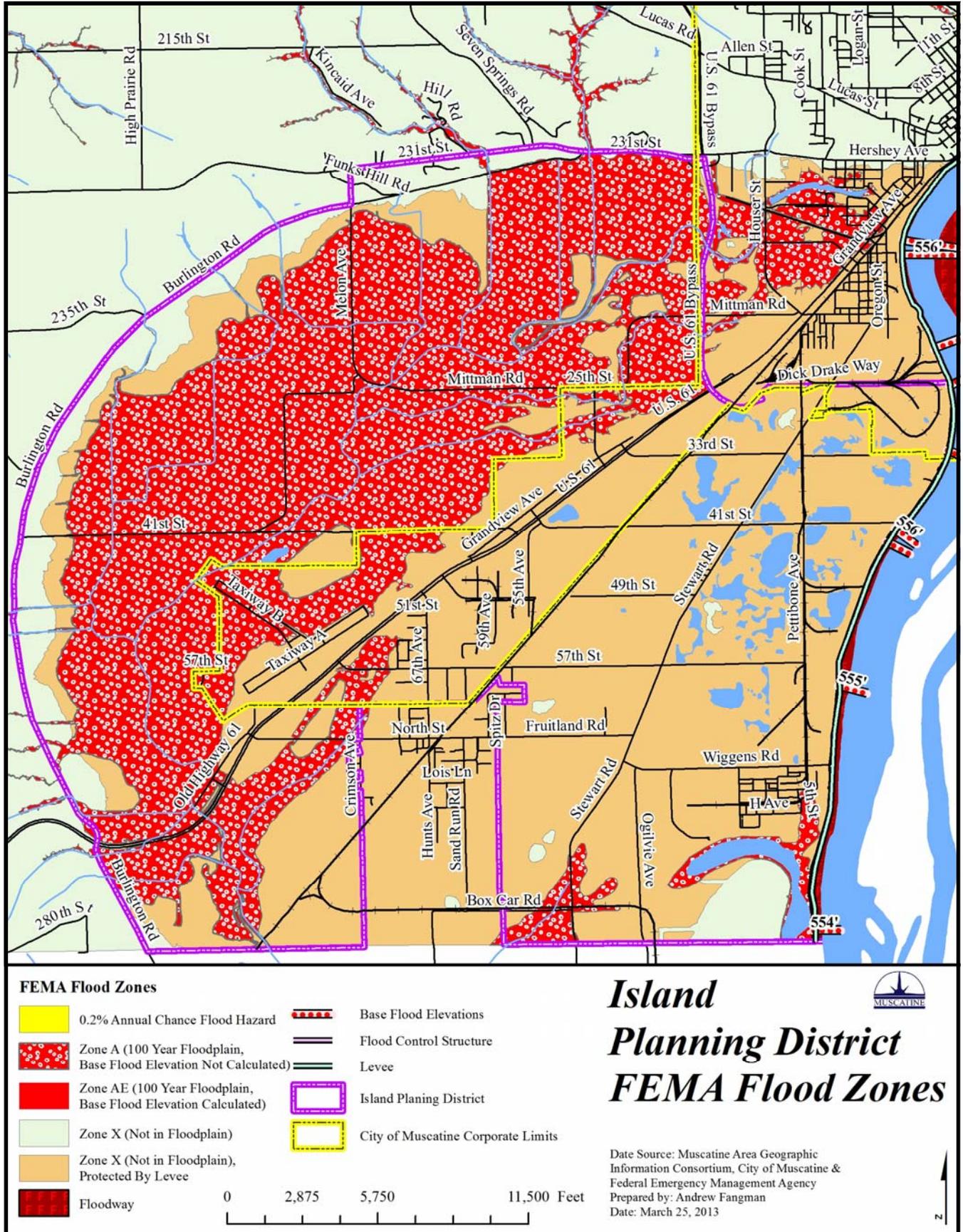


Figure 20: Island Planning District Flood Zones



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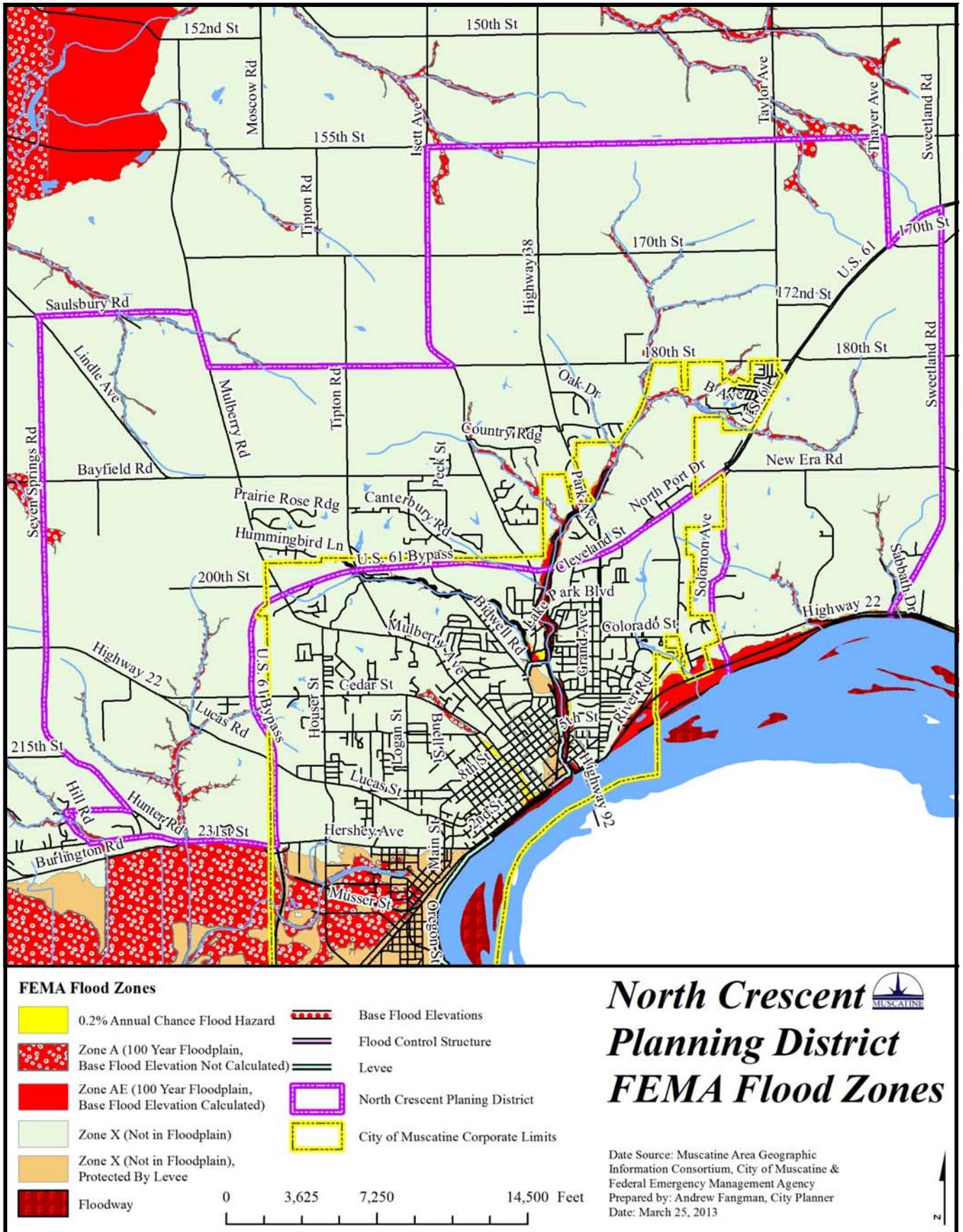


Figure 21: North Crescent Planning District Flood Zones



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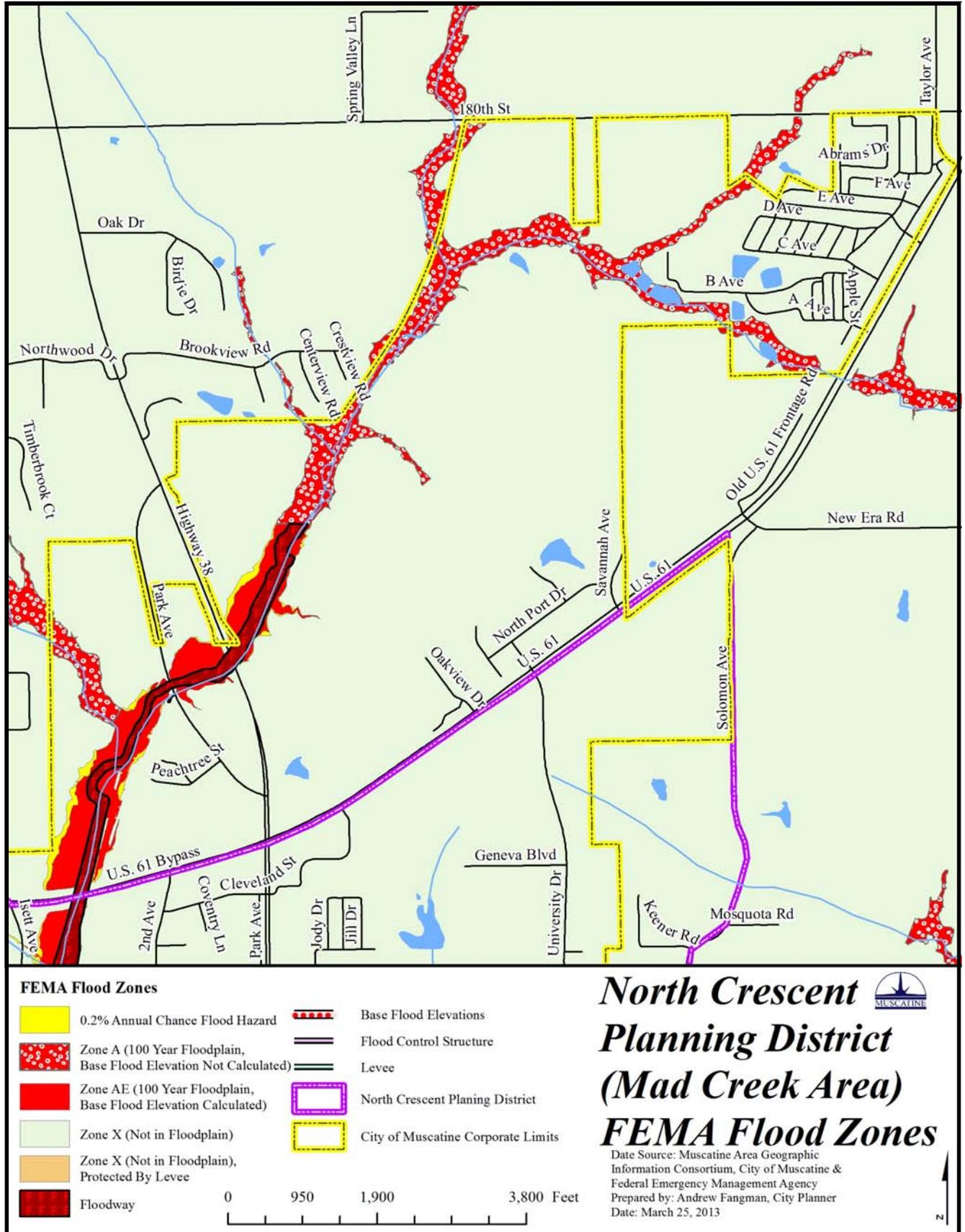


Figure 22: North Crescent Planning District Flood Zones



Forthcoming Revisions to Flood Zones

In 2012 the Federal Emergency Management Agency (FEMA) changed the status of the Muscatine Island Levee, which runs along the Mississippi River from approximately the intersection of Broadway Street and Mississippi Drive downriver into Louisa County, from provisionally accredited to accredited. Obtaining full accreditation of the Muscatine Island Levee will lead to revisions to FEMA Flood Insurance Rate Maps (FIRM) that cover areas protected by the Muscatine Island Levee, which includes all of the City of Muscatine south of Hershey Avenue.

As part of the process of accrediting the Muscatine Island Levee a detailed study of internal drainage ponding was prepared. Interior drainage ponding is a type of flooding that occurs behind a levee when high water on the river prevents or severely limits the drainage of storm water falling on the area protected by the levee it collects in low-lying areas causing flooding. Based on this study FEMA has issued a preliminary draft of revisions to the FIRM that show a significant reduction in areas designated as in the 100-year flood plain (Zone A or AE) associated with interior drainage ponding.

Maps on the following pages show how the 100-year flood plain (Zone A or AE) differ between the currently effective FIRM which went into effect on July 18, 2011, and those on the preliminary FIRM that resulted from the Muscatine Island Levee accreditation. Areas shown in red are in the 100-year flood plain in both the currently effective FIRM and the preliminary revised FIRM. Areas shown in yellow are currently within the 100-year flood plain, but will no longer be once the preliminary revised FIRM becomes effective.

When these changes to the FIRM become effective there will be a dramatic reduction in the size of the 100-year flood plain. Within the City of Muscatine, south of Hershey Avenue, there will be no longer be any structures within the 100-year flood plain. Currently dozens of homes, businesses and other structures within this area are within the 100-year flood plain. Removal from the 100-year flood plain has significant benefits for property owners. Nearly all mortgages require homes and businesses located within the 100-year flood plain to purchase flood insurance. The revised flood zones will save a significant number of Muscatine homeowners and businesses a significant amount of money annually. These properties will also benefit from their removal from the Flood Plain Zoning District which imposes significant land use restrictions on properties.

The preliminary revised Flood Insurance Rate Maps, related to the Muscatine Island Levee accreditation, were issued on January 18, 2013. During the Spring of 2013 a 90-day appeal period, during which Community officials and others may object to the information presented in the preliminary FIRM, will occur. FEMA will then resolve all appeals and comments in coordination with community officials and appellants before finalizing the revised flood zones. Next, FEMA will issue a Letter of Final Determination, which establishes that the revisions are final. Currently FEMA is projecting that the Letter of Final Determination will be issued on October 2, 2014. This then begins a 6-month adoption/compliance period during which the City of Muscatine must amend its floodplain management regulations to reflect the revisions to flood zones. The new flood zones become effective at the end of the 6-month adoption/compliance period, currently projected by FEMA to be April 2, 2015



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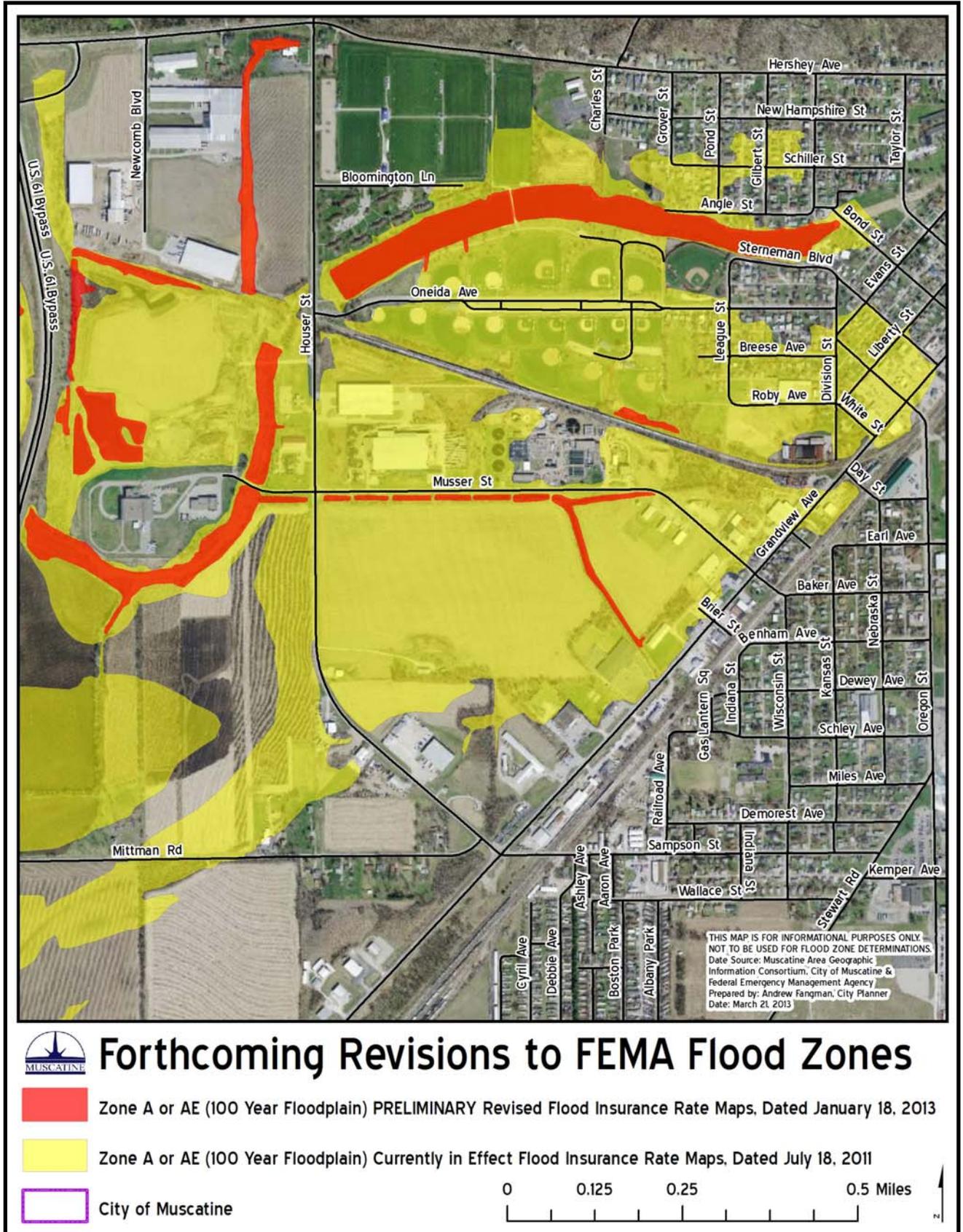
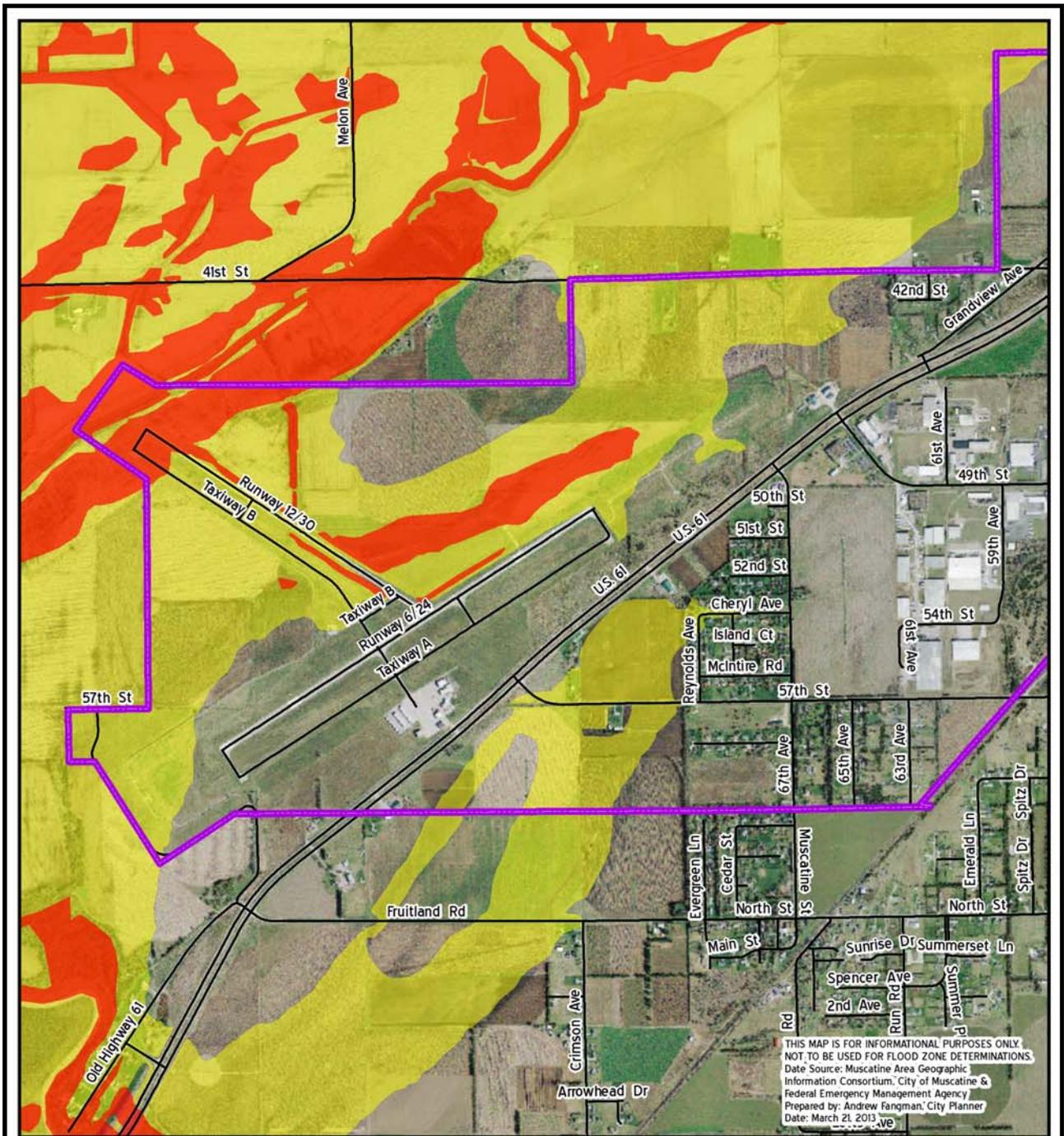


Figure 23: Forthcoming Revisions to FEMA Flood Zones (South End)



Forthcoming Revisions to FEMA Flood Zones

- Zone A or AE (100 Year Floodplain) PRELIMINARY Revised Flood Insurance Rate Maps, Dated January 18, 2013
- Zone A or AE (100 Year Floodplain) Currently in Effect Flood Insurance Rate Maps, Dated July 18, 2011
- City of Muscatine

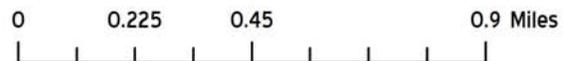


Figure 24: Forthcoming Revisions to FEMA Flood Zones (Airport Area)

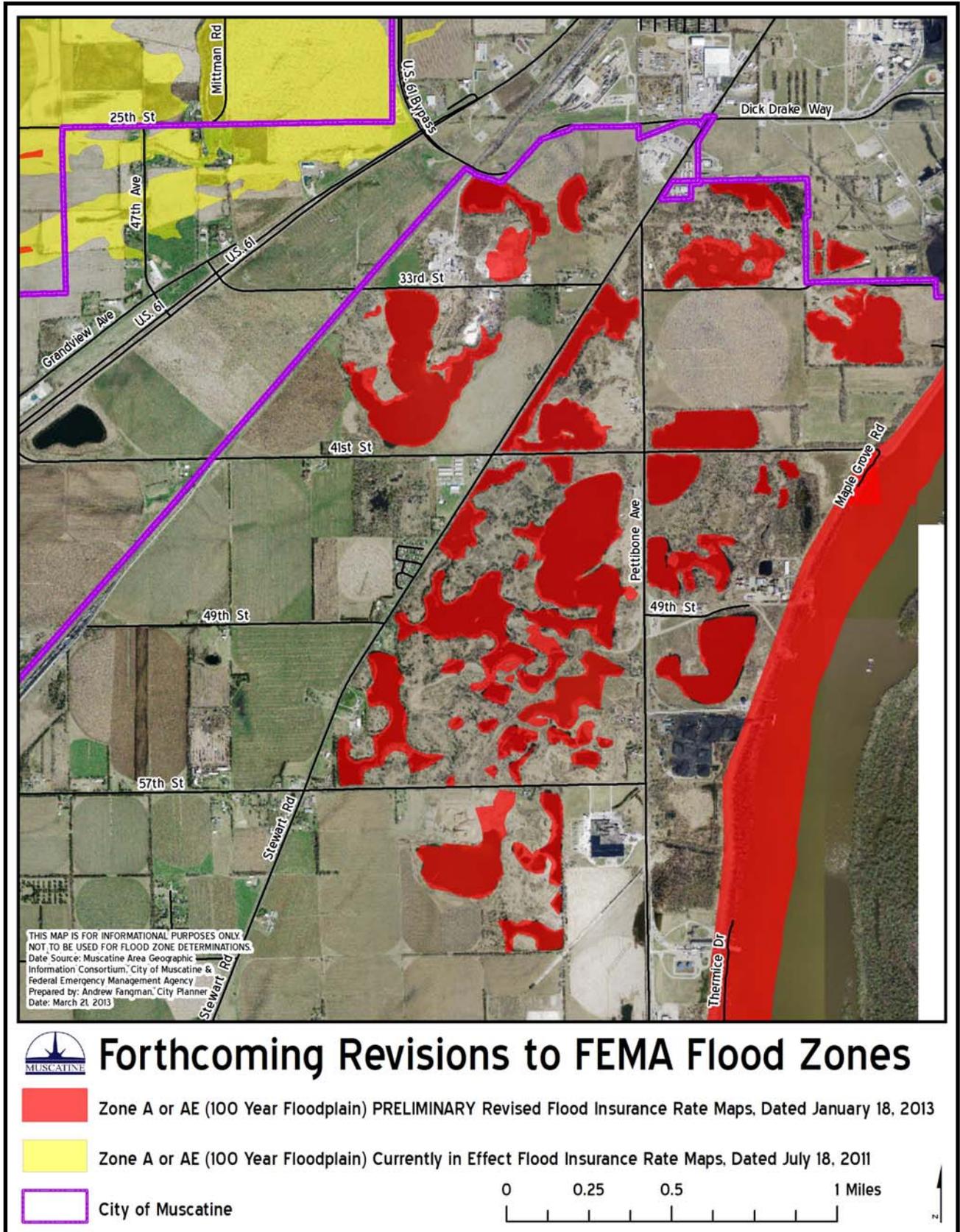


Figure 25: Forthcoming Revisions to FEMA Flood Zones (Pettibone Avenue Area)



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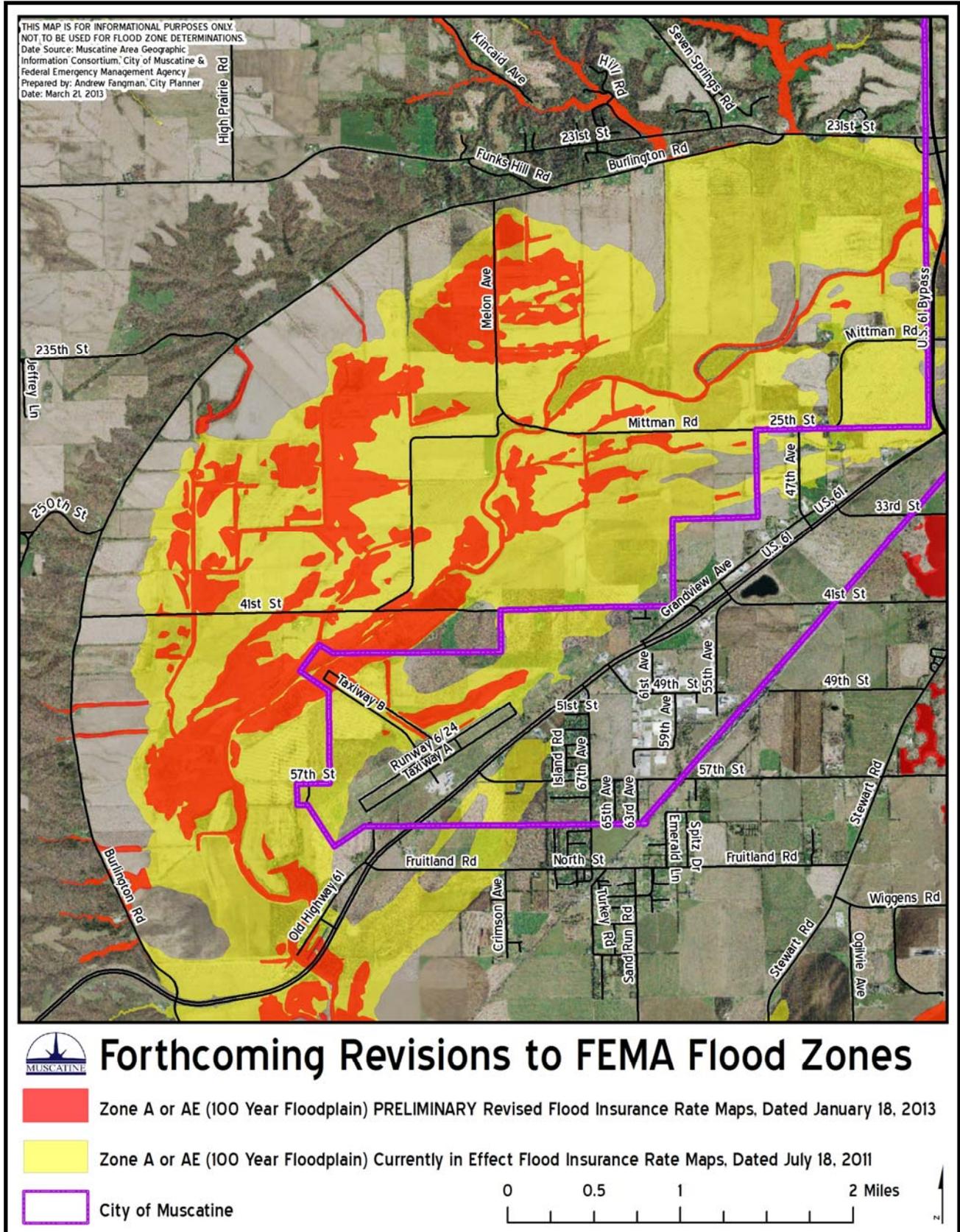


Figure 26: Forthcoming Revisions to FEMA Flood Zones (Island Area)



Soil Characteristics

Three main elements make up the topography of Muscatine; upland plains, broad flood plains, and highly eroded valley sides. Although the Muscatine area was greatly modified by glaciers, the present topography is primarily the result of stream erosion. The north and northwest portion of the City has a level to gently undulating bottomland topography. Most of the soils are deep, silty or loamy. Floodplains are chiefly along the Muscatine Slough, Mad Creek, Geneva Creek, and the Mississippi River and its tributaries. The floodplain elevations range from 550 feet at the southeastern end of the City to 545 feet on the sand plains in the northern part. The floodplains are underlain by water-deposited sand, silt, and clays. They are relatively shallow and located over limestone and shale bedrock.

The Soil Association Map identifies the soil types found in Muscatine. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil. The name of the association is derived from the names of the major soils present in the given association.

The predominant soil associations within the City of Muscatine include the following:

- Fayette-Lindley Association: Underlies most of the developed/urban areas within the City.
- Colo-Coland-Ambraw Association: Follows the banks and watershed areas of the Muscatine Slough in the Muscatine Island region.
- Fruitfield-Elrick-Toolesboro Association: Occupies portions of the Muscatine Island from the Muscatine Municipal Airport to the Mississippi River, including the sand and gravel pits located just outside the city limits.
- Downs-Tama Association: Located along the central ridge region of Muscatine.

The Fayette-Lindley Association generally consists of gently sloping to very steep hillsides. The surface is well drained and consists of silty and loamy soils that formed in loess and glacial till. Due to a well developed system of drainage ways, runoff is rapid. This association is suitable for additional development, however, special consideration should be given to areas with steep slopes and areas with unstable soils containing shrink-swell characteristics. This soil association makes up about 17% of the county.

The Colo-Coland-Ambraw association is nearly level, poorly drained and contains silty and loamy soils that formed in alluvium. Bottomland areas, such as the areas adjacent to the Muscatine Slough, fall within the Colo-Coland-Ambraw soil association. Natural surface drainage is poorly developed. Drainage ditches have been installed to remove excess surface and sub-surface water. They also convey runoff water from nearby uplands to permanent streams, such as the Muscatine Slough, or major drainage ditches. The gray silty clays that are commonly found within this association provide moderate permeability. Flooding can be a hazard, especially in areas that are not protected by levees or stream channel improvements. This soil association is suitable for future development when special consideration is given to flood protection and wet soil conditions. The Colo-Coland-Ambraw association makes up about 6% of the county.



The Fruitfield-Elrick-Toolesboro Association is nearly level to gently sloping and contains sandy and loamy soils that formed in alluvium. This association is found in wide bottomlands that are excessively drained. Most areas within the City of Muscatine containing this soil association are protected by levees. It is subject to rare flooding when high river levels cause levee protection to fail. The soil consists mostly of sand, therefore the permeability of the Fruitfield-Elrick-Toolesboro soil is very rapid. Available water capacity is very low. This soil association is suitable for additional development if it is protected from flooding. This association makes up about 4% of the county.

The Downs-Tama Association consists of gently sloping to strongly sloping, well drained, silty soils that formed in loess. It is located in the north-central urban regions of the planning area and dips south into the City limits along Mulberry Avenue and to the southwest of Mulberry Avenue. It is commonly found on upland ridgetops and side slopes. Permeability of the Downs soil is moderate with medium runoff. Available water capacity is high, with shrink-swell tendencies when unstable shales and clays are present. This soil association makes up 26% of the county.

Factors influencing soil quality with respect to development include slope, permeability, shrink-swell characteristics, corrosive potentials, load bearing capacities, wetness, and drainage characteristics. Most prevalent soils within the planning area appear well drained, having been formed in loess on the upland till. Most of the soil types found in the developed areas of Muscatine are silty loams with surface and subsurface characteristics that vary considerably. Except for portions of the Colo-Coland-Ambraw Association, nearly all soil types in the City of Muscatine are suitable for future building sites and most soils have a bearing strength rating of “good”.

The areas of probable limitations on development lie primarily along the creeks. Steep slopes, severe erosion and flooding are the main development constraints in these areas. It is recommended that soil tests are performed prior to the design of foundations in areas known to have expansive soils and rock units. Expansive soils, such as clays, can significantly change in volume due to shrink and swell and freezing and thawing. Characteristics of expansive or swelling materials are highly plastic clays and clay shales that often contain clay materials such as montmorillonites. The City should maintain soil maps and require developers to identify soil types and measures taken (if any) in the design and drainage of each development that is necessitated by the soil type.



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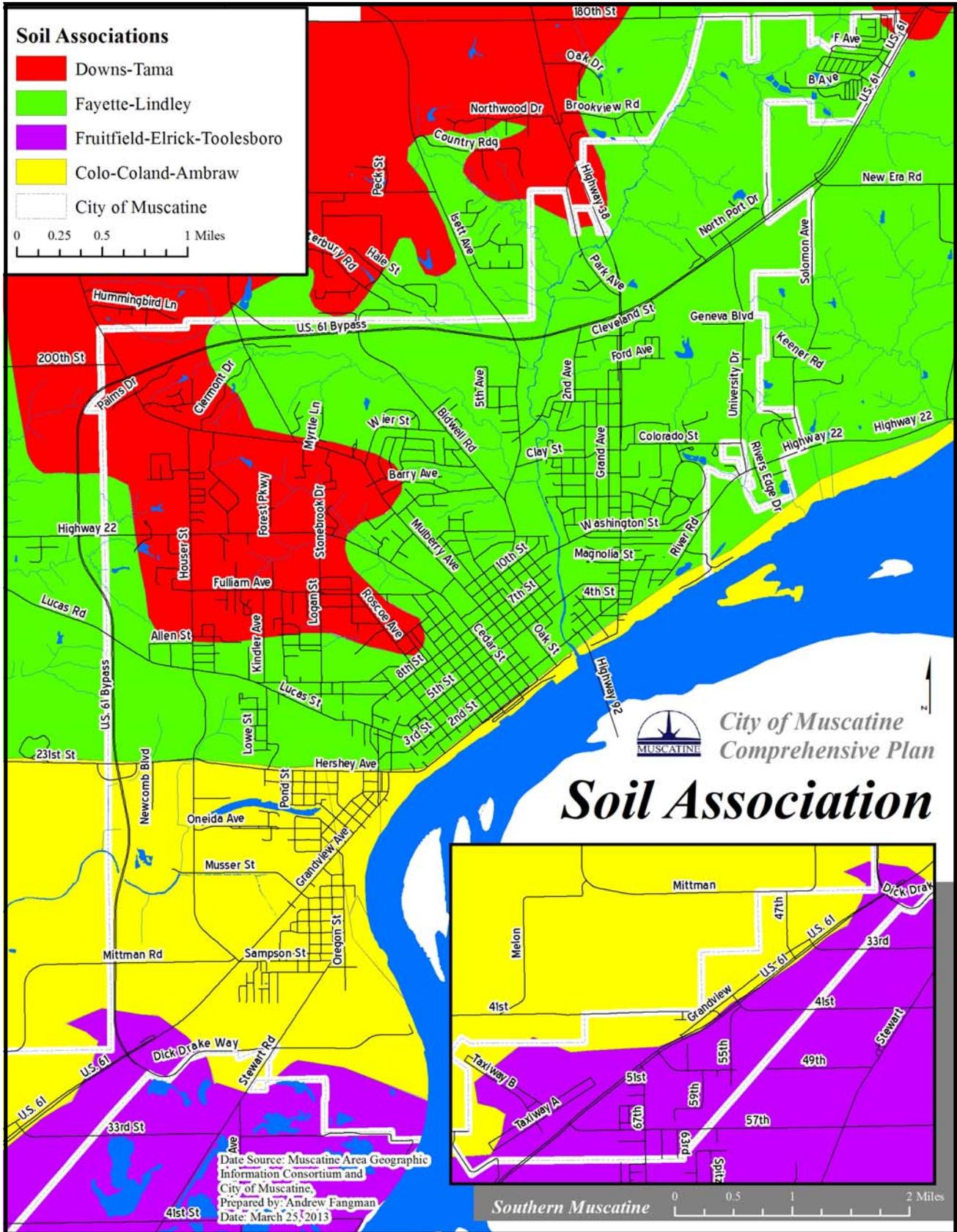


Figure 27: Soil Associations



Wetlands

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. The water creates severe physiological problems for all plants and animals except those that are adapted for life in water or in saturated soil. Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

The presence of wetlands in itself would not necessarily prevent development, but does indicate the area is sensitive and development will need to be approached in a more sensitive manner. Alteration of wetlands in the form of filling or draining can have an adverse effect on wetlands and increase flooding and runoff in other areas. For this reason, they require special attention. Federal law also can protect wetlands under the regulations administered by the U.S. Army Corps of Engineers. It is necessary to consult with the City and the Army Corps of Engineers before developing near wetlands.

In 1977, the United States Fish and Wildlife Service began the National Wetlands Inventory (NWI), a systematic effort to classify and map wetlands. The wetland amounts reported by the NWI are based on interpretations of aerial photographs, and do not consider whether areas interpreted as wetlands are regulated.

Among the ways that National Wetland Inventory classifies wetlands is by either the dominant life form of the vegetation or the physiography and composition and water regime which is based on when and how much water is present. Emergent wetlands are known by many names, including marsh, meadow, fen, prairie pothole, and slough. They are a habitat dominated by soft-stemmed herbaceous plants such as cattails, bulrushes, sedges, reeds, manna grasses, slough grass, etc. Scrub-shrub wetlands are dominated by shrubs, saplings and other woody plants less than 20 feet tall. Scrub-shrub wetlands may also be referred to as swamps. In Forested wetlands woody plants taller than 20 feet dominate the vegetation. Water tolerant shrubs and saplings often form a second layer beneath the forest canopy, with an herbaceous layer below, e.g. Forested wetlands are also referred to as wooded swamps. Wetlands classified as unconsolidated bottoms are characterized by the lack of large stable surfaces for plant and animal attachment they have at least 25% cover of particles smaller than stones, and a vegetative cover less than 30% and are either permanently flooded, intermittently exposed, and semipermanently flooded.

In areas classified as temporarily flooded, surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season. In areas classified as saturated, the substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present. Areas classified as seasonally flooded, surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the land surface. In Wetlands that are semipermanently flooded. Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface. Wetlands classified as intermittently exposed have surface water present throughout the year except in years of extreme drought.



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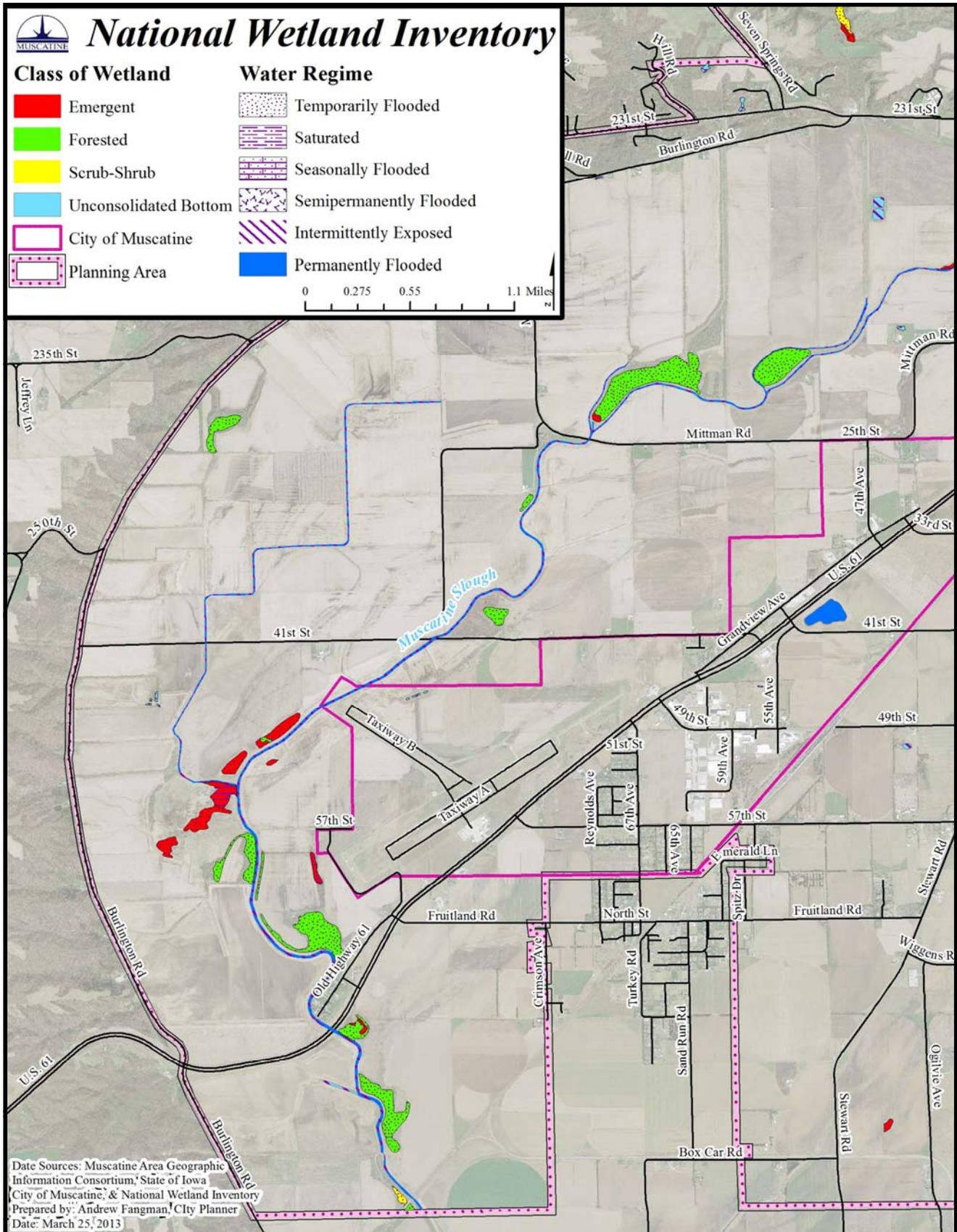


Figure 28: National Wetland Inventory—Muscatine Slough Area



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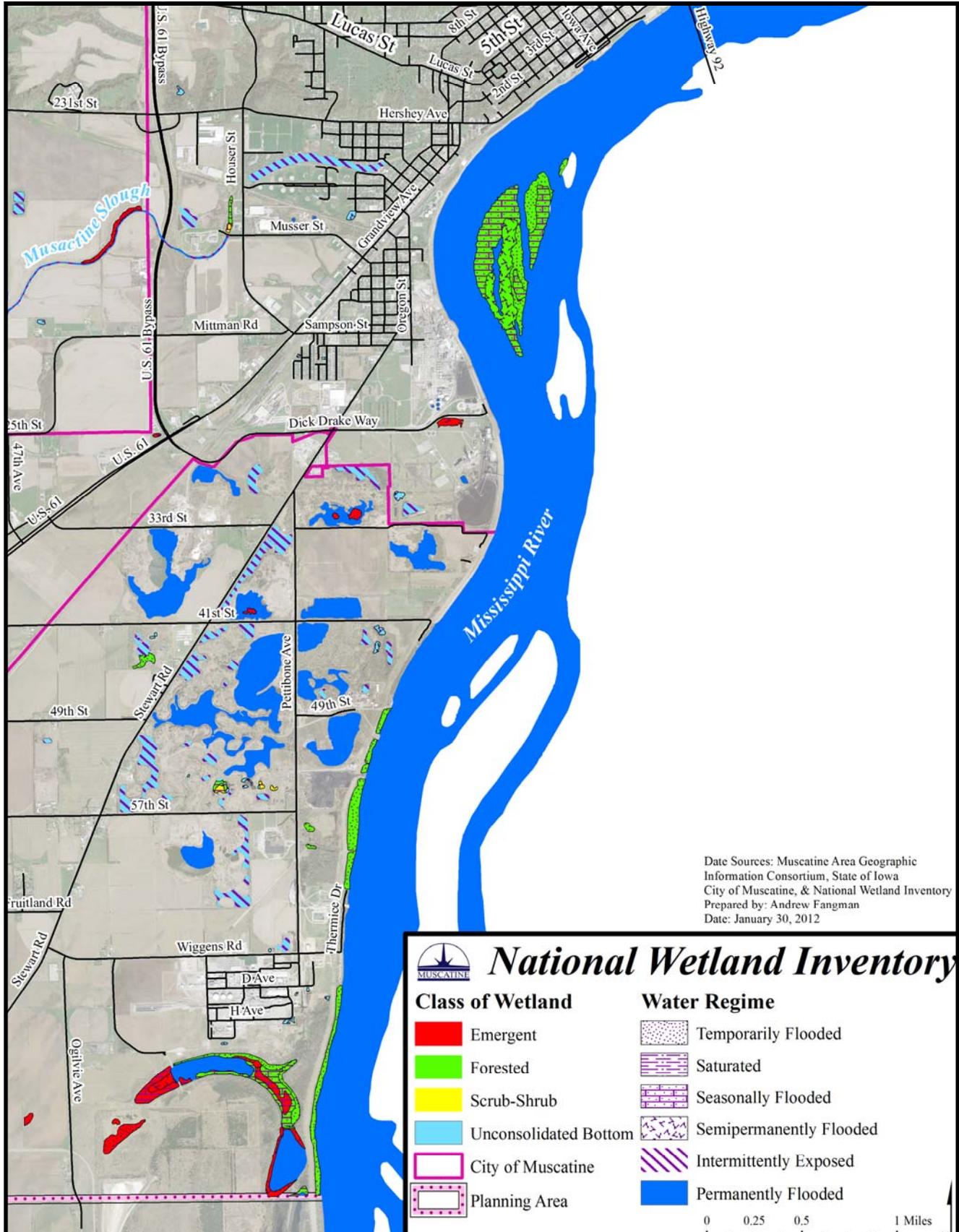


Figure 29: National Wetland Inventory—Mississippi River Area



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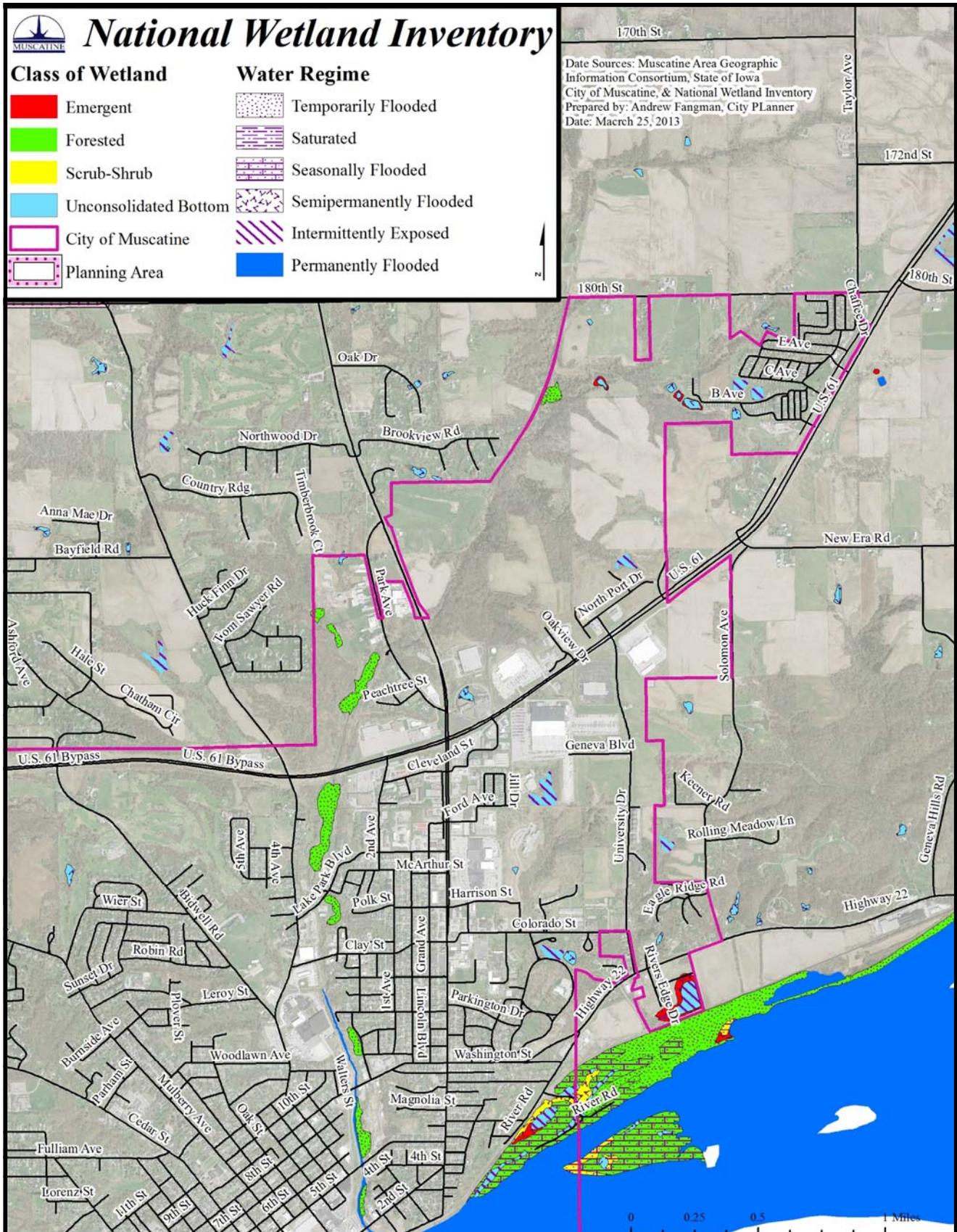


Figure 30: National Wetland Inventory—Mad Creek Area



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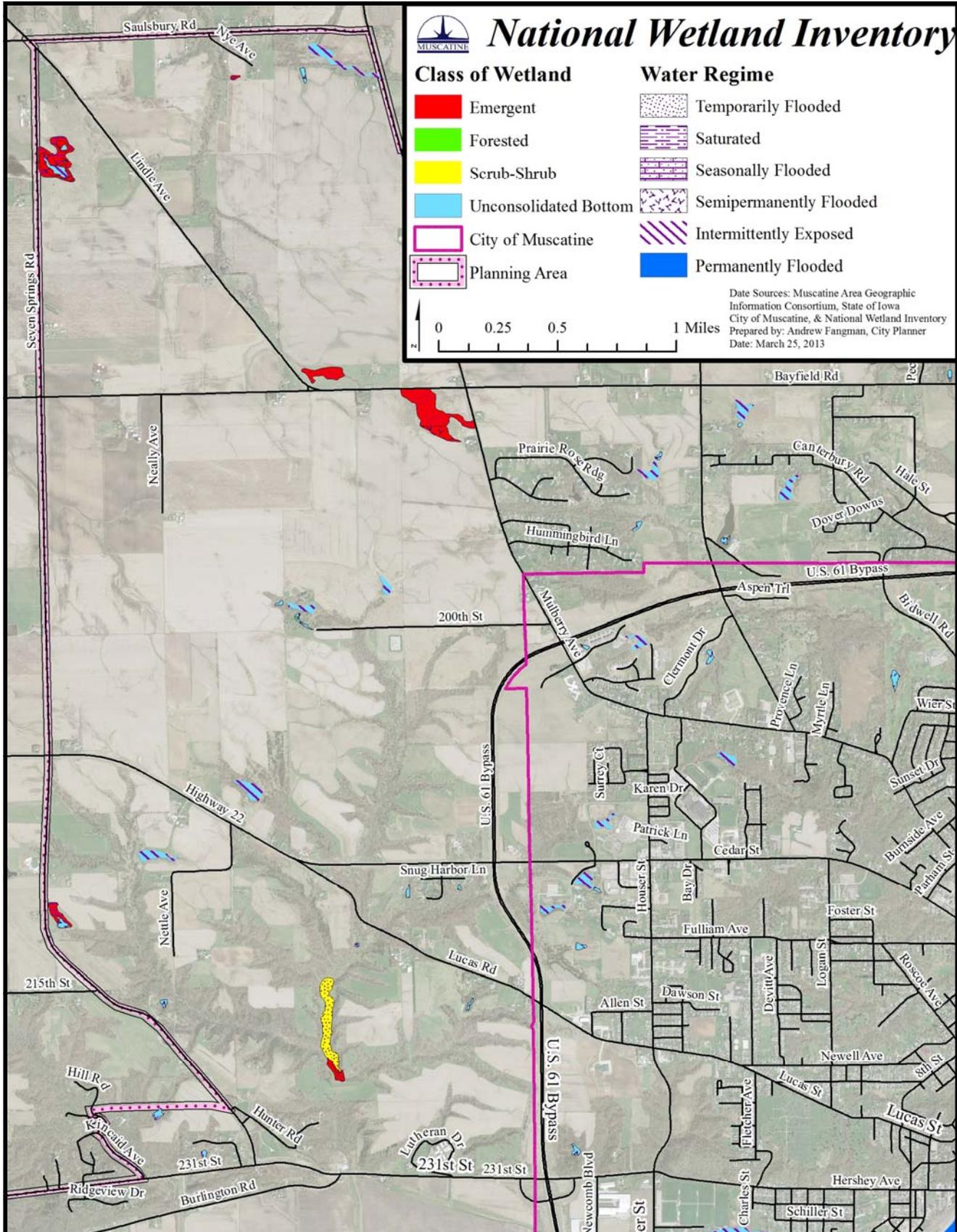


Figure 31: National Wetland Inventory—Northwest Muscatine

Sewer Separation

Many of the older portion of the City of Muscatine are served by combined sewers constructed early in the history of Muscatine. Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe.

Most of the time, combined sewer systems transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess and untreated wastewater directly to the Mississippi River through a combined sewer overflow.

The United States Environmental Protection Agency considers untreated sewage from combined sewer systems that gets discharged directly into the Mississippi River to be a violation of the Clean Water Act. To address this the City has, for the past 20 years, been methodically separating the storm and sanitary sewers in community. In 2007, the City of Muscatine signed a consent order with the EPA which commits to separate sanitary and storm sewers and remove all combined sewer overflows.

The 2011 completion of the Hershey Avenue Area Sanitary and Storm Sewer Separation Project which allowed the combined sewer overflow at the Hershey Avenue Pumping Station has left the combined sewer overflow at the Papoose Creek Pumping Station as the only remaining combined sewer overflow. To remove this combined sewer overflow the combined sewers that flow to the Papoose Creek Pumping Station must be replaced with separate sanitary and storm sewer lines, this project has been titled the West Hill Sewer Separation Project. Figure 33 on page 4-40 illustrates the location of all the combined sewer lines that will ultimately be replaced with separated storm and sanitary lines as part of the West Hill Sewer Separation Project.



Figure 32: Hershey Avenue Area Sanitary and Storm Sewer Separation Project along West 3rd Street

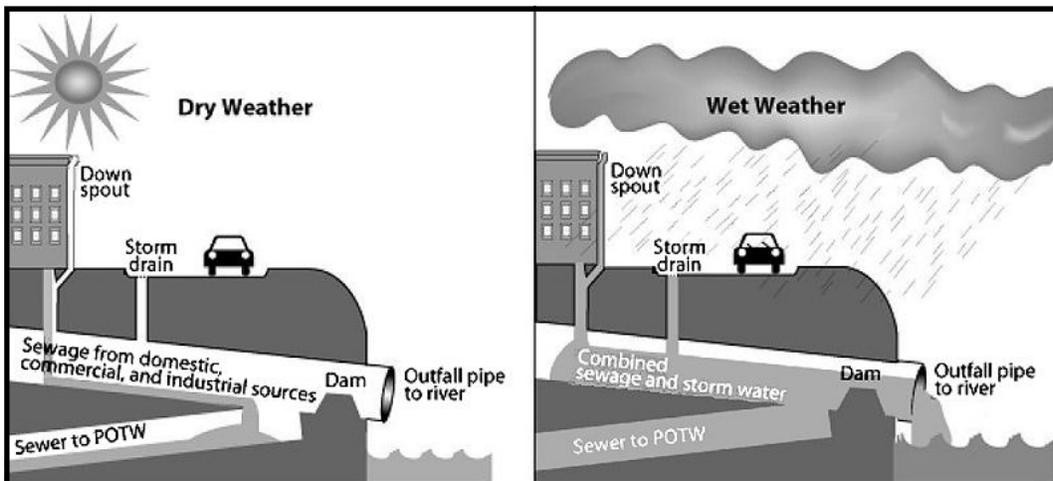


Figure 33: Illustration of a Combined Sewer System. (U.S. Environmental Protection Agency)



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The West Hill Sewer Separation Project will be the largest single public works project ever undertaken by the City of Muscatine. Completion is not expected to occur before 2028 at a cost of approximately \$50 million. Due to size and cost of the overall project it has been broken into multiple phases. Construction on the first phase began in the spring of 2012. In addition to being a major and federally mandated upgrade to the City’s sanitary and storm sewer system the West Hill Sewer Separation Project will also result in a major upgrade to the City’s street infrastructure. Nearly all the work will be in the public right-of-way and will require full width pavement and asphalt restoration, meaning that some of the oldest streets within the City will get rebuilt as part of this project. Additionally there will be new, replaced, and repaired sidewalks, driveway aprons, curb and gutter, radius returns, and handicap ramps.

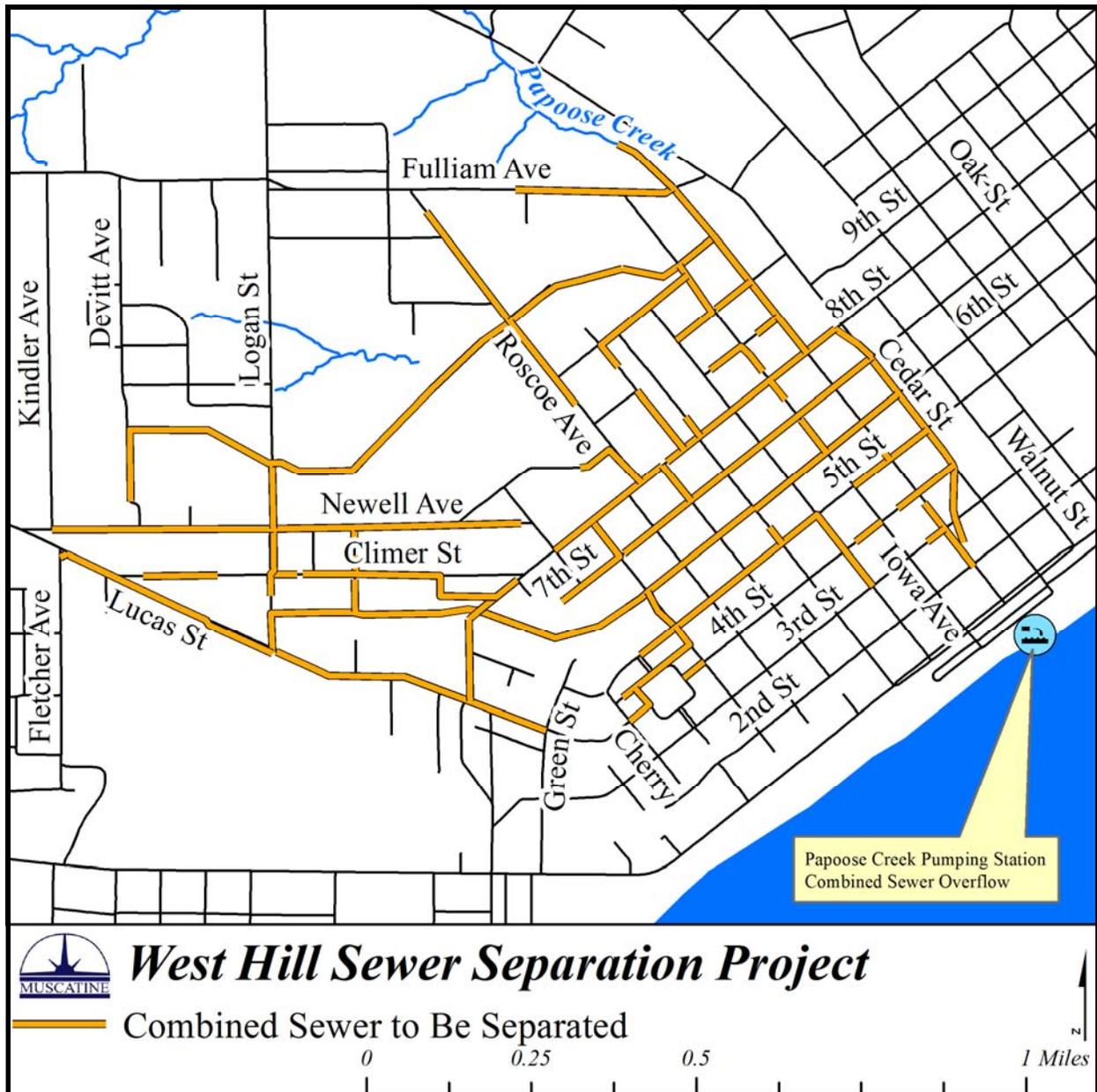


Figure 34: West Hill Sewer Separation Project Location



Leaking Underground Storage Tanks

Leaking underground storage tanks can be a significant source of environmental contamination and may pose a threat to human health and safety. In 1983, CBS's 60 Minutes aired a story titled "Check the Water," which brought national attention to families suffering from the effects of a gasoline leak from an underground storage tank. Less than a year later, Congress passed and the President signed a new law directing EPA to protect our nation's land and water from underground storage tank (UST) leaks.

Under federal law an underground storage tank falls under federal regulations. An UST is a tank and associated piping with 10% or more of its volume below ground which stored or is storing a regulated substance. A regulated substance is an element, compound or solution which, if released into the environment, may present danger to the public health or welfare, or the environment and includes the following:

1. Any petroleum or petroleum-based substances (motor fuels, petroleum solvents, lubricants, used oil, etc.);
2. Any substance that exhibits hazardous characteristics defined in the Resource Conservation and Recovery Act (RCRA) hazardous waste regulations
3. Any substance regulated under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA).

In Iowa the Department of Natural Resource administers underground storage tank regulations and programs. Part of this is the identification and mitigation of leaking underground storage tank (LUST) sites where petroleum contamination has been found. There may be more than one LUST site per UST site. These sites have been classified into the following three categories: (locations within the planning area and their classification are shown on Figures 35 through 41 though on pages 4-45 through 4-45.)

- High Risk - Corrective action and monitoring required.
- Low Risk - Annual monitoring required is required.
- No Action Required – The Iowa Department of Natural Resources requires no more action related to this site.



Air Quality

In Iowa the authority and responsibility to regulate air quality rests with the Iowa Department of Natural Resources. In addition to administering air quality standards and regulations that are based on the Code of Iowa and the Iowa Administrative Code, the United States Environmental Protection Agency has delegated the Iowa Department of Natural Resources as the authority to administer federal air quality regulations.

The legal authority for federal programs regarding air pollution control is based on the 1990 Clean Air Act Amendments (1990 CAAA). These are the latest in a series of amendments made to the Clean Air Act (CAA). This legislation modified and extended federal legal authority provided by the earlier Clean Air Acts of 1963 and 1970. The 1990 Clean Air Act Amendments (1990 CAAA), requires EPA to set National Ambient Air Quality Standards (NAAQS) for wide-spread pollutants from numerous and diverse sources considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards. Primary standards set limits to protect public health, including the health of “sensitive” populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against visibility impairment, damage to animals, crops, vegetation, and buildings. The Clean Air Act requires periodic review of the science upon which the standards are based and the standards themselves.

Any entity that has emission that meets the criteria to be considered a “major source” under Title V of the federal Clean Air Act is required to obtain a Major Source Operating Permit (Title V) from the Iowa Department of Natural Resources. These permits are legally binding documents that include enforceable conditions with which the source owner/operator must comply. Some permit conditions are general to all types of emission units and some permit conditions are specific to the source. Overall, the permit conditions establish limits on the types and amounts of air pollution allowed, operating requirements for pollution control devices or pollution prevention activities, and monitoring and record keeping requirements. A facility can be considered a “major source” under the Title V programs if it meets any of these three criteria:

- Emits more than 100 tons of any of the six criteria pollutants as defined under the National Ambient Air Quality Standards:
 - Carbon monoxide (CO)
 - Lead (Pb) compounds
 - Nitrogen Dioxides (NO₂)
 - Ozone (O₃)
 - Particulate Matter (PM 10) (less than 10 microns in diameter)
 - Sulfur Oxides (SO_x) or Sulfur Dioxide (SO₂)

Facilities with a final Title V Operating Permit must submit a Semi-Annual Monitoring Report by September 30 and March 31, and an Annual Compliance Certification by March 31, of each year. These reports are the basic, minimum reporting requirements under Iowa’s Title V Operating Permit program. These reports allow industry, citizens, and regulatory agencies to be informed when a facility fails to meet Title V permit conditions and what action is being taken to correct these problems.



Within the City of Muscatine planning area the following entities have Title V Operating Permits. The locations of these entities are depicted on Figures 35 through 4-41 on pages 4-46 through 51. Copies of these operating permits and their associated monitoring report can be obtained on the website of the Iowa Department of Natural Resources.

- Allsteel Muscatine Components Plant
- Grain Processing Corporation
- H.J. Heinz, L.P.
- Mckee Button Company
- Monsanto Company
- Muscatine Power and Water
- The Hon Company - Oak Steel Plant
- Union Tank Car Co.

There are six criteria pollutants as defined under the National Ambient Air Quality Standards (NAAQS). Muscatine has regular exceedances of the NAAQS for Particles less than 2.5 micrometers in diameter (PM_{2.5}) and Sulfur Dioxide (SO₂). Addressing these ambient air quality exceedances is one of the most important environment issues currently facing the Muscatine area. The State Hygienic Laboratory at the University of Iowa operates the air quality monitoring stations in the Muscatine area on behalf of Iowa DNR. Real time data from these monitoring stations can be found at <http://www.shl.uiowa.edu/services/ambient/realtime.xml>.

“Particulate matter,” also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. PM_{2.5} is generated by all types of combustion: motor vehicles, power plants, wood burning and some industrial processes. Most fine particle pollution is formed when organic compounds, nitrogen oxides, ammonia and sulfur dioxide react in the atmosphere to form secondary PM_{2.5}. In much of eastern Iowa, PM_{2.5} background values currently exceed 80 percent of the NAAQS. PM_{2.5} monitors are installed at Garfield School, Franklin School, Musser Park and Greenwood Cemetery. The vast majority of the PM_{2.5} exceedances were recorded Garfield School.

Sulfur dioxide (SO₂) is one of a group of highly reactive gasses known as “oxides of sulfur.” Current scientific evidence links short-term exposures to significant SO₂ concentrations, ranging from 5 minutes to 24 hours, with an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms. EPA’s National Ambient Air Quality Standard for SO₂ is designed to protect against exposure to the entire group of sulfur oxides (SO_x). The EPA promulgated new lower standards SO₂ that became effective August 23, 2010. Between August 23, 2010 and the end of 2011 a total of 51 exceedances of this new standard for the allowable amount of sulfur dioxide (SO₂) were recorded in Muscatine. A SO₂ monitor is located at Musser Park.

In 2011, Grain Processing Corporation one of the most significant local emitters of SO₂ and PM_{2.5} in Muscatine, finished obtaining all the necessary regulatory permits broke ground on a \$75 million state-of-the-art grain dryer which will retire from use 11 existing grain dryers that make use of older technology. A \$20 million upgrade to the environmental control systems for its boilers also began in 2011. In 2015 when both of these project are fully operational, they are projected to reduce sulfur dioxide emissions by 87% and small particulate matter emissions by 63% substantially improving the air quality in Muscatine.



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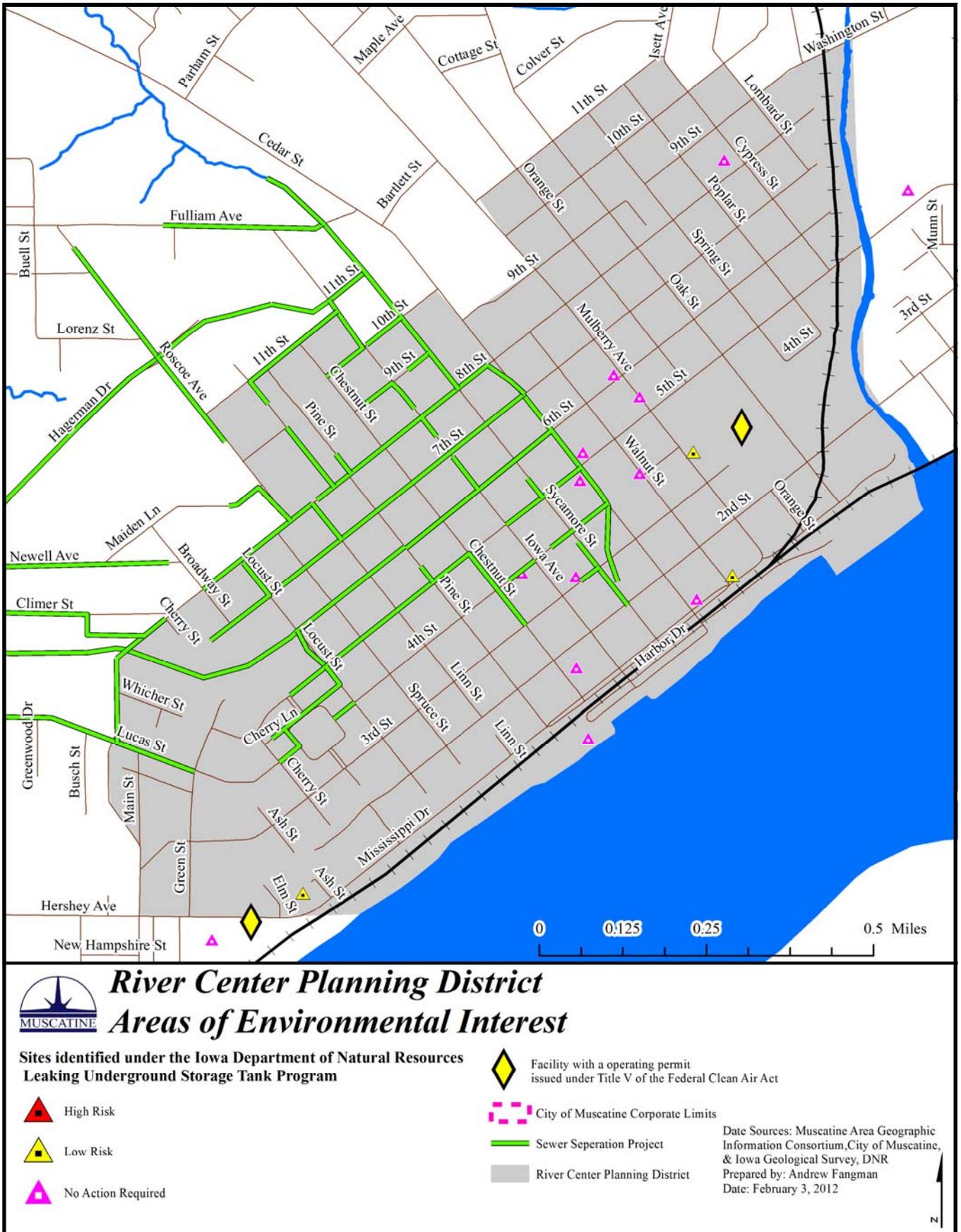


Figure 35: River Center Planning District Areas of Environmental Interest



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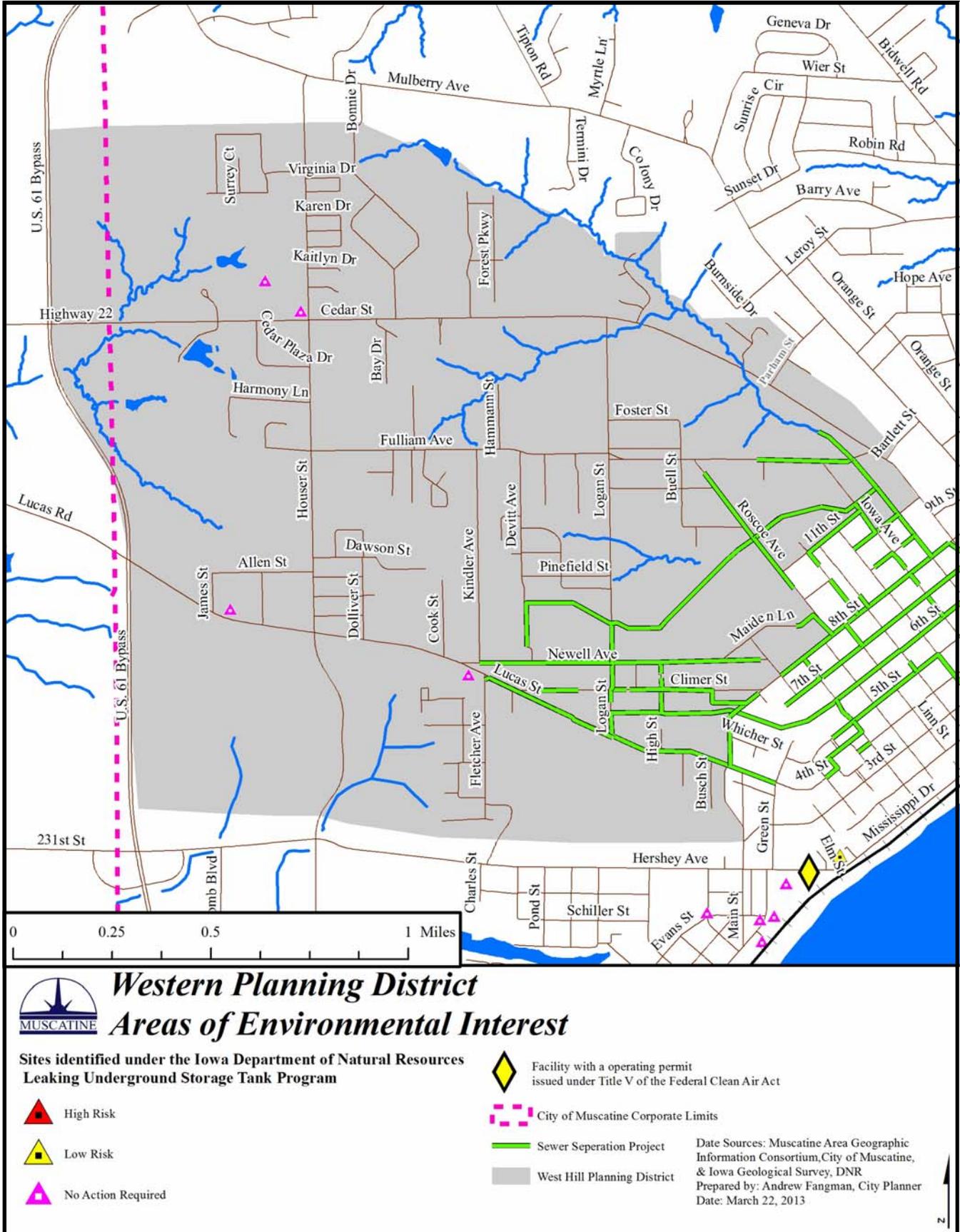


Figure 36: West Hill Planning District Areas of Environmental Interest



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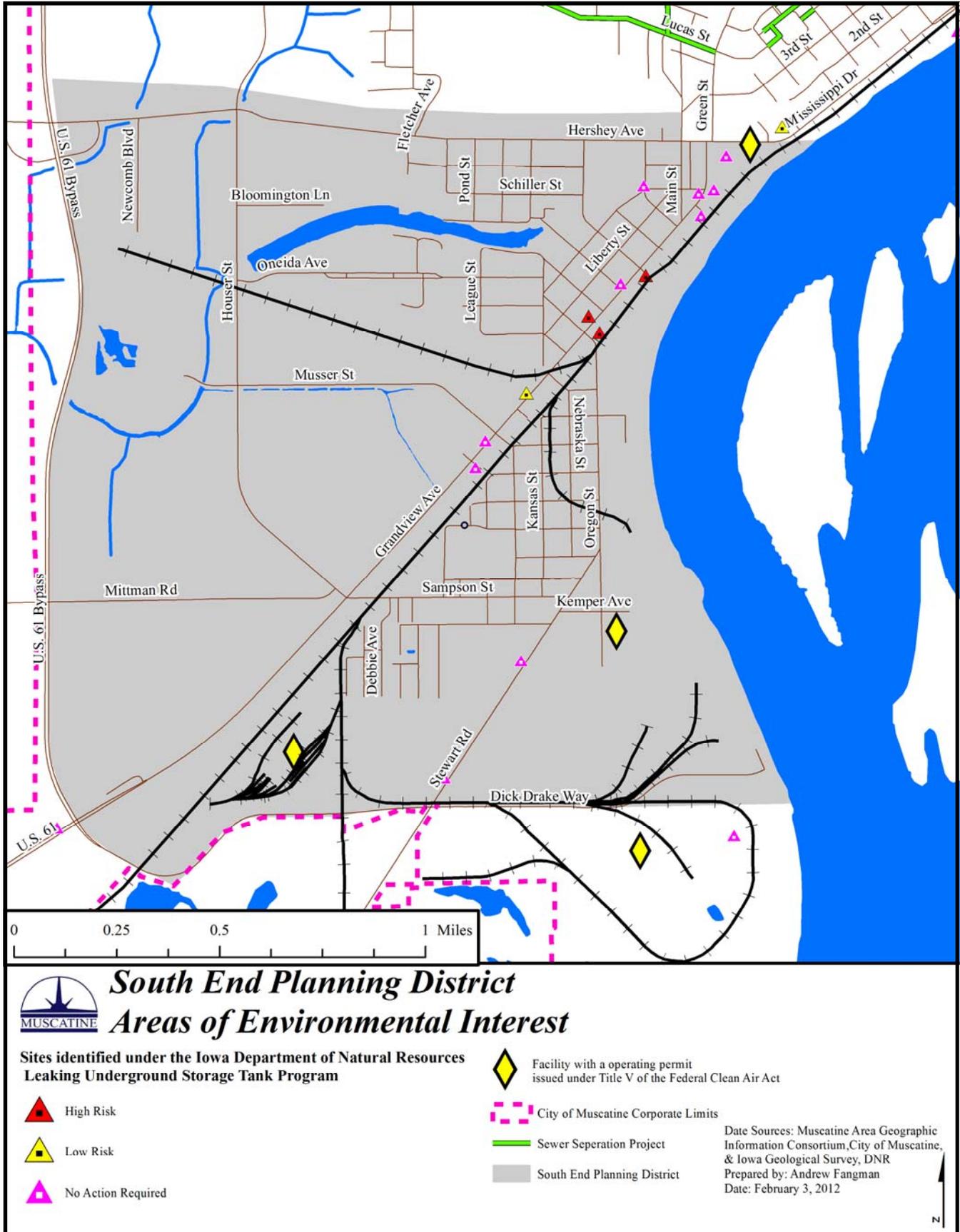


Figure 37: South End Planning District Areas of Environmental Interest



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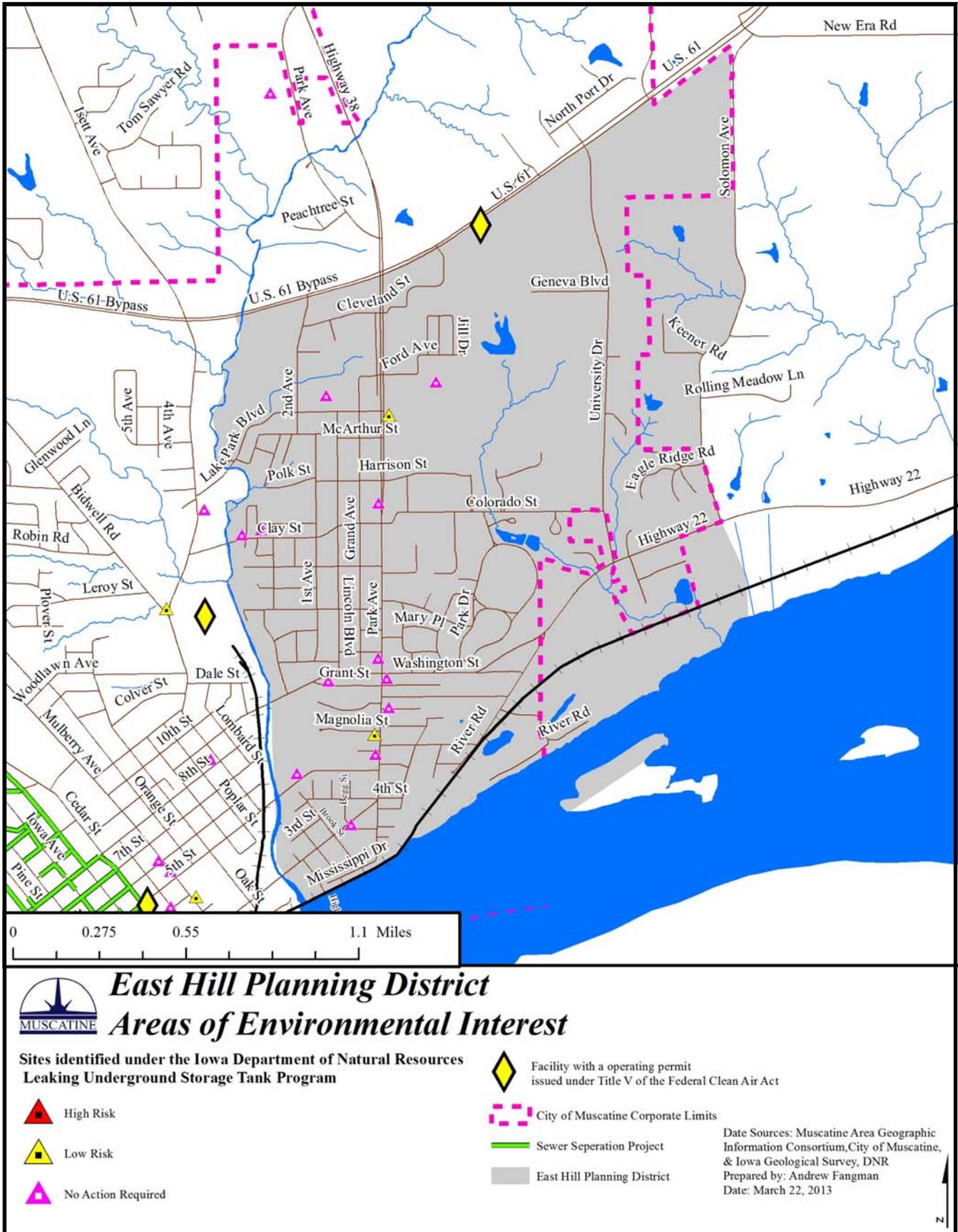


Figure 38: East Hill Planning District Areas of Environmental Interest



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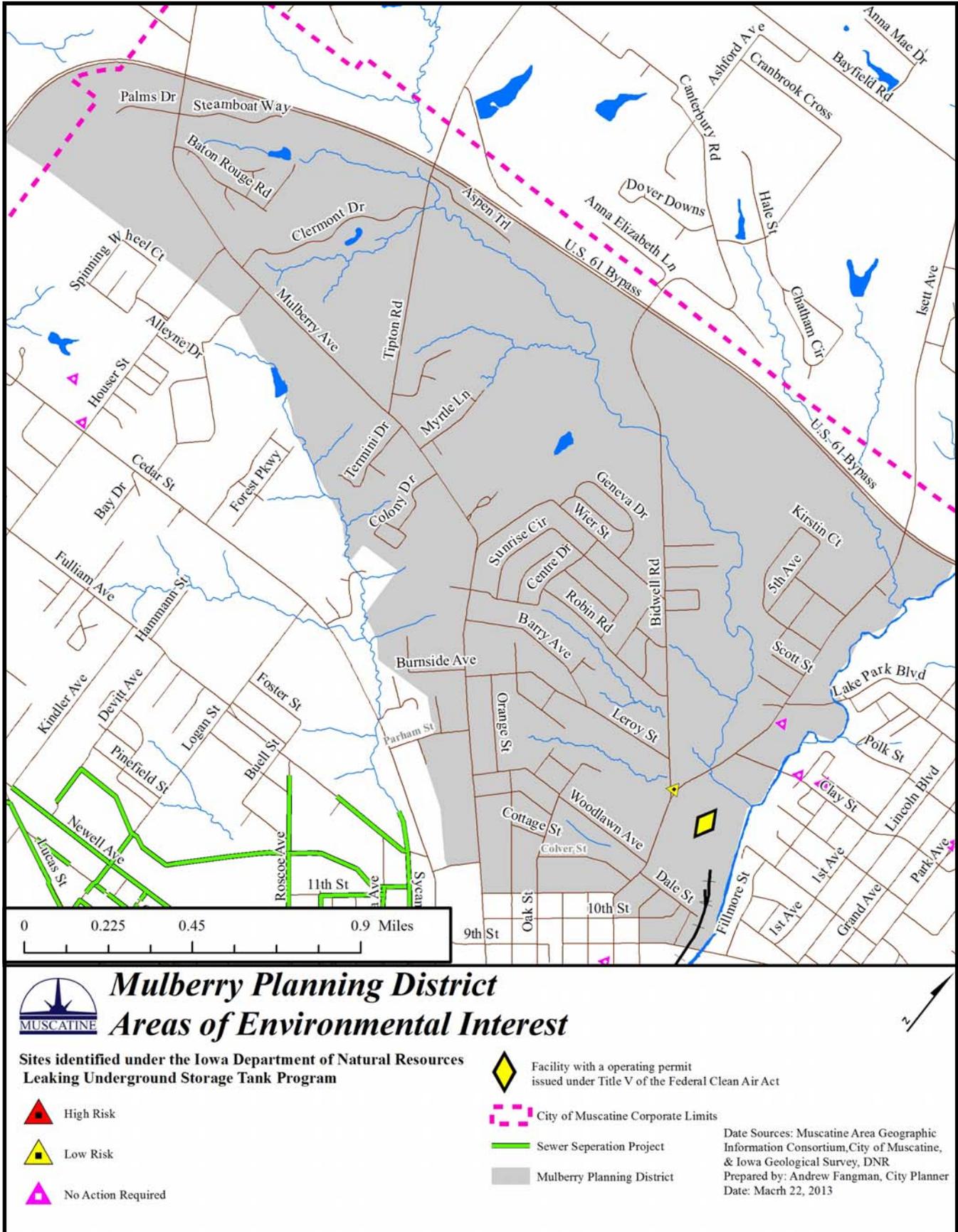


Figure 39: Mulberry Planning District Areas of Environmental Interest



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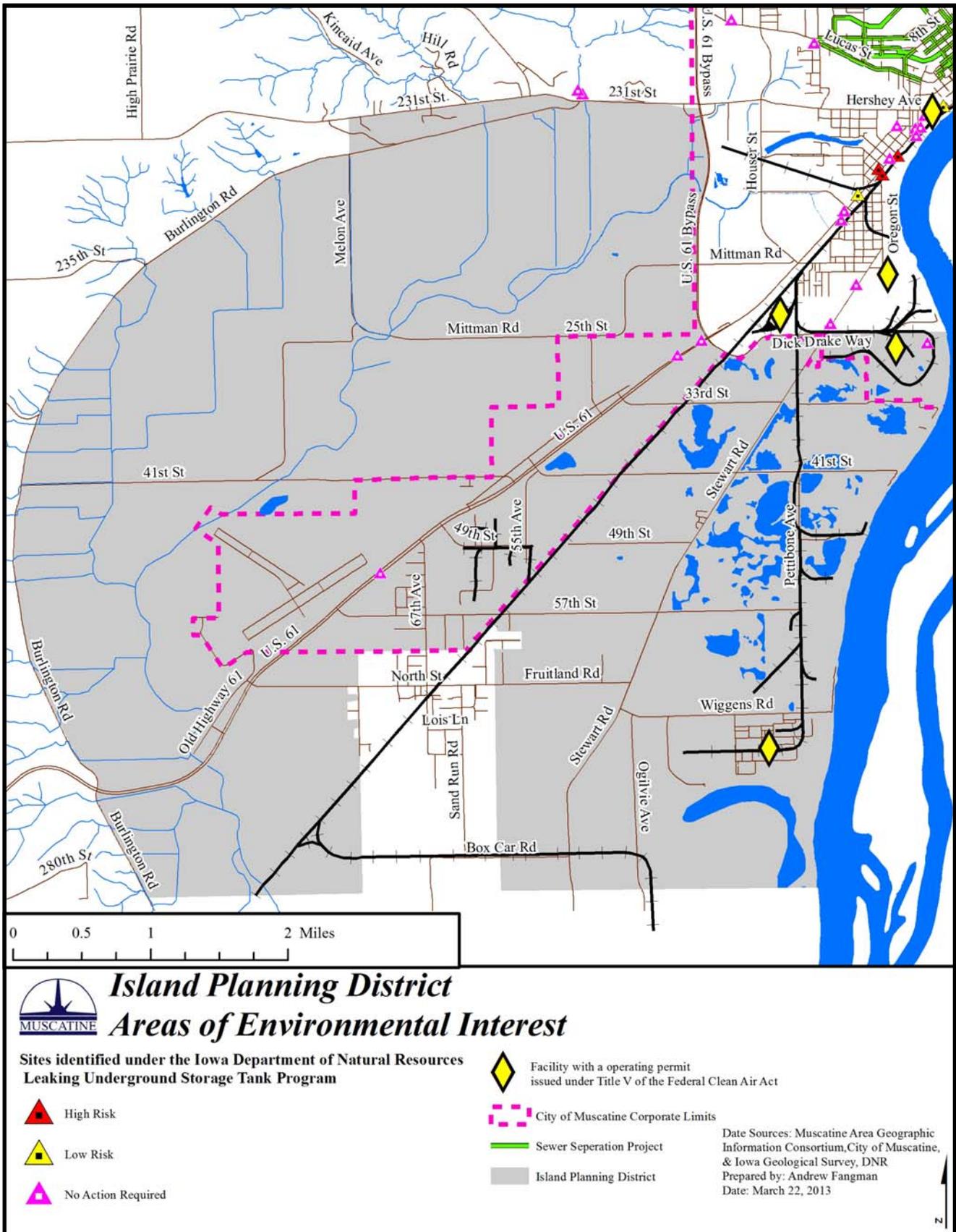


Figure 40: Island Planning District Areas of Environmental Interest



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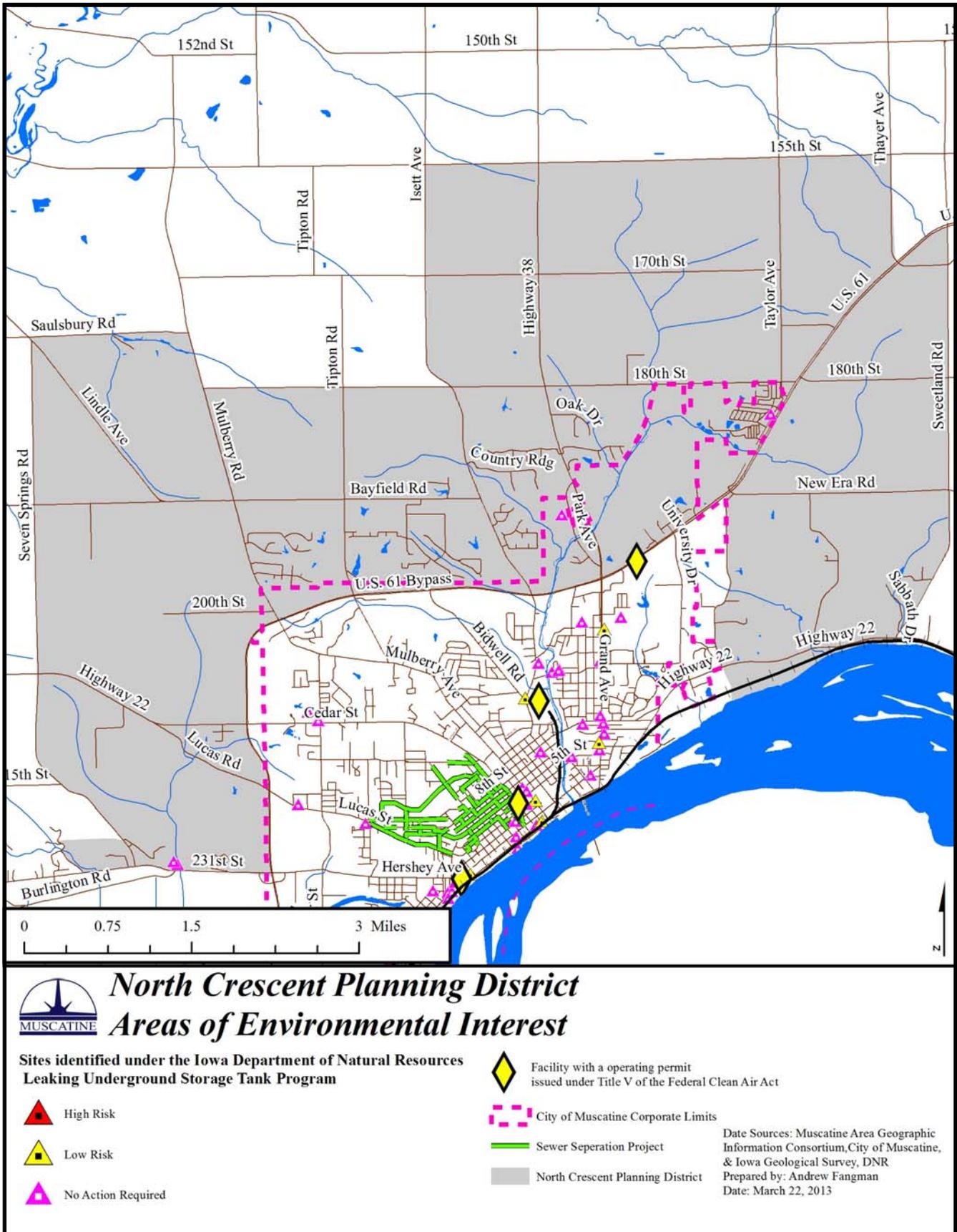


Figure 41: North Crescent Planning District Areas of Environmental Interest



Environmental Quality Goals and Implementation Strategies

In order for goals to be achieved there must be strategies to implement the vision of a better Muscatine that is laid out in the goals in the comprehensive plan. Each goal contained in the Plan is accompanied by specific implementation strategies necessary to make that goal a reality.

There are three types of implantation strategies: policies, actions, and projects. Policies contain the standard which if followed in all city actions and activities subject to review by the City, will advance the goal that they support. Policies contained with the comprehensive plan are advisory and compliance is not mandatory, however when taking an action contrary to what is contained in the Plan this fact should be noted and an explanation given.

Actions detail the specific initiatives that the city can take to achieve a listed goal. Actions include such things as creating the necessary regulations to implement a goal, perform a study to be understand how a goal might be achieved or identify funding to achieve a goal.

Projects are specific capital improvement projects that if constructed would advance a listed goal. When the city develops future capital improvement plans, strong consideration should be given to these specific projects listed in the comprehensive plan.

Goal EQ.1: Public Facilities/Operations

For public facilities and operations to be a model for the private sector in implementing environmental quality programs.

Policy EQ.1.A: City of Muscatine employees will make as few work related trips as feasible.

Action EQ.1.B: The City of Muscatine will where feasible implement trip reduction programs for municipal employees, including such things as:

- Teleconferencing in lieu of employee travel to conferences and meetings when feasible.
- Telecommuting where and when feasible.

Policy EQ.1.C: City of Muscatine vehicles should be procured and operated in manner to reduce emissions.

Action EQ.1.D: Where feasible City vehicles will be replaced or upgraded in manner that reduces vehicle emissions.

Action EQ.1.E: Reduction of emissions and fuel consumption will be an important consideration in operations of City vehicles.



Goal EQ.2: Energy Consumption

Reduce the environmental impacts related to energy consumption and production.

Policy EQ.2.A: City of Muscatine regulations and policies will promote energy efficiency.

Policy EQ.2.B: Encouragement of production of energy in a manner that reduces negative environmental impacts.

Action EQ.2.C: The City of Muscatine will work with local energy providers and businesses to promote voluntary incentive based programs to encourage the use of energy efficient designs and equipment.

Action EQ.2.D: The City of Muscatine will cooperate with the local building industry, and utilities to promote voluntary enhanced energy conservation standards for new construction and rehabilitation projects.

Action EQ.2.E: The City of Muscatine will encourage local energy producers to continue to monitor the feasibility of making changes to the manner of energy production that would reduce emissions.

Action EQ.2.F: The City of Muscatine will make changes to the zoning ordinance to better accommodate, without negatively impacting neighboring properties, businesses and residents generating power with their own wind turbines or solar panels.

Goal EQ.3: Education and Community Partnerships

Work with community partners to improve the environmental quality of the community and the public's understanding of these issues.

Policy EQ.3.A: The City of Muscatine will work with community partners to improve the public's understanding of the land use, transportation, and environment quality link.

Action EQ.3.B: The City of Muscatine will work with local public and private groups that provide education programs regarding the impact of excessive idling on air quality.

Action EQ.3.C: The City of Muscatine will work with neighboring jurisdictions and affected agencies to address cross-jurisdictional and regional transportation and air quality issues.



Goal EQ.4: West Hill Sewer Separation Project

Complete the West Hill Sewer Separation project by 2028.

Policy EQ.4.A: As future phases of the West Hill Sewer Separation Project are designed and constructed, to determine if work being done as part of the West Sewer Separation Project can be leveraged to achieve other goals set forth in the Comprehensive Plan.

Project EQ.4.B: Completion of the West Hill Separation Project in multiple phases.

Goal EQ.5: Flood Plain

To regulate the use of land in those areas of the City which are subject to predictable inundations at frequent intervals to assure that flood carrying capacity within the altered or relocated portion of any watercourse is maintained. Such land use controls are necessary to qualify property owners for flood insurance under the National Flood Insurance Act of 1968. The regulations, while permitting reasonable economic and social use of such properties, help protect health, safety, and general welfare and reduce financial burdens imposed on the community, governmental units, and its individuals caused by frequent and periodic floods and the overflow of lands.

Policy LU.5.A: The City of Muscatine will maintain legally enforceable floodplain management regulations that are compliant with Title 44 Code of Federal Regulations 60, in order to ensure that Muscatine residents and business are eligible to participate in the National Flood Insurance Program.

Action EQ.5.B: Monitor and update when necessary the City's floodplain management regulations to ensure continued compliance with Title 44 Code of Federal Regulations 60.