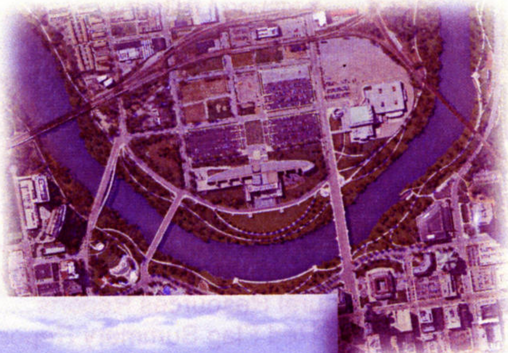
MAIN STREET DAM REMOVAL & SCIOTO GREENWAYS

FEASIBILITY STUDY



Columbus Downtown Development Corporation

Stantec

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List of Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
APE	area of potential effects
ASC	ASC Group, Inc.
CDDC	Columbus Downtown Development Corporation
CLF	Columbus Landmarks Foundation
CLOMR	Conditional Letter of Map Revision
COSI	Center of Science and Industry
CSO	Combined Sewer Overflow
EWH	exceptional warm water habitat
FCEO	Franklin County Engineer's Office
FEMA	Federal Emergency Management Agency
FIRMS	Flood Insurance Rate Maps
FWDT	Floodway Data Table
gpm	gallons per minute
LiDAR	Light Detection and Ranging
LOMR	Letter of Map Revision
MOA	Memorandum of Agreement
MSI	MSI Design
MSL	mean sea level
MWH	Modified Water Habitat
NEPA	National Environmental Policy Act of 1969
NLCD	National Land Cover Dataset
NRHP	National Register of Historic Places
OAI	Ohio Archaeological Inventory
OARS	OSIS Augmentation Relief Sewer
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
OHI	Ohio Historic Inventory
OHPO	Ohio Historic Preservation Office
OSIS	Olentangy-Scioto Intercepting Sewer
OSU	The Ohio State University

OUPS	Ohio Utility Protection Service
PCBs	polychlorinated biphenyls
QBS	Qualifications Based Selection
QHEI	Qualitative Habitat Evaluation Index
Rii	Resource International, Inc.
SCS	sediment core sampler
SPF	Standard Project Flood
SQG	Sediment Quality Guidelines
Stantec	Stantec Consulting Services Inc.
SVOC	Semi-Volatile Organic Compound
TSD	Technical Support Document
USACE	U.S. Army Corps of Engineers
USCS	United Soils Classification System
USEPA	United States Environmental Protection Agency
USFW	U.S. Fish & Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WWH	Warm Water Habitat

1.0 Introduction and Background

Today, Columbus is in the middle of a riverfront renaissance. With the opening of North Bank Park, the construction of the Scioto Mile, and the recent addition of the Scioto Audubon Metro Park, the Downtown riverfront is being transformed. Columbus has the opportunity to create an unparalleled green, river corridor that runs through the heart of the Downtown. Currently, the Main Street Dam holds back the Scioto River forming an overly-wide river channel. Removing the dam will allow the water course to be narrowed and green space to be added along its edges. This new urban riverfront could be expanded with new green space and pathways that encourage interaction at the river level. The proposed removal of the Main Street Dam builds on the previous projects and allows downtown to truly embrace the Scioto River.

1.1 PROJECT PARTNERS

The Columbus Downtown Development Corporation (CDDC), in partnership with the City of Columbus, funded the efforts of the Main Street Dam Removal Feasibility Study. A Qualifications Based Selection (QBS) process was utilized in the procurement of the professional services needed for the project.

The Stantec Consulting Services Inc. (Stantec) team was selected to provide the professional services for this project. The Stantec team consisted of the following members: MSI Design (MSI); Resource International, Inc. (Rii); ASC Group, Inc. (ASC); and Coldwater Consulting, LLC.

1.2 PURPOSE OF THE STUDY

The first step toward realizing the removal of the Main Street Dam and the redevelopment of the riverfront is a feasibility study that will map out clearly the conceptual designs of the river restoration and the green space development and identify issues that will need to be addressed during the project lifecycle.

1.3 PROJECT GOALS

The first step toward realizing the removal of the Main Street Dam and the redevelopment of the riverfront is a feasibility study that will map out clearly the conceptual designs of the river restoration and the green space development and identify issues that will need to be addressed during the project lifecycle. Project Goals

The main objectives of this feasibility study are to develop:

- A conceptual design with alternatives that are based on sound engineering;
- Budgetary cost estimates for final design tasks and construction, including potential funding sources;

- A project plan that identifies issues to be addressed during final design, permitting requirements, and a project timeline; and
- Renderings and presentations of the proposed project to be utilized for garnering support and funding.

1.4 PROJECT AREA AND EXISTING CONDITIONS

The Main Street Dam is located on the Scioto River approximately 1.2 miles downstream of the confluence with the Olentangy River in downtown Columbus, Ohio. The pool created by the dam extends upstream through downtown Columbus for approximately 2.3 miles to the Dublin Road Low Head Dam. The dam was initially constructed as a timber structure in the mid 1800's to provide water to the feeder canal for the Ohio-to-Erie Canal. After the flood of 1913 destroyed the timber dam, it was rebuilt as a concrete structure in 1921, and then raised in 1929 to its current height.

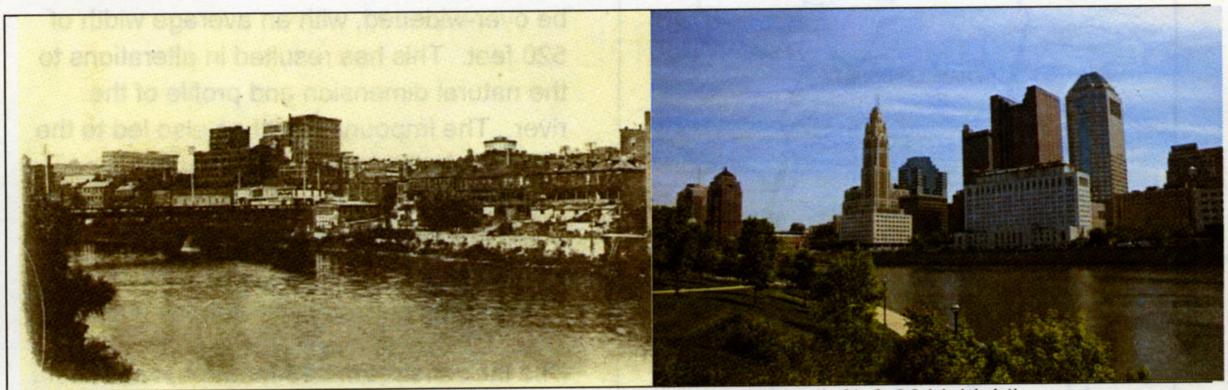

Figure 1-1. Scioto River Looking Northeast in 1906 (left) & 2011 (right).

1.4.1 Project Extents

The proposed project will include the removal of the Main Street Dam and the subsequent restoration of the Scioto River. The area targeted for restoration following the removal of the dam extends from approximately 850 feet downstream of the dam to the confluence with the Olentangy River. The total project length is roughly 7,000 feet. The width of the proposed project will vary, but will be contained within the extents of the current floodwall.

Figure 1-2. Proposed Project Disturbance Area

1.4.2 Existing River Conditions

The Scioto River basin has been modified by extensive anthropogenic causes. The river itself has many hydro-modifications as it flows through the City of Columbus. The first river obstruction upstream of the confluence with the Ohio River is the Greenlawn Dam, which is located just downstream of the proposed Main Street Dam Removal project area. Moving upstream, the following dams are encountered: Main Street Lowhead Dam, Dublin Road Lowhead Dam, Griggs Reservoir Dam, and O'Shaughnessy Reservoir Dam.

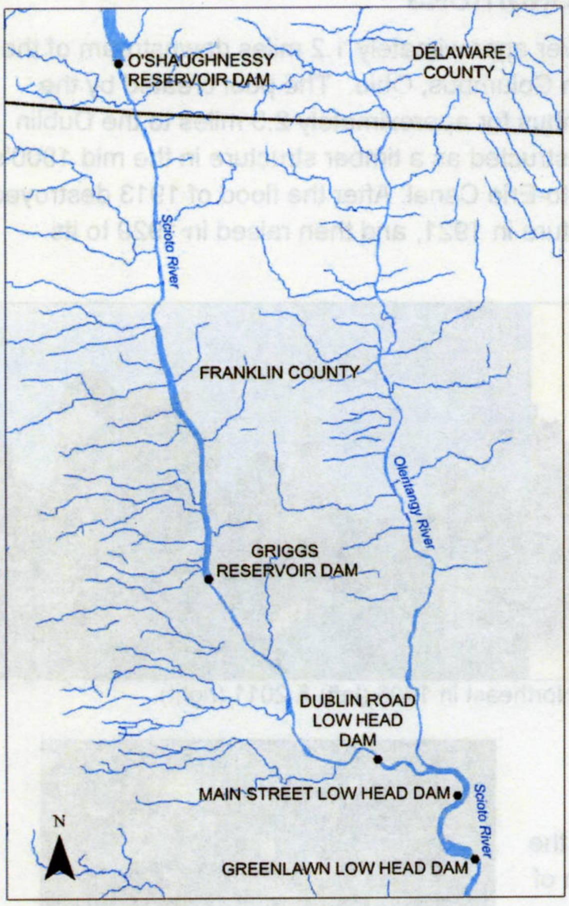

Figure 1-3. Dams Along Scioto River

The Scioto River meanders through a Valley Type VIII, terraced alluvial valley (Rosgen 1996). Flood flows are contained by levees, including the Franklinton Floodwall (West Columbus Local Protection Project).

The impoundment created by the Main Street Dam has caused the Scioto River to be over-widened, with an average width of 520 feet. This has resulted in alterations to the natural dimension and profile of the river. The impoundment has also led to the near elimination of riffle and pool facets, which is inhibiting the river from reaching its potential use attainment of Warm Water Habitat (WWH) as defined by the Ohio Environmental Protection Agency (OEPA).

The lack of stream bed features, near shore cover, and velocity and depth variation are significant hindrances to habitat within the channel. Riparian vegetation has also been reduced in many areas due to infrastructure encroachment.

1.4.3 Existing Bridges

Multiple bridges exist in the proposed project area extending from immediately downstream of the Main Street Dam upstream to the confluence with the Olentangy River. Included in this segment of the Scioto River are the recently completed Main Street Bridge, the Rich Street Bridge (currently under construction), the Broad Street Bridge, and three railroad bridges. These structures were evaluated to determine if they will encounter any potential impacts resulting from the proposed dam removal and stream restoration. More detailed information regarding these bridges and the evaluations can be found in Section 8.0 of this report.

1.4.4 Existing Utilities

Copies of all existing plan information for combined, sanitary and storm sewers and waterlines were obtained from the City of Columbus. Plan information for private utilities was obtained through a request with Ohio Utility Protection Service (OUPS). Base maps were prepared using information obtained from the Franklin County Auditor's GIS mapping database. Exhibits showing existing utility locations are located in Appendix B.

1.4.4.1 River Utility Crossings

In the project area, there are 3 utility lines crossing the Scioto River: a 10-inch and 36-inch sanitary force main just upstream of the Main Street Dam, a 138 kV electric line and a 12-inch gas line just upstream of the Main Street Bridge (See Appendix B, Exhibit 4). These features will be accounted for, maintained and protected during the restoration phase of the project through the use of natural channel design techniques.

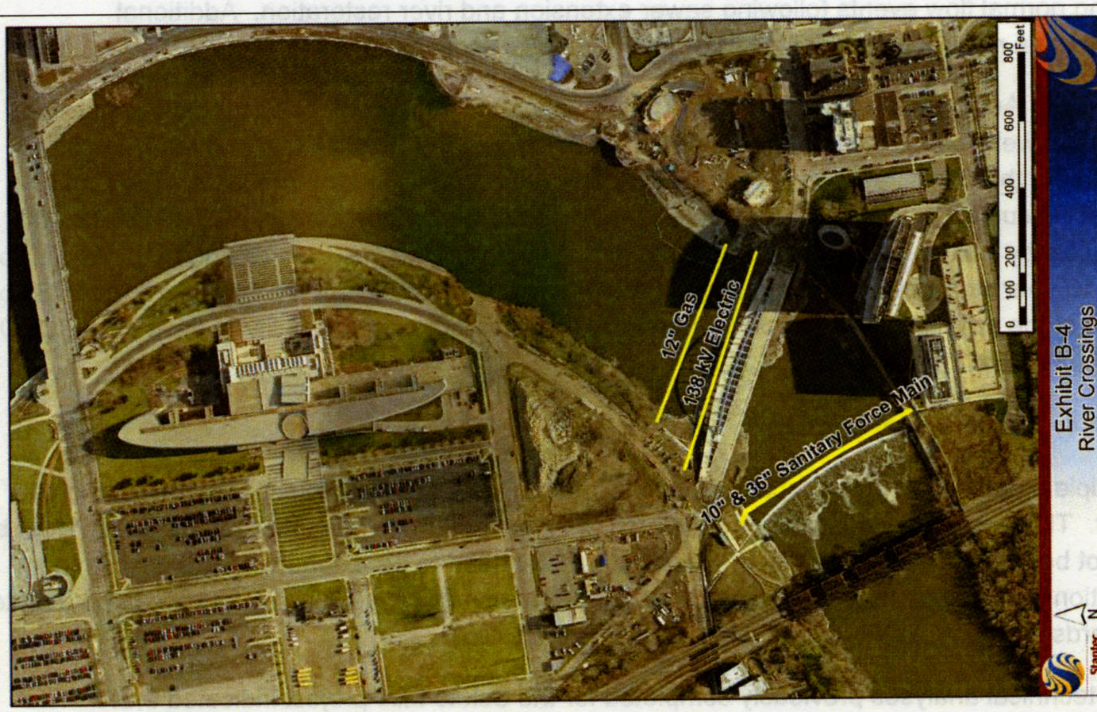

Figure 1-4. River Utility Crossings

1.4.4.2 Olentangy-Scioto Intercepting Sewer (OSIS)

The Olentangy-Scioto Intercepting Sewer (OSIS) was constructed in the 1920s and receives combined sanitary and storm flows for transport to the City's wastewater treatment plants. A portion of the OSIS is located directly behind the floodwall along Civic Center Drive. Some concern exists that the OSIS may potentially be affected by proposed loading changes along the Civic Center Drive Floodwall. A detailed analysis of the OSIS was completed and discussed in more detail in Section 8.0 of this report.

1.4.4.3 Combined Sewer Overflows

There are eight combined sewer overflow (CSO) locations in the project area. During dry weather and small wet weather events (i.e., rainfall and snowmelt), combined sewers are designed to transport all flows to a wastewater treatment plant. During larger wet weather events the volume of storm water entering the combined sewer system may exceed the capacity of the combined sewers and/or the treatment plant. When this happens, combined sewers are designed to allow a portion of the untreated combined wastewater to overflow into the nearest ditch, stream, river or lake. This prevents the rupturing of pipes, backing up of sewage into basements, and/or flooding of streets (OEPA). Due to the proposed narrowing of the river, these CSO locations will need to be extended to connect to the new channel location. CSO locations that are currently submerged during normal flow events will remain submerged during normal flow events following sewer extension and river restoration. Additional information regarding CSO extensions is available in Section 8.0 of this report.

The OSIS Augmentation Relief Sewer (OARS) is a 20 foot diameter deep tunnel designed to intercept wet weather overflows that currently empty into the Scioto River and carry the flows instead to the City's Jackson Pike and Southerly Wastewater Treatment Plants. The OARS project is currently under construction and expected to be complete by 2015. The OARS will significantly limit the amount of CSOs that occur; however, the OARS is designed to handle up to a 10 year storm event and any storm greater than a 10 year event will overflow into the Scioto River at the current CSO locations. Therefore, the operational functionality of the existing CSO locations must remain.

1.4.4.4 Storm Sewer Outfalls

Multiple storm sewer outfall locations exist along the length of the project on both sides of the river. These outfalls vary in size from 8-inch to 72-inch diameter circular culverts to a 12-foot by 6-foot box culvert. The majority of these outfalls will need to be extended to the new channel location to maintain connectivity with the river. Some smaller outfalls may be able to be directed towards a green infrastructure feature, such as a bioswale.

Geotechnical analyses previously completed for the Scioto Mile project indicated that subsurface conditions were not sufficient for supporting the large box culverts that exist in the project area. At these locations, support slabs founded on drilled piers were constructed to support the box culverts. Extensions of these culverts will also require an extension of the support slab and foundation. More information on the structural concerns of storm sewer outfalls is contained in Section 8.0 of this report.

1.5 PROPERTY OWNERSHIP

The majority of the property within the proposed project area is owned by or maintained by the City of Columbus. This also includes the river. The State of Ohio turned this segment of the Scioto River over to the City of Columbus in 1911.

House Bill No. 584 was passed on May 31, 1911 and approved on June 7, 1911 by the General Assembly of the State of Ohio. This bill transferred from the State of Ohio to the City of Columbus "…the bed and banks of said Scioto River…from what is known as the state dam across such stream near the foot of Main Street [Main Street Dam] in the City of Columbus, Franklin County, Ohio, and extending northward to the north line of the present penitentiary grounds…" This act permits the City to use the bed and banks of the Scioto River for the purposes of "boulevard, boating, park, playground and other strictly public purposes…"

House Bill No. 584 also authorized the City of Columbus "…to take charge of the state dam [Main Street Dam] across such river [Scioto River] and maintain and improve or reconstruct the same in any manner that will be for the best interest to the public…"

[House Bill No. 584.]

AN ACT

To abandon for canal purposes the slack water in the Scioto river through the city of Columbus, Ohio, and to transfer certain rights therein to the city of Columbus.

WHEREAS, The state of Ohio about the year 1833 appropriated the bed and banks of the Scioto river for canal purposes from the site of the state dam across such river near the foot of Main street to a point opposite the north line of the present penitentiary grounds in the city of Columbus, Franklin county, Ohio, and,

WHEREAS, The city of Columbus, Ohio, is desirous of improving and beautifying such stream by constructing and maintaining boulevards along portions of the banks thereof and of raising the water in the channel of such stream so as to make boating for launches and other water craft thereon safe and practical, and,

WHEREAS, The city of Columbus has borne the expense of maintaining the levees along the west bank of said river for more than half a century and thereby saving the state thousands of dollars in claims for damages, therefore,

Be it enacted by the General Assembly of the State of Ohio:

SECTION 1. That the slack water in the Scioto river from what is known as the state dam across such stream near the foot of Main street in the city of Columbus, Franklin county, Ohio, and extending northward to the north line of the present penitentiary grounds, be and the same is hereby abandoned for canal purposes.

SECTION 2. That so much of the bed and banks of said Scioto river in the city of Columbus, Franklin county, Ohio, between the points named in section one of this act be, and the same is, hereby transferred to the city of Columbus, Ohio, for boulevard, boating, park, playground and other strictly public purposes, but for no other purpose or purposes, upon the condition that such city of Columbus enter upon such premises and make substantial improvements thereon for the purposes above named within three years from the date of the approval of this act, and that such city forever maintain the existing levees on the west bank of such river, and such city shall prevent the discharge of sewerage into the channel of such river, and the placing of matter of any kind therein tending to render the stream insanitary.

SECTION 3. The said city of Columbus is also authorized to take charge of the state dam across such river and maintain and improve or reconstruct the same in any manner that will be for the best interests of the public, and the city council of such city shall have power to prescribe by ordinance such rules and regulations for the navigation of boats upon the channel of such stream as it may deem necessary, and prescribe reasonable penalties for the violation of such ordinances.

SECTION 4. The state of Ohio shall have the right to resume the use of the water and banks of such river whenever it is required for canal purposes, or whenever it is required in any scheme for canalizing the Scioto river, and in either case the state may resume control and use of any dam located on the site of the present dam or any other dam either above or below the present structure.

SECTION 5. This act shall be in full force and effect whenever the council of the city of Columbus by a vote of not less than two-thirds of the members thereof shall signify its acceptance of this grant upon the terms and conditions specified in this act.

SECTION 6. Whenever any portion of the banks or stream herein transferred is used for any other purpose than the purposes specified in this act, it shall immediately revert to the state of Ohio.

SECTION 7. This grant is made subject to all leases and rights heretofore granted by the state of Ohio that may be in force at the date of the approval of this act.

S. J. VINING,
Speaker of the House of Representatives.
HUGH L. NICHOLS,
President of the Senate.

Passed May 31st, 1911.
Approved June 7th, 1911.

JUDSON HARMON,
Governor.
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Figure 1-5. House Bill 584

1.5.1 Main Street Bridge

The Main Street Bridge was completed in 2011 and was built in existing right-of-way conveyed to the State of Ohio. The northernmost portion of the structure consists of a bike path that falls outside of the boundaries of the existing right-of-way. An aerial easement was conveyed to the State of Ohio to cover the bike path.

1.5.2 Rich Street Bridge

At the time of the writing of this report, the Rich Street Bridge is currently under construction. Construction is scheduled to be completed in 2012. Right-of-way acquired for the project was acquired in the name of the City of Columbus, Ohio.

1.5.3 Broad Street Bridge

The Broad Street Bridge was replaced in 1990 and was constructed in existing right-of-way conveyed to the State of Ohio.

1.5.4 Railroad Bridges

The three (3) railroad bridges in the project area are owned by either CSX or Norfolk Southern (the southernmost of the three bridges is shared between both railroad companies). A detailed search of publicly available records did not turn up any documents related to the granting of rights-of-way or easements for the railroad bridges. The railroad companies own land for their facilities outside the normal edge of water. It is thereby concluded that the railroad companies own only the bridge structures themselves, and not the riverbed upon which they lie.

1.5.5 Adjacent Properties

Various public and private entities own land immediately adjacent to the Scioto River, including:

American Electric Power	Columbus Metropolitan	Ohio Building Authority
Bicentennial Plaza Ltd	CSX Transportation	Pennsylvania Lines LLC
Cardinal Title Holding Co	Franklin County Commissioners	Pizzuti/Miranova Corp.
Chesswell Company	GFS Chemicals Inc.	Riversouth Authority
City of Columbus	Handwell Company	Riversouth Holdings
Donald R. Clifton II	Larry A Heiser	Stanberry Development LLC
Columbia Gas of Ohio Inc.	Huntington Center	State of Ohio
Columbus & Southern	Thomas A. Nastoff	Supreme Court of Ohio
Columbus Downtown	New York Central Lines	United States of America

Source: Franklin County Auditor

A map showing the locations of these properties is shown in Appendix A, Exhibit 2.

2.0 Historic Preservation

2.1 HISTORY OF THE RIVER IN DOWNTOWN

In what is now downtown Columbus, the Scioto River has attracted inhabitants since before Lucas Sullivant founded the first permanent settlement in 1797. At that time, the Scioto River provided clean drinking water, transportation, good fishing, hunting, and recreation. The floodplains along its banks also provided fertile ground for growing crops. Several islands and sandbars were scattered along the river, which provided an escape to anyone who wanted to find peace and relaxation away from city life.

By 1812, Columbus was chosen as the state capital since it was in an ideal location in the center of the state and had access to major transportation routes (the river, canals, and the railroad) for shipping goods and transporting people. As the city's population grew, so did its businesses. Warehouses, factories, tanneries, distilleries, and homes lined the banks of the river. Over time, manufacturing and the growing population took a toll, and the river was abused and then neglected. The river was polluted with raw sewage and industrial waste. It flooded frequently spreading disease and destroying property.

By the mid 1800's the original timber dam at Main Street was built to provide water for the feeder canal which connected the Scioto River to the Ohio-to-Erie Canal.

In the early 1900s, the city had begun planning to reclaim the area downtown around the river, which called for new riverfront parks and new buildings to line its banks. Planning was delayed when in March of 1913 the river flooded, and in Franklinton more than ninety people lost their lives and thousands were left without homes. The Main Street Dam, bridges, businesses, warehouses, and homes were swept away, and critical sections of the feeder canal were destroyed, which resulted in much of the canal being abandoned. Historical records indicate that the city began filling in the feeder canal in 1918.

After the flood, the Army Corps of Engineers recommended widening and deepening the river by building retaining walls, and a series of dams to prevent future flooding and to make the river downtown more aesthetically pleasing since unsightly mud-flats had been exposed after the Main Street Dam was destroyed and the river, once again, had narrowed closer to its natural course.

Today's Main Street Dam was built in 1921 and resulted in a wider river. The dam was altered in 1929, adding another foot and a half in height, which again widened the river to what is now its current width. Over time, alterations in the river's course and the construction of dams and bridges have caused all traces of the islands once seen on the Scioto to disappear.

The Main Street Dam has slowed the flow of the Scioto River, reducing dissolved oxygen levels and inhibiting the river from transporting its sediment load. The dam has limited the navigability of the river, preventing boat passage and fish from migrating upstream. The Main Street Dam has assisted in creating an unhealthy environment for aquatic life.

2.2 CULTURAL RESOURCES REPORTS

As part of understanding the potential impacts of the proposed project on the historic and cultural resources of the community, and being prepared for agency coordination required for the project permitting and funding processes, a Red Flag Summary Report and a Literature Review were compiled. The Cultural Resource Red Flag Summary and the Literature Review were prepared by ASC. The full text of the reports is contained in the following subsections. Additional maps, figures, and photographs can be found in Appendix C.

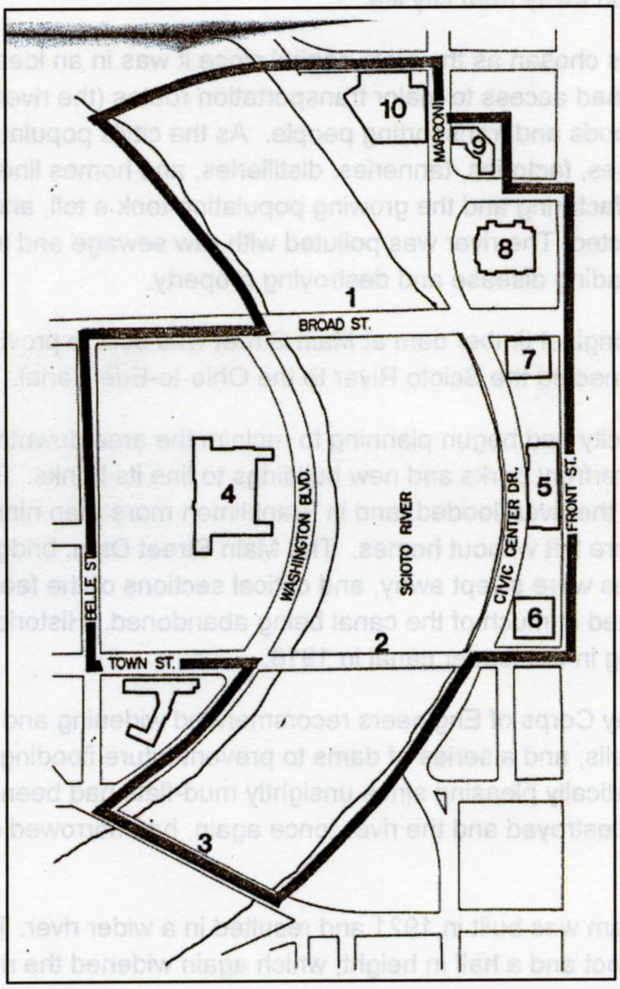

Figure 2-1. Civic Center Historic District

2.2.1 Red Flag Summary Report

The lone red flag cultural resource in the project area is the Civic Center Historic District. The District was determined eligible for listing in the National Register of Historic Places (NRHP) on September 14, 1988. It is eligible under Criterion A for its association with community planning, engineering, politics/government, and transportation in the city of Columbus, and Criterion C for its Art Deco, Neoclassical, and Renaissance Revival architecture. The District has two components: riverfront improvements, including a retaining wall (between 40 feet north of Broad Street and 40 feet south of Town Street) and three contributing bridges (Broad, Town, and Main streets, all now demolished and replaced), and seven government buildings, five of which are contributing resources (Central High School [individually listed in the NRHP], State Office Building [individually listed in the NRHP], City Hall, Central Police Station, and the Federal Court House and Post Office), two of which are non-contributing resources (the buildings immediately north and south of the State Office Building). The District does not include the Main Street Dam, which is located immediately south of the District.

The majority of the riverfront improvements were built between 1917 and 1921. All were designed in the Renaissance Revival style and erected after the width of the Scioto River had significantly widened as a result of flood protection improvements, including construction of the Main Street Dam in 1921, in response to the devastating flood of 1913. The government buildings were built after the riverfront improvements. They were built in the Neoclassical and Art Deco styles.

The approximate boundaries of the District are from Main Street north along Washington Boulevard to Town Street, west on Town Street to Belle Street, north on Belle Street to Broad Street, east on Broad Street to the western bank of the Scioto River, north along the Scioto River bank to a point opposite West Long Street, east across the Scioto River to West Long Street, east along West Long Street to Marconi Boulevard, south on Marconi Boulevard to a point opposite the first alley south of West Long Street, east along the alley to Ludlow Alley, south along Ludlow Alley to West Gay Street, east along West Gay Street to North Front Street, south along North Front Street to Broad Street, west along Broad Street to Civic Center Drive, and south along Civic Center Drive to Main Street.

Pertaining to the District, on June 26, 2009, a Memorandum of Agreement (MOA) executed between the U.S. Army Corps of Engineers (USACE), Huntington District, the Ohio Historic Preservation Office (OHPO), and the City of Columbus governing the expansion of the John W. Galbreath Bicentennial Park included the following stipulations:

1) The City's Department of Development will coordinate the review of all projects within the boundaries of the Columbus Civic Center Historic District with the City's Historic Preservation Office, the Columbus Historic Resources Commission, and the CLF, provided that by June 26, 2014, the projects have not reached the engineering phase;
2) For those projects, the City's Department of Development will present the City's Historic Preservation Office, the Columbus Historic Resources Commission, the CLF, the U.S.

Army Corps of Engineers, Huntington District, and the OHPO with a description of the project and its goals, maps showing the project location, Stage 1 construction plans, and analyses of direct and indirect effects of the project on contributing resources within the Columbus Civic Center Historic District that considers all aspects of their integrity, including setting, feeling, and association;

3) The City's Department of Development will solicit comments from these organizations regarding the effects of the project(s) on historic properties; and

4) The City's Department of Development will provide written responses to comments received from these organizations. The American Institute of Architects, Columbus Chapter, the Columbus Historical Society, and the CDDC were invited to sign the MOA as concurring parties, but only the latter concurred.

2.2.2 Historical Maps

All pre-1853 historical maps examined at the Ohio Historical Society's Archives/Library, including those from the early 1800s (not included in this summary), show the Scioto River in what is now downtown Columbus as approximately 150 to 250 feet wide. Prezreminsky (ca.1845) shows what is presumably a linear canal feature on the east side of the Scioto River between Town Street on the north and the former Columbus Feeder Canal on the south. Today, the John W. Galbreath Bicentennial Park occupies the former location of the confluence of the feeder canal and the Scioto River. This is the only historical map that shows this feature. No dam is shown on this map, so the feature does not appear to have been a mill race. This feature would have been upstream of today's Main Street Dam.

Leiby (1853) shows the river 250 to 300 feet wide in downtown Columbus. Leiby also shows a southern channel of the Scioto River approximately midway between Broad Street on the south and what was then the Columbus and Xenia Railroad on the north. Today, the former location of the southern channel is where Veteran's Memorial is located. This channel was partially filled in between 1856 and 1865. An island, Bloody Island, was shown immediately north of a larger island (Ridgway Island) created by the southern channel.

Hart and Mapother (1856) are the first to show a dam (the "State Dam") on the Scioto River, just north of Belle Street, on the north side of the river. They show the river nearly 400 feet wide just above and below the dam, narrowing to slightly more than 200 feet at State Street. They show Bloody Island and a larger island owned by J. Ridgway. They label the southern channel of the Scioto River, south of Ridgway's Island, "thoroughfare." They also show a railroad spur crossing the Scioto River to the Ohio Penitentiary immediately west of Bloody Island. The river is nearly 400 feet wide at this point.

Fisher (1865) also shows the "State Dam." The river is 400 feet wide below the dam, narrowing to slightly more than 200 feet at State Street. Fisher also shows the partial filling of the southern channel of the Scioto River south of the island owned by Ridgway, which has disappeared on this map. Bloody Island appears as two small islands.

Caldwell et al. (1872) shows the Scioto River as 300 feet wide below the Columbus and Hocking Valley Railroad Bridge over the Scioto River south of Belle Street. He shows a paper mill on the southern bank of the river midway between the railroad bridge and the Columbus Feeder Canal. He also shows the southern channel of the Scioto River has been completely filled, and Bloody Island has disappeared.

Graham (1876) shows the dam and upstream paper mill, where the river is 300 to 400 feet wide, again narrowing to slightly more than 200 feet wide at State Street. The river is more than 400 feet wide at its northern bend south of the Ohio Penitentiary.

Baist (1899) shows the Scioto River nearly 400 feet wide south of the dam, and the paper mill now labeled "Woolen Mills." At State Street, the river is approximately 250 feet wide.

Baist (1910) shows roughly the same river widths as Baist (1899). The Woolen Mills is now labeled "Tannery."

Baist (1920) shows the river width of 1899 and 1910 (dashed line), abandoned/underwater (dashed line) lots, particularly on the west side of the river, what is now Washington Blvd. between Broad and Rich Streets, and engineering improvements, including the construction of embankments on both sides of the river south of Rich Street, an adjacent wall along the east embankment north of the railroad bridge to just west of Short Street, and 15-foot high (flood) walls on both sides of the river north and west of Broad Street. Although the river width of 1920 is not shown, based on the engineering improvements and abandoned lots, primarily on the west side of the river, the river was widened considerably, to approximately 600 feet in downtown and 400 feet west of the bend south of the Ohio Penitentiary, following the 1913 flood.

2.2.3 Literature Review

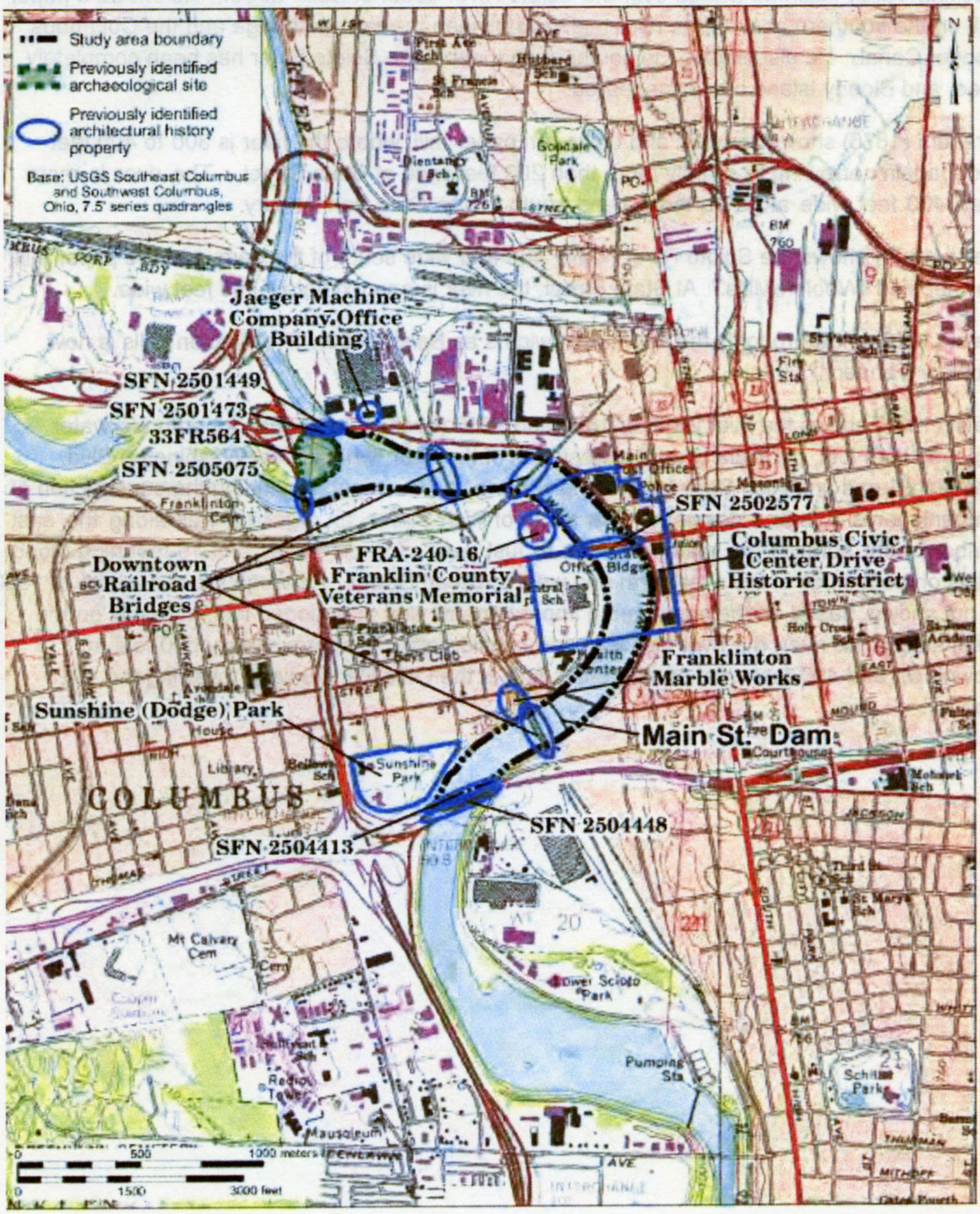

Figure 2-2. Previously Identified Cultural Resources

The following sources available from the OHPO were consulted during the literature review on July 26 and 27, 2011:

- Online Mapping System
- Lists of formal, preliminary, and consensus NRHP determinations of eligibility
- Pending and inactive NRHP nomination forms
- NRHP questionnaires
- Troutman's (2003) *Ohio Cemeteries: 1803–2003*
- Ohio Historic Inventory (OHI) forms
- Ohio Historic Bridge Inventory and Ohio Department of Transportation (ODOT) Bridge Inventory forms
- Contract architectural history reports
- Historic American Engineering Record files
- USGS 7.5′ topographic maps associated with the Ohio Archaeological Inventory (OAI)
- OAI forms
- Contract archaeology reports, and
- Mills' (1914) *Archeological Atlas of Ohio*.

Also consulted was ODOT's Buckeye Assets (2011).

The literature review identified a number of extant cultural resources in the study area. The lone archaeological site recorded in the study area is 33FR564. Skinner and Nass (1985) concluded that the prehistoric component of the site was a secondary deposit above historic fill, the latter of which extended at least five meters below the surface. The fill composing the historic period component contained twentieth-century kitchen and architectural debris dumped at the site, possibly from another location. The site was recommended ineligible for the NRHP. The Skinner and Nass (1985) archaeological investigation was conducted prior to the proposed development of a hotel and restaurant at what is now Confluence Park.

Two other areas have been surveyed for archaeological resources in the study area: North Bank Park (Brown 2003) and the West Columbus Floodwall (Walsh and Miller 1992). Neither identified archaeological sites in the study area. Mills (1914) does not show any archaeological sites in or adjacent to the study area.

The foremost architectural historical resource in the study area is the Columbus Civic Center Historic District. The district was determined eligible for listing in the NRHP on September 14, 1988. It is eligible under Criterion A for its association with community planning, engineering, politics/government, and transportation in the city of Columbus, and Criterion C for its Art Deco, Neoclassical, and Renaissance Revival architecture. The District has two components: riverfront improvements, including a retaining wall (between 40 feet north of Broad Street and 40 feet and south of Town Street) and three contributing bridges (Broad, Town, and Main streets, all now demolished and replaced), and seven government buildings, five of which are contributing resources (Central High School [individually listed in the NRHP], State Office Building [individually listed in the NRHP], City Hall, Central Police Station, and the Federal Court House and Post Office), two of which are non-contributing resources (the buildings immediately north and south of the State Office Building).

The majority of the riverfront improvements were built between 1917 and 1921. All were designed in the Renaissance Revival style and erected after the width of the Scioto River had been doubled or tripled as a result of flood protection improvements, including construction of the Main Street Dam in 1918, in response to the devastating flood of 1913. The government buildings were built after the riverfront improvements. They were built in the Neoclassical and Art Deco styles.

The approximate boundaries of the District are from Main Street north along Washington Boulevard to Town Street, west on Town Street to Belle Street, north on Belle Street to Broad Street, east on Broad Street to the western bank of the Scioto River, north along the Scioto River bank to a point opposite West Long Street, east across the Scioto River to West Long Street, east along West Long Street to Marconi Boulevard, south on Marconi Boulevard to a point opposite the first alley south of West Long Street, east along the alley to Ludlow Alley, south along Ludlow Alley to West Gay Street, east along West Gay Street to North Front Street, south along North Front Street to Broad Street, west along Broad Street to Civic Center Drive, and south along Civic Center Drive to Main Street.

The city of Columbus, an OHPO and National Park Service Certified Local Government, includes the Scioto River Bridge Group in the Columbus Register of Historic Properties, so listed in 1983.

Other extant architectural historical resources in or near the study area are the Jaeger Machine Company Office Building (listed in the NRHP), four railroad bridges, FRA-240-16 (Franklin County Veterans Memorial), Franklinton Marble Works, and Sunshine (Dodge) Park. ODOT (2011) records six bridges in the study area. Four are recorded as "not historic," one was recorded as "not determined" and the sixth was recorded as "none/not applicable." Five architectural historical surveys have been undertaken in the study area: Broad Street/Old National Road (Miller et al. 1998, downtown Columbus (Recchie and Darbee 1989, 1990), and east Franklinton (Burant 1994; Potterfield 1989). Before their demolition, the Broad, Town, and Main Street bridges were documented in the Historic American Engineering Record (Engle 2002; Hampton et al. 2008; Sherman 1989). According to Troutman (2003), no cemeteries are in or adjacent to the study area.

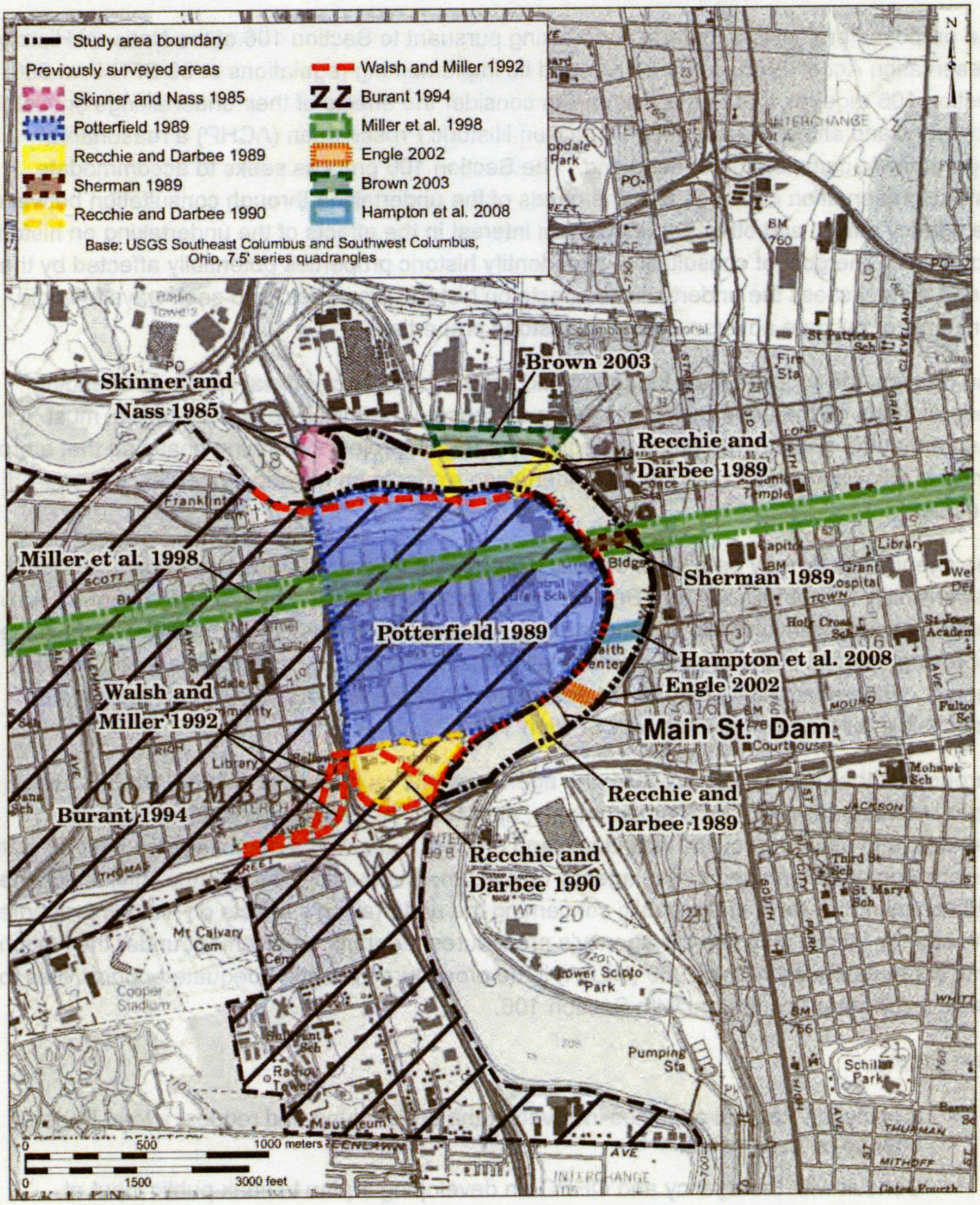

Figure 2-3. Previously surveyed areas in or near the study area.

2.3 OHPO REQUIREMENTS AND NEXT STEPS

The proposed project is a Federal undertaking pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations at 36 CFR Part 800. Section 106 requires that Federal agencies consider the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on undertaking. The Section 106 process seeks to accommodate historic preservation concerns with the needs of the undertaking through consultation between the agency official and other parties with an interest in the effects of the undertaking on historic properties. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess the undertaking's effects on historic properties, and seek ways to avoid, minimize, or mitigate adverse effects on historic properties.

The Section 106 process must be completed before the agency official approves spending Federal funds on the undertaking or issuing a license or permit. The agency official must ensure that the Section 106 process begins early in the project's planning phase so that a broad range of alternatives pertaining to the undertaking's effects on historic properties are considered.

The agency official may be a state or local government official who has been delegated legal responsibility for compliance with Section 106 in accordance with Federal law. If more than one Federal agency is involved in the undertaking, i.e., funding, licensing, permitting, or otherwise approving aspects of the project, some or all of the agencies may designate a lead Federal agency. Federal agencies that do not designate a lead Federal agency remain individually responsible for their compliance with Section 106.

Throughout the Section 106 process, the agency official must consult with the OHPO, Indian tribes, representatives of local governments, applicants for Federal assistance, permits, licenses, and other approvals, individuals and organizations with a demonstrated interest in the undertaking as determined by the agency official, and the public. The agency official must seek and consider the views of the public concerning the undertaking's effects on historic properties. The agency official may use the agency's procedures for public involvement under the National Environmental Policy Act of 1969 (NEPA) if the procedures provide adequate opportunities for public involvement consistent with Section 106.

Next Steps:

- Identify the Federal agencies involved in the undertaking and request a lead Federal agency be designated.
- Consult with the agency and OHPO on developing a plan to seek public input at appropriate times in the Section 106 process, and to notify the public about proposed actions that may affect historic properties.
- Consult with the agency official and the OHPO to identify any other parties entitled to be consulting parties and invite them to participate, including Indian tribes. The agency

official must make a reasonable and good faith effort to identify Indian tribes that might attach religious and cultural significance to historic properties in the area of potential effects (APE). The APE is the geographical area or areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties.

- Consult with the agency and OHPO to determine and document the APE, what level of effort is needed to identify historic properties in the APE (i.e., literature review [completed], Phase I architectural history, Phase I archaeological survey), determine if historic properties will be affected, and if so determine if the effects are adverse or not. If the effects are adverse, the agency official must notify the ACHP and consult with consulting parties and the public to seek ways to avoid, minimize, or mitigate adverse effects.
- Assuming the City's Department of Development has approval authority over this project for the City of Columbus, and the project enters the engineering phase prior to June 26, 2014, the existing MOA requires the Department to coordinate project review with the City's historic preservation officer, the City's historic resources commission, and the CLF. The Department would provide these entities, plus the OHPO and the USACE, with a project description, goals, maps of the APE, stage 1 construction plans, and an analysis of direct and indirect effects of the project on the remaining contributing resources within the Columbus Civic Center Historic District. These entitles have 30 calendar days to provide the Department with written comments on the project's effects on the District. The Department must provide written responses to comments received.
- It is possible that no archaeological investigations will be needed. However, it is also possible that the USACE and OHPO will ask for archaeological investigations after demolition of the dam exposes the former land lots now under water, especially on the west side of the river below COSI and Vets Memorial. This could be specified in stipulations contained in a MOA executed for this specific project. The key is consultation with the OHPO and the USACE.
- A separate MOA may need to be executed between the parties to the Bicentennial Park MOA. Other consulting parties may be identified in this process. This, and the opportunity for the public to comment on the effects of this project on historic properties, will be a concern of the OHPO.

3.0 Ecology

The removal of the Main Street Dam and subsequent river restoration is expected to have a positive impact on the aquatic habitat in this segment of the Scioto River. Engineering plans and other supporting information will be used to seek authorization to remove the Main Street Dam under Nationwide Permit #27 (Aquatic Habitat Restoration, Establishment, and Enhancement Activities). The USACE is required to coordinate with the U.S. Fish & Wildlife Service (USFW) and ODNR Wildlife on potential impacts to federally listed species that may occur as a result of the proposed project.

3.1 USE ATTAINMENT DESIGNATION

The Scioto River upstream and downstream of the potential project area is classified as a WWH according to the OEPA aquatic life use system. However, the 2.5 mile stretch of river in the project area is classified as modified water habitat (MWH) (OEPA 1999), a reflection of poor water quality, degraded habitat, and impaired aquatic communities.

3.1.1 Habitat Assessment

This habitat assessment highlights habitat characteristics of this segment of the Scioto River and compares data of impounded stream reaches with non-impounded reaches. Data used in this assessment included field surveys conducted by the OEPA in 1996[1]. The habitat of the Middle Scioto River was assessed from approximately River Mile 132.3 (RM 132.3), at the confluence with the Olentangy River, to the Greenlawn Dam (RM 129.8), near Greenlawn Avenue.

3.1.2 Qualitative Habitat Evaluation Index

River habitat was assessed for the Olentangy River in the study area primarily through evaluation of the Qualitative Habitat Evaluation Index (QHEI), scores provided. The QHEI is a physical habitat index that is designed to provide a quantified evaluation of the general macrohabitat (i.e. large-scale habitat) characteristics that are important to fish communities. These macrohabitat characteristics are physical factors that affect fish communities and that are usually important to other aquatic life, such as invertebrates.

[1] Reported in 1996 Technical Support Documents (TSDs), published as Biological and Water Quality Studies, OEPA, Division of Surface Water, 1999

The QHEI is composed of six metrics which have been found to be associated with stream fish communities:

- Substrate;
- Instream cover;
- Channel morphology;
- Riparian zone and bank erosion;
- Pool/glide and riffle-run quality; and
- Map gradient.

QHEI metrics describe the attributes of the physical habitat that could potentially be important in explaining the presence, absence and composition of fish communities in a given stream. QHEI scores range from 0 to 100. QHEI scores less than 45 generally cannot support the assemblages associated with WWH. QHEI scores greater than 60 are generally conducive to supporting a WWH designation. QHEI scores greater than 75 commonly have habitat conditions which can support exceptional warm water habitat (EWH)[1].

Biological and water quality studies conducted by the OEPA (1999 TSDs) were reviewed for QHEI scores relevant to the study area. These data was used to summarize and provide details as to the existing habitat conditions in the study area. Table 3-1 provides a summary of QHEI data collected for three reaches of the Scioto River between the confluence of the Olentangy River and Greenlawn Avenue, sampled in 1996.

Table 3-1. QHEI Scores for Sample Sites in the Scioto River between the Confluence of the Olentangy River and Greenlawn Avenue

River Mile	Location	QHEI Score	Date of Survey	Source	Impoundment Status
133.0	Above confluence of Olentangy River	68.0	1996	1996 TSD for Middle Scioto River, OEPA	Non-impounded
131.8	Town St. dam pool	39.0	1996	1996 TSD for Middle Scioto River, OEPA	Impounded
129.1	Greenlawn Avenue (below dam pool)	72.5	1996	1996 TSD for Middle Scioto River, OEPA	Non-impounded

The average QHEI score of these non-impounded portions of the lower Olentangy River and Scioto River was 70.3, which falls into the narrative rating of “good,” and can likely support

WWH assemblages of aquatic species. The impounded sections of the river, by contrast, scored a QHEI of 39, which is considered "poor," and falls within the range of impaired streams[2].

Habitat quality varied between the non-impounded and impounded areas of the study area. Non-impounded reaches of the river (RMs 133.0 and 129.1) have substrate features that have been predominantly characterized by boulder, cobble, and gravel. Moderate to extensive amounts of instream cover were documented for both non-impounded reaches. The stream channel for these reaches exhibited moderate to high sinuosity and exhibit signs of recovery from channelization[3].

The impounded area (RM 131.8) contained the most depauperate (very poor) physical conditions within the middle Scioto River study area. In contrast to the non-impounded reaches, this reach was highly channel modified, exhibiting no recovery from channelization and contained sparse to no instream cover[1].

Given the disparity in physical conditions between the currently impounded reach of the Scioto River and the non-impounded reach, it is reasonable to assume that removal of the source of impoundment will result in improvement of the physical characteristics of that reach. As evidenced by QHEI scores, habitat is good within the non-impounded reaches of the river. These demonstrate the potential of this area of the Middle Scioto River to support a WWH assemblage of aquatic species.

3.2 FISH

In 1999, OEPA found Ohio state-listed fish species while surveying 29 sampling stations from river mile 97.9 to 145.0 on the Scioto River (OEPA 1999). One Ohio State-Endangered fish was observed, the shortnose gar (*Lepisosteus platostomus*). State-Threatened species observed during this survey were the bluebreast darter (*Etheostoma camurum*) and the Tippecanoe darter (*Etheostoma tippecanoe*). Two Ohio species of special concern found during surveys include the muskellunge (*Esox masquinongy*) and the river redhorse (*Moxostoma carinatum*). Similar studies were completed in 2005 and 2009 on the Olentangy River in Delaware County and found no federal or state-endangered species (OEPA 2010). The Scioto madtom is the only federally-endangered fish that could potentially occur in the project area. However, Trautman (1981) reported that the Scioto madtom is known from only one location in Ohio (Big Darby Creek) and that it has not been collected since 1957, nor has this fish been found in the project area despite having been repeatedly surveyed by OEPA.

In August of 2009, OEPA surveyed the Scioto River immediately upstream of the Main Street Dam. They found only 23 species. The aquatic invasive common carp (*Cyprinus carpio*) comprised over 62 percent of the biomass. Other species present included those commonly

[2] Ohio EPA, 2006

[3] Reported in 1996 Technical Support Documents (TSDs), published as Biological and Water Quality Studies, OEPA, Division of Surface Water, 1999

found in lakes such as largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*), and black crappie (*Pomoxis nigromaculatus*). Two species designated as "intolerant" by OEPA were present in the pool; *Moxostoma carinatum* (n = 11) and *Moxostoma duquesni* (n = 2). In the free flowing section of the Scioto, approximately two miles downstream of Main Street Dam and immediately downstream of Greenlawn Dam, OEPA found 44 species. Darter richness was dramatically higher in the reach below Greenlawn Dam. Common carp comprised only eight percent of the biomass. Seven "intolerant" species were captured in this reach.

Table 3-2. Species observed in the Scioto River immediately upstream of the Main Street Dam and in the free flowing section of the Scioto River below the Greenlawn Avenue Dam. Table also identifies host species for Federal special status freshwater mussels. Etr = *Epioblasma torulosa rangiana*, Etq = *Epioblasma triquetra*, Pc = *Pleurobema clava*, Qc = *Quadrula cylindrica*, and Vf = *Villosa fabalis*.

Scientific Name	Common Name	Main Street Dam pool	Downstream Greenlawn Ave. Dam	Hosts for Listed Mussel Species
Dorosoma cepedianum	Gizzard Shad	x	x	
Ictiobus cyprinellus	bigmouth buffalo		x	
Ictiobus niger	black buffalo		x	
Ictiobus bubalus	smallmouth buffalo		x	
Carpiodes cyprinus	quillback	x	x	
Carpiodes carpio	river carpsucker		x	
Moxostoma erythrurum	golden redhorse	x	x	
Moxostoma carinatum	river redhorse	x	x	
Moxostoma anisurum	silver redhorse		x	
Moxostoma duquesni	black redhorse	x		
Hypentelium nigricans	northern hogsucker		x	
Minytrema melanops	spotted sucker		x	
Moxostoma breviceps	smallmouth redhorse		x	
Cyprinus carpio	common carp	x	x	
Nocomis micropogon	river chub		x	
Phenacobius mirabilis	suckermouth minnow		x	
Notemigonus crysoleucas	golden shiner	x		

Scientific Name	Common Name	Main Street Dam pool	Downstream Greenlawn Ave. Dam	Hosts for Listed Mussel Species
Notropis atherinoides	emerald shiner		x	Qc
Luxilus chrysocephalus	striped shiner	x	x	Pc, Qc
Notropis photogenis	silver shiner		x	
Notropis rubellus	rosyface shiner		x	Qc
Cyprinella whipplei	steelcolor shiner		x	
Cyprinella spiloptera	spotfin shiner	x	x	Qc
Notropis stramineus	sand shiner		x	
Notropis volucellus	mimic shiner		x	
Pimephales notatus	bluntnose minnow	x	x	
Campostoma anomalum	central stoneroller	x	x	Pc
Ictalurus punctatus	channel catfish		x	
Noturus flavus	stonecat madtom		x	
Labidesthes sicculus	brook silverside	x	x	
Morone chysops	white bass		x	
Pomoxis annularis	white crappie	x	x	
Pomoxis nigromaculatus	black crappie	x		
Ambloplites rupestris	rock bass		x	
Micropterus dolomieu	smallmouth bass	x	x	
Micropterus salmoides	largemouth bass	x		Vf
Micropterus punctulatus	spotted bass		x	
Lepomis cyanellus	green sunfish	x	x	
Lepomis macrochirus	bluegill sunfish	x	x	
Lepomis gibbosus	pumkinseed sunfish	x		
Lepomis humilis	orangespotted sunfish	x	x	
Lepomis megalotis	longear sunfish	x	x	
	hybrid x sunfish	x		

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Scientific Name	Common Name	Main Street Dam pool	Downstream Greenlawn Ave. Dam	Hosts for Listed Mussel Species
	greefn sf X bluegill SF		x	
Sander canadensis	sauger		x	
	sauger x walleye	x		
Percina phoxocephala	slenderhead darter		x	
Percina caprodes	logperch	x	x	Etq, Pc
Etheostoma blennioides	greenside darter	x	x	Vf
Etheostoma zonale	banded darter		x	Etr
Etheostoma caeruleum	rainbow darter		x	Vf
Etheostoma flabellare	fantail darter		x	
Aplodinotus grunniens	freshwater drum		x	
		25	45	

3.3 MUSSELS

Although some federally listed mussel species (Table 3-3) historically occurred within Franklin and Pickaway Counties, none have been observed in the Scioto and Olentangy Rivers in recent years (12 surveys, 1999-2011) (Table 3-4). Some Ohio state-listed mussels were found either live or fresh dead during ten surveys on the Scioto River from 1999-2009. Several sites were sampled at various locations in Franklin and Pickaway Counties, Ohio (Appendix D, Exhibit 1). The Ohio state-endangered washboard mussel (*Megalonaias nervosa*) was observed on the Scioto River. The Ohio state-threatened species observed were also in the Scioto River and they included the black sandshell (*Ligumia recta*), threehorn wartyback (*Obliquaria reflexa*), and fawnsfoot (*Truncilla donaciformis*). Ohio state species of special concern observed included flat floater (*Anodonta suborbiculata*) and deertoe (*Truncilla truncata*) (Hoggarth 2004a, 2004b, 2009a, 2009b, Hoggarth and Museum of Biological Diversity 2002, 2008, Hoggarth et al. 2007, SEES and Hoggarth 2009, SEES et al. 2008, Tetzloff 1999). No Ohio State endangered or threatened species were found in the Olentangy River in Franklin County during two surveys from 2010-2011 but the *Alasmidonta marginata*, *Lampsilis fasciola*, and *Pleurobema sintoxia*, all State Species of Concern, were confirmed present (Stantec 2010, Stantec 2011).

Table 3-3. Historical species list for the Scioto River in Franklin and Pickaway Counties, Ohio, from the Molluscs Division, Ohio State University, Museum of Biological Diversity

Scientific Name	Common Name	Species Status
Actinonaias ligamentina ligamentina	Mucket	
Alasmidonta marginata	Elktoe	SSC
Alasmidonta viridis	Slippershell	
Amblema plicata plicata	Threeridge	
Anodonta suborbiculata	Flat floater	SSC
Anodontoides ferussascianus	Cylindrical papershell	
Cyclonaias tuberculata	Purple wartyback	SSC
Ellipsaria lineolata	Butterfly	SE
Elliptio crassidens crassidens	Mule's ear	
Elliptio dilatata	Spike	
Epioblasma torulosa rangiana	Northern riffle shell	FE, SE
Epioblasma triquetra	Snuffbox	PFE, SE
Fusconaia ebenus	Ebony shell	SE
Fusconaia flava	Wabash pigtoe	
Fusconaia maculata maculata	Longsolid	SE
Lampsilis cardium	Plain pocketbook	
Lampsilis fasciola	Wavy-rayed lampmussel	SSC
Lampsilis ovata	Sharp-ridged pocketbook	SE
Lampsilis radiata luteola	Fatmucket	
Lasmigona complanata complanata	White heelsplitter	
Lasmigona costata	Fluted-shell	
Leptodea fragilis	Fragile papershell	
Ligumia recta	Black sandshell	ST
Megalonaias nervosa	Washboard	SE
Obliquaria reflexa	Threehorn wartyback	ST

Scientific Name	Common Name	Species Status
Obovaria subrotunda	Round hickorynut	
Pleurobema cordatum	Ohio pigtoe	SE
Pleurobema rubrum	Pyramid pigtoe	SE
Pleurobema sintoxia	Round pigtoe	SSC
Potamilus alatus	Pink heelsplitter	
Potamilus ohiensis	Pink papershell	
Ptychobranchus fasciolaris	Kidneyshell	SSC
Pyganodon grandis grandis	Giant floater	
Quadrula cylindrica cylindrica	Rabbitsfoot	FC, SE
Quadrula pustulosa pustulosa	Pimpleback	
Quadrula quadrula	Mapleleaf	
Strophitus undulatus undulatus	Creeper	
Toxolasma parvum	Lilliput	
Tritogonia verrucosa	Pistolgrip	
Truncilla donaciformis	Fawnsfoot	ST
Truncilla truncata	Deertoe	SSC
Uniomerus tetralasmus	Pondhorn	ST
Utterbackia imbecillis	Paper pondshell	
Villosa fabalis	Rayed bean	PFE, SE
Villosa iris iris	Rainbow mussel	

SE-Ohio state endangered, ST-Ohio state threatened, SSC-Ohio state species of special concern, FE-Endangered Species Act Endangered, PFE-Endangered Species Act Proposed Endangered, FC-Endangered Species Act Candidate

Table 3-4. Species of mussels found in the Scioto and Olentangy Rivers within Franklin and Pickaway Counties, Ohio. Mussels include live and fresh dead samples

Latin Name	Common Name	Downstream Scioto	Olentangy
Alasmidonta marginata	Elktoe	X	X
Amblema plicata	Threeridge	X	X
Anodonta suborbiculata	Flat floater	X	
Anodontoides ferussacianus	Cylindrical papershell		X
Fuscoania flava	Wabash pigtoe	X	X
Lampsilis cardium	Plain pocketbook	X	X
Lampsilis fasciola	Wavy-rayed lampmussel	X	X
Lampsilis radiada luteola	Fatmucket	X	X
Lasmigona complanata	White heelsplitter	X	X
Lasmigona costata	Fluted-shell	X	X
Leptodea fragilis	Fragile papershell	X	
Ligumia recta	Black sandshell	X	
Megalonaias nervosa	Washboard	X	
Obliquaria reflexa	Three horn wartyback	X	
Obovaria subrotunda	Round hickorynut	X	
Pleurobema sintoxia	Round pigtoe		X
Potamilus alatus	Pink heelsplitter	X	
Potamilus ohiensis	Pink papershell	X	
Pyganodon grandis	Common Floater	X	X
Quadrula pustulosa	Pimpleback	X	
Quadrula quadrula	Mapleleaf	X	X
Strophitus undulatus	Creeper		X
Toxolasma parvum	Lilliput	X	X
Tritogonia verrucosa	Pistolgrip	X	
Truncilla donaciformis	Fawnsfoot	X	

Latin Name	Common Name	Downstream Scioto	Olentangy
Truncilla truncata	Deertoe	X	
Utterbackia imbecillis	Paper pondshell	X	X

Sources: Hoggarth 2004a, Hoggarth 2004b, Hoggarth 2009a, Hoggarth 2009b, Hoggarth and Museum of Biological Diversity 2002, 2008, Hoggarth et al. 2007, SEES and Hoggarth 2009, SEES et al. 2008, Stantec 2010, Stantec 2011, Tetzloff 1999

3.4 CONCLUSION

- Water quality in the project area is poor partly due to Main Street Dam and the influence of Combined Sewer Overflows.
- Review of recent studies produced no records of Federally Endangered, Threatened, or Proposed Endangered/Threatened freshwater mussels within the project area.
- No records of Federally Endangered, Threatened, or Proposed Endangered/Threatened freshwater mussels were found for nearby reaches of the Scioto River and the Olentangy River.
- Some fish and freshwater mussels with special status designations conferred by the State of Ohio are known to occur in nearby reaches of the Scioto River and the Olentangy River.
- Aquatic communities are degraded in the project area and differ substantially from those downstream of Greenlawn Dam and elsewhere in the Scioto River.

Given the nature and magnitude of water quality impairments in the project area, it is unlikely that special status aquatic species will be impacted during the removal of this dam. Combined efforts to remove Main Street Dam and reduce CSOs will yield substantial improvements in aquatic community composition within the project area.

This information was shared with USFW on November 30, 2011. An e-mail response from Angela Boyer (Appendix E) indicates that the agency believes that it is unlikely that any federally listed, proposed or candidate mussels species occur within the proposed project area.

4.0 Hydrogeological Evaluation

4.1 INTRODUCTION

To evaluate the relationship of groundwater encountered behind the floodwall and the OSIS, Stantec determined that an understanding of the local groundwater geology (hydrogeology) and its inter-relationship with the river was needed. For the purpose of this evaluation, the Study Area extends southward from the confluence of the Olentangy and Scioto Rivers on the northeast margin of downtown Columbus, to the Main Street lowhead dam located on the southwest margin of downtown Columbus.

To evaluate the hydrogeology of the Study Area, the evaluation is divided into five interrelated tasks. These tasks are as follows:

- Characterize the nature of the bedrock and bedrock topography beneath the Study Area through available historical information.
- Characterize the unconsolidated sediments overlying bedrock beneath the Study Area through available historical information.
- Characterize the nature of groundwater beneath the Study Area through available historical information.
- Evaluate the data and provide conclusions.

4.1.1 Historical Information Review

An objective of this subsurface characterization effort was to obtain as much direct subsurface information as possible in the form of historical boring logs for the Study Area. In addition to Study Area specific boring logs, selected water-well logs on file with the Ohio Department of Natural Resources (ODNR) Division of Water were obtained and reviewed. Published and unpublished bedrock and groundwater maps available from the ODNR Division of Geologic Survey and Division of Water were also reviewed to characterize the nature of groundwater and subsurface conditions in the Study Area.

In addition, Dr. Scott Bair of The Ohio State University (OSU) School of Earth Sciences was contacted concerning any potential master theses or doctoral dissertations that may be available concerning the geology or hydrogeology of the downtown Columbus area. Although Dr. Bair was not aware of any such reports concerning the downtown area, he had provided Stantec with a master thesis concerning the Olentangy River basin immediately north of the OSU campus. The thesis is titled: "Hydrology of a Constructed Riparian Wetland System Characterization and Predictive Modeling" by John Stephen Koreny, OSU, 1996. Because the OSU campus is only 1.7 miles north of the current Study Area and the geologic and hydrogeologic settings are very similar, some of the key findings in this thesis provided useful information for the current evaluation.

4.2 STUDY AREA CHARACTERIZATION AND DESCRIPTION

4.2.1 General Description

The Study Area ranges from the confluence of the Olentangy and Scioto Rivers on the northeast margin of downtown Columbus, to the Main Street low head dam located on the southwest margin of downtown Columbus. This stretch of the Scioto River is steeply banked immediately adjacent to the river under normal flow conditions with a broad flood plain extending to the north of the confluence and to the west of the channel. Due to the eastern swing of the river meander in downtown Columbus, the western flood plain forms a low, broad, flat peninsula. The eastern bank is much steeper and rises in elevation 75 to 100 feet over a distance of two-tenths of a mile toward the central downtown area.

The Study Area is underlain by unconsolidated sediments overlying shale and limestone bedrock. The configuration of the bedrock surface and the deposition of the unconsolidated sediments are the result of pre-glacial and glacial-fluvial activities. These activities likely occurred more than 10,000 years ago.

The unconsolidated sediments overlying the shale and limestone bedrock range in thickness from 75 feet in the western peninsula floodplain to over 150 feet under downtown Columbus.

The OSIS and floodwall are located beneath and along the eastern bank of the river along Marconi Boulevard. The sewer is behind, and embedded in the floodwall.

4.3 BEDROCK CHARACTERIZATION

The upper bedrock stratigraphy beneath the Study Area is Devonian in age (360-416 million years ago). The Devonian geologic formations in descending order, youngest to oldest, are the: Ohio Shale, Olentangy Shale, Delaware Limestone, Columbus Limestone, and Salina Group. Well logs indicate that the upper portion of these formations is highly fractured likely due to erosion and glacial scouring. The bedrock surface beneath the Study Area is predominately comprised of the Devonian Age Columbus Limestone. On the northern margin of the Study Area, where the bedrock surface rises in elevation, is the younger Devonian Age Delaware Limestone present at the bedrock surface.

The topography of the bedrock surface beneath the Study Area reflects an erosional drainage pattern that resulted from pre-glacial and glacial-fluvial activity. Available bedrock maps showing bedrock topography in the Study Area indicate the presence of a confluence of three deep bedrock channels just to the south of the current confluence of the Scioto and Olentangy Rivers. Exhibits 8 & 9 in Appendix E provides a regional bedrock surface topography map within and surrounding the Study Area. As can be seen in this figure, the paths of the current Olentangy and Scioto Rivers roughly follow the channels of the pre-glacial local drainage system reflected in the bedrock topography. This bedrock map also shows an additional bedrock channel entering the Study Area from the northeast that is not currently reflected in the surface topography and is not occupied by a current day river. Channels such as these are referred to as buried bedrock river valleys.

The elevation of the bedrock surface in the deepest portion of the ancient confluence of these pre-glacial rivers is under 600 feet mean sea level (msl). The current ground surface elevation over the ancient confluence ranges from 700 to 760 feet msl. Soil boring and well logs for the Study Area confirm this thickness of sediments overlying bedrock. For reference, the top of the Main Street Dam has an elevation of approximately 703 feet msl.

4.4 CHARACTERIZATION OF THE UNCONSOLIDATED SEDIMENTS

The repeated advances and retreats of the continental glaciers across Ohio, including the Study Area, resulted in significant changes to the previous erosional landscape. In the Study Area, heterogeneous unconsolidated soils deposited over bedrock are the result of glacial-fluvial deposition followed by erosion or reworking by the glaciers or fluvial action. Sediments composed of sand, gravel and silt from the melting glaciers filled the low areas in the old bedrock erosional surface. Surficial sediments in the current floodplain areas also include silty-clay floodplain deposits. This surficial layer has also been disturbed by the activities of man throughout the Study Area.

The Olentangy River Valley area 3 to 5 miles north of this Study Area has been evaluated extensively as a part of James Koreny's OSU master thesis research (Koreny, 1996). Koreny characterized the unconsolidated soils and bedrock surface in his study area through the construction of cross sections from historical boring logs and new soil boring logs obtained during his study. These findings indicate the subsurface configuration consisting of glacial outwash deposits resting on bedrock and capped with clayey glacial till and floodplain sediments extends from Lane Avenue at least as far as North Broadway Avenue at the northern margin of his thesis Study Area.

Boring logs for borings drilled on the western portion of the OSU campus were evaluated by Stantec as part of a study related to the removal of the Fifth Avenue low head dam. These borings showed the same subsurface sequence as Koreny's observations. In this current evaluation regarding the removal of the Main Street Dam, driller's logs available for the downtown Columbus area from ODNR also show the same subsurface sequence. In summary, from North Broadway Avenue at the north end of Koreny's Study Area to the south end of the current Study Area in downtown Columbus, the geology of the subsurface appears consistent and continuous. This is a total distance of approximately 5.2 miles along the Olentangy River valley to the confluence with the Scioto River.

4.5 HYDROGEOLOGY OF THE STUDY AREA

Groundwater in the Study Area is obtained from limestone and dolomite bedrock and the sand and gravel deposits overlying bedrock (Schmidt 1993). This is confirmed by well driller's logs available from ODNR for the Study Area. Water extracted from these wells frequently exceeds 250 gallons per minute (gpm).

The saturated limestone bedrock and the unconsolidated sand and gravel outwash deposits located in the bedrock valley form a buried valley aquifer which is the principal aquifer in the central part of both Study Areas. Based on direct measurements obtained during Koreny's study, this aquifer is a highly permeable formation (Koreny, 1996,). Through direct field measurements, Koreny also determined that the aquifer is confined in nature. In a confined aquifer, the water level in wells installed in the aquifer rises to a level above the upper margin of the saturated zone bearing the groundwater. In other terms, the aquifer is under pressure. This is confirmed by well drillers' logs for water wells drilled in the downtown Columbus area.

A number of shallow wells, usually under 20 feet in depth, have been installed in scattered locations around downtown Columbus for the purpose of observing shallow groundwater contamination. These borings usually encounters water/saturated conditions ranging from 12 feet to 16 feet below ground surface. In these shallow wells installed close to the river, the water level elevations generally appear to correlate with river water levels indicating that the subsurface shallow groundwater zone is in communication with the river. This communication with the river was also found to be the case in Koreny's study area as well as the OSU campus area.

It is unclear, based on all the sources reviewed, whether this shallow zone is connected to the deeper aquifer. However, given the large amount of porous sand and gravel reported on all well and boring logs reviewed, it is likely that they are connected in at least some locations in the area.

A report by Rii dated November 10, 2009 and titled "Groundwater Investigation, Scioto Mile Riverfront Project" summarizes the subsurface findings from the drilling and installation of three wells behind the floodwall along Marconi Boulevard. The investigation was conducted to examine the cause of water seeps observed along the river side of the floodwall.

The investigation found two porous water bearing zones behind the wall where the groundwater levels rose above the top elevation of the zones, indicating the water is under pressure. The top most of these zones was present at an elevation of approximately 713 feet msl, and a lower one was present at 699 feet msl. It is speculated in the report that drains installed during the construction of the wall have clogged resulting in groundwater seeps along the seams in the floodwall.

The three wells screened in these units were pumped and the two wells screened in the shallow unit were pumped dry. However, the one screened in the deeper unit could not be pumped dry. It is likely that this lower unit is part of the prolific aquifer beneath the Study area.

The report indicates the groundwater elevation in the deeper zone is 704.69 feet msl. This is very close to the average pool elevation of the river of 704 feet msl. It is likely that the river and this deeper groundwater unit are in communication under the floodwall. If this porous water bearing zone is a laterally continuous unit there would be communication with the river around the margins of the floodwall.

4.5.1 Groundwater Flow-Conceptual Model

As part of Koreny's study, the water elevations in 44 wells were measured weekly for 1.5 years and then monthly for an additional 1.5 years for a 3 year total observation period. From selected measurement events, groundwater flow maps (potentiometric maps) for his study area were constructed. In addition, water levels were measured continuously in five wells located close to the river using semi-continuous recording devices.

Koreny found that relative groundwater elevations changed over time, but there was little change in groundwater flow direction. Through this direct measurement, Koreny determined that the aquifer discharges to the Olentangy River in his Study Area. Therefore it is inferred that it also discharges to the Olentangy and Scioto Rivers in this Study Area due to the same subsurface composition and configuration.

Koreny also found that the groundwater flow system was influenced by seasonal fluctuations and to a lesser extent by the Olentangy River stage. Near the Olentangy River, he found that the aquifer was greatly influenced by the rise and fall of river stage. High river stage resulted in high groundwater levels and low river stage resulted in low groundwater levels.

"The low head dams at Clinton Park and Dodridge Road greatly influence the groundwater head distribution near the river." Throughout his Study Area, groundwater flows from the aquifer to the river. This type of river is termed a gaining river. "However, for a short stretch above each dam the river changes to a losing river and water flows out of the river and into the groundwater flow system" (Koreny, 1996). This is also likely the case for the Main Street Dam because the subsurface geology and groundwater system appears to be the same as that in Koreny's study area.

Water level data was recorded for 1.5 years on semi-continuous recording devices Koreny installed on two wells adjacent to the river. This data was then compared to continuously recorded river stage data. The response of the aquifer water levels was directly related to river stage. When the water level increased in the river, water levels in the nearby monitor wells in the sand and gravel aquifer also increased. However, as stated above the changes in the water levels in the aquifer due to seasonal river stage changes did not significantly change the overall flow in the system. In the case of the Main Street Dam, the removal of the dam and the subsequent lowering of the river level mimics seasonal water level changes that occur naturally throughout the Olentangy and Scioto River systems.

The water levels in the shallow groundwater surrounding the pool behind the Main Street Dam and along the floodwall, will also rise when the river floods. Then a dewatering of the groundwater along the banks of the river will take place lowering the shallow groundwater levels yet again after the flood subsides.

4.1 SUMMARY OF FINDINGS

An in-depth evaluation of the sand and gravel aquifer beneath the Olentangy River valley 3 to 5 miles north of the current Study Area conducted by an OSU graduate student shows a dynamic relationship between Olentangy River and the highly permeable aquifer occupying the Olentangy River valley. The aquifer both discharges to the river, and receives water from the river related to the locations of the lowhead dams along the river, and in response to river stage. Based on the information obtained for this evaluation, this dynamic relationship likely exists in the current Study Area. With regard to aquifer levels related to river stage, this recharge and discharge relationship has been occurring since the river was originally formed.

5.0 Sediments

5.1 SEDIMENT SAMPLING

Surficial sediment samples were collected at ten locations in the Olentangy River upstream of the Main Street Dam. The samples were collected in general accordance with OEPA Sediment Sampling Guide and Methodologies, 2nd Edition, November 2001.The sediment samples were submitted to TestAmerica's analytical laboratory in Pittsburgh, Pennsylvania for Volatile Organic Compound (VOC), Semi-volatile Organic Compound (SVOC), metals, pesticides, herbicides, and polychlorinated biphenyls (PCBs) analysis. The analytical results were evaluated following OEPA Guidance on Evaluating Sediment Contaminant Results, dated January 2010.

5.2 SEDIMENT SAMPLING FIELD PROCEDURES AND METHODOLOGY

On August 26 & 29, 2011, Rii staff conducted River Bed Sediment Sampling on the Scioto River above the Main Street Dam at the following locations:

- Three (3) samples parallel to the Main Street Dam as closely and safely north of the dam (upstream from the dam).
- Three (3) samples across the Scioto River north of the New Main Street Bridge.
- Four (4) samples taken in the middle of the river between Town Street Bridge and where the Scioto and Olentangy Rivers meet at Confluence Park.

The sampling crew included environmental specialists Steve Sawyer and Chris Smith, and surveyor Mark Schloss. Samples were collected from a 15 foot aluminum power boat, utilizing a sediment core sampler (SCS) kit. The SCS kit consisted of four (4) 3 foot extension rods, T-handle, sludge core barrel, slide hammer and clear plastic liners. Once suitable and collectable materials were located, the SCS kit was maneuvered down to the river bottom and driven into the sediment. Numerous attempts were required to collect enough material to fill four (4) laboratory provided glass containers for analyses. A new plastic liner was used at each sampling location to avoid possible cross-contamination between samples. All samples were handled wearing disposable latex gloves to minimize cross-contamination of the samples.

Due to the rocky nature of the river bottom, numerous attempts were made at many locations to obtain the sediment samples. The re-sample areas had to be relocated until a softer bottom was acquired. Once a successful sampling location was identified, the sampling location was marked using a hand held global positioning system (GPS). After sample cores were extracted from the river, the samples were immediately placed in the required laboratory containers and preserved on ice until received by the laboratory. Glass containers were labeled SED-1 through SED-10, respective to location. Upon completion of the field sampling on August 29, 2011, the coolers containing the jarred samples were shipped for overnight delivery to the independent laboratory, TestAmerica located at 301 Alpha Drive, Pittsburgh, Pennsylvania 15238.

After each sampling location was complete, an additional sample was collected and analyzed for sediment characterization and grain size analysis by the Rii soil laboratory. All laboratories testing of the representative samples were performed in accordance with American Society for Testing and Materials and American Association of State Highway and Transportation Officials (ASTM/AASHTO) procedures to clarify existing soil according to the United Soils Classification System (USCS). All State of Ohio boating regulations were demonstrated and followed throughout this project.

5.3 LAB RESULTS AND ANALYSIS

Stantec evaluated each of the general analytical groups against the referenced Residential Criteria. The results of that comparison are provided below:

VOCs – the analytical data did not report any compound which met or exceeded the Residential Criteria.

SVOCs – the analytical data reported five compounds which met or exceeded the Residential Criteria. These are:

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Dibenzo(a,h)anthracene
- Indeno(1,2,3-cd)pyrene

Metals – the analytical data reported one metal that met or exceeded the Residential Criteria.

- Arsenic
  - While the arsenic results exceed the referenced criteria, the reported results are close to generally accepted background concentrations.

Pesticides – the analytical data did not report any compound which met or exceeded the Residential Criteria.

Herbicides – the analytical data did not report any compound which met or exceeded the Residential Criteria.

Polychlorinated Biphenyl's (PCBs) – the analytical data did not report any compound which met or exceeded the Residential Criteria.

Since the SVOC reported results exceed the referenced criteria, the sediment does not pass this screening process and the sediment should therefore be considered contaminated above a level of concern.

Characterization of the sediments as a material considered contaminated above a level of concern requires several considerations regarding the planning of the proposed dam removal. These considerations include, but are not limited to:

- Potential requirements for personal protective equipment and worker training during material disturbance;
- Implementation of techniques to minimize the spread or cross contamination of clean media from the disturbance of contaminated media;
- Segregation of potentially clean and potentially impacted material during excavation, stock piling, and material re-use;
- Management and potential treatment of water emanating from contaminated staged materials; and
- Material reuse or disposal.

The Guidance document suggests that if sediment contaminants may be toxic to human health, and there exists a potential exposure pathway between humans and the sediment, that a human health risk assessment be performed to quantify the potential risk of exposure. This approach is applicable where the sediment may stay in place, but the current project involves evaluation of the risk associated with temporary sediment exposure during disturbance activities, and the potential to reuse the sediment in post dam removal construction earth work.

The presence of SVOCs in river sediments is fairly common in urban settings, especially behind structures (e.g., low head dams) where these materials tend to accumulate. The purpose of this assessment is not to fully evaluate the consequences of contaminated sediment on the proposed project, but to identify considerations and potential alternatives that may be employed to minimize their impact.

5.4 COORDINATION WITH OEPA AND NEXT STEPS

The OEPA Guidance follows standard Risk Assessment approaches which incorporate the evaluation of an exposure pathway when considering analytical results. An exposure pathway refers to the way in which a person may come into contact with a hazardous substance, such as direct contact, ingestion, or inhalation. An exposure pathway is considered "complete" when conditions exist for contact to occur.

The Guidance document considers both exposure pathways for humans and/or aquatic life. Since no entity, including the City of Columbus, has been directly identified as being responsible for any contamination in the sediment upstream of the Main Street Dam, the current consideration focuses on exposure resulting from actions potentially taken by the City (i.e., dam removal, dredging, and excavation). In consultation with OEPA, this data evaluation focuses on these activities and the potential resulting effects on the human health exposure pathway. For example, OEPA does not consider the exposure pathway for direct contact with sediments "complete" for most submerged contaminated materials. However, if submerged materials are dredged, excavated, or the river pool lowered in such a fashion that allows for direct contact with contaminated materials, the exposure pathway is completed during or following these activities. Therefore, the first question to be answered during the assessment of this data is whether proposed activities associated with the removal of the Main Street Dam may result in the completion of a human health exposure pathway. Given that humans may come into direct contact with river bottom materials and/or sediments during dredging, excavation, materials management, dam removal and resulting permanent de-watering of riverbed areas, the answer is that a completed exposure pathway would occur and/or exist during, and possibly following project completion. Based on the potential presence of a completed human health exposure pathway, the Guidance suggests that the analytical data be compared to referenced Sediment Quality Guidelines (SQG). For direct contact, the Guidance suggests that the analytical data be compared to the United States Environmental Protection Agency (USEPA) Region 9 Preliminary Remediation Goals for Soil.

Planning considerations have been incorporated into three potential future scenarios.

Prior to Proposed Dam Demolition

The first phase of the sediment evaluation was to confirm or deny the presence of contaminants that rises to a level of concern. The result of this first phase has confirmed that surficial sediments are impacted with SVOCs above the referenced criteria.

If the proposed project plan requires the removal of sediments/riverbottom materials in depths of greater that one foot, some consideration should be given to collecting additional samples for purposes of evaluating the vertical contaminate profile. Since the previous sampling event indicated the presence of a minimal sediment vertical section, underlain by hardbottom materials, it is unlikely that elevated SVOC concentrations would be present below one foot that would rise to a level of concern. In absence of this data, the surficial sediment analytical results will be used to represent any and all excavated sediment and riverbed materials. Establishing a vertical contaminate profile may minimize the cost associated with special management or disposal of excavated or disturbed materials.

Further, since the baseline sampling identified SVOCs that rise to a level of concern above the dam, similar sampling should be performed below the dam to establish a preconstruction baseline below the dam sediment profile. This profile can assist the project planner in understanding the risk (or lack thereof) associated with sediment migration during disturbance activities and be used for post project monitoring, if required.

During Demolition/Area Restoration

Excavated material that exceeds the screening criteria should be properly managed during the project. Prior to disturbance of contaminated materials, a staging area should be established outside of the floodplain for material management. The staging area should be constructed in a fashion to minimize the potential for contamination and be constructed in a manner to control, treat and discharge (as necessary) decanted water and/or stormwater emanating from the stockpile. Potentially contaminated materials should be segregated and placed in the staging area for future re-use or disposal.

After the removal of the dam structure, it is understood that the river may narrow considerably from its current width. This narrowing of the river will expose previously submerged sediments/riverbed materials along certain portions of the river channel. In addition, other excavation activities may change the current geometry of the river in an attempt to return it to a pre-development meandering flowline. These activities may result in "completing" exposure pathways (i.e., direct contact) in areas where a completed pathway previously did not exist.

Further, it is understood that additional unconsolidated materials will be placed over some/most exposed areas to raise the existing grade to the surrounding topography. Other amendment, such as walking and/or bike paths, may be constructed.

During area restoration, it is anticipated that contaminated stockpiles soils will be allowed to be placed beneath clean fill. Placement of the contaminated sediment/river bottom materials, overlain by clean soils (preferably 2 feet in thickness) will eliminate a potential exposure pathway between contaminated materials and humans.

Other alternatives may include soil mixing or offsite disposal of the contaminated material.

Post Area Restoration

Several activities may be required or considered after the redevelopment of this area. First, OEPA may require that a human health risk assessment be performed to incorporate the elimination of exposure pathways as a condition for accepting the use of contaminated materials in the backfill. In addition, a Management Plan may be required, possibly including an easement or deed restriction, to prohibit excavation in areas where contaminated soils were used as backfill materials. Management Plans generally require that the site conditions be reviewed at 5 year intervals for a set period of time into the future. Lastly, sediment sampling may be required below the work area to ensure that construction activities did not mobilize and contaminate areas downstream of the construction project.

5.5 SEDIMENT MANAGEMENT

The goals of a sediment management plan are two-fold. First, to prevent pulses of silt from eroding in the dam pool and depositing downstream of the dam during the breach and second, to maintain normal sediment transport rates after the dam removal and restoration.

A detailed sediment management plan should be developed during the preliminary and final design phases of the project based on all of the data collected throughout the project phases and in conjunction with the final design. The dam breach will most likely be recommended during the historic, low-flow period of the year. The breach may also be done in phases to allow the dam pool to drop slowly preventing sediment fines from washing downstream.

6.0 Concept Plan

The proposed project encompasses three major aspects: The removal of the Main Street Dam; Subsequent river and riparian restoration; and the park features of the greenway that is made possible by the narrowing of the river channel. The following subsections describe the proposed concept plan that was developed during this phase of the project.

6.1 DAM REMOVAL

The Main Street Dam impounds approximately 2.3 miles of the Scioto River, extending to the Dublin Road Low Head Dam, inhibiting the river from reaching its potential use attainment of WWH. The dam also poses a liability and public safety risk evidenced by the loss of life at similar structures in the City of Columbus and around the country. The dam has caused the river to be over-widened in the impounded segment, resulting in alteration of the natural dimension and profile of the river and elimination of riffle/pool habitat. Removing the dam and utilizing natural channel design techniques to narrow the river segment will promote the restoration of the river's form and function.

This project will include the removal of the Main Street Dam and the subsequent restoration of the upstream, impacted segment of the Scioto River. The dam is approximately 13.5 feet high and 580 feet long (See Exhibits 2 and 3 in Appendix H) when measured at its upstream face, and will be entirely removed between its abutments. The existing abutments will remain in place after demolition is complete.

A comprehensive water and sediment management plan should be created during the final design phase of the project to establish dam breach protocol. Much of the contributing flow to this point on the river is regulated by structures throughout the watershed; however, hydrologic conditions are naturally variable and will play a major role in the phasing and schedule of deconstruction activities. While the Greenlawn Dam located downstream of the project area will likely prevent the transport of larger particles from the impoundment, any finer sized particles will likely remain in suspension and pass over the Greenlawn Dam. The goal of the water and sediment management plan is to provide safe and manageable working conditions, and to limit the potential for erosion, and subsequent deposition, of impounded sediments in the reaches downstream during the breach.

Breaching of the dam and dewatering of the impoundment should occur in late summer/early fall, during the historic low-flow period of the river. The dam should be removed in small, vertical increments, resulting in a slow drawdown of the dam pool. The slower the water level is lowered, the less likely fine sediments will be washed downstream. Consideration of stress to aquatic wildlife within, and adjacent to, the impoundment should be accounted for during permitting, design, and construction phases.

6.2 RIVER AND RIPARIAN RESTORATION

The primary goal of the restoration phase of the project is to restore the impounded section of the Scioto River; specifically targeting improvement of water quality and aquatic habitat using active restoration. The project also must be aesthetically pleasing. The high profile, urban location makes early vegetation establishment critical.

Other goals and objectives of the project include:

- Increase ambient Dissolved Oxygen (DO)
- Reduce low flow temperatures
- No rise in base flood elevations
- No reduction in protection level provided by the West Columbus Local Protection Project (Franklinton Floodwall)
- Improve habitat diversity
    - Restore aquatic and riparian habitat
    - Bed variability and diversity (riffle, run, pool, glide facets)
    - Habitat complexity (in-stream and bank structures)
    - Improved in-stream cover

These goals will be met by using natural channel design techniques, including: the construction of sustainable and narrower low-flow and bankfull channels; creation of an active geomorphic floodplain; use of in-stream structures consisting of wood, gravel, cobble, boulders, and native riparian vegetation; and the addition of habitat elements that are currently lacking from the project area, including vernal pools, ephemeral pools, side/back channels, and other features to support local fauna.

6.2.1 Project Area and Watershed Assessment

The Main Street Dam is located just downstream of the Main Street Bridge on the Scioto River in downtown Columbus, Ohio. The area of river targeted for restoration following the removal of the dam extends from approximately 850 feet downstream of the dam to the confluence with the Olentangy River. The total project length is approximately 7,000 feet. The Scioto River has been modified by extensive anthropogenic changes including O'Shaughnessy Reservoir, Griggs Reservoir, Dublin Road Low Head Dam, and other hydro-modifications. The river meanders through a terraced alluvial valley (Valley Type VIII, Rosgen 1996). River flood flows are contained by levees, including the West Columbus Local Protection Project (Franklinton Floodwall). The river is moderately entrenched.

Relevant Watershed Characteristics:

- Southern Ohio Loamy Till Plain – Columbus Lowland Physiographic Region
- Average Annual Precipitation is between 35 and 39 inches (Source: ODNR – Division of Soil and Water Resources)
- The watershed land use is mostly agricultural with mixed residential. The land use in the project area is urban.

The existing longitudinal profile indicates the channel lacks sufficient riffle and pool facets. The absence of bed features, near shore cover, refuge, and velocity and depth variation are the most significant habitat hindrances within the channel. Riparian vegetation and habitat has been reduced in many areas due to infrastructure encroachment.

6.2.2 Design Constraints

The primary design constraint for this project is the existing infrastructure along the project corridor (linear utilities and bridge piers, abutments, etc.) All of these features can be accounted for, maintained, and protected by utilizing natural channel design techniques, in which the channel is restored to a "pre-dam" condition. The proposed channel, both low-flow and bankfull, would be narrower, deeper, and have better bed variability.

6.2.3 Regional and Local Relationships

Regional and local geomorphological relationships are a vital part of the natural channel design process. These relationships are important to assess geomorphic stability, determine the degree of impairment, and to help predict the stable geomorphic form. They typically focus on understanding the geomorphic setting of the watershed, including concepts such as: regional hydrology and channel geometry curves and flood frequency analyses, sediment regimes, and reference reach conditions. An understanding of these relationships can be used to evaluate the departure of a stream reach from the stable form and the recovery potential of the stream. As part of this study, regional curve relationships and reference reach data were analyzed.

6.2.3.1 Regional Curves

The principle tenet of natural channel design is creating stable conditions: a channel that is capable of conveying both the water and sediment delivered to the watershed system without significant alteration to the channel shape or profile. One tool for deriving the appropriate size of a channel is the use of regional curves. Regional curves characterize relationships for bankfull stream dimensions (cross-sectional area, width and depth) as well as discharge, and are based on drainage area. Bankfull dimensions and discharge are used to develop basic design parameters. For the purpose of this study, and given the Scioto's altered watershed, highly varied hydrologic response to storm events, and its many channel modifications, it is recommended to use regional curves based on cross-sectional area and not discharge.

Typically, regional curves are derived for large-scale areas such as physiographic provinces (large areas of similar geologic origin), geographic regions (e.g. Eastern United States, North Carolina Piedmont) or major river watersheds (e.g. Snake River). Two regional curves applicable to this project are shown in Table 6-1.

Table 6-1. Regional Curves of Bankfull Cross-Sectional Area vs. Drainage Area

Location	Regional Curve	Source
Eastern U.S.	$A_{bkf}=21.174(DA)^{0.675}$	Dunne and Leopold (1978)
Ohio	$A_{bkf}=42.049(DA)^{0.637}$	USGS (2005)

The regional curves are useful for their initial estimate of bankfull dimensions. Differences between the two curves can be attributed to differences between hydro-physiographic provinces. The Ohio curve was created using data solely from the State of Ohio, while the Eastern U.S. curve was created using data from a broader range of sites.

The preliminary, proposed cross section used for this study is a multi-stage channel utilizing a low flow, inner berm stage and a bankfull stage. The inner berm feature is a dynamic feature, while the bankfull stage is more stable from event to event. Figure 6-1 shows the preliminary, proposed bankfull cross sectional area as compared to regional curve data. Since regional curve data is based on natural streams and the Scioto River has been modified by extensive anthropogenic changes, a bankfull cross sectional area slightly below the regional curve trend lines was selected to account for the increase in flood storage provided by the multiple reservoirs located upstream of the project site. Published regional relationships for inner berm features are not currently known to exist. Therefore, it is up to the designer to field verify the data related to this feature, typically through reference reach surveys, which are discussed in the following section.

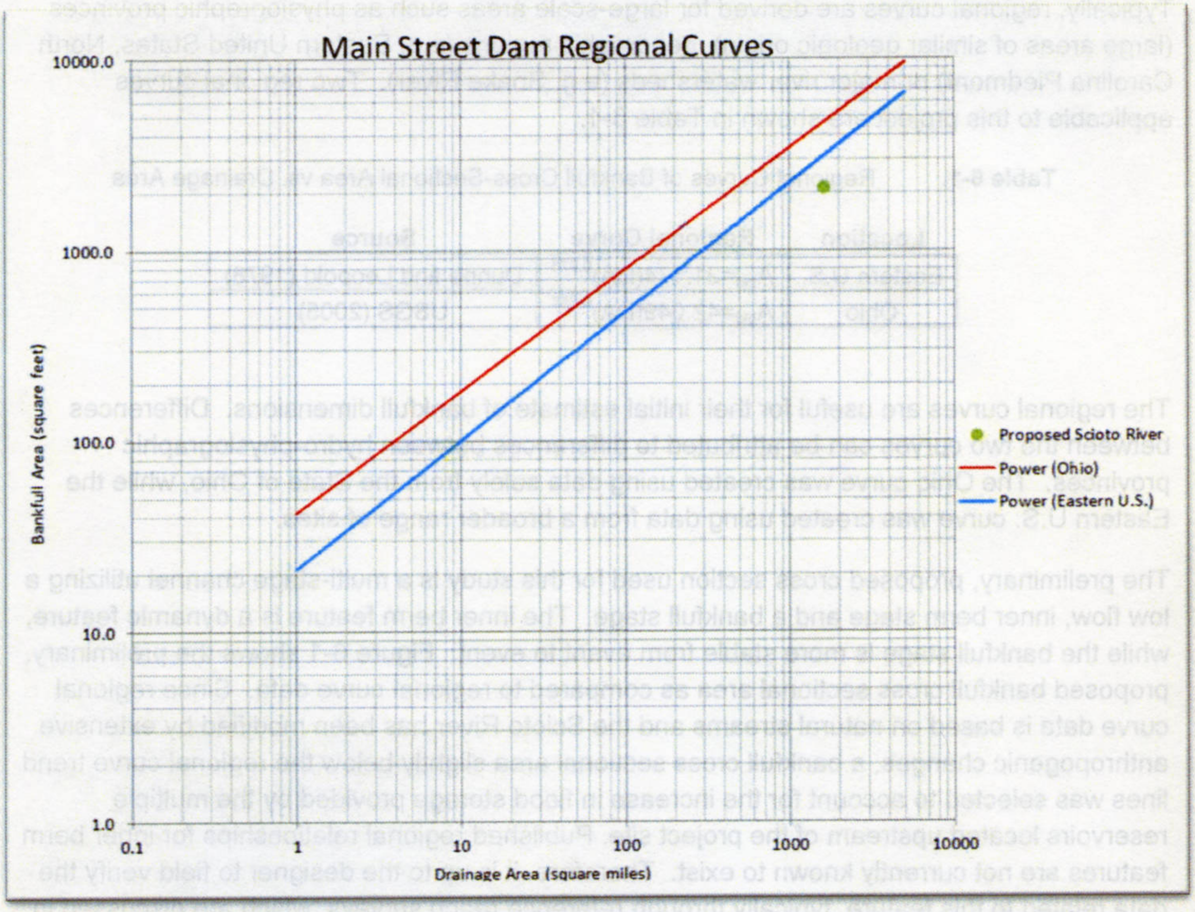


Figure 6-1. Regional Curve

6.2.3.2 Reference Reaches

A second tenet of natural channel design is the use of a reference reach as a blueprint for replication in the disturbed or impaired stream reach. A reference reach is a stable stream that maintains dimension, pattern and profile over time without aggrading or degrading (Rosgen 1996). The reference reach concept is discussed at length by Rosgen in several publications (1996, 2006, and 2007). The preliminary, proposed design will be verified and adjusted during final design based on reference reach data.

6.2.4 Design

The Scioto River restoration will consist primarily of Priority II (restoring the floodplain adjacent to the channel) and Priority IV (modifying the dimension, pattern and profile of the river in place using structures) restoration plans using natural channel design approaches. The cross-sectional geometry developed from the previously described methods is inter-related with the slope and plan form of the river, thus an iterative process is required to arrive at a final design solution. This process will allow for optimization of cut and fill quantities to manage cost. The final design will then be back-checked against the effective conditions HEC-RAS model to verify no-rise in base flood elevations.

A second component of the design will be the application of a sediment transport model. Two sediment transport functions must be analyzed: sediment competency and sediment transport capacity.

Sediment competency is a measure of the largest-sized particle a stream can transport. Competence is directly proportional to a stream's velocity. Complete natural channel design involves using riffle materials that the river is competent to transport, as material is constantly being replenished from upstream sources. Due to the lack of bedload being delivered by the watershed to replenish riffle material, it is anticipated that threshold riffles (ones in which the substrates will not move during flood flows) will be designed.

Sediment transport capacity is the maximum load of sediment that a stream can transport at a given stage. Capacity is directly proportional to the stream's discharge (i.e. the greater the amount of water flowing in the stream, the greater the amount of sediment it can carry). If the sediment load exceeds the river's transport capacity, the sediment will drop out of suspension and begin depositing, which leads to bar and shoal formation. These features can lead to further bed and bank instabilities. Following dam removal and restoration, it is critical to minimize the amount of sediment released downstream to prevent these conditions.

The design will be dependent upon early vegetation establishment. Structures will be designed to stabilize the channel bed and banks while the vegetation becomes established; however, unexpected conditions, such as drought or a fall flood, could warrant supplemental planting and maintenance. When dealing with an ecosystem restoration project in a natural system, the first two years following construction are critical. The project may require additional planting and/or erosion and sediment control maintenance until the vegetation becomes established.

As previously mentioned, reference reaches will be surveyed to provide guidance for stable design parameters. Many different parameters such as widths, depths and curve radii are measured and calculated for the reference reaches. To account for differing scales of river, these are applied to the proposed design using dimensionless ratios. The ratios make the parameter a function of a characteristic of the stream, such as bankfull width. In this manner, we can correlate, for example, pool-to-pool spacing between streams by dividing the spacing by the respective bankfull width. It is important to note, that some ratios of the final design may fall outside the reference conditions due to the numerous urban constraints, such as bridge crossings.

The proposed natural channel design will fulfill the goals of the project by removing the Main Street Dam, restoring river connectivity, and improving aquatic habitat through channel and riparian restoration. Existing infrastructure constraints will be incorporated into the design to provide protection and seamless aesthetics, while achieving ecological and hydraulic goals. The final restoration product will increase river functionality, add excellent aquatic habitat and improve water quality.

6.3 PARK FEATURES

With the engineering parameters of the Main Street Dam Removal defined, the project team has created a Concept Plan for the narrowed river, restored river edge and adjacent parkland. The implementation of a natural channel design allows for the creation of approximately 33 acres of ground that can be used to meet floodplain requirements, restore river habitat and enhance greenway connections and downtown parkland.

This restored river channel will have a positive impact on the aquatic habitat of the Scioto River, improving the river's health and water quality. The additional green space would link into the existing greenway system with bike paths and landscaped park areas. This enhanced greenway corridor will connect The Ohio State University to Downtown Columbus and provide recreational opportunities such as cycling, canoeing and kayaking. Taken together, these improvements will create an opportunity for the public to experience and interact with the river in a more natural state.

The Master Plan Concept seeks to build on recent park investment along the downtown riverfront from North Bank Park to the Scioto Audubon Metro Park. Elements of the Scioto Mile will be enhanced with new plaza and event spaces, especially at the Town Street Prow that will have a two-level overlook. New pathways on both sides of the Scioto River tie into the existing downtown and regional bikeway system and allow for interaction and access at the river level. The park pathway and plaza areas transition to naturalized river edge condition that is designed to withstand flood events.

On the west side of the river, an extension of the plaza and lawn in front of COSI will create an expanded event space. Building on the theme of connections, a proposed pedestrian bridge will directly connect COSI and the Scioto Peninsula to the Scioto Mile Promenade and Downtown Columbus helping to visually and physically link these two nodes of activity.

With these improvements, downtown will no longer turn its back on the Scioto River. Instead, it will be able to use the river for recreation, admire it for its natural beauty and celebrate it as the "central park" of Downtown Columbus.

Phase One Improvements

To enable the efficient implementation of this project, the proposed Master Plan Concept improvements have been divided into two phases. Phase One improvements, which focus on dam removal, river channel formation, river restoration and associated greenway and bike path components of the Master Plan, are detailed below:

- Remove concrete lowhead dam south of the Main Street Bridge

- Remove accumulated sediment behind dam
- Restore a more naturalized and narrower river course and channel topography with the creation of pools, riffles, and glides. These improve river flow and river habitat.
- Create stabilized riveredge and naturalized river bank using bioengineering methods – no riprap or concrete walls with the exception of limited, target areas for public access to the river edge.
- Provide greenway system with bike paths, park space, and connections to existing public parks and amenities

Phase One Elements (Numbers correspond to Figures 6-2 and 6-4)

1. Restored River Channel: Reconfigured river channel sculpted with pools, riffles and glides to create a more natural and healthy river environment, supporting a diverse aquatic habitat.

2. Restored River Edge: Bio-engineered, stabilized and vegetated river edge with native plant material and riparian habitat. The river edge transitions from native plantings to manicured parkland upslope of the leisure trail.

3. Leisure Trail: Continuous 12-foot-wide leisure trail on both the east and west banks that is integrated with the Scioto-Olentangy Bikeway and larger regional bike trail system.

4. Town Street Prow: Two-level plaza space that preserves the existing Town Street Prow and creates a lower-level overlook to the river and West Bank. The two levels are connected by a grand stair along the south edge of the existing Prow.

6. Scioto Quay: Lower level walkway along river's edge with space for seating, strolling and events. The quay brings people to the river, provides a link in the trail system, and forms part of the East Landing.

7. Event Plaza and Lawn: Extension of the plaza and lawn space in front of COSI to create a venue for expanded festivals, events and exhibits.

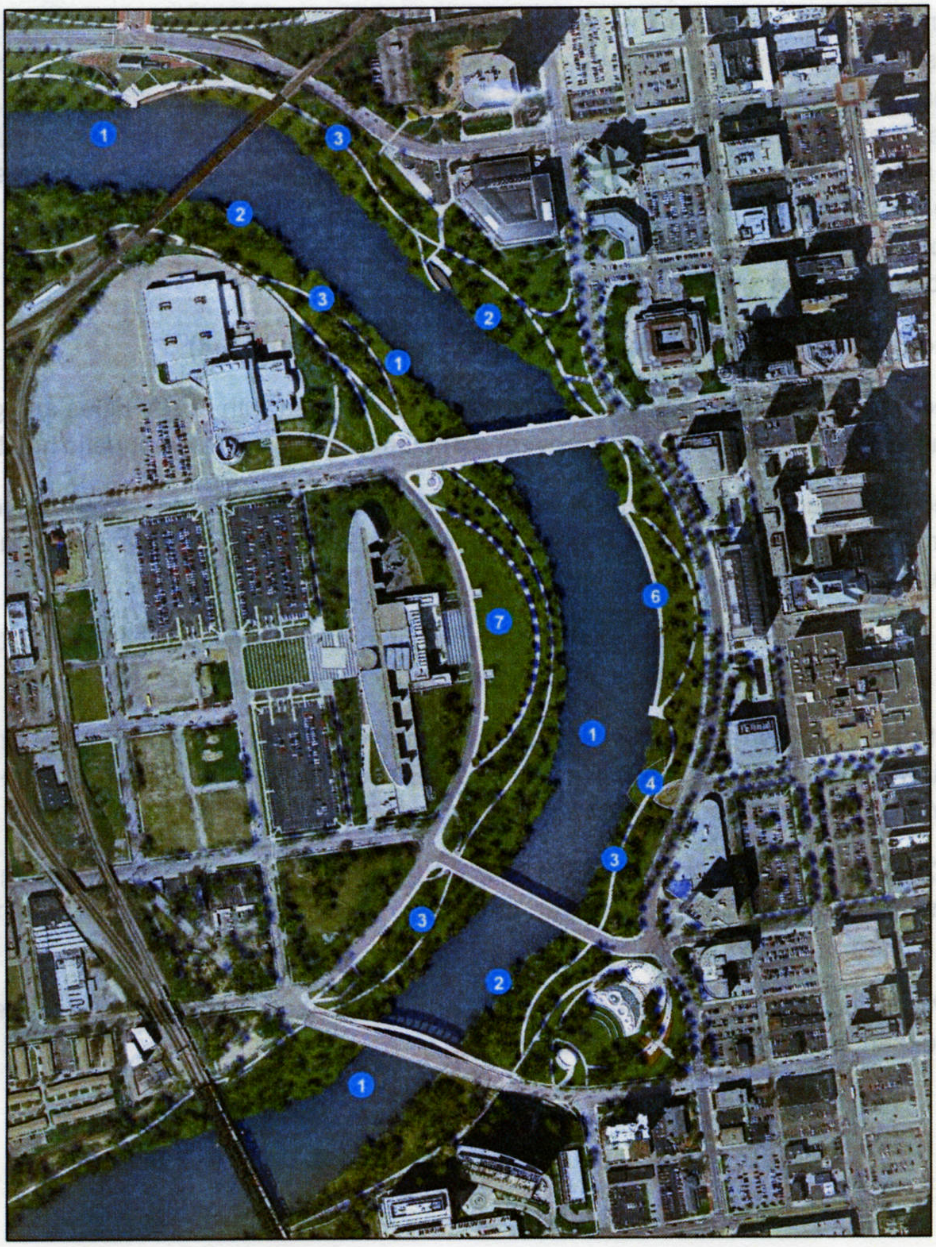


Figure 6-2. Phase I Concept Rendering

Figure 6-3. Phase I Perspective Rendering

Figure 6-4. Master Concept Rendering

7.0 Hydrology and Hydraulics

7.1 INTRODUCTION

A hydrologic and hydraulic (H&H) analysis was performed to evaluate the effect of the Main Street Dam removal on Scioto River hydraulics and water surface elevations. The results of this analysis will be used to determine post-dam removal water surface elevations for the normal flow and for various flood conditions.

The study area of the Scioto River for this project extends from just downstream of the Greenlawn Avenue Low Head Dam to just upstream of the Dublin Road Low Head Dam.

7.2 EXISTING SCIOTO RIVER HYDROLOGIC AND HYDRAULIC STUDIES

The effective hydrologic and hydraulic analyses for the Scioto River were prepared by the USACE, Huntington District, completed in September 2001 and published in the March 2004 *Flood Insurance Study for Franklin County, Ohio and Incorporated Areas.* This study was done to convert the previous HEC-2 model to HEC-RAS and to incorporate the newly constructed West Columbus Local Protection Project.

DLZ Ohio, Inc., under contract from the City of Columbus, completed a Scioto River study in 2010. The purpose of this study was to combine various smaller models into one model from the Franklin/Pickaway County line to the most upstream Interstate 670 bridge crossing. This model contains the following: Data from a 2003 Letter of Map Revision (LOMR) completed by Malcolm Pirnie, which was not accepted by the Federal Emergency Management Agency (FEMA), for the State Route 665 bridge replacement; Burgess & Niple's lateral flow model for the Olen area just upstream of the SR 665 bridge to the I-270 bridge; EMH&T's CLOMR model for removal of the Town Street bridge and the construction of the new Main Street and Rich Street bridges; and the effective model for all other areas.

7.3 HYDROLOGIC ANALYSIS

7.3.1 Flow Discrepancy

The effective hydrologic analysis was completed by the USACE, Huntington District, and published in the 2004 revision to the Franklin County, Ohio FIS. However, a discrepancy exists between the published flow data and the flow data used in the effective hydraulic model; the published flows were never included in a hydraulic analysis. Per guidance from FEMA Region V, if the effective Flood Insurance Rate Maps (FIRMs) and Floodway Data Table (FWDT) are based on the effective hydraulic model, then subsequent models shall use the same flow data as used in the effective model. Due to this guidance, flows for the 10- and 1-percent-annual-chance events were taken directly from the effective hydraulic model.

7.3.2 Drainage Area Weighting

Average streamflow discharge estimates were determined by performing drainage area weighting with the average streamflow discharges from the nearby gaged sites. Four U.S. Geological Survey (USGS) gages were used for this drainage area weighting calculation: 03231500 – Scioto River at Chillicothe, 03227500 – Scioto River at Columbus OH, 03221000 – Scioto River below O'Shaughnessy Dam near Dublin OH, and 03219500 – Scioto River near Prospect OH. Average streamflows from the gaged sites were taken directly from the United States Geological Survey (USGS) Water-Resources Investigations Report (WRIR) 01-4140, *Low-Flow Characteristics of Streams in Ohio through Water Year 1997*, by David E. Straub.

The equation used to weight the flow for the un-gaged sites on the Scioto River are illustrated in Figure 7-1.

7.3.4 Results

Table 7-1. summarizes the peak discharges used in this study

Flow Change Location	Drainage Area	Average Streamflow (WRIR 01-4140)	10% Flow	1% Flow	SPF Flow
	(sq. mi.)	(cfs)	(cfs)	(cfs)	(cfs)
Greenlawn Dam	1617.43	1361	36800	75000	111,000
US Olentangy River	1069.08	875	28900	57000	87,468

7.4 HYDRAULIC ANALYSIS

7.4.1 Existing Conditions Model

The USACE's Hydraulic Engineering Center River Analysis System (HEC-RAS) computer program (Version 4.1.0) was used to create an existing conditions model for the area beginning at lettered cross section AB and extending upstream to lettered cross section AO. From cross section 7220 to cross section 14713, cross section geometric was extracted from a triangulated irregular network (TIN) created from 2009 City of Columbus Light Detection and Ranging (LiDAR) points and 2011 hydrographic survey data obtained by Rii. For all other cross sections, overbank geometric data was extracted from the TIN and channel geometric data was taken from the effective hydraulic model.

Overbank Manning's 'n' values were estimated from a 2006 National Land Cover Dataset (NLCD) of Ohio prepared by the USGS and from field reconnaissance. Channel 'n' values were determined to be 0.032. The overbank 'n' values were extracted from GIS using HEC-GeoRAS 4.3.93 and manually modified where necessary. Table 7-2 shows the overbank Manning's 'n' values used for each corresponding land use. These values were taken from Chow (1959) and McCuen (1998).

Table 7-2. Manning's Coefficients

Roughness Coefficients (Manning's "n")

Land Cover	N Value
Open Water	0.04
Developed, Open Space	0.04
Developed, Low Intensity	0.05
Developed, Medium Intensity	0.06
Developed, High Intensity	0.08
Barren Land	0.04
Deciduous Forest	0.10
Evergreen Forest	0.10
Mixed Forest	0.10
Shrub / Scrub	0.05
Grassland / Herbaceous	0.05
Pasture / Hay	0.05
Cultivated Crops	0.04
Woody Wetlands	0.06
Emergent Herbaceous Wetlands	0.05

Reference: Chow (1959), McCuen (1998)

For cross sections located just upstream and downstream of bridges, ineffective areas were added to model the reduction in effective flow area caused by the obstruction of the bridge embankment. A 1:1 contraction ratio was assumed upstream of bridges. Downstream expansion ratios were selected based on Table 5-1 of the January 2010 HEC-RAS River Analysis Hydraulics Reference Manual. Also, expansion and contraction coefficients were adjusted to 0.3 and 0.5, respectively, per Table 5-2 of the same publication.

The discharges determined using the previously described hydrologic methods were input into the HEC-RAS model. Flow changes were entered at the upstream-most reach of the study and just downstream of the confluence with the Olentangy River. Reach boundary conditions were selected in accordance with FEMA's *Guidelines and Specifications for Flood Hazard Mapping Partners*. The boundary conditions applied were known water surface for the SPF and the 10- and 1-percent-annual-chance events and the normal depth slope for the average streamflow.

7.4.2 Post-Project Conditions Model

A post-project conditions model was created using the pre-project conditions model as a basis with the Main Street Dam inline structure removed and a proposed pedestrian bridge added. Cross section geometry from cross section 8459 to cross section 14713 was modified to show the proposed channel narrowing and stream restoration design. Manning's 'n' values were updated in these areas to reflect changes resulting from this work. Flows and boundary conditions remained the same as represented in the existing conditions model.

7.4.3 Standard Project Flood

As previously mentioned, the West Columbus Local Protection Project was constructed to provide a barrier around the Franklinton area, just southwest of downtown Columbus. This floodwall was included in both the existing and post-project condition models. The location of the wall and top of wall elevations were taken from a 2005 survey performed by Woolpert, Inc. for the USACE and provided to Stantec by the City of Columbus.

When compared to the existing condition model, post-project SPF water surface elevations generally decrease downstream of the Broad Street Bridge and increase upstream of the Broad Street Bridge. When compared to the top of wall elevations, the post-project condition SPF does not overtop the floodwall at any location. The smallest amount of freeboard in the post-project conditions is 0.60', located in the area of I-670, just upstream of Souder Avenue.

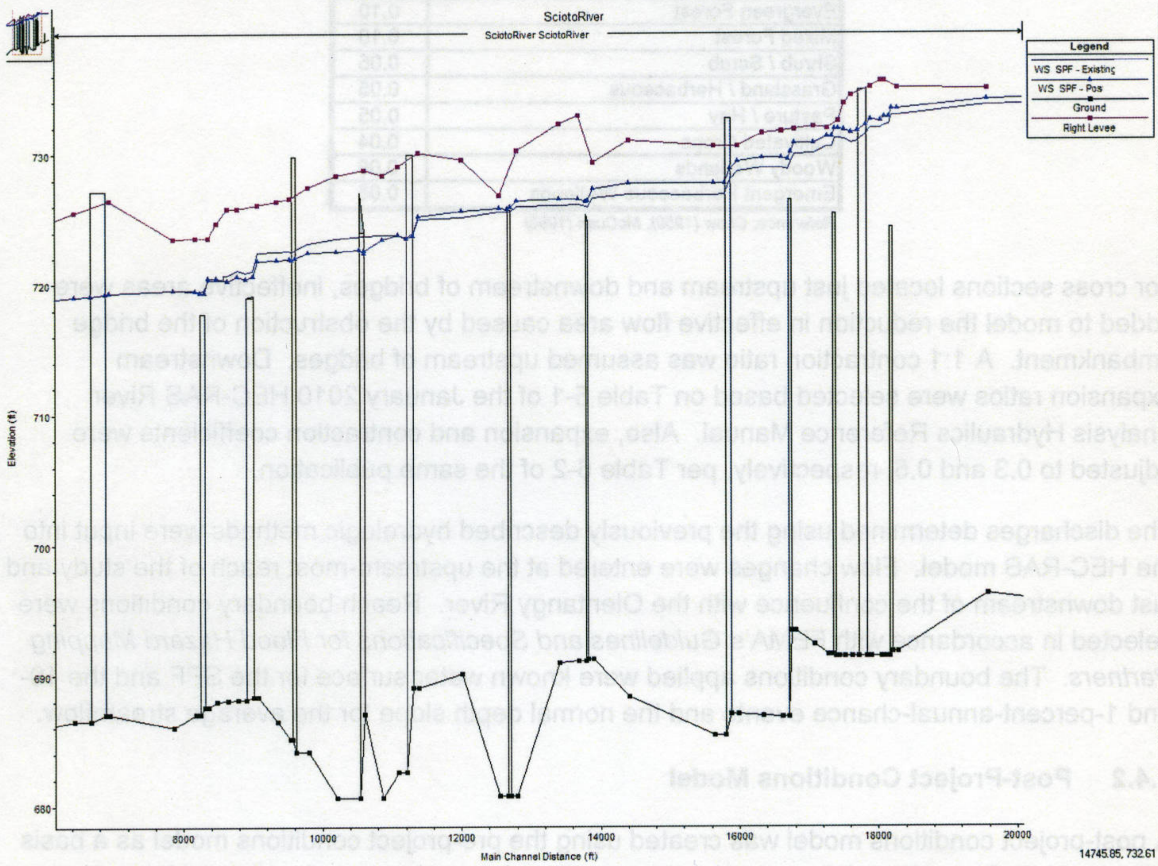


Figure 7-2. Existing & Post-Project SPF Compared to Top of Floodwall

7.5 RESULTS

Model runs were executed for both the existing and post-project conditions models and results were summarized. Table 7-3 below summarizes the maximum changes in water surface elevation for the average streamflow, SPF, 10- and 1-percent-annual-chance events.

Table 7-3. Changes in Water Surface Elevations

Flow Event	Maximum Decrease of WSE from Existing Conditions (feet)	Maximum Increase of WSE from Existing Conditions (feet)
Average Streamflow	7.03	0.00
10-percent-annual-chance	4.03	0.00
1-percent-annual-chance	1.41	0.00
Standard Project Flood	1.07	0.88

As can be seen from the table above, the dam removal will have a significant effect on smaller recurrence interval events and a much smaller effect on large events. A Conditional Letter of Map Revision (CLOMR) will not be necessary as there is no rise in the FEMA regulatory flood elevations.

Appendix G compares the existing conditions modeling results versus the post-project modeling results for the various flow events.

7.6 RECOMMENDED NEXT STEPS

The following tasks need to be completed to finalize the hydraulic modeling of the Scioto River to evaluate the effects of the Main Street Dam removal and prepare for demolition of the dam and restoration of the river:

- **Floodway Analysis.** A revised floodway analysis needs to be performed for the post-project conditions model.
- **Floodplain Permit Application.** A floodplain permit application needs to be submitted to the local floodplain administrator showing no rise in the regulatory flood elevations.
- **FEMA LOMR.** A LOMR application is required to be submitted to FEMA following construction of the project for revisions to the effective base flood elevations and floodway due to the removal of the Main Street Dam.

8.0 Structures and Bridges

The evaluation performed for this phase of the project includes both structural and geotechnical components, including:

- Obtain and review historical data;
- Perform site visits to visually evaluate existing conditions; and
- Compile data for evaluation.

Historical data reviewed was obtained from several sources, including the City of Columbus, the ODOT, the Franklin County Engineer's Office (FCEO), Norfolk Southern Corp., and the CDDC. Data obtained included plans and details of structures, geotechnical data, well log and other relevant data.

Multiple site visits were performed by Stantec personnel between August and November 2011. Existing site conditions, including structures, were documented and evaluated. The location of these structures is shown in Appendix H, Exhibit 1.

The primary focus for the geotechnical evaluation was to identify and evaluate structures that could be impacted by the dam removal and to support Stantec's Structural Engineering Group with their evaluation.

The hydraulic profiles generated from the H&H evaluation (see Section 7 – Hydrology and Hydraulics) were reviewed to compare the various flood events prior to and after removal of the dam. It was determined the average annual pool elevations along the river will change as follows:

- Lower approximately 7 feet from the Main Street Dam to the CSX Railroad Bridge;
- Lower approximately 6.5 feet from the CSX Railroad Bridge to Souder Avenue;
- Lower 2.5 to 6.5 feet from Souder Avenue to I-670;
- Lower 2 to 2.5 feet from I-670 to just downstream of the Dublin Road Low Head Dam;
- No change upstream of the Dublin Road Low Head Dam.

The H&H results also indicate flow velocities will increase slightly due to the lower water surface elevations and narrower river width following dam removal and restoration. Due to this, any flow abnormalities that are occurring now, with the dam in place, may be increased after the dam is removed.

Stream degradation (scouring of the stream bed) may occur when stream velocities are high enough to lift and transport river bed material. Section 5 – Sediments provides specific data of the existing stream condition and Section 6.2 – River and Riparian Restoration provides information on how the proposed natural channel design addresses sediment transport.

If scour conditions at piers and other structures within and along the river channel exist with the dam in place, it is reasonable to expect that after dam removal, scour could increase. If this condition currently exists at a critical location, further scour evaluations should be performed. Scour protection typically consists of rock channel protection, crushed aggregate slope protection or concrete slope protection depending upon the flow characteristics.

8.1 STRUCTURAL UNDERSTANDING OF BRIDGES

Table 8.1 provides a list of all of the bridges evaluated, with the distance from the Dam and existing and proposed water surface elevation data.

Table 8-1. List of Bridges

Structure	Distance Upstream of Main Street Dam (ft)	Water Surface Elevation Before Dam Removal* (NAVD88)	Water Surface Elevation After Dam Removal* (NAVD88)	Change in Elevation (ft)
CSX/Norfolk Southern Shared Railroad Bridge	320#	696.74	696.74	0.00
Main Street Dam (upstream face)	0	703.77	696.74	-7.03
Main Street Bridge	370	703.77	696.75	-7.02
Rich Street Bridge	1,075	703.78	696.76	-7.02
Broad Street Bridge	2,700	703.79	696.80	-6.99
Norfolk Southern Railroad Bridge	4,100	703.80	696.86	-6.94
CSX Railroad Bridge	5,250	703.80	696.91	-6.89
St. Rt. 315 Bridge	7,200	703.81	697.05	-6.76
Souder Avenue Bridge	8,250	703.84	697.21	-6.63
I-670 Ramp SE Bridge	8,900	703.85	699.93	-3.92
I-670 Bridge	9,250	703.95	701.58	-2.37
I-670 Ramp SC Bridge	9,700	703.99	701.82	-2.17

Structure located downstream of Main Street Dam
* Based on Average Annual Streamflow

8.1.1 CSX/Norfolk Southern Shared Railroad Bridge (downstream of Main Street Dam)

This shared railroad bridge is actually two bridges on common piers. The east bridge is used by Norfolk Southern and the west bridge by CSX. The combined structure is 70 feet wide by 590 feet long and was constructed to its present condition in 1919. The record plans for the bridge are shown on Exhibits 4 through 6 in Appendix H. The abutments and piers are supported on separate footings at elevation 684 (estimated from record plans) with piling tipped at an unknown elevation.

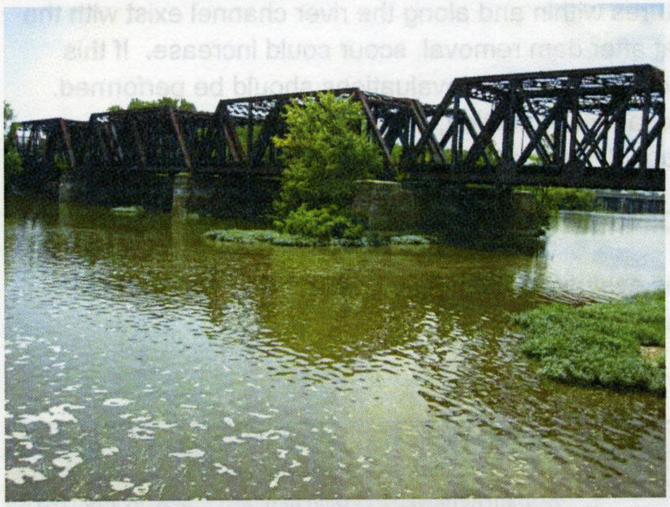


Photo 8-1. NS/CSX Bridge showing aggradation at pier

Aggradation (as shown in Photo 8-1) is occurring around two of the piers. This build-up of material can increase the risk of contraction scour; however, due to the type of pier footings, which include pilings, the piers are considered structurally sound, assuming they have not been uncovered by scour.

Since the structure is located downstream of Main Street Dam, no measureable change in water surface elevations are expected; however, normal flow stream velocities will increase as a result of the removal of the dam. Stantec recommends a scour analysis be performed to determine the existing scour condition and to evaluate future scour concerns.

8.1.2 Main Street Bridge

The Main Street Bridge is located approximately 370 feet upstream of the Main Street Bridge. The bridge is shown in Photo 8-2.

Photo 8-2. Main Street Bridge (looking south)

Record plans from the City of Columbus, Transportation Division show that in 2011, the existing seven span, reinforced concrete, open spandrel barrel arch bridge was replaced with a three span, inclined arch bridge on a reinforced concrete substructure. Selected record plans are provided as Exhibits 7 through 9 in Appendix H.

The bottom of the existing pier footings do not extend to the existing channel bottom. Per record plan information, the bottoms of the pier footings are at elevation 701.15, approximately 8.5 feet above the thalweg elevation. The bottom of the abutment footings are at elevation 692.0. Abutment and pier footings are supported by 6-foot diameter drilled shafts tipped at shale bedrock (approximately elevation 665.0).

Due to the dam removal and subsequent narrowing of the river channel, as indicated by the H&H Study (see Section 7), the average annual water surface elevation will drop approximately 7 feet and flow in spans 1 and 3 will be eliminated. The bottom of the existing pier footings will then either be exposed or buried in the new bankfull bench. If exposed, it will be necessary to construct a pier skirt to conceal the exposed drilled shafts. A pier skirt will only result in an aesthetic change to the bridge; it will have no structural impacts.

Based on the information evaluated, no significant structural disturbance is expected to occur to this bridge. Stantec recommends a scour analysis be performed to evaluate future scour concerns.

8.1.3 Rich Street Bridge

As of the time of the writing of this report, the Rich Street Bridge is currently under construction. This new precast and post-tensioned concrete rib arch bridge replaced the previous earth filled concrete spandrel arch Town Street Bridge. Pertinent record plans are provided as Exhibits 10 and 11 in Appendix H.

The Rich Street Bridge is 60 feet wide, 562 feet long and is located approximately 1,075 feet upstream of the Main Street Dam. The bridge is shown in Photo 8-3.

Photo 8-3. Rich Street Bridge looking north

Per record plan information, pier caps are set on 5.5-foot-diameter drilled shafts, which are set 3 feet, minimum, into limestone bedrock (approximately elevation 634). The bottom of the pier caps are at elevation 700.90. The bottom of the abutment footings are at elevation 702.5 and 704.0. The abutment footings are founded on HP 12x74 steel piles, 55-60 feet long.

Similar to the Main Street Bridge, due to the dam removal and subsequent narrowing of the river channel, as indicated by the H&H Study (see Section 7), the average annual water surface elevation will drop approximately 7 feet, and flow in spans 1 and 5 will be eliminated. The bottom of the existing pier caps will no longer be submerged by the average water surface. It will be necessary to construct a pier skirt to conceal the exposed drilled shafts. A pier skirt will only result in an aesthetic change to the bridge; it will have no structural impacts.

Stantec recommends a scour analysis be performed to evaluate future scour concerns.

8.1.4 Broad Street Bridge

The Broad Street Bridge is 100 feet wide and 660 feet long and was constructed in 1990. The bridge is located approximately 2,700 feet upstream of the Main Street Dam. Photo 8-4 shows the bridge. Record plans are shown as Exhibits 12 and 13 in Appendix H.

Photo 8-4. Broad Street Bridge looking south

Pier caps are set on 7 foot diameter drilled shafts, which are set a minimum of 3 feet into limestone bedrock (approximately elevation 630). The bottom of the pier caps are at elevation 700.0. The bottom of the abutment footings are at elevation 695.0 and are founded on HP 14x73 piles with an average length of 65 feet.

Due to the dam removal and subsequent river restoration, the average annual water surface elevation at the Broad Street Bridge will decrease by approximately 7 feet. Flow in spans 1, 2 and 5 will be eliminated. The bottom of the existing pier caps will either be exposed or buried in the new bankfull bench. If exposed, it will be necessary to construct a pier skirt to conceal the exposed drilled shafts. A pier skirt will only result in an aesthetic change to the bridge; it will have no structural impacts.

Stantec recommends a scour analysis be performed to evaluate future scour concerns.

8.1.5 Norfolk Southern Railroad Bridge

The Norfolk Southern Railroad Bridge was built in two phases. The first phase was constructed in 1903 and includes the three truss spans. The second phase was constructed in 1921 and includes the two pony truss spans. The bridge is 31 feet wide and 670 feet long. Photo 8-5 shows the Norfolk Southern bridge in the foreground and the CSX bridge in the background. Selected record plans are shown as Exhibits 14 through 16 in Appendix H.

Photo 8-5. Norfolk Southern and CSX Bridges (looking north)

Per the record drawings provided by Norfolk Southern Corp., pier footings are roughly 21-feet by 50-feet each and founded at approximately elevation 682. Each is supported by piling spaced 3-foot on-center. Abutment footings are founded at approximately elevation 690 and are supported by piling spaced 2-feet, 10 inches on-center. Size, length and material of piles are not clear from record drawings; however, the piles are assumed to be wood.

Based on the information evaluated, no significant disturbance is expected to occur to this bridge; however, due to age of the available record drawings, Stantec recommends additional field investigations to verify plan information.

There is some evidence of scour occurring on the downstream side of the bridge piers. Stantec recommends performing a detailed scour analysis to determine existing and future scour conditions.

8.1.6 CSX Railroad Bridge

The CSX Railroad Bridge is approximately 30 feet wide and 650 feet long. It is located approximately 5,250 feet upstream of the Main Street Dam. A request for construction plans for the bridge was made to CSX and was denied. CSX indicated that plans will be made available once the project has been authorized by the City of Columbus and has moved into detailed design. Bridge geometry data used in this study was taken from aerial imagery and previously completed hydraulic models. The bridge can be seen in the background of Photo 8-5.

Due to the dam removal and subsequent river restoration, the average annual water surface elevation at the CSX Railroad Bridge will decrease by nearly 7 feet. Flow in spans 1 and 5 will be eliminated.

Based on the information available, Stantec does not expect any significant disturbance to occur to this bridge; however, Stantec recommends obtaining the construction plans from CSX as soon as possible, and, assuming the significant age of the record drawings, performing additional field investigations to verify plan information.

Stantec recommends a scour analysis be performed to evaluate future scour concerns.

8.1.7 State Route 315 Bridge

The State Route 315 Bridge is located approximately 7,200 feet upstream of Main Street Dam and approximately 900 feet upstream of the Scioto River's confluence with the Olentangy River. It is nearly 400 feet long and varies in width from 136 feet to 154 feet. Record plans are shown as Exhibits 17 and 18 in Appendix H.

Per the record drawings, pier footings are roughly 18-feet by 13-feet each. The southern-most pier is founded at elevation 685, while the other 2 piers are founded at elevation 687. Each pier footing is supported by HP 12x53 piling tipped at an unknown elevation.

Stream restoration activities associated with this project will not extend upstream of the confluence with the Olentangy; therefore, the only change impacting this structure is a decrease in average annual water surface elevation of 6.76 feet. Stantec does not expect this change to have any adverse impacts to the structure.

8.1.8 Souder Avenue Bridge

The Souder Avenue Bridge is 35 feet wide and approximately 410 feet long. It is located approximately 8,250 feet upstream of the Main Street Dam and approximately 2,000 feet upstream of the Scioto River's confluence with the Olentangy River. Record plans are shown as Exhibits 19 and 20 in Appendix H.

Similar to the State Route 315 Bridge, the only change to impact this structure will be a decrease in average annual water surface elevations of approximately 6.5 feet.

No adverse impact to this structure is anticipated.

8.1.9 Interstate 670, On & Off Ramp Bridges

The I-670 Bridge is located approximately 9,250 feet upstream of the Main Street Dam and approximately 3,000 feet upstream of the Scioto River's confluence with the Olentangy River, with on- and off-ramps located approximately 350 feet upstream and 250 feet downstream, respectively. Record plans are shown as Exhibits 21 through 26 in Appendix H.

Since stream restoration activities associated with this project will not extend upstream of the Scioto's confluence with the Olentangy, the only change impacting these structures will be a decrease in average annual water surface elevations of approximately 4 feet at the downstream-most ramp to approximately 2 feet at the upstream-most ramp.

No adverse impacts to these structures are anticipated.

8.2 STRUCTURAL EVALUATION OF UTILITIES

Geotechnical evaluations previously completed in 2009 as part of the CDDC's Scioto Mile Riverfront Project were used in the analysis of existing outfalls along the project area. The current storm sewer outfalls and CSOs will be impacted by the narrowing of the river corridor. It will be necessary to either extend these utilities to the new channel location or to find another means of maintaining the connection to the river (e.g. green infrastructure techniques).

8.2.1 Sewer Extensions

Large diameter outfalls, such as the various CSOs along the project reach and the box culverts recently constructed as part of the Scioto Mile Riverfront project, will be sensitive to post-construction settlement. It is recommended that these proposed sewer extensions be supported on deep foundations consisting of either drilled shafts or Augered Cast in Place (ACIP) piles. Based on the proximity of many of these sewer extensions to the existing OSIS, it is believed that driven piles may incur undue vibrations and stresses on the existing sewer and foundation. These foundations should be extended to bear in the dense to very dense sand and gravel that exists at elevation 680 and below.

8.2.2 Utilities crossing Scioto River

There are three (3) individual utilities that cross the Scioto River in the project area:

- 10-inch & 36-inch force main sanitary located just upstream of the Main Street Dam (Exhibits 27 and 28 in Appendix H);
- 138 kV electric line located just upstream of the Main Street Bridge (Exhibits 29 through 31 in Appendix H); and
- 12-inch, medium pressure gas line located just upstream of the previously mentioned 138 kV electric (Exhibits 32 and 33 in Appendix H).

Preliminary analysis indicates these utilities have sufficient cover to not be impacted by the proposed stream restoration activities. Additionally, all of these utilities lie in a proposed riffle segment that will be constructed with riffle armoring, further protecting the utilities from any potential scour that could otherwise occur.

8.3 STRUCTURAL ISSUES WITH THE OSIS AND WALL

Preliminary analyses were performed to assess the potential variations in the OSIS structural response to loading scenarios associated with the proposed Scioto River channel modifications. Using conventional lateral soil pressure theories, the load on the river-side wall of the OSIS trunk sewer was computed for both the pre-project and proposed project conditions, for water levels of 1-year and 100-year mean return periods. For the 1-year water level, the moment within the OSIS wall was calculated to increase from approximately 1.1 kip-feet per foot of wall to approximately 22.7 kip-feet per foot of wall. For the 100-year water level, the moment within the OSIS wall was calculated to increase from approximately 3.7 kip-feet per foot of wall to approximately 28.9 kip-feet per foot of wall. These values reflect unfactored, or service-level, loads, and are approximations because of the limited amount of data available. Further investigations may refine or alter these values.

While the computed increase in load is clearly significant, it remains possible that the higher loads are still within the structural capacity of the OSIS wall. Calculation of the structural capacity of the OSIS wall relies on the material strength properties of the concrete and steel in the OSIS wall, but these properties are not known. The original design calculations for the OSIS contain what appear to be allowable values for these strengths, but the factor of safety used to derive these allowable values is not known. Use of these values as actual strengths is probably therefore conservative, but this is not certain. Furthermore, the reinforcement design shown in the calculations does not match the reinforcement design shown on available construction drawings. This casts further doubt on the use of the strength values found in the design calculations. But using these values to compute the moment capacity of the OSIS wall yields a value of 31.0 kip-feet per foot of wall. This capacity value is computed at a service-level as described in the calculations in Appendix I. This value is slightly above the computed service-level demand, indicating that the OSIS wall is adequate for the new load. However, given the uncertainties in this calculation, further investigation is recommended.

Stantec recommends additional investigation into the historical records of the original design and construction of the OSIS wall to determine the basic material properties and final geometry of the concrete and steel in the OSIS wall. Additionally, field investigation into the condition of the OSIS wall, retrieval of concrete cores for strength testing, verification of reinforcing steel size/placement are also recommended. Additional analyses assessing the resultant displacements of the OSIS wall under proposed loads, as well as modeling of potential structural modifications to minimize impacts to the OSIS, are also advised during the design phase of the project.

8.4 IMPROVEMENTS REQUIRED

The bridges in the study area are supported on piers founded on friction piles. Based on available record plans, most of the piling is tipped in bedrock. Where record plans were not available, or were of an increased age (i.e. railroad bridges), it is recommended that the structure be evaluated for scour. Piles that are uncovered by scour can reduce the stability of the bridge. This evaluation may include field probes at suspected scour locations.

It is recommended that locations identified as a concern for scour be evaluated. This would include collection additional topography to determine the amount of existing scour. These results would then be compared to the originally designed bridge calculations to determine if the existing scour depths are within the expected limits of the design.

River crossing utilities should be further evaluated, by field methods if possible, to verify their exact location and condition. Proposed channel elevations can be adjusted to accommodate the exact elevation of the utilities.

Small to medium diameter sewer outfalls shall either be extended to the proposed channel using typical trenching methods or by utilizing green infrastructure techniques. Large diameter pipe and box culvert extensions will need to be supported on deep foundations of drilled shafts or ACIP piles. Driven piles may not be used due to the danger of damage to the OSIS.

9.0 Permitting

The proposed project will require permitting from several different agencies before construction can begin. The Scioto River is considered a water of the United States; therefore, federal permits will be required. It is highly probable that the US Army Corps of Engineers (USACE) will be the lead agency regarding federal permitting. The river also has a regulated floodplain, which will require floodplain permitting under the National Flood Insurance Program (NFIP). If federal funds are utilized on the project, provisions of the National Environmental Policy Act (NEPA) must also be followed.

9.1 SECTION 404 PERMITTING (USACE)

The Clean Water Act (CWA) Section 404 establishes a program to regulate the discharge of dredged and fill material into waters of the United States, including wetlands. Responsibility for administering and enforcing Section 404 is shared by USACE and EPA. USACE administers the day-to-day program, including individual permit decisions and jurisdictional determinations; develops policy and guidance; and enforces Section 404 provisions. EPA develops and interprets environmental criteria used in evaluating permit applications, identifies activities that are exempt from permitting, reviews/comments on individual permit applications, enforces Section 404 provisions, and has authority to veto USACE permit decisions.

Since the Scioto River is considered a water of the United States, the proposed project will fall under the jurisdiction of the section 404 permitting process through the USACE. The nature and scope of the project would fall under one of the Nationwide Permits (NWP) allowing the permitting process to be less rigorous and time consuming than obtaining an individual permit.

The proposed project should be covered under the conditions of the NWP 27 - Aquatic Habitat Restoration, Establishment, and Enhancement Activities. Following is the current (2007) definition of the types of projects covered under this NWP:

"Activities in waters of the United States associated with the restoration, enhancement, and establishment of tidal and non-tidal wetlands and riparian areas and the restoration and enhancement of non-tidal streams and other non-tidal open waters, provided those activities result in net increases in aquatic resource functions and services.

To the extent that a Corps permit is required, activities authorized by this NWP include, but are not limited to: the removal of accumulated sediments; the installation, removal, and maintenance of small water control structures, dikes, and berms; the installation of current deflectors; the enhancement, restoration, or establishment of riffle and pool stream structure; the placement of in-stream habitat structures; modifications of the stream bed and/or banks to restore or establish stream meanders; the backfilling of artificial channels and drainage ditches;

the removal of existing drainage structures; the construction of small nesting islands; the construction of open water areas; the construction of oyster habitat over unvegetated bottom in tidal waters; shellfish seeding; activities needed to reestablish vegetation, including plowing or discing for seed bed preparation and the planting of appropriate wetland species; mechanized land clearing to remove non-native invasive, exotic, or nuisance vegetation; and other related activities. Only native plant species should be planted at the site."

Pre-construction notification (PCN) to the USACE is required for the proposed project to be covered under NWP 27. The PCN consists of submitting a package that includes a letter clearly describing the project and relevant project information, a set of engineering drawings, a delineation of all waters of the United States in the proposed project area, a list of any threatened or endangered species or suitable habitat in the project area, and any potential historical sites that may be impacted by the proposed project.

The USACE has 30 days to determine if the PCN is complete. Once the PCN is determined complete, the USACE has 45 days to determine if the project is authorized under the appropriate NWP. The USACE will provide a written response stating that the project is authorized to proceed under the conditions of the appropriate NWP.

The current NWPs expire in March of 2012. In a recent meeting with the USACE, they indicated that draft versions of the new permits should be released soon. They do not expect them to change drastically. The new NWPs should be in place before submittals for the proposed project would be developed.

The Section 404 permitting process also requires that coordination take place with other agencies before the issuance of any permits. The agency coordination required for the proposed project will be with the United States Fish and Wildlife (USFW) and ODNR Wildlife concerning threatened and endangered species and with the Ohio Historic Preservation Office (OHPO) concerning historical and cultural resources.

9.1.1 USFW Coordination

Informal coordination with USFW was started during the feasibility study phase of the proposed project as indicated in Section 3.0 Ecology of this report. The literature review and habitat evaluation indicated that no federal species of concern are likely to be found in the project area. Based on this information, USFW may not require a mussel survey for this project.

Communication with the Reynoldsburg, OH office of USFW will be on-going through the preliminary and final design phases of the project to ensure that any concerns are addressed. This coordination effort will enable USFW to quickly respond favorably to the project when the USACE seeks their comments before the Section 404 authorization is given for the proposed project.

9.1.2 ODNR Coordination

Coordination is also required with ODNR Wildlife concerning state species of concern. Even though it is unlikely that federal species of concern are likely to be found in the project area, state species of concern may be present. ODNR is also concerned about the proposed project impacts to common species in the project area. It is likely that ODNR will require a mussel survey in the project area to determine the number of species and populations found in the project area. A plan for mussel relocation during construction will most likely be a condition of the section 404 permit authorization. The relocation plan may also include a post project monitoring plan to record the survivability of the relocated populations.

Close coordination with ODNR Wildlife to determine the need for the mussel survey, and then develop the survey protocol and relocation plan if required, will enable ODNR to quickly respond favorably when the USACE seeks their comments before the Section 404 authorization is given for the proposed project.

9.1.3 OHPO Coordination

The USACE must also seek comments from OHPO regarding potential impacts to the historical and cultural resources before issuing Section 404 authorization for the proposed project. The cultural resources studies conducted during the feasibility study phase of the project are contained in Section 2.0 Historic Preservation. These studies indicate the presence of historic resources that will require compliance with Section 106 of the National Historic Preservation Act (NHPA).

Close coordination with OHPO during the preliminary and final design phase of the proposed project to fulfill the requirements of Section 106 NHPA is imperative. The anticipated requirements of the Section 106 NHPA process for this proposed project are listed in Section 2.3 of this report.

9.2 SECTION 401 PERMITTING (OEPA)

Pursuant to the federal Clean Water Act, anyone who wishes to discharge dredged or fill material into the waters of the United States, regardless of whether on private or public property, must obtain a Section 404 permit from the USACE and a Section 401 Water Quality Certification (WQC) from the OEPA.

The current (2007) Section 404 NWPs have associated Section 401 certifications from OEPA, pursuant to specific conditions for the types of NWPs. If the proposed project is covered and authorized under the NWP 27, the associated 401 certification would be attached. However, since the new NWPs have not yet been published, there could be a delay in getting new section 401 certifications from OEPA once the current ones expire. The gap is only expected to be 6 months or less based on the previous process in 2007. Therefore, these issues should be resolved before permitting is required for the proposed project.

9.3 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

The National Environmental Policy Act (NEPA) is a United States environmental law that established a national policy promoting the enhancement of the environment. NEPA's most significant effect was to set up procedural requirements for all federal government agencies to prepare Environmental Assessments (EAs) and Environmental Impact Statements (EISs). EAs and EISs contain statements of the environmental effects of proposed federal agency actions. NEPA's procedural requirements apply to all federal agencies in the executive branch.

9.3.1 NEPA Process

If the proposed project receives any federal funding, the project will be subject to the requirements and procedures dictated by NEPA. The following is a synopsis of the NEPA process as outlined by Wikipedia.org.

The NEPA process consists of an evaluation of relevant environmental effects of a federal project or action undertaking, including a series of pertinent alternatives. The NEPA process begins when an agency develops a proposal to address a need to take an action. Once a determination of whether or not the proposed action is covered under NEPA there are three levels of analysis that a federal agency may undertake to comply with the law. These three levels include: preparation of a Categorical Exclusion (CE), preparation of an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI); or preparation and drafting of an Environmental Impact Statement (EIS).

<u>Preparation of a Categorical Exclusion:</u>

A CE is a category of actions that the agency has determined does not individually or cumulatively have a significant effect on the quality of the human environment (40 C.F.R. §1508.4). If a proposed action is included in the description provided for a listed CE established by the agency, the agency must check to make sure that no extraordinary circumstances exist that may cause the proposed action to have a significant effect in a particular situation. Extraordinary circumstances typically include such matters as effects to endangered species, protected cultural sites, and wetlands. If the proposed action is not included in the description provided in the CE established by the agency, or there are extraordinary circumstances, the agency must prepare an EA or an EIS, or develop a new proposal that may qualify for application of a CE.

<u>Preparation of an Environmental Assessment and Finding of No Significant Impact:</u>

The purpose of an EA is to determine the significance of the environmental effects and to look at alternative means to achieve the agency's objectives. The EA is intended to be a concise document that (1) briefly provides sufficient evidence and analysis for determining whether to prepare an EIS; (2) aids an agency's compliance with NEPA when no environmental impact statement is necessary; and (3) facilitates preparation of an Environmental Impact Statement when one is necessary(40 C.F.R. § 1508.9). If after investigation and drafting of the environmental assessment no substantial effects on the environment are found the agency may produce a Finding of No Significant Impact (FONSI).

Preparation of an Environmental Impact Statement:

The EIS is a more detailed evaluation of the environmental impacts when compared to the content of the environmental assessment. The crafting of EIS has many components including public, outside party and other federal agency input concerning the preparation of the EIS. These groups subsequently comment on the draft EIS.

In some circumstance an agency may wish to undertake the construction of an EIS without the initial drafting of the environmental assessment. This will take place under circumstances in which the agency believes that the action will undoubtedly have adverse effects on the environment or is considered an environmentally controversial issue.

CE (Categorical Exclusion)

A CE is based on an agency's experience with a particular kind of action and its environmental effects. The agency may have studied the action in previous EAs, found no significant impact on the environment based on the analyses, and validated the lack of significant impacts after the implementation. If this is the type of action that will be repeated over time, the agency may decide to amend their implementing regulations to include the action as a CE. In these cases, the draft agency procedures are published in the Federal Register, and a public comment period is required. Participation in these comment periods is an important way to be involved in the development of a particular CE. A CE for one agency cannot be used by a different agency unless that agency has followed this procedure.

EA (Environmental Assessment)

An EA is a screening document used to determine if an agency will need to prepare either an EIS or construct a FONSI. EAs are concise public documents that include: a brief discussion of the need for the proposal; of alternatives and a listing of agencies and person consulted.

Most agency procedures do not require public involvement prior to finalizing an EA document. Agencies advise that facilitating public comment be considered at the draft EA stage.

EAs need to be of sufficient length to ensure that the underlying decision about whether to prepare an EIS is legitimate, but should not attempt to be a substitute for an EIS.

FONSI (Finding Of No Significant Impact)

A FONSI presents the reasons why an action will not have a significant effect on the human environment. It must include the EA or summary of the EA that supports the FONSI determination.

EIS (Environmental Impact Statement)

If it is determined that a proposed federal action does not fall within a designated categorical exclusion or does not qualify for a FONSI, then the responsible agency or agencies must prepare an EIS.

The purpose of an EIS is to ultimately help public officials make informed decisions that are a reflection of an understanding of environmental consequences and the alternatives available.

An EIS is required to describe:

• The environmental impacts of the proposed action;
• Any adverse environmental impacts that cannot be avoided should the proposal be implemented;
• The reasonable alternatives to the proposed action;
• The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and
• Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

9.4 FLOODPLAIN PERMITTING (CITY OF COLUMBUS)

Chapter 1150 of the Columbus, Ohio Code of Ordinances addresses Floodplain Management. Because the proposed project will include work in the regulatory floodway of the Scioto River, prior to the beginning of construction, the City of Columbus' Floodplain Administrator must issue a Special Flood Hazard Area Development and Use Permit for the project. At the time of the writing of this report, the City's Floodplain Administrator is Ms. Renee Van Sickle, PE, CFM.

Section 1150.19 of the City's Code of Ordinances states that the following activities may be permitted in the floodway, provided compliance with all standards of City Codes:

- Conservation projects;
- Recreational trails;
- Bridges when constructed above the flood protection elevation, or as approved by FEMA;
- Storm water outfalls; and
- Temporary construction activities in support of other permitted activities.

In order to receive a floodplain permit, a Hydraulics Report, including a HEC-RAS model comparing pre-project to post-project conditions, must be submitted. This HEC-RAS model must show that "no-rise" in base flood elevations occurs due to the proposed project.

The City of Columbus also has a compensatory storage requirement governing work within a regulatory floodplain. This requirement states that for a certain volume of material placed in a floodplain, an equal or greater volume of material must be removed from the same floodplain, on the same project site. Due to the large amount of material that will be imported as part of the proposed project, it will not be possible to meet this requirement.

Through work completed on the 5th Avenue Dam Removal and Olentangy River Restoration project, the City of Columbus has indicated that either a variance will be granted for dam removal/river restoration projects, or a calculation quantifying the volume of storage behind the dam can be used to meet the compensatory storage requirement, as long as the amount of fill does not exceed the volume of the impoundment. As of the writing of this report, a decision has not been made by the City. Once the decision has been made, the precedence established as part of the 5th Avenue Dam Removal project will apply to the Main Street Dam Removal project.

9.5 LETTER OF MAP REVISION (FEMA)

A Conditional Letter of Map Revision (CLOMR) will not be required for this project, as long as the Hydraulics Report shows "no-rise" in base flood elevations occurs due to the proposed project.

A Letter of Map Revision (LOMR) is based on as-built conditions and will be required to be submitted to FEMA within 6 months of the completion of construction. A LOMR will officially revise the Flood Insurance Rate Map(s) (FIRMs) showing

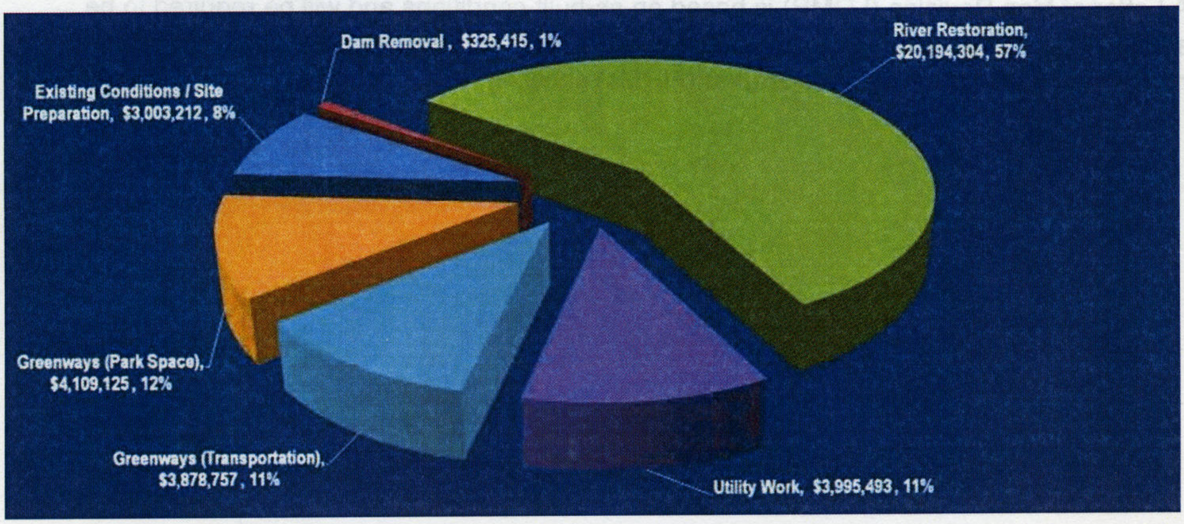
10.0 Estimate of Probable Costs

A preliminary estimate of probable costs was completed for the proposed project. This estimate of probable costs represents the design professional's opinion of the most likely costs for the project. This opinion of probable costs was compiled by a design professional familiar with the construction industry. It should be recognized, however, that the design professional has no control over the cost of labor, materials, or equipment. The design professional also has no control over the contractor's methods of determining bid prices, or over competitive market conditions. This estimate of probable costs represents the design professional's best judgment, however, the design professional cannot, and does not, guarantee that future bids will not vary from this, or future, estimates of probable costs.

10.1 SUMMARY

Figure 10-1 shows a summary of the Preliminary Estimate of Probable Costs for Phase I of the Main Street Dam Removal/Scioto Greenways Project, totaling $35,506,305:

Figure 10-1. Preliminary Estimate of Probable Cost – Phase I



10.2 DETAILED BREAKDOWN

Detailed Estimates of Probable Costs used to create the Phase I costs shown in Figure 10-1, as well as costs for the master plan, were created by Stantec, MSI, and CDDC. These detailed estimates include labor and materials, a percent escalation to 2014 (the proposed start of construction), all general requirements and soft costs, as well as a cost contingency. These detailed Estimates of Probable Costs are included in Appendix J.

11.0 Work Plan

The major tasks moving forward to implement the proposed project are:

- Develop a funding strategy and secure funding;
- Produce preliminary and final design plans and documents;
- Obtain required permits;
- Acquire access easements, rights-of-way, and covenants as needed;
- Construct the project; and
- Monitor the success of the river restoration.

These major tasks are made up of many various efforts and requirements. Defining the specific scope items for each of these will be an on-going effort. Throughout the previous sections of the Feasibility Study Report, several issues are identified that need to be addressed in the preliminary and final design phases of the proposed project.

11.1 PROPOSED PROJECT TIMELINE

A proposed timeline for the project has been developed in conjunction with CDDC and continues to be refined.

Appendix A

Stantec

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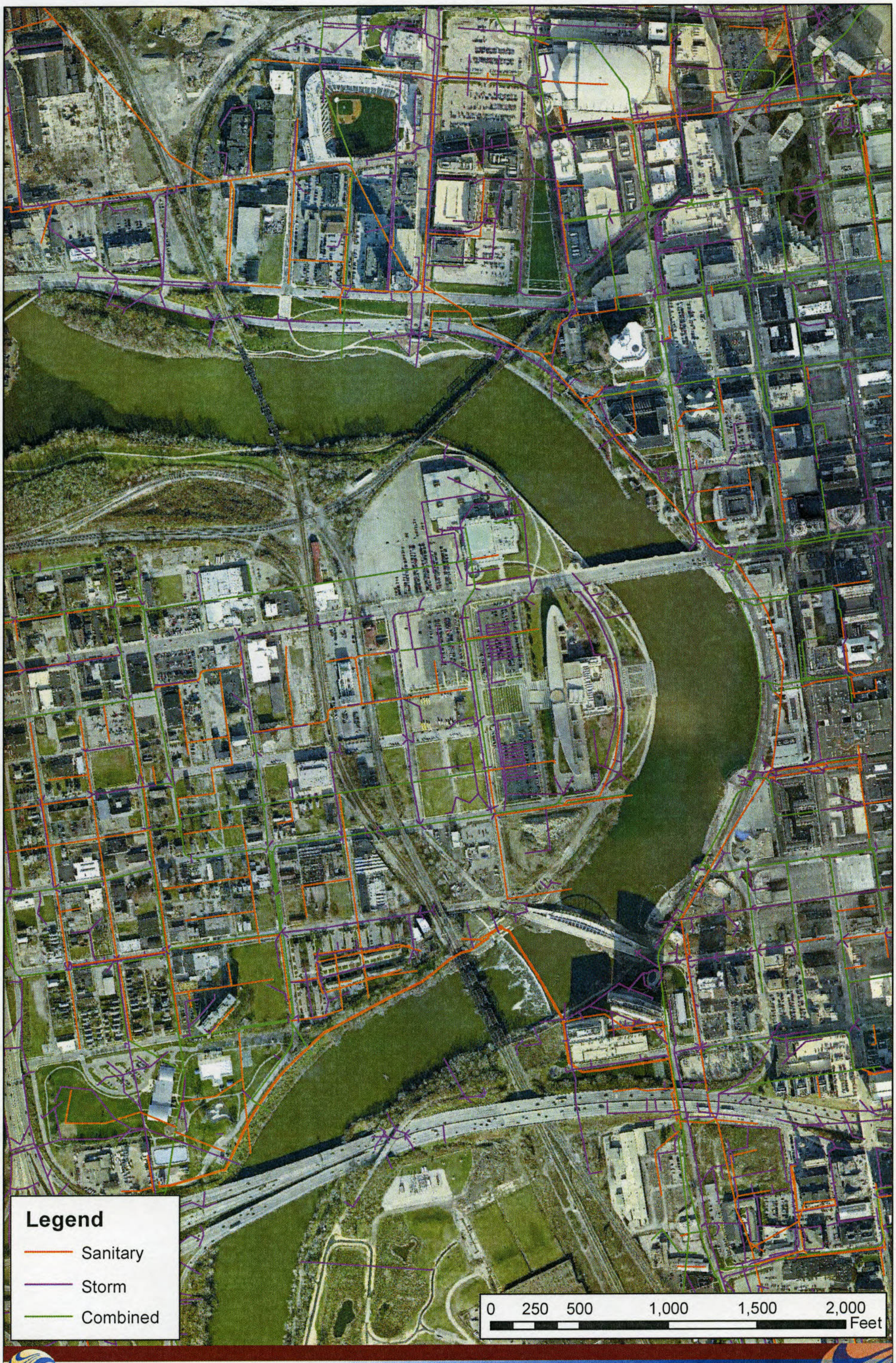
Exhibit A-1
Limits of Disturbance

Stantec

N

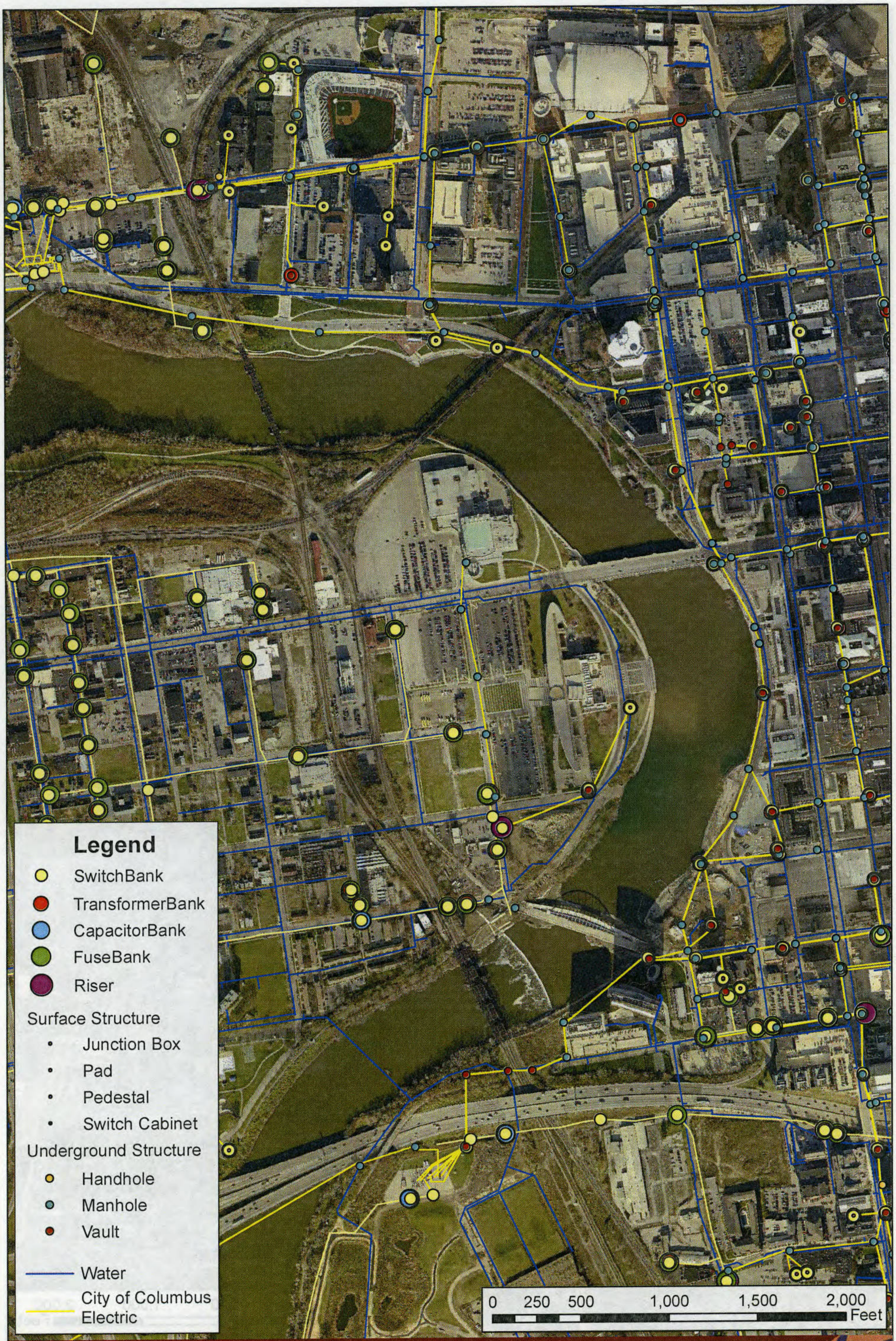
Exhibit A-2
Property Ownership

Appendix B



Stantec N

Exhibit B-1
Sanitary & Storm Sewers



Stantec

N

Exhibit B-2
Electric & Water

Note: Private electric facilities are not shown on this map, but do exist in the project area.

Stantec N

Exhibit B-3
CSOs

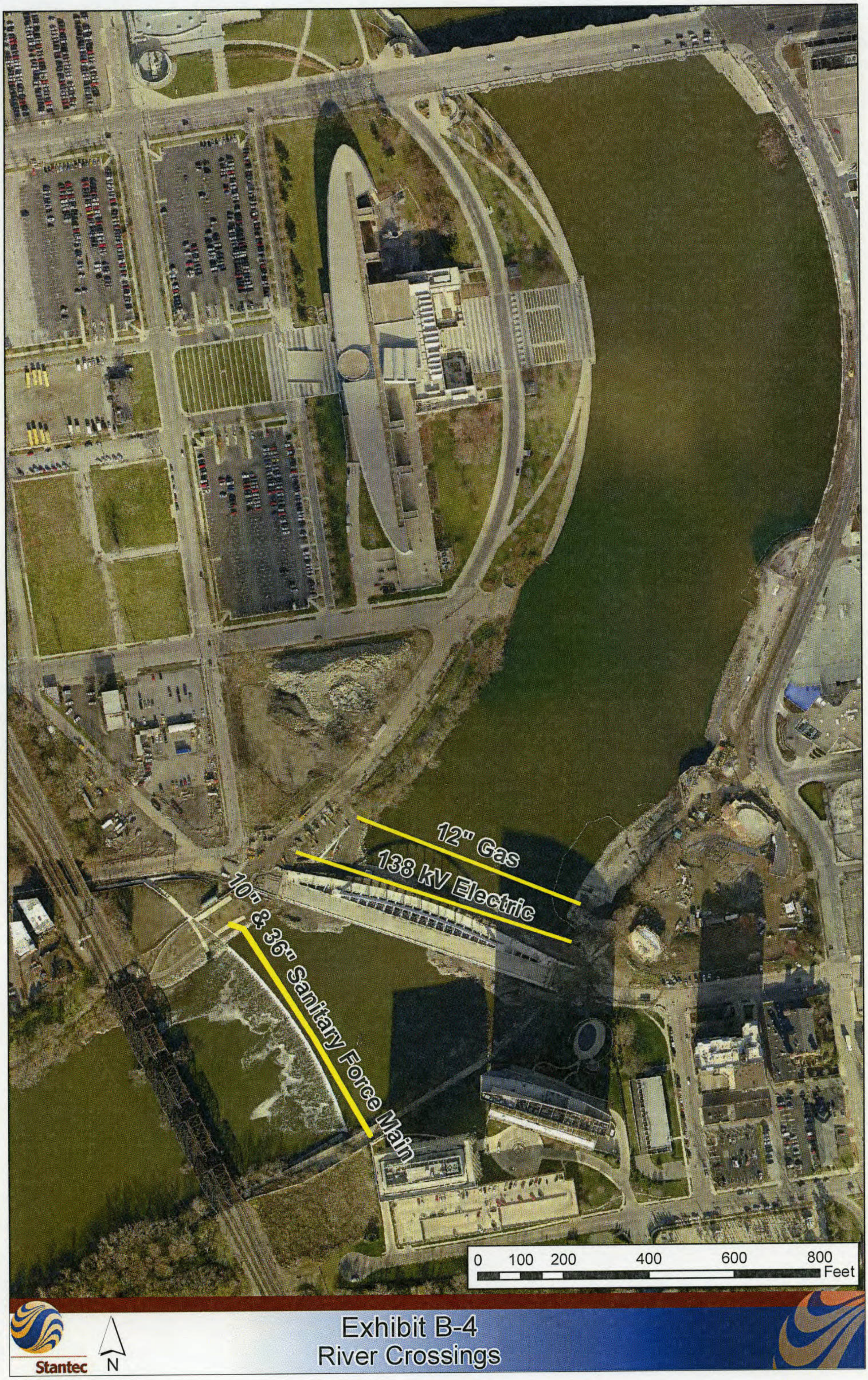


Exhibit B-4
River Crossings

Appendix C

Cultural Resource Literature Review for the Main Street Dam and Redevelopment of the Scioto Riverfront Feasibility Study in the City of Columbus, Franklin County, Ohio

By

Alan Tonetti

ASC GROUP, INC.

ARCHAEOLOGY ARCHITECTURE ENVIRONMENT

CULTURAL AND ENVIRONMENTAL CONSULTANTS

Cultural Resource Literature Review for the Main Street Dam and Redevelopment of the Scioto Riverfront Feasibility Study in the City of Columbus, Franklin County, Ohio

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September 22, 2011

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LITERATURE REVIEW

The following sources available from the Ohio Historic Preservation Office (OHPO) were consulted during the literature review on July 26 and 27, 2011:

- Online Mapping System
- Lists of formal, preliminary, and consensus National Register of Historic Places (NRHP) determinations of eligibility
- Pending and inactive NRHP nomination forms
- NRHP questionnaires
- Troutman's (2003) *Ohio Cemeteries: 1803–2003*
- Ohio Historic Inventory (OHI) forms
- Ohio Historic Bridge Inventory and Ohio Department of Transportation (ODOT) Bridge Inventory forms
- Contract architectural history reports
- Historic American Engineering Record files
- USGS 7.5′ topographic maps associated with the Ohio Archaeological Inventory (OAI)
- OAI forms
- Contract archaeology reports, and
- Mills' (1914) *Archeological Atlas of Ohio*.

Also consulted was the ODOT's Buckeye Assets (2011).

The literature review identified a number of extant cultural resources in the study area. The lone archaeological site recorded in the study area is 33FR564 (Figure 1; Table 1). Skinner and Nass (1985) concluded that the prehistoric component of the site was a secondary deposit above historic fill, the latter of which extended at least five meters below the surface. The fill composing the historic period component contained twentieth-century kitchen and architectural debris dumped at the site, possibly from another location. The site was recommended ineligible for the NRHP. The Skinner and Nass (1985) archaeological investigation was conducted prior to the proposed development of a hotel and restaurant at what is now Confluence Park.

Two other areas have been surveyed for archaeological resources in the study area: North Bank Park (Brown 2003) and the West Columbus Floodwall (Walsh and Miller 1992). Neither identified archaeological sites in the study area. Mills (1914) does not show any archaeological sites in or adjacent to the study area.

The foremost architectural historical resource in the study area is the Columbus Civic Center Historic District (Figure 1; Table 2). The district was determined eligible for listing in the NRHP on September 14, 1988. It is eligible under Criterion A for its association with community planning, engineering, politics/government, and transportation in the city of Columbus, and Criterion C for its Art Deco, Neoclassical, and Renaissance Revival architecture. The District has two components: riverfront improvements, including a retaining wall (between 40 feet north of Broad Street and 40 feet and south of Town Street) and three contributing bridges (Broad, Town, and Main streets, all now demolished and replaced), and seven government buildings, five of which are contributing resources (Central High School [individually listed in the NRHP], State Office Building [individually listed in the NRHP], City Hall, Central Police Station, and the Federal Court House and Post Office), and two of which are non-contributing resources (the buildings immediately north and south of the State Office Building).

The majority of the riverfront improvements were built between 1917 and 1921. All were designed in the Renaissance Revival style and erected after the width of the Scioto River had been doubled or tripled as a result of flood protection improvements, including construction of the Main Street Dam in 1918, in response to the devastating flood of 1913. The government buildings were built after the riverfront improvements. They were built in the Neoclassical and Art Deco styles.

The approximate boundaries of the District are from Main Street north along Washington Boulevard to Town Street, west on Town Street to Belle Street, north on Belle Street to Broad Street, east on Broad Street to the western bank of the Scioto River, north along the Scioto River bank to a point opposite West Long Street, east across the Scioto River to West Long Street, east along West Long Street to Marconi Boulevard, south on Marconi Boulevard to a point opposite the first alley south of West Long Street, east along the alley to Ludlow Alley, south along Ludlow Alley to West Gay Street, east along West Gay Street to North Front Street, south along North Front Street to Broad Street, west along Broad Street to Civic Center Drive, and south along Civic Center Drive to Main Street.

The city of Columbus, an OHPO and National Park Service Certified Local Government, includes the Scioto River Bridge Group in the Columbus Register of Historic Properties, so listed in 1983.

Other extant architectural historical resources in or near the study area are the Jaeger Machine Company Office Building (listed in the NRHP), four railroad bridges, FRA-240-16 (Franklin County Veterans Memorial), Franklinton Marble Works, and Sunshine (Dodge) Park (Figure 1; Table 2). ODOT (2011) records six bridges in the study area (Figure 1; Table 2). Four are recorded as "not historic," one was recorded as "not determined" and the sixth was recorded as "none/not applicable." Five architectural historical surveys have been undertaken in the study area: Broad Street/Old National Road (Miller et al. 1998, downtown Columbus (Recchie and Darbee 1989, 1990), and east Franklinton (Burant 1994; Potterfield 1989). Before their demolition, the Broad, Town, and Main Street bridges were documented in the Historic American Engineering Record (Engle 2002; Hampton et al. 2008; Sherman 1989) [Figure 2]. According to Troutman (2003), no cemeteries are in or adjacent to the study area.

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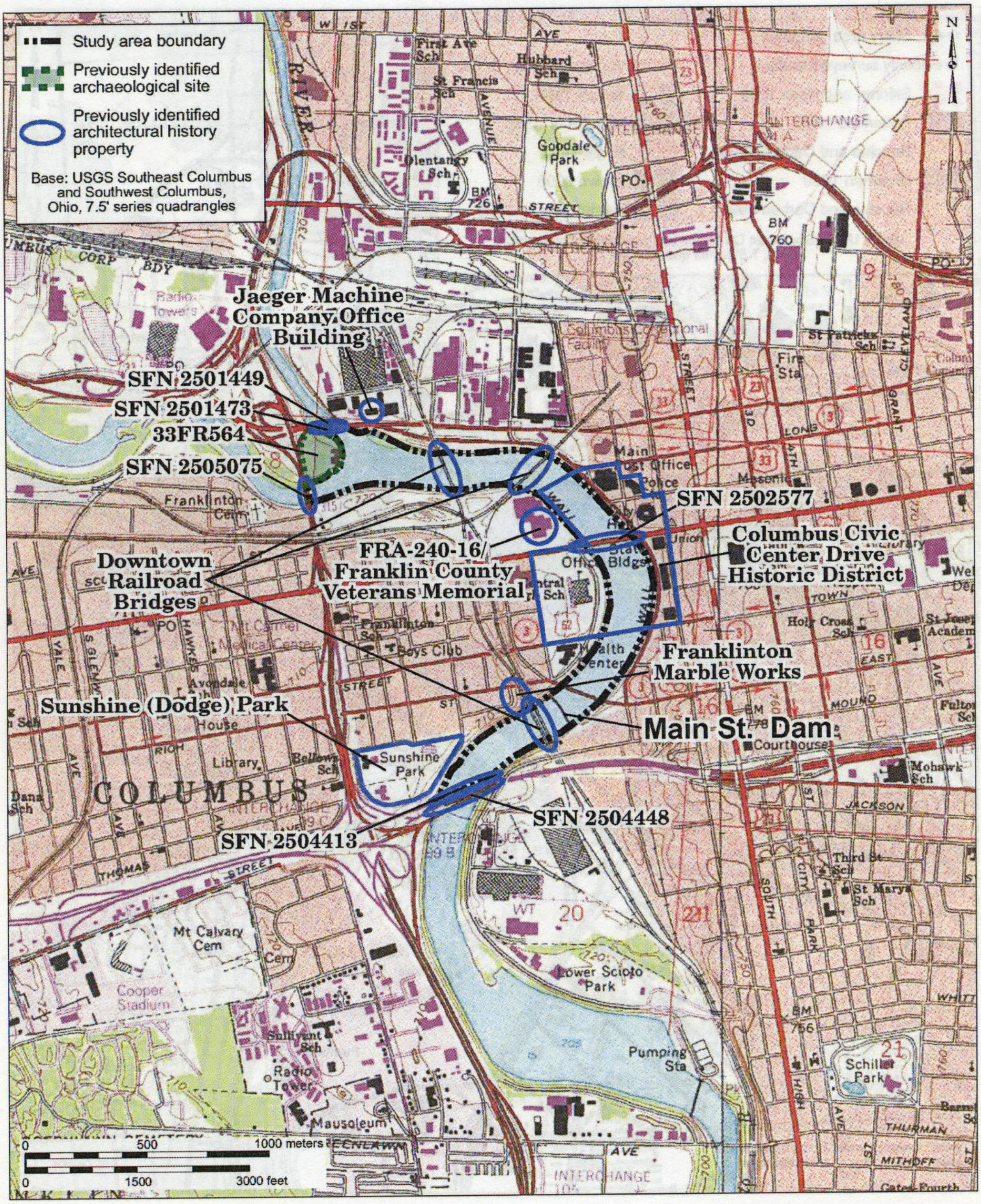

Figure 1. Previously identified cultural resources in or near the study area.

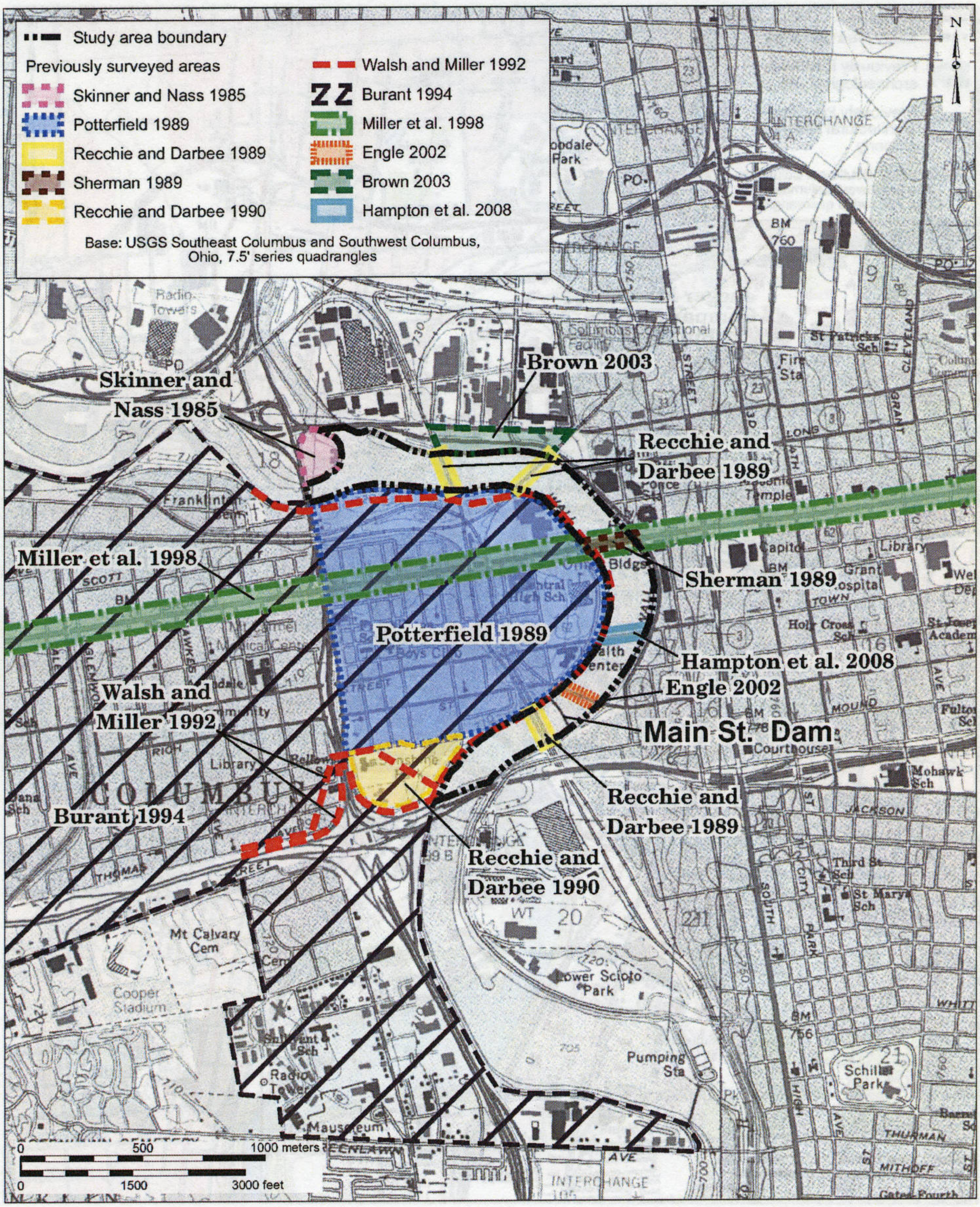

Figure 2. Previously surveyed areas in or near the study area.

Table 1. Previously Identified Archaeological Sites in the Vicinity of the Main Street Dam Removal and Scioto Riverfront Development Project, Columbus, Franklin County, Ohio.

7.5′ Quadrangle and Date	OAI No.	OAI Recorder or Agency and Date	Cultural Affiliation and Site Type	Landform	Distance to Water (m)	Site Size (m^2)	National Register Criteria Status
Southwest Columbus 1965, photorevised 1995	33FR564	Ohio Historical Society 1985	Unassigned prehistoric/ unknown, and 20th Century/ dump	Terrace	Adjacent to Scioto River	Approximately 6 acres (9,662 square meters)	Not eligible

Table 2. Extant Previously Identified Architectural History Properties in the Vicinity of the Main Street Dam Removal and Scioto Riverfront Development Project, Columbus, Franklin County, Ohio.

7.5′ Quadrangle and Date	OHI/Structure No./Name	OHI Recorder or Agency and Date	Address/Location of Building/Structure	Date(s) of Construction	Style and Type of Building/Structure	National Register Criteria Status
Southwest Columbus 1965, photorevised 1995	Columbus Civic Center Drive Historic District	Not Applicable	Roughly bounded by Main St., Belle St., Broad St., western bank of the Scioto River, Long St., Front St., Town St., and Civic Center Drive	ca. 1917–1937	Two components: 1) Riverfront improvements, including retaining walls and three (now demolished) bridges, and 2) seven (five contributing, two non-contributing) government buildings	Determined eligible in 1988
Southwest Columbus 1965, photorevised 1995	Jaeger Machine Company Office Building	Not Applicable	550 West Spring St.	1936	Art Deco industrial building	Listed 1983
Southwest Columbus 1965, photorevised 1995	Downtown Railroad Bridges	Not Applicable	Scioto River north and south of Franklinton	Early Twentieth Century	Four steel thru truss bridges	Unknown
Southwest Columbus 1965, photorevised 1995	Franklinton Marble Works	Not Applicable	373 and 375 West Rich St.	ca. 1910	Two vernacular industrial buildings	Unknown
Southwest Columbus 1965, photorevised 1995	Sunshine (Dodge) Park	Not Applicable	667 Sullivant Ave.	1936 (2006)	Recreation facility	Unknown

Table 2. Extant Previously Identified Architectural History Properties in the Vicinity of the Main Street Dam Removal and Scioto Riverfront Development Project, Columbus, Franklin County, Ohio.

7.5′ Quadrangle and Date	OHI/Structure No./Name	OHI Recorder or Agency and Date	Address/Location of Building/Structure	Date(s) of Construction	Style and Type of Building/Structure	National Register Criteria Status
Southwest Columbus 1965, photorevised 1995	FRA-240-16/Franklin County Veterans Memorial	Franklinton Area Commission 1994	250–300 West Broad St.	1955 (ca.1995)	Modern Movement entertainment/recreation building	Unknown
Southwest Columbus 1965, photorevised 1995	SFN 2501473	Not Applicable	FRA 33 1553 R over the Olentangy River	1954 (1999)	Steel beam continuous bridge	Not historic (Buckeye Assets July 28, 2011)
Southwest Columbus 1965, photorevised 1995	SFN 2501449	Not Applicable	FRA 33 1553 L over the Olentangy River	1954 (1999)	Steel beam continuous bridge	Not historic (Buckeye Assets July 28, 2011)
Southwest Columbus 1965, photorevised 1995	SFN 2505075	Not Applicable	FRA 315 114 over the Scioto River and Rickenbacker Drive	2001	Prestressed concrete box beam continuous bridge	None/not applicable (Buckeye Assets June 1, 2011)
Southwest Columbus 1965, photorevised 1995	SFN 2502577	Not Applicable	FRA 40 1227 R over the Scioto River	1992	Concrete other bridge	Not determined (Buckeye Assets July 19, 2011)
Southwest Columbus 1965, photorevised 1995	SFN 2504413	Not Applicable	FRA 70 1322 L over the Scioto River	1975	Steel beam continuous bridge	Not historic (Buckeye Assets June 1, 2011)
Southwest Columbus 1965, photorevised 1995	SFN 2504448	Not Applicable	FRA 70 1322 R over the Scioto River	1958 (1975)	Steel beam continuous bridge	Not historic (Buckeye Assets June 1, 2011)