HONEY CREEK AQUATIC ECOSYSTEM RESTORATION - SECTION 206 WRDA 1996

Draft Integrated Feasibility Report & Environmental Assessment

USACE, Chicago and Detroit Districts

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EXECUTIVE SUMMARY

This Integrated Feasibility Report and Environmental Assessment presents the results of an ecosystem restoration feasibility study for Honey Creek located in Wauwatosa, Wisconsin, Milwaukee County. This Report presents the assessment of ecological conditions and potential alternative plans to restore important riverine habitat for transient and migratory fishes, birds and wildlife within a modified, yet restorable riverine environment. This report gathered historic and current site conditions, and forecasts 'Future Without' and 'Future With' project conditions for specific reaches within Honey Creek, while considering watershed attributes. This report also provides a Recommended Plan for restoring habitat within the study area.

The Milwaukee Metropolitan Sewerage District (MMSD) has initiated and undergone several projects to restore rivers and streams within the Milwaukee metropolitan area that were channelized and lined with concrete in the 1960's as part of a flood reduction project. The MMSD has developed a strong commitment to improving the quality and function of habitat. Habitat restoration for the purpose of addressing past stream modification, invasive species issues, and providing important habitat for various fish and wildlife species within Honey Creek is congruent with the restoration commitment of MMSD. The MMSD has in turn requested that the U.S. Army Corps of Engineers (USACE) initiate a study under the Section 206 Water Resources Development Act (WRDA) 1996, Public Law 104-305, Aquatic Ecosystem Restoration authority to ascertain the feasibility of restoring important riverine habitat within Honey Creek and, to a larger degree, within the Menomonee River Watershed. The need for the proposed project is due to human induced disturbances to the remaining natural processes within the Honey Creek watershed, including fire suppression, altered hydraulics through lining of the stream channel with concrete, increased colonization of invasive species, urbanization pressures and fragmentation.

The Honey Creek study area extends from the outlet of Honey Creek to the Menomonee River, upstream to the utility crossing near the Wisconsin Lutheran High School (approximately 1,600 feet downstream of the culverts north of Interstate 94 at 84th Street and O'Connor Avenue). Much of this reach, approximately 6,700 linear feet, consists of a concrete channel that was installed as part of a flood reduction project built by the MMSD and Milwaukee County in the 1960's. The remainder of the study area, approximately 2,600 linear feet, consists of natural substrates that provides some habitat value, but is experiencing bank erosion.

Based on site qualitative and quantitative investigations, the main aquatic resource problems within Honey Creek, in which the 206 Authority may take opportunity to address, are as follows:

1. Loss of Fluvial-geomorphic Processes (Riverine Habitat)
    a. Loss of cut & fill alluviation (actively meandering and migrating)
    b. Abnormal sediment inputs, transport and substrate sorting
    c. Instability of banks, streambank armoring and lack of native vegetation
    d. Loss of habitat features (e.g. riffles, pools)
    e. Flow velocities homogenized (hydraulics)
    f. Presence of foreign debris and loss of natural organic debris (e.g., large wood)
2. Degradation of Hydrologic Regime
    a. 90% impervious surface across watershed
    b. Natural hydrologic inputs altered
    c. Flashy urban hydrography with extremely high flood flows
    d. Loss of hydro periods
    e. Fragmentation of channel by culverts, abutments and channelization
    f. Loss of hyporheic zone connectivity
3. Loss of Riparian Zone
    a. Reduced extent of riparian buffers
    b. Habitat fragmentation

c. Loss of riparian inputs (large woody debris, leaf litter, insects/other food)

4. Loss of Species Richness (riverine and riparian native species)
    a. Extirpation through physical removal; development/agriculture
    b. Loss in remnant areas via invasive species and other degradation
    c. Fragmentation of stream channels and riparian zones

To address the listed problems above, six (6) measures, including the 'No Action' measure, were developed and input into the IWR-Planning Suite in terms of costs and benefits (stream and riparian plant community habitat outputs). Based on these inputs and criteria, the IWR Planning software generated 20 alternative combinations for ecosystem restoration. A cost effectiveness analysis was used to ensure that certain options would be screened out if they produced the same amount or less output at a greater cost than other options with a lesser cost. Of the 20 alternative combinations, nine (9) cost effective combinations were identified, with a subset of five (5) plans being identified as "Best Buys". The 'No Action' plan is always deemed cost effective and a "best buy". Eleven (11) alternative combinations were screened out as non-cost effective.

Alternative 8 was selected from the five (5) "Best Buy" plans as the National Ecosystem Restoration (NER) plan (synonymous with the Preferred Plan and Tentatively Selected Plan). Rationale for selecting the Tentatively Selected Plan is presented in *Section 4.6, Plan Comparison & Tentatively Selected Plan (TSP) Recommendation*. Alternative Plan 8 consists of the following measures presented in *Section 4.1, Habitat Measures*:

The implementation of these features is generally described as follows and according to the measure's descriptions in *Section 4.1, Habitat Measures*. More detail would be added to the plan should this project commence to the design and implementation phase, for example, specifying spatial distribution of native plugs within a given zone and species clumping, plantings centers, soil amendment percentages, temporary predator controls, and establishment activities. General construction activities and sequencing would include:

(1) Site Preparation – The first task would be to install safety fencing, signage and other temporary safety features (barricades, temporary path reroutes, timing of construction activities, appropriate field apparel for access to the site, etc.) in order to keep the public out of the site during heavy construction. Staging areas and access and construction haul roads would be created and demarcated as well. Instructive signage for workers would be set up as well to signify off limit work areas and site restrictions.

(2) Concrete Channel Removal – Recent and past fish surveys show that there are usually minimal fish present within the reaches of Honey Creek that have a concrete lined channel. The V-shaped smooth concrete channel therefore would be broken and removed in order to restore natural riverine substrates and morphology. A temporary coffer-dam system or pipe by-pass system would be used to pass half the channel flows through the 390-foot restoration zone in order to work in the dry; any system implemented would impact less than .25-ac, be quickly removable prior to imminent flooding and would not increase any stage of flows. Removed concrete would be transported offsite to the proposed disposal and storage facility that is being purchased by the MMSD.

(3) Geomorphic Contouring – Once targeted woody and invasive species are removed, Honey Creek's banks would be graded to provide a suitable hydrogeomorphology for establishing native riparian, native marsh, and native meadow plant species. These areas will be contoured, and all excess soils will be incorporated into the landscape design; all materials will be managed on site and not removed. Grading activities would be limited to areas along the bank. Graded areas will be planted with native seeds, plugs, or shrubs and immediately stabilized to prevent erosion. Haul roads would be created within the graded areas to maintain the movement and hauling of materials during construction to defined paths in order to prevent new plantings and habitat from becoming damaged and for construction site safety. Large boulders, dolomitic limestone slabs, and woody debris would be transported via the haul roads and placed at various locations along the

Honey Creek channel where erosion points exist, or the opportunity for providing sustainable habitat structure is available. The stone and large woody debris material would not attenuate flood-flows. Soil amendments identified above would be placed along the Honey Creek channel in contoured areas where emergent aquatic plants can be established for the persistent marsh habitat. These would be placed by small machines or by hand from the bank to achieve the appropriate hydrogeomorphic setting and to provide a kick-start growth medium for native aquatic plants.

(4) Honey Creek Channel Restoration – After the concrete channel is removed, riverine morphologic features of riffles and j-hooks would be installed. These riffles and j-hooks would be created from large boulders and cobbles that are locked into the channel bed and banks. Remaining channel areas outside these riffles and j-hooks would be lined with natural riverine substrates of sand, gravel, and cobbles as well; these will be placed based on predicted channel velocities for the bank-full width condition and adaptive management during construction.

(5) Invasive Species Eradication – All invasive plant species would be physically, and if need be, chemically eradicated from the planting zones. A "No Invasive Tree Clearing" window between 01 March and 01 October would be established in conjunction with the Region 3 U.S. Fish and Wildlife Service and the local birding community. All woody species removed and not selected for Large Woody Debris habitat would be chipped and utilized for project features or appropriately recycled. Based on lessons learned from other restoration projects, the addition of these wood chips greatly aids in starting a plant community where soils lack or have no organic material, aiding as well in soil water retention for early plant establishment phases. Those species having allelopathic chemicals or the potential to provide an invasive species seed source would be destroyed on site via fire or appropriately disposed; such species include European buckthorn, Norway maple, etc. Herbicide application would also be employed; all required permits for licensed herbicide application practices near water ways would be applied for and adhered to.

(6) Native Plant Community Establishment – Next would be to establish native plant communities of persistent marsh, transitional meadow, and riparian woodland over the remaining 4 years of the construction period. Planting lists are presented as Future With-Project Planting Lists located in *Appendix H – Monitoring Plan and Habitat Analysis*. Zones would be seeded and planted with seed and live plugs. Live plug areas will require predatory control, primarily stringing and caging to prevent beaver, Canada goose and common carp predation. Again, the duration of the construction contract would primarily be for spot herbicide application and additional planting; most activities would be similar to public landscaping activities. The haul roads created for moving large materials would then be utilized to maintain and establish native plant communities along the project area, as well as provide access trails for the community.

(7) Best Management Practices (BMPs) – Soil erosion and sediment control measures would be incorporated into the design documents and will comply with local and federal environmental requirements. A 5-year period of BMPs and erosion prevention would be implemented by the contractor. The minimum measures required at the project site may include:

- Hydroseeding, seeding, and mulching to stabilize disturbed areas
- Installation of silt fences around graded slopes and stockpile areas
- Protection of the waterway where grading occurs with silt fencing to prevent sediments from traveling into the waterway
- Stabilizing construction entrances to limit soil disturbance at the ingress/egress from the site
- Installing erosion blanket over unprotected finished grades that are to be unplanted for at least two weeks

(8) Incidental Recreational Features – As mentioned under Native Plant Community Establishment, haul roads would be needed for moving large materials and would then be needed to maintain and establish native plant communities along the project area. Once construction and the establishment period are completed,

these haul roads/maintenances roads would be dressed with site-clearing wood chips and left in place (for the most part) to provide the community with incidental recreation trails as well as access to the restored Honey Creek. The incidental recreation trails would also keep recreation users from making footpaths that could destroy the native plant communities that are being restored. The location of the haul roads/maintenance roads/incidental recreation trails would be developed in coordination with the non-federal sponsor.

(9) Operations & Maintenance – Once the construction contract is complete, the non-Federal sponsor will maintain the project and associated habitat benefits. These activities would primarily include invasive plant species control, additional native plantings, woody debris management, minor additions of river cobbles, and public access control. The haul roads created for construction and establishment would be turned into wood chipped maintenance trails/ incidental recreation trails for public use and access to Honey Creek.

The estimated Total Project First Cost FY21 of the Tentatively Selected Plan is $[redacted] for Design and Implementation, and the estimated annual operations, maintenance, repair, replacement and rehabilitation (OMRR&R) cost is $[redacted]. The Federal portion of the estimated total project cost is $[redacted] for Design & Implementation. The non-Federal share of the estimated first cost of the project is about $[redacted] and will be covered by lands, easements, rights-of-way, utility of public facility relocations, and dredged or excavated material disposal areas (LERRDs) of [redacted] and a cash contribution of $[redacted].

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch.

Draft Finding of No Significant Impact

Honey Creek Aquatic Ecosystem Restoration Study,
Wauwatosa, Milwaukee County, Wisconsin
Section 206 WRDA 1996
Draft Integrated Feasibility Report and Environmental Assessment

May 2021

The U.S. Army Corps of Engineers Chicago and Detroit Districts (Corps), have conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969, as amended. The Final Integrated Feasibility Report and Environmental Assessment (IFR/EA) dated _____, 2021, for the Honey Creek Aquatic Restoration Study addresses man-made alterations of a portion of Honey Creek that have led to the degradation of the aquatic ecosystem, which allows for opportunities and feasibility in the City of Wauwatosa, Milwaukee County, Wisconsin.

The Draft IFR/EA, incorporated herein by reference, evaluated various alternatives that would restore a sustainable and connected riverine and riparian habitat in the study area. The tentatively selected plan is the National Ecosystem Restoration Plan and includes:

- Removing approximately 6,700 linear feet of concrete from Honey Creek
- Stream channel contouring to incorporate a diversity of aquatic habitats including persistent marsh and transitional meadow
- Restoring the Honey Creek stream channel with natural riverine substrates of sand, gravel, and cobble
- Restore instream habitat diversity and hydraulics with addition of woody debris, riffles, and j-hooks
- Removing invasive and non-native trees, shrubs, grasses, and forbs
- Placing soil amendments of organic compost, sand, silt, or woodchips for native riparian woodland plantings

In addition to the "No Action" plan, 20 alternatives were evaluated. The alternatives included varying levels of ecosystem outputs. The Final Array of Alternatives evaluated were deemed "Best Buy" alternatives using IWR Planning Suite Software. The Final Array of Alternatives included the (1) No Action Plan; (2) restoration of riparian woodland only (39.1 acres); (3) restoration of riparian woodland only (46.0 acres); (4) restoration of riparian woodland (46.0 acres), transitional meadow/persistent marsh (2.2 acres), and stream channel using mixture of sand, gravel, and cobble substrates; and (5) restoration of riparian woodland (46.0 acres), transitional meadow/persistent marsh (2.2 acres), and stream channel using mixture of cobbles and crushed aggregate. The Final Array of Alternatives, along with the evaluation of the alternatives, is presented in Chapter 4, Plan Formulation and Evaluation.

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the tentatively selected plan are listed in Table 1:

Table 1: Summary of Potential Effects of the Tentatively Selected Plan

	Insignificant effects	Insignificant effects as a result of mitigation	Resource unaffected by action
Geology and Soils	☒	☐	☐
Hydrology	☒	☐	☐
Hydraulics	☒	☐	☐
Water Quality	☒	☐	☐
Hazardous, toxic, and radioactive waste	☒	☐	☐
Air Quality	☒	☐	☐
Plant Communities	☒	☐	☐
Macroinvertebrates	☒	☐	☐
Fishes	☒	☐	☐
Reptiles and Amphibians	☒	☐	☐
Birds	☒	☐	☐
Mammals	☒	☐	☐
Threatened and Endangered Species	☒	☐	☐
Archaeological and Historical Properties	☐	☒	☐
Social Properties	☐	☐	☒
Recreational Activities	☒	☐	☐
Environmental Justice	☐	☐	☒

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the tentatively selected plan. Best management practices (BMPs) as detailed in the IFR/EA will be implemented, if appropriate, to minimize impacts.

No compensatory mitigation is required as part of the tentatively selected plan.

Public review of the draft IFR/EA and FONSI was completed on _____, 2021. All comments submitted during the public review period were responded to in the Final IFR/EA and FONSI.

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, the U.S. Army Corps of Engineers determined that the tentatively selected plan may affect but is not likely to adversely affect the following listed species or their designated critical habitat: northern long-eared bat and rusty patched bumble bee. The U.S. Fish and Wildlife Service concurred with the Corps' determination on July 20, 2020.

Pursuant to section 106 of the National Historic Preservation Act of 1966, as amended, the U.S. Army Corps of Engineers determined that historic properties would not be adversely affected by the tentatively selected plan as long as stipulated conditions in the Section 106 Determination of Effect (Appendix I of the IFR/EA) are met to avoid potential adverse effects to the historic WPA/CCC limestone wall features in the project area. The Wisconsin State Historic Preservation Office concurred with the determination on January 6, 2021.

Pursuant to the Clean Water Act of 1972, as amended, the discharge of fill material associated with the tentatively selected plan has been found to be compliance with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Appendix A of the IFR/EA.

A water quality certification pursuant to section 401 of the Clean Water Act will be obtained from the Wisconsin Department of Natural Resources prior to construction. In a letter dated _____, 2021, the

Wisconsin Department of Natural Resources stated that the tentatively selected plan appears to meet the requirements of the water quality certification, pending confirmation based on information to be developed during the pre-construction engineering and design phase. All conditions of the water quality certification will be implemented in order to minimize adverse impacts to water quality.

A determination of consistency with the Wisconsin Coastal Management program pursuant to the Coastal Zone Management Act of 1972 will be obtained from the Wisconsin Coastal Management program prior to construction. In a letter dated June 26, 2019, the Wisconsin Coastal Management program stated that the tentatively selected plan appears to be consistent with state Coastal Zone Management plans, pending confirmation based on information to be developed during the pre-construction engineering and design phase. All conditions of the consistency determination shall be implemented in order to minimize adverse impacts to the coastal zone.

All applicable environmental laws have been considered and coordination with appropriate agencies and officials has been completed.

Technical, environmental, and cost effectiveness criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Based on this report, the reviews by other Federal, State, and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the tentatively selected plan would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date: _____

_____

Scott Katalenich
Lieutenant Colonel, U.S. Army
District Commander

HONEY CREEK AQUATIC ECOSYSTEM RESTORATION - SECTION 206 - WAUWATOSA, MILWAUKEE COUNTY, WI

INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

May 2021

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List of Acronyms

AA	Average Annual
AAHSI	Average Annual Habitat Suitability Index
AAHU	Average Annual Habitat Unit
AOC	Area of Concern
AST	Aboveground Storage Tanks
ASTM	American Society for Testing of Materials
BMP	Best Management Practice
CCC	Civilian Conservation Corps
CE/ICA	Cost Effectiveness/Incremental Cost Analysis
CEQ	Council on Environmental Quality
CWCCIS	Civil Works Construction Cost Index System
DEM	Digital Elevation Models
EDC	Engineering During Construction
EM	Engineering Manual
E.O.	Executive Order
ESA	Environmental Site Assessments
EX	Existing Conditions
FONSI	Finding of No Significant Impact
FQA	Floristic Quality Assessment
FWCA	Fish and Wildlife Conservation Act
FWOP	Future Without-Project
FWP	Future With-Project
GIS	Geographic Information System
HSI	Habitat Suitability Index
HU	Habitat Unit
IBI	Index of Biotic Integrity
LERRD	Land, Easements, Rights-of-Way, Relocation, and Disposal
LF	Linear Feet
MMSD	Milwaukee Metropolitan Sewerage District
NAAHU	Net Average Annual Habitat Unit
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
P&S	Plans and Specifications
P.L.	Public Law
PPA	Project Partnership Agreement
QHEI	Qualitative Habitat Evaluation Index
REC	Recognized Environmental Conditions
SHPO	State Historic Preservation Office
TPC	Total Project Cost
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Congress
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

UST	Underground Storage Tank
WDNR	Wisconsin Department of Natural Resources
WPA	Works Progress Administration
WRDA	Water Resources Development Act

CHAPTER 1 – Introduction

1.1 Report Structure

This Integrated Feasibility Report and Environmental Assessment (IFR/EA) presents the results of an ecosystem restoration feasibility study for the Honey Creek Aquatic Ecosystem Restoration. This Draft IFR/EA presents the assessment of ecological conditions and potential plans to restore important riverine habitat for transient and migratory mussels, fishes, birds and wildlife within a modified, yet restorable riverine environment. This report gathered historic and current site conditions, and forecasts future without- and future with-project conditions for this tributary of the Menomonee River while considering watershed attributes. This report also provides a recommended plan for restoring habitat within the study area.

The report contains the following chapters and appendices:

Chapter 1 – *Introduction*: introduces the project and provides a description of the study area and a summary of relevant studies and projects completed

Chapter 2 – *Inventory of Study Area and Forecasting:* contains an inventory or description of the study area, which includes an assessment of pertinent historic, current and future without-project conditions

Chapter 3 – *Problems and Opportunities:* discusses the problems within the study area, potential opportunities to remedy them, a study goal, restoration objectives and limiting constraints

Chapter 4 – *Plan Formulation and Evaluation:* discusses how plans have been formulated, presents the cost effectiveness and ecological benefits of each alternative, and discusses the evaluation process used to identify the National Ecosystem Restoration (NER) plan and select a recommended plan

Chapter 5 – *Environmental Assessment:* provides a description of potential impacts, both negative and positive, to cultural, ecological and physical resources within the surrounding environment and their significance

Chapter 6 – *Description of the NER Plan*: discusses the recommended plan and monitoring and adaptive management

Chapter 7 – *Plan Implementation*: discusses construction sequencing, project costs and cost sharing responsibilities

Chapter 8 – *Recommendation:* provides the District Commander's recommendation for implementation of an ecosystem restoration plan

Appendix A: 404(b)(1)/401 & Coordination
Appendix B: Civil Design
Appendix C: Cost Engineering
Appendix D: Hydrology and Hydraulics
Appendix E: HTRW Environmental Site Assessments
Appendix F: Geotechnical Analyses
Appendix G: Real Estate
Appendix H: Monitoring Plan & Habitat Analysis
Appendix I: Archaeology Phase I Assessment

1.2 Study Authority

33 USC § 2330 – Section 206 of the Water Resources Development Act (WRDA) of 1996, as amended

(a) General authority.

(1) In general. The Secretary may carry out a project to restore and protect an aquatic ecosystem or estuary if the Secretary determines that the project--

(A) (i) will improve the quality of the environment and is in the public interest; or

(ii) will improve the elements and features of an estuary (as defined in section 2902 of this title); and

(B) is cost-effective.

(2) Dam removal. A project under this section may include removal of a dam.

(b) Cost sharing.

(1) In general. Non-Federal interests shall provide 35 percent of the cost of construction of any project carried out under this section, including provision of all lands, easements, rights-of-way, and necessary relocations.

(2) Form. Before October 1, 2003, the Federal share of the cost of a project under this section may be provided in the form of reimbursements of project costs.

(c) Agreements.

(1) In general. Construction of a project under this section shall be initiated only after a non-Federal interest has entered into a binding agreement with the Secretary to pay the non-Federal share of the costs of construction required by this section and to pay 100 percent of any operation, maintenance, and replacement and rehabilitation costs with respect to the project in accordance with regulations prescribed by the Secretary.

(2) Nonprofit entities. Notwithstanding section 1962d-5b of Title 42, for any project carried out under this section, a non-Federal interest may include a nonprofit entity, with the consent of the affected local government.

(d) Cost limitation. Not more than $ 10,000,000 in Federal funds may be allotted under this section for a project at any single locality.

(e) Use of natural and nature-based features. In carrying out a project to restore and protect an aquatic ecosystem or estuary under subsection (a), the Secretary shall consider, and may include, with the consent of the non-Federal interest, a natural feature or nature-based feature, as such terms are defined in section 2289a of this title, if the Secretary determines that inclusion of such features is consistent with the requirements of subsection (a).

(f) Funding. There is authorized to be appropriated to carry out this section $ 62,500,000 for each fiscal year.

HISTORY: (P.L. 104-303, Title II, § 206 Oct 12, 1996, 110 Stat. 3679; P.L. 106-53, Title II, § 210 Aug. 17, 1999, 113 Stat. 287; P.L. 110-114, Title II, § 2020, Nov. 8, 2007, 121 Stat. 1078; P.L. 113-121, Title I § 1030(g), June 10, 2014, 128 Stat. 1232; P.L. 115-270, Title I, §§ 1149(a), 1157(f), Oct. 23, 2018, 132 Stat. 3787, 3794.)

1.3 Study Purpose & Need

This report documents whether a project is warranted for federal participation based on a feasibility level assessment of estimated costs, potential benefits, and possible environmental impacts of various alternatives, all of which follow the U.S. Army Corps of Engineers (USACE) planning and policy guidelines. The purpose of the proposed project is ecological restoration that would address past stream modification, invasive species issues, and provide important habitat for various fish and wildlife species. By restoring riverine and connecting habitats, this project could provide essential life history requirements for residential, transient and migratory fish and wildlife within a highly urbanized area. If an alternative is found to be worth the investment, the next steps would include the signing of a Project Partnership

Agreement (PPA) and the development of a contract set of Plans and Specifications (P&S). The non-federal sponsor (NFS) is the Milwaukee Metropolitan Sewerage District (MMSD), whom is an involved stakeholder supporting land use change on their properties.
The MMSD has a strong commitment to improving the quality and function of habitat within its area of responsibility. Habitat restoration for the purpose of addressing past stream modification, invasive species issues, and providing important habitat for various fish and wildlife species within Honey Creek is congruent with the commitment of MMSD. The MMSD has, in turn, requested that the USACE initiate a study under Section 206 of WRDA 1996, Public Law 104-305, Aquatic Ecosystem Restoration authority, to ascertain the feasibility of restoring important riverine habitat in Honey Creek, and to a larger degree, within the Menomonee River Watershed. The need for the proposed project is due to human-induced disturbances to the remaining natural processes within the Honey Creek watershed, including fire suppression, altered hydraulics through lining of the stream channel with concrete, increased colonization of invasive species, urbanization pressures and fragmentation.

1.4 Study Area

Honey Creek is a small sub-watershed (11 square miles) of the larger Menomonee River watershed, located in southeast Wisconsin in the Milwaukee metropolitan area (Figure 1). The Honey Creek drainage area resides in a highly urbanized area within portions of the communities of Greendale, Greenfield, Milwaukee, Wauwatosa, and West Allis. The drainage area includes paved streets, curbs and gutters, and attendant storm sewers, which convey stormwater runoff to Honey Creek. Despite being a small sub-watershed, the creek remains perennial. Honey Creek originates from a storm sewer outfall at South 43rd Street in the City of Greenfield. It flows primarily in a northerly direction for approximately 8.8 miles, until joining the main Menomonee River at approximately 72nd Street in the City of Wauwatosa. In addition, the Wisconsin State Fair Park is also contained within the Honey Creek watershed, located in the City of West Allis. Honey Creek flows beneath State Fair Park in an enclosed concrete channel that consists of three 10' x 15' box culverts that emerge immediately north of Interstate 94 (I-94) at 84th Street and O'Connor Avenue. The enclosed, realigned channel lies directly underneath the Milwaukee Mile Racetrack oval.

Channel modifications have occurred to approximately 7.2 miles of Honey Creek (representing 87 percent of the creek's length). Channel alterations for the purposes of flood-damage reduction included channel confinement, deepening, straightening, lining with concrete and placing underground. These alterations were made to accommodate increased stream flows due to urban development and to provide a stable, low-maintenance channel.

The project area is an approximately 9,300 linear feet (LF) reach of Honey Creek extending from the outlet of Honey Creek to the Menomonee River upstream to the utility crossing near the Wisconsin Lutheran High School (approximately 1,600 feet downstream of the culverts north of Interstate 94 at 84th Street and O'Connor Avenue) (Figure 2). Most of this reach, approximately 6,700 LF, consists of a concrete channel that was installed as part of a flood reduction project built by the MMSD and Milwaukee County in the 1960's and it provides extremely limited habitat value. The remainder of the reach, approximately 2,600 LF, consists of natural substrates that provides some habitat value, but is experiencing greater than normal bank erosion due to upstream channel modifications (i.e., concrete lined channel).

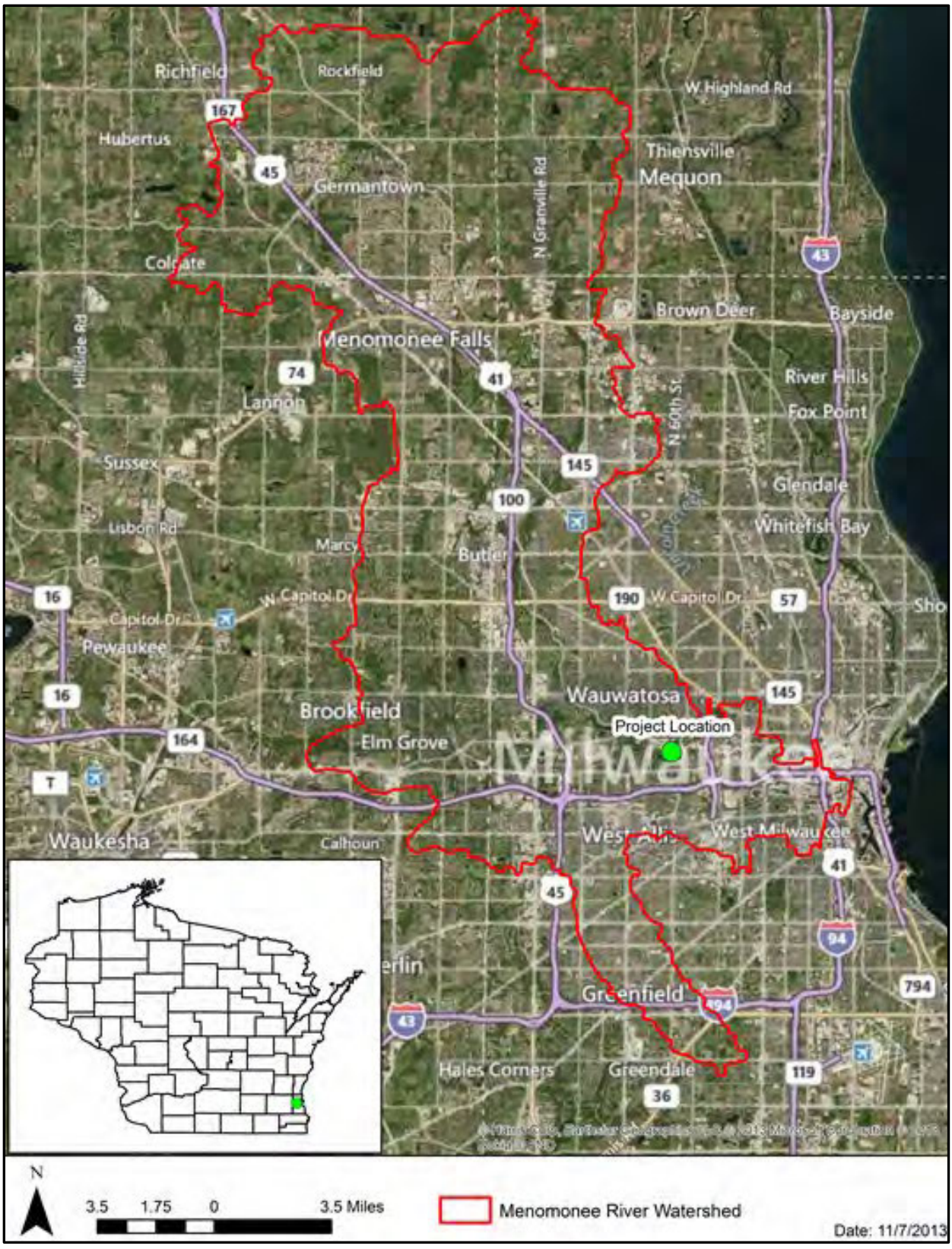

Figure 1– Location of the project area within the Menomonee River Watershed

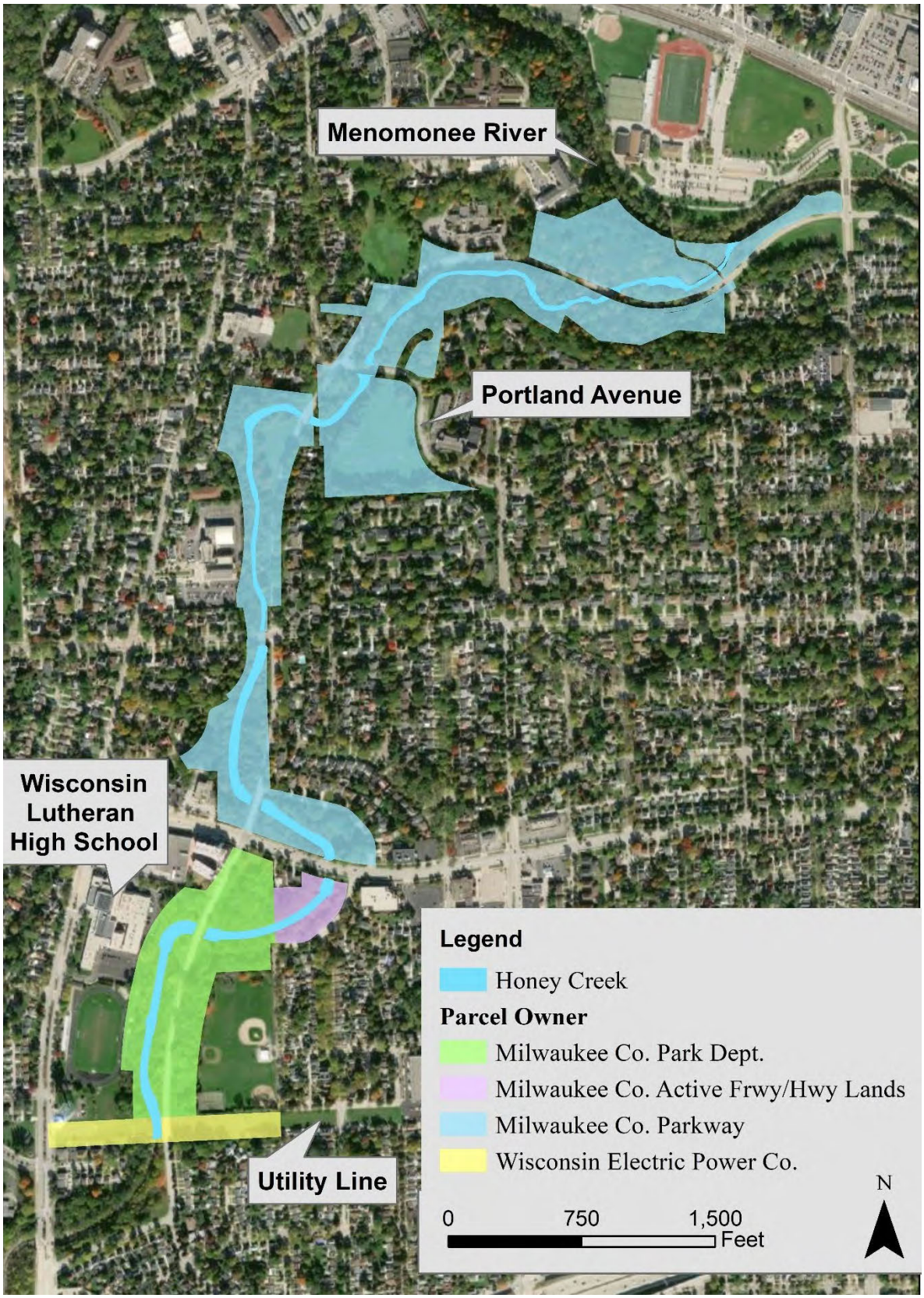

Figure 2 – Study area within Honey Creek with perspective property owners.

1.5 Prior Studies & Projects

This section summarizes the studies, reports and nearby projects that are pertinent to this study.

1.5.1 Pertinent Reports & Studies

United States Geological Survey, MMSD, 2014. Biological Water-Quality Assessment of Selected Streams in the MMSD Planning Area of Wisconsin, 2007.— The report outlines the results of a 2004 and 2007 biological assessment of several Milwaukee streams including Honey Creek. The Biological assessment included algal, invertebrate, fish assemblages in concert with water chemistry and other hydrological data. Overall, the study suggested Honey Creek had degraded further from 2004 to 2007.

Southeastern Wisconsin Regional Planning Commission, Memorandum Report No. 194, Stream Habitat Conditions and Biological Assessment of the Kinnickinnic and Menomonee River Watersheds: 2000-2009.— This report summarizes the biological and habitat quality within each watershed. Limiting factors, information needs, goals, objectives, actions, and priorities for physical and biotic habitat are identified within the report.

Southeastern Wisconsin Regional Planning Commission, Planning Report No. 50, A Regional Water Quality Management Plan Update for the Greater Milwaukee Watersheds, Part One - Chapters 1-12, Including the May, 2013 Amendment to Planning Report No. 50.— Study outlines the regional water quality management plan for the greater Milwaukee watersheds.

Southeastern Wisconsin Regional Planning Commission, Technical Report No. 39, Water Quality Conditions and Sources of Pollution in the Greater Milwaukee Watersheds, Part Two of Three, Chapters 5-12.— Study investigates the source of pollution throughout the watershed and provides information specific to the Menomonee River watershed.

MMSD, 2016. Surface Water Quality Annual Summary Report.— The report outlines water quality sampling throughout the Milwaukee area and in which includes Honey Creek. The synopsis of Honey Creek within the report mentions "[...] the biggest problem with this creek has been the ecological degradation and habitat loss due to channel modifications."

MMSD Water Quality Monitoring Data.— Comprehensive water quality measurements at Honey Creek at several site locations through time.
http://www.waterbase.glwi.uwm.edu/mmsd/mmsd-data-select.php?site_id=100

1.5.2 Pertinent Projects

USACE, Detroit. 2014. Menomonee River Section 206 Aquatic Ecosystem Restoration – The report outlines the removal of 2,400 LF of concrete channel and replace it with angular stone to produce riffles and pools. The objective of the project was to restore connectivity from the lower reach to the upper reaches of the Menomonee River. Construction on this project was completed in 2017.

USACE, Detroit. Underwood Creek Section 206 Aquatic Ecosystem Restoration – The report is like the Menomonee River project. This project removes 4,000 LF of concrete of Underwood Creek in Wauwatosa. The concrete lined channel is being replaced with angular stone to produce riffles and pools in order to produce a less unnatural stream bed. Construction on this project was completed in the fall of 2018.

CHAPTER 2 – AFFECTED ENVIRONMENT

The purpose of this step of the planning process is to develop an inventory and forecast of critical resources (physical, environmental, social, etc.) relevant to the problems and opportunities under consideration in the planning area. This information is used to define and characterize the problems and opportunities. A quantitative and qualitative description of these resources is made, for both current and future conditions, and is used to define Existing and Future Without-Project Conditions. Existing (EX) Conditions are those at the time the study is conducted. The forecast of the Future Without-Project (FWOP) Conditions reflects the conditions expected during the period of analysis. The Future Without-Project Conditions provides the basis from which alternative plans are formulated and impacts are assessed. Since impact assessment is the basis for plan evaluation, comparison and selection, clear definition and full documentation of the FWOP Conditions are essential. Gathering information about historic and Existing Conditions requires an inventory. Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes and other conditions are likely to have an impact on problems and opportunities. Information gathering and forecasts will continue throughout the planning process. As such, Chapter 2 contains the following:

- An inventory of relevant historic conditions;
- An inventory of relevant current conditions and the studies that have been completed to identify those conditions; and
- A forecast of FWOP conditions.

2.1 Historic Setting

Historically, prior to extensive settlement, the southwestern portion of Milwaukee County (where the proposed project is located) was covered in a mosaic of forest, savanna, and prairie habitats. Forests were extensive in the Lake Michigan coastal area and would have also been present in the area surrounding Honey Creek. Forrest composition would have been primarily maple-basswood forest and beech-maple forest. Lowland hardwood swamps and wetlands covered the area that would eventually become the City of Milwaukee. Extensive wetlands would have been present where the Milwaukee River flows into Lake Michigan and would have also been present along portions of the Honey Creek floodplain. The natural habitats of the area began to suffer during an era of exploitation, as timber became harvested. In addition, settlers removed nearly all the prairie lands and only a few wetland areas remained.

In general, the Menomonee River and its tributaries (such as Honey Creek) were once naturally diverse, free-flowing streams that were modified by European settlers into homogenized channels that were used to facilitate drainage and water supply for irrigation and power. The modifications destroyed and degraded riparian wetlands and set the stage for decades of floodplain development. Due to urbanization of the watershed and the increase in impervious surfaces, flooding became a growing problem. Responses to flooding led to stream channel lining, deepening, straightening and relocating, all to move stormwater downstream more rapidly. Honey Creek has experienced modifications to approximately 7.2 miles of its channel, which represents 87 percent of the creek's total length. Specific channel modifications to Honey Creek include channel confinement, deepening, straightening, lining with concrete and placement underground. As described above in the Inventory discussion, the native species richness, abundance and health was severely degraded from the natural state. The concrete paving and enclosure of some reaches of Honey Creek has significantly degraded the overall biological integrity and function of the creek from an ecological perspective.

2.2 Physical Resources

The following provides information pertinent to riverine connectivity and habitat decisions.

2.2.1 Geology & Soils

Geology – The four major stages of glaciation that occurred in the southeast region of Wisconsin laid the foundation for the physiology, topography, and soils of Milwaukee County. The last and most influential stage of glaciation was the Wisconsin stage that is said to have ended in Wisconsin about 11,000 years ago. The glacier movement and deposition caused a derangement of surface drainage in the areas it covered. As a result of some of this former glacial activity, large areas of Milwaukee County were covered with wetlands prior to urban development. Other areas of Milwaukee County consist of gently rolling land. A steep escarpment is also present along the Lake Michigan boundary at the north and south ends of the county, away from the mouths of the Milwaukee, Menomonee, and Kinnickinnic Rivers.

The underlying regional bedrock is Silurian-age dolomite of the Racine Formation. Characteristics of the bedrock are medium to coarse grained, thin- to thick- bedded, very light to light gray, and fossiliferous. The project area has been subjected to several periods of glacial advances, the most recent of which was the Wisconsin Glacial period, which began approximately 35,000 years ago and ended approximately 11,000 years ago. Younger, unconsolidated glacial deposits overlay the bedrock and vary in thickness from a few feet to more than 500 feet.

Soils –The U.S. Department of Agriculture Natural Resource Conservation Service's web soil survey was queried for soils present within the study area; however, soils in this area have not been mapped. According to the 1971 soil survey for Milwaukee and Waukesha Counties (USDA Soil Conservation Service 1971), the acreage within the city limits of Milwaukee "was excluded from the survey, because the soils in that area had been disturbed too extensively for a detailed survey to be practical." At a more general local scale, the soils in the study area fall within the Ozaukee-Morley-Mequon association. This association is typically found in glaciated uplands where the soils formed in a thin layer of loess and the underlying glacial till. They have a subsoil of silty clay loam and silty clay and are considered well-drained to somewhat poorly drained (USDA Soil Conservation Service 1971).

2.2.2 Watershed Hydrography

Detailed hydrology, hydraulics and modeling for the Honey Creek may be found in *Appendix D – Hydrology and Hydraulics*. The following provides information pertinent to riverine connectivity and habitat decisions.

Climate and Climate Change

The climate of the study area is predominantly continental with some modification by Lakes Michigan and Superior. Weather patterns significantly affect conditions within the watershed, as they dictate the frequency and timing of precipitation and subsequent flood pulses. Because more than half of the annual precipitation occurs from April to September (Table 1 and Figure 3), flood events in the watershed are more likely to occur during that time. In winter, total snowfall is generally heavy with an average annual snowfall of approximately 47 inches (Wisconsin State Climatology Office 2018). The average winter high temperature is 32°F with an average low of 18°F. The average summer high temperature is 77°F with an average low of 61°F. Average annual (liquid equivalent) precipitation is approximately 34 inches (Wisconsin State Climatology Office 2018). The freeze-free season is slightly more than 180 days in the

Milwaukee Area. The median date of last spring freeze is around early May while the first autumn freeze typically occurs around mid-October.

Table 1 – Average Temperatures and Precipitation by Month for the Milwaukee Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High (°F)	29	33	42	54	65	75	80	78	71	59	46	33
Avg. Low (°F)	16	19	28	37	47	57	64	63	55	43	32	20
Avg. Precipitation (in.)	1.73	1.61	2.24	3.54	3.39	3.90	3.66	3.94	3.15	2.64	2.68	2.01

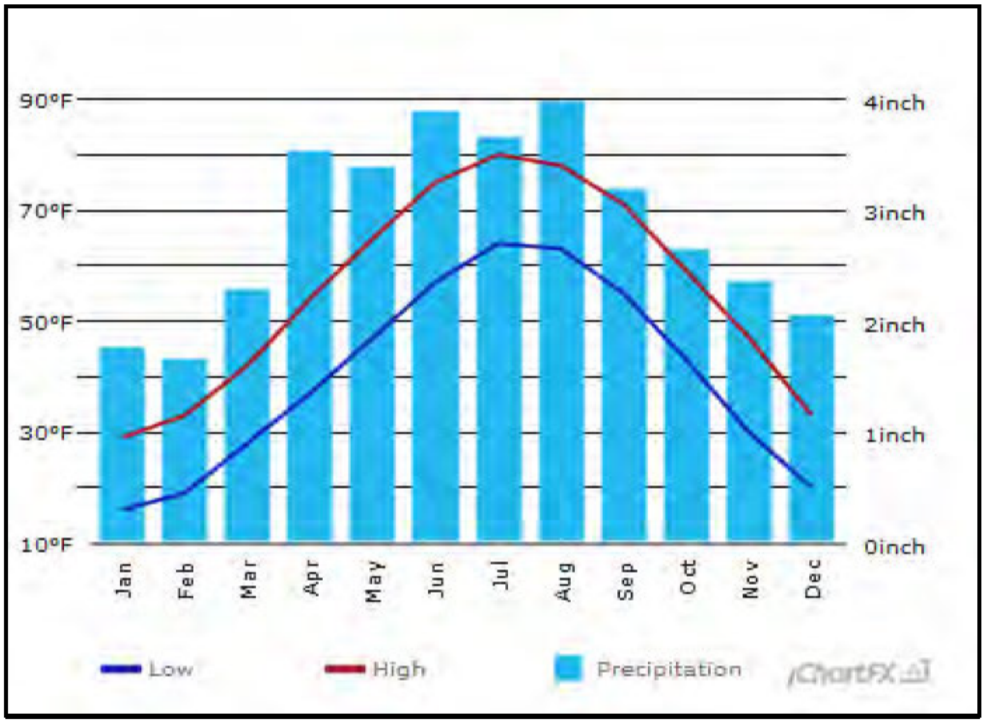

Figure 3 – Seasonal Cycle of Average Temperatures and Precipitation in the Greater Milwaukee Region

The USACE is required to assess Climate Preparedness and Resiliency (C-P-R) in relation to all Civil Works project planning and implementation efforts, in consultation with internal and external experts, using the best available and actionable climate science. As part of this effort, the USACE has developed concise reports summarizing observed and projected climate and hydrological patterns, at a HUC2 watershed scale, cited in reputable peer-reviewed literature and authoritative national and regional reports. Trends are characterized in terms of climate threats to USCE Business Lines. The reports also provide context and linkage to other agency resources for climate resiliency planning, such as downscaled climate data for sub-regions, and Watershed Vulnerability Assessment tools.

The USACE literature review report, which focused on the Great Lakes Region, was finalized in April 2015 (USACE 2015). According to the Fourth National Climate Assessment (NCA4), 42% more precipitation is falling in the Great Lakes Region now as compared with the first half of the 20th century, and that the precipitation is concentrated in larger events.

The USACE literature review document summarizes several studies which have attempted to project future changes in hydrology. Based on a review of four studies, the projected total annual precipitation is expected to have a small increase when compared to the historic record, while the precipitation extremes are projected to see a large increase. It is noted that consensus between the studies is low, and although most studies indicate an overall increase in observed average precipitation, there is variation in how these trends manifest both seasonally and geographically.

For the Great Lakes Region, increases in temperatures have been observed, and additional increases in temperature are predicted for the future. In addition, for the Great Lakes Region, "nearly all studies note an upward trend in average temperatures, but generally the observed change is small. Some studies note seasonal differences with possible cooling trends in fall or winter." There is a strong consensus within the literature that average temperatures are projected to continue to increase over the next century in the Great Lakes Region and study area.

In some parts of the region, increases in streamflow have been observed. Future projections of streamflow rates are highly variable. For the Great Lakes Region, trends in observed low and annual streamflow were variable, with slight streamflow increases observed at some gages, but other gages showing no significant changes. Significant uncertainty exists in projected runoff and streamflow, with some models projecting increases and others decreases. Changes in runoff and streamflow may also vary by season. Outlooks of water levels in the Great Lakes also have considerable uncertainty, but overall lake levels are expected to decline over the next century. A detailed discussion on climate change is presented in Appendix D.

Land Use

Honey Creek is located in Milwaukee County, Wisconsin. The Milwaukee County Interactive Mapping tool (Milwaukee County 2018) was used to determine land uses within the immediate vicinity of Honey Creek. The predominant land use is residential, accounting for 58.1 % of the immediate area. Recreation (13.6%), open lands (12.4%), government and institutional (11.6%), communication and institutional (2.2%), and commercial (2.0%) make up the remainder of the immediate area (Milwaukee County 2018).

Geomorphology & Gradient

Regarding geomorphology, the Honey Creek channel would have been created by glaciation in the area. While the channel has not been overly straightened in the past, the geomorphological processes has been inhibited due to the lining of the channel with concrete. The lined concrete channel has not allowed the stream to shift in location through the natural erosion/transport/deposition process, therefore, the general characteristics of the channel have not changed since the concrete was placed. The concrete channel lacks natural stream characteristics such as riffle/pool complexes, varied aquatic habitats (e.g., undercut banks, woody debris, aquatic vegetation, etc.), and connection to the floodplain.

Regarding stream gradient and topography, watershed boundaries, land slope and stream slope are topographic features that significantly influence watershed processes. Traditionally, topographic maps such as those published by the U.S. Geological Survey (USGS) have provided the basis for delineation of watershed boundaries and calculation of land slopes. Digital Elevation Models (DEM) are now commonly used to delineate topography in applications using georeferenced data, such as Geographic Information Systems (GIS) datasets. The DEM displayed in Figure 4 provides elevations in color ramp throughout the Honey Creek study area. The elevation ranges from 682 feet above sea level at the upstream end of the study area to 634 feet at the downstream end of the study area. The elevation change is 54 feet over approximately 1.94 river miles, which yields a stream gradient of approximately 28 feet per mile.

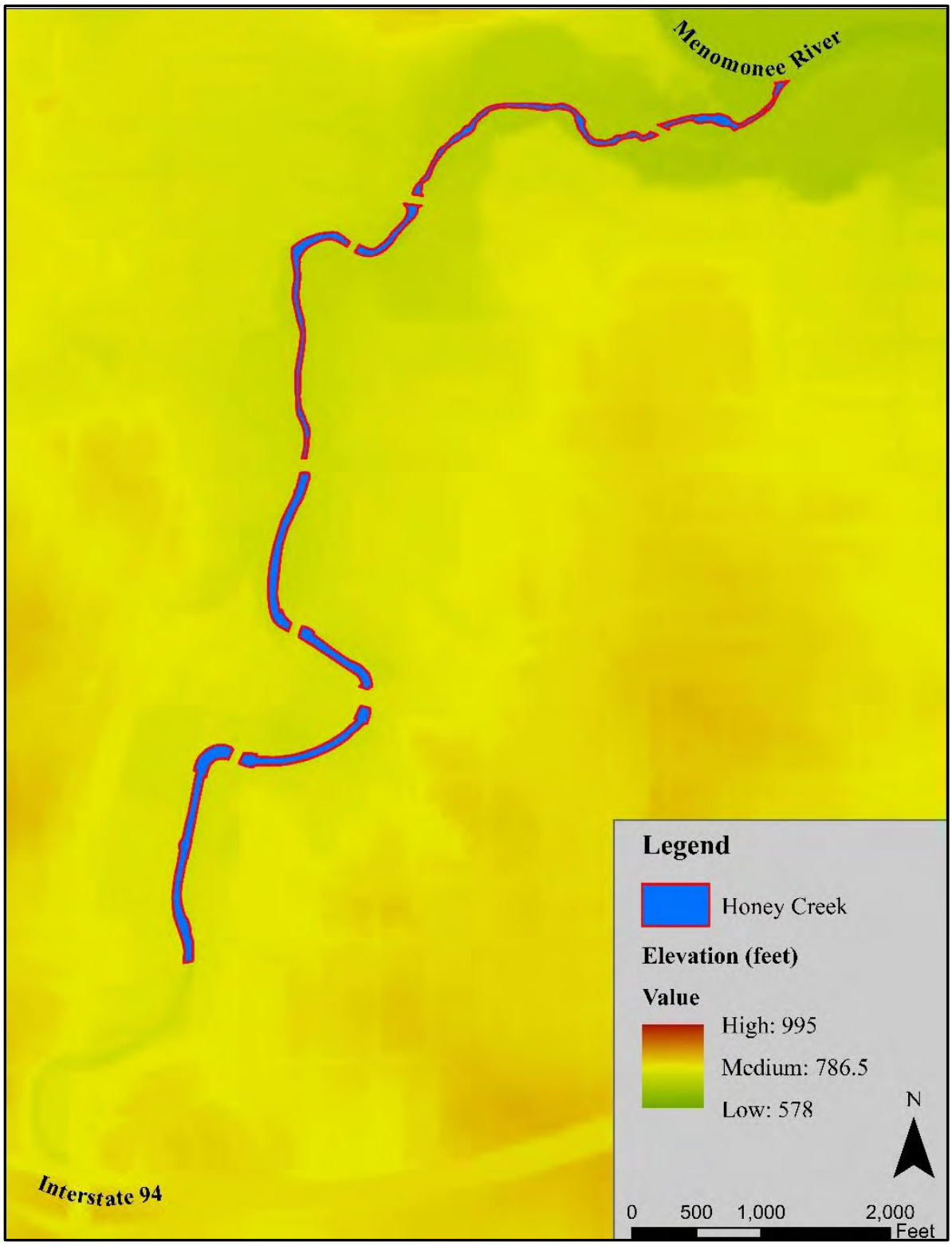

Figure 4 – Honey Creek Watershed Topography/Geomorphology

Hydrology & Hydraulics

Honey Creek is an example of a tributary that has lost most of its in-stream and riparian habitat. The total area of the watershed is 10.8 square miles at its confluence with the Menomonee River. The stream flows in a generally northerly direction for approximately 8.8 miles. The stream begins in the city of Greenfield as wetland and overland drainage before entering a 3.2-mile-long concrete channel that meanders into the City of West Allis. At the north end of McCarty Park (Milwaukee County Park System), the stream becomes totally enclosed for approximately 2.1 miles until it emerges just north of Interstate 94 near the City of Wauwatosa. It then flows through additional lined sections for approximately 2 miles before joining the Menomonee River in Hart Park.

Much of the Honey Creek reach that is part of the proposed project has had its hydraulics drastically altered through the lining of the channel with concrete. There are several drop-down structures (approximately 3 to 4) throughout the concreted portion. In the lower portion of the study reach the channel has not been lined with concrete, and natural substrates as well as pool/riffle complexes are present.

Like many other urban watersheds, large-scale drainage of wetlands, substantial increases in impervious surfaces and storm sewer drainage improvements in the Honey Creek watershed have resulted in a watershed with an extremely flashy hydrology and very little stormwater storage capacity. A “flashy” hydrology means that the water level in the river goes up very quickly during a storm event and down quickly afterward. Hydrological data available from the USGS Water Data website (http://waterdata.usgs.gov/wi/nwis/current/?type=flow) are presented below for Honey Creek (Figure 5). Figure 5 shows the average discharge by month for Honey Creek in 2017. The gage is located just downstream of the study area between Portland Avenue and 72nd Street (04087119) in Wauwatosa, Wisconsin, near the Honey Creek Parkway Bridge. The streamflow and hydrological information are important for certain riverine habitat parameters and native plant community delineation.

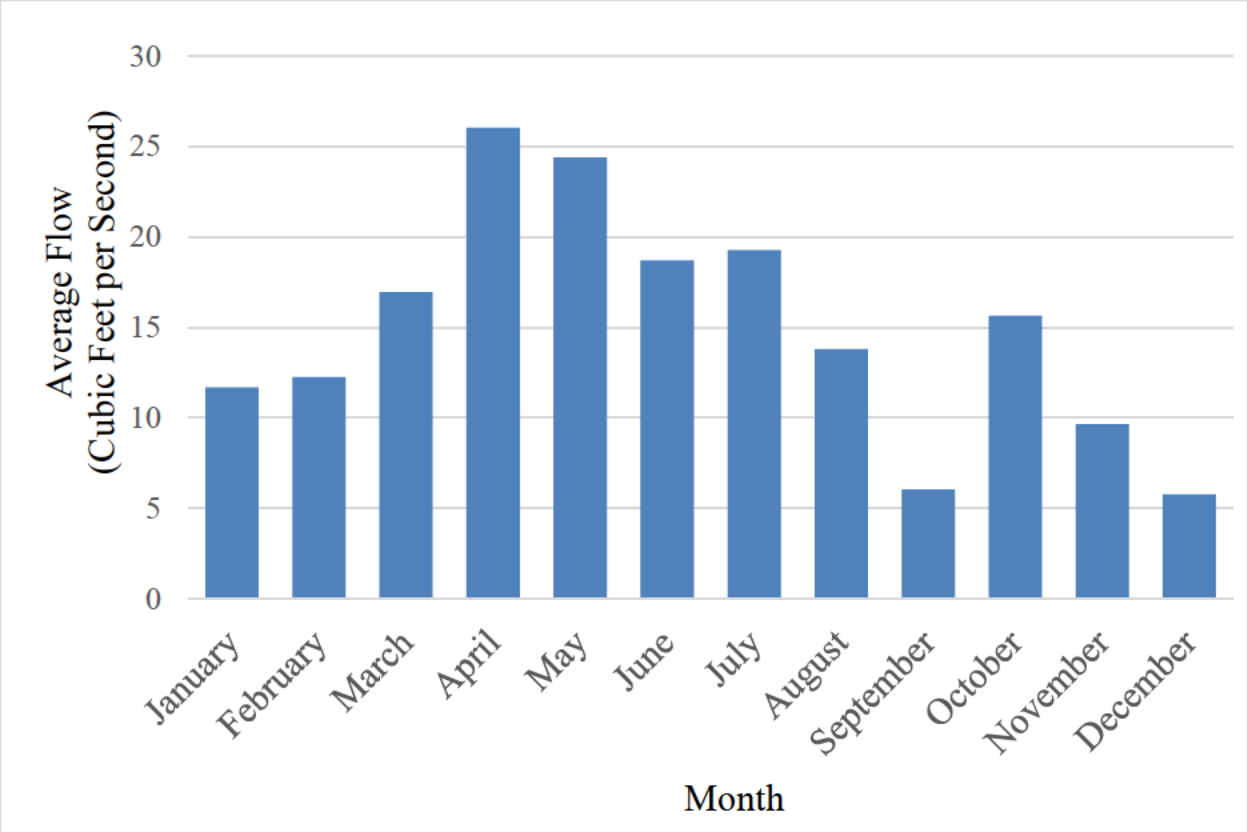

Figure 5 – Average Monthly Flows for Honey Creek near the Honey Creek Parkway Bridge (04087119)

2.2.3 Water Quality

Every two years, Section 303(d) of the Clean Water Act requires states to publish a list of all waters that are not meeting water quality standards. Honey Creek has been included on Wisconsin's 2016 impaired waters list due to one or more pollutants and associated water quality impacts. During the 2012 listing cycle, total phosphorus sample data exceeded the 2012 Wisconsin Consolidated Assessment and Listing Methodology (WisCALM) criteria for the fish and aquatic life use, and biological impairment was observed (i.e., at least one macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the poor condition category). During the 2014 cycle, total phosphorus sample data once again exceeded 2014 WisCALM listing criteria for the Fish and Aquatic Life use and biological impairment was observed. During the 2018 cycle, chloride sample data exceeded 2018 WisCALM listing criteria for the Fish and Aquatic Life Use. Lastly, Honey Creek is severely degraded and is impaired due to recreational restrictions (i.e., full body contact – swimming, boating) caused by high levels of Fecal Coliform bacteria. The assessment information indicates Fecal Coliform counts exceed 400 cfu/100 ml 38% of the time (annually), 14% of the time from May to September, and the mean is 4000 cfu/100mL, which exceeds WisCALM thresholds. Fecal coliform loads from Honey Creek are considered significant. Honey Creek is a Category 5 water, meaning Total Maximum Daily Load's (TMDL's) have not yet been developed.

2.2.4 Sediment (Substrate) Types & Quality

Within the study area, much of the Honey Creek channel has been lined with concrete, except for approximately 2,600 LF at the downstream end. Near the downstream end of the study area where the creek has not been lined with concrete, natural substrates such as sand, gravel, and cobbles are prevalent

(Figure 6), while bedrock outcroppings are present within the study are just north of Portland Avenue (Figure 7). The upstream end of the study area is completely lined with concrete with some sand and gravel substrates deposits (Figure 8).

Figure 6 – Near downstream end of study area.

Figure 7 – Study area north of Portland Avenue.

Figure 8 – Near upstream end of study area.

2.2.5 HTRW Assessment

Two Phase I Environmental Site Assessments were prepared for the study area and are included in *Appendix E – HTRW Environmental Site Assessments*. The assessments were conducted in accordance with the guidelines established in ASTM E1527-13 for Phase I Environmental Site Assessments (ESA) and are based on review of available historical and environmental records, visual observations of the surface of the site and adjoining properties, and personal interviews with persons having knowledge of the property. The study area has generally remained undeveloped throughout recent history, and the site vicinity was primarily undeveloped and/or agriculture prior to 1940. After 1940, development consisted of primarily residential and institutional with sparse commercial development. No evidence of underground storage tanks (USTs), above ground storage tanks (ASTs), hazardous substances, petroleum products, chemicals, soil staining, transformers, or indicators of any other waste products were observed during reconnaissance. The following recognized environmental conditions (RECs) were identified in the Phase I ESA completed for the portion of the study area that extends from Interstate 94 to Portland Avenue:

- Several historic spills have occurred onsite or within Honey Creek. There is a potential that historic spills have impaired the soils at the site or sediments within Honey Creek.
- Significant quantities of fill were utilized at the site in order to channelize Honey Creek. There is a potential that a portion of the fill is foundry sand or other industrial wastes.

A Phase II ESA was conducted to determine the nature and extent of potential contaminants present in the study area. A series of seven soil borings were advanced in the project area between Interstate 94 and Portland Avenue. A total of twelve (12) environmental soil samples were collected and analyzed for contaminants. Results of the investigation are included in *Appendix E – HTRW Environmental Site Assessments*. Contaminants of concern in soils include polynuclear aromatics (PNAs), polychlorinated biphenyl's (PCBs), and metals. Review of the analytical test results suggest that soils at the site would not be classified as hazardous waste; however, further testing and coordination with regulatory agencies may be necessary to identify disposal and/or reuse options of materials generated from onsite restoration activities. Recommendations for handling HTRW found in the study area are presented in *Appendix E*.

2.2.6 Air Quality

The Federal Clean Air Act requires the U.S. Environmental Protection Agency (USEPA) to set national ambient air quality standards (NAAQS) for six criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides) which are considered harmful to public health and the environment. Areas not meeting the NAAQS for one or more of the criteria pollutants are designated as "nonattainment" areas by the USEPA. The study area, in Milwaukee County, Wisconsin, is not currently within a non-attainment area. In the past, Milwaukee County was in non-attainment for sulfur dioxide (1992) and PM-2.5 (2009-2013); but was designated to maintenance status in 1993 and 2014, respectively. The county was also in non-attainment for 1-hour ozone (1992-2004) and 8-hour ozone (2004-2011); however, these standards were revoked in 2005 and 2015, respectively. Air quality is not considered to be a major factor in the health of the existing ecosystem.

2.3 Ecological Resources

2.3.1 Plant Communities

The majority of the project area does not support any stable native plant communities but is instead predominately comprised of unassociated woody growth. These woody plants are a mix of native and

non-native/invasive adventive (i.e., species that has arrived in a new locality generally with help from humans and does not have a self-sustaining population; cultivated plants are an example of adventive plant populations) shrubs and trees that established as a result of human-induced disturbances and fire suppression and do not occur together under natural conditions as associates within self-sustaining communities. Areas with unassociated woody growth within the study area support a mix of common opportunistic native trees such as ash-leaf maple (*Acer negundo*), silver maple (*Acer saccharinum*), common hackberry (*Celtis occidentalis*), green ash (*Fraxinus pennsylvanica*), American basswood (*Tilia americana*), and slippery elm (*Ulmus rubra*). Equally prevalent within these areas are dense thickets of the non-native/invasive European buckthorn (*Rhamnus cathartica*).

Other non-native/invasive adventive species within the study area, but not an exhaustive list, include Norway maple (*Acer platanoides*), garlic mustard (*Alliaria petiolata*), mother-of-the-evening (*Hesperis matronalis*), showy fly honeysuckle (*Lonicera* X *bella*), sweet-clover (*Melilotus* spp.), Asian bittersweet (*Celastus orbiculatus*), winged euonymus (*Euonymus alatus*), honeysuckles (*Lonicera* spp.), European privet (*Ligustrum vulgare*), and reed canary grass (*Phalaris arundinacea*).

The diversity of herbaceous ground cover within these areas are either very low or non-existent (i.e. bare ground). Some pockets of woodland communities do exist on drier portions of the site and where small floodplain shelves have formed; however, these areas only support moderately conservative native species such as green-head coneflower (*Rudbeckia laciniata*), inflated narrow-leaf sedge (*Carex grisea*), obedient-plant (*Physostegia virginiana*), clustered black-snakeroot (*Sanicula odorata*), beggar's-lice (*Hackelia virginiana*), and farewell-summer (*Symphyotrichum lateriflorum*). The stream banks are devoid of vegetation where steep slopes and rock armoring occur. The concrete lined channel bottom is not currently amenable to supporting vegetation. Remaining non-wooded areas are lawns dominated by adventive species such as Kentucky blue grass (*Poa pratensis*), plantain (*Plantago* spp.), hairy crab grass (*Digitaria sanguinalis*), clover (*Trifolium* spp.), yard knotweed (*Polygonum aviculare*), and common dandelion (*Taraxacum officinale*). Floristic inventories and Floristic Quality Assessment (FQA) metrics are provided in *Appendix H – Monitoring Plan and Habitat Analysis*.

2.3.2 Riverine Habitat

The riverine habitat within the project area is severely degraded and provides little to no ecological function. The streambed consists of a straightened, trapezoidal, concrete-lined channel to move water downstream quickly (Figure 9). Per the USEPA (Westlake 2017), "Honey Creek is an example of a tributary that has lost most of its in-stream and riparian habitat due to its conversion to a concrete-lined stream. […] Concrete-lined streams provide almost no habitat and degrade conditions in unlined downstream sections by creating highly erosive flow velocities during wet weather conditions and excessively warm water during low flow conditions." In addition to the concrete lining, several drop structures (approximately six) exist throughout the system causing barriers to upstream fish passage. The benthic habitat is negligible throughout the project reach except for a few locations where small piles of gravel and sand have accumulated. Due to the lack of suitable benthic substrates within the stream, no aquatic vegetation can be found throughout the project area. Invasive species dominate the riparian zones throughout the project, further degrading stream habitat. The loss of substrates, in-stream cover, channel morphology, riparian zone, and riffle pool complexes cumulatively degrade the ecosystem resulting in little to no ecological function and integrity.

Figure 9 – View of typical Honey Creek streambed throughout the project reach.

2.3.3 Aquatic Macroinvertebrates

Aquatic macroinvertebrate data is available for Honey Creek. Sampling for these species occurred in the downstream reach of the study area where Honey Creek flows into the Menomonee River and where more natural substrates are present. Subsequently, the aquatic macroinvertebrates may not be representative of aquatic macroinvertebrates that may be present in the concrete lined portions of the channel which make up much of the study area. In April 2016, students from the Wisconsin Lutheran College conducted kick net samples for aquatic macroinvertebrates in Honey Creek (Gorr 2018). A total of 57 organisms were collected from three orders. The results were nine organisms in the Order Trichoptera, Family Hydropsychidae; one organism in the Order Diptera, Family Tipulidae; and 47 organisms in the Order Isopoda, Family Asellidae. The researchers used the Hilsenhoff Family Biotic Index and the Tolerance Values to assess the aquatic macroinvertebrate community and in turn the quality of Honey Creek. The results indicated that the aquatic macroinvertebrate community is highly tolerant which in turn indicates very poor water quality (Gorr 2018).

2.3.4 Fishes

Honey Creek has been intensively sampled for fish over the last three decades. Dr. Robert Anderson from Wisconsin Lutheran College has collected fish every few years to almost annually since 1993 within Honey Creek and adjacent waterways. The data from these collections is provided below in Table 2. In all, a total of 18 species have been documented in Honey Creek. All but 2 species documented are native. The two non-native species include Common Carp (*Cyprinus carpio*) and Brown Trout (*Salmo trutta*). In general, the impacted stream bed, lack of substrates and the impacted adjacent riparian habitat have had an impact on the fish assemblage. Data from Dr. Anderson shows a maximum IBI for Honey Creek to be

20; indicative of poor habitat. The potential for additional species colonizing Honey Creek are possible by other fish species located within the greater Menomonee River Watershed. A total of 30 native species (Table 3) have been documented within the adjacent Menomonee River compared to the 16 species in Honey Creek.

Table 2 – List of documented species and total within Honey Creek since 1993. Non-native species are demarcated with an asterisk (*). All data was provided by Dr. Robert Anderson from Wisconsin Lutheran College in Milwaukee, Wisconsin.

	Year																		
Name	**1993**	**1995**	**1996**	**1999**	**2000**	**2002**	**2003**	**2004**	**2005**	**2006**	**2008**	**2009**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Total**
Black Bullhead (*Ameiurus melas*)	1																		1
Blacknose Dace (*Rhinichthys atratulus*)	160	14	88	141	56	89	117	33	79	73	55	52	106	123	95	80	61	143	1565
Bluegill (*Lepomis macrochirus*)	1			1							2								4
Bluntnose Minnow (*Pimephales notatus*)	3	26														10			39
Brook Stickleback (*Culaea inconstans*)																		1	1
Central Mudminnow (*Umbra limi*)								36											36
Central Stoneroller (*Campostoma anomalum*)				7	1						2	2	14	9	3	17	50	120	225
Common Carp* (*Cyprinus carpio*)	2	1		1	2			1											7
Creek Chub (*Semotilus atromaculatus*)	328	15	31	72	42	11	47	14	28	2	44	19	15	26	23	22	14	20	773
Fathead Minnow (*Pimephales promelas*)		6														3		5	14
Green Sunfish (*Lepomis cyanellus*)	6			1	2		5	1	3		8	1	1	1				2	31
Johnny Darter (*Etheostoma nigrum*)	1						3											26	30
Largemouth Bass (*Micropterus salmoides*)							1												1
Longnose Dace (*Rhinichthys cataractae*)		8	13																21
Northern Pike (*Esox lucius*)	1																		1
River Shiner (*Notropis blennius*)										2									2
Sand Shiner (*Notropis stramineus*)								1											1
White Sucker (*Catostomus commersoni*)	105	8	6	99	72	38	50	28	32	5	13	18	10	12	2	87	7	29	621
Total	**608**	**78**	**138**	**322**	**175**	**138**	**223**	**114**	**142**	**82**	**124**	**92**	**146**	**171**	**123**	**219**	**132**	**346**	**3373**
Number of Species	**10**	**7**	**4**	**7**	**6**	**3**	**6**	**7**	**4**	**4**	**6**	**5**	**5**	**5**	**4**	**6**	**4**	**8**	**18**

Table 3 – Comparison of native species found in Honey Creek since 1993 to records of fish species captured within the Menomonee River Basin.

Name	Honey Creek	Menomonee River Basin
Black Bullhead (*Ameiurus melas*)	X	X
Brown Bullhead (*Ameiurus nebulosus*)		X
Central Stoneroller (*Campostoma anomalum*)	X	X
Largescale Stoneroller (*Campostoma oligolepis*)		X
White Sucker (*Catostomus commersoni*)	X	X
Redside Dace (*Clinostomus elongatus*)		X
Brook Stickleback (*Culaea inconstans*)	X	X
Northern Pike (*Esox lucius*)	X	X
Iowa Darter (*Etheostoma exile*)		X
Fantail Darter (*Etheostoma flabellare*)		X
Least Darter (*Etheostoma microperca*)		X
Johnny Darter (*Etheostoma nigrum*)	X	X
Brassy Minnow (*Hybognathus hankinsoni*)		X
Green Sunfish (*Lepomis cyanellus*)	X	X
Pumpkinseed (*Lepomis gibbosus*)		X
Bluegill (*Lepomis macrochirus*)	X	X
Common Shiner (*Luxilus cornutus*)		X
Largemouth Bass (*Micropterus salmoides*)	X	X
Golden Shiner (*Notemigonus crysoleucas*)		X
River Shiner (*Notropis blennius*)	X	X
Sand Shiner (*Notropis stramineus*)	X	X
Southern Redbelly Dace (*Phoxinus erythrogaster*)		X
Bluntnose Minnow (*Pimephales notatus*)	X	X
Fathead Minnow (*Pimephales promelas*)	X	X
Black Crappie (*Pomoxis nigromaculatus*)		X
Blacknose Dace (*Rhinichthys atratulus*)	X	X
Longnose Dace (*Rhinichthys cataractae*)	X	X
Southern Blacknose Dace (*Rhinichthys obtusus*)		X
Creek Chub (*Semotilus atromaculatus*)	X	X
Central Mudminnow (*Umbra limi*)	X	X

2.3.5 Reptiles & Amphibians

A list of reptiles and amphibians was assembled utilizing publications and available data that are known to occur within the watershed and have potential to occur within the study area. Amphibian and reptile habitat are very degraded or non-extant within the study except for those common and tolerant species. The most abundant riverine reptiles and amphibians within Honey Creek include, but are not limited to: bullfrog (*Lithobates catesbeiana*), green frog (*Lithobates clamitans*), northern leopard frog (*Lithobates pipiens*), American toad (*Anaxyrus americanus*), snapping turtle (*Chelydra serpentina*), painted turtle (*Chrysemys picta*), common gartersnake (*Thamnophis sirtalis*), common watersnake (*Nerodia sipedon*), DeKay's brownsnake (*Storeria dekayi*), blue-spotted salamander (*Ambystoma laterale*), eastern tiger salamander (*Ambystoma tigrinum*).

2.3.6 Birds

The western shoreline of Lake Michigan is recognized as "one of the most important flyways for migrant songbirds in the United States by many ornithologists and birdwatchers worldwide" (Shilling and Williamson, BCN) and is considered globally significant. An estimated 5 million songbirds use the north-south shoreline of Lake Michigan as their migratory sight line. The Cornell Lab of Ornithology e-Bird website was queried for observational bird data near Honey Creek. While data is not available for Honey Creek specifically, there is data available for two parks — Jacobus Park and Hawthorn Glen — which are within a 1.5 mile radius of the study area (Table 4). Species observed at the parks are likely like those that could be found utilizing Honey Creek and its riparian corridor. Of the 124 bird species observed within a 1.5-mile radius of the project, 37 are protected under the Migratory Bird Treaty Act. Additionally, seven of the species were listed on Audubon's 2014 State of the Birds report (Audubon 2014) as common species that have lost more than half of their global population over the past four decades.

Table 4 – Nesting & Migratory Birds Recorded from within 1.5 miles of Study Area

Common Name	Scientific Name	Common Name	Scientific Name
American crow	*Corvus brachyrhynchos*	House sparrow	*Passer domesticus*
American goldfinch	*Spinus tristis*	House wren	*Troglodytes aedon*
American kestrel	*Falco sparverius*	Indigo bunting	*Passerina cyanea*
American redstart	*Setophaga ruticilla*	Killdeer	*Charadrius vociferus*
American robin	*Turdus migratorius*	Least flycatcher	*Empidonax minimus*
American tree sparrow	*Spizella arborea*	Lincoln's sparrow	*Melospiza lincolnii*
American woodcock	*Scolopax minor*	Magnolia warbler	*Setophaga magnolia*
Baltimore oriole	*Icterus galbula*	mallard	*Anas platyrhynchos*
Bank swallow[a]	*Riparia riparia*	Mourning dove	*Zenaida macroura*
Barn swallow	*Hirundo rustica*	Mourning warbler	*Geothlypis philadelphia*
Bay-breasted warbler	*Setophaga castanea*	Nashville warbler	*Leiothlypis ruficapilla*
Belted kingfisher	*Megaceryle alcyon*	Northern cardinal	*Cardinalis cardinalis*
Black-and-white warbler	*Mniotilta varia*	Northern flicker	*Colaptes auratus*
Blackburnian warbler	*Setophaga fusca*	Northern parula	*Setophaga americana*
Black-capped chickadee	*Poecile atricapillus*	Northern rough-winged swallow	*Stelgidopteryx serripennis*
Blackpoll warbler	*Setophaga striata*	Northern waterthrush	*Parkesia noveboracensis*
Black-throated blue warbler	*Setophaga caerulescens*	Orange-crowned warbler	*Vermivora celata*
Black-throated green warbler	*Setophaga virens*	Ovenbird	*Seiurus aurocapillus*
Blue jay	*Cyanocitta cristata*	Palm warbler	*Setophaga palmarum*
Blue-gray gnatcatcher	*Polioptila caerulea*	Peregrine falcon[c]	*Falco peregrinus*
Blue-headed vireo	*Vireo solitarius*	Philadelphia vireo	*Vireo philadelphicus*
Broad-winged hawk	*Buteo platypterus*	Purple finch	*Haemorhous purpureus*
Brown creeper	*Certhia americana*	Pine siskin	*Spinus pinus*
Brown thrasher	*Toxostoma rufum*	Red-bellied woodpecker	*Melanerpes carolinus*
Brown-headed cowbird	*Molothrus ater*	Red-breasted merganser	*Mergus serrator*

Common Name	Scientific Name	Common Name	Scientific Name
Canada goose	*Branta canadensis*	Red-eyed vireo	*Vireo olivaceus*
Canada warbler	*Cardellina canadensis*	Red-headed woodpecker	*Melanerpes erythrocephalus*
Cape May warbler[a]	*Setophaga tigrina*	Red-shouldered hawk	*Buteo lineatus*
Carolina wren	*Thryothorus ludovicianus*	Red-tailed hawk	*Buteo jamaicensis*
Cedar waxwing	*Bombycilla cedrorum*	Red-winged blackbird	*Agelaius phoeniceus*
Cerulean warbler	*Setophaga cerulean*	Ring-billed gull	*Larus delawarensis*
Chestnut-sided warbler	*Setophaga pensylvanica*	Rose-breasted grosbeak	*Pheucticus ludovicianus*
Chimney swift[a]	*Chaetura pelagica*	Ruby-crowned kinglet	*Regulus calendula*
Chipping sparrow	*Spizella passerine*	Ruby-throated hummingbird	*Archilochus colubris*
Cliff swallow	*Petrochelidon pyrrhonota*	Rusty blackbird[a]	*Euphagus carolinus*
Common goldeneye	*Bucephala clangula*	Savannah sparrow	*Passerculus sandwichensis*
Common grackle[a]	*Quiscalus quiscula*	Scarlet tanager	*Piranga olivacea*
Common merganser	*Mergus merganser*	Sharp-shinned hawk	*Accipiter striatus*
Common yellow throat	*Geothlypis trichas*	Solitary sandpiper	*Tringa solitaria*
Cooper's hawk	*Accipiter cooperii*	Song sparrow	*Melospiza melodia*
Dark-eyed junco	*Junco hyemalis*	Spotted sandpiper	*Actitis macularius*
Downy woodpecker	*Picoides pubescens*	Swainsons' thrush	*Catharus ustulatus*
Eastern bluebird	*Sialia sialis*	Swamp sparrow	*Melospiza georgiana*
Eastern kingbird	*Tyrannus tyrannus*	Tennessee warbler	*Leiothlypis peregrine*
Eastern phoebe	*Sayornis phoebe*	Tree swallow	*Tachycineta bicolor*
Eastern screech owl	*Megascops asio*	Turkey vulture	*Cathartes aura*
Eastern towhee	*Pipilo erythrophthalmus*	Veery	*Catharus fuscescens*
Eastern wood-pewee	*Contopus virens*	Warbling vireo	*Vireo gilvus*
Fox sparrow	*Passerella iliaca*	White-breasted nuthatch	*Sitta caolinensis*
Gadwall	*Anas strepera*	White-crowned sparrow	*Zonotrichia leucophrys*
Golden-crowned kinglet	*Regulus satrapa*	White-eyed vireo	*Vireo griseus*
Golden-winged warbler	*Vermivora chrysoptera*	White-throated sparrow	*Zonotrichia albicollis*
Gray catbird	*Dumetella carolinensis*	Wild turkey	*Meleagris gallopavo*
Gray-cheeked thrush	*Catharus minimus*	Wilson's snipe	*Gallinago delicate*
Great blue heron	*Ardea Herodias*	Wilson's warbler[a]	*Cardellina pusilla*
Great crested flycatcher	*Myiarchus crinitus*	Winter wren	*Troglodytes hiemalis*
Great horned owl	*Bubo virginianus*	Wood duck	*Aix sponsa*
Hairy woodpecker	*Leuconotopicus villosus*	Wood thrush	*Hylocichla mustelina*
Hermit thrush	*Catharus guttatus*	Yellow warbler	*Setophaga petechial*
Herring gull[a]	*Larus argentatus*	Yellow-bellied sapsucker	*Sphyrapicus varius*
Hooded warbler	*Setophaga citrine*	Yellow-rumped warbler	*Setophaga coronate*
House finch	*Haemorhous mexicanus*	Yellow-throated vireo	*Vireo flavifrons*

[a] Common declining bird species

2.3.7 Mammals

A list of mammals was assembled utilizing publications and available data that are known to occur within the watershed and have potential to occur within the study area. Large mammal habitat is much degraded or non-extant within the study area; however, white-tailed deer (*Odocoileus viginianus*), coyote (*Canis latrans*), and red fox (*Vuples vulpes*) make up the large mammal potential for the study area. Small mammals that have the potential to occur within the study area include, but are not limited to black rat (*Rattus rattus*), Norwegian rat (*Rattus norvegicus*), eastern gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), eastern chipmunk (*Tamias striatus*), Virginia opposum (*Didelphis viginiana*), North American beaver (*Castor canadensis*), woodchuck (*Marmota monax*), muskrat (*Ondatra zibethicus*), striped skunk (*Mephitis mephitis*), eastern cottontail (*Sylvagius floridanus*), raccoon (*Procyon lotor*), American mink (*Neovison vison*), little brown bat (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), and silver-haired bat (*Lasionycteris noctivagans*).

2.3.8 Threatened and Endangered Species

Federal Threatened and Endangered Species

A query of the U.S. Fish and Wildlife Service's (USFWS) Environmental Conservation Online System Information for Planning and Consultation (ECOS-IPaC) on March 2, 2020 resulted in an official species list of federally-listed species that may be present within the project area. The obtainment of the official species list from ECOS-IPaC fulfills the requirement for federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action". Two federally-listed threatened, endangered, or candidate species were identified as potentially occurring within the project area (Table 5). No critical habitat has been designated within or adjacent to the project area.

Table 5 - Federally-listed Species with the Potential of Occurring within the Project Area.

Species Name	Federal Status	Habitat	Potential to Occur
northern long-eared bat (*Myotis septentrionalis*)	Threatened	Hibernates in caves and mines – swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests and woods during the summer.	**May occur**; no known hibernacula or maternity roosts within the project area. Suitable foraging habitat present.
rusty patched bumble bee (*Bombus affinis*)	Endangered	Found in grasslands with flowering plants from April through October, underground and abandoned rodent cavities or clumps of grasses above ground as nesting sites, and undisturbed soil for hibernating queens to overwinter.	**May occur**; suitable foraging habitat present.

Northern Long-eared Bat

Status. The northern long-eared bat (*Myotis septentrionalis*) is federally-listed as threatened.

Distribution and Habitat. The northern long-eared bat's range includes much of the eastern and north central United States. The species' range contains 37 states, including Wisconsin. During the summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities or in crevices of both live trees and snags. Males and non-reproductive females may also roost in cooler places, like caves and mines. During the winter, northern long-eared bats hibernate in caves and mines (USFWS 2015).

Potential for Occurrence. There are no known hibernacula within the vicinity of the project area. There may be suitable roosting habitat present at the project location, although, roosting of the species at this location is not known. In addition, the riparian area around Honey Creek may provide suitable foraging habitat for this species. Although there are no known roosting locations within the project area, the forested area surrounding Honey Creek does provide potential roosting habitat as well as potential foraging habitat during the summer for the northern long-eared bat. Therefore, there is the potential for the northern long-eared bat to occur within the project area.

Rusty Patched Bumble Bee

Status. The rusty patched bumble bee (*Bombus affinis*) is federally-listed as endangered.

Distribution and Habitat. Historically, the rusty patched bumble bee was broadly distributed across the eastern United States and Upper Midwest, from Maine in the U.S. and southern Quebec and Ontario in Canada, south to the northeast corner of Georgia, reaching west to the eastern edges of North and South Dakota. The species has been reported from 13 states, including Wisconsin. Rusty patched bumble bees once occupied grasslands and tallgrass prairies of the Upper Midwest and Northeast (USFWS 2019). Bumble bees need areas that provide nectar and pollen from flowers, nesting sites (underground and abandoned rodent cavities or clumps of grasses), and overwintering sites for hibernating queens (undisturbed soil) (USFWS 2019).

Potential for Occurrence. The rusty patched bumble bee map (https://www.fws.gov/midwest/endangered/insects/rpbb/rpbbmap.html) was used to determine if there were any areas of high potential for this species within the vicinity of the project location. The project area extending from the upstream end (i.e., utility line) downstream to approximately 200 feet upstream of Wisconsin Avenue is within the rusty patched bumble bee 'low potential zone'. The remainder of the project area extending from approximately 200 feet upstream of Wisconsin Avenue downstream to the confluence of Honey Creek with the Menomonee River is within the rusty patched bumble bee 'high potential zone'. In addition, the proposed disposal site for the project is in the rusty patched bumble bee 'high potential zone'.

A survey of the project area for the rusty patched bumble bee has not been conducted. Since the project area is located within a 'high potential zone' it is assumed that the bumble bee is present; however, it is not expected that the project area provides overwintering sites for hibernating queens. The rusty patched bumble bee requires undisturbed, sandy, loose soil for overwintering sites for hibernating queens. Soils in the area are disturbed and likely too compacted to provide suitable overwintering sites for hibernating queens. The project area does likely provide foraging habitat for the rusty patched bumble bee and potential nest sites.

Based on the information listed above and site assessments, there is the potential for federally-endangered and threatened species to occur within the study area. Since the purpose of the proposed project is ecosystem restoration it is expected that both the northern long-eared bat and the rusty patched bumble bee would benefit from the proposed project. Therefore, the USACE has determined that the project 'may affect but is not likely to adversely affect' the northern long-eared bat and the rusty patched bumble bee. A 'not likely to adversely affect' letter was provided to the U.S. Fish and Wildlife Service for review on June 29, 2020. The USFWS provided their concurrence with the 'not likely to adversely affect' determination in a letter dated July 20, 2020. For additional details on the assessment for the determination and the USFWS concurrence letter refer to Appendix A.

2.4 Cultural & Social Resources

2.4.1 Archaeological & Historical Properties

Within the study area the Civilian Conservation Corps (CCC) Camp Bluemound is the only identified archaeological site (Milwaukee County Department of Parks, Recreation, and Culture 2012). A Phase 1 archaeological survey was conducted in 2019 and no archaeological sites were identified within the study area.

The Honey Creek Parkway itself has been listed on the National Register of Historic Places. According to the National Register nomination, the period of significance for the parkway extends from 1932, with the implementation of the plan for the parkway, to 1955, when road improvements and lining of the creek were completed. The historic boundary is defined in the nomination and includes county-owned land that

follows the back edge of pavement along Honey Creek Parkway Drive and adjacent city roads. Contributing structures (Table 6 and Figure 10) within the parkway primarily are bridges that were constructed by the CCC. Between 1928 and 1941, the CCC constructed six masonry veneered reinforced concrete bridges with stone coming from the nearby Currie Park quarry. Additional resources within the study area include the Works Progress Administration (WPA) constructed retaining walls, located adjacent to the Portland Avenue Bridge (Bridge No. P-40-0770; AHI 140741) and intermittently lining the creek (Milwaukee County Department of Parks, Recreation, and Culture 2012).

Table 6 - Honey Creek Parkway List of Contributing Resources

Resource Name	Contributing/Noncontributing to Honey Creek Parkway National Register Property	Resource AHI No.	Construction Date
Honey Creek Parkway	Contributing	150321	1932
Honey Creek Parkway Drive	Contributing	203321	1932
Bridge No. P-40-0777	Contributing	140741	1933
Bridge No. P-40-0776	Contributing	140739	1934
Bridge No. P-40-0778	Contributing	140738	1933
Bridge No. B-40-0988	Contributing	149022	1928
Bridge No. B-40-0570	Contributing	140718	1933
WPA-constructed retaining walls (intermittently throughout parkway)	Contributing		1936
Honey Creek Camp (Archaeological Site)	Unknown		1933

Figure 10 – Location of Contributing National Register Property Within Honey Creek Parkway

2.4.2 Recreation

The study area lies completely within the 113.7 acres Honey Creek Parkway. The Honey Creek Parkway is centrally located in Milwaukee County between the communities of Wauwatosa in the north and West Allis in the south. The parkway features a natural setting with a curved parkway drive, pendant lighting, bridges, stone retaining walls, open meadows, mature deciduous and coniferous trees, and naturalized vegetation. Portions of the Oak Leaf Trail system fall within the Honey Creek Parkway, which provides active recreational pursuits such as biking, walking, jogging, and in-line skating. Also located within the study area are Hawthorne Outdoor Soccer Park and Dyer Playfield. Hawthorne Outdoor Soccer Park is located south of Portland Avenue and provides two full size soccer fields for recreational leagues as well as residents. Dyer Playfield is located between West Dixon Street to the south and West Blue Mound Road to the North provides a community ballpark.

2.4.3 Social Setting

Honey Creek is in southeastern Wisconsin within the Milwaukee and Wauwatosa city limits. Milwaukee is the 31st most populous city in the United States with just under 600,000 people. The U.S. Census Bureau's American Fact Finder and Quick Facts (U.S. Census Bureau 2019) for Milwaukee City, Wauwatosa City, Milwaukee County, and Wisconsin were reviewed for socioeconomic information presented in Table 7.

Table 7 - 2010 U.S. Census Data for the Cities of Milwaukee and Wauwatosa

Category	Milwaukee	Wauwatosa	Milwaukee County	Wisconsin
Population[a]				
Total Population	599,086	47,687	956,586	5,763,217
Under 18 years	26.2%	21.7%	24.3%	22.5%
Under 5 years	7.6%	7.1%	7.0%	5.9%
Race[a]				
White	35.8%	84.7%	52.2%	81.8%
Black or African American	38.5%	4.7%	26.1%	6.2%
American Indian and Alaska Native	0.4%	0.3%	0.5%	0.8%
Asian	4.0%	4.4%	4.1%	2.6%
Native Hawaiian and Other Pacific Islander	0.0%	0.0%	0.0%	0.0%
Hispanic of Latino	18.4%	3.5%	14.6%	6.6%
Some other race alone	0.1%	0.1%	0.1%	0.1%
Two or more races	2.7%	2.4%	2.5%	1.8%
Education[a]				
High School Graduate or Higher	83.0%	96.7%	87.4%	91.7%
Bachelor's Degree or Higher	23.8%	59.2%	30.1%	29.0%
Income & Poverty[a]				
Median Household Income	$38,289	$74,929	$46,784	$56,759
Below Poverty Level	27.4%	7.1%	20.5%	12.3%

[a] 2013-2017 American Community Survey 5-year Estimates

2.4.4 Summary of Native American Coordination

The following Native American tribes were contacted by letter date November 1, 2017 regarding the proposed ecosystem restoration along Honey Creek. Tribes contacted by letter included Bad River Band

of Lake Superior Chippewa, Forest County Potawatomi Community, Ho-Chunk Nation, Lac Courte Oreilles Band of Lake Superior Chippewa, Lac du Flambeau Band of Lake Superior Chippewa, The Menominee Indian Tribe of Wisconsin, Stockbridge-Munsee Band of Mohican Indians, Oneida Nation, Red Cliff Band of Lake Superior Chippewa, St. Croix Chippewa Community, and Sokaogon Chippewa Community. The Stockbridge-Munsee Band of Mohican Indians provided a response stating, "The project is not located in our cultural area of interest; therefore, we do not have comment or need to consult further." The Corps received no other responses. In addition to scoping, tribes were consulted by letter dated December 7, 2020 about the conditional 'no adverse effect' determination. The Corps received no response. Mailing list and coordination letters are provided in *Appendix A – 404(b)(1)/401 and Coordination*.

2.5 Forecasting Habitat Quality

Calculating predicted change in habitat quality was calculated by using a Habitat Suitability Index (HSI). The HSI is an algebraic function that typically uses various habitat structure components as indicators, such as cover, food, and natural processes, or biological components of species richness, abundance, evenness, etc. Two HSIs that were certified by the USACE's Center of Expertise for Ecosystem Restoration were used for this study. The Qualitative Habitat Evaluation Procedure (QHEI) reflects the river's physical habitat quality, and the FQA (page 17) reflects the quality of plant community as habitat. The QHEI and FQA were utilized to quantify Existing (EX), FWOP and Future With-Project (FWP) Conditions for the riverine and riparian portions of the study area. Fish and wildlife are highly indicative of habitat quality for riverine and riparian health, since they are highly responsive to primary (hydrology/hydraulics/geomorphology) and secondary (plants/habitat structure) ecosystem driver changes. Changes in habitat will directly affect the richness, abundance and distribution of study area fish and wildlife.

2.5.1 Qualitative Habitat Evaluation Index (QHEI)

The QHEI is a physical habitat index designed to provide an empirical, quantified evaluation of the lotic (flowing) macrohabitat characteristics that are important to fish communities (Ohio EPA 2006). A detailed analysis of the development and use of the QHEI is available in Rankin (1989) and Rankin (1995). The QHEI is composed of six principal metrics each of which are briefly described below. The maximum possible QHEI score is 100, and the lowest is a zero (0). Each of the metrics are scored individually and then summed to provide the total QHEI segment score. This was completed at least once for each sampling site during each year of sampling. The QHEI protocol also standardizes definitions for riverine habitats, for which a variety of existing definitions and perceptions exist. Consistency for these was derived from Platts et al. (1983). The USACE utilized the Ohio EPA protocol to collect data and score QHEI sites for Honey Creek.

QHEI Riverine Habitat Metrics

1. **Substrate:** This metric includes two components, substrate type and substrate quality and notes the presence of all substrate types present in pools/glides and riffles/runs that each comprise enough quantity to support species that may commonly be associated with that substrate type. This metric awards points to those sites with a diversity of high-quality substrate types, including concepts of siltation and embeddedness (the degree that cobble, gravel, and boulder substrates are surrounded, impacted in, or covered by fine materials). Maximum points are 20.
2. **In-stream Cover**: This metric scores presence of in-stream cover types and amount of overall in-stream habitat cover. These features include, but are not limited to deep pools, undercut banks,

islands, large boulders, large woody debris, aquatic vegetation, over hanging vegetation, etc. Maximum points are 20.

3. **Channel Morphology**: This metric emphasizes the quality of the stream channel that relates to the creation and stability of macrohabitat. It includes channel sinuosity, channel development, channelization, and channel stability. Maximum points are 20.
4. **Riparian Zone and Bank Erosion:** This metric emphasizes the quality of the riparian buffer zone and quality of the floodplain vegetation. This includes riparian zone width, floodplain quality, and extent of bank erosion. Each of the three components requires scoring the left and right banks (looking downstream). The average of the left and right banks is taken to derive the component value. Maximum points are 10.
5. **Pool/Glide and Riffle-Run Quality:** This metric emphasizes the quality of the pool/glide and/or riffle/run habitats. This includes pool depth, overall diversity of current velocities (in pools and riffles), pool morphology, riffle-run depth, riffle-run substrate, and riffle-run substrate quality. Maximum points are 20.
6. **Reach Gradient**: Local or map gradient is calculated from USGS 7.5-minute topographic maps by measuring the elevation drop through the sampling area. Gradient classifications (Table V-4-3 found in Ohio EPA 2006) were assigned by stream size category after examining scatter plots of IBI vs. natural log of gradient in feet/mile (see Rankin 1989). Maximum points are 10.

The principle theory underlying the QHEI model is that the integrity and structure of a riverine fish community is partially related to the physical characteristics of the habitat. The QHEI provides an indicator of habitat quality by measuring those physical factors which are known to affect fish communities. Rankin (1989) examined the relationship between the QHEI and the IBI. The analysis resulted in a significant positive relationship between QHEI and IBI scores further supporting the underlying assumptions of the model (Rankin 1989; Santucci et al 2005). The individual metrics in the model are all supported by fluvial geomorphologic principles as reported by literature and supported by empirical evidence.

As stated earlier in Chapter 2, much of the project area channel (6,700 LF) is lined with concrete, while the remainder of the project area channel (2,600 LF) is unlined and consists of natural substrates. The QHEI assessment does take into consideration the substrates, therefore, in order to account for the differences in substrate within the project area channel, the lined portion of the channel will be referred to as Reach 1 while the unlined portion of the channel will be referred to as Reach 2. Separate QHEI's were prepared for both Reach 1 and Reach 2 existing habitat conditions (EX) for Honey Creek. The separate QHEI's for each reach were then multiplied by a weighting factor to account for the discrepancy in the length of the two channel reaches. The weighted QHEI's for each reach were then averaged together to get an overall weighted average QHEI for the project area channel. Table 8 provides the EX habitat conditions for Reach 1 and Reach 2 and the average QHEI score for Honey Creek. Raw data sheets may be found in *Appendix H – Monitoring Plan and Habitat Analysis*.

Table 8 - Existing Condition QHEI Scores for Honey Creek

Category	Attribute	Honey Creek	
		Reach 1	Reach 2
Substrate	Type	9	17
	Quality	0	0
	Sum (Max 20 Points)	9	17
In-stream Cover	Type	1	8
	Amount	1	3
	Sum (Max 20 Points)	2	11
Channel Morphology	Sinuosity	1	2
	Development	1	3
	Channelization	1	1
	Stability	3	3
	Sum (Max 20 Points)	6	9
Riparian Zone	Width	3	1
	Flood Plain Quality	1	1
	Bank Erosion	3	3
	Sum (Max 10 Points)	7	5
Pool/Glide Quality, Current Velocity	Max Depth	0	1
	Current	2	3
	Channel Width	1	1
	Sum (Max 12 Points)	3	5
Riffle/Run Quality	Riffle Depth	0	1
	Run Depth	1	2
	Substrate Stability	0	2
	Substrate Embedded	0	1
	Sum (Max 8 points)	1	6
Gradient	(Max 10 Points)	4	6
QHEI Score (EX)		**32**	**59**

* calculated using Eco-PCX certified protocol

To tabulate the weighting factor for each reach, the total channel length was calculated followed by calculating the percentage each reach comprises of the total channel length. The percentage each reach comprises is used as the weight value and to calculate the weighting factor. To get the weighted QHEI scores, the original QHEI for Reach 1 was multiplied by the weighting factor for Reach 1, and the original QHEI for Reach 2 was multiplied by the weighting factor for Reach 2. The two-resulting weighted QHEI scores for Reach 1 and Reach 2 were then added together to get the average weighted QHEI score for the

total channel length. This method gives more weight to the QHEI score for Reach 1 since this reach comprises over two-thirds of the total channel length. Therefore, the average weighted QHEI is more representative of the entire channel. The weighting factors used to calculate the average weighted QHEI for the existing condition were also used in the determining the average weighted QHEI for the future without project condition and future with project condition.

Calculation of Total Channel Length and Portion of Total Channel Length Occupied by each Reach

- 6700 LF (Reach 1) + 2600 LF (Reach 2) = 9300 LF Total Channel Length
- (6700 LF (Reach 1) / 9300 LF (Total Channel Length)) * 100 = 72% (portion of total channel length Reach 1 accounts for)
- (2600 LF (Reach 1) /9300 LF (Total Channel Length)) * 100 = 28% (portion of total channel length Reach 2 account for)

Calculation of the Weighting Factor for each Reach

- Reach 1 accounts for 72% of total channel length, therefore weighting factor is 0.72
- Reach 2 accounts for 28% of total channel length, therefore weighting factor is 0.28

Calculation of Weighted QHEI Score for each Reach

- 32.0 (Reach 1 Original QHEI Score) * 0.72 (Reach 1 Weighting Factor) = 23.0 (Reach 1 Weighted QHEI Score)
- 59.0 (Reach 2 Original QHEI Score) * 0.28 (Reach 2 Weighting Factor) = 16.5 (Reach 2 Weighted QHEI Score)

Calculation of Weighted Average QHEI for Total Channel Length (Reach 1 and Reach 2 Combined)

- (23.0 (Reach 1 Weighted QHEI Score) + 16.5 (Reach 2 Weighted QHEI Score)) / 2 = 39.6 (Weighted Average QHEI for Total Channel Length)

The weighted average QHEI score for the total channel length is rounded up from 39.6 to 40.0 and is used for the HSI.

2.5.2 QHEI as the Habitat Suitability Index (HSI)

The HSI is the quality portion of the USACE's habitat assessment procedure to analyze measures, alternatives or plans in terms of ecosystem benefits/outputs. The QHEI has acceptable application for USACE HSI procedures in that the scoring of metrics and calculating an overall score is simple, and output interpretation is straightforward (see MEMORANDUM FOR CECW-LRD Recommendation for Regional Approval for Use of the Qualitative Habitat Evaluation Index 11 December 2014). The data required for input was gathered firsthand by USACE (2015). Since the QHEI model output is a score between 0-100, it is easily indexed to a score between 0 and 1.0; this provides uniform and useful information across USACE ecosystem studies. Existing condition (EX) HSI score for Honey Creek is 40.0 out of 100, which is classified as a "poor" habitat. The equation to normalize the weighted average QHEI score is:

- Weighted Average QHEI Score / 100 = HSI_{QHEI}
- $40.0/100 = .40_{\text{Average Weighted QHEI}}$

2.5.3 Stream Acres as Quantity Measure

USACE planning guidelines require that there be a quantity component to the habitat assessment for determining FWOP and FWP Conditions. Since the plant community assessment utilizes acres as the quantity unit, acres were used for riverine habitat to make the analyses equivalent and avoid double counting. About 8.2 acres of channel could be directly affected by this project.

- Acres = 8.2 could be directly affected by this project.

2.5.4 Stream Average Annual Habitat Units (AAHUs)

In order to equally assess measures, alternatives or plans, the benefit portion of the analysis must be annualized just as the costs are. The method per USACE planning guidelines typically assigns benefits over a 50-year period of analysis. This study used 50-years as a reasonable period of analysis, noting that benefits may be accrued in perpetuity; however, guidance limits the period of analysis to 50-years. Habitat Units (HUs) were calculated by:

- HSI_{QHEI} x Stream Acres Affected = HUs
- .40 x 8.2 = 3.25 HU_{EX}

FWOP and FWP Average Annual Habitat Suitability Index (AAHSI) are calculated by:

- HSI_{n50} / 50 years = AAHSI

AAHUs are calculated by:

- AAHSI x Stream Acres Affected = AAHUs

Even though there may be apparent benefits to be gained, there are still minor benefits existing in the Future-Without Project Condition, as evident by the average weighted QHEI score of 40.0. To ensure that existing benefits are not claimed by potential actions, only the net benefits gained are utilized. This unit is called the Net Average Annual Habitat Unit (NAAHU), which is represented as:

- FWP AAHUs – FWOP AAHUs = Net Average Annual Habitat Units ($NAAHU_{QHEI}$)

2.5.5 Floristic Quality Assessment (FQA)

The FQA is based on the Chicago Region's floristic coefficients of conservatism (C value) and native species richness developed by Swink and Wilhelm (1979). The C value is a numerical number between 0 and 10 that classifies a plant species as a weed (C = 0 – 3), a high quality, sensitive native plant (C = 7 – 10) and those species in between (C = 4 – 6). The C value of the FQA can be used to quantify the past, present and future effects on native plant communities. The mean C value for each plant community is calculated by:

$\bar{C}$ = Sum of the Coefficient of Conservatism / # of Native Species

Plants are exceptional indicators of short and long-term disturbance in terms of their immediate response to changes in geomorphology, soils and hydrology of an area. In turn, the change in plant community species and structure affects the animal assemblages utilizing them. Plant/animal associations for most

Chicago Region plants may be found on the Illinois Wild Flower Home Page (http://www.illinoiswildflowers.info/). The existing plant community is degraded riparian woodland. Table 9 provides the (EX) habitat conditions for the study area's existing plant community. FQA spread sheets may be found in *Appendix H – Monitoring Plan and Habitat Analysis*.

Table 9 - Existing Condition Mean C Values for the Study Area Plant Community

	Degraded Riparian Woodland
Total Species Richness	104
Native Species Richness	54
Mean C w/Adventives	1.28
FQA w/Adventives	13.0

2.5.6 Mean C Value as the Habitat Suitability Index (HSI)

The quality portion of the USACE's habitat assessment procedure is to analyze plant community measures, alternatives or plans, in terms of ecosystem benefits/outputs. The FQA has acceptable usability for USACE HSI procedures, in that the scoring of metrics and calculating an overall score is simple, and output interpretation is straightforward (http://cw-environment.usace.army.mil/model-library.cfm?CoP=Restore&Option=View&Id=318). The data required for input was gathered and quality checked by USACE botanists. Since the FQA model output (Coefficient of Conservatism) is a score between 0-10, it is easily indexed to a score between 0 and 1.0; this provides uniform and useful information across USACE ecosystem studies. Baseline floristic quality was surveyed in October 2017, which will serve as a comparison for predictions of changes to the plant community based on alternative future scenarios. Existing condition (EX) HSI scores for the study area are presented in (Table 10).

Table 10 - Mean C Values Conversion to HSI for Existing Conditions (EX)

Plant Community	Integrity	Mean C	EX HSI_{FQA}
Degraded Riparian Woodland	Poor	1.28	0.128

The equation to normalize the Mean C Value is:

- Mean C Value / 10 = HSI_{FQA}

2.5.7 Plant Community Acres as Quantity Measure

The plant community assessment utilized acres as the quantity unit. Table 11 provides the acres per existing plant community found within the study area (see Figure 11).

Table 11 - Acres of Existing Plant Community within the Study Area

Plant Community	Acres
Degraded Riparian Woodland	48.7

2.5.8 Plant Community AAHUs

In order to equally assess measures, alternatives or plans, the benefit portion of the analysis must be annualized just as the costs are. The method per USACE planning guidelines typically assigns benefits over a 50-year period of analysis, or project life. This study will use 50-years as a reasonable period of analysis, noting that the benefits may be accrued in perpetuity. HUs are calculated by:

- HSI x Plant Community Acres Affected = HUs

Table 12 shows the HUs for the existing plant community. Figure 11 shows the existing habitat conditions.

Table 12 - Existing (EX) Habitat Units (HUs) for Degraded Riparian Woodland Plant Community

Plant Community	Integrity	Mean C	EX_HSI$_{FQA}$	Acres	EX_HUs	EX_AAHUs
Degraded Riparian Woodland	Poor	1.28	0.13	48.7	6.33	6.33

FWOP and FWP Average Annual HSI are calculated by:

- HSI_{n50} / 50 years = $AAHSI_{FQA}$

AAHUs are calculated by:

- AAHSI x Plant Community Acres Affected = $AAHU_{FQA}$

Even though there may be apparent benefits to be gained, there are still benefits existing in the Future-Without Project Condition within the existing plant community, as evident by the Mean C Value. To ensure that existing benefits are not claimed by potential actions, only the net benefits gained are utilized. This unit is called the NAAHU, which is represented as:

- FWP AAHUs – FWOP AAHUs = Net Average Annual Habitat Units ($NAAHU_{FQA}$)

Figure 11 – Honey Creek Existing Habitat Conditions and Associated Acreages

2.6 Future Without-Project Conditions / No Action

Conditions within the Menomonee River watershed (excluding Honey Creek) are expected to gradually improve over the next 50 years. The MMSD is currently removing 3,100 LF of concrete lining on the Menomonee River downstream of Honey Creek. Additionally, the USACE Detroit District is pursuing an ecosystem restoration project on the Menomonee River adjacent to MMSD's project that removes the final barrier to fish passage from Lake Michigan. Overall gains in water quality, sediment quality, and habitat availability are expected to occur as a result of regulation and restoration efforts by the local government entities. Other foreseen restoration projects are primarily focused on connectivity and aquatic habitat restoration within the Menomonee and Milwaukee Rivers. Regarding Honey Creek specifically, there are no current or future plans for large scale connectivity or aquatic habitat restoration projects; therefore, the degraded condition of Honey Creek is expected to remain relatively static. In terms of riverine and riparian plant community habitat, the reach of Honey Creek within the study area has achieved a stable but degraded state in terms of presence of non-native/invasive plant species and is not expected to further degrade.

Climate change is expected to have a negligible impact on the study area during the 50-year period of analysis in terms of ecosystem structure and function; however, project performance is preserved under a wide range of possible climate change scenarios during the period of analysis. There is a potential for average global temperatures to increase, storms to become more intense, and droughty periods with singular high rainfall events. The key to sustainability within these conditions is to have highly diverse (heterogenous genotypes) riparian plant communities established so that they can ebb and flow with the changing climate patterns, which is termed *adaptation* or *natural selection*. The anthropogenic changes to the Honey Creek aquatic ecosystem complex have caused greater adverse impacts than climate change is anticipated to induce, and the river already has a high degree of hydrologic flashiness due to the urban nature of the watershed. Minor increases or decreases in stream flows would have no significant bearing on habitat and connectivity, whereas natural fluvial geomorphic functions and processes would allow the ecological system to adapt accordingly.

Existing conditions (EX HSI), therefore, are expected to be quite indicative of the hydrologic Future Without-Project Conditions (FWOP HSI) for both riverine and riparian communities.

FWOP Conditions Quantified

In terms of ecosystem health, the existing conditions (EX HSI_{QHEI} and EX HSI_{FQA}) would be quite indicative of the Future Without-Project Conditions (FWOP HSI_{QHEI} and FWOP HSI_{FQA}), since without a federal project, management efforts would not be able to remedy the adverse effects caused by past impairments. The effects induced by past impairments have imparted its damage long ago (1850s – 1970s) and the affected area is now in relative equilibrium, since the concrete lined channel is highly stable and does not allow for change to the river or riparian zones without intervention. The assumptions and analysis determined that the riverine EX and FWOP Conditions are equivalent. However, it is important to note that historically, transitional meadows and persistent marshes would have also been present along Honey Creek. Since transitional meadow and persistent marsh habitat would have historically been present along Honey Creek, and the project looks at restoring these community types, to provide a FWOP baseline these community types are accounted for in the FWOP Condition. They are not accounted for in the EX Condition since they do not currently exist within the Honey Creek project area. Figure 12 shows the FWOP AAHUs achieved per habitat type and project over the 50-year planning period of analysis. Table 13 shows how the existing habitat conditions were used to project the FWOP habitat Conditions and AAHUs.

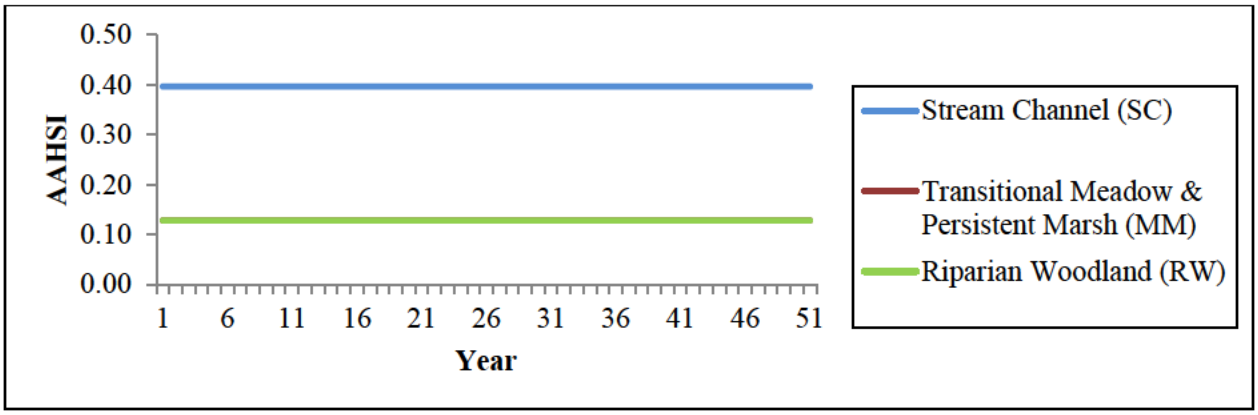

Figure 12 - FWOP Average Annual Habitat Suitability Index (AAHSI) Forecast

Table 13 - Riverine & Riparian FWOP AAHSI & AA Habitat Units

Condition	Habitat Types	Acres	EX HSI	AAHSI	EX HUs	FWOP AAHUs
Existing	Stream Channel	8.2	0.40		3.25	
	Degraded Riparian Woodland	48.7	0.13		6.33	
No Action / FWOP	Stream Channel	8.2		0.40		3.25
	Transitional Meadow and Persistent Marsh[a]	0		0.13		0.00
	Riparian Woodland	48.7		0.13		6.33

[a] Note that transitional meadow and persistent marsh are not present in the existing condition, nor are they likely to occur in the FWOP Condition without a federal project. However, these habitats would have historically occurred in Honey Creek, therefore, they are noted in the FWOP Condition. They would occur in areas that are currently occupied by the degraded riparian woodland, therefore, if they existed their AAHSI would be the same as Riparian Woodland. However, since they don't exist currently, there is no acreage associated with them.

CHAPTER 3 – Problems & Opportunities

This chapter provides a description of identified problems within the study area along with opportunities for improvement. It also outlines the overall project goal along with a list of planning objectives and constraints.

3.1 Problems and Opportunities

Human activity over the past two centuries has altered the geomorphology, hydrology, hydraulics, sediment transport, groundwater recharge/discharge, soils and plant communities historically present within the watershed, floodplain and river channel of Honey Creek. These modifications have subsequently caused structural habitat degradation, fragmentation, pollution and invasive species issues, all of which are intertwined. Although common animal species such as beaver, fox, coyote and residential city birds are frequently observed in these ruderal (human induced) thicket habitats, alterations to the system have significantly reduced species richness, abundance and distribution of native plant and animal assemblages, and suppressed biodiversity as a whole. As a result, ecosystem heterogeneity and water quality have become a great concern for the watershed. The impacts of these trending problems can be lessened and ultimately reversed via on-the-ground and institutional efforts. This study provides a look at lines of opportunity to provide restored river miles, acres of wetland, fish, wildlife and important migratory bird habitat.

3.1.1 Study Area Problems

The study reaches of Honey Creek have been channelized to obtain faster flow and increased capacity during floods. Loss of riparian zone and side-stream wetlands have resulted in in-stream habitat degradation, loss in resiliency and morphology of natural banks, reduced natural organic inputs (woody debris/leaves/insects) and poor water quality. Concrete channels further eliminated in-stream habitat to a total loss, elevate water temperatures too warm for most aquatic life and can biologically fragment stream reaches. Accordingly, riparian, wetland and stream ecosystems have been severely impacted with reduced abundance, diversity and health of aquatic and riparian organisms. Specific problems include but are not limited to:

1. Loss of Fluvial-geomorphic Processes (Riverine Habitat)
    a. Loss of cut & fill alluviation (actively meandering and migrating)
    b. Abnormal sediment inputs, transport and substrate sorting
    c. Instability of banks, streambank armoring and lack of native vegetation
        i. Portions of the channel have been armored with gabion baskets, WPA walls, etc., whereas other portions of the channel have no armoring and are experiencing erosion
    d. Loss of habitat features (e.g. riffles, pools)
    e. Flow velocities homogenized (hydraulics)
    f. Presence of foreign debris and loss of natural organic debris (e.g., large wood)
2. Degradation of Hydrologic Regime
    a. 90% impervious surface across watershed
    b. Natural hydrologic inputs altered
    c. Flashy urban hydrography with extremely high flood flows
    d. Loss of hydro periods
    e. Fragmentation of channel by culverts, abutments and channelization
    f. Loss of hyporheic zone connectivity
3. Loss of Riparian Zone
    a. Reduced extent of riparian buffers

    b. Habitat fragmentation
    c. Loss of riparian inputs (large woody debris, leaf litter, insects/other food)
4. Loss of Species Richness (riverine and riparian native species)
    a. Extirpation through physical removal; development/agriculture
    b. Loss in remnant areas via invasive species and other degradation
    c. Fragmentation of stream channels and riparian zones

When evaluating the entire suite of species that utilize the river and riparian corridor within the study area, it becomes clear that many native insect, fish, amphibian, reptile and bird species are limited due to the need of functional and connected habitat zones. The lack of riparian woodland connecting to the stream has resulted in the loss of native species, primarily amphibians, reptiles and birds. The habitat quality assessments of the riverine and riparian habitats utilizing the QHEI and FQA (respectively), provided a qualitative basis for confirming these holistic and chronic problems.

3.1.2 Specific Study Area Opportunities

Based on site qualitative and quantitative investigations, and aside from the synthetic hydrogeomorphic changes to the system, there are several aquatic resource opportunities within Honey Creek that could be addressed by the Section 206 Authority:

- Opportunity to restore passage for mussel and fish species to access habitat within Honey Creek
    - Mussels depend on fish passage for dispersal, fish being glochidia (larval) hosts
- Opportunity to provide varied riverine (lotic/flowing) velocities and forces that riverine species require
- Opportunity to restore hyporheic zone connectivity – reliability of flow consistency and connectivity with groundwater
- Provide natural sediment (substrate) transport
    - Restore substrate composition and sorting
    - Provide natural macro-habitat features
        - Islands, deep pools, riffles, native aquatic vegetation, bars, undercut banks
    - Restore ability to naturally filter and clean water and sediments (substrates)
        - Moving water facilitates cleansing as substrates (sediment) move through the river becoming exposed to saprophytes (animals, bacteria, fungi) and oxygen
- Restore native species richness and composition of riparian zone plant communities
    - Restore structural diversity (monotypic thickets)
    - Provide diverse food sources
    - Reduce noxious chemical sources from non-native plants (i.e. European buckthorn, garlic mustard)
    - Restore longitudinal (along the river) and lateral (up the bank) connectivity
- Continue to provide adequate flood conveyance, while providing improved habitat

3.2 Goal & Objectives

3.2.1 Goal

The goal of this study is to determine a cost effective and ecologically beneficial plan which would restore a sustainable and connected riverine and riparian habitat, while considering No Action as a baseline alternative.

3.2.2 Objectives

Federal Ecosystem Objectives

The Federal Objective of water and related land resources planning is to contribute to national economic and/or ecosystem development in accordance with national environmental statutes, applicable executive orders, and other federal planning requirements and policies. The use of the term "federal objective" should be distinguished from planning/study objectives, which are more specific in terms of expected or desired outputs, whereas the federal objective is considered more of a national goal. Water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to study objectives and to the Federal Objective. Contributions to national improvements are increases in the net value of the output of national goods, services and ecosystem integrity. Contributions to the Federal Objective include increases in the net value of those goods, services and ecosystems that are, or are not, marketable.

Restoration of the nation's environment is achieved when damage to the environment is reversed, lessened, eliminated or avoided, and important cultural and natural aspects of our nation's heritage are preserved. The objectives and requirements of applicable laws and executive orders are considered throughout the planning process in order to meet the Federal Objective. The following laws and executive orders that specifically provided guidance for this study are not limited to, but include:

- Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)
- Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661)
- Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 et seq.)
- Responsibilities of Federal Agencies to Protect Migratory Birds (E.O. 13186)
- Clean Water Act of 1977, as amended (33 U.S.C. 1251 et seq.)
- National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.)
- Invasive Species (E.O. 13112)
- Nonindigenous Aquatic Nuisance Prevention & Control Act of 1990, as amended (16 U.S.C. 4701 et seq.)
- National Invasive Species Act of 1996 (P.L. 104 – 332)
- Protection of Wetlands (E.O. 11990)
- Protection and Enhancement of Environmental Quality (E.O. 11514)
- Floodplain Management (E.O. 11988)

Responsibilities of Federal Agencies to Protect Migratory Birds (E.O. 13186)

Migratory birds are of great ecological and economic value to this country and to other countries. They contribute to biological diversity and bring tremendous enjoyment to millions of Americans who study, watch, feed, or hunt these birds throughout the United States and other countries. The United States has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds. Such conventions include the Convention for the Protection of Migratory Birds with Great Britain on behalf of Canada 1916, the Convention for the Protection of Migratory Birds and Game Mammals-Mexico 1936, the Convention for the Protection of Birds and Their Environment- Japan 1972, and the Convention for the Conservation of Migratory Birds and Their Environment-Union of Soviet Socialist Republics 1978.

These migratory bird conventions impose substantive obligations on the United States for the conservation of migratory birds and their habitats, and through the Migratory Bird Treaty Act (Act), the United States has implemented these migratory bird conventions with respect to the United States. This Executive Order directs executive departments and agencies to take certain actions to further implement the Act (….)

(g) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.
(h) "Action" means a program, activity, project, official policy (such as a rule or regulation), or formal plan directly carried out by a Federal agency. Each Federal agency will further define what the term "action" means with respect to its own authorities and what programs should be included in the agency-specific Memoranda of Understanding required by this order. Actions delegated to or assumed by nonfederal entities, or carried out by nonfederal entities with Federal assistance, are not subject to this order. Such actions, however, continue to be subject to the Migratory Bird Treaty Act.

This study/project has great potential to provide critical migratory bird food and cover. The potential exists for returning ecosystem functions to a long stretch of migratory corridor along Honey Creek which resides within the Lake Michigan Route of the Mississippi Flyway.

Planning Objectives

As part of the USACE Civil Works mission, the Federal Objective of ecosystem restoration projects is to restore the structure, function and dynamic processes of degraded ecosystems to a less degraded, more natural condition. The non-federal sponsor has an ecosystem restoration objective that partners well with the Federal Objective stated above. Study objectives are statements that describe the desired results of the planning process by solving the problems associated with the study purpose, problems and opportunities. Objectives must be clearly defined and provide information on the effect desired, the subject of the objective (what will be changed by accomplishing the objective), the location where the expected result will occur, the timing of the effect (when would the effect occur), and the duration of the effect.

Two (2) planning objectives were identified by the study team, the non-federal sponsor and various stakeholders. These will be used as targets for solving aquatic resource problems within the study area:

Objective 1 – Reestablish Quality and Connectivity of Riverine Habitats

Currently, Honey Creek is impaired by concrete lining its channel, which in turn has effectively eliminated aquatic habitat. Due to the highly urbanized watershed and presence of the concrete lining there is no natural recovery mechanism for habitat structure. These impairments are specific to impeding riverine hydraulics, sediment transport and substrate sorting, resulting in a loss of structural habitat heterogeneity (geomorphology). The effects desired by meeting this objective are to provide riverine functions and/or structure to restore, connect and sustain habitats. The targeted location of these affects would be in the reach of creek within the study area. This objective seeks to reestablish natural fluvial geomorphic parameters (hydraulics, substrates) and structures to support riverine habitats within the study area. Improvement is measured via the predicted increase in quality of riverine habitat (FWP HSI (QHEI)). This objective could be achieved within approximately 5 years and is expected to be sustained at least 50 years (i.e., the life of the project).

Objective 2 – Reestablish Quality and Connectivity of Riparian Habitats

Currently, the study area is devoid of any natural riparian plant communities. Aside from small patches, the lack of native plants has effectively reduced native species richness of insect, amphibian, reptile, bird, and mammal species. The effect desired by meeting this objective is to return tracts of healthy native riparian zone. The targeted location of these affects would be within the zones adjacent to the river. This objective seeks to reestablish native riparian woodland plant community species richness and structure for resident and transient riparian animal species. Improvement is measured via the predicted increase in distribution in plant quality as measured by the increase in habitat quality (FWP HSI (FQA)). This

objective could be achieved within approximately 5 years and is expected to be sustained at least 50 years (i.e., the life of the project).

3.3 Planning Constraints

The PDT has identified six planning constraints for this study. The following planning constraints are statements about things the proposed project wants to avoid doing or things within the proposed project area that cannot be changed.

1. Avoid and minimize adverse changes to municipal infrastructure such as, stormwater outfalls, transportation, utilities, etc.;
2. Avoid inducing flood conditions both up- and downstream of the project;
3. Avoid potential impacts to the CCC Camp Bluemound, an archaeological site;
4. Avoid potential impacts to Honey Creek Parkway and its contributing structures which are listed on the National Register of Historic Places; and
5. Minimize visual, sound and travel disruptions to the surrounding urban area during project construction.

CHAPTER 4 – Plan Formulation & Evaluation

The formulation, evaluation, and comparison of alternative plans comprise the third, fourth, and fifth steps of the USACE planning process. These steps are often referred to collectively as "plan formulation". Plan formulation is an iterative process that involves cycling through these steps to develop a reasonable range of alternative plans, and then evaluating and comparing those plans to select a final recommended plan, which is feasible for implementation.

Plan formulation for ecosystem restoration presents a challenge because alternatives have non-monetary benefits. To facilitate the plan formulation process, the Study Team used the methodology outlined in USACE Engineering Regulation, ER 1105-2-100, Planning Guidance Notebook. The steps in the methodology are:

1. Identify a primary project purpose. For this study, ecosystem restoration (ER) is identified as the primary purpose.
2. Formulate and screen management measures to achieve planning objectives and avoid/minimize planning constraints. Measures are the building blocks of alternative plans.
3. Formulate, evaluate, and compare an array of alternatives to achieve the primary purpose and identify cost effective plans.
4. Perform an incremental cost analysis on the cost-effective plans to determine the NER plan.

4.1 Habitat Measures

The alteration, fragmentation, and finally loss of natural habitats are major causes of the increasingly rapid decline in biotic diversity on Earth (Burgess & Sharpe 1981; Harris 1984; Saunders et al. 1987; Marzluff & Ewing 2001). To solve such problems one must consider not only the dynamics of the target species, but also the changes in the abiotic structure and processes surroundings (Per Angelstam 1992). Therefore, the following measures specifically address the resource problems by taking the opportunity to target the abiotic conditions of the Honey Creek fluvial geomorphic setting as the two planning objectives illustrate.

4.1.1 Habitat Management Measure Identification & Screening

The following habitat restoration measures were developed by the PDT and non-federal sponsor. In addition, the PDT and non-federal sponsor developed the habitat restoration measures to include the use of natural and/or nature based features to achieve aquatic and riparian habitat restoration. The advantages, disadvantages, and unknowns associated with each measure were also determined. Each restoration measure was initially evaluated for their effectiveness in addressing study area problems (refer to Section 3.1.1. Study Area Problems) and achieving the project goals and objectives (refer to Section 3.2.2 Objectives), while maintaining the ability to be implemented under the project authority. Based on this initial screening process, no measures were eliminated from further consideration. All measures were kept for further consideration, combined into different arrays of alternative plans, and evaluated for cost-effectiveness based on habitat outputs and costs. Figure 20 and Figure 21 depict an overview of the physical and biological measures proposed for Honey Creek.

Stream Channel Restoration (SCa and SCb)

Concrete Removal – This effort under the Stream Channel Restoration Option A (SCa)1 and Stream Channel Restoration Option B (SCb) measures seeks to remove the concrete lining the Honey Creek stream channel within the targeted study area. Approximately 6.0-acres of intact and broken concrete

would be excavated from the stream channel and disposed of. The non-federal sponsor, MMSD, is currently in the process of purchasing approximately 19.7 acres of land from Milwaukee County, where the excavated concrete would be disposed of (refer back to Figure 13). The property is generally located between West Morgan Avenue to the north, South 116th Street to the east, 112th Street to the south, and South River Ridge Boulevard to the west. The disposal property is located within approximately 5 to 6 miles of the project location. Only about 4.7 acres of the 19.7-acre site would be needed for disposal of the concrete from the Honey Creek channel. In addition, approximately 0.86 acres of property owned by the City of Greenfield, adjacent to the Milwaukee County parcel, would be needed temporarily for access to the material disposal site. Concrete beneath the bridges was assumed to remain in place in order to not jeopardize the integrity of the bridges. If in the future any of the bridges within the project area are replaced by the Wisconsin Department of Transportation (WisDOT), then concrete from under the bridges may be removed, where consistent with the bridge replacement design, as part of the WisDOT bridge replacement project.

Figure 13 – Location of Proposed Concrete Disposal Area

A second option for concrete disposal was originally considered; however, it was eliminated from further consideration during the planning phase. It was proposed that the concrete in Honey Creek could be removed from the channel, crushed and cleaned on site, and then buried either beneath the channel, beneath the floodplain, or a combination of the two. There was concern that burying the concrete on site could affect the waterway by influencing the pH of the stream. Therefore, the PDT, along with the non-federal sponsor, eliminated this option from further consideration for this project.

Geomorphic Contouring – This effort under the SCa and SCb measures seeks to create a more functional and naturalistic geomorphology of the Honey Creek within the targeted study area. Honey Creek is currently a confined channel, which causes high shear stress on the stream bottom and banks. This effectively removes or degrades channel habitat structure and could lead to mass wasting and slumping of banks as the stream moves towards dynamic equilibrium. Geomorphic contouring seeks to alleviate the shear stress of the confined channel via opening up various areas of the riparian zone to allow anything over the 5-year flood into a floodplain terrace, or what is termed a Two-Stage Creek. Subsequent to concrete removal, the stream channel would be optimally graded to recreate the wetted channel width, thalweg (low-flow channel), banks and slopes, floodplain terraces, persistent marsh and transitional meadow areas (Figure 14). Floodplain and non-floodplain areas could be excavated low enough to where annually persistent wetlands could be developed. This would require excavating down to the water table in non-flooded areas. Concerns for flooding outside of the public owned properties would be alleviated by optimizing floodplain zone areas and additions of small earthen berms around floodplain zones.

Figure 14 – Example of Reestablishment of Floodplain Connectivity, Underwood Creek, WI Section 506

Stream Substrates, Development & Connectivity – This effort is where SCa and SCb are different. Once the concrete is removed from the lined portion of the Honey Creek channel, substrates would need to be brought in to create habitat for macroinvertebrates and bottom-dwelling fish. Under SCa, a single layer of 6 to 15-inch diameter cobbles would be placed in the channel. Void spaces in the cobble layer would be filled with a mixture of crushed aggregate (approximately 0 to 6 inch in diameter) and 3 to 9-inch diameter cobbles depending on the void space size. Under SCb, a mixture of substrates would be placed

to a depth of approximately 1-inch throughout the entire channel. The substrate mixture would be comprised of 20% sand, 60% gravel (up to 3-inch diameter) and 20% pebble/cobbles (3-9-inch diameter).

Stream development under both SCa and SCb would be restored by placing boulder and cobble riffles, j-hooks, cross-veins, bars and other stream development features (Figure 15). All material used for stream development would be indicative of the unimpaired reaches of Honey Creek, which are typically glacially derived sands, gravels, cobbles and erratic boulders. Quarried or shot rock (dolomitic/granite riprap) would not be specified for stream development features. All major core boulder stones for stream development features would be appropriately sized to just be large enough not to move due to shear stress from the new hydraulic regime created by concrete removal, bank grading and floodplain terracing. All bridge crossings would be fitted with a boulder and cobble riffle on the downstream end to ensure fish passage during low to normal flows. These would be constructed to avoid future slumping and allowing the stream to become fragmented again.

Figure 15 – Example of Stream Development Restoration, Red Mill Pond Section 506

Large Woody Revetments – Since the targeted study area corridor is located within a tightly situated urban area, Honey Creek cannot be allowed to significantly meander or migrate. This effort under both SCa and SCb, in combination with the other in stream structures, would prevent channel meandering via stabilizing the stream bends by providing a diverse habitat interface between the water and the bank, and a robust under-structure of timber and stone (Figure 16). Undercut banks in combination with large rootwads are known to be a highly productive habitat in small streams, for both game fish and rare sensitive species such as the western blacknose dace (*Rhinichthys obtusus*). Rootwads will eventually rot

away depending on the species of wood used, however, this temporary condition is accounted for by planting stream bank trees on top of the revetment, such as Sycamore, which can naturally armor banks with their roots. The rock core beneath would allow for undercutting of the rootwad, but not allow the bank to erode. Stone buried within the bank that does not interface with the stream water can be reused concrete rubble and/or quarried riprap. Stone at the water interface would be a mix of large glacio/fluvio boulders and cobble.

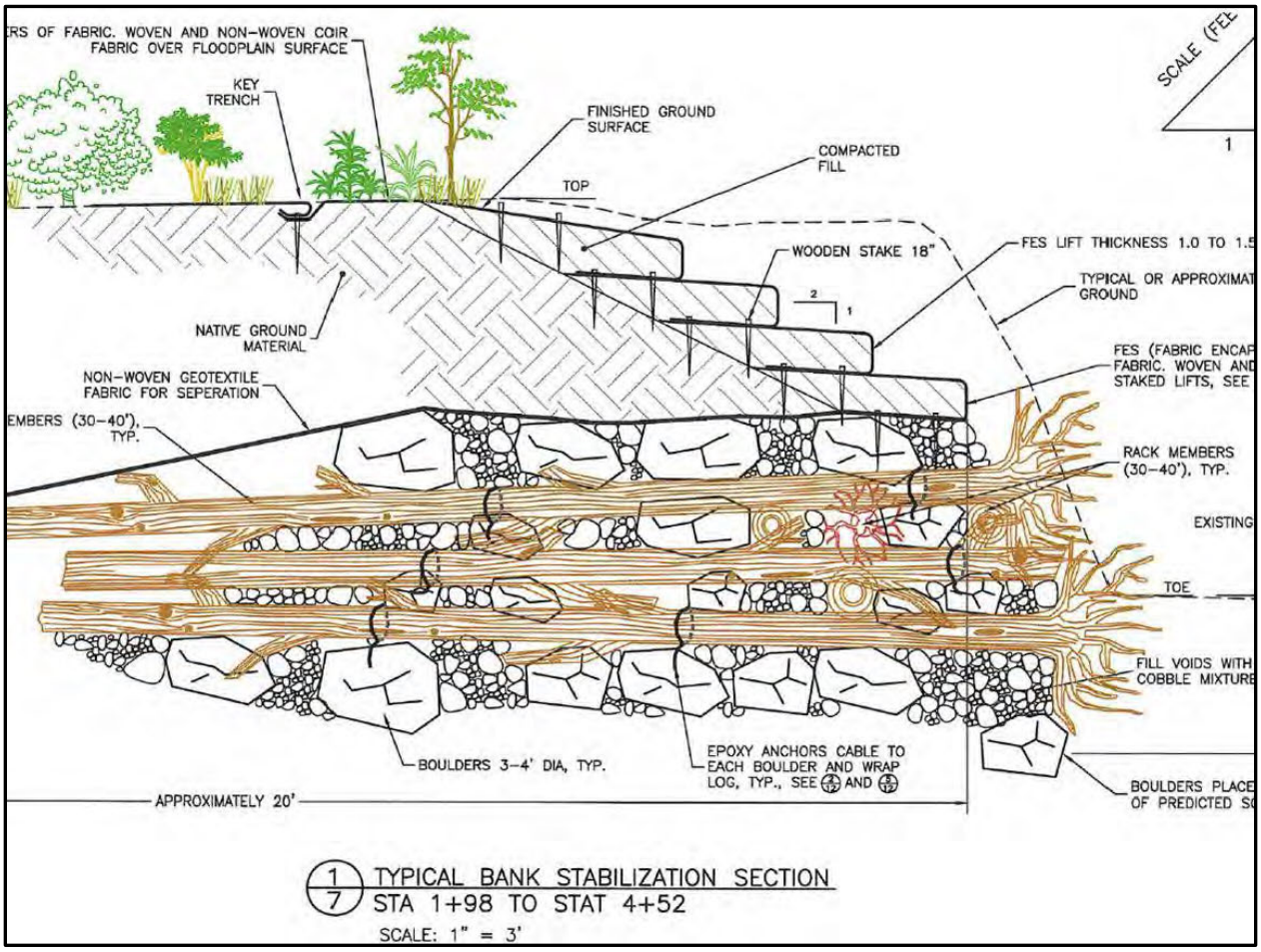

Figure 16 – Example of Large Woody Revetment at Stream Bends, River Riparian Section 206

Transitional Meadow and Persistent Marsh (MM)

Early records of the Milwaukee, Menomonee, and Kinnickinnic Rivers and their tributaries (e.g., Honey Creek) reveal the presence of a significant wetland complex with an abundance of hydrophytic emergent vegetation. Persistent marsh would be restored in floodplain and non-floodplain areas that are excavated low enough to connect to the water table (Figure 17). This measure is dependent on the Stream Channel Restoration measure since marsh and meadow habitat cannot be restored if the stream is not reconnected to its floodplain. This measure does not include invasive and/or exotic species removal. Some conservative species to be reestablished in transitional meadow areas, but are not limited to, include Emory's sedge, American lotus, pickerel weed, American water-plantain, and green arrow-arum. Some conservative species to be reestablished in persistent marsh areas, but are not limited to, include swamp-loosestrife, rice cut grass, northern water-horehound, and sweet coneflower.

Approximately 1.1 acres of transitional meadow and 1.1 acres of persistent marsh would be restored. Transitional meadow and persistent marsh plant species would be primarily plugged and minimally seeded over the whole area. These plantings would be protected with anti-predatory (e.g., Canada geese and common carp) meshing/fending until established. Native plant species lists for the FWP Condition are in *Appendix H – Monitoring Plan and Habitat Analysis*. Measure activities include:

- Minimally seed areas with native aquatic macrophyte seed mix (1.1 acres) and native hydrophytic emergent plant seed mix (1.1 acres)
- Plant plugs of aquatic macrophyte and hydrophytic emergent plan species to provide habitat structure and diversity
- Hand-wicking (herbicide) invasive species for remainder of project

Figure 17 – Example of Restored Riverine-Persistent Floodplain Wetland, Eugene Field Park Section 206

Riparian Woodland (RWa, RWb, and RWc)

Invasive Species Removal – This effort under Riparian Woodland Option A (RWa), Riparian Woodland Option B (RWb), and Riparian Woodland Option C (RWc) seeks to address invasive and non-native plant species from all plant communities located within the Honey Creek targeted study area. Over 50% of the current riparian plant community consists of invasive and non-native species, with those of particular

concern including, but not limited to, European buckthorn, Norway maple, garlic mustard, mother-of-the-evening, showy fly honeysuckle, sweet-clover, and reed canary grass.. The RWa, RWb, and RWc measures would address those areas that were not graded for purposes of stream channel restoration (SCa or SCb) or other floodplain/wetland excavation areas, as clearing and grubbing for this effort would effectively remove all plant species. This effort is a one-time activity, with all spot treatments during establishment periods accounted for under the individual plant community measures. All non-native and weedy species are identified on the plant inventory sheets in *Appendix H – Monitoring Plan and Habitat Analysis*. Some notable features of this measure include:

- Removal of non-native vegetation through herbicide and mechanical methods
- Spot herbicide or hand pull all invasive aquatic and terrestrial species in quality native areas
- Perform prescribed burns in recommended areas

Native Plant Establishment – This effort under Riparian Woodland Option A (RWa), Riparian Woodland Option B (RWb), and Riparian Woodland Option C (RWc) seeks to establish a diverse riparian woodland native plant community along the Honey Creek stream corridor. Tree canopy structure would be restored in a threefold manner: 1) by removing invasive adventive tree species such as European buckthorn and Norway maple (Figure 18) 2), leaving native mature red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), common hackberry, green ash, black walnut (*Juglans nigra*), and the oaks (*Quercus* spp.) 3) planting more of the native trees previously mentioned.

The secondary understory of woodland would be restored by removing invasive shrub thickets, such as Asian bittersweet (*Celastrus orbiculatus*), winged euonymus (*Euonymus alatus*), honeysuckles (*Lonicera* spp.), European privet (*Ligustrum vulgare*) and European buckthorn, and planting native understory trees and shrubs, such as swamp loosestrife (*Decodon verticillatus*), pale dogwood (*Cornus obliqua*), and red osier (*Cornus stolonifera*). The ground layer understory would be restored by a removing a long list of herbaceous weeds such as garlic mustard, burdock (*Arctium* spp.), spotted knapweed (*Centaurea maculosa*), ground ivy (*Glechoma hederacea*), reed canary grass and common reed (*Phragmites australis*) and replanting with native understory species (refer to Appendix H for the complete plant species lists).

Under the three riparian woodland options, different amounts of acres would be restored (Figure 19). Riparian Woodland Option A would restore approximately 19.5 acres, Riparian Woodland Option B would restore approximately 39.1 acres, and Riparian Woodland Option C would restore approximately 46.0 acres. The various acreages were evaluated in order to assess the incremental benefit of increasing the amount of riparian woodland restored. Woodland tree, shrub, flower and grass species would be strategically seeded and plugged over the entire area. Native plant species lists for the FWP Condition are located in *Appendix H – Monitoring Plan and Habitat Analysis* and would be the same for all three riparian woodland restoration options. Activities under the three measure options include the following, with the different acreages denoted:

- Remove all invasive and non-native tree, shrub, flower and grass species
    - RWa ~ 19.5-ac
    - RWb ~ 39.1-ac
    - RWc ~ 46.0-ac
- Selectively seed areas with native woodland seed mix
    - RWa ~ 15.5-ac
    - RWb ~ 25.9-ac
    - RWc ~ 18.2-ac
- Plant live tree, shrub, flower and grasses (plugs) of native woodland species to provide habitat structure and diversity

- Establish native Riparian Woodland community over a 5-year period
    - Spot herbicide invasive species for remainder of project
    - Provide and maintain predator control systems
    - Replant as needed to achieve FQA criteria
    - Perform prescribed burns/mowing (as needed) for remainder of project

Figure 18 – Invasive Species Removal Spatial Coverage

Figure 19 – Example of Native Woodland Community Restoration

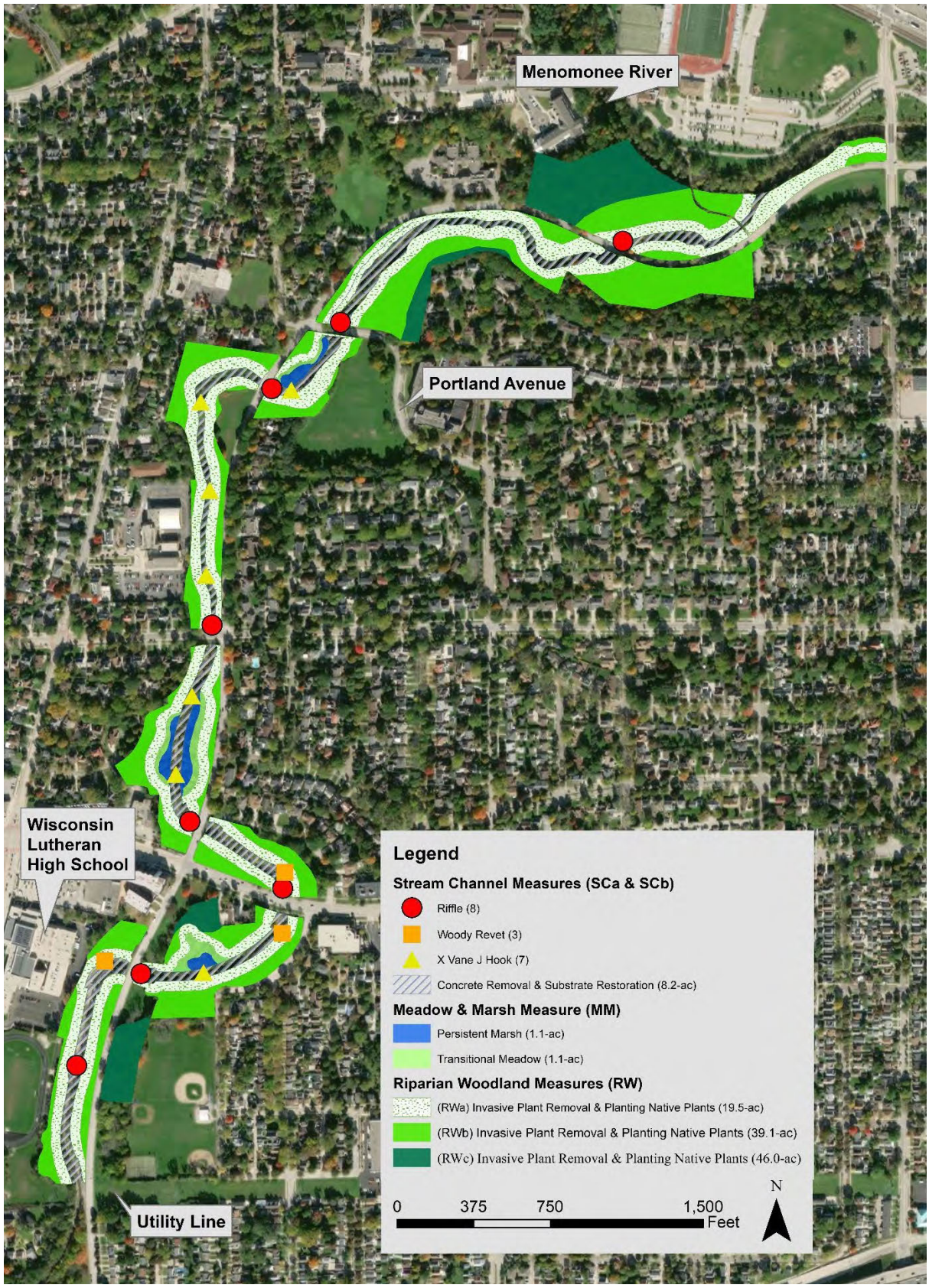

Figure 20 – Honey Creek Physical Measures Overview Map

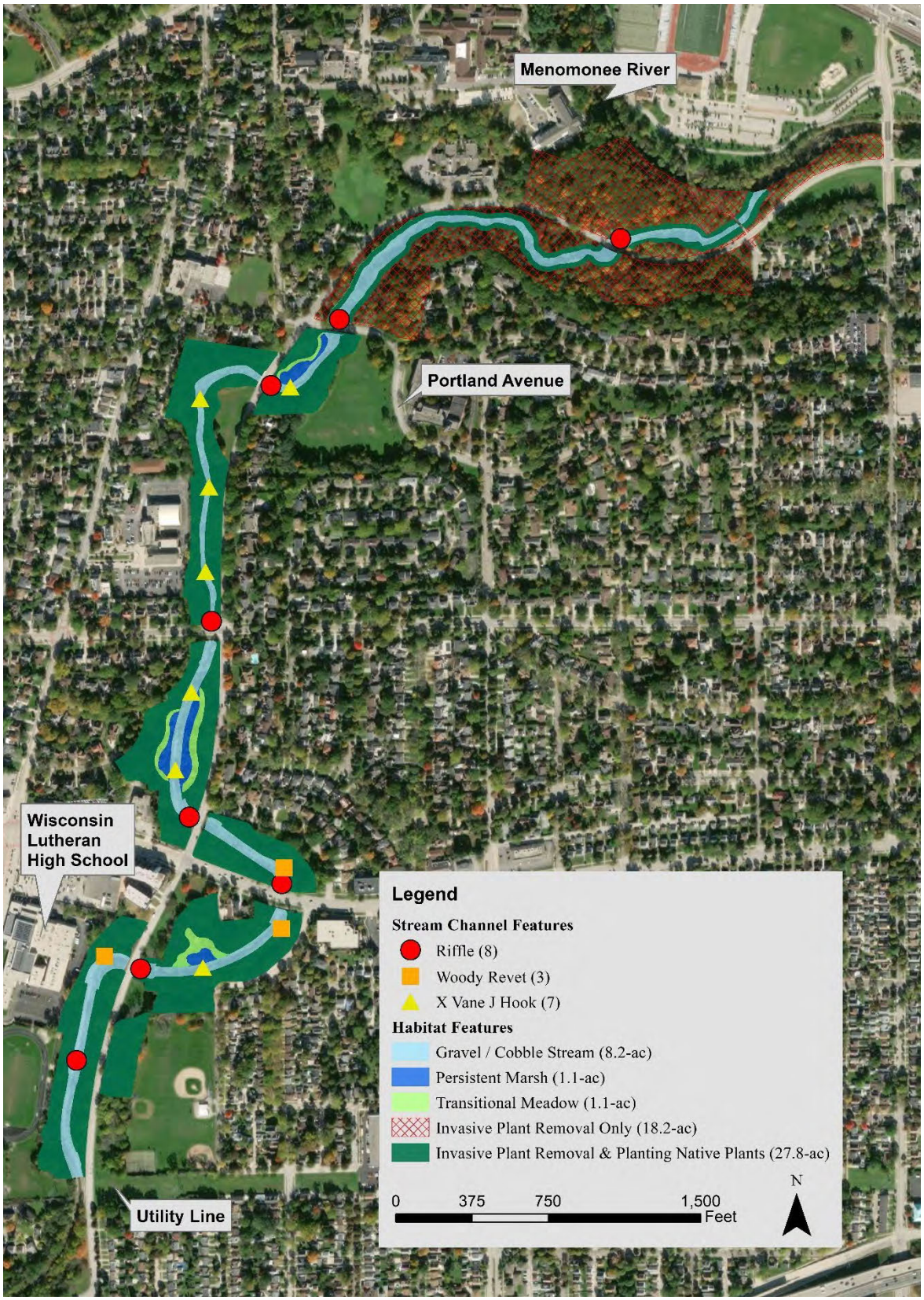

Figure 21 – Honey Creek Biological Measures Overview Map

4.1.2 Habitat Measures Cost & Assumptions

Plan formulation level cost estimates were prepared for each measure (Table 15). These cost estimates do not represent Total Project Cost (TPC) estimates, but rather individual restoration measures that are the building blocks of a complete plan. These plan formulation level cost estimates were developed by the Cost Engineering Office, using data from current similar construction contracts, cost data and publications, and informal discussions with vendors. Costs include construction, staging, access, haul road construction, preliminary real estate estimates, adaptive management, monitoring and operations and maintenance. A preliminary real estate estimate for plan formulation purposes was provided per acre by the Real Estate Office. The measures were used to provide a monetary basis for the assessment of project alternatives.

Annualizing costs is a method whereby the project costs are discounted to a base year then amortized over the period of analysis. The base year for this project was determined to be the year in which the first phase of the project is to be completed (calendar year 2023). Costs that occur prior to this year need to be compounded to the base year, while those occurring after the base year need to be discounted to the base year. The period of analysis for this project is 50 years. The present value method was used to discount future costs to the base year. Costs are compounded or converted to present value for the base year then amortized over the 50-year period of analysis to determine the average annual cost. The discount rate was determined by the appropriate Economic Guidance Memorandum 20-01, Federal Interest Rates for Corps of Engineers Projects, which is 2.750%. In summary, all costs presented were estimated using the FY 2020 federal discount rate and price level. The construction period is only 1 year for this type of project; however, the establishment period is 4 years. Calculation of the measures Average Annual Cost (AA Cost) was completed via the Certified IWR Planning Suite Annualization Calculator (Table 14).

Table 14 - Total and Average Annual Costs per Measure

Code	Measure	Measure Cost[a]	IVE LERRD[b]	Adaptive Management	Monitoring[c]	Total Measure	AA Cost[d]	AAO&M[e]
NA	No Action	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SCa	Stream Channel (Option A: Cobble & Aggregate Mixture)	$						
SCb	Stream Channel (Option B: Sand, Gravel, Cobble Mixture)	$						
MM	Meadow Transitional & Marsh Persistent	$						
RWa	Riparian Woodland (Option A: 50-ft buffer on each side)	$						
RWb	Riparian Woodland (Option B: 100-ft buffer on each side)	$						
RWc	Riparian Woodland (Option C: entire riparian area)	$						

[a] provided by TS-DC with 15% contingency
[b] Independent Value Estimation (IVE) for lands, easements, rights-of-way, utility or public facility relocations, and dredged or excavated material disposal areas (LERRDs)
[c] based on 5 years monitoring all components
[d] Average Annual (AA) Cost
[e] Average Annual Operation & Maintenance (AA O&M)

4.1.3 Habitat Measure Benefits

The evaluation of habitat benefits is a comparison of the FWOP HSI and acres and FWP HSI and acres scenarios for each measure. The EX and FWOP Conditions for this study are the same since the degradation in habitat quality has reached equilibrium. A comparison of the FWOP and FWP net gain in HUs was performed in order to determine if a measure, or group of measures (alternatives), would have beneficial effects to the Honey Creek ecosystem. The FWOP and FWP scenarios were evaluated using the QHEI and FQA methodology (*Section 2.5 Habitat Quality Forecasting*). Raw calculation sheets for the FWP QHEI and FQA are provided in *Appendix H – Monitoring Plan and Habitat Analysis.* The FWP calculations for QHEI and FQA scores translate the change in score should the measures be implemented under a federal project. The QHEI stream parameters of substrate, in-stream cover, channel morphology, bank erosion, riparian zone, riffle/pool, and gradient were adjusted based on the changes that would be induced by measure SC. The average Mean C_{FQA} scores per plant communities were based on the change

in species composition for Transitional Meadow and Persistent Marsh and Riparian Woodland. The following calculations ultimately provide the NAAHUs and are presented in Figure 22 and Table 15.

Stream Channel FWP_{QHEI}

- Stream Channel Area Affected → 8.2 acres
- Stream Channel Quality Affected by SCa → 8.2 acres x 0.85 = 3.69 NAAHUs (concrete to natural/cobble only substrates)
- Stream Channel Quality Affected by SCb → 8.2 acres x 0.84 = 3.61 NAAHUs (concrete to natural/sand, gravel, cobble mix substrates)

Riparian FWP_{FQA}

- Direct Riparian Area Affected
  - Transitional Meadow & Persistent Marsh = 2.2-acres
  - Riparian Woodland Option A = 19.5-acres
  - Riparian Woodland Option B = 39.1-acres
  - Riparian Woodland Option C = 46.0-acres
- Direct Riparian Quality (Mean C) Affected
  - Transitional Meadow & Persistent Marsh = 5.00
  - Riparian Woodland (Option A, B, and C) = 4.10

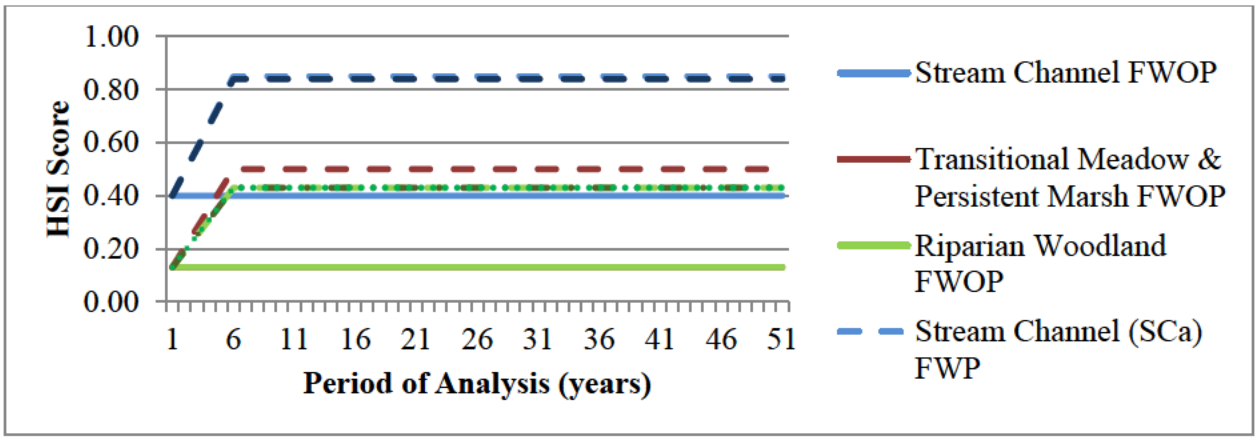

Figure 22 – FWOP vs. FWP for Stream Habitat (SCa and SCb) and Marsh and Riparian (RWa, RWb, and RWc) Plant Community Habitat Suitability. Transitional Meadow & Persistent Marsh and Riparian Woodland FWOP = 0.13, Which Overlie Each Other. Riparian Woodland FWP Options A, B, and C = 0.41, Which Overlie Each Other.

Table 15 – Net Average Annual (50-years) Habitat Units per Measure

Description	Habitat Types	Acres	HSI[a]	AAHUs[b]	NAAHUs[c]
No Action / FWOP	Stream Channel Restoration	8.2	0.40	3.28	
	Transitional Meadow & Persistent Marsh	0.0	0.13	0.00	
	Riparian Woodland	46.0	0.13	6.33	
Action / FWP	Stream Channel Restoration (SCa)	8.2	0.85	6.97	3.69
	Stream Channel Restoration (SCb)	8.2	0.84	6.89	3.61
	Transitional Meadow & Persistent Marsh (MM)	2.2	0.48	1.05	1.05
	Riparian Woodland (RWa)	19.5	0.41	8.04	1.71
	Riparian Woodland (RWb)	39.1	0.41	16.12	9.79
	Riparian Woodland (RWc)	46.0	0.41	18.86	12.53

[a] Average Annual Habitat Suitability Index (AAHSI)
[b] Average Annual Habitat Units (AAHUs)
[c] Net Average Annual Habitat Units (NAAHUs)

4.2 Alternative Plan Generation

Six (6) measures, including the "No Action" measure, were input into the IWR-Planning Suite in terms of costs and benefits shown in Table 16. The Transitional Meadow & Persistent Marsh measure is the only measure with a dependency — Stream Channel Restoration. Stream Channel Restoration Option A and Stream Channel Restoration Option B are not combinable with each other. Additionally, Riparian Woodland Option A, Riparian Woodland Option B, and Riparian Woodland Option C are all not combinable with each other. Based on these inputs and criteria, the IWR Planning software generated 20 alternative combinations for ecosystem restoration. These alternative combinations were processed for cost effectiveness analyses via the certified IWR Planning Suite Cost Effective and Incremental Cost Analysis, which are presented in the following sections.

Table 16 – Measure AA Costs & Net AA Habitat Units (NAAHUs)

Code[a]	Measure	AA Cost	NAAHUs
NA	No Action (FWOP)	$ -	0
SCa	Stream Channel Restoration Option A	$ 458,092	3.69
SCb	Stream Channel Restoration Option B	$ 321,156	3.61
MM	Transitional Meadow & Persistent Marsh	$ 21,113	1.05
RWa	Riparian Woodland Option A	$ 35,389	1.71
RWb	Riparian Woodland Option B	$ 70,959	9.79
RWc	Riparian Woodland Option C	$92,990	12.53

[a] for use in the IWR-Planning Suite Software

4.3 Cost Effectiveness/Incremental Cost Analysis

Cost effectiveness and incremental cost analysis (CE/ICA) are two distinct analyses that must be conducted to evaluate the effects of alternative plans according to USACE policy. First, it must be shown through cost effectiveness analysis that a restoration plan's output cannot be produced more cost effectively by another alternative. *Cost effective* means that, for a given level of non-monetary output, no other plan costs less and no other plan yields more output at a lower cost.

Incremental cost analysis means that the subset of cost-effective plans is examined sequentially to ascertain which plans are most efficient in the production of environmental benefits. Those most efficient plans are called "Best Buys." As a group of measures, they provide the greatest increase in output for the least increases in cost. They have the lowest incremental costs per unit of output. In most analyses, there will be a series of Best Buy plans, in which the relationship between the quantity of outputs and the unit cost is evident. As the scale of Best Buy plans increases (in terms of output produced), average costs per unit of output and incremental costs per unit of output will increase as well. The incremental analysis by itself will not point to the selection of any single plan. The results of the incremental analysis must be synthesized with other decision-making criteria (i.e., significance of outputs, acceptability, completeness, effectiveness, risk and uncertainty, reasonableness of costs) to help the study team select and recommend a particular plan.

4.3.1 Cost Effectiveness

The cost effectiveness analysis was used to ensure that certain options would be screened out if they produced the same amount or less output at a greater cost than other options with a lesser cost. Twenty (20) alternative combinations were analyzed for cost effectiveness. Of these, nine (9) cost effective combinations were identified (Figure 23 and Table 17), with a subset of five (5) plans being identified as "Best Buys". The "No Action plan" is always deemed cost effective. Eleven (11) alternative combinations were screened out as non-cost effective.

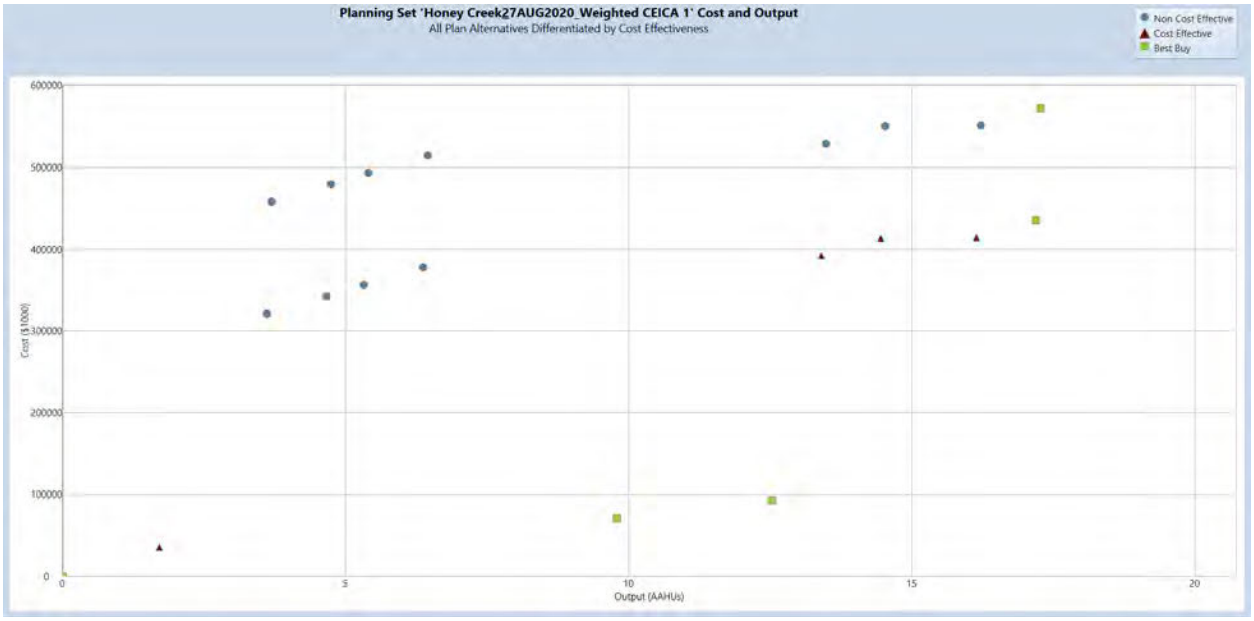

Figure 23 - Cost Effective Analysis on Twenty Alternative Combinations

Table 17 - Cost Effective Analysis on Twenty Alternative Combinations

#	Alternative Plan	AA Cost	AAHUs	Cost Effectiveness
1	No Action Plan	$0.00	0	Best Buy
2	RWa	$35,389	1.71	Cost Effective
3	RWb	$70,959	9.79	Best Buy
4	RWc	$92,990	12.53	Best Buy
5	SCb, RWb	$392,115	13.4	Cost Effective
6	SCb, MM, RWb	$413,228	14.45	Cost Effective
7	SCb, RWc	$414,146	16.14	Cost-Effective
8	SCb, MM, RWc	$435,259	17.19	Best Buy
9	SCa, MM, RWc	$572,195	17.27	Best Buy
10	SCb	$321,156	3.61	Non-cost Effective
11	SCa	$458,092	3.69	Non-cost Effective
12	SCb, MM	$342,269	4.66	Non-cost Effective
13	SCa, MM	$479,205	4.74	Non-cost Effective
14	SCb, RWa	$356,545	3.52	Non-cost Effective
15	SCa, RWa	$493,481	5.4	Non-cost Effective
16	SCb, MM, RWa	$377,658	6.37	Non-cost Effective
17	SCa, MM, RWa	$514,594	6.45	Non-cost Effective
18	SCa, RWb	$529,051	13.48	Non-cost Effective
19	SCa, MM, RWb	$550,164	14.53	Non-cost Effective
20	SCa, RWc	$551,082	16.22	Non-cost Effective

4.3.2 Alternative Description

The following are descriptions of the nine (9) cost-effective alternative plans that were generated by the IWR Planning Suite software.

Alternative 1 – No Action: The "No Action" alternative forms the baseline for evaluating the environmental benefits of the proposed action. Without the federal project, the wildlife and aquatic habitat that is already in poor quality in the project area would continue to exist in a degraded state, offering low-quality aquatic and terrestrial habitat and low biological diversity, dominated by species tolerant of degraded environmental conditions. The concrete lined creek will continue to exhibit flashy hydraulic behavior and be effective at conducting flood flows, but the long-term ecological effect of restoring habitat for native species would not occur. The area will continue to offer low-quality aquatic habitat. Under existing conditions, the project site provides virtually no fish habitat.

Alternative 2 – Riparian Woodland (Option A): Alternative 2 consists of removing invasive and non-native plant species from within a 50-feet buffer on either side of the Honey Creek channel and replacing with native plant species (approximately 19.5 acres). The native plantings will create shade and foraging habitat for fish and invertebrates, while contributing to bank stability and riverine erosion control. Under this alternative, the entire riparian area along Honey Creek would not be restored and no instream restoration would occur.

Alternative 3 – Riparian Woodland (Option B): Alternative 3 consists of removing invasive and non-native plant species from within a 100-feet buffer on either side of the Honey Creek channel and replacing with native plant species (approximately 39.1 acres). The native plantings will create shade and foraging habitat for fish and invertebrates, while contributing to bank stability and erosion control. Under this alternative, the entire riparian area along Honey Creek would not be restored and no instream restoration would occur.

Alternative 4 – Riparian Woodland (Option C): Alternative 4 consists of removing invasive and non-native plant species along the entire riparian zone (approximately 46.0 acres) of Honey Creek that is within the study area and replacing with native plant species. The native plantings will create shade and foraging habitat for fish and invertebrates, while contributing to bank stability and erosion control. Under this alternative, the entire riparian area along Honey Creek within the study area would be restored, but no instream restoration would occur.

Alternative 5 – Stream Channel Restoration (Option B) and Riparian Woodland (Option B): Alternative 5 builds upon Alternative 3 by restoring 100-feet buffer of riparian woodland on either side of the Honey Creek channel (approximately 39.1 acres) as well as restoring instream features. Under Alternative 5, approximately 6,700 LF of concrete channel lining would be removed from Honey Creek and disposed of at an appropriate offsite location. The concrete beneath bridge crossings would be left in place to maintain the structural integrity of the crossings. The channel profile and riffle placement were designed to account for the concrete under the bridges so that additional erosion is not induced. The channel would then be restored with natural substrates including sand, gravel, and cobbles, and contouring would occur to create natural riffle/pool complexes. Additionally, woody debris would be added within the channel to provide habitat for fish, invertebrates, and turtles.

Alternative 6 – Stream Channel Restoration (Option B), Persistent Marsh/Transitional Meadow, and Riparian Woodland (Option B): This alternative builds upon Alternative 5 by restoring a portion of the riparian zone (approximately 39.1 acres) along Honey Creek that is within the study area, restoring instream features, and restoring wetland complexes. Under this alternative, approximately 6,700 LF of concrete channel lining would be removed from Honey Creek and disposed of at an appropriate offsite location. The concrete beneath bridge crossings would be left in place to maintain the structural integrity of the crossings. The channel would then be restored with a mixture of natural substrates including sand, gravel, and cobbles, and contouring would occur to create natural riffle/pool complexes. Floodplain and non-floodplain areas would be excavated to an elevation low enough to allow these areas to develop into annually persistent wetland complexes. The strategically-placed wetlands will increase available flood storage within the project site and provide an ecosystem connection between aquatic and riparian communities. This alternative would also include the sediment transport enhancement features such as boulders, rock veins, and woody revetment features similar to Alternative 5. This alternative will also address invasive species management and native plant community establishment in the same manner as Alternatives 5 and 3.

Alternative 7 – Stream Channel Restoration (Option B) and Riparian Woodland (Option C): This alternative builds upon Alternative 4 by restoring the entire riparian zone (approximately 46.0 acres) as well as restoring instream features. Under this alternative, approximately 6,700 LF of concrete channel lining would be removed from Honey Creek and disposed of at an appropriate offsite location. The concrete beneath bridge crossings would be left in place to maintain the structural integrity of the crossings. The channel would then be restored with natural substrates including sand, gravel, and cobbles, and contouring would occur to create natural riffle/pool complexes. Additionally, woody debris would be added within the channel to provide habitat for fish, invertebrates, and turtles.

Alternative 8 – Stream Channel Restoration (Option B), Persistent Marsh/Transitional Meadow, and Riparian Woodland (Option C): This alternative is similar to Alternative 6, except that under this alternative the entire riparian zone (approximately 46.0 acres) along Honey Creek would be restored. The stream channel restoration and marsh/transitional meadow measures are the same as described in Alternative 6.

Alternative 9 – Stream Channel Restoration (Option A), Persistent Marsh/Transitional Meadow, and Riparian Woodland (Option C): This alternative is similar to Alternative 8, except that under this

alternative the channel would be restored with substrates comprised of a layer of crushed aggregate and a layer of cobbles. The persistent marsh/transitional meadow and riparian woodland measures are the same as described for Alternative 6.

4.3.2 Incremental Cost Analysis

An Incremental Cost Analysis was performed on the five (5) Best Buy plans identified from the Cost Effectiveness analysis, including the No Action plan. The objective of the Incremental Cost Analysis is to assist in determining whether the additional output provided by each successive plan is worth the additional cost. This Incremental Cost Analysis (Table 18 and Figure 24) compares the alternative combinations for ecological restoration that were considered in the selection of the NER Plan.

Table 18 - Summary of CE/ICA "Best Buy" Alternative Plans

#	Alternative Plan	AAHUs	AA Cost	AA Cost / AAHUs ($1000/AAHUs)	Incremental Cost ($1000)	Incremental AAHUs	Incremental Cost / Incremental AAHUs
1	No Action	0	$0	$0	$0	0	$0
3	RWb	9.79	$70,959	$7,248	$70,959	9.79	$7,248
4	RWc	12.53	$92,990	$7,421	$22,031	2.74	$8,040
8	SCb, MM, RWc	17.19	$435,259	$25,320	$342,269	4.66	$73,448
9	SCa, MM, RWc	17.27	$572,195	$33,132	$136,936	0.08	$1,711,700

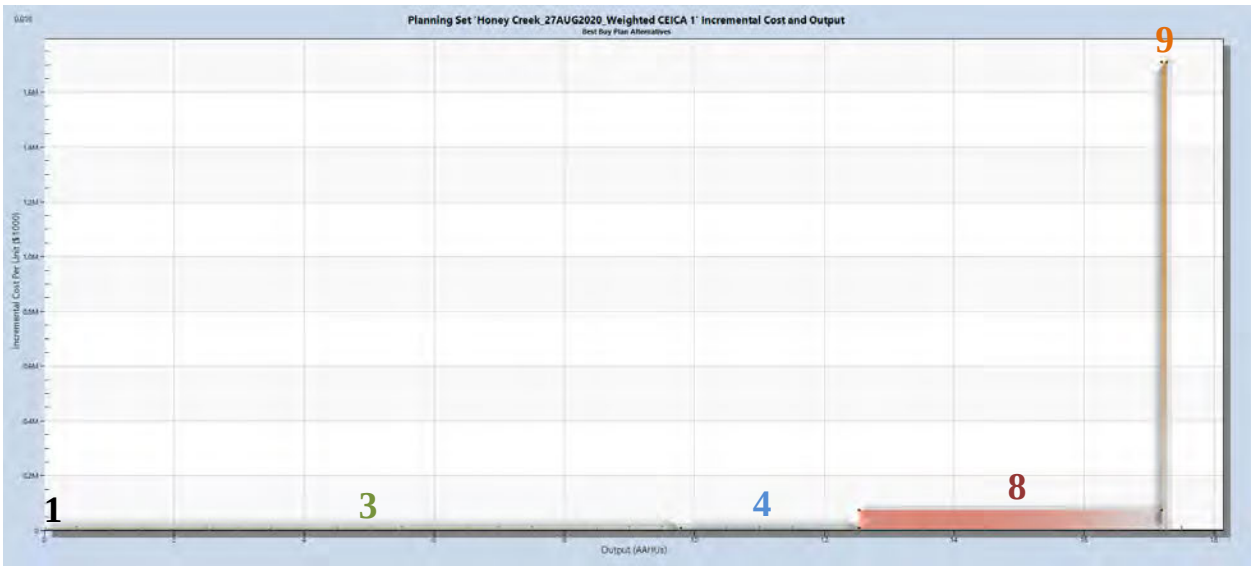

Figure 24 - Incremental Cost and Output of "Best Buy" Alternative Plans

The primary break points are between Alternative 1 and Alternative 3 and Alternative 8 and Alternative 9. Alternative 1 is the No Action Plan which produces 0 AAHUs since there would be no project implemented. Alternative 3 is the restoration of a portion of the riparian area along Honey Creek, approximately 39.1 acres. Alternative 3 produces 9.79 AAHUs which is an increase of 9.79 AAHUs over Alternative 1 (No Action plan). The incremental cost for the additional AAHUs for Alternative 3 is approximately $7,248 per AAHU. Although the incremental cost per additional AAHU is $7,248, Alternative 3 includes the restoration of some riparian habitat which would partially address one of the study objectives. Alternative 1 does not implement a project, therefore, no restoration would occur and none of the study objectives would be addressed. Since Alternative 3 addresses one of the planning

objectives (i.e., Planning Objective 2) as opposed to none of the planning objectives (i.e., Alternative 1), the selection of Alternative 3 over Alternative 1 would be justified. However, Alternative 3 would not address both planning objectives since this alternative does not include any instream restoration or restoration of wetland complexes (i.e., Planning Objective 1).

Alternative 4 includes the restoration of the entire riparian zone along Honey Creek instead of just a portion. Like Alternative 3, Alternative 4 would only address one of the planning objectives (i.e., Objective 2). Compared to Alternative 3, selecting Alternative 4 over Alternative 3 would result in an approximately 28% increase in Habitat Units and a 24% increase in average annual cost. Although Alternative 4 would more completely address Planning Objective 2, like Alternative 3, Alternative 4 would not address both planning objectives since this alternative does not include any instream restoration or restoration of wetland complexes (i.e., Planning Objective 1).

Alternative 8 builds upon Alternative 4, by restoration of instream features and wetland complexes, as well as the restoration of the entire riparian zone along Honey Creek. Moving from Alternative 4 to Alternative 8 is a significant change in incremental cost per additional AAHU. Alternative 8 provides 17.19 AAHUs with an incremental cost of $73,448 per additional AAHU. The difference in incremental cost per incremental AAHU between Alternative 8 and Alternative 4 is $65,408. While this is a significant increase in incremental cost for an additional 4.66 AAHUs (a 37% increase in habitat units over Alternative 4), the selection of Alternative 8 is justified since the implementation of this alternative would address the study objectives through the restoration of stream, wetland, and riparian habitats.

The last Best Buy alternative for which an incremental cost analysis was conducted is Alternative 9. Alternative 9 is the same as Alternative 8, except a mixture of crushed aggregate and cobbles would be used to restore the stream channel as opposed to a mixture of sand, gravel, and cobble substrates as in Alternative 8. Alternative 9 only provides an additional 0.08 AAHU (a 0.46 % increase in habitat units over Alternative 8). The incremental cost for the additional AAHU is significant, with the cost being $1,711,700 for less than one (1) additional AAHU. This is a difference of $1,638,252 between the incremental cost per incremental AAHU for Alternative 8 and Alternative 9. Since Alternative 8 already addresses the planning objectives, and Alternative 9 would only use different substrates that are not necessarily more beneficial for aquatic organisms than the substrates used in Alternative 8, the selection of Alternative 9 over Alternative 8 is not justified based on the Incremental Cost Analysis.

The following Significance and four (4) planning criteria discussions detail why it is both justified and important to implement Alternative 8 in terms beyond the Incremental Cost Analysis.

4.4 Significance of Ecosystem Outputs

Due to the challenges associated with comparing non-monetized benefits, the concept of output significance plays an important role in ecosystem restoration evaluation. Along with information from CE/ICA, information on the significance of ecosystem outputs will help determine whether the proposed environmental investment is worth its cost (justified) and whether an alternative should be recommended. Statements of significance provide qualitative information to help decision makers evaluate whether the value of the resources of any given restoration alternative are worth the costs incurred to produce them. The significance of the Honey Creek Study Area habitat restoration outputs is herein recognized in terms of institutional, public, and/or technical importance.

Institutional Recognition

Institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, tribes, or private groups. Sources of

institutional recognition include public laws, executive orders, rules and regulations, treaties, and other policy statements of the federal government; plans, laws, resolutions, and other policy statements of states with jurisdiction in the planning area; laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area; and charters, bylaws, and other policy statements of private groups.

Migratory Bird Treaty Act (1918)

The Migratory Bird Treaty Act is the domestic law that implements the United States' commitment to four international conventions for the protection of migratory birds and their habitats. The Act protects species or families of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. The four Migratory Bird Conventions are:

- Convention for the Protection of Migratory Birds with Great Britain on behalf of Canada (1916)
- Convention for the Protection of Migratory Birds and Game Mammals - Mexico (1936)
- Convention for the Protection of Migratory Birds and Their Environment - Japan (1972)
- Convention for the Protection of Migratory Birds and Their Environment - Union of Soviet Socialist Republics (1978)

The Mississippi Flyway

There are four principal North American flyways – the Atlantic, Mississippi, Central and Pacific. The Mississippi Flyway's eastern boundary runs along western Lake Erie, whereas the western boundary is somewhat ambiguous as it merges unnoticeably into the Central Flyway. The longest migration route in the Western Hemisphere lies in the Mississippi Flyway from the Arctic coast of Alaska to Patagonia, in which some shorebird species fly this nearly 3,000-mile route twice. Parts of all four flyways merge over Panama.

The Lake Michigan route of the Mississippi Flyway includes the Menomonee River and its tributaries, which flows nearly parallel to the Lake Michigan shoreline. This route of the flyway is ideal for migratory waterfowl due to it being uninterrupted by mountains, dotted with tens of thousands of lakes, wetlands, ponds, streams and rivers, and is well timbered in certain reaches. Wisconsin urban areas and farmland do not provide the type and variety of food and shelter required by nearly all migrating birds. In comparison, Lake Michigan's shoreline provides a variety of plant life and habitat for resting and refueling. The Milwaukee metropolitan area's parks and even residential backyards are particularly important because they are the only patches of habitat left within a concrete watershed. The preservation of open space along water bodies is critical to the survival of millions of birds that migrate through the Milwaukee metropolitan area every spring and fall. The Honey Creek study area has great potential to provide critical migratory bird habitat with the restoration measures implemented.

Currently, 124 species of nesting and migratory birds known from the Milwaukee metropolitan area have been observed within the study area. Alternative 1 is the No Action alternative and includes no restoration project, therefore, it is not in support of the Migratory Bird Treaty Act. Alternative Plans 3, 4, 8 and 9 support the Migratory Bird Treaty Act; however, Alternative Plans 8 and 9 support the Act to the greatest extent. Alternative Plans 3 and 4 would restore the riparian woodland community to varying degrees. Restoration of the riparian woodland community under these two alternatives would provide high quality forging, nesting, and resting habitat but primarily for only upland bird species. Alternatives Plans 8 and 9, both of which include the restoration of the plant communities as well as instream habitat, would provide high quality foraging, nesting, and stop-over habitat for upland bird species as well as water obligate bird species — herons, egrets, waterfowl, and kingfisher.

E.O. 13186 – *Responsibilities of Federal Agencies to Protect Migratory Birds* – Federal agencies shall restore or enhance the habitat of migratory birds and prevent or abate pollution or detrimental alteration of the environment for migratory birds. This project would restore fish passage, fish habitat, marsh, meadow, and riparian woodland, thus providing forage and shelter for numerous migratory bird species. This project lies within a significant portion of the Mississippi Flyway along the coast of Lake Michigan that particularly favors both ecological and economically valuable waterfowl species.

Approximately seven waterfowl that are known to be hunted within the United States have been observed and identified within the study area of the Honey Creek restoration project. These species include common merganser, red-breasted merganser, wood duck, common goldeneye, mallard, Canada goose, and gadwall. These species of waterfowl over winter as far south as South America and breed as far north as Alaska, resulting in a migration route that traverses as many as 14 states. Therefore, the restoration of waterways within the Mississippi and Great Lakes Flyways, like Honey Creek, may provide recreational hunting benefits to as many as 14 states.

Alternative Plans 8 and 9 fulfill the USACE's role and responsibility by utilizing its ecosystem restoration mission, authority, and supporting polices to restore diverse habitats for Migratory Waterfowl and fishes that support these bird species. Alternative Plans 3 and 4 do not include restoration of instream habitat and therefore do not support the aquatic habitat used by these migratory waterfowl and their prey. Alternative Plan 1, the No Action Alternative, would also not support migratory waterfowl since no project would be constructed.

E.O. 13340 *Establishment of Great Lakes Interagency Task Force and Promotion of a Regional Collaboration of National Significance for the Great Lakes* - Identified the Great Lakes as a national treasure and defined a Federal policy to support local and regional efforts to restore and protect the Great Lakes ecosystem through the establishment of regional collaboration. A few activities have been accomplished by Federal agencies working in partnership with state, tribal, and local governments in response to the Executive Order. The USACE has been a major participant in these activities. The Executive Order established the Great Lakes Interagency Task Force. The Task Force worked with the governors of the eight Great Lakes states, mayors, and tribal leaders to establish the Great Lakes Regional Collaboration.

The initial goal of the Collaboration was to develop a "strategy for the protection and restoration of the Great Lakes" within 1 year. Alternative Plans 8 and 9 would restore physical characteristics of Lake Michigan coastal habitats, which is in full support of this Act. Alternative Plans 3 and 4 only partially restore physical characteristics of Lake Michigan coastal habitats since these alternatives only include restoration of the riparian woodland community. Alternative Plan 1, the No Action alternative, does not support this Act since no project would be constructed and no habitat would be restored. The Collaboration developed the strategy by using teams consisting of 1,500 stakeholders for the following eight priority issues identified by the Great Lakes governors and mayors with items in bold relative to this project:

1. Toxic contaminants
2. Non-point source pollution
3. Coastal health
4. **Habitat/species**
5. Contaminated sediments/AOCs
6. Indicators/information
7. Sustainable development
8. **Invasive species**

Fish and Wildlife Conservation Act of 1980 – all federal departments and agencies, to the extent practicable, and consistent with the agency's authorities, should promote the conservation of non-game fish, wildlife, and their habitats. Alternative Plans 8 and 9 would restore physical characteristics of Lake Michigan coastal habitats including plant communities and riverine communities. Alternative Plans 3 and

4 only partially restore physical characteristics of Lake Michigan coastal habitats since these alternatives only include restoration of the riparian woodland plant community. Alternative Plan 1, the No Action alternative, would not restore Lake Michigan coastal habitats since under this alternative no project would be constructed and no habitat would be restored.

E.O. 11514 *Protection and Enhancement of Environmental Quality* – the federal government shall provide leadership in protecting and enhancing the quality of the nation's environment to sustain and enrich human life. Improving both aquatic and riparian habitat and aesthetic values of Honey Creek would be achieved via Alternatives 8 and 9. Alternatives 3 and 4 only partially improve habitat and aesthetic values of Honey Creek. While under both Alternatives 3 and 4 the riparian woodland plant community would be restored to varying degrees, the riverine community would remain covered in concrete, which does not provide aquatic habitat nor is it aesthetically pleasing. Alternative 1, the No Action plan, does not protect or enhance environmental quality since no project would be constructed and no habitat would be restored. If implemented, Alternatives 8 and 9 would provide an example to other large metropolitan areas that industrialized and urbanized areas can be reclaimed for the public and nature to enhance environmental quality.

E.O. 11990 *Protection of Wetlands* – each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Alternative Plans 3 and 4 only include the restoration of the riparian woodland community to varying degrees. Alternative Plans 8 and 9 restore riparian and wetland habitat as well as include stream channel restoration, thereby restoring the hydrology and hydraulics necessary to maintain wetlands along Honey Creek. Alternative 1, the No Action plan, would not minimize the destruction, loss, or degradation of wetlands since no construction would occur and no habitat would be restored.

E.O. 13751 *Safeguarding the Nation from the Impacts of Invasive Species* – This executive order calls for actions to 'prevent the introduction of invasive species and provide for their control and to minimize the economic, plant, animal, ecological, and human health impacts that invasive species cause' utilizing laws of the United States of America, including the NEPA of 1969, as amended (42 USC §4321, et seq.), the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 USC §4701, et seq.), the Plant Protection Act (7 USC §7701, et seq.), the Lacey Act, as amended (18 USC §42; 16 USC §3371-3378, et seq.), the Endangered Species Act of 1973, as amended (16 USC §1531, et seq.), the Noxious Weed Control and Eradication Act of 2004 (7 USC §7781, et seq.), and other pertinent statutes. E.O. 13751 amends and replaces the earlier E.O. 13112 *Invasive Species*.

Alternative Plans 3, 4, 8, and 9 would fully address the intent of E.O. 13751 through the removal of non-native species and the establishment of native species. Alternative Plan 1, the No Action plan, would not address E.O. 13751 since no construction would occur and no non-native species would be removed, minimized, and/or eradicated.

Endangered Species Act of 1973 – all federal departments and agencies shall seek to conserve endangered species and threatened species. The purpose of the Act is to conserve ecosystems upon which endangered and threatened species depend. Regarding federally-listed species, Alternative Plans 3 and 4 potentially provide habitat, through the restoration of riparian woodland, for the federally-endangered rusty patched bumblebee and the federally-threatened northern long-eared bat which feeds on insects found in the understory of woodland areas. As for listed species, Alternative Plans 8 and 9 would restore transitional meadow and persistent marsh habitat which provide habitat for Blanding's turtle and Butler's garter snake, two Wisconsin species of special concern. Additionally, Alternative Plans 8 and 9, which include stream channel restoration, provide improved foraging habitat for the endangered peregrine falcon as well as spawning habitat for Wisconsin species of special concern the Least Darter, which is found in the

Menomonee River. Alternative 1, the No Action plan, would not improve habitat for any federal-listed species, since no construction would occur and no riparian or stream channel restoration would be realized.

Clean Water Act – restore the chemical and biological integrity of the nation's waters. Although water quality improvement is not within the USACE Mission, policy acknowledges that habitat restoration provides incidental water quality improvements most of the time (Engineering Pamphlet [EP] 1165-2-1). The Clean Water Act also has provisions for wetland and biological integrity protection. The No Action alternative, Alternative 1, does not support this Act by denying opportunity to improve water quality and increase viable wetland acres. Alternatives 8 and 9 would fully support the Clean Water Act since instream habitat would provide ancillary water quality improvements (increased dissolved oxygen), and restored riparian and meadow/marsh habitat would help filter runoff and reduce pollutants entering the creek. Alternatives 3 and 4 would also partially support the Clean Water Act through the restoration of riparian habitat which would help filter runoff and reduce pollutants entering Honey Creek. Alternative 1, the No Action Plan, would not support the Clean Water Act since no construction would occur and no riparian or stream channel restoration would be realized.

Public Recognition

Public recognition means that some segment of the general public recognizes the importance of an environmental resource, as evidenced by people engaged in activities that reflect an interest or concern for that resource. Such activities may involve membership in an organization, financial contributions to resource-related efforts, and providing volunteer labor and correspondence regarding the importance of the resource.

Menomonee Valley Partners, Inc.

Since its inception in 1999, the Menomonee Valley Partners, Inc. has served as the lead agency in the redevelopment of Milwaukee's Menomonee Valley. The Menomonee Valley Partners, Inc. is a nonprofit organization with a mission to revitalize and sustain the Menomonee Valley as a thriving urban district that advances economical, ecological, and social equity for the benefit of the greater Milwaukee community. The group envisions a thriving Valley with a well-balanced mix of industrial, recreational, and entrainment uses that strengthen Milwaukee in the following ways: 1) economically, with strong companies and jobs near workers' homes; 2) ecologically, with sustainable development and environmental stewardship; 3) geographically, with renewed ties to surrounding neighborhoods; and 4) equitably, with opportunities for all.

Wild Ones, Menomonee River Area

The Menomonee River Area Chapter of Wild Ones was established in 1997. The group works to expand natural landscaping in the hopes that urban environments can provide habitats and plants that wildlife require for food, shelter, and reproduction.

Milwaukee Riverkeeper

The Milwaukee Riverkeeper is a non-profit organization that is a licensed member of the Waterkeeper Alliance, an international coalition ensuring clean water and strong communities. The mission of the organization is to protect, improve, and advocate for water quality, riparian wildlife habitat, and sound land management in the Milwaukee, Menomonee, and Kinnickinnic River watersheds. The organization has volunteers that participate in monitoring water quality of waterways within the aforementioned watersheds, survey shorelines for signs of degradation and threats to water quality and wildlife habitat,

host canoe and kayak events, educate citizens to become effective water advocates, participate in cleanups to remove trash from across the watersheds, and advocate for stream restoration and improved public access to rivers.

Stakeholder Support

Support of the Honey Creek Ecosystem Restoration Project presented in this Draft IFR/EA includes, but are not limited to the USEPA, USFWS, and Wisconsin Department of Natural Resources (WDNR), are all critical and involved stakeholders.

Technical Recognition

Technical recognition means that the resource qualifies as significant based on its "technical" merits, which are based on scientific knowledge or judgment of critical resource characteristics. Whether a resource is determined to be significant may of course vary based on differences across geographical areas and spatial scale. While technical significance of a resource may depend on whether a local, regional, or national perspective is undertaken, typically a watershed or larger (e.g., ecosystem, landscape, or ecoregion) context should be considered. Technical significance should be described in terms of one or more of the following criteria or concepts: scarcity, representation, status and trends, connectivity, limiting habitat, and biodiversity.

Scarcity is a measure of a resource's relative abundance within a specified geographic range. Generally, scientists consider a habitat or ecosystem to be rare if it occupies a narrow geographic range (i.e., limited to a few locations) or occurs in small groupings. Unique resources, unlike any others found within a specified range, may also be considered significant, as well as resources that are threatened by interference from both human and natural causes.

Representation is a measure of a resource's ability to exemplify the natural habitat or ecosystems within a specified range. The presence of a large number and percentage of native species, and the absence of exotic species, implies representation as does the presence of undisturbed habitat.

Status and Trend measures the relationship between previous, current and future conditions.

Connectivity is the measure of a resource's connection to other significant natural habitats.

Limiting Habitat is the measure of resources present supporting significant species.

Technical Summary – Wildlife conservation in urban habitats is increasingly important due to current *urbanization trends* (Fernández-Juricic and Jokimäki 2001). Alternative Plans 8 and 9 focus on restoring diverse habitats along a portion of Honey Creek, which is **representative** of **scarce** riverine habitat of quality within the Milwaukee and Wauwatosa city limits. Restored habitats would include a diverse stream channel reconnected to its floodplain and persistent marsh habitats grading into transitional meadow which would then flow into wooded riparian. These habitats were known to be much more widespread at one point in history; with recent efforts to reestablish these along the Menomonee, Milwaukee, and Kinnickinnic Rivers, of which Honey Creek is a tributary to. In terms of **connectivity**, these alternatives would first and foremost remove the concrete channel lining Honey Creek, thereby reestablishing in-stream connectivity. Portions of the concrete channel include drop structures which prohibit upstream fish and mussel movement during low flows. With removal of the concrete, in-stream connectivity would be restored to fish and mussel species during reduced flows. Removal of the concrete lined channel would also restore the hyporheic zone and connectivity between the hyporheic zone and groundwater. During periods of stream intermittency, stream fauna exhibit anatomical adaptations that

allow resistance towards dessication (Boulton 2003), or they seek refuge in exposed macrophytes, algal mats, moist substrates, receding pools, or the hyporheic zone (Stanley et al. 1994, del Rosario and Resh 2000; Boulton 2003). Receding pools and the hyporheic zone are often cited as the best refugia for intermittent-stream biota (Williams 1977; Stanley et al. 1994; Gagen et al. 1998; Boulton 2003; Magoulick and Kobza 2003). For example, Boulton (2003) found that, in streams experiencing drought, a majority of surveyed macroinvertebrate species survived in isolated pools, whereas Williams (1977) found that recolonization in streams with or without pools was primarily from the substrate, suggesting that macroinvertebrates sought refuge in the hyporheic zone (area between surface water and ground water [mixing area]) during flow intermittency. Additionally, DiStefano et al. (2009) found Meek's Crayfish and Williams Crayfish burrowing into the substrate of an intermittent stream to avoid dessication. Therefore, reestablishing the connectivity of the hyporheic zone and groundwater by removing the concrete lined channel would provide important refugia during periods of potential stream intermittency within Honey Creek, especially during the summer months. This alternative also restores connectivity of the stream channel to its floodplain, by grading back channel banks and providing marsh and transitional meadow habitat during higher flows. Alternatives 8 and 9 further increase connectivity by adding patches of habitat within the Milwaukee metropolitan area, lessening the distance species have to travel over inhospitable areas of urbanized lands to forage, shelter, and/or nest.

The Menomonee River, Milwaukee River, and Kinnickinnic River and their tributaries as well as the coastal zone of Lake Michigan in Wisconsin are trending towards widespread improvement and **connectivity**. Per their letter dated 17 November 2017 (Westlake 2017), the USEPA stated that "[s]ince 1999, the local project sponsor, MMSD, has been actively restoring and re-naturalizing several of the region's concrete channels in portions of the Kinnickinnic River, Lincoln Creek, Underwood Creek, the Menomonee River, and other Milwaukee County waterways with restricted upstream fish passage." Connectivity within the site is important as well, especially between different plant communities for amphibians, reptiles, small mammals and insects. Hydrologic gradients provide the basis for plant community species richness and structure, and because of the gradients, these plant communities seamlessly connect to each other. This makes it critical to restore in-between habitats such as persistent marsh and transitional meadow, which connect the submersed riverine habitat with the riparian woodland.

Species such as the snapping turtle, eastern tiger salamander require these habitats and transition zones in order to reproduce. Certain keystone fish, such as northern pike, require spawning habitat for reproduction and recruitment, and just as well need the fringe marsh along Honey Creek for spawning and nursery habitat (Stephenson 1990, Jude and Papas 1992). The fringe area of many lakes and ponds is also critical in that they provide structure and food to maintain diverse macroinvertebrate populations that support both aquatic and terrestrial species by being food sources (Krieger 1992). Many species of waterfowl also require fringe marsh for both nesting and rearing of young. The proposed habitat restoration would have great potential to support various endangered and special concern species, including the peregrine falcon, Butler's gartersnake, Blanding's turtle, and least darter. Restored habitats may also attract the federally endangered rusty patched bumble bee and the federally threatened northern long-eared bat.

4.5 Acceptability, Completeness, Effectiveness & Efficiency

Acceptability, completeness, effectiveness, and efficiency are the four evaluation criteria USACE uses in evaluating alternative plans. Alternatives considered in any planning study, not just ecosystem restoration studies, should meet minimum subjective standards of these criteria in order to qualify for further consideration and comparison with other plans.

Acceptability

An ecosystem restoration plan should be acceptable to state and federal resource agencies and local governments. There should be evidence of broad-based public consensus and support for the plan. The tentatively recommended plan must be acceptable to the non-federal cost-sharing partner.

The Honey Creek Aquatic Restoration study was developed in a collaborative fashion, in which planning, and design meetings screened and refined habitat restoration measures. Alternative 1, No Action, provides no ecosystem improvements and is not acceptable to the Federal Objective, the non-federal sponsor's goals, and stakeholder desires. Alternatives 8 and 9 are the most acceptable in terms of the Federal Objective and non-federal sponsor/stakeholder vision for reestablishing a sustainable and viable ecosystem within the Honey Creek study area. Alternatives 3 and 4 provide limited benefits but generally leave critical aquatic habitat types and stream connectivity during low flows in a degraded state. Taking the Federal Objective, study objectives, municipal planning initiatives and documents, and non-federal sponsor/stakeholder needs into consideration, Alternatives 8 and 9 provide the most diverse habitat possible and therefore would be the most acceptable.

Completeness

A plan must provide and account for all necessary investments or other actions needed to ensure the realization of the planned restoration outputs. This may require relating the plan to other types of public or private plans if these plans are crucial to the outcome of the restoration objective. Real estate, operations and maintenance, monitoring, and sponsorship factors must be considered. Where there is uncertainty concerning the functioning of certain restoration features an adaptive management plan should be proposed and must be accounted for in the implementation plan.

All of the factors were considered in the development or post formulation assessment of alternative plan costs/outputs, consistency with other federal and non-federal Plans, real estate, operation and maintenance (O&M), monitoring and non-federal sponsorship. Alternative 1 does not provide any action to restore degraded habitats and, therefore, is incomplete in realization of ecosystem improvements. Alternatives 3 and 4 are incomplete in terms of restoring all potential habitats and are inconsistent with the MMSD's local plans for reestablishing riverine connectivity within the Menomonee River and its tributaries. Alternatives 8 and 9 are the most complete, in that they would change the study area from a concrete lined channel with degraded riparian habitat into a more diverse riverine habitat system for native fish, wildlife, and migratory birds. Alternatives 8 and 9 do not require additional investment beyond standard O&M in order to achieve the restoration goals or restoration sustainability. Alternatives 8 and 9 are expected to restore a complete and sustainable aquatic ecosystem within a portion of Honey Creek.

Effectiveness

A plan must provide and account for meeting goals and objectives of the study to ensure the realization of the planned restoration outputs.

Objective 1 – Reestablish Quality and Connectivity of Riverine Habitats: This objective seeks to reestablish natural hydrologic and geomorphic parameters to support critical riverine habitats within the Honey Creek study area.

Objective 2 – Reestablish Quality and Connectivity of Riparian Habitats: This objective seeks to reestablish natural hydrologic and geomorphic parameters to support critical riparian habitats within the Honey Creek study area.

- Alternative 1 takes no action, and therefore does not meet the two planning objectives since the FWOP Conditions do not foresee natural recovery of this system.

- Alternative 3 would restore riparian woodland habitat along a portion of the Honey Creek channel within the study area, or approximately 39.1 acres of riparian zone. No restoration of stream or marsh/meadow habitats would occur. This alternative would partially address Objective 2 but would not address Objective 1 since hydrologic and geomorphic parameters to support riparian habitats would not be restored.

- Alternative 4 would restore riparian woodland habitat along the entire Honey Creek channel within the study area, or approximately 46.0 acres of riparian zone. No restoration of stream or marsh/meadow habitats would occur. This alternative would fully address Objective 2 but would not address Objective 1 since hydrologic and geomorphic parameters to support riparian habitats would not be restored.

- Alternative 8 is like Alternative 4 but includes restoration of hydrologic and geomorphic parameters. It would restore transitional meadow/persistent marsh habitat (2.2 acres), approximately 46.0 acres of riparian woodland, and approximately 8.2 acres of stream channel using j-hooks, woody debris, and a mixture or substrates. The substrates used to restore the channel are a mixture of sand, gravel, and cobbles. This alternative fully addresses Objectives 1 and 2 within the purview of the Section 206 authority and USACE policies.

- Alternative 9 is the same as Alternative 8, except the substrates used to restore the channel would be crushed aggregate covered by a layer of cobbles. This alternative fully addresses Objectives 1 and 2 within the purview of the Section 206 authority and USACE policies.

Efficiency

An ecosystem restoration plan must represent a cost-effective means of solving habitat problems and seizing opportunities to improve the environment. It must be determined that the plan's restoration outputs cannot be produced more cost effectively than any other plan via the USACE's Six-Step Planning Process.

Six (6) measures, including No Action, were refined to seize site specific opportunities, address Honey Creek study area problems, and were further honed by targeting two ecosystem objectives. Using the USACE Institute for Water Resources Planning Suite Software, 20 alternative combinations were generated from the measures. Through the CE/ICA analyses, nine (9) cost effective combinations were identified, which is inclusive of the five (5) Best Buy plans. The No Action plan is always deemed cost effective and is then considered a Best Buy plan. Eleven (11) alternative combinations were screened out as non-cost effective. Only the five (5) Best Buy plans were considered for selection, since they are all considered highly efficient. As discussed in Section 4.3.2, Incremental Cost Analysis, there were breakpoints between the five Best Buy plans.

Alternatives 3 and 4 are considered cost efficient and justified for selection over Alternative 1, No Action plan, since both the alternatives address to some degree Objective 2 of the planning objectives. However, Alternatives 3 and 4 would not address Objective 1. Alternative 1 would address neither of the planning objectives.

Alternative 8 is considered cost efficient and justified for selection over Alternatives 3 and 4, since Alternative 8 includes the restoration of the entire riparian zone along Honey Creek as well as the restoration of instream features and wetland complexes. Moving from Alternatives 3 and 4 to Alternative

8 is a significant change in incremental cost per additional AAHU, however, the implementation of Alternative 8 would address both planning objectives by restoring both stream, wetland, and riparian habitats. The last Best Buy alternative, Alternative 9, is the same as Alternative 8, except different substrates would be used to restore the stream channel. Alternative 9 only provides an additional 0.08 AAHU over Alternative 8 with the incremental cost for the additional AAHU being significant; $1,711,700 for less than one (1) additional AAHU. Since Alternative 8 already addresses both planning objectives, and Alternative 9 would only restore different substrates, the selection of Alternative 9 over Alternative 8 is not justified, nor is it cost efficient. Therefore, Alternative 8 is considered the most cost-efficient alternative plan since it not only restores riparian woodland habitat, but also wetland and aquatic habitat at a cost less than Alternative 9.

In order to further justify the efficiency of Best Buy Alternatives 8 and 9 over the No Action alternative and Alternatives 3 and 4, the CE/ICA was run separating out the stream channel restoration measures from the Marsh/Transitional Meadow and Riparian Woodland measures. Stream channel restoration measures are generally more costly per habitat unit than measures to restore plant communities due to the level of effort required to implement the measures. By separating out the stream channel restoration measures from the plant community restoration measures, the cost-effectiveness break points can be more easily discerned and the justification for these more costly measures can be more easily shown. Figure 25 shows the results of the Incremental Cost Analysis just between Stream Channel Restoration Option A (SCa) and Stream Channel Restoration Option B (SCb). Looking at the figure, it better depicts the magnitude of the additional benefit achieved by selecting either Alternative 8 or 9, both of which include stream channel restoration measures, over Alternative 3 or 4, which include only riparian woodland restoration measures. In addition, Figure 25 shows a clear break point between the two stream restoration measures, SCb and SCa, and it shows that SCb provides more habitat units for less cost than SCa. Since SCb is part of Alternative 8, Figure 25 further justifies the cost efficiency of Alternative 8 over Alternative 9, which includes SCa.

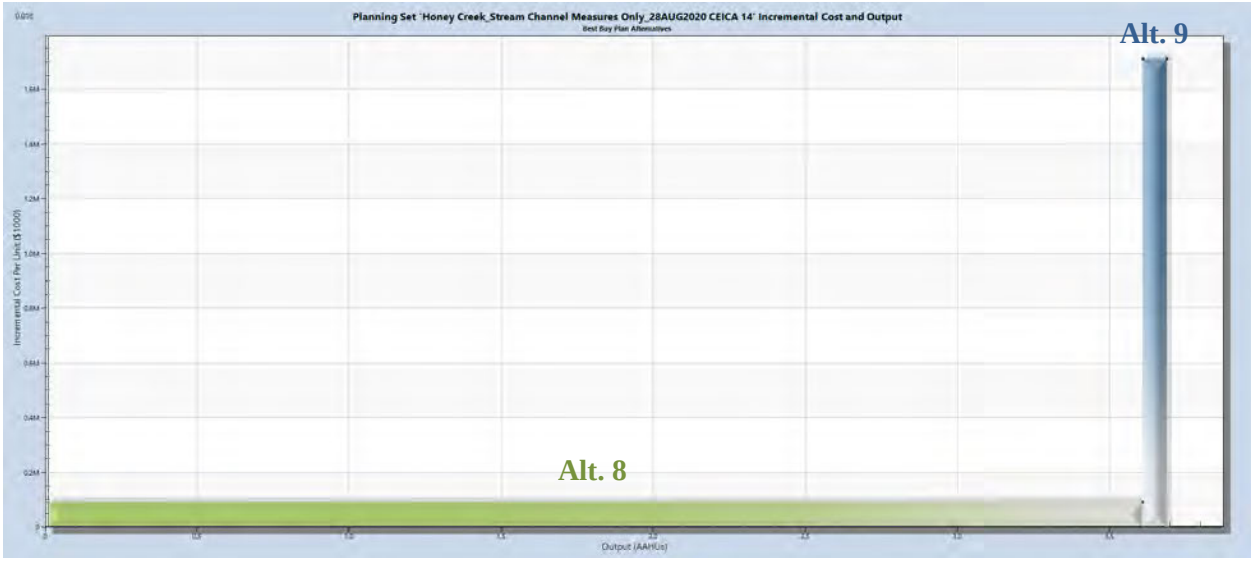

Figure 25 - Incremental Cost and Output of "Best Buy" Alternative Plans. Alternative 8 is the green bar, Alternative 9 is the blue bar.

4.5.1 Risk and Uncertainty

When the costs and outputs of alternative restoration plans are uncertain and/or there are substantive risks that outcomes will not be achieved, which may be the case, the selection of a recommended alternative

becomes more complex. It is essential to document the assumptions made and uncertainties encountered during the planning analyses. Restoration of some types of ecosystems may have relatively low risk. For example, removal of drainage tiles to restore hydrology to a wetland area. Other activities may have higher associated risks such as restoration of coastal marsh for example, which exist in areas subject to hurricanes. When identifying the NER plan, the associated risk and uncertainty of achieving the proposed level of outputs must be considered. For example, if two plans have similar outputs but one plan costs slightly more, according to cost effectiveness guidelines, the more expensive plan would be dropped from further consideration. However, it might be possible that, due to uncertainties beyond the control or knowledge of the planning team, the slightly more expensive plan will produce greater ecological output than originally estimated, in effect qualifying it as a cost-effective plan. But without considering the uncertainty inherent in the estimate of outputs, that plan would have been excluded from further consideration.

Overall, there is very low risk associated with Alternatives 3, 4, 8, and 9 of not performing as predicted. Sufficient investigations to the level of project complexity were performed to ensure that the restored plant communities would not revert to invasive, weedy species again by (a) lessons learned from constructed park-like plant restoration projects i.e. Underwood Creek 506, Menomonee River 506, and (b) designing plant communities to the target hydrology and geomorphology instead of planting communities not appropriate for the location and characteristics of the site..

Complete eradication of invasive species always presents a certain level of risk and uncertainty, as the chances of reinvasion are likely to occur without proper management, increasingly so when native species have not yet established. A prominent issue is that invasive plant species are adapted for colonizing areas that are disturbed and have ruined soils. Measures that alleviate ruined soil properties consist of minor grading and adding leaf litter compost to the top 6 inches of soil during late summer or early fall. Incorporating soil amendments decreases bulk density, holds moisture longer and increases organic matter and microbial activity. This would further the soil's ability to provide for native plants and reduce the vulnerability of the plant community to noxious weed invasion. This measure has been found to work on several USACE habitat restoration projects where the soils were physically ruined. The other end of the spectrum would be the addition of inorganic substrates to reverse the overly organic substrates currently in place. The only situation worse than a plant community completely comprised of weedy, nonnative species, is no plant community at all.

When controlling invasive plant species, the use of herbicides is often the preferred method. Herbicides are any chemical substance that is used specifically to kill plants. Many of the modern systemic herbicides that are used in natural areas target specific plant processes or pathways and are formulated to only impact those plants. They are applied to the aboveground part of the plant and are transported throughout the plant to the root system. Selective application methods include foliar spray or wicking, cut stump applications, and basal bark applications to standing shrubs and thin-barked trees. Each of these techniques is designed to minimize the amount of herbicide used as well as the risk of damage to non-target plants and the environment. The main types of herbicide are selective and non-selective herbicides. As the names suggest, 'selective herbicides' are formulated to control certain species of vegetation while leaving others unaffected. 'Non-selective herbicides' affect all vegetation. Although there are two generally overarching types of herbicides, it is important to understand that different brands and formulations of herbicides can act differently on different plants; therefore, it is imperative to understand the product that is being used and how it will behave in the plants, soil, and water. Herbicide labels provide critical information on the safe use and application of herbicides, and all herbicide usage for this project will follow labeled application and safety instructions. Lastly, the use of herbicides in a riparian zone also carries the risk of runoff into the creek, which may harm the aquatic habitat, fish, and other organisms.

Native plantings also have an associated risk of not establishing due to a variety of unforeseen events. Predation from herbivorous animals is likely since common carp and Canada geese are prevalent in the area. Weather also plays a large role in the establishment success of new plantings. Periods of drought, flood or early frost can alter the survival percentage of plantings. To mitigate these risks, planting over several years, overplanting and/or adaptive management, and monitoring may be incorporated into the plan. In addition, climate change may or may not affect project outcomes. Increased temperatures or rainfall may lead to changes in the ecosystem of the project area; however, Lake Michigan primarily drives the weather in the Milwaukee metropolitan area and may partly mitigate climate change concerns in the near future. This climate concern is alleviated by having a broader pallet of adaptive plant species to compensate for potential climatic shifts.

Urban stream flows may pose a risk to performance of the recommended plan; however, the proposed riffles to restore the stream channel with alluvial material will be designed to specifically handle the larger urban derived flood pulses. These structures, when constructed properly, will provide habitat in itself and induce other habitat features, such as point bar formation, scour pools, and diverse substrate patches. In turn, these new formations can provide critical hydraulic conditions such as critical and helical flows, all of which would attract lotic macroinvertebrates and fishes. An additional measure within the recommended plan ensuring stream channel resiliency to urban stream flows is floodplain connectivity as well as vegetating areas with bare soils prone to erosion. These actions will in turn lessen the risk and uncertainty associated with invasive species removal by preventing further degradation to soils and creating an environment suitable for native plant establishment.

4.6 Plan Comparison & Tentatively Selected Plan (TSP) Recommendation

When selecting a single alternative plan for recommendation from those that have been considered, the criteria used to select the NER plan include all the evaluation criteria discussed above. Selecting the NER plan requires careful consideration of the plan that meets planning objectives and constraints and reasonably maximizes environmental benefits while passing tests of CE/ICA, significance of outputs, acceptability, completeness, efficiency, and effectiveness. This restoration project was planned in cooperation with the MMSD and various federal, state, and local stakeholders. Also, this restoration project makes a significant contribution to regional, national, and international programs that include the North American Waterfowl Management Plan, Lake-wide Management Plans, and the Coastal Zone Management Plan. This plan included an opportunity for open comment to allow all stakeholder parties to contribute.

All costs associated with a plan were considered, and tests of CE/ICA have been satisfied for the alternatives analyzed. The cost estimates were based on current ecosystem restoration projects that are in construction and design phases. Having established confidence in the estimated implementation costs, the remaining test of reasonableness is to assess the value of the resource to be improved based on the cost to implement the improvement. The importance of Migratory Birds in terms of human uses and aesthetics has been documented through numerous sources, most importantly the Migratory Bird Treaty Act (1918) and E.O. 13186 *Responsibilities of Federal Agencies to Protect Migratory Birds*.

Non-monetary values associated with the Honey Creek restoration project include a variety of ecological, social and educational benefits. The project will provide important stop-over habitat for birds traveling along the Great Lakes portion of the Mississippi Flyway, a migratory route recognized as nationally significant by the Audubon Society. An estimated 5 million birds, and more specifically tropical songbirds and waterfowl, utilize this route. In addition, the native habitat types planned will benefit native resident species. A variety of aquatic species such as fish, macroinvertebrates, and amphibians will greatly benefit through the addition of important foraging, refuge, and spawning habitat. The restoration

of the Honey Creek study area to a more natural state will markedly increase the ecological integrity of the surrounding area and is justified for the investment.

The plan that reasonably maximizes net NER benefits and is consistent with the Federal Objective, authorities and policies, is identified as the NER plan. This NER Plan is considered as the Preferred Plan for direct, indirect, and cumulative effects assessment under National Environmental Policy Act (NEPA) as discussed in the following Chapter. The NER/Preferred Plan was determined to be Alternative 8 (Figure 26). Alternative 8 is considered the most cost effective plan as it restores all potential habitats for this reach of Honey Creek (e.g., riparian, wetland, and aquatic) while costing less than the other alternative plan that provides a similar benefit (i.e., Alternative 9).

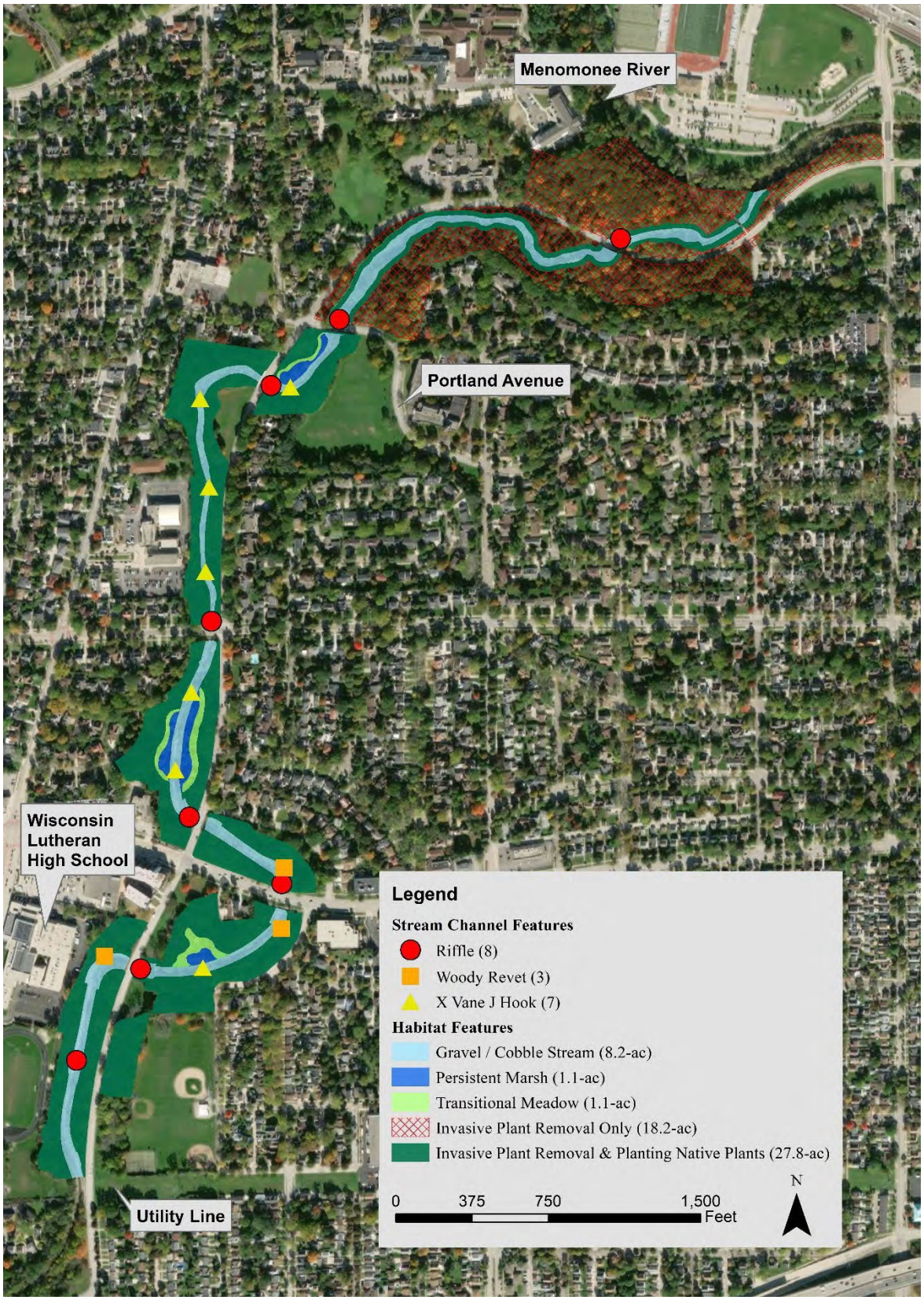

Figure 26 - Tentatively Selected Plan / Preferred Plan / NER Plan

CHAPTER 5 – ENVIRONMENTAL ASSESSMENT

This chapter involves prediction of direct, indirect and cumulative environmental effects to current conditions stemming from implementation of the Preferred Plan/NER Plan.

5.1 Need and Purpose

Early records reveal that the Milwaukee Estuary Area, including the Milwaukee, Menomonee, and Kinnickinnic Rivers and their tributaries (e.g., Honey Creek) has been substantially channelized, relocated, dredged, filled, and dammed to convert the significant wetland complex into the highly constructed navigable port that currently exists (Southeastern Wisconsin Regional Planning Commission 2010). This conversion allowed for the development and growth of the greater Milwaukee metropolitan area that currently exists, but this conversion has led to significant environmental degradation in water quality, fisheries, and wildlife habitat. Between 1836 (earliest known survey of the entire Menomonee River) and present time, significant channelization and diversion of stream channels within the river systems has occurred (Southeastern Wisconsin Regional Planning Commission 2010).

Currently, the Honey Creek study area no longer provides a diversity of high-quality native habitats sufficient to maintain even moderate levels of biodiversity. Based on site inventory and characterization by the USACE, a set of Problems and Opportunities were developed by the study team, non-federal Sponsors and supporting stakeholders. These drive the need for action, which is due to human induced disturbances to the remaining natural processes within the Honey Creek watershed, including fire suppression, altered hydraulics through lining of the stream channel with concrete, increased colonization of invasive species, urbanization pressures and fragmentation. The purpose of the proposed project is to address past stream modification, invasive species issues, and provide important habitat for various fish and wildlife species within Honey Creek.

5.2 Alternatives Considered

Section 4.1 provides discussion on the suite of measures that were developed to address study problems and meet objectives. These measures were processed through the IWR Planning Suite program to generate cost effective plans. The Cost Effectiveness and Incremental Cost Analysis (CE/ICA) takes implementation and real estate costs and ecosystem outputs into consideration. Ecosystem outputs were measured via the Qualitative Habitat Evaluation Index (QHEI) and the Floristic Quality Assessment (FQA). Five (5) alternative plans, including the No Action Plan, were deemed best case scenarios for project implementation. Alternative 8 was selected as the NER Plan, which for the purposes of this Environmental Assessment, is synonymous with the Preferred Plan or TSP. Rationale for selecting the NER/Preferred Plan is presented in Section 4.6.

- Alternative Plan 1 – No Action
- Alternative Plan 3 – (RWb) Riparian Woodland 39.1-ac
- Alternative Plan 4 – (RWc) Riparian Woodland 46.0-ac
- Alternative Plan 8 – (RWa) Riparian Woodland 46.0-ac, (MM) Marsh/Meadow 2.2-ac, (SCb) Stream Channel 8.2-ac
- Alternative Plan 9 – (RWa) Riparian Woodland 46.0-ac, (MM) Marsh/Meadow 2.2-ac, (SCa) Stream Channel 8.2-ac

5.3 The Affected Environment

A detailed description of the affected environment can be found in Chapter 2 – Study Area Inventory and Forecasting. Based on data collection, analysis, and modeling conducted under this feasibility study, and in coordination with federal, state, and local governmental agencies and published studies by academia, it was determined that the physical, chemical, and biological conditions of the Honey Creek study area are in a state of habitat equilibrium, albeit a highly degraded one. As a result, dominant species present at the site are tolerant to habitat loss, anthropogenic disturbance, and poor water quality. Examples of these tolerant to disturbance species include gray squirrel, coyote, deer, mallard, beaver, muskrat, common carp, largemouth bass and bullhead. Slight improvements in water quality and some vegetation patches that have occurred are not enough for native plant and animal communities to reestablish, resulting in missing critical structural habitat components. The No Action alternative conditions are synonymous with the FWOP Conditions, which are presented in Section 2.6.

5.4 Direct and Indirect Effects of the Preferred Plan

In addition to the effects discussed in the following sections, a 404(b)(1) analysis is provided in *Appendix A – 404(b)(1)/401 and Coordination*. This analysis further documents whether there are effects to the aquatic environment resulting from the construction activities of the preferred plan.

5.4.1 Physical Resources

Geology and Soils

The study area lies over Silurian-age dolomite of the Racine Formation. The regional bedrock is for the most part buried within the study area by manmade fills on bank and riparian areas, only being moderately exposed in some portions of the stream bed. Since the minor surficial grading would not disturb this geomorphic feature or displace glacial materials present, there would be no adverse effects resulting from implementation of the Preferred Plan/NER Plan. In terms of ecological function, all soils within the study area are considered manmade, and relatively unsuitable for a diverse array of native microbial, plant and insect growth. These soils primarily consist of mixed topsoil's, clay, and gravels and fines derived from concrete and urban dirt. Geomorphic feature and soil effects resulting from the implementation of the Preferred Plan/NER Plan are negligible.

Sediment within Honey Creek will not be impacted. Once the concrete channel is removed, natural substrates (i.e., glacially derived gravel, pebbles, cobbles, boulders) will be restored, allowing natural sediment-related processes to be recovered.

No adverse impacts to the geology or soils within the material disposal site are expected either. The concrete/soil/other material removed from the project site would be stored at the disposal site permanently or until it could be recycled and used for another project. Disposal of material would only be on the surface; no burial of material would occur on site.

Climate and Climate Change

Climate change is expected to have a negligible impact on the study area during the 50-year period of analysis in terms of ecosystem structure and function; however, project performance is preserved under a wide range of possible climate change scenarios during the period of analysis. There is a potential for average global temperatures to increase, storms to become more intense, and droughty periods with singular high rainfall events. The key to sustainability within these conditions is to have highly diverse

(heterogenous genotypes) riparian plant communities established so that they can ebb and flow with the changing climate patterns, which is termed *adaptation* or *natural selection*. The anthropogenic changes to the Honey Creek aquatic ecosystem complex have caused greater adverse impacts than climate change is anticipated to induce, and the river already has a high degree of hydrologic flashiness due to the urban nature of the watershed. Minor increases or decreases in stream flows would have no significant bearing on habitat and connectivity, whereas natural fluvial geomorphic functions and processes would allow the ecological system to adapt accordingly.

Hydrology

Storm sewer drainage improvements, draining of wetlands, increase in impervious surfaces, and stormwater runoff have destroyed the natural hydrology of the Honey Creek study area (see *Section 2.2.2 Watershed Hydrography*). Implementation of the Preferred Plan/NER Plan would be geared towards habitat supported by the current hydrologic regime, and only manipulates hydraulics and geomorphology. Since the Preferred Plan/NER Plan would be implemented in a fashion as to not manipulate hydrology, no adverse effects resultant from implementing the Preferred Plan/NER Plan are expected. No impacts to hydrology at the material disposal site are expected. The Root River is located to the east of the disposal site; however, the disposal site is not adjacent to the Root River nor within the Root River's 100- or 500-year floodplain. Wisconsin DNR has mapped wetlands located along the bottom southwest corner of the proposed disposal site; however, this area would be avoided and not included in the 4.7 acres needed for the disposal and storage of the concrete/soil/other material removed from Honey Creek nor the 0.86 acres that would be required for access to the disposal site.

Hydraulics

The Milwaukee, Kinnickinnic, and Menomonee Rivers (of which Honey Creek is a tributary to) used to contain significant wetland complexes; however, this hydraulic regime is no longer intact. Within Honey Creek, the lining of the channel with concrete destroyed natural hydraulic features such as riffles, runs, and pools. Therefore, currently all in-channel hydraulics within the study are induced by man and are not supportive of ecological functions. Implementation of the Preferred Plan/NER Plan would be geared towards adding structure to low and normal flow elevations in the form of large woody debris, fluvial stone riffles, step-pools, and boulder clusters. There would also be the addition of large woody debris bank armoring above the normal flow elevations to alleviate bank scour and erosion of substandard materials to be incorporated into a river's sediment transport regime. Since the Preferred Plan/NER Plan would be implemented in a fashion as to a) manipulate low and normal flow hydraulics to induce velocity diversification for fishes and macroinvertebrates, and b) to create pockets of persistent marsh and transitional meadow plant communities, no adverse effects resultant from implementing the Preferred Plan/NER Plan are expected to the hydraulic regime within the study area.

Regarding flood flows, the NER Plan would have no short-term or long-term adverse effect to the conveyance of flood flows. Construction of the instream project features would be scheduled to occur during months when low flows are experienced, therefore, construction activities would not increase the likelihood of downstream flooding or flood damages. Long-term, the addition of project features such as riffles, woody debris, and contouring of the channel banks would provide instream structure and connectivity to the floodplain all of which help reduce water velocity and create more floodwater storage, thereby reducing the height of a flood peak. In addition, the restoration of the riparian zone with native plants would help hold the stream banks together and decrease flow velocity, thereby reducing the risk that the stream will dramatically change course over the project lifetime (i.e., 50 years). Overall, the NER Plan is not expected to have an adverse effect to flood flows. The NER Plan would continue to provide adequate flood conveyance within Honey Creek, and project features would help reduce water velocity during storm events.

No impacts to hydraulics at the material disposal site are expected. The Root River is located to the east of the disposal site; however, the disposal site is not adjacent to the Root River nor within the Root River's 100- or 500-year floodplain. Wisconsin DNR has mapped wetlands located along the bottom southwest corner of the proposed disposal site; however, this area would not be included in the 4.7 acres that would be needed for the disposal and storage of the concrete/soil/other material removed from Honey Creek nor the 0.86 acres that would be required for access to the disposal site.

Water Quality

Currently, water quality within the study area is degraded, with impairments to fish and aquatic life use as well as recreational restrictions (see *Section 2.2.3 Water Quality*). In their scoping letter dated 17 November 2017, the USEPA stated (Westlake 2017) that "[…] impairments include fecal coliform. A recent MMSD planning effort determined that 87% of fecal coliform present in the watershed originates from urban stormwater runoff." Regarding dissolved oxygen, the USEPA stated (Westlake 2017) that "[U]nderwood Creek and Honey Creek generally meet DO standards some of the time." Regardless of the impairments, water quality is sufficient enough to allow moderately conservative species to inhabit the area (Table 2). The Preferred Plan/NER Plan would have incidental water quality benefits through the removal of the concrete lined channel, addition of in-stream habitat (e.g., riffles, woody debris), and addition of transitional meadow/persistent marsh habitat, all of which would improve dissolved oxygen, lower temperatures, filter nutrients, and prevent fine materials from entering the stream.

The subsequent establishment of transitional meadow/persistent marsh and riparian woodland species would also provide moderate water quality improvements through filtering water, shading portions of the stream channel, and providing high quality allochthonous material to the creek. Short-term adverse impacts stemming from increases in turbidity due to construction activities could occur, but these impacts are expected to be short in duration and would be minor since erosion controls and BMPs will be followed. Adverse long-term effects to water quality stemming from construction activities are not anticipated, since erosion controls and BMPs will follow the Wisconsin Water Quality Standards. Turbidity and erosion will be controlled during construction activities and until the project area is stabilized with new plant growth.

No impacts to water quality at the material disposal site are expected. The Root River is located to the east of the disposal site; however, the disposal site is not adjacent to the Root River nor within the Root River's 100- or 500-year floodplain. Wisconsin DNR has mapped wetlands located along the lower southwest corner of the proposed disposal site; however, this area would not be included in the 4.7 acres that would be needed for the disposal and storage of the concrete/soil/other material removed from Honey Creek, nor the 0.86 acres required for access to the disposal site. There would be no runoff from the material that could potentially make its way into the Root River or the wetlands located on the site; therefore, no impacts to these site's water quality are expected.

Hazardous, Toxic and Radioactive Wastes (HTRW)

Multiple Phase I and Phase II Environmental Site Assessments (ESAs) were prepared for the study area and are included in *Appendix E – HTRW Environmental Site Assessments*. Results of the Phase II ESA suggest that soils in upstream portions of the study area may contain HTRW; contaminants of concern in soils include PNAs, PCBs, and RCRA metals. As a result of the Phase II ESA, the boundaries of the study area were modified during the feasibility phase to avoid portions of the study area where the presence of HTRW would limit the amount of soil disturbance acceptable to the non-federal sponsor and comply with USACE HTRW policy. The area of HC-18-01 is no longer part of the study area to avoid HTRW. This area consists of 1,600 feet of stream extending from the utility crossing near the Wisconsin Lutheran High

School (the current southern boundary of the project footprint) upstream to the culverts south of I-94 at 84th Street and O'Connor Avenue (see Figure 27).

In addition, the best location to revise the project limit to avoid the area of HC-18-01 and affected utilities encompassed the area of HC-18-02 (see Figure 27). It was not removed from the study area due to HTRW concerns. Further analysis in design may help delineate the boundary between HC-18-01 and HC-18-02 to maximize the project benefits. Thus, if any portions of HC-18-02 are used in the project, the recommendation is to follow the implementation advice for the area of HC-18-06 (see *Appendix E – HTRW Environmental Site Assessments*).

Figure 27: Phase 2 ESA sampling map. Blue line indicates new upstream (southern) project limit.

Within the reduced project footprint there remains an isolated upland location where PAHs, benzo(a)pyrene and chrysene, are present with concentrations that exceed the groundwater protection or direct contact Residual Contaminant Levels (RCLs) for residential properties in the State of Wisconsin (generally, area of HC-18-06) (see Figure 27). In accordance with the HTRW policy, the presence of PAHs in soils in the vicinity of this isolated upland location is an HTRW condition due to the presence of CERCLA regulated substances. The Phase I/Phase II HTRW investigations suggest that there is no indication of a historic or continued release of contaminants impacting the upland areas of the site; therefore, the likelihood of a CERCLA or other regulatory HTRW response action required by the State or USEPA is very unlikely. PAHs present at the low concentrations identified are likely representative of the background condition of soils in an urban area.

Regarding soil management activities for implementation of stream restoration measures, it is recommended that all soils be reused onsite. Soil materials with low concentrations of contaminants can be handled and reused onsite with little to no increased human health or ecological risk if conducted in accordance with the State of Wisconsin Department of Natural Resources (WDNR) exemptions for managing minimally contaminated materials using NR718 (WDNR Remediation and Redevelopment Program) or using a Low Hazard Exemption under NR720 (WDNR Solid Waste Disposal Program). Requirements for managing materials onsite are dependent on site-specific fact-finding, which will be identified during the design phase of the project and are specific to the location and volume of materials being generated onsite and the ultimate location of disposition of materials onsite. Additional coordination with the WDNR will be conducted during the design phase of the project to define the program requirements and any additional investigation required. If soils and/or sediments removed from Honey Creek cannot be managed onsite, or is not supported by the resource agencies, all soils and/or sediments requiring off-site disposal will be characterized for appropriate disposal alternatives in accordance with Federal, State and local laws and regulations. Any special handling and/or off-site landfill disposal costs associated with managing soils is considered a HTRW response action that is a non-cost shared Non-Federal project sponsor expense.

Air Quality

The local air quality in Milwaukee County, Wisconsin is currently in attainment and/or maintenance status for the six criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide) (see *Section 2.2.6 Air Quality* for additional discussion). Once implemented, the project itself will be neutral in terms of air quality, with no features that either emit or sequester air pollutants to a large degree. During the project construction, heavy equipment would cause minor, temporary air quality impacts, however, all equipment will follow current air quality control requirements for diesel exhaust, fuels, and similar requirements. A general conformity analysis was not conducted due to the short and temporary nature of any air quality impacts.

No impacts to air quality at the material disposal site are expected. There potentially could be short-term impacts due to fugitive dust when the concrete/soil/other material is dumped at the disposal site; however, these impacts would be short in duration.

5.4.2 Ecological Resources

Plant Communities

Most of the project area does not support any stable native plant communities (see *Section 2.3.1 Plant Communities*). The communities present were established as a result of human-induced disturbances and fire suppression and do not occur together under natural conditions as associates within self-sustaining communities. Additionally, the changes to the site hydrology and hydraulics have resulted in an absence

of wetland plant communities. The Preferred Plan/NER Plan recommends contouring of the stream banks to recreate bank slopes, floodplain terraces, and areas were wetland habitat, such as persistent marsh and transitional meadow plant communities, can be restored. Additionally, the Preferred Plan/NER Plan recommends removing non-native plant species, adding high organic carbon soil amendments, and 5 years of establishing native persistent marsh, transitional meadow, and riparian woodland. Based on this, there would be no adverse effects to natural plant communities within the Honey Creek study area. Plant community effects resulting from the implementation of the Preferred Plan/NER Plan are highly beneficial. Plant lists for with and without project conditions are provided in *Appendix H – Monitoring Plan and Habitat Analysis*.

No impacts to plant communities at the material disposal site are expected. The site currently has one wetland located along the bottom southwest corner of the property boundary. This area would be avoided for disposal and storage of the concrete/soil/other material. The remainder of the site is low quality sparse forest along with patches of turf grass. For the disposal, only 4.7 acres is needed, and 0.86 acres is needed for access to the site. The location of the disposal site requires that some trees be removed to prepare the area (e.g., haul roads, disposal site, etc.); however, only trees that need to be removed will be. Therefore, the impact to the low-quality habitat should be minimal.

Macroinvertebrates

Sampling studies by the Wisconsin Lutheran College show that the aquatic macroinvertebrate community within Honey Creek is highly tolerant (see *Section 2.3.3 Aquatic Macroinvertebrates*). This is typical for concrete lined urban channels. The Preferred Plan/NER Plan would remove the concrete lining the channel, place natural substrates, install large woody debris, diversify hydraulics, and restore persistent marsh and transitional meadow habitat. The change alone from concrete to natural substrates (i.e., sand, gravel, and cobble) would dramatically increase aquatic macroinvertebrate diversity by providing habitat in the interstitial spaces between the substrates. Establishing a higher diversity of native grasses, flowers, shrubs, and trees within the riparian zone would also be expected to increase invertebrate diversity (see plant lists in *Appendix H – Monitoring Plan and Habitat Analysis*) by providing native flora that some of these species depend upon in their lifecycle. Based on this, there would be no short- or long-term adverse effects to aquatic or terrestrial invertebrate communities within the study area. Invertebrate effects resulting from the implementation of the Preferred Plan/NER Plan are beneficial.

No impacts to invertebrates at the material disposal site are expected. The placement of the concrete/soil/other material could compact soils which may impact invertebrates found within the soils at the disposal site; however, in terms of relative abundance the impact to these terrestrial invertebrates would be minor to negligible.

Fishes

In general, the concrete lining of the channel, lack of substrates, loss of wetland habitat, and the degraded riparian habitat have impacted the fish assemblage within Honey Creek (see *Section 2.3.5 Fishes*). The maximum IBI for Honey Creek using fish sampling data is currently 20 which is indicative of poor habitat. The Preferred Plan/NER Plan would remove the concrete lining the channel, place natural substrates, install large woody debris, diversify hydraulics, and restore persistent marsh and transitional meadow habitat within Honey Creek. The change alone from the concrete lined channel to a stream with a diversity of natural substrates (i.e., sand, gravel, and cobble) would dramatically increase fish diversity by providing habitat. Additionally, the restoration of a higher diversity of native grasses, flowers, shrubs, and trees within the riparian zone would provide high quality allochthonous inputs to the stream, thereby increasing the quality of forage within the stream as well as foraging opportunities for fish. An increase in forage quality and quantity within Honey Creek would also be expected to result in an increase in fish

diversity. Once restored, recolonization of Honey Creek would be possible by species present within the greater Menomonee River Watershed (see *Section 2.3.5 Fishes*). Based on this, there would be no short- or long-term adverse effects to native fish communities within the study area. Effects to fish communities resulting from the implementation of the Preferred Plan/NER Plan are beneficial.

Coordination with the WDNR regarding the project was commenced with a scoping letter dated 1 November 2017. This coordination is expected to continue with the 30-day public review of the draft report. In their scoping letter dated 17 November 2017, the USEPA (Westlake 2017) stated that "[I]n related projects, WDNR has implemented in-water work restrictions between March 15 and June 15." If requested by WDNR, in-water work restrictions will be included in order to reduce any potential impacts to reproducing fishes that may be present in Honey Creek.

No impacts to fishes at the material disposal site are expected. As discussed above under *Water Quality*, the Root River is located to the east of the disposal site; however, the disposal site is not adjacent to the Root River nor within the Root River's 100- or 500-year floodplain.

Reptiles & Amphibians

Reptiles, and especially amphibians are easily affected by habitat and water quality degradation. The massive changes to Honey Creek within the study area effectively eliminated sensitive species of amphibian and reptiles, leaving tolerant species behind, such as Painted and Snapping Turtles (see *Section 2.3.6 Reptiles & Amphibians*). The Preferred Plan/NER Plan recommends bank contouring, large woody debris placement, and native plantings to facilitate amphibian and reptile migration, reproduction, and health. Based on this, there would be no adverse effects to reptile and amphibian communities within the Honey Creek study area or the surrounding area resulting from implementation of the Preferred Plan/NER Plan. Reptile and amphibian community effects resulting from the implementation of the Preferred Plan/NER Plan are beneficial.

No impacts to reptiles or amphibians are expected at the material disposal site. As discussed in previous sections, the site does have one mapped wetland along the property's bottom southwest corner meaning amphibians and reptiles could be present at the site since habitat is available; however, this location would be avoided for disposal of the concrete/soil/other material. Instead, the concrete/soil/other material would be disposed of in open areas of the site that are currently covered in turf grass and provide no suitable habitat for amphibians or reptiles.

Birds

The Honey Creek study area is located within the Great Lakes portion of the Mississippi Flyway, which is nationally recognized as an important route for many migratory and resident birds (see *Section 2.3.7 Birds*). The Preferred Plan/NER Plan recommends the removal of invasive plant species and the establishment of native plants which provide habitat and higher quality food sources for organisms and plants that support migratory birds and in particular, water birds (e.g., herons, ducks, mergansers, grebes, etc.). Limited removal of native trees and shrubs would be limited to those bank areas that require grading. Additionally, clearing of invasive species will be timed appropriately to avoid any potential impacts to nesting migratory species. Based on this, there would be no adverse effects to migratory and residential birds within the study area or the surrounding area resulting from implementation of the Preferred Plan/NER Plan. Effects to bird species within the study area from the implementation of the Preferred Plan/NER Plan are beneficial.

No impacts to birds are expected at the material disposal site. The disposal site does include habitat for birds such as wetlands and woodlands; however, for the most part these areas that may be of higher

quality would be avoided as disposal locations for the concrete/soil/other material. Some trees will be removed in order to prepare a site large enough to store the concrete. The remaining woodland should continue to provide habitat for any birds that might utilize the area.

Mammals

Currently, only mammal species indicative of urban habitats are present within the study area (see *Section 2.3.8 Mammals*). Based on this, there would be no adverse effects to small or large mammals within the study area resulting from implementation of the Preferred Plan/NER Plan. Effects to mammal species within the study area resulting from the implementation of the Preferred Plan/NER Plan are beneficial, but minor.

No impacts to mammals are expected at the material disposal site. The disposal site does include potential habitat for mammals such as wetlands and woodlands; however, these areas would be avoided as disposal locations for the concrete/soil/other material. Instead, the concrete/soil/other material would be disposed of in open areas of the site that are currently covered in turf grass or a few sparse trees but provide limited to no suitable habitat for mammals.

Threatened and Endangered Species

Federal – A query of the USFWS ECOS-IPaC on March 2, 2020 resulted in an official species list of federally-listed species that "may be present" within the project area. There are two species that may be present: northern long-eared bat and rusty patched bumble bee.

Suitable summer habitat for northern long-eared bat exists within the project site, although surveys for bats have not been conducted on site. As northern long-eared bats are found in Wisconsin, and as potential roosting trees are present in the project area, the USACE concludes that northern long-eared bats may be present. As stated in the description of the TSP, selective tree removal is part of the project. Trees to be removed would be non-native and invasive species (e.g., European buckthorn, Norway maple, etc.), however, the northern long-eared bat appears to not be dependent on a certain species of tree for roosts throughout their range; rather, certain tree species will form suitable cavities or retain bark suitable for their use (Foster and Kurta 1999). Therefore, since the species could utilize non-native and invasive trees for roosting, tree removal would not be allowed to occur between March 1 and October 1.

In addition to tree removal activities, northern long-eared bats that may be in the project area will likely be exposed to increased noise disturbance as a result of operating construction equipment and demolition of the concrete channel. There are no known hibernacula within the project area, therefore, northern long-eared bats will not be exposed to increased noise disturbance between October and March. Between March and October, when northern long-eared bats are not hibernating and may be present, exposure to increased noise disturbance due to project activities is likely. All construction activities will occur during daylight hours when bats are roosting. The novelty of the construction noises and their relative volume levels will likely dictate the range of responses from individuals or colonies of bats that may be roosting in the project area. At low noise levels (or farther distances), bats initially may be startled but will likely habituate to the low background noise levels. At closer range and louder noise levels, bats will probably be startled to the point of fleeing from their day-time roosts. Because the noise levels in the construction area will continue for more than a single day, the bats roosting within or close to these areas are likely to shift their focal roosting areas further away or may temporarily abandon these roosting areas completely.

It is important to note, that while construction noise could cause northern long-eared bats that may be roosting in the area to abandon their roosting site, northern long-eared bats are known to switch roost trees frequently (i.e., about every 2 days) over the course of the summer (Foster and Kurta 1999, WDNR

2017). In addition, although a different species, the Indiana bat was found to use roosts near the Interstate-70/Indianapolis International Airport area, including a primary maternity roost. This primary maternity roost was not abandoned despite constant noise from the Interstate and airport runways (Sparks et al. 2005, Whitaker, Jr. and Sparks 2008). Therefore, it is possible that northern long-eared bats, if roosting within the project area, will habituate to the construction noise and not abandon their roost sites. Lastly, it is important to note that the construction activities causing the greatest increase in noise (e.g., breaking of concrete, placement of substrate, grading of channel banks, etc.) will likely only occur for one summer. The remainder of the construction schedule (i.e., years 2 through 5) will be control of invasive species through herbicide application and planting of native vegetation, which would generate negligible noise in the project area and would not be expected to disturb northern long-eared bats from their roosting sites.

With regard to the rusty patched bumble bee, the rusty patched bumble bee map (https://www.fws.gov/midwest/endangered/insects/rpbb/rpbbmap.html) was used to determine if there were any areas of high potential for this species within the vicinity of the project area. The project area extending from the upstream end (i.e., utility line) downstream to approximately 200 feet upstream of Wisconsin Avenue is within the rusty patched bumble bee "low potential zone". The remainder of the project area extending from approximately 200 feet upstream of Wisconsin Avenue downstream to the confluence of Honey Creek with the Menomonee River is within the rusty patched bumble bee "high potential zone". In addition, the proposed disposal site for the project is in the rusty patched bumble bee "high potential zone". Although approximately half of the project area is listed within the "high potential zone", the Wisconsin Wildlife Action Plan (https://dnr.wi.gov/topic/EndangeredResources/Animals.asp?mode=detail&SpecCode=IIHYM24020), a comprehensive resource for the conservation of rare and declining species and their habitats in Wisconsin, identifies the ecological landscapes within the project area as being lowly associated with the rusty patched bumble bee (WDNR 2019). Although the Wisconsin Wildlife Action Plan shows that ecological landscapes within the project area are lowly associated with the rusty patched bumble bee, the USACE is still concluding that rusty patched bumble bee may be present since a portion of the project is within a 'high potential zone', there is potential active season habitat present, and no surveys for the bumble bee have been conducted on site.

Potential stressors to the rusty patched bumble bee as a result of the project that were assessed included concrete removal/channel restoration activities, geomorphic contouring activities, invasive species eradication, and native plant community establishment. Concrete removal/channel restoration activities (e.g., concrete removal, substrate placement, woody debris placement, etc.) are not expected to have an impact on the rusty patched bumble bee. All concrete removal/channel restoration activities would occur in habitat defined as 'open water', and the rusty patched bumble bee is not likely to be present in this type of habitat during the active season or during overwintering (USFWS 2019). Geomorphic contouring activities associated with the proposed project include gentling the bank slopes between 5:1 and 10:1 where feasible to promote restoration of the floodplain and wetland plant growth. Since geomorphic contouring activities would occur along the channel banks where the habitat would be defined as 'open water' and/or 'unvegetated', this activity is not expected to have an impact to the rusty patched bumble bee.

Similar to above, 'open water' and 'unvegetated' habitat where grading activities would occur is not considered prime habitat for the rusty patched bumble bee and the species is not likely to be present in this type of habitat during the active season or during overwintering (USFWS 2019). Invasive species eradication would occur in potential active season habitat for the rusty patched bumble bee. However, due to the potential presence of northern long-eared bat in the project area, clearing of non-native and invasive vegetation for the proposed project would not occur between March 1 and October 1. The active season for the rusty patched bumble bee is approximately April through October, therefore, invasive species eradication activities would occur outside the active season of this species and no impacts are expected.

Lastly, native plant community establishment would occur during the active season for the rusty patched bumble bee. This activity would include seeding and planting live plugs of native species as well as spot herbicide application to ensure eradication of non-native/invasive species. The seeding and planting of native species is expected to benefit the rusty patched bumble bee by providing high quality pollen and nectar sources in potential active season foraging habitat.

Based on the above analysis presented for the northern long-eared bat and the rusty patched bumble bee, the USACE concludes that the project "may affect, but is not likely to adversely affect" northern long-eared bat and rusty patched bumble bee. A letter was sent to the USFWS June 29, 2020 requesting their concurrence with this determination. The USFWS responded via email July 20, 2020 that they concurred with the "may affect, but is not likely to adversely affect the northern long-eared bat and the rusty patched bumble bee". The concurrence from the USFWS with the determination concludes Section 7 consultation requirements.

State – The Wisconsin Natural Heritage Inventory data was queried on 11 January 2018 for important resource areas falling within Township 7N and Range 21E. The search identified three communities within the study area — floodplain forest, southern dry-mesic forest, and southern mesic forest.

The Preferred/NER Plan would restore sustainable, connected, native stream habitat, wetland, and plant communities. This is undertaken by ensuring hydrogeomorphic features are sufficient and that invasive plant species no longer have a dominating affect. Based on this, there would be no adverse effects to Threatened and Endangered Species within the Honey Creek study area resulting from implementation of the Preferred Plan/NER Plan. Effects to listed species resulting from the implementation of the Preferred Plan/NER Plan are beneficial.

No impacts to threatened or endangered species would be expected at the material disposal site. The disposal site does include potential habitat for migratory birds as well as potential habitat for listed reptiles/amphibians; however, these areas (e.g., wetlands and woodlands) would be avoided as disposal locations for the concrete/soil/other material. Instead, the concrete/soil/other material would be disposed of in open areas of the site that are currently covered in turf grass or a few sparse trees but provide no suitable habitat for federally- -listed threatened or endangered species.

5.4.3 Cultural Resources

Archaeological and Historical Properties

The Honey Creek Parkway is listed on the National Register of Historic Places. An archaeological survey was conducted in 2019 and no archaeological sites were identified within the study area. A structural assessment was also conducted on the WPA/CCC walls, a contributing feature to the Honey Creek Parkway, in 2019. In addition, the USACE prepared a Determination of Effect (DOE) for the historic features within the area of potential effect. The report determined that there would be no direct or indirect impacts to the historic bridges listed as contributing elements. Regarding the WPA/CCC walls, the DOE determined that the limestone walls are visually, but not directly impacted by the TSP. The removal of the concrete channel and channel restoration with sand, gravel, and cobbles is anticipated to slow down water velocity and act as a protective measure against further erosion on the walls. However, the DOE did find that there is potential for the walls to be directly impacted by inadvertent damage by construction machinery, vibrations from construction equipment during the removal of the concrete channel, or during the eradication of non-native species and other ecosystem restoration activities. To avoid potential adverse effects from inadvertent impacts during construction, USACE would implement the following measures prior to initiating construction:

- Establish a Datum. Digitally photo document the WPA/CCC limestone retaining walls prior to any construction activity and submit an existing conditions letter report to the SHPO and USACE files.
- Secure the Resources. Place security fencing 20 feet around the historic WPA/CCC limestone retaining walls and around areas with stone slabs in the creek bed.
- Avoid Adverse Effects During Invasive Species Removal. Identify non-native trees and plants to be removed adjacent to the walls and develop a monitored removal plan to avoid inadvertent damage.
- Monitor. Submit bi-monthly monitoring reports to the SHPO. Should inadvertent impacts occur, stop all work in the area and begin consultation on mitigation of the adverse effect under Section 106 of the NHPA.

For additional details on the DOE and the stipulated conditions listed above refer to Appendix I. Overall, the USACE has determined that the TSP, at the Feasibility Study level will constitute no adverse effect as defined by 36 CFR Part 800.5 to the Honey Creek Parkway or the larger NRHP listed Milwaukee County Parkway System when the stipulated conditions listed above are met to avoid potential adverse effects to the historic WPA/CCC limestone wall features. Further Section 106 coordination will be required as the project design development progresses in regard to geomorphic contouring and maintenance roads/incidental recreation trail locations to ensure adverse effects are avoided.

Native American tribes having an historical cultural interest in southeastern Wisconsin were notified regarding the potential project via letter dated 1 November 2017. The Stockbridge-Munsee Band of Mohican Indians was the only tribe to provide a response email. In the email they stated that "[t]he project is not located in our cultural area of interest; therefore, we do not have comment or need to consult further." In addition to scoping, tribes were consulted by letter dated December 7, 2020 about the conditional 'no adverse effect' determination. The Corps received no response.

Social Properties

The Honey Creek study area lies completely within the 113.7 acres of the Honey Creek Parkway. Residential properties primarily surround the Parkway with some commercial properties. Also adjacent to the parkway is the Wisconsin Lutheran High School. Within the Parkway are portions of the Oak Leaf Trail system, the Hawthorne Outdoor Soccer Park, and Dyer Playfield (see *Section 2.4.2 Recreation*). The Preferred Plan/NER Plan will not have any adverse effects on the area's social properties. Portions of the Oak Leaf Trail, Hawthorne Outdoor Soccer Park, and Dyer Playfield that abut the Honey Creek riparian area would see the removal of Eurasiatic thickets, however, this would create a more aesthetically pleasing environment for users of these areas. Also, greater access to the river would be provided through the addition of wood chip maintenance roads/incidental recreation trails.

There are no social properties located on the material disposal site. Residential housing is generally located on the south side of the property while the east side of the property abuts 116th Street. The north and west sides of the property are adjacent to vacant land owned by City of Greenfield and Milwaukee County, respectively. Disposal and storage of the concrete/soil/other material at the proposed location would have no impact on these adjacent properties.

Recreational Activities

As discussed above under Social Properties, the Honey Creek study area lies within the Honey Creek Parkway. Surrounding the Parkway are primarily residential properties with some commercial properties. Within the Parkway are portions of the Oak Leaf Trail system, the Hawthorne Outdoor Soccer Park, and

Dyer Playfield (see *Section 2.4.2 Recreation*). The aforementioned areas are heavily used by the public for both passive and active recreational purposes. The Preferred Plan/NER Plan will not have any adverse effects on the area's recreational properties. Hawthorne Outdoor Soccer Park and Dyer Playfield are adjacent to the Parkway and would only likely see the removal of Eurasiatic thickets, which would create a safer and aesthetically pleasing environment for park users. All active recreation zones (i.e. sports fields, tennis courts, biking tracks, etc.) are not part of the project. Any portions of the Oak Leaf Trail system that would need to be moved for riverbank grading would be replaced brand new. Also, greater access to the river would be provided through the addition of wood chip maintenance roads that could incidentally be used as recreation trails. The addition of the wood chip maintenance roads/incidental recreation trails would result in a minor long-term beneficial impact to passive recreation.

There are no recreational facilities located on the material disposal site; therefore, disposal and storage of the concrete/soil/other material at the proposed location would have no impact on recreational activities.

5.4.4 17 Points of Environmental Quality

The 17 points are defined by Section 122 of the Rivers, Harbors and Flood Control Act of 1970 (P.L. 91-611) from (ER 1105-2-240 of 13 July 1978). Effects to these points are discussed as follows:

Noise – None of the alternative plans would cause minor or temporary increases in noise levels beyond the current conditions. The effects would stem from machinery utilized to remove approximately 6,700 LF of concrete from the Honey Creek channel, remove invasive species, conduct topographic grading, and dispose of concrete at the proposed disposal location. The concrete removal has potential to create a lot of noise; however, the small work area, short duration, and the location of the activity lessens these effects to temporary and minor. The NER plan shows where the concrete will be removed and processed (see Figure 13).

Displacement of People – None of the alternative plans will displace any people.

Aesthetic Values – Primary visual changes stemming from the Preferred/NER plan would be a) Eurasiatic thicket removal on the banks, bank contouring, and the removal of concrete from the Honey Creek channel. After native plant communities are established, the aesthetic values would soften towards a natural native system instead of an altered system with non-native plant communities.

Community Cohesion – None of the alternative plans would disrupt community cohesion. Instead, the alternative plans would restore open space for community activities and increased acres of available space for passive recreation.

Desirable Community Growth – None of the alternative plans would adversely affect community growth.

Desirable Regional Growth – None of the alternative plans would adversely or beneficially affect regional growth.

Tax Revenues – None of the alternative plans would adversely or beneficially affect tax revenues.

Property Values – None of the alternative plans would have adverse effects on property values. Instead, implementation of any of the alternative plans would have the potential to increase surrounding land values since the aesthetics would improve due to project restoration measures.

Public Facilities – None of the alternative plans would adversely affect public facilities within the study area. Trail facilities along Honey Creek would be improved with the addition of wood chip trails allowing increased access to the river.

Public Services – None of the alternative plans would adversely or beneficially affect public services.

Employment – None of the alternative plans would adversely affect employment. Implementation of any of the alternative plans could temporarily increase employment during construction activities.

Business and Industrial Activity – None of the alternative plans would adversely or beneficially affect local commerce.

Displacement of Farms – There are no farms within the study area; therefore, none of the alternatives would cause the loss of farmland.

Man-made Resources – None of the alternative plans would adversely or beneficially affect man-made resources.

Natural Resources – The No Action Plan allows for the Honey Creek study area ecosystem to remain degraded. The Preferred Plan/NER Plan would improve natural resources such as fish, wildlife, migratory birds, water quality, natural food production, fishing, bird watching, paddling, etc.

Air Quality – All of the alternative plans would be *de minimis* in terms of Clean Air Act compliance. Temporary vehicle emission impacts, due to construction activities, would meet current federal regulations.

Water Quality – None of the alternative plans would adversely affect water quality. The Preferred Plan/NER Plan would incidentally improve water quality by removing concrete from the Honey Creek channel, adding large woody debris, restoring emergent plants for bacterial filtering of waters, and establishing a dense riparian native plant community, which would reduce run-off to the river and provide the stream healthy allochthonous materials.

5.5 Cumulative Effects

Consideration of cumulative effects requires a broader perspective than examining just the direct and indirect effects of a proposed action. It requires that reasonably foreseeable future impacts be assessed in the context of past and present effects to important resources. Often it requires consideration of a larger geographic area than just the immediate "project" area. One of the most important aspects of cumulative effects assessment is that it requires consideration of how actions by others (including those actions completely unrelated to the proposed action) have and will affect the same resources. In assessing cumulative effects, the key determinant of importance or significance is whether the incremental effect of the proposed action will alter the sustainability of resources when added to other present and reasonably foreseeable future actions. Cumulative environmental effects for the proposed ecosystem restoration project were assessed in accordance with guidance provided by the Council on Environmental Quality (CEQ) and the U.S. Environmental Protection Agency (USEPA 315-R-99-002). This guidance provides an eleven-step process for identifying and evaluating cumulative effects in NEPA analyses.

5.5.1 Scope of Cumulative Effects Analysis

Through this environmental assessment, the cumulative effects issues and assessment goals are established, the spatial and temporal boundaries are determined, and the reasonably foreseeable future actions are identified. Cumulative effects are assessed to determine if the sustainability of any of the resources is adversely affected with the goal of determining the incremental impact to key resources that would occur should the proposal be permitted. The spatial boundary for the assessment was broadened to consider watershed effects. The spatial boundary being considered is normally in the general area of the proposed ecological restoration; however, the area may be expanded on a case-by-case basis if some resource condition necessitates broadening the boundary. The analysis will include the Honey Creek study area within the Menomonee River watershed.

Three temporal boundaries were considered:

- Past – early- to mid- 1800's because this is the approximate time that the landscape developed for agricultural and industrial use and the build-out of Milwaukee
- Present – 2021 when the decision is being made on the most beneficial ecological restoration.
- Future – 2071, the year used for determining project life end, although the ecological restoration should last until a geologic event disturbs the area.

Projecting the reasonably foreseeable future actions is difficult. The proposed action (ecosystem restoration) is reasonably foreseeable; however, the actions by others that may affect the same resources are not as clear. Projections of those actions must rely on judgment as to what are reasonable based on existing trends and where available, projections from qualified sources. Reasonably foreseeable does not include unfounded or speculative projections. Some future projections were taken from watershed and specific studies generated for the general project area. In this case, reasonably foreseeable future actions include:

- Further improvements in water quality due to large-scale projects, small BMPs, laws and policies, and education
- Further improvements in aquatic and riparian habitat in and along the Menomonee River and to a larger degree the Lake Michigan system
- Further improvements in connectivity within the Menomonee River and to a greater degree between Lake Michigan system habitats

5.5.2 Cumulative Effects on Resources

The plan formulation process considered existing and planned projects, studies and known ecological restoration projects in the study area. Existing Projects were identified in *Section 1.5.2 Pertinent Project* that have the potential for affecting or being affected by a potential Honey Creek restoration project. Prior studies and reports listed in *Section 1.5 Prior Studies & Projects* were reviewed to ensure that the modeled conditions are the best possible representation of actual conditions. The Technical Recognition Section also takes existing and future habitat restoration projects into consideration for assessing project effects. Finally, the study team also worked with Federal, State and local agencies to coordinate ongoing planning to address local environmental and infrastructure issues.

Physical Resources

The past has brought alteration to the physical resources of the entire Menomonee River, including its tributaries. Geology, soils, topography, hydrology, hydraulics, water quality and fluvial geomorphology

have all been modified or obliterated to build Milwaukee and its suburbs. Large portions of the Menomonee River and its tributaries were channelized and/or lined with concrete causing the loss of natural hydrology and hydraulics as well as wetland habitat. Due to watershed-scale alterations, as well as daily operating procedures (i.e., road salting, stormwater runoff, concrete channels, etc.), all-natural physical resources have been impacted. It is reasonably foreseeable that projects within the Menomonee River and its tributaries for ecological restoration purposes would occur and begin to lessen the past significant and adverse effects.

Given the past, current, and future condition of the Menomonee River and its tributaries, the implementation of ecosystem restoration and infrastructure projects would be minor in terms of the vast array and quantity of adverse effects caused by past development and current management practices of the system; however, they are important in terms of beginning to address physical natural resource issues within the watershed. There are no irrecoverable loss of resources identified in terms of geology, soils, substrates, topography, hydrology, water quality, and fluvial geomorphology due to implementation of the Preferred Plan/NER Plan. Cumulative beneficial effects to the Menomonee River and its tributary Honey Creek are anticipated in terms of soils, substrates, hydraulics, and minor water quality.

Ecological Resources

Resulting from the massive physical resource impacts to the entire Menomonee River and its tributaries, the obliteration of natural communities and functions followed suit. The watershed was once a diverse mosaic of marsh, prairie, savanna, woodland, sloughs, and glacial ponds that had a steady and dependable hydrology. The extreme physical resource modifications have caused most of the natural land use to be converted into concrete. No longer is there a natural landscape mosaic within the Menomonee River watershed to provide enough natural habitats for fish and wildlife habitat or to attenuate large rainfall events. The existing concrete channel within Honey Creek and the presence of Eurasiatic thickets lining the waterway, appear to provide an ecosystem setting, but are low diversity, low abundant amalgamation of systems that primarily perpetuate erosion and provide sources of noxious weeds.

Considering these past, current, and future conditions of the watershed, the implementation of the Preferred Plan/NER Plan within the Honey Creek study area is minor in terms of the vast array and quantity of significant, adverse effects caused by the building of Milwaukee; however, it is instrumental in beginning to reverse the trend set by the anthropogenically induced problems the watershed suffers. Therefore, there are no irrecoverable losses of resources identified in terms of plant, insect, fish, amphibian, reptile, bird, and mammal taxa or to their required habitats due to implementation of the Preferred Plan/NER Plan. Cumulative beneficial effects to the Menomonee River and its tributaries and to a greater degree coastal Lake Michigan are anticipated in terms of fish and wildlife and their preferred habitats.

Cultural and Historic Resources

The Honey Creek Parkway is listed on the National Register of Historic Places. There are WPA/CCC walls within the project area that are a contributing feature to the historic nature of the Honey Creek Parkway. A Section 106 DOE was prepared for the APE (Appendix I). Regarding cumulative effects, it was determined in the DOE that the Preferred Plan/NER Plan alters but does not diminish the ability of the resource to convey significance. In addition, conditions would be implemented prior to construction of the Preferred Plan/NER Plan in an effort to avoid adverse effects from inadvertent impacts during construction. Overall, the Preferred Plan/NER Plan restores the APE by removing the non-contributing concrete channel and restores a rustic riverine environment, keeping with the WPA/CCC wall rustic aesthetic. Therefore, the Preferred Plan/NER Plan would have no cumulative effects to cultural and historic resources.

Cumulative Effects Summary

The cumulative effects of the Preferred Plan/NER Plan are beneficial and environmentally important, but not significant from the cumulative/watershed effects perspective. The environment and its human community are expected to benefit from replacing unsightly and overgrown Eurasiatic plant communities with rich and abundant native plant communities, contouring banks, removing the concrete channel and restoring instream aquatic habitat and hydraulics.

5.6 Compliance with Environmental Statutes

The Preferred Plan presented in this integrated Environmental Assessment are in compliance with appropriate statutes, executive orders, and memoranda including the Natural Historic Preservation Act of 1966; the Endangered Species Act of 1973; the Fish and Wildlife Coordination Act; E.O. 12898 (environmental justice); E.O. 11990 (protection of wetlands); E.O. 11988 (floodplain management); and the Rivers and Harbors Act of 1899. The potential project is in compliance with the Clean Air Act; the Clean Water Act, and the National Environmental Policy Act of 1969. There were no adverse environmental effects identified which cannot be avoided should the proposal be implemented [NEPA, § 102(1)(C)(ii) and CEQ Regulations, § 1502.16]. This proposal reverses some of the adverse effects of man's local and short-term uses of the environment, while maintaining and restoring the long-term productivity of a portion of Lake Michigan's coastal zone [NEPA, § 102(1)(C)(iv) and CEQ Regulations, § 1502.16]. The only irreversible and irretrievable commitments of resources [NEPA, § 102(1)(C)(v) and CEQ Regulations, § 1502.16] would be the use of fossil fuels needed to operate the construction equipment to implement the proposed project. No other irreversible and irretrievable commitments of resources resulting from the proposed action should it be implemented have been identified.

Energy Requirements & Natural or Depletable Resources

The only energy requirements to sustain this project would be the power of the sun, wind, water, and animals. The sun imperative for plant growth. Wind, water, and animal power is needed to distribute native plant seeds in the late fall and through the winter months. Waterpower will create the hydraulic forces needed to attract and provide for riverine animals and keep substrates healthy and loose. Temporary use of fossil fuel burning vehicles would be used in the first year of construction on an intermittent basis to grade surficial soils, remove weeds, place habitat features and plant native seeds and plugs. Since long term energy requirements to sustain this project are highly sustainable in the sun, wind, water, and organism, it is expected there would be no irrecoverable loss to energy resources resulting from implementation of the Preferred/NER Plan, with additional benefits of carbon sequestration.

Environmental Justice

E.O. 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*) requires that, to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands.

U.S. Census data for the Cities of Milwaukee and Wauwatosa were compared to data for Milwaukee County to evaluate potential disproportional adverse impacts to minority populations, low-income populations, and children due to implementation of the proposed project. Regarding minority populations,

approximately 64.1% of the total population in Milwaukee is comprised of minority populations. This means that a minority population exists within Milwaukee since the minority population exceeds 50 percent. In contrast, approximately 15.4% of the total population in Wauwatosa is comprised of minority populations. Therefore, the minority population of Milwaukee does exceed the minority population of Milwaukee County (47.9%), whereas the population of Wauwatosa does not exceed the minority population of Milwaukee County.

Regarding low-income populations, Milwaukee has a median household income of approximately $38,289 which is less than the median household income of Milwaukee County which is approximately $46,784. In addition, approximately 27.4% of households in Milwaukee are below the poverty line, while only approximately 20.5% of households in Milwaukee County are below the poverty line. In contrast, the median household income of Wauwatosa is approximately $74,929 which is higher than the median household income for Milwaukee County (i.e., $46,784). In addition, approximately 7.1% of households in Wauwatosa are below the poverty line which is less than the percentage of households below the poverty line for Milwaukee County (i.e., 20.5%).

Lastly, regarding children, approximately 7.6% of the total population in Milwaukee is comprised of children under the age of 18. Similarly, approximately 7.1% of the total population in Wauwatosa is comprised of children under the age of 18. The percentage of the total population within Milwaukee and Wauwatosa that are children is higher than the percentage of the total population that are children within Milwaukee County (i.e., 7.0%); however, the percentages are not meaningfully different.

In addition to the above details regarding the project area, the disposal area was also reviewed for potential environmental justice issues. Per the USEPA Environmental Justice mapper, the location of the proposed disposal area has a minority population less than 50%, a low-income population less than 50%, and the proportion of children comprising the total population is less than 50%. Any of the previously identified populations being above 50% would elicit potential environmental justice issues, however, since the minority population, low-income population, and children population are all under 50% in the area where the disposal site is located no environmental justice issues arise from the use of the disposal site.

In summary, in terms of the project area, the City of Milwaukee meets thresholds for the presence of a minority population and a low-income population but does not meet the threshold for a population with a high proportion of children. The City of Wauwatosa does not meet the thresholds for the presence of a minority population, low-income population, or a population with a high proportion of children. Although there is a higher percentage of minorities and low-income households within Milwaukee, and hence portions of the project study area, the implementation of the proposed project is not expected to have a disproportionate impact on a minority or low-income community. The proposed project is an aquatic ecosystem restoration project that would provide benefits, such as recreational opportunities, to surrounding communities. In terms of the proposed disposal site, the location does not meet the thresholds for the presence of a minority population, low-income population, or a population with a high proportion of children. The USEPA Environmental Justice mapper was also used to determine if any issues within the surrounding area exist (https://ejscreen.epa.gov/mapper/). Based on the reports generated from the mapper tool, no Environmental Justice issues occur within the project area. The reports are included in *Appendix A – 404(b)(1)/401 and Coordination*.

Clean Air Act

The local air quality in Milwaukee County, Wisconsin is currently in attainment and/or maintenance status for the six criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide) (see *Section 2.2.6 Air Quality* for additional discussion). Due to the small scale and

short duration of this project, the main sources of emissions would be vehicle emissions and dust associated with the construction activities. The project does not include any stationary sources of air emissions, and a General Conformity Analysis was not completed. The temporary mobile source emissions from this project are *de minimis* in terms of the NAAQS and the State Implementation Plan. All construction vehicles will comply with federal vehicle emission standards. USACE and its Contractors comply with all Federal vehicle emissions requirements. USACE follows EM 385-1-1 for worker health and safety and requires all construction activities to be completed in compliance with Federal health and safety requirements.

Section 401 and 404 of the Clean Water Act

A Section 404(b)(1) analysis was completed for the Preferred/NER Plan and is in *Appendix A – 404(b)(1)/401 and Coordination*. Features addressed by the 404(b)(1) include temporary stream flow redirection, concrete channel removal, placement of natural substrates of fluvial boulder, cobble, gravel and sand to replace concrete channel, aquatic/semi-aquatic soil mix for establishing persistent marsh and wet meadow, large woody debris, and minor bank toe modifications during bank slope gentling. There would be no net loss in acres of open water or wetland, with net increase in acres of wetland. No adverse effects were determined; highly beneficial effects to Clean Water Act parameters are expected. If there is any modification to the plan that increases fill quantities during the next phase (design), USEPA will be notified.

USFWS Coordination

Coordination with the USFWS commenced with a project scoping letter dated November 1, 2018. As stated in prior sections of the report, a query of the USFWS's ECOS-IPaC was conducted on March 2, 2020 and result in an official species list of federally listed species that "may be present" within the project area. The obtainment of the official species list from ECOS-IPaC fulfills the requirement for federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action." There are two species that may be present: northern long-eared bat and rusty patched bumble bee. The USACE analyzed the potential impacts to these two species due to implementation of this project and documented that analysis in this report and in a letter that was provided to the USFWS on June 29, 2020. Based on the analysis that was conducted, the USACE concluded that the proposed action "may affect but is not likely to adversely affect" northern long-eared bat and rusty patched bumble bee. The USFWS responded via email July 20, 2020 that they concurred with USACE's determination and their email concluded consultation requirements.

Department of Natural Resources Coordination

Coordination with the WDNR commenced with a project scoping letter dated November 1, 2018. It is anticipated that WDNR will provide concurrence during the 30-day Agency Review period after the draft documents are reviewed.

Coastal Zone Management Act

The Preferred/NER Plan is expected to be consistent to the maximum extent practicable with the Wisconsin Coastal Zone Management Program (WCMP). The USACE commenced initial coordination with the WCMP in 2019 via informal email and phone conversations. The WCMP provided a letter dated June 26, 2019 stating that at this point in the process, "WCMP does not have enough information to offer any comments on the project, but encourages [USACE] to continue coordinating with [WCMP] as well as any state agencies (such as Wisconsin Department of Natural Resources) and local offices that may be

involved in the project." The WCMP will be provided a copy of the draft environmental assessment during the public review period at which time they may provide additional comments. A coastal consistency determination was provided to the WCMP in a letter dated February 19, 2021.

National Historic Preservation Act

Coordination with the State Historic Preservation Office (SHPO) and Native American Tribes having a cultural interest in southeastern Wisconsin was commenced with a project scoping letter dated November 1, 2018. The Stockbridge-Munsee Band of Mohican Indians was the only tribe to provide a response email in which they states "[t]he project is not located in our cultural area or interest; therefore, we do not have comment or need to consult further." USACE determined that historic properties would not be adversely affected by the tentatively selected plan as long as stipulated conditions in the Section 106 Determination of Effect (Appendix I of the IFR/EA, also refer to Section 5.4.3 of the main report) are met to avoid potential adverse effects to the historic WPA/CCC limestone wall features in the project area. The Wisconsin State Historic Preservation office concurred with the determination on January 6, 2021.

5.7 Draft Finding of No Significant Impact (FONSI)

The draft FONSI may be found at the front of this document. An Environmental Assessment was completed for the proposed habitat restoration Honey Creek study area, Milwaukee, Wisconsin. The Environmental Assessment has found that there would be no adverse effects resulting from implementation of the Preferred Plan/NER Plan. A 30-day Agency and Public Review period was held from _____, 2020 to _____, 2020. All pertinent comments received will be incorporated into the document. The Draft NEPA document and supporting appendices will be placed on the Detroit and Chicago Districts' Civil Works webpages for maximum distribution. The FONSI will be updated with accurate dates and Agency responses after the 30-day Agency and Public Review.

CHAPTER 6 – DESCRIPTION OF THE NER PLAN

6.1 Project Authorization

Alternative plans that qualified for further consideration, best buy plans, are compared against each other in order to identify the selected alternative to be recommended for implementation. A comparison of the effects of various alternative plans must be made and tradeoffs among the differences observed and documented to support the final recommendation. The effects include a measure of how well the plans do with respect to planning objectives including NER benefits and costs. Effects required by law or policy and those important to the stakeholders and public are to be considered. Previously in the evaluation process, the effect of each alternative plan was considered individually and compared to the without-project condition. In this step, plans are compared against each other, with emphasis on the important effects of those that influence the decision-making process. The comparison step concludes with a ranking of plans.

6.2 TSP / NER Plan Components

The National Ecosystem Restoration (NER) Plan is the Tentatively Selected Plan (TSP) (also synonymous with the Preferred Plan), which is Alternative 8. Rationale for selecting the NER/Preferred Plan is presented in *Section 4.6 Plan Comparison & Tentatively Selected Plan (TSP) Recommendation*. Alternative Plan 8 consists of the following measures presented in *Section 4.1 Habitat Measures*: Stream Channel Restoration Option B (SCb), Persistent Marsh and Intermittent Meadow (MM), and Riparian Woodland Option A (RWa). The implementation of all these measures would restore riverine fish habitat and connectivity, riverine wetlands, gentle and plant banks with native trees, shrubs, grasses and flowers, and riparian woodland. The implementation of these features is generally described as follows and according to the measure descriptions in *Section 4.1 Habitat Measures*. More detail would be added to the plan should this project commence to the design and implementation phase, for example, specifying spatial distribution of native plugs within a given zone and species clumping, planting centers, soil amendment percentages, temporary predator controls, and establishment activities. General construction activities and sequencing would include:

(1) Site Preparation – The first task would be to install safety fencing, signage and other temporary safety features (barricades, temporary path reroutes, timing of construction activities, appropriate field apparel for access to the site, etc.) in order to keep the public out of the site during heavy construction. Staging areas and access and construction haul roads would be created and demarcated as well. The road system provides incidental ecosystem restoration benefits, for example, keeping equipment and pedestrians from disturbing wildlife and impacting planted restoration areas. Instructive signage for workers would be set up as well to signify off limit work areas and site restrictions.

(2) Concrete Channel Removal – Recent and past fish surveys show that there are usually minimal numbers of fish present within the reaches of Honey Creek that have a concrete lined channel. The V-shaped smooth concrete channel therefore would be broken and removed in order to restore natural riverine substrates and morphology. A temporary coffer-dam system or pipe by-pass system would be used to pass half the channel flows through the 390-foot restoration zone in order to work in the dry; any system implemented would impact less than .25-ac., be quickly removable prior to imminent flooding and would not increase any stage of flows. Removed concrete would be transported offsite to the proposed disposal and storage facility that is being purchased by the MMSD (refer back to Figure 13).

(3) Geomorphic Contouring – Once targeted woody and invasive species are removed, Honey Creek banks would be graded to provide a suitable hydrogeomorphology for establishing native riparian, native

marsh, and native meadow plant species. These areas will be contoured, and all excess soils will be incorporated into the landscape design; all materials will be managed on site and not removed. Grading activities would be limited to areas along the bank. Graded areas will be planted with native seeds, plugs, or shrubs and immediately stabilized to prevent erosion. Haul roads would be created within the graded areas to maintain the movement and hauling of materials during construction to defined paths in order to prevent new plantings and habitat from becoming damaged and for construction site safety.

Large boulders, dolomitic limestone slabs, and woody debris would be transported via the haul roads and placed at various locations along the Honey Creek Channel where erosion points exist or the opportunity for providing sustainable habitat structure is available. The stone and large woody debris material would not attenuate flood-flows. Soil amendments identified above would be placed along the Honey Creek channel in contoured areas where emergent aquatic macrophytes can be established for the persistent marsh habitat. These would be placed by small machines or by hand from the bank to achieve the appropriate hydrogeomorphic setting and to provide a kick-start growth medium for native aquatic macrophytes.

(4) Honey Creek Channel Restoration – After the concrete channel is removed, riverine morphologic features of riffles and j-hooks would be installed. These riffles and j-hooks would be created from large boulders and cobbles that are locked into the channel bed and banks. Remaining channel areas outside these riffles and j-hooks would be lined with natural riverine substrates of sand, gravel, and cobbles as well; these will be placed based on predicted channel velocities for the bank-full width condition and adaptive management during construction.

(5) Invasive Species Eradication – All invasive plant species would be physically, and if need be, chemically eradicated from the planting zones. A "No Invasive Tree Clearing" window would be observed between 1 March and 1 October, which is typically established for all USACE ecosystem restoration projects in conjunction with the Region 3 USFWS and the local birding community. All woody species removed and not selected for Large Woody Debris habitat would be chipped and utilized for project features or appropriately recycled. Based on lessons learned from other restoration projects, the addition of these wood chips greatly aids in starting a plant community where soils lack or have no organic material, aiding as well in soil water retention for early plant establishment phases. Those species having allelopathic chemicals or the potential to provide an invasive species seed source would be destroyed on site via fire or appropriately disposed; such species include European buckthorn, Norway maple, etc. Herbicide application would also be employed; all required permits for licensed herbicide application practices near waterways would be applied for and adhered to.

(6) Native Plant Community Establishment – Next would be to establish native plant communities of persistent marsh, transitional meadow, and riparian woodland over the remaining 4 years of the construction period. Planting lists are presented as 'FWP Planting Lists' located in *Appendix H – Monitoring Plan and Habitat Analysis*. Zones would be seeded and planted with seed and live plugs. Live plug areas will require predatory control, primarily stringing and caging to prevent Beaver, Canada goose and common carp predation. Again, the duration of the construction contract would primarily be for spot herbicide application and additional planting; most activities like public landscaping activities. The haul roads created for moving large materials would then be utilized to maintain and establish native plant communities along the project area as well as provide access trails for the community.

(7) Best Management Practices (BMPs) – Soil erosion and sediment control measures would be incorporated into the design documents and will comply with local and federal environmental requirements. A 5-year period of BMPs and erosion prevention would be implemented by the contractor. The minimum measures required at the project site may include:

- Hydroseeding, seeding, and mulching to stabilize disturbed areas
- Installation of silt fences around graded slopes and stockpile areas
- Protection of the waterway where grading occurs with silt fencing prevent sediments from traveling into the waterway
- Stabilizing construction entrances to limit soil disturbance at the ingress/egress from the site
- Installing erosion blanket over unprotected finished grades that are to be unplanted for at least two weeks

(8) Incidental Recreational Features – As mentioned under Native Plant Community Establishment, haul roads would be needed for moving large materials and would then be needed to maintain and establish native plant communities along the project area. Once construction and the establishment period are completed, these haul roads/maintenances roads would be dressed with site-clearing wood chips and left in place (for the most part) to provide the community with incidental recreation trails as well as access to the restored Honey Creek. The incidental recreation trails would also keep recreation users from making footpaths that could destroy the native plant communities that are being restored. The location of the haul roads/maintenance roads/incidental recreation trails would be developed in coordination with the non-federal sponsor.

(9) Operations & Maintenance – Once the construction contract is complete, the non-federal sponsor will maintain the project and associated habitat benefits. These activities would primarily include invasive plant species control, additional native plantings, woody debris management, minor additions of river cobbles, and public access control. The haul roads created for construction and establishment would be turned into wood chip-surfaced maintenance trails/ incidental recreation trails for public use and access to Honey Creek.

6.3 Real Estate Considerations

The Real Estate Plan *Appendix G – Real Estate* was prepared in support of the feasibility study phase of the Honey Creek Aquatic Ecosystem Restoration study. The Real Estate Plan identifies and describes the area proposed for construction, operation and maintenance of the Project, in addition to the real estate requirements and procedures for implementation of a recommended Plan.

Non-Federal Sponsor Lands – The non-federal sponsor for this study currently owns none of the lands required for project purposes. However, it is anticipated that the County of Milwaukee will sign a joint project partnership agreement (PPA) with MMSD and USACE and provide the necessary lands, easements, rights-of-way, relocations, and disposal areas (LERRDs) required for project construction. The County of Milwaukee currently owns approximately 57.76 acres in fee that is necessary for project construction and is also in the process of acquiring an additional 0.64 acres in fee from the City of Wauwatosa.

A temporary work area easement is proposed for the 4.7 acres required for the disposal site, which is owned by the County of Milwaukee. Another temporary work area easement is proposed for the 0.86 acre necessary to access the disposal site. This is currently owned by the City of Greenfield; however, the County is currently considering acquiring this area in fee as well.

LERRD Crediting – Currently, the crediting amount is estimated to be $[redacted].

6.4 Monitoring Plan

Section 2039 of WRDA 2007, 33 U.S.C § 2330a, directs the Secretary to ensure that when conducting a feasibility study for a project (or a component of a project) for ecosystem restoration that the recommended project can include a plan for monitoring the success of the ecosystem restoration for a period of up to ten years from completion of construction of an ecosystem restoration project. This monitoring will be cost shared.

A five-year monitoring plan will be implemented for this project (Appendix H – Monitoring Plan). The USACE, Chicago District in conjunction with the NFS (i.e., MMSD) would conduct monitoring to determine the success of the project. Refer to Appendix H – Monitoring Plan for the components each entity would be responsible for surveying. The principal goal of a resulting project is to restore stream, riparian, wetland, and buffering plant communities to provide habitat for migratory birds and local fish and wildlife. Baseline data for current conditions at Honey Creek are detailed in this feasibility study. The following specific monitoring objectives were established to determine the effectiveness of this project:

- Restore stream and riparian corridor habitat as measured by the presence of naturalized stream hydrology and hydraulics.
- Reestablish natural fluvial geomorphic parameters (hydraulics, substrates) and structures to support riverine and riparian habitats within the study area. Improvement is measured via the predicted increase in quality of riverine habitat (QHEI).
- Eradicate/reduce the presence of non-native and invasive species: Target Invasive Species Eradication Percentage < 10% Areal Coverage.
- Improve native plant species richness and assemblage structure as measured by coefficient of conservatism of the Chicago Region Floristic Quality Index: Target Overall Mean C Score $\geq$ 3.

Monitoring Costs & Schedule

It was determined that 5-years of monitoring is enough for the proposed urban restoration (Table 19). Past restoration projects have shown that benefits are accrued within 5 years (or less), where riverine hydraulics and fishes are reestablished. Also, the riparian plant communities and composite floral species of higher tolerances to urban disturbances proposed would be stable by the monitoring commenced after completion of construction.

Table 19 - Schedule of Monitoring Costs

Tasks	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Component 1	$ [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Component 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Component 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Final Report	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

6.4.1 – Adaptive Management Measures

A 5-year contract would be utilized to ensure recruitment and establishment of native communities (abiotic and biotic) is successful. All hydrogeomorphic work would be accomplished within the first several months of the contract to allow establishment and monitoring time. Options would be placed in the contract for future adaptive management measures that could be exercised at any point of the contract duration, but most frequently in years 3, 4 and 5. These may include but are not limited to changing or

adjusting features to achieve the required hydrology, hydraulics and/or geomorphology; additional native plant treatments; or other improvements. All adaptive management decisions and exercising of contract options would be driven by monitoring.

Adaptive management measures are not the same as typical O&M activities described in the following section. These measures are technically response actions to changes that adversely affect how the system was predicted to respond. In so being adaptive, there are no absolute measures that can be defined prior to issue arising. The primary concerns for this project are restoration and establishment of native plant communities. Descriptions of adaptive managements below are brief and will be further detailed once a complete set of Plans and Specifications is drafted. This is necessary since the adaptive management measures will need to be based upon contracting bid items, final feature designs and predicted adverse responses. It is also noted that these measures have relatively low costs to regain lasting benefits.

Fish Habitat – Failure of habitat to support the expected species would primarily result from stability issues within the channel. Conditions unforeseen, such as unexpected floods or other human activities could cause these issues to arise. Adaptive management actions would be undertaken to offset these instability issues, such as adding stone, adjusting orientation of the structures, varying dimensions of structures, etc.

Native Plantings – The risk of large-scale plant failure is low, mostly due to the species selection of those adapted to the conditions found within Honey Creek. Most of the requirements for native plant communities are covered under routine O&M. If for some reason extensive patches of native plant community begin to fail, the cause would need to be determined in order to design and implement repair measures. Accidental or intentional human induced instances have damaged or removed native plantings in the past as well. No matter what the solution would be for the cause of the problem, it would certainly be coupled with reestablishing native plant patches by replanting. It may be that other thriving areas would be able to have live plants and seed transferred to the damaged patch. Or it may be that plants and seed would need to be repurchased. Actions would include, but not limited to, installing native seed over the winter months, installation live plugs, adding in soil amendments to reduce available nutrients in order to increase the soil suitability for native plant species, etc.

6.5 Operation & Maintenance

The O&M costs of the proposed project are estimated to be an average annual cost of about $[redacted] over 50 years (Table 20). A detailed O&M Manual containing all the duties will be provided to the non-federal sponsor after construction is closed out. The O&M for ecosystem projects are practical and minimal due to initial project design efforts and design targets for sustainability, where O&M costs are predicted to drop as the communities naturalize and come to equilibrium. Most, if not all, of the O&M activities are no different than the specific activities that take place during construction, but to a lesser degree. The O&M described here is not the same as the Adaptive Management measures described in the previous section.

Table 20 - Operations & Maintenance Costs per Year

TASK	Annual Frequency	Acres Treated	Cost/Acre	Total AA Cost
Mowing	0.33	7	$[redacted]	$[redacted]
Invasive Control	0.5	25	$[redacted]	$[redacted]
Seeding	0.25	8	$[redacted]	$[redacted]
Stream	0.33	2	$[redacted]	$[redacted]
TOTAL				[redacted]

Invasive Plant Species Control – This maintenance activity is probably the most important to conduct. Preventing the establishment of invasive species and weedy vegetation prevents the need for large scale herbicide or physical eradication and replanting efforts. An annual maintenance plan should be drafted taking into account the types of invasive and non-native species to be treated and the acreage of the treatment area. Problematic areas will include the transitional meadow and persistent marsh zones. Species such as white and yellow sweet clover, cut-leaved teasel, reed canary grass, common reed, buckthorn and honeysuckle are known invasive species, which will need to be kept under control.

Precautions should be taken to ensure that any long-term herbicide application is appropriately dispensed to only remove non-native plants and invasive species while avoiding native plant communities.

Native Plant Community Maintenance – Maintenance will be required to preserve the species richness, abundance and structure of the restored plant communities within Honey Creek. Aside from minor re-plantings, it will be important to continue to protect plant communities from external changes by man's daily activities, whether single incidents or chronic stressors. These can cause native plant communities to experience significant species richness declines even to the point of becoming monotypic stands. The best operational measure to quickly identify and rectify external stressors is vigilance. Routine inspections by the non-federal sponsor's qualified stewards are imperative to notice adverse change quickly. The long-term monitoring plan provided above will not catch quick change as would routine inspection by site stewards.

Precautions should be taken to ensure the MMSD staff understands the limits of native plant communities and how those areas should be maintained. Buffers around aquatic resources and native plants which border mowed turf grass areas should be avoided when routine mowing occurs.

CHAPTER 7 – PLAN IMPLEMENTATION

7.1 Requirements

The following are anticipated and will be sought prior to implementation of plan components:

- 401 Water Quality Certification
- National Pollutant Discharge Elimination System (NPDES) General Permit
- Coastal Zone Management Act
- Floodway Construction Permit
- Permit for Herbicide Application is obtained during construction by the contractor
- Right of Entry (ROE)
- Applicable Local Requirements

7.2 Project Schedule & Costs

Table 21 – Study and Tentative Project Schedule

Schedule Item	Completion Date
District Quality Control	October 2020
Agency Technical Review	November 2020
Legal and Policy Review	May 2021
TSP Milestone Meeting	May 2021
Public Review	May 2021
Feasibility Report Approved	July 2021
PPA Signed	September 2021
Real Estate Complete	February 2022
Contract Award	October 2022
Implementation Complete	Fall 2024

7.2.1 Total Project Costs

Total project costs include costs for the study, design, implementation, contingencies, construction management, engineering during construction (EDC) and project management. Costs for design and management are estimated based on a percentage of estimated implementation costs and contingencies. These costs will be revised prior to the execution of a PPA and actual costs for these activities will be used to remedy final cost sharing responsibilities during project close-out. Total project costs were escalated to the mid-point of estimated construction using factors contained in EM 1110-2-1304, Civil Works Construction Cost Index System (CWCCIS). Table 22 provides a summary of the project first costs (FY21) for the NER Plan. In addition, Table 23 provides a summary of the fully funded project costs for the NER Plan as presented in the Cost Certification TPC.

Table 22 – NER Plan Total Cost and Cost Apportionment (First Cost FY21)

Feasibility Phase[a]	
Detailed Project Report (Full-Federal)	
Detailed Project Report (Shared)[b]	
Federal Share	
Non-Federal Share	
Design & Implementation[c]	
100% Plans & Specifications	
Construction[d]	
Management	
Monitoring	
LERRDs[e]	
Total Shared Project Cost	
Fed / non-Fed Breakdown	
Federal Share	
Non-Federal Share	
Non-Federal LERRDs	
Non-Federal Cash	

[a] MXD does not include in Cost Certification
[b] Feasibility Costs are cost shared 50/50 after first $100,000 (full federal)
[c] Design & Implementation Costs are cost shared 65% federal and 35% non-federal
[d] Includes adaptive management costs
[e] Estimate provided by LRE Real Estate

Table 23 – NER Plan Total Cost and Cost Apportionment (Fully Funded FY21)

Feasibility Phase[a]	
Detailed Project Report (Full-Federal)	
Detailed Project Report (Shared)[b]	
Federal Share	
Non-Federal Share	
Design & Implementation[c]	
100% Plans & Specifications	
Construction[d]	
Management	
Monitoring	
LERRDs[e]	
Total Shared Project Cost	
Federal/ Non-Federal Breakdown	
Federal Share	
Non-Federal Share	
Non-Federal LERRDs	
Non-Federal Cash	

[a] MXD does not include in Cost Certification
[b] Feasibility Costs are cost shared 50/50 after first $100,000 (full federal)
[c] Design & Implementation Costs are cost shared 65% federal and 35% non-federal
[d] Includes adaptive management costs
[e] Estimate provided by LRE Real Estate

7.2.2 Financial Capability of Non-Federal Sponsor

In accordance with regulation ER 1105-2-100, *Appendix D – Economic and Social Considerations*, the non-federal sponsor has enough funds currently available to cost-share this project. The non-federal sponsor is committed to its specific cost share of the preconstruction engineering and design phase and expresses willingness to share in the costs of construction to the extent that can be funded.

CHAPTER 8 – RECOMMENDATION

I have considered all significant aspects of the problems and opportunities as they relate to the project resource problems of the Honey Creek Aquatic Ecosystem Restoration Project, under Section 206 of the Continuing Authorities Program. Those aspects include environmental, social, and economic effects, as well as engineering feasibility. I recommend that the NER Plan be implemented as a federal project, with such modifications thereof, as in the discretion of the Commander, USACE may be advisable. The estimated total project first cost FY21 of the NER Plan is $1[redacted] and the estimated annual operations, maintenance, repair, replacement and rehabilitation (OMRR&R) cost is $[redacted]. The federal portion of the estimated total project first cost is $[redacted] for Design & Implementation. The non-federal share of the estimated first cost of the project is approximately $[redacted] and will be covered by LERRDs of $[redacted] and a cash contribution of $[redacted].

As established in P.L. 99-662, as amended, project costs are shared with the non-federal sponsor in accordance with project outputs. The MMSD has agreed to serve as the local cost-sharing sponsor for the Honey Creek Aquatic Ecosystem Restoration Section 206 restoration project. The cost-sharing requirements and provisions will be formalized with the signing of the PPA between the local sponsor and USACE prior to initiation of contract award activities. In this agreement, the local sponsor will agree to pay 35 percent of the total project costs. Federal implementation of the recommended project would be subject to the non-federal sponsor agreeing to comply with applicable federal laws and policies, including but not limited to:

1. Provide 35 percent of the separable project costs allocated to environmental restoration as further specified below
   a) Provide the non-Federal share of all complete planning and design work upon execution of the PCA
   b) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations determined by the government to be necessary for the construction and O&M of the project
   c) Provide or pay to the government the cost of providing all features required for the construction of the project
   d) Provide, during construction, any additional costs as necessary to make its total contribution equal to 35 percent of the separable project costs allocated to environmental restoration
2. Contribute all project costs in excess of the USACE implementation guidance limitation of $10,000,000
3. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project or the functional portion of the project at no cost to the government in accordance with applicable federal and state laws and any specific directions prescribed by the government
4. Give the government a right to enter, at reasonable times and in a reasonable manner, upon land that the local sponsor owns or controls for access to the project for the purpose of inspection and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project
5. Assume responsibility for operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of the project or completed functional portions of the project, including mitigation features, without cost to the government in a manner compatible with the project's authorized purpose and in accordance with applicable federal and state laws and specific directions prescribed by the government in the OMRR&R manual and any subsequent amendments thereto
6. Comply with Section 221 of Public Law (P.L.) 91-611, Flood Control Act of 1970, as amended, and Section 103 of the WRDA of 1986, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resource project or separable element thereof until the nonfederal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element
7. Hold and save the United States free from damages due to construction of or subsequent maintenance of the project except those damages due to the fault or negligence of the United States or its contractors
8. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs

9. Perform or cause to be performed such investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 *U.S. Code* 9601 through 9675, that may exist in, on, or under lands, easements, or rights-of-way necessary for the construction, and O&M of the project, except that the nonfederal sponsor shall not perform investigations of lands, easements, or rights-of-way that the government determines to be subject to navigation servitude without prior written direction by the government
10. Assume complete financial responsibility for all necessary cleanup and response costs for CERCLA-regulated material located in, on, or under lands, easements, or rights-of-way that the government determines necessary for the construction and O&M of the project
11. To the maximum extent practicable, conduct OMRR&R of the project in a manner that will not cause liability to arise under CERCLA
12. Prevent future encroachment or modifications that might interfere with proper functioning of the project
13. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, P.L. 91-646, as amended in Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, P.L. 100-17, and the uniform regulation contained in Part 24 of Title 49, *Code of Federal Regulations* (CFR), in acquiring lands, easements, and rights-of-way for construction and subsequent O&M of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said acts
14. Comply with all applicable federal and state laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964, P.L. 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto and published in 32 CFR, Part 300, as well as Army Regulation 600-7 entitled "Non-Discrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"
15. Provide 35 percent of that portion of the total cultural resource preservation, mitigation, and data recovery costs attributable to environmental restoration that are in excess of 1 percent of the total amount authorized to be appropriated for environmental restoration
16. Do not use federal funds to meet the nonfederal sponsor's share of total project costs unless the federal granting agency verifies in writing that the expenditure of such funds is authorized to be used to carry out the *Project*.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program, nor the perspective of higher review levels within the Executive Branch.

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Bibliography

Audubon. 2014. State of the Birds 2014: Common Birds in Steep Decline List. Available at https://www.allaboutbirds.org/state-of-the-birds-2014-common-birds-in-steep-decline-list/. Accessed January 12, 2018.

Boulton, A.J. 2003. Parallels and contrasts in the effects of drought on stream macroinvertebrate assemblages. *Freshwater Biology* 48(7):1173-1185.

Burgess, R.L. & D.M Sharpe. 1981. Forest island dynamics in man-dominated landscapes. 1981 pp. xvii + 311 pp.

Del Roasio, R.B. and V.H. Resh. 2000. Invertebrates in intermittent and perennial streams: is the hyporheic zone a refuge from drying? *Journal of the North American Benthological Society* 19(4):680-696.

DiStefano, R.J., D.D. Magoulick, E.M. Imhoff, and E.R. Larson. 2009. Imperiled crayfishes use hyporheic zone during seasonal drying of an intermittent stream. *Journal of the North American Benthological Society* 28(1):142-152.

Foster, R., and A. Kurta. 1999. Roosting ecology of the northern bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana bat (*Myotis sodalis*). *Journal of Mammalogy* 80:659-672. **DOI:** 10.2307/1383310

Gagen, C.J., R.W. Standage, and J.N. Stoeckel. 1998. Ouchita madtom (*Noturue lachneri*) metapopulation dynamics in intermittent Ouchita mountain streams. *Copeia* 1998(4):874-882.

Gorr, B. 2018. Honey Creek Watershed-Health of the Tributary. Available at http://envirohistory.uwgb.org/Honey_Creek_Watershed-Health_of_the_Tributary. Accessed January 12, 2018.

Magoulick, D.D. and R.M. Kobza. 2003. The role of refugia for fishes during drought: a review and synthesis. *Freshwater Biology* 48(7):1186-1198.

Marzluff, J.M. & K. Ewing. 2001. Restoration of Fragmented Landscapes for the Conservation of Birds: A General Framework and Specific Recommendations for Urbanizing Landscapes. *Restoration Ecology* 9(3):280-292. **DOI:** 10.1046/j.1526-100x.2001.009003280.x

Milwaukee County. 2018. Milwaukee County Interactive Mapping. Available at http://county.milwaukee.gov/mclio/applications/interactivemapping.html. Accessed January 11, 2018.

Milwaukee County Department of Parks, Recreation, and Culture. 2012. Volume 1: Milwaukee County Parkway Inventory Report. Prepared by Mead & Hunt. WisDOT ID 2967-14-00. Available at: https://county.milwaukee.gov/ImageLibrary/Groups/cntyParks/Planning/FinalParkwayInventoryReport.pdf

P. Angelstam. 1992. Conservation of Communities – The Importance of Edges, Surroundings and Landscape Mosaic Structure. Ecological Principles of Nature Conservation. Conservation Ecology Series: Principles, Practices and Management. pp 9-70.

Santucci, V.J., S.R. Gephard, S.M. Pescitelli. 2005. Effects of Multiple Low-Head Dams on Fish, Macroinvertebrates, Habitat, and Water Quality in the Fox River, Illinois. *North American Journal of Fisheries Management* 25:975–992. **DOI:** 10.1577/M03-216.1

Saunders et al. 1987. Changes in the Avifauna of a region, district and remnant as a result of fragmentation of native vegetation: the wheat belt of Western Australia, a case study. *Biological Conservation* 50(1-4):99-135. **DOI:** 10.1016/0006-3207(89)90007-4

Southeastern Wisconsin Regional Planning Commission. 2010. Stream Habitat Conditions and Biological Assessment of the Kinnickinnic and Menomonee River Watersheds: 2000-2009. Memorandum Report Number 194.

Sparks, D., C. Ritzi, J. Duchamp, and J. Whitaker, jr. 2005. Foraging habitat of the Indiana bat (*Myotis sodalis*) at an urban-rural interface. *Journal of Mammalogy* 86(4):713-718. **DOI:** 10.1644/1545-1542(2005)086[0713:FHOTIB]2.0.CO;2

Stanley, E.H., D.L. Buschman, A.J. Boulton, N.B. Grimm, and S.G. Fisher. 1994. Invertebrate resistance and resilience to intermittency in a desert stream. *American Midland Naturalist* 131(2):288-300.

U.S. Census Bureau. 2019. American FactFinder, Community Facts. Available at: https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml. Accessed June 20, 2019.

USDA Soil Conservation Service (U.S. Department of Agriculture Soil Conservation Service). 1971. Soil Survey of Milwaukee and Waukesha Counties Wisconsin. Available at: https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/wisconsin/mil_wauWI1971/mil-wauWI1971.pdf. Accessed January 11, 2018.

Westlake, K. 2017. Letter from Mr. Westlake (U.S. Environmental Protection Agency) to Ms. Herleth-King (U.S. Army Corps of Engineers). November 17.

Whitaker, Jr., J.O. and D.W. Sparks. 2008. Roosts of Indiana bats (*Myotis sodalis*) near the Indianapolis International Airport, 1997-2001. *Proceedings of the Indiana Academy of Science* 117:193-202.

Williams, D.D. 1977. Movements of benthos during the recolonization of temporary streams. *Oikos* 29(2):306-312.

Wisconsin Department of Natural Resources [WDNR]. 2017. Northern Long-Eared Bat (*Myotis septentrionalis*) Species Guidance. Available at: https://dnr.wi.gov/files/PDF/pubs/er/ER0700.pdf

Wisconsin State Climatology Office. 2018. Milwaukee Climate. Available at: http://www.aos.wisc.edu/~sco/clim-history/7cities/milwaukee.html. Accessed January 11, 2018.