

VILLAGE OF MCFARLAND    **Sustainability & Natural Resources**    *NOTICE OF PUBLIC MEETING*  
**Committee**

**Monday, November 13, 2023**

**6:00 PM**

**McFarland Municipal Center**  
*Community Room*

**AGENDA**

You are invited to this meeting through a Zoom webinar. The public may attend in-person or remotely through the webinar or telephone options listed below.

PLEASE CLICK THE LINK BELOW TO JOIN THE ZOOM WEBINAR:

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**1. CALL TO ORDER, ROLL CALL.**

**2. PUBLIC APPEARANCES.**

- a. This is an opportunity for members of the public to address the Sustainability and Natural Resources Committee for items that are not on the agenda. Please remember this is a hybrid meeting conducted in person and through the Zoom online meeting platform. Meeting attendees wishing to address the Committee about items not on the agenda may do so at this time. Zoom attendees should type their name and address in the Question and Answer feature within the Zoom online meeting platform at this time. Members of the public who are present in person and wish to address the Committee should fill out a public comment form and turn into the meeting chairperson. When you are called upon to speak, state your name, address, and provide your comments to the Committee for their consideration. Please adhere to the 3-minute time limit. Additionally, you may send your public comments to [sustainability@mcfarland.wi.us](mailto:sustainability@mcfarland.wi.us) to be included as part of the meeting.

Members of the public may also speak during their selected agenda item as they designate on the public comment form or in the Question and Answer feature on Zoom.

**3. APPROVAL OF MINUTES.**

- a. Motion to approve the minutes of the Sustainability & Natural Resources Committee meeting held on September 11, 2023.

**4. BUSINESS.**

- a. Discussion and action to make a recommendation to the Village Board to accept updates to the mounds policy for Preservation and Maintenance.
- b. Presentation and discussion of the draft Urban Forestry Management Plan
- c. Discussion and action to recommend the Village Board accept the Village of McFarland Community Center Net Zero Energy Predesign Report.
- d. Discussion and action to recommend the Village Board accept the Comprehensive Energy Plan Report.

**5. SCHEDULE NEXT MEETING DATE.**

a. Monday, December 11, 2023 at 6:00 p.m.

## 6. ADJOURNMENT.

Any person who has a qualifying disability as defined by the Americans with Disabilities Act that requires the meeting or materials at the meeting to be in an accessible location or format should contact the McFarland Municipal Center at (608)838-3153, 5915 Milwaukee Street, McFarland, Wisconsin, or [village.clerk@mcfarland.wi.us](mailto:village.clerk@mcfarland.wi.us) by 2:00 p.m. at least 5 business days prior to the meeting so that any necessary arrangements can be made to accommodate each request. If the meeting or request is less than 5 business days from the meeting, requests for accommodations may still be made and reasonable efforts will be made to accommodate each request.



**Minutes**  
**Sustainability & Natural Resources**  
**Committee Meeting**  
**September 11, 2023**

**Members Present:** Mike Flaherty, Carolyn Clow (6:09 PM), Kitty Brussock (6:02 PM), Nina Schultz, Bruce Fischer, Judy Taber

**Members Absent:** Angela Freedman

**Staff Present:** Sayer Larson, Kong Thao, Phil McDade

1. CALL TO ORDER

Clow called the meeting to order at 6:00 PM.

2. PUBLIC APPEARANCES.

No public appearances.

3. APPROVAL OF MINUTES.

- a. Schultz motioned to approve the minutes of the June 12, 2023, Sustainability & Natural Resource Committee meeting. Seconded by Fischer. Motion carried 4-0.

4. BUSINESS.

- a. Discussion regarding updates to the mounds policy for Preservation and Maintenance.

Larson provided summary on the agenda item and several details on the updates made to the document. The Committee discussed the mentioned updates and bike trail route near the site. No action was taken on this item.

- b. Discussion and action regarding revisions to Tree Planting Bid and Specification Request for Proposal.

Larson provided summary on the agenda item covering the updates to the RFP. The Committee discussion included types of species plantings included in the RFP. Larson clarified several items were shown as examples only and schedule of plantings.

Fischer motioned to recommend approval of the edits to the Tree Planting Bid and Specification Request for Proposal. Taber seconded the motion. Motion passed 6-0.

- c. Discussion and action to submit the Village of McFarland's 2022 Green Tier Annual Report to the Wisconsin Department of Natural Resources.

Thao provided summary on the agenda item, highlighting several data points collected in the report. The Committee discussed the Green Tier's overall initiative and intent behind the data collection. Thao confirmed the processes has seen its growth since the previous reporting, however, remains optimistic the reporting will be a valuable source the longer this goes.

Fischer motioned to approve submittal of the Village of McFarland's 2022 Green Tier Annual Report to the Wisconsin Department of Natural Resources. Schultz seconded the motion. Motioned passed 6-0.

d. Discussion and action to pursue SolSmart Designation.

Thao provided summary on the agenda item highlighting SolSmart Designation and the benefits for participating communities. The Committee's discussion included details on SolSmart's grading criteria, tiers classification, benefits of the designation, and households.

Schultz motioned to approve submittal of a letter of intent to SolSmart to become a SolSmart designated community. Brussock seconded the motion. Motion passed 6-0.

e. Discussion and action to make a recommendation to the Village Board regarding Ordinance 2023-10, an ordinance amending various sections of the McFarland Building Code related to site erosion control and stormwater management.

Thao provided summary on the agenda addressing the purpose of the ordinance and its amendments. The Committee discussed further details on regulations on impervious surfaces among lakeside properties and runoff potential.

Fischer motioned to recommend approval to the Village Board of Ordinance 2023-10, an ordinance amending various sections of the McFarland Building Code related to site erosion control and stormwater management. Taber seconded the motion. Motion passed 6-0./

f. Discussion and action to make a recommendation to the Village Board regarding Ordinance 2023-09, an ordinance amending various changes to Chapter 62 – Zoning, relate to solar energy collection systems.

Thao provided summary on the agenda item highlighting the changes and additions the ordinance introduces. The Committee discussed the terms for solar systems, permitted uses, and accessory structures. Clow commented that the review of this ordinance would be relevant to item 4d. of this meeting's agenda item.

Clow motioned to recommend approval to the Village Board of Ordinance 2023-09, an ordinance amending various changes to Chapter 62 – Zoning, related to solar energy collection systems after its review by SolSmart. Fischer seconded the motion. Motion passes 6-0.

5. SCHEDULE NEXT MEETING DATE.

- a. Thursday, October 19, 2023, at 6:00 PM

6. ADJOURNMENT.

Fischer motioned to adjourn; Seconded by Brussock. Motion carried 6-0. Meeting adjourned at 6:55 PM.

  
**McFarland**  
**SUMMARY SHEET**

**MEETING DATE:** Monday, November 13, 2023

**SECTION:** Business

**DEPARTMENT:** Public Works

**CONTACT:** Sayer Larson, Parks Superintendent, Kong Thao, Associate Planner

**AGENDA ITEM:** Discussion and action to make a recommendation to the Village Board to accept updates to the mounds policy for Preservation and Maintenance.

**PREVIOUS ACTION:**

None.

**ISSUE SUMMARY:**

Please find enclosed the updated Policy for Preservation and Maintenance of Native American Mounds. A copy of the original document has been included for reference. The original policy was adopted on August 9, 2010 and was created to provide direction to village staff. The updated policy incorporates recommendations from the Ho-Chunk Nation's Tribal Historic Preservation Officer, Bill Quackenbush. These recommendations were submitted by Mr. Quackenbush through a requested review by village staff.

The policy was previously presented to the committee at their September 11, 2023 meeting. There have been no changes made since the policy was presented. Staff are seeking recommendation of the committee to the Village Board.

**FINANCIAL/BUDGET IMPACT:**

There are no specific financial considerations to update this policy as work was completed by staff. There may be budgetary considerations to implement portions of the policy.

**VILLAGE PLAN REFERENCE:**

[Policy Preservation and Maintenance](#) of McFarland's Indian Mounds

**ORDINANCE REFERENCE:**

None.

**BOARD, COMMISSION OR COMMITTEE RECOMMENDATION:**

Recommended motion:

*Motion and second to recommend approval to the Village Board regarding the mounds policy for Preservation and Maintenance as presented.*

**ATTACHMENTS:**

1. Policy for Preservation & Maintenance of Native American Mounds 2023



2. Policy for Preservation and Maintenance of McFarlands Indian Mounds 2010
3. Policy review



POLICY FOR  
PRESERVATION  
~~AND~~  
MAINTENANCE OF  
NATIVE AMERICAN MOUNDS  
~~MCFARLAND'S~~

[Reserved for photo]

# INDIAN MOUNDS

ADOPTED August 9, 2010

UPDATED Month, X, 2023

## Acknowledgments

Bill Quackenbush, Tribal Historic Preservation Officer,  
Cultural Resources Division, Ho Chunk Nation  
&  
[The Indigenous People of the Ho Chunk Nation]

2010 Ad Hoc Advisory Committee on Indian Mounds (Original Document) Contributing Staff  
from the Original Document

Don Peterson, Former Village Administrator  
Steve Hoefft, Former Public Works Director Steve Jackson, Chair  
Sally Hansen, [Former Chair of XXX]  
Kevin Wernet, Former Trustee  
Shelia Plotkin, Former Trustee  
Coleen Baird, Former Trustee  
Kate Barrett  
Sally Hansen  
John Hauser  
John Hauser, Former Trustee  
Patrick Kane, Former Trustee  
Ron Larson, Former Trustee  
Shelia Plotkin

Contributing Village Staff, 2022-23  
Matt Schuenke, Village Administrator  
Lee Igl, Public Works Director  
Jim Hessling, Former Public Works Director  
Sayer Larson, Parks Superintendent  
Aimee Irwin, Assistant to the Public Works Director  
Andrew Bremer, Community & Economic Development Director  
Kong Thao, Associate Planner

Special Thanks  
Jim Hessling, Public Works Director (Former)



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## I. —INTRODUCTION

Southern Wisconsin is known for its prehistoric IndianNative American mounds. The mounds were built by people of the Effigy Mound Culture, Late Woodland Stage, from approximately 650 to 1200 CE (Common Era).<sup>\*</sup> Many are burial grounds. Others may have served as man-made landmarks. The mounds are symbols/expressions of the mound ~~builders~~builder's religious faith and are considered sacred sites by Native Americans to this day. Fourteen of these rare and archaeologically significant treasures still exist on Village-owned property in McFarland. They are located in Indian Mound ~~Conservation~~Conservancy Park (IMCP), Siggelkow Road Park, the Taylor Road Conservancy, and Woodland Commons ConservancyPark. Other mounds exist on private property within Village limits, and there may be others yet to be discovered on Village-owned lands. The McFarland Village Board recognizes that these few remaining mounds are of enormous historical and cultural value and has adopted and implemented this policy to ensure their protection and preservation for many generations to come.

~~\*Common Era~~

## II. —CULTURAL IMPORTANCE

Over the centuries, Wisconsin's IndianNative American mounds have disappeared in large numbers. They have been destroyed, damaged or neglected — victims of agricultural practices, impacted by the advancement of urban development,<sup>1</sup> indifference and/or ignorance. To ~~halt~~prevent further destruction and ~~to~~ raise public consciousness, the Ho Chunk Nation, cultural descendants of the mound builders, has reached out to communities where mounds exist and provided information and expertise on mound preservation and maintenance through their Department of Heritage Preservation.<sup>1</sup> ~~Similarly~~Similarly, the Wisconsin Department of Natural Resources,<sup>2</sup> the Lower Wisconsin State Riverway Board,<sup>3</sup> and the Wisconsin Historical Society<sup>4</sup> have issued maintenance protocols aimed at preserving what remains of this part of Wisconsin's cultural and archaeological heritage. All of these land stewardship bodies recognize that IndianNative American mound sites are irreplaceable and stress the responsibility of the ~~land~~owner~~landowner~~ to protect these areas.

The Village of McFarland accepts this responsibility and further desires to become a role model for others to emulate.<sup>5</sup> ~~It As a start, the~~The Village has taken public ownership of the lands containing most of the mounds within the Village and has established conservancy uses on these lands to help protect the mounds. At one time, more than 80 IndianNative American mounds graced the McFarland area. Prior to the Village taking ownership of what is now IMCP, two of the nine mounds that once occupied that land were destroyed by the grading of the hillside above Burma Road in the 1950's. Over the years, community volunteers and school groups have done maintenance work such as removing invasive species and woody brush from some of the mounds and relocating and improving trails. The importance of this matter connects the history of the land with its future occupants, emphasizing the auspices of the four lakes region.

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<sup>1</sup> Mound Preservation and Maintenance, Ho-Chunk Department of Heritage Preservation

<sup>2</sup> Burials, Earthworks, And Mounds Preservation Policy & Plan, WI Dept. of Natural Resources

<sup>3</sup> Proposed Protocols for Cultural Resources Protection and Preservation on Public and Private Lands In the Lower Wisconsin State Riverway

<sup>4</sup> Wisconsin Historical Society Assessment ~~of~~Lewisof Lewis Mound Group - ~~October~~October 2007



### III. —PRESERVATION AND MAINTENANCE OF THE MOUNDS

#### A. Legal Framework

Wisconsin statutes designate the Wisconsin Historical Society as the oversight authority for Indian Native American mound lands throughout the state. ~~Those Under Wis Stats. statutes [157.70(6m)-(b)(2 & 3)-2 and 3],~~ which regulates burial sites that are on public lands, imposes certain requirements on municipalities. These regulations include: prohibiting the transfer of any burial site to any person who is not a municipality unless the transfer provides for preservation of the burial site from any disturbance by any person and unless the transfer is approved by the Wisconsin Historical Society; and requiring that the municipality shall endeavor to take positive action to preserve any burial site on land it owns through appropriate land use management, including but not limited to appropriate multiuse purposes such as nature preserves.

~~All~~ All of the acreage in IMCP is listed on the National Register of Historic Places which means that no ground disturbing activities are allowed anywhere within that park. Any activities that might potentially cause ground disturbance on or near the mounds in other parks require prior approval from the Wisconsin Historical Society. This approval process typically involves preparation and submittal of a plan by the Village President, ~~or Village Administrator, or Village Parks Superintendent~~ for review by Wisconsin Historical Society staff. As appropriate, the Wisconsin Historical Society may circulate the proposed plan for review and comment by Native American nations in the state, with whom the agency is responsible for coordinating preservation efforts.

#### B. Approach

McFarland's mounds do not exist in isolation. All of them are in conservancies, and any maintenance activities undertaken on the mounds will inevitably have some impact on the surrounding natural and man-made environments. Managing the mounds properly and avoiding detrimental impacts to the broader environmental context within which they exist is a complex challenge. Diverse perspectives on meeting this challenge were expressed via community input at a public meeting,<sup>5</sup> within the Committee's internal discussions, and in documents submitted to the Committee by concerned residents.<sup>6</sup> ~~There was no one-size-fits-all approach with which Committee members felt comfortable. As a result, the Committee's objective has been to determine a balanced approach to preservation and maintenance that meets McFarland's unique challenges.~~

~~In November 2022, two Village Staff members were invited to visit the Kingsley Bend Mound site located outside of Wisconsin Dells, to tour and discuss methods of preservation. On site to provide the tour was the local Tribal Historic Preservation Officer (THPO) of the Ho-Chunk Nation, Bill Quackenbush. With over 30 years of experience, the conversation covered many methods on how to best approach mound maintenance strategies and the importance of the mounds to the Native American community. Prior to the visit, the Official THPO also provided comments to the original 2010 Policy for Preservation and Maintenance of McFarland's Indian Mounds. As a result, the Committee's objective has been to determine a balanced approach to preservation and maintenance that meets McFarland's unique challenges.~~

<sup>5</sup> Indian Mounds: Cultural Resources Fact Sheet 2, National Resource Conservation Service

<sup>6</sup> Fact Sheet: How Trees Benefit Mounds and The Oaks in Indian Mound Conservancy, Alan R. Lulloff, P.E. CFM

The specific preservation and maintenance practices to be used will vary by mound site and from one individual mound to the next. This document henceforth establishes minimum requirements, as describe below, for the ~~There is, nonetheless, a~~ systematic series of protocols that should be followed at all sites to ensure that the desired goals are achieved.

~~That~~ common approach recommended herein would typically involve the following steps:

1. Have a comprehensive site assessment of each mound site conducted by the State Archeologist that would include an archeological overview and appropriate mapping.
- ~~1.~~—A vegetation assessment and an overall risk assessment should also be conducted by a certified arborist and an ecological restoration expert. Such site assessments for the mounds in IMCP were conducted in 2006-2007 by the Wisconsin Historical Society. A forester and an ecologist from the WDNR have also reviewed
2. surrounding conservancy areas in IMCP and provided suggestions on approaches to managing vegetation and improving forest health.
- ~~2.3.~~ Determine the optimal conditions for protection and preservation of the mound site and prepare a ~~long-term~~ long-term maintenance plan to establish and maintain those optimal conditions.
- ~~3.4.~~ Obtain necessary approvals of this maintenance plan from the Burial Preservation Office of the Wisconsin Historical Society.
- ~~4.5.~~ Stabilize the current condition of the mounds to prevent any deterioration.
- ~~5.6.~~ Prepare a ~~five-year~~ five-year plan, to be updated annually, which identifies phased maintenance projects and practices to be undertaken at each of the four mound sites. Allocate the necessary resources in the annual budget process or pursue available grant funding to implement those plans.
- ~~6.7.~~ At the completion of each phase of maintenance, photograph, monitor, and evaluate the results over the course of at least one full growing season prior to determining what maintenance activities should be undertaken in the next phase, how the activities should be prioritized, and when the next phase should commence.
- ~~7.8.~~ Conduct public education/outreach activities and provide appropriate site amenities to promote greater understanding and enjoyment of the mound sites by the public in a manner that does not pose additional risk to the mounds.
- ~~8.9.~~ Pursue local “landmark” status for Taylor Road Conservancy and Woodland Commons Conservancy. Evaluate the potential benefits—merits of having the Taylor Road Conservancy and Woodland Commons Park these mound sites listed on the National Register of Historic Places. ~~Pursue local “landmark” status for all four mound sites.~~
- ~~9.10.~~ Conduct regular assessments of progress and continue these preservation and maintenance policies, plans and practices or revise them accordingly.

## ~~C.~~ C. Goals and Objectives

The purpose of taking the common approach to preservation and maintenance described above is to meet goals and achieve results that should apply uniformly to all four IndianNative American mound sites identified in this plan. The desired outcome and end vision for all sites are defined in the following goals and would be achieved by accomplishing the following objectives:

**GOAL #1** — Ensure that the IndianNative American mounds are protected from potential damage, stabilize the current condition of the mounds so they do not deteriorate, and improve the condition of the mounds as available resources permit.

### **OBJECTIVES:**

1. Eliminate or minimize risks or threats that pose an unreasonable risk to the mounds and its surrounding areas.
2. If trail access to an area is deemed desirable, design or relocate trails so they do not encroach any closer than fifteen-twenty-five feet (2+5') from the mounds.
3. Direct bikers away from the mounds with appropriate signage and, if necessary, physical barriers.

**GOAL #2** — Raise public awareness about the IndianNative American mound sites and their human and natural history by conducting an effective education and public outreach program.

**OBJECTIVES:**

1. 1. Provide suitable overlook points along the trails which permit observers to appreciate visually the shape of the mound(s) from a safe distance,
2. 2. Install non-obtrusive warning signs to protect the mounds and interpretive signs to help observers better understand the mounds and their history.
3. 3. Offer accompanying public education activities to foster a greater understanding of the historical, archeological, and cultural significance of the mounds.

**GOAL #3** — In order to protect the mounds from potential damage and to respect the preferences of the Ho Chunk Nation regarding the presence of vegetation on their ancestral sites, and Wisc. Stat. 157.70(2)(a), the Village must achieve an eventual condition where no trees or shrubs are growing on the mounds or within a tfiven feet (105') buffer zone and where each distinct mound shape is clearly defined and visible to an observer.

**OBJECTIVES:**

1. 1. Remove all shrubsbrush, non-native, and invasive species.
2. Remove in-phases all trees except selected large, healthy, deep-rooted trees that are retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage might occur during tree removal, or for other management purposes.
3. Remove these-any remaining trees as they deteriorate or die from natural causes.
4. Establish native ground cover on the mounds to protect against erosion and other potential damage and to minimize future maintenance efforts.
5. Emphasize the definition of each mound by using contrasting types of vegetation or in some other natural-looking manner.

## IV. SITE ASSESSMENTS

Since the amount and quality of site assessment data that is currently available varies a-great-deal across the four mound sites, a comprehensive assessment by the Wisconsin Historical Society or other qualified professionals is required as an initial step for each IndianNative American mound site to evaluate the existing plant community and the opportunity for restoration of the native plant community. The process will help, to determine the current conditions of the mounds, to-determine if there is a need for additional mapping, and to assess potential risks to the mounds. This assessment will identify those features which render each site unique and will influence the maintenance regimen selected.



## A. Archaeological Overview

If one has not been conducted previously, an archeological overview of the site should be conducted both before and after phased maintenance work is implemented. If possible, the "before" overview should be conducted by the State Archeologist. At a minimum, the number and type of mounds should be ~~described~~described, and surface observations should be ~~made~~recorded and which includes a narrative recording ~~ing in narrative and attached with in~~ photographic ~~forms~~images. The ~~current~~ condition of the mounds should be noted, such as whether the edges are well-defined or diffuse and whether the mounds are well-preserved or have been damaged. An additional walk through of ~~each the~~ site should be conducted ~~and with both the Archaeologist & Ho-Chunk Nation THPO. This meeting should include any recordings of additional activity made on or concerning the burial mounds. This data should be updated regularly notations made following the creation of a 5-year history of activities such as~~ extensive tree removal or introduction of fire to the site. To date, ~~a the IMCP is the only burial mound that has received a proper archeological overview has been completed only for the mounds in IMCP.~~

## B. Mapping

Mapping is important to assure that an accurate record of each ~~IndianNative American~~ mound site is maintained. While adequate maps of the mound groups are generally available, ~~it might be very useful if the~~ maps contain ~~ing~~ greater detail ~~would be more useful~~. Village staff shall work with the Burial Sites Preservation staff in the Wisconsin Historical Society to acquire files from WHS that define the established mound protection boundaries for all ~~IndianNative American~~ mounds documented to exist on Village-owned lands. Where they have not been previously documented, new technologies are available ~~that would to~~ enhance existing maps. ~~Furthermore, the application of~~ Global Positioning System (GPS) coordinates ~~along with LiDAR and Geographical Information Systems Mapping (GIS) with will~~ ~~an increase the~~ accuracy level ~~of one foot should be taken for~~ all mounds. ~~Although the accuracy of this data will be limited by the tree canopy and the often ill-defined often ill-defined~~ nature of the mound edges. Maps of each individual mound site should be as accurate as possible and should document (as appropriate) the mound's shape, dimensions, mound-mound angles, and the presence of depressions or other potential burial features. Notations regarding proximity to water features, roads, trails, property lines, and nearby development, topographical information, and other notable features of the site should be added to the maps as site assessments are completed. The most complete maps currently exist for IMCP, but these maps lack much of the recommended detail. The existing maps for the other three mound sites ~~are even less require more~~ detail ~~sed~~ and need to be expanded.

## C. Vegetation Assessment

An initial survey of trees, shrubs, and ground cover should be conducted and used in determining future vegetation management practices for each site. It may be appropriate to consult with a professional qualified in ecological restoration in developing this vegetation assessment. The assessment should describe the existing plant community and species, identify endangered or threatened species as well as invasive species. ~~The assessment should also include, evaluateion of~~ relics of ~~similar~~ native plant communities and the potential for future restoration and sustainability of native species. ~~Other, and notes regarding~~ existing tree canopy and ground cover ~~are important details to include.~~

~~Next, aA general~~ tree inventory detailing the species, size, ~~and a general current rating of the~~ condition of ~~all those~~ trees growing on ~~or near~~ the mounds ~~and within a fifteen foot twenty-five-foot (2+5')~~ buffer area from the base of the mounds should be completed by a certified arborist. This inventory should identify trees for removal based on objective criteria developed by the



arborist and approved by the Village. The inventory will also differentiate between native and non-native trees and between deep-rooted and shallow-rooted species. The assessment should also note whether the use of controlled burns might be an appropriate and desirable vegetation management tool for the mounds and/or adjacent areas. Finally, the Village should establish a policy on mowing management for grass on and around the mound's base. No surveys ~~that-which~~ fully satisfy ~~all~~ of all these assessment criteria have been completed for any of the four mound sites.

## D. Risk Assessment

Using the information developed during the archeological survey, mapping, and vegetation assessment phases, each mound site should be assessed for inherent risks.<sup>7</sup> Notations should be recorded regarding potential threats to the mound(s) from: erosion;<sup>5</sup> proximity to neighboring development, roads, pedestrian or bicycle trails, playgrounds, and parks;<sup>2</sup> non-native or invasive species;<sup>2</sup> ~~and~~ tree species of concern due to disease or insects;<sup>2</sup> and damage caused by humans or wildlife activity. Mounds associated with a "high-risk" for damage should receive immediate attention to assure protection and preservation.

Shallow-~~—~~rooted trees can be a risk for *windthrow*, trees that can be uprooted due to extreme weather such as heavy wind or tornado. According to the National Resource Conservation Service, however, having tree cover on mounds can have both advantages and disadvantages. "The possibility of wind thrown trees is a potential area of concern. Overturned trees can pull up large chunks of soil with the root system causing damage to cultural deposits. Root penetration of trees and scrub can also have a significant impact on archeological deposits. However, removal of ~~long established~~long-established trees can be more detrimental to the mound than maintaining the existing cover."<sup>7</sup>

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<sup>7</sup> Indian Mounds: Cultural Resources Fact Sheet 2, National Resource Conservation Service

## V. —PHASED MAINTENANCE OF THE MOUNDS

A good deal of deferred maintenance work on the mounds will be required. The phasing of maintenance is a practical reality given current limitations in available financial and labor resources. Another advantage ~~of for~~ a phased approach is that it allows an evaluation to be conducted at the conclusion of each management phase. If any unintended or unexpected effects have occurred, future maintenance plans can be adjusted accordingly.

As each of the ~~IndianNative American~~ mound sites is ~~different, with its own~~ unique with its own surroundings and potential risks, the specific protection and maintenance practices to be used will vary between sites. The pace of the maintenance efforts and the timing of various phases will also differ between sites based on priorities established through the site assessment process and funding availability.

Vegetation management on mound sites would follow the sequential phases described below. The phased maintenance project also includes a diagrammed ~~in-flow chart form in Table 1,~~ and ~~summarized in Table 2~~ provides a summary of the phased process. No specific time frame ~~has been~~ established for the completion of a particular phase ~~at this time nor is there a planned the start date set of the for the phased maintenance following phase.~~ It is understood that steps to establish healthy ground cover of native species, including ongoing removal of non-native and invasive species, would be continuous throughout the process as sunlight conditions change with progressive removal of tree canopy. At least one full growing season should be allowed to pass before beginning a subsequent maintenance phase. This will allow a proper period for monitoring and evaluating the results of the previous phase.

Maintaining a photographic history of the appearance of each mound before, during, and after each maintenance phase is strongly recommended. The data base of photographs should be properly indexed and catalogued by specific mound, phase, and dated. Photographs ~~cs~~ should also be stored in a commonly available on-line format that is searchable and from which potential users can download and print selected material. Additionally, the Village should be sharing the photographic history of each mound's information with both the State Historical Society and Ho-Chunk Nation to gather feedback after each phase is completed.

### A. Phase 1, Initial Vegetation Management

1. ~~P(Before photos)~~ Catalog photos ~~of graph~~ each mound from ~~several-varying~~ angles, noting the ~~date location and time~~ taken for consistency.
2. On the mounds themselves:
  - ~~a. Remove all brush and all non-native or invasive species of groundcover and trees~~
  - ~~b. Remove all shrubs brush~~ and all non-native or invasive species of groundcover and a. trees.
  - ~~e.b.~~ Remove all dead, down, and unhealthy trees; all shallow-rooted trees, regardless of size; and any trees recommended for removal by a certified arborist if they pose an undue risk to the mounds for other reasons.
  - ~~d.c.~~ Remove all trees less than 5" diameter at breast height (DBH) in size.
  - ~~e.d.~~ Seed native vegetation in a mixture recommended by a qualified professional.
- ~~1. Within a twenty-five a fifteen feet (215'') buffer areas~~ from the base of the mounds:
- 3.

- a. — Remove all dead, down, and unhealthy trees; all shallow-rooted trees, regardless of size; and any trees recommended for removal by a certified arborist if they pose an undue risk to the mounds for other reasons.

a. —

3.4. (After Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency ~~Photograph each mound from several angles, noting the date taken.~~

## Evaluation Phase.

~~B.~~ Regularly scheduled evaluations ~~(should begin occur before and after work is completed on each mound after. Following this, staff should allow one complete growing season prior to transitioning to the next phase. The steps below provide additional context for the evaluation phase.)~~

1. (Before Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency.
- ~~1. Photograph each mound from several angles, noting the date taken~~
2. Document the specific maintenance activities performed to ~~dated~~date.
  - a. Describe any detrimental results from the work done in the previous phase (e.g., an increase in invasive species, signs of erosion).
  - b. Describe any positive results from the previous phase (e.g., increased sunlight, improved growth of native vegetation).
- ~~3. 3.~~ Based on the analysis of results made during this Evaluation Phase, modify as appropriate the maintenance priorities and activities planned for the next phase.
4. (After Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency ~~Photograph each mound from several angles, noting the date taken.~~

## B. C. Phase 2, Vegetation Management

1. (Before Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency.
- ~~1. Photograph each mound from several angles, noting the date taken~~
2. On the mounds themselves:
  - a. Ongoing removal of all ~~shrubs~~brush, ~~small~~ trees, and all non-native or invasive species of groundcover
  - b. Remove all trees between 5" - 12" DBH in size. Also remove those trees so recommended by a certified arborist if they pose an undue risk to the ~~mounds~~mounds.
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified ~~professional~~professional.
3. Within ~~a twenty-five feet (25')~~ the 0-10ft buffer area from the base of the mounds:
  - ~~a.~~ Remove all brush and all non-native or invasive species of groundcover and ~~a.~~ trees
  - b. Remove all trees less than 5" DBH in size, and aAlso remove those trees so recommended by a certified arborist if they pose an undue risk to the ~~mounds~~mounds.
  - c. Seed native vegetation in a mixture recommended by a qualified ~~professional~~professional.
4. Within the 10-25ft buffer area:
  - a. Remove non-native and invasive species
5. (After Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency.
- ~~4. Photograph each mound from several angles, noting the date taken~~

Repeat~~D.~~ Evaluation Phase included in Phase 1 (see above)

### C. E. Phase 3, Vegetation Management

1. (Before Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency.
- ~~1. Photograph each mound from several angles, noting the date taken~~
2. On the mounds themselves:
  - a. Ongoing removal of all ~~shrubs~~brush, ~~small~~ trees, and all non-native or invasive species of groundcover
  - b. Remove all remaining trees unless it is determined that selected large, healthy, deep-rooted trees should be retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage would occur during tree removal, or for other management ~~purposes~~purposes.
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified ~~professional~~professional.
3. Within ~~a five~~ twenty five feet (25') ~~the 0-10ft~~ buffer area from the base of the mounds:
  - a. Ongoing removal of all ~~shrubs~~brush, small trees and all non-native or invasive species of groundcover
  - b. Remove all trees less than 12" DBH in size. Also remove those trees so recommended by a certified arborist if they pose an undue risk to the ~~mounds~~mounds.
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified ~~professional~~professional.
4. Within ~~a fifteen~~ twenty five feet (25') ~~the 10-25ft~~ buffer area from the base of the mounds:
  - a. Remove ~~all brush and~~ all non-native or invasive species ~~of groundcover and~~ ~~tree~~trees.
  - b. Remove all trees with shallow root systems less than 5" DBH in size. Also remove those trees so recommended by a certified arborist if they pose an undue risk to the ~~mounds~~mounds.
  - c. Seed native vegetation in a mixture recommended by a qualified professional
5. (After Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency.
- ~~5. Photograph each mound from several angles, noting the date taken~~

Repeat Evaluation Phase included in Phase 1 above.

F. ~~—~~ Evaluation Phase (see above)

### G. D. Phase 4, Vegetation Management

1. (Before Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency.
- ~~1. Photograph each mound from several angles, noting the date taken~~
2. On the mounds themselves:
  - a. Ongoing removal of all ~~shrubs~~brush ~~and small~~ trees, and all non-native or invasive species of groundcover
  - b. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified ~~professional~~professional.

3. Within ~~twenty-a five feet~~five feet (25') the 0-10ft buffer area from the base of the mounds:
  - a. Ongoing removal of ~~all brush and small trees and~~ all non-native or invasive species ~~of groundcover~~
  - b. Remove all remaining trees unless it is determined that selected large, healthy, deep-rooted trees should be retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage would occur during tree removal, or for other management ~~purposes~~purposes.
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified ~~professional~~professional.
4. Within the 10-25ft buffer area from the base of the mounds:
  - a. On going removal of all non-native and invasive species.
  - b. Monitor the health of remaining trees.
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified professional.
5. (After Photos) Catalog photos of each mound from varying angles, noting the location and time taken for consistency.
4. ~~Photograph each mound from several angles, noting the date taken~~

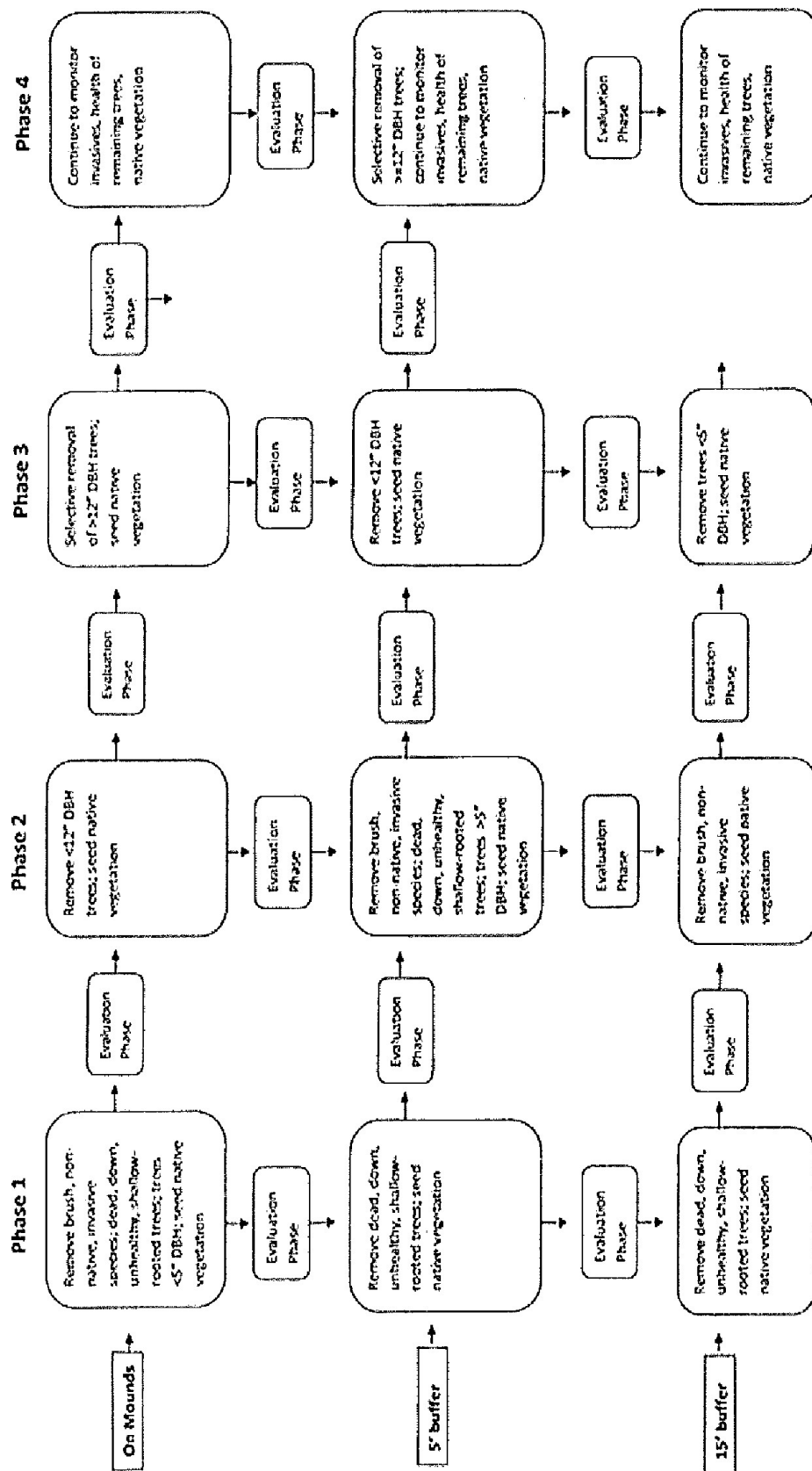


TABLE 2  
PHASES OF VEGETATION MANAGEMENT

|                                                                                                         | ON<br>MOUNDS         | 5'<br>BUFFER         | BUFFER               |
|---------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|
| Remove brush) non-native and invasive species                                                           | Phase 1              | Phase 2              | Phase 3              |
| Remove dead, down, unhealthy, and shallow-rooted trees                                                  | Phase 1              | Phase 1              | Phase 1              |
| Remove DBH trees. Also remove trees so recommended by a certified arborist                              | Phase 1              | Phase 2              | Phase 3              |
| Seed native vegetation in a mixture recommended by a qualified professional                             | All phases as needed | All phases as needed | All phases as needed |
| Remove <12" DBH trees. Also remove trees so recommended by a certified arborist                         | Phase 2              | Phase 3              | Not applicable       |
| Selective removal of 12" DBH and larger trees. Also remove trees so recommended by a certified arborist | Phase 3              | Phase 4              | Not applicable       |

NOTE: An evaluation phase should occur after each management phase. Evaluation should include photographing each mound noting the date, documenting specific maintenance activities that occurred in the previous management phase, and describing any positive or negative effects of those activities. This information should be used to guide appropriate modifications of the maintenance priorities and activities planned for the next management phase.

Table 2: Phases of Vegetation Management



|                            | PHASE 1                                                                                          | PHASE 2                                                                                                 | PHASE 3                                                    | PHASE 4                                                                                                       |
|----------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Recommended Mound Activity | Remove brush – nonnative, invasive species, dead, down, unhealthy, shallow-rooted trees, <5" DBM | Remove <12" DBM trees                                                                                   | Selective removal of >12: DBH trees                        | Continue to monitor invasives, health of remaining trees, native vegetations                                  |
|                            | Evaluation phase                                                                                 | Evaluation phase                                                                                        | Evaluation phase                                           | Evaluation phase                                                                                              |
| Within 5' Buffer           | Remove dead, down unhealthy, shallow-rooted trees                                                | Remove brush, non-native, invasive species, dead, down, unhealthy, shallow rooted trees; trees > 5" DBH | Remove < 12" DBH trees                                     | Select removal of >12" DBH trees; continue to monitor invasives, health of remaining trees, native vegetation |
|                            | Evaluation phase                                                                                 | Evaluation phase                                                                                        | Evaluation phase                                           | Evaluation phase                                                                                              |
| Within 25' Buffer          | Remove dead, down unhealthy, shallow-rooted trees                                                | Remove brush, non-native, invasive species                                                              | Remove trees <5", DBH                                      | Continue to monitor invasives, health of remaining trees, native vegetation                                   |
| Phase Evaluation           | Proceed to Phase 2 after all activities of Phase 1 are met                                       | Proceed to Phase 3 after all activities of Phase 2 are met                                              | Proceed to Phase 4 after all activities of Phase 3 are met |                                                                                                               |

| <u>WORK ZONE</u>        | <u>PHASE 1</u>                                                                                                       | <u>PHASE 2</u>                                                                                                             | <u>PHASE 3</u>                                                    | <u>PHASE 4</u>                                                                                                          |
|-------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <u>Mound</u>            | <u>Remove shrubs – non-native species, invasive species, dead, down, unhealthy, shallow-rooted trees, &lt;5" DBH</u> | <u>Remove &lt;12" DBM trees</u>                                                                                            | <u>Selective removal of &gt;12: DBH trees</u>                     | <u>Continue to monitor invasives, health of remaining trees, native vegetations</u>                                     |
|                         | <u>Evaluation phase</u>                                                                                              | <u>Evaluation phase</u>                                                                                                    | <u>Evaluation phase</u>                                           | <u>Evaluation phase</u>                                                                                                 |
| <u>0 - 10' Buffer</u>   | <u>Remove dead, down unhealthy, shallow-rooted trees</u>                                                             | <u>Remove shrubs, non-native species, invasive species, dead, down, unhealthy, shallow rooted trees; trees &gt; 5" DBH</u> | <u>Remove &lt; 12" DBH trees</u>                                  | <u>Select removal of &gt;12" DBH trees; continue to monitor invasives, health of remaining trees, native vegetation</u> |
|                         | <u>Evaluation phase</u>                                                                                              | <u>Evaluation phase</u>                                                                                                    | <u>Evaluation phase</u>                                           | <u>Evaluation phase</u>                                                                                                 |
| <u>10 - 25' Buffer</u>  | <u>Remove dead, down unhealthy, shallow-rooted trees</u>                                                             | <u>Remove non-native and invasive species</u>                                                                              | <u>Remove shallow rooted trees &lt;5", DBH</u>                    | <u>Continue to monitor invasives, health of remaining trees, native vegetation</u>                                      |
| <u>Phase Evaluation</u> | <u>Proceed to Phase 2 after all activities of Phase 1 are met</u>                                                    | <u>Proceed to Phase 3 after all activities of Phase 2 are met</u>                                                          | <u>Proceed to Phase 4 after all activities of Phase 3 are met</u> |                                                                                                                         |

NOTE: An evaluation phase should occur after each management phase. Evaluations should include photographing each mound noting the date, documenting specific maintenance activities that occurred in the previous management phase, and describing any positive or negative effects of those activities. This information should be used to guide appropriate modifications to the maintenance priorities and activities planned for the next management phase.

## VI. GENERAL MOUNDS MAINTENANCE CONSIDERATIONS

### ~~A.~~ A. Tree and Shrub Removal

Removal of trees and shrubs from mounds and within ~~a twenty-a five feet~~~~five feet~~ (2510'-C) buffer area from the base of the mounds is generally desirable to protect them from windthrow and other damage, and to encourage growth of native groundcover that will help prevent erosion. To help mitigate the potential of windthrow, all shallow-rooted trees will be removed during Phase I of the maintenance. However, some selected large, healthy, deep-rooted trees may be retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage might occur during tree removal, or for other management purposes. Heritage trees are defined in Sec. 59-20(g) as a tree on Village property that is deemed significant by virtue of its species, size or its historical, ecological or horticultural attributes and, as such, is protected from removal without written permission from the Village Forester. ~~the Village's Tree and Shrub Ordinance.~~ The condition of any large trees that are retained should be re-evaluated periodically to ensure that their health is stable and that they continue to pose no undue risk to the mounds. When removing a tree of any diameter, cut it off as close to the ground as possible. Score the stump(s) every year to speed up the decay process. Eventually, down to the point where Village staff can mow over these areas.

No ground disturbance is allowed. All tree removal should be done when the ground is frozen hard. Trees growing on the mounds should be hand ~~cut, or~~~~cut or~~ cut with a machine that can stay at least ~~fifteen-twenty-five~~ feet (25') from the mounds. No machinery is permitted to be used, however, on slopes steeper than 12% or on lands listed on the National Register of Historic Places, unless approved by the Wisconsin Historical Society. The trees should be cut close to the ground and stumps should be left intact. The stumps can be treated to prevent regrowth. During tree removal, trees should not be dropped or dragged across the mounds, and machinery and other vehicles should not be driven across the mounds. The logs and other material should be hauled away or scattered or piled at least ~~fifteen-twenty-five~~~~twenty-five~~ feet (25-50') from the defined burial area or mound.

Woody shrubs and ~~other~~ invasive ~~species~~ can be removed at any time with proper care since their removal should not require use of heavy equipment or involve ground disturbance. All vegetative waste material should be removed from the area. Replacement vegetation should be appropriate for the current use or planned restoration objectives.

### ~~B.~~ B. Burning

- The use of fire to control woody vegetation and to enhance the native plant community in a prairie or savanna ecosystem is an important management tool, but the decision to use controlled burns should be made on an individual site basis and balanced against other factors that should be considered consistent with Village ordinances and protocols. Surveys should be conducted following any controlled burning to look for possible artifacts and to determine the response of the native plant community to fire. Installation of firebreaks and use of firefighting equipment at a site should be carefully monitored for both safety and potential ground disturbance reasons. Use fire preservation as a means of

maintenance and burn alternate times. Example: Burn the area in the spring of 2020 and return for a second burn in the fall of 2021. This helps to establish plants, growth, and the seedbank.

## C. ~~C.~~ Chemical Treatment

Removal of the roots of mature woody vegetation via hand-pulling is not recommended due to the ground disturbance that results. When treating materials and invasives such as Buckthorn and briars it is ok to use Garlon or Tordon to treat when necessary. Chemical treatments to control woody vegetation or nonnative invasive species can be very effective when applied propertyproperly. To minimize the use of chemicals, however, hand pulling should be used for control of small seedlings and most herbaceous plants.

## ~~D.~~ D. Trails

Pedestrian and wheeled traffic should never be allowed on the mounds. Trails should be established at those sites where public visitation either is likely or is encouraged. Trails should be located a minimum of fifteentwenty-five feet (2+5') or more from the outer perimeter of the mound. Small trees and large brush stems that have been removed from the mounds in Phase I or II may be used for trail demarcation. The use of wood chips, shredded bark, or mowing may be considered for trail maintenance. In locating and designing trails, consideration should be given to the proximity of the mounds, aesthetics, view sheds and erosion control. All trails should be made as accessible to the disabled as possible.

## ~~E.~~ E. Signage

The Village should retain control of the wording and placement of all signage and coordinate the placement with the Wisconsin Historical Society. Signage at mound sites should be minimized but efforts should be made to educate and inform the public about the significance of the site and the people who constructed the earthworks. Maps of the mounds at specific sites or in a general context of other mound groups in the vicinity may be useful. A generic sign for selected sites that describes the effigy mound building cultureculture, and the types of mounds (effigy, linear or conical) may be appropriate. Affirmation of the sacred nature of the site to Native American peoples should be included in the signage. A strong statement about staying off the mounds and information on the burial sites preservation law should be included. Site specific signage should include a map of the site and information regarding the unique features of the site. In some circumstances, brochures or small maps could be provided to visitors.

## F. —Repair of Damaged Mounds

Where appropriate, repair of mounds damaged by post Euro-Yankee settlement activities and/or natural causes may be considered. Burrowing animals are to be removed from mounds. Displaced soil from burrowing will be used to fill hole by hand. Coordination with the Wisconsin Historical Society ias required.

## G. —Use of Volunteers

Volunteers may be enlisted to assist with mounds maintenance activities, monitoring, and education. The proximity of the mound site in IMCP to a number of local schools affords an ideal opportunity for student and parent involvement in the maintenance of the mounds. As described in Section VIII, involving community volunteers is also an effective way to expand education about the mound building culture and the sanctity of the surviving mounds to Native Americans.

Volunteers have been very active in the removal of invasive species and promoting the growth of native vegetation within IMCP. A Village program could be developed to assist in the management of Nneighborhood groups who are ~~should be~~ recruited and encouraged to adopt a particular site. A reference manual should be developed by Village Staff and provided to participating groups containing information useful to volunteers ~~and~~. This -a-standard system should be developed for tracking the time contributed and the work tasks performed by volunteers. The use of power equipment by volunteers should be monitored closely by a qualified team leader. Persons using chainsaws or mechanical brush cutters must be approved by Village staff and have appropriate safety training and equipment. The number of persons using mechanical equipment should be strictly limited to promote safety.

## H. Reporting Disturbances

## VII. RECOMMENDED MAINTENANCE PLANS FOR SPECIFIC MOUND SITES

### A. Indian Mound ~~Conservation Park~~ Conservancy (IMCP)

IMCP contains the Lewis Mound Group which consists of nine (9) mounds, including one ~~sh014~~ ~~short~~-tailed quadruped in the shape of a bear, four linear, one long hook-shaped linear, one oval, and two conical mounds (see map ~~below on~~ page 28). Portions of the linear and a portion on one of the ~~conicals~~ ~~conical~~ mounds were destroyed by ~~development~~ ~~development~~, but partial restoration has occurred. The site is listed on the National Register of Historic Places and the nomination covers the entire ~~10-acre~~ ~~10-acre~~ area of IMCP. The mounds have been catalogued in small groups and as single mounds. No ground disturbing activities are permitted anywhere within IMCP.

Considerable maintenance work on the mounds in IMCP has already been completed by the Village, community volunteers, and through the McFarland School District's School Forest Program. A site assessment was completed in 2006-2007 by the Wisconsin Historical Society. On the subject of tree removal, the assessment found then that "At this point in time, all of the trees growing on the mounds seem to be healthy and they are not in immediate danger of tipping over."

<sup>8</sup> Individually and in concert, these groups have completed a site assessment, relocated some segments of walking trails away from the mounds, removed invasive species (ongoing process), re-established native species (ongoing process), and erected some informational signage. The Village acknowledges these previous contributions to preserving and maintaining the mounds and thanks those who have participated.

IMCP was designated in 2010 as a Community Forest. It is located adjacent to the McFarland School Forest which was established in 2006. The McFarland School Forest Stewardship Plan, which included the ~~Indian~~ ~~Native American~~ mound area through a 2007 Land Use Agreement with the Village, was prepared in 2007 and updated in 2009 by WDNR Forester Steve Holaday. It outlines forest management objectives and recommendations throughout the School Forest. Appendix A of the Stewardship Plan, prepared by State Archeologist John Broihahn, contains an assessment of the ~~current~~ conditions of the mounds and a detailed set of recommendations for future maintenance of the mounds.

Village of McFarland's Plan Commission approved Ordinance 2022-18 on January 17, 2023, an ordinance rezoning certain lands at 6330 Exchange Street and 4901 Burma Road in respects to a land exchange agreement between the Village and the School District. The Commission also approved a Certified Survey Map, CSM, for lot line adjustments between the two lots. The approvals confirmed the transfer of the School Forest from the School District to the Village while remaining open for public use.

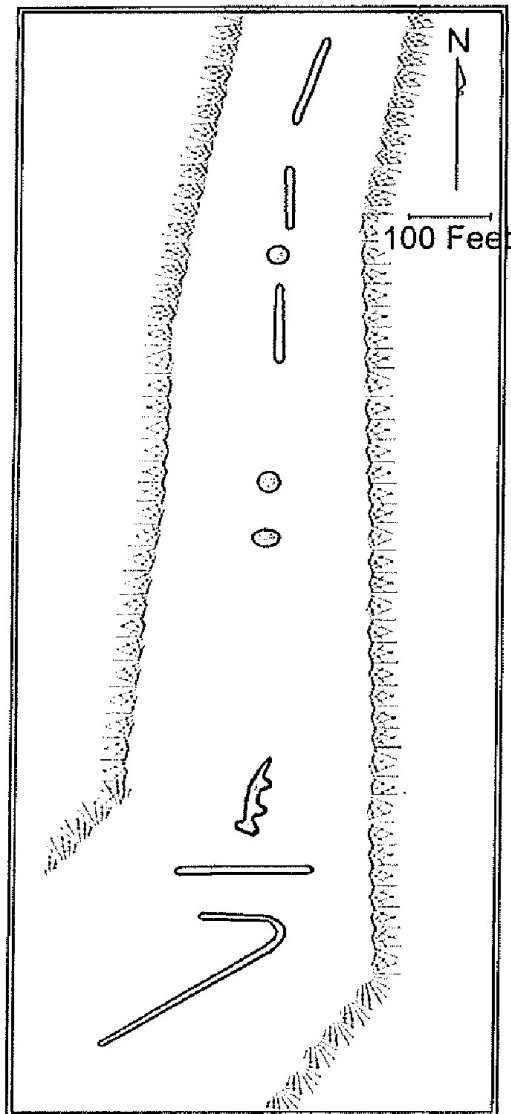
In view of the extensive studies that have been conducted on IMCP and the work already completed, the following maintenance priorities are established for the mounds in IMCP:

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<sup>8</sup> Wisconsin Historical Society Assessment of Lewis Mound Group – ~~October~~, ~~October~~ 2007

1. The June 2009 amendment to the McFarland School Forest Stewardship Plan, which splits the former "Stand 1 " into two separate forest stands, should be incorporated by the WDNR forester into a new Community Forest management plan for IMCP. This would lead to re-establishment of an oak woodland or oak opening community around the mound groupings, consistent with the native vegetation believed to be present at the time the mounds were built.
2. The October 2007 Wisconsin Historical Society Assessment for the Lewis Mound Group should be followed as a guideline to prioritize maintenance practices on each individual mound.
3. Trails should be relocated further away from the mounds where necessary, erosion of the trail surfaces minimized, and views of the mounds from the trails improved. Relocation of the trail that cuts into mound #2 should be an immediate priority.
4. Tree and shrub removal on and around the mounds should be completed in accordance with Section VI of this policy. Removal of non-native and invasive species and ~~reestablishment~~re-establishment of native ground cover species should be ongoing.
5. Informational signage should be installed to protect the mounds and other environmentally sensitive areas, to lead visitors through the park, and to interpret the cultural significance of the mounds.
6. The misleading signage at the west entrance regarding the bike trail should be changed to clarify that the trails in IMCP are not intended for bike riding and that, if bikes are taken into the park, they should be walked and not ridden.
7. The bear mound, the linear mound at the top of the park, and the partial mound should be prioritized as the first mounds to receive Phase I maintenance and used as demonstration projects to assess the appropriateness and effectiveness of the recommended maintenance protocols. Once Phase I maintenance activities are completed on these higher priority mounds, Phase I work on all remaining mounds should commence as soon as time and resources permit.
8. Seek approval from Wisconsin Historical Society to remove man-made fill deposited years ago at the base area of the old water tower and along the southern edge of the access road. As an alternative, seek approval to augment and regrade these areas to create more natural looking contours.

IMCP Mound Site





## B. Siggelkow Road Park

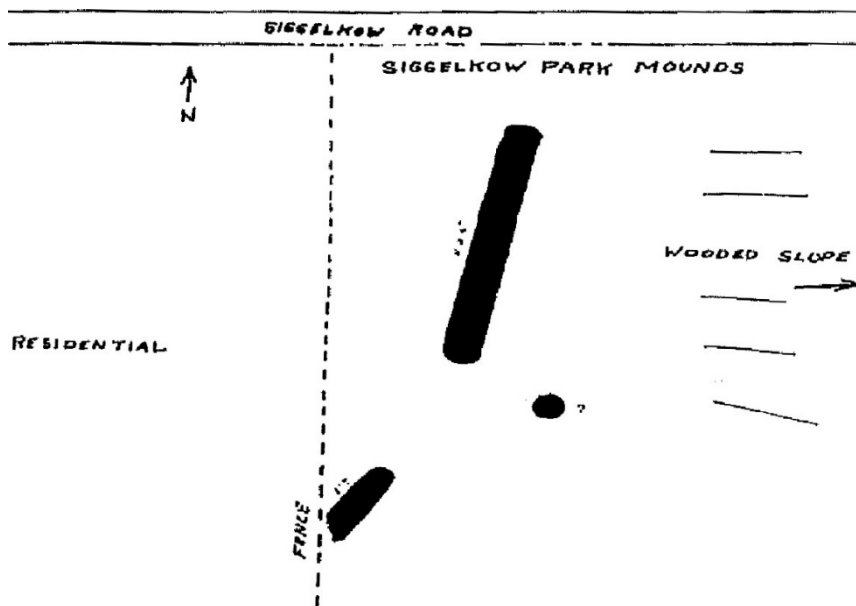
Siggelkow Road Park contains the Siggelkow Park Mounds Group which consists of at least two linear mounds and an unknown number of other potential mounds. The northernmost of these linears is approximately ~~22~~25 feet long, ten feet (10') wide, and two feet (2') high and has been potted or looted. The second mound, which is located southwest of the first, is about 57 feet long but has been truncated by residential development. There are also faint signs of a possible conical or effigy mound remnant. These mounds have been catalogued as a group with a fifteen feet (15') no disturbance buffer. The Siggelkow Park Mound Group is eligible for listing on the National Register of Historic Places "because it is likely to contain important information on the prehistoric Late Woodland cultural stage in Wisconsin and because it is a good representative of a distinctive type and period of construction."

The Siggelkow Park mound site has been mapped and broadly evaluated by the Wisconsin

Historical Society but they have not provided any specific recommendations on maintenance. The following short term maintenance priorities are established for the mounds site in Siggelkow Park:

1. Complete a comprehensive site assessment including a tree inventory, risk assessment, and a more thorough archeological evaluation of the possible remnant of a conical or effigy mound.
- ~~2. Complete Phase I of vegetation management consistent with Section VI of this policy.~~
- ~~3.2 Prepare a Follow~~long term~~long-term~~ plan of phased maintenance steps in Section V of this policy.

## Siggelkow Park Mound Site



### C. Taylor Road Conservancy

The Taylor Road Conservancy is located on the eastern drumlin of conjoined drumlins that now straddle Lexington Street. It contains the Evans-Nelson mound site which currently consists of one linear mound. Historical records indicate the earlier presence of more linear mounds at this [site site](#), but they apparently have been destroyed by a combination of cultivation and the huge cut made into the hill southwest of Taylor Road.<sup>5</sup> The remaining linear mound has been truncated by a logging-style road at its southern end but is otherwise in good condition. Approximately one half of the mound is located on Village-owned park land and the other half was carved out of Lot 20 of Woodland Commons subdivision and dedicated to the Village, so the entire mound is under public ownership and protection. This mound has been catalogued with a fifteen feet (15') no disturbance buffer. As part of the [previous](#) subdivision platting process, the Village created a twenty feet (20') buffer and environmental corridor around the mound. [With the new mound update, the Village is looking to increase the buffer around the mound to twenty-five feet \(25'\).](#) (See map under "D" [below](#).)

The Taylor Road Conservancy mound site has been privately surveyed and also located and broadly evaluated by the Wisconsin Historical Society which did not provide any specific recommendations on maintenance. The following short term maintenance priorities are established for the mound site at the Taylor Road Conservancy:

1. Relocate as soon as possible the footpath that currently crosses a portion of the mound and block off the old footpath,
2. Complete a comprehensive site assessment including mapping and a risk assessment.
- ~~3. Complete Phase I of vegetation management consistent with Section VI of this policy.~~
- ~~4.3. Install warning signage and notify adjacent residents about the presence of the mound and educate them on its cultural significance and the importance of protecting the integrity of the mound.~~
- ~~4. 5. Prepare a long term long-term plan of Follow phased maintenance steps in Section V of this policy.~~

## ~~D.~~ D. Woodlands Commons Park Conservancy

Woodland Commons Park Conservancy is located on the western drumlin of conjoined drumlins that now straddle Lexington Street. It contains the Dale Mound Site which currently consists of one linear and one angular linear which is bent at right angles to itself. Historical records indicate the earlier presence of four mounds at this ~~site~~site, but some were apparently destroyed in 1984 when the hillside was excavated for fill for reconstructing US Highway 51. The northernmost surviving linear was also truncated by this excavation process. This mound site has been catalogued as a group with a fifteen feet (15) no disturbance buffer. As part of the subdivision platting process, the Village created a twenty feet (20') buffer and environmental corridor around each mound.

The Woodland Commons Park Conservancy mound site has been privately surveyed and also located and broadly evaluated by the Wisconsin Historical Society which did not provide any specific recommendations on maintenance. The following short term maintenance priorities are established for the mound site at Woodland Commons Conservancy Park:

- ~~1. 1. Remove immediately any evidence of human encroachment and inappropriate use of the area near the northernmost mound. Construct as soon as possible a low split rail fence to prevent future encroachment.~~
- ~~2. 2. Complete a comprehensive site assessment including mapping, a tree inventory, and a risk assessment.~~
- ~~3. 3. Complete Phase I of vegetation management consistent with Section VI of this policy.~~
- ~~4. 4. Prepare a long term long-term plan of Follow phased maintenance steps in Section V of this policy.~~

Taylor Road Conservancy Mound Site and Woodland Commons Mound Site



## VIII. ——— MONITORING AND EVALUATION OF MOUND SITES

It is important that the Village make steady, annual progress in implementing these mound preservation and maintenance policies and goals. An example of an ongoing assessment grid has been created for potential use in keeping simultaneous track of the progress being made at all four mound sites (see Appendix A). Another example assessment grid, which is site-specific and more detailed, has also been created to monitor progress at each individual mound site (see Appendix B). Something similar to these example assessment grids should be updated annually and used by the Village Board (or a body to which it assigns the responsibility) Sustainability & Natural Resources Committee to re-evaluate the status and current condition of all mound sites.

The Village should establish and update annually a five-year plan which sets forth clear goals for preservation, maintenance, and possible restoration of the mounds in each of the four sites. The annual update should be completed in time to set priorities and establish funding needs as part of the Village's budget process.

This policy should be reviewed at least every five years with an eye to evaluating its continued applicability to the various mound sites. As appropriate, the policy should be updated to reflect changes in community thinking or approach, new discoveries, methods, or technological applications, unexpected field results, or changes in available funding or labor resources.

## ~~IX.~~ IX. EDUCATION AND PUBLIC OUTREACH

Indian Mound Conservation Park Conservancy (IMCP) is managed by the Village and is registered as a Community Forest. The McFarland School Forest occupies 69 acres adjacent to the mound site and is currently used for field trips and classes including Native American History and the mound building culture. ~~There exists~~ potential ~~programming exists~~ for ~~developing~~ cooperative educational activities between the Village and the School District, due to the proximity of the mound site to the schools. These entities share not only contiguous boundaries, but a strong commitment to fostering an informed and engaged citizenry. Their cooperative efforts provide a foundation for achieving the very desirable goal of education and public outreach. Effective education and public outreach at IMCP may encourage other Village civic or interest groups to become involved with the preservation and maintenance of the mounds.

Recommended objectives of an effective education and public outreach program would include:

1. To inform visitors about the human and natural history of the sites
2. To enhance existing cultural and historical resources with complementary educational activities (e.g.e.g., joint activities with the McFarland Historical Museum or the McFarland School District)
3. To foster teaching and learning related to Native American culture and history
- ~~4.~~ 4. ——— To develop awareness, appreciation, knowledge, and skills related to sustainable care of the environment and the Indian Native American mounds mounds.
- ~~5.~~ 5. ——— To engage residents and students in experiential learning through field experiences
- ~~6.~~ To create a “Friends of McFarland Burial Mounds” ~~buy into~~ assist with site maintenance activities.

7. Work with Village School ~~P~~programs to assist in various field activities.

Desirable components of an education and public outreach program ~~that~~ would help achieve the above objectives. The following could begin property trail signage along might include trails and informational signage designated pathways and entrances, classes/workshops organized by the Village and School District with, ~~and~~ speakers, ~~and perhaps~~ an interpretive center. Because of the natural settings in which most of the mounds are located, it would be possible to easily integrate educational objectives related to the environment on such topics as ecology, forest management, native and invasive species, wildlife, birding,

nature writing, storm water management, and water quality. The environmental education objectives for the McFarland School District, which incorporate all of these suggested ~~topics; topics,~~ have been developed and are outlined in the School Forest Education Plan.

## ~~X.~~ X. CONCLUSION

The Village Board believes that the recommendations contained in this policy document ~~will~~ advance McFarland and its community ~~a long way~~ toward meeting desirable goals for preserving, maintaining, and restoring McFarland's IndianNative American mounds. The Board is confident that, as interim goals are reached, ongoing evaluations completed, and new goals established, the Village will make continuous progress in establishing the optimum environment for protecting and preserving the mounds at all four of the sites.

In adopting these policies, the Village Board has been guided by several over-arching principles. These are the enormous sense of responsibility engendered by the presence of the IndianNative American mounds, the profound desire to protect and preserve the mounds for future generations, and the recognition that McFarland, ~~though restricted by small size and fiscal limitations,~~ can and must increase its efforts to do what must be done in the interests of the IndianNative Americans and their culture. ~~mounds.~~ The Village of McFarland and its residents should refocus on the fact that these burial mound sites are in essence large mortuaries and sacred sites that carry much history and connection to a group of people. The specific sites are no different than any other cemetery that we are familiar with.

On May 3, 2023, the Village Board and School Board approved Resolution #2023-07: a resolution acknowledging and celebrating the inherent sovereignty of the Ho-Chunk nation and the 11 additional Indigenous Nations within what is now referred to as the State of Wisconsin. Appendix X provides the details of the

# APPENDICES

Appendix A — General Assessment Grid (example) for all Four Mound Sites

Appendix B — Specific Assessment Grids (example) for Each Mound Site

Appendix C — *Assessment of Current Conditions and Recommendations for the Lewis Mound Group in ~~IndianNative American~~Indian Mound Conservation Park* — John Broihahn, State Archeologist

Appendix D — *Restatement of the Lewis Mound Group Assessment* Alan Lulloff

Appendix ~~E~~ — *Mound Preservation and Maintenance*, Ho-Chunk Department of Heritage Preservation

Appendix ~~F~~ — ~~F~~ — *Burials, Earthworks, and Mounds Preservation Policy & Plan*, WI Dept. of Natural Resources

Appendix G — *Proposed Protocols for Cultural Resources Protection and Preservation on Public and Private Lands In the Lower Wisconsin State Riverway*

Appendix H — ~~IndianNative American~~Indian Mounds.' *Cultural Resources Fact Sheet 2*, National Resource Conservation Service

Appendix I — *Fact Sheet: How Trees Benefit Mounds and The Oaks in ~~IndianNative American~~Indian Mound Conservancy*, Alan R. Lulloff, P.E. CFM



**POLICY FOR  
PRESERVATION  
AND  
MAINTENANCE OF  
MCFARLAND'S  
INDIAN MOUNDS**

*ADOPTED August 9, 2010*

## I. INTRODUCTION

Southern Wisconsin is known for its prehistoric Indian mounds. The mounds were built by people of the Effigy Mound Culture, Late Woodland Stage, from approximately 650 to 1200 CE.\* Many are burial grounds. Others may have served as man-made landmarks. The mounds are symbols/expressions of the mound builders religious faith and are considered sacred sites by Native Americans to this day. Fourteen of these rare and archaeologically significant treasures still exist on Village-owned property in McFarland. They are located in Indian Mound Conservation Park (IMCP), Siggelkow Park, the Taylor Road Conservancy, and Woodland Commons Park. Other mounds exist on private property within Village limits, and there may be others yet to be discovered on Village-owned lands. The McFarland Village Board recognizes that these few remaining mounds are of enormous historical and cultural value and has adopted and implemented this policy to ensure their protection and preservation for many generations to come.

\*Common Era

## II. CULTURAL IMPORTANCE

Over the centuries, Wisconsin's Indian mounds have disappeared in large numbers. They have been destroyed, damaged or neglected – victims of agricultural practices, the advance of urban development, indifference and/or ignorance. To halt further destruction and to raise public consciousness, the Ho Chunk Nation, cultural descendants of the mound builders, has reached out to communities where mounds exist and provided information and expertise on mound preservation and maintenance through their Department of Heritage Preservation.<sup>1</sup> Similarly, the Wisconsin Department of Natural Resources,<sup>2</sup> the Lower Wisconsin State Riverway Board,<sup>3</sup> and the Wisconsin Historical Society<sup>4</sup> have issued maintenance protocols aimed at preserving what remains of this part of Wisconsin's cultural and archaeological heritage. All of these land stewardship bodies recognize that Indian mound sites are irreplaceable and stress the responsibility of the land owner to protect these areas.

The Village of McFarland accepts this responsibility and further desires to become a role model for others to emulate. It has taken public ownership of the lands containing most of the mounds and has established conservancy uses on these lands to help protect the mounds. At one time, more than 80 Indian mounds graced the McFarland area. Prior to the Village taking ownership of what is now IMCP, two of the nine mounds that once occupied that land were destroyed by the grading of the hillside above Burma Road in the 1950's. Over the years community volunteers and school groups have done maintenance work such as removing invasive species and woody brush from some of the mounds and relocating and improving trails.

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<sup>1</sup> *Mound Preservation and Maintenance*, Ho-Chunk Department of Heritage Preservation

<sup>2</sup> *Burials, Earthworks, And Mounds Preservation Policy & Plan*, WI Dept. of Natural Resources

<sup>3</sup> *Proposed Protocols for Cultural Resources Protection and Preservation on Public and Private Lands In the Lower Wisconsin State Riverway*

<sup>4</sup> *Wisconsin Historical Society Assessment of Lewis Mound Group - October, 2007*

### III. PRESERVATION AND MAINTENANCE OF THE MOUNDS

#### A. Legal Framework

Wisconsin statutes designate the Wisconsin Historical Society as the oversight authority for Indian mound lands throughout the state. Those statutes [157.70(6m) (b) 2 and 3] which regulate burial sites that are on public lands impose certain requirements on municipalities. These regulations include: prohibiting the transfer of any burial site to any person who is not a municipality unless the transfer provides for preservation of the burial site from any disturbance by any person and unless the transfer is approved by the Wisconsin Historical Society; and requiring that the municipality shall endeavor to take positive action to preserve any burial site on land it owns through appropriate land use management, including but not limited to appropriate multiuse purposes such as nature preserves.

All of the acreage in IMCP is listed on the National Register of Historic Places which means that no ground disturbing activities are allowed anywhere within that park. Any activities that might potentially cause ground disturbance on or near the mounds in other parks require prior approval from the Wisconsin Historical Society. This approval process typically involves preparation and submittal of a plan by the Village President or Administrator for review by Wisconsin Historical Society staff. As appropriate, the Wisconsin Historical Society may circulate the proposed plan for review and comment by Native American nations in the state, with whom the agency is responsible for coordinating preservation efforts.

#### B. Approach

McFarland's mounds do not exist in isolation. All of them are in conservancies, and any maintenance activities undertaken on the mounds will inevitably have some impact on the surrounding natural and man-made environments. Managing the mounds properly and avoiding detrimental impacts to the broader environmental context within which they exist is a complex challenge. Diverse perspectives on meeting this challenge were expressed via community input at a public meeting,<sup>5</sup> within the Committee's internal discussions, and in documents submitted to the Committee by concerned residents.<sup>6</sup> There was no one-size-fits-all approach with which Committee members felt comfortable. As a result, the Committee's objective has been to determine a balanced approach to preservation and maintenance that meets McFarland's unique challenges.

The specific preservation and maintenance practices to be used will vary by mound site and from one individual mound to the next. There is, nonetheless, a systematic series of protocols that should be followed at all sites to ensure that the desired goals are achieved. That common approach recommended herein would typically involve the following steps:

1. Have a comprehensive site assessment of each mound site conducted by the State Archeologist that would include an archeological overview and appropriate mapping. A vegetation assessment and an overall risk assessment should also be conducted by a certified arborist and an ecological restoration expert. Such site assessments for the mounds in IMCP were conducted in 2006-2007 by the Wisconsin Historical Society. A forester and an ecologist from the WDNR have also reviewed

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<sup>5</sup> *Indian Mounds: Cultural Resources Fact Sheet 2*, National Resource Conservation Service

<sup>6</sup> *Fact Sheet: How Trees Benefit Mounds and The Oaks in Indian Mound Conservancy*, Alan R. Lulloff, P.E. CFM

- surrounding conservancy areas in IMCP and provided suggestions on approaches to managing vegetation and improving forest health.
2. Determine the optimal conditions for protection and preservation of the mound site and prepare a long term maintenance plan to establish and maintain those optimal conditions.
  3. Obtain necessary approvals of this maintenance plan from the Burial Preservation Office of the Wisconsin Historical Society.
  4. Stabilize the current condition of the mounds to prevent any deterioration.
  5. Prepare a five year plan, to be updated annually, which identifies phased maintenance projects and practices to be undertaken at each of the four mound sites. Allocate the necessary resources in the annual budget process or pursue available grant funding to implement those plans.
  6. At the completion of each phase of maintenance, photograph, monitor, and evaluate the results over the course of at least one full growing season prior to determining what maintenance activities should be undertaken in the next phase, how the activities should be prioritized, and when the next phase should commence.
  7. Conduct public education/outreach activities and provide appropriate site amenities to promote greater understanding and enjoyment of the mound sites by the public in a manner that does not pose additional risk to the mounds.
  8. Evaluate the potential benefits of having the Taylor Road Conservancy and Woodland Commons Park mound sites listed on the National Register of Historic Places. Pursue local “landmark” status for all four mound sites.
  9. Conduct regular assessments of progress and continue these preservation and maintenance policies, plans and practices or revise them accordingly.

### **C. Goals and Objectives**

The purpose of taking the common approach to preservation and maintenance described above is to meet goals and achieve results that should apply uniformly to all four Indian mound sites. The desired outcome and end vision for all sites are defined in the following goals and would be achieved by accomplishing the following objectives.

**GOAL #1** – Ensure that the Indian mounds are protected from potential damage, stabilize the current condition of the mounds so they do not deteriorate, and improve the condition of the mounds as available resources permit.

#### **OBJECTIVES:**

1. Eliminate or minimize risks or threats that pose an unreasonable risk to the mounds.
2. If trail access to an area is deemed desirable, design or relocate trails so they do not encroach any closer than fifteen feet (15') from the mounds.
3. Direct bikers away from the mounds with appropriate signage and, if necessary, physical barriers.

**GOAL #2** – Raise public awareness about the Indian mound sites and their human and natural history by conducting an effective education and public outreach program.

#### **OBJECTIVES:**

1. Provide suitable overlook points along the trails which permit observers to appreciate visually the shape of the mound(s) from a safe distance.
2. Install non-obtrusive warning signs to protect the mounds and interpretive signs to help observers better understand the mounds and their history.

3. Offer accompanying public education activities to foster a greater understanding of the historical, archeological, and cultural significance of the mounds.

**GOAL #3** – In order to protect the mounds from potential damage and to respect the preferences of the Ho Chunk Nation regarding the presence of vegetation on their ancestral sites, achieve an eventual condition where no trees or shrubs are growing on the mounds or within a five feet (5') buffer zone and where each distinct mound shape is clearly defined and visible to an observer.

**OBJECTIVES:**

1. Remove all brush, non-native, and invasive species.
2. Remove in phases all trees except selected large, healthy, deep-rooted trees that are retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage might occur during tree removal, or for other management purposes.
3. Remove these remaining trees as they deteriorate or die from natural causes.
4. Establish native ground cover on the mounds to protect against erosion and other potential damage and to minimize future maintenance efforts.
5. Emphasize the definition of each mound by using contrasting types of vegetation or in some other natural-looking manner.

#### **IV. SITE ASSESSMENTS**

Since the amount and quality of site assessment data that is currently available varies a great deal across the four mound sites, a comprehensive assessment by the Wisconsin Historical Society or other qualified professionals is required as an initial step for each Indian mound site to evaluate the existing plant community and the opportunity for restoration of the native plant community, to determine the current conditions of the mounds, to determine if there is a need for additional mapping, and to assess potential risks to the mounds. This assessment will identify those features which render each site unique and will influence the maintenance regimen selected.

##### **A. Archaeological Overview**

If one has not been conducted previously, an archeological overview of the site should be conducted both before and after phased maintenance work is implemented. If possible, the “before” overview should be conducted by the State Archeologist. At a minimum, the number and type of mounds should be described and surface observations should be made and recorded in narrative and in photographic forms. The condition of the mounds should be noted, such as whether the edges are well-defined or diffuse and whether the mounds are well-preserved or have been damaged. An additional walk through of the site should be conducted and updated notations made following extensive tree removal or introduction of fire to the site. To date, a proper archeological overview has been completed only for the mounds in IMCP.

##### **B. Mapping**

Mapping is important to assure that an accurate record of each Indian mound site is maintained. While adequate maps of the mound groups are generally available, it might be very useful if the maps contained greater detail. Village staff shall work with the Burial Sites Preservation staff in the Wisconsin Historical Society to acquire files from WHS that define the established mound protection boundaries for all Indian mounds documented to exist on Village-owned lands. Where they have not been previously documented new technologies are available that would enhance existing maps. Global Positioning System (GPS) coordinates with an accuracy level of

one foot should be taken for all mounds, although the accuracy of this data will be limited by the tree canopy and the often ill-defined nature of the mound edges. Maps of each individual mound site should be as accurate as possible and should document (as appropriate) the mound shape, dimensions, mound-mound angles, and the presence of depressions or other potential burial features. Notations regarding proximity to water features, roads, trails, property lines, and nearby development, topographical information, and other notable features of the site should be added to the maps as site assessments are completed. The most complete maps currently exist for IMCP, but these maps lack much of the recommended detail. The existing maps for the other three mound sites are even less detailed and need to be expanded.

### **C. Vegetation Assessment**

An initial survey of trees, shrubs, and ground cover should be conducted and used in determining future vegetation management practices for each site. It may be appropriate to consult with a professional qualified in ecological restoration in developing this vegetation assessment. The assessment should describe the existing plant community and species, identify endangered or threatened species as well as invasive species, evaluate relics of native plant communities and the potential for future restoration and sustainability of native species, and note existing tree canopy and ground cover. A tree inventory detailing the species, size, and a general rating of the condition of all trees growing on the mounds and within a fifteen foot (15') buffer area from the base of the mounds should be completed by a certified arborist. This inventory should identify trees for removal based on objective criteria developed by the arborist and approved by the Village. The inventory will also differentiate between native and non-native trees and between deep-rooted and shallow-rooted species. The assessment should also note whether the use of controlled burns might be an appropriate and desirable vegetation management tool for the mounds and/or adjacent areas. No surveys that fully satisfy all of these assessment criteria have been completed for any of the four mound sites.

### **D. Risk Assessment**

Using the information developed during the archeological survey, mapping, and vegetation assessment phases, each mound site should be assessed for inherent risks. Notations should be recorded regarding potential threats to the mound(s) from: erosion; proximity to neighboring development, roads, pedestrian or bicycle trails, playgrounds, and parks; non-native invasive species and tree species of concern due to disease or insects; and damage caused by humans or wildlife. Mounds associated with a “high-risk” for damage should receive immediate attention to assure protection and preservation.

Shallow – rooted trees can be a risk for windthrow. According to the National Resource Conservation Service, however, having tree cover on mounds can have both advantages and disadvantages. “The possibility of wind thrown trees is a potential area of concern. Overturned trees can pull up large chunks of soil with the root system causing damage to cultural deposits. Root penetration of trees and scrub can also have a significant impact on archeological deposits. However, removal of long established trees can be more detrimental to the mound than maintaining the existing cover.”<sup>7</sup>

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<sup>7</sup> *Indian Mounds: Cultural Resources Fact Sheet 2, National Resource Conservation Service*

## **V. PHASED MAINTENANCE OF THE MOUNDS**

A good deal of deferred maintenance work on the mounds will be required. The phasing of maintenance is a practical reality given current limitations in available financial and labor resources. Another advantage of a phased approach is that it allows an evaluation to be conducted at the conclusion of each management phase. If any unintended or unexpected effects have occurred, future maintenance plans can be adjusted accordingly.

As each of the Indian mound sites is different, with its own unique surroundings and potential risks, the specific protection and maintenance practices to be used will vary between sites. The pace of the maintenance efforts and the timing of various phases will also differ between sites based on priorities established through the site assessment process and funding availability.

Vegetation management on mound sites would follow the sequential phases described below, diagrammed in flow chart form in Table 1, and summarized in Table 2. No specific time frame is established for the completion of a particular phase or the start of the following phase. It is understood that steps to establish healthy ground cover of native species, including ongoing removal of non-native and invasive species, would be continuous throughout the process as sunlight conditions change with progressive removal of tree canopy. At least one full growing season should be allowed to pass before beginning a subsequent maintenance phase. This will allow a proper period for monitoring and evaluating the results of the previous phase.

Maintaining a photographic history of the appearance of each mound before, during, and after each maintenance phase is strongly recommended. The data base of photographs should be properly indexed and catalogued by specific mound, phase, and date. Photographs should be stored in a commonly available on-line format that is searchable and from which potential users can download and print selected material.

### **A. Phase 1**

1. Photograph each mound from several angles, noting the date taken
2. On the mounds themselves:
  - a. Remove all brush and all non-native or invasive species of groundcover and trees
  - b. Remove all dead, down, and unhealthy trees; all shallow-rooted trees, regardless of size; and any trees recommended for removal by a certified arborist if they pose an undue risk to the mounds for other reasons.
  - c. Remove all trees less than 5" diameter at breast height (DBH) in size
  - d. Seed native vegetation in a mixture recommended by a qualified professional
3. Within a fifteen feet (15') buffer area from the base of the mounds:
  - a. Remove all dead, down, and unhealthy trees; all shallow-rooted trees, regardless of size; and any trees recommended for removal by a certified arborist if they pose an undue risk to the mounds for other reasons.
4. Photograph each mound from several angles, noting the date taken

### **B. Evaluation Phase (should begin after one complete growing season)**

1. Photograph each mound from several angles, noting the date taken
2. Document the specific maintenance activities performed to date
  - a. Describe any detrimental results from the work done in the previous phase (e.g., an increase in invasive species, signs of erosion)
  - b. Describe any positive results from the previous phase (e.g., increased sunlight, improved growth of native vegetation)

3. Based on the analysis of results made during this Evaluation Phase, modify as appropriate the maintenance priorities and activities planned for the next phase

### **C. Phase 2**

1. Photograph each mound from several angles, noting the date taken
2. On the mounds themselves:
  - a. Ongoing removal of all brush, small trees, and all non-native or invasive species of groundcover
  - b. Remove all trees between 5" - 12" DBH in size. Also remove those trees so recommended by a certified arborist if they pose an undue risk to the mounds
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified professional
3. Within a five feet (5') buffer area from the base of the mounds:
  - a. Remove all brush and all non-native or invasive species of groundcover and trees
  - b. Remove all trees less than 5" DBH in size. Also remove those trees so recommended by a certified arborist if they pose an undue risk to the mounds
  - c. Seed native vegetation in a mixture recommended by a qualified professional
4. Photograph each mound from several angles, noting the date taken

### **D. Evaluation Phase (see above)**

### **E. Phase 3**

1. Photograph each mound from several angles, noting the date taken
2. On the mounds themselves:
  - a. Ongoing removal of all brush, small trees, and all non-native or invasive species of groundcover
  - b. Remove all remaining trees unless it is determined that selected large, healthy, deep-rooted trees should be retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage would occur during tree removal, or for other management purposes
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified professional
3. Within a five feet (5') buffer area from the base of the mounds:
  - a. Ongoing removal of all brush, small trees and all non-native or invasive species of groundcover
  - b. Remove all trees less than 12" DBH in size. Also remove those trees so recommended by a certified arborist if they pose an undue risk to the mounds
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified professional
4. Within a fifteen feet (15') buffer area from the base of the mounds:
  - a. Remove all brush and all non-native or invasive species of groundcover and trees
  - b. Remove all trees less than 5" DBH in size. Also remove those trees so recommended by a certified arborist if they pose an undue risk to the mounds
  - c. Seed native vegetation in a mixture recommended by a qualified professional
5. Photograph each mound from several angles, noting the date taken

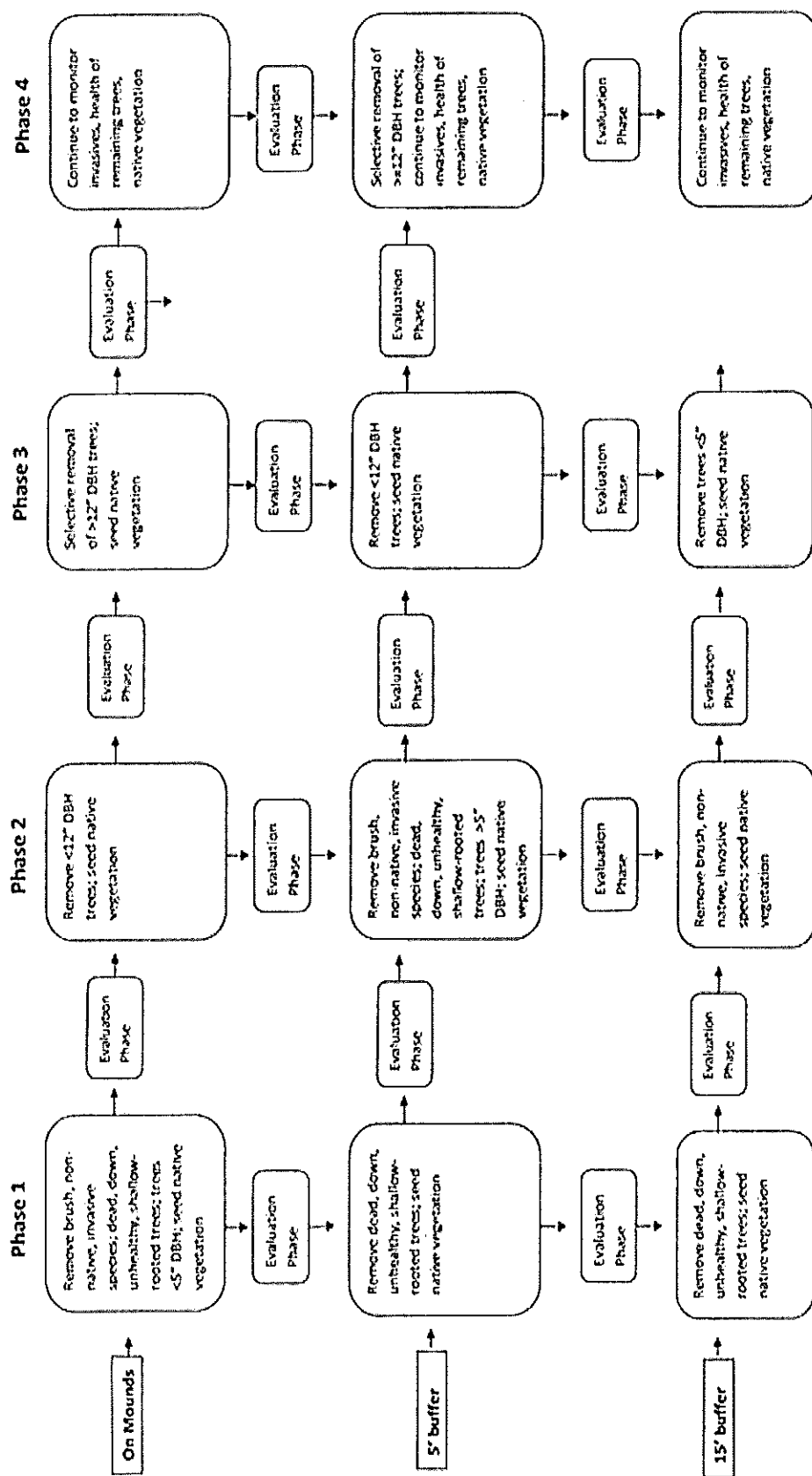


## **F. Evaluation Phase (see above)**

### **G. Phase 4**

1. Photograph each mound from several angles, noting the date taken
2. On the mounds themselves:
  - a. Ongoing removal of all brush and small trees and all non-native or invasive species of groundcover
  - b. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified professional
3. Within a five feet (5 ') buffer area from the base of the mounds:
  - a. Ongoing removal of all brush and small trees and all non-native or invasive species of groundcover
  - b. Remove all remaining trees unless it is determined that selected large, healthy, deep-rooted trees should be retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage would occur during tree removal, or for other management purposes
  - c. As necessary, continue seeding of native vegetation in a mixture recommended by a qualified professional
4. Photograph each mound from several angles, noting the date taken

TABLE 1



**TABLE 2  
PHASES OF VEGETATION MANAGEMENT**

|                                                                                                         | ON<br>MOUNDS         | 5'<br>BUFFER         | 15'<br>BUFFER        |
|---------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|
| Remove brush, non-native and invasive species                                                           | Phase 1              | Phase 2              | Phase 3              |
| Remove dead, down, unhealthy, and shallow-rooted trees                                                  | Phase 1              | Phase 1              | Phase 1              |
| Remove <5" DBH trees. Also remove trees so recommended by a certified arborist                          | Phase 1              | Phase 2              | Phase 3              |
| Seed native vegetation in a mixture recommended by a qualified professional                             | All phases as needed | All phases as needed | All phases as needed |
| Remove <12" DBH trees. Also remove trees so recommended by a certified arborist                         | Phase 2              | Phase 3              | Not applicable       |
| Selective removal of 12" DBH and larger trees. Also remove trees so recommended by a certified arborist | Phase 3              | Phase 4              | Not applicable       |

*NOTE: An evaluation phase should occur after each management phase. Evaluation should include photographing each mound noting the date, documenting specific maintenance activities that occurred in the previous management phase, and describing any positive or negative effects of those activities. This information should be used to guide appropriate modifications of the maintenance priorities and activities planned for the next management phase.*

## **VI. GENERAL MOUNDS MAINTENANCE CONSIDERATIONS**

### **A. Tree and Shrub Removal**

Removal of trees and shrubs from mounds and within a five feet (5') buffer area from the base of the mounds is generally desirable to protect them from windthrow and other damage, and to encourage growth of native groundcover that will help prevent erosion. To help mitigate the potential of windthrow, all shallow-rooted trees will be removed during Phase 1 of the maintenance. However, some selected large, healthy, deep-rooted trees may be retained for forestry or environmental purposes, to preserve heritage trees, when significant unavoidable mound damage might occur during tree removal, or for other management purposes. Heritage trees are defined in the Village's Tree and Shrub Ordinance. The condition of any large trees that are retained should be re-evaluated periodically to ensure that their health is stable and that they continue to pose no undue risk to the mounds.

No ground disturbance is allowed. All tree removal should be done when the ground is frozen hard. Trees growing on the mounds should be hand cut, or cut with a machine that can stay at least fifteen feet (15') from the mounds. No machinery is permitted to be used, however, on

slopes steeper than 12% or on lands listed on the National Register of Historic Places, unless approved by the Wisconsin Historical Society. The trees should be cut close to the ground and stumps should be left intact. The stumps can be treated to prevent regrowth. During tree removal, trees should not be dropped or dragged across the mounds, and machinery and other vehicles should not be driven across the mounds. The logs and other material should be hauled away or scattered or piled at least fifteen feet (15 ') from the defined burial area or mound.

Woody shrubs and invasives can be removed at any time with proper care since their removal should not require use of heavy equipment or involve ground disturbance. All vegetative waste material should be removed from the area. Replacement vegetation should be appropriate for the current use or planned restoration objectives.

## **B. Burning**

The use of fire to control woody vegetation and to enhance the native plant community in a prairie or savanna ecosystem is an important management tool, but the decision to use controlled burns should be made on an individual site basis and balanced against other factors that should be considered consistent with Village ordinances and protocols. Surveys should be conducted following any controlled burning to look for possible artifacts and to determine the response of the native plant community to fire. Installation of firebreaks and use of firefighting equipment at a site should be carefully monitored for both safety and potential ground disturbance reasons.

## **C. Chemical Treatment**

Removal of the roots of mature woody vegetation via hand-pulling is not recommended due to the ground disturbance that results. Chemical treatments to control woody vegetation or non-native invasive species can be very effective when applied properly. To minimize the use of chemicals, however, hand pulling should be used for control of small seedlings and most herbaceous plants.

## **D. Trails**

Pedestrian and wheeled traffic should never be allowed on the mounds. Trails should be established at those sites where public visitation either is likely or is encouraged. Trails should be located a minimum of fifteen feet (15') or more from the outer perimeter of the mound. Small trees and large brush stems that have been removed from the mounds in Phase I or II may be used for trail demarcation. The use of wood chips, shredded bark, or mowing may be considered for trail maintenance. In locating and designing trails, consideration should be given to the proximity of the mounds, aesthetics, view sheds and erosion control. All trails should be made as accessible to the disabled as possible.

## **E. Signage**

The Village should retain control of the wording and placement of all signage and coordinate the placement with the Wisconsin Historical Society. Signage at mound sites should be minimized but efforts should be made to educate and inform the public about the significance of the site and the people who constructed the earthworks. Maps of the mounds at specific sites or in a general context of other mound groups in the vicinity may be useful. A generic sign for selected sites that describes the effigy mound building culture and the types of mounds (effigy, linear or conical) may be appropriate. Affirmation of the sacred nature of the site to Native American peoples should be included in the signage. A strong statement about staying off the mounds and information on the burial sites preservation law should be included. Site specific signage should

include a map of the site and information regarding the unique features of the site. In some circumstances, brochures or small maps could be provided to visitors.

#### **F. Repair of Damaged Mounds**

Where appropriate, repair of mounds damaged by post Euro-Yankee settlement activities and/or natural causes may be considered. Coordination with the Wisconsin Historical Society is required.

#### **G. Use of Volunteers**

Volunteers may be enlisted to assist with mounds maintenance activities, monitoring, and education. The proximity of the mound site in IMCP to a number of local schools affords an ideal opportunity for student and parent involvement in the maintenance of the mounds. As described in Section VIII, involving community volunteers is also an effective way to expand education about the mound building culture and the sanctity of the surviving mounds to Native Americans.

Volunteers have been very active in the removal of invasive species and promoting the growth of native vegetation within IMCP. Neighborhood groups should be recruited and encouraged to adopt a particular site. A reference manual should be provided containing information useful to volunteers and a system should be developed for tracking the time contributed and the work tasks performed by volunteers. The use of power equipment by volunteers should be monitored closely by a qualified team leader. Persons using chainsaws or mechanical brush cutters must be approved by Village staff and have appropriate safety training and equipment. The number of persons using mechanical equipment should be strictly limited to promote safety.

### **VII. RECOMMENDED MAINTENANCE PLANS FOR SPECIFIC MOUND SITES**

#### **A. Indian Mound Conservation Park (IMCP)**

IMCP contains the Lewis Mound Group which consists of nine (9) mounds, including one short tailed quadruped in the shape of a bear, four linear, one long hook-shaped linear, one oval, and two conical mounds (see map below). Portions of the linear and a portion on one of the conicals were destroyed by development but partial restoration has occurred. The site is listed on the National Register of Historic Places and the nomination covers the entire 10 acre area of IMCP. The mounds have been catalogued in small groups and as single mounds. No ground disturbing activities are permitted anywhere within IMCP.

Considerable maintenance work on the mounds in IMCP has already been completed by the Village, community volunteers, and through the McFarland School District's School Forest Program. A site assessment was completed in 2006-2007 by the Wisconsin Historical Society. On the subject of tree removal, the assessment found then that "At this point in time, all of the trees growing on the mounds seem to be healthy and they are not in immediate danger of tipping over."<sup>8</sup> Individually and in concert, these groups have completed a site assessment, relocated some segments of walking trails away from the mounds, removed invasive species (ongoing process), re-established native species (ongoing process), and erected some informational signage. The Village acknowledges these previous contributions to preserving and maintaining the mounds and thanks those who have participated.

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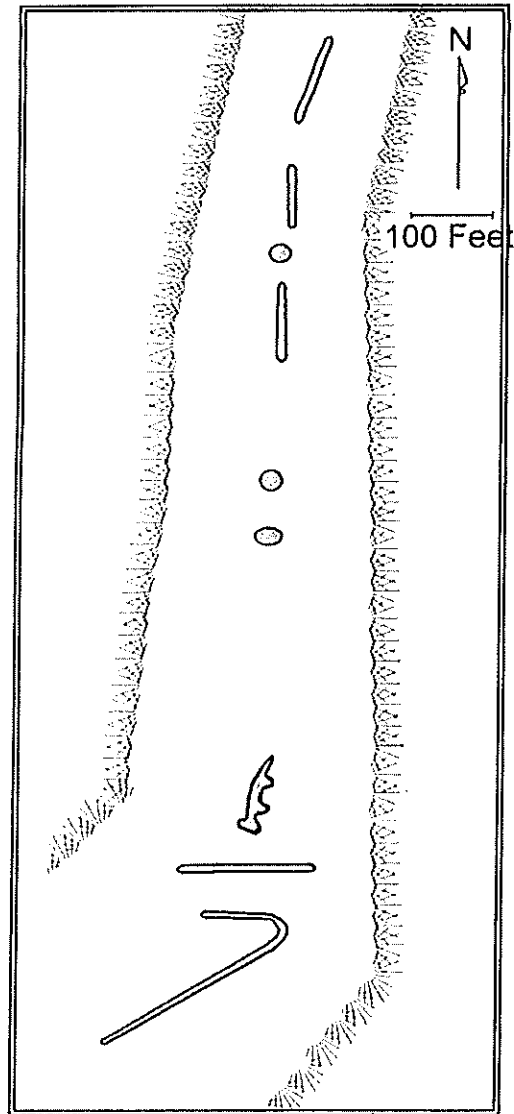
<sup>8</sup> *Wisconsin Historical Society Assessment of Lewis Mound Group – October, 2007*

IMCP was designated in 2010 as a Community Forest. It is located adjacent to the McFarland School Forest which was established in 2006. The McFarland School Forest Stewardship Plan, which included the Indian mound area through a 2007 Land Use Agreement with the Village, was prepared in 2007 and updated in 2009 by WDNR Forester Steve Holaday. It outlines forest management objectives and recommendations throughout the School Forest. Appendix A of the Stewardship Plan, prepared by State Archeologist John Broihahn, contains an assessment of the current conditions of the mounds and a detailed set of recommendations for future maintenance of the mounds.

In view of the extensive studies that have been conducted on IMCP and the work already completed, the following maintenance priorities are established for the mounds in IMCP:

1. The June 2009 amendment to the McFarland School Forest Stewardship Plan, which splits the former "Stand 1" into two separate forest stands, should be incorporated by the WDNR forester into a new Community Forest management plan for IMCP. This would lead to re-establishment of an oak woodland or oak opening community around the mound groupings, consistent with the native vegetation believed to be present at the time the mounds were built.
2. The October 2007 Wisconsin Historical Society Assessment for the Lewis Mound Group should be followed as a guideline to prioritize maintenance practices on each individual mound.
3. Trails should be relocated further away from the mounds where necessary, erosion of the trail surfaces minimized, and views of the mounds from the trails improved. Relocation of the trail that cuts into mound #2 should be an immediate priority.
4. Tree and shrub removal on and around the mounds should be completed in accordance with Section VI of this policy. Removal of non-native and invasive species and re-establishment of native ground cover species should be ongoing.
5. Informational signage should be installed to protect the mounds and other environmentally sensitive areas, to lead visitors through the park, and to interpret the cultural significance of the mounds.
6. The misleading signage at the west entrance regarding the bike trail should be changed to clarify that the trails in IMCP are not intended for bike riding and that, if bikes are taken into the park, they should be walked and not ridden.
7. The bear mound, the linear mound at the top of the park, and the partial mound should be prioritized as the first mounds to receive Phase 1 maintenance and used as demonstration projects to assess the appropriateness and effectiveness of the recommended maintenance protocols. Once Phase 1 maintenance activities are completed on these higher priority mounds, Phase 1 work on all remaining mounds should commence as soon as time and resources permit.
8. Seek approval from Wisconsin Historical Society to remove man-made fill deposited years ago at the base area of the old water tower and along the southern edge of the access road. As an alternative, seek approval to augment and regrade these areas to create more natural looking contours.

# IMCP Mound Site



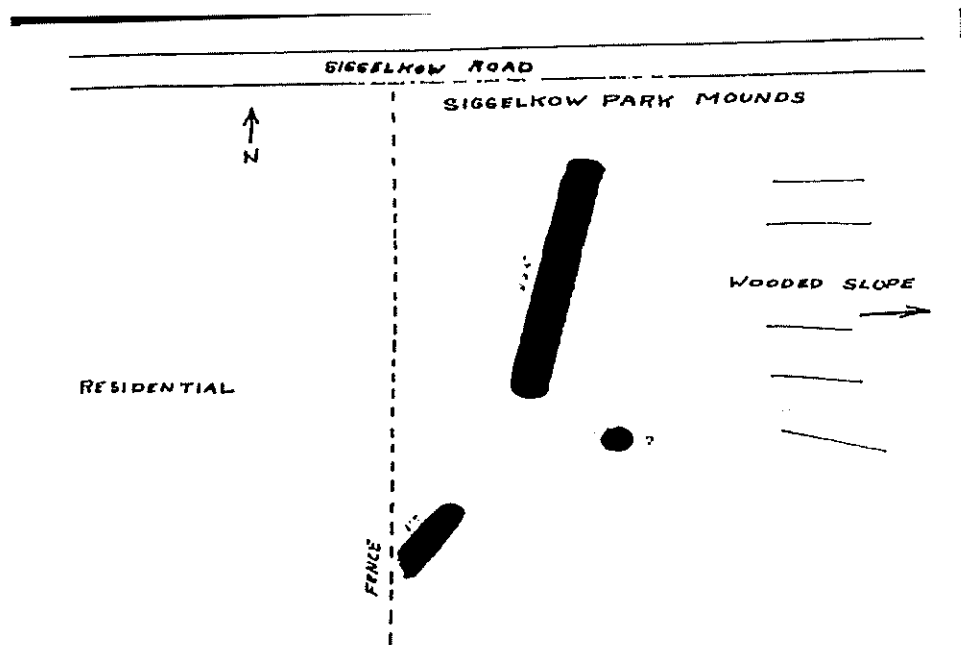
## B. Siggelkow Park

Siggelkow Park contains the Siggelkow Park Mounds Group which consists of at least two linear mounds and an unknown number of other potential mounds. The northernmost of these linears is approximately 225 feet long, ten feet (10') wide, and two feet (2') high and has been potted or looted. The second mound, which is located southwest of the first, is about 57 feet long but has been truncated by residential development. There are also faint signs of a possible conical or effigy mound remnant. These mounds have been catalogued as a group with a fifteen feet (15') no disturbance buffer. The Siggelkow Park Mound Group is eligible for listing on the National Register of Historic Places "because it is likely to contain important information on the prehistoric Late Woodland cultural stage in Wisconsin and because it is a good representative of a distinctive type and period of construction."

The Siggelkow Park mound site has been mapped and broadly evaluated by the Wisconsin Historical Society but they have not provided any specific recommendations on maintenance. The following short term maintenance priorities are established for the mounds site in Siggelkow Park:

1. Complete a comprehensive site assessment including a tree inventory, risk assessment, and a more thorough archeological evaluation of the possible remnant of a conical or effigy mound.
2. Complete Phase 1 of vegetation management consistent with Section VI of this policy.
3. Prepare a long term plan of phased maintenance.

### Siggelkow Park Mound Site





### **C. Taylor Road Conservancy**

The Taylor Road Conservancy is located on the eastern drumlin of conjoined drumlins that now straddle Lexington Street. It contains the Evans-Nelson mound site which currently consists of one linear mound. Historical records indicate the earlier presence of more linear mounds at this site but they apparently have been destroyed by a combination of cultivation and the huge cut made into the hill southwest of Taylor Road. The remaining linear mound has been truncated by a logging-style road at its southern end but is otherwise in good condition. Approximately one half of the mound is located on Village-owned park land and the other half was carved out of Lot 20 of Woodland Commons subdivision and dedicated to the Village, so the entire mound is under public ownership and protection. This mound has been catalogued with a fifteen feet (15') no disturbance buffer. As part of the subdivision platting process, the Village created a twenty feet (20') buffer and environmental corridor around the mound. (See map under "D" below.)

The Taylor Road Conservancy mound site has been privately surveyed and also located and broadly evaluated by the Wisconsin Historical Society which did not provide any specific recommendations on maintenance. The following short term maintenance priorities are established for the mound site at the Taylor Road Conservancy:

1. Relocate as soon as possible the footpath that currently crosses a portion of the mound and block off the old footpath.
2. Complete a comprehensive site assessment including mapping and a risk assessment.
3. Complete Phase 1 of vegetation management consistent with Section VI of this policy.
4. Install warning signage and notify adjacent residents about the presence of the mound and educate them on its cultural significance and the importance of protecting the integrity of the mound.
5. Prepare a long term plan of phased maintenance.

### **D. Woodlands Commons Park**

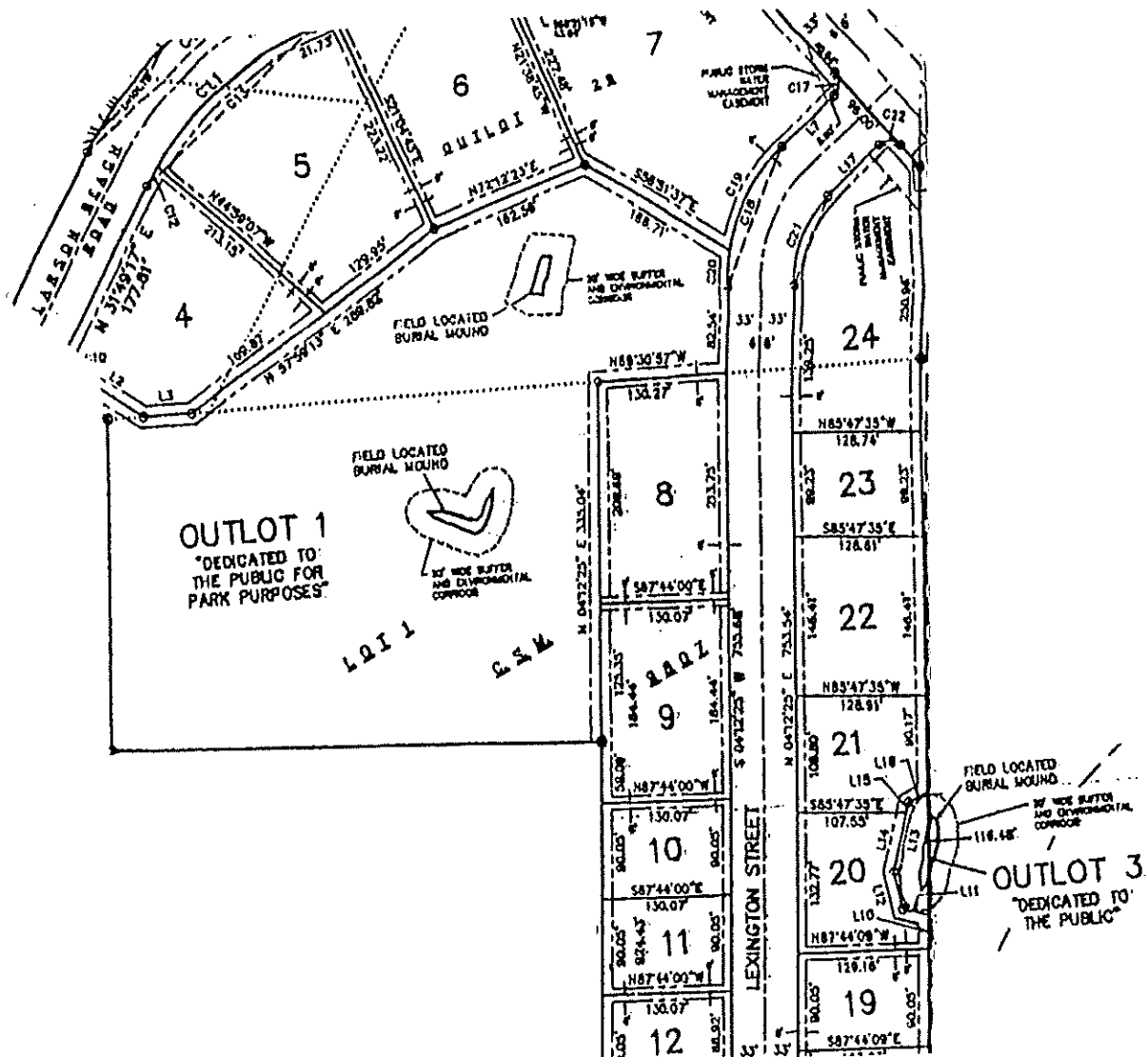
Woodland Commons Park is located on the western drumlin of conjoined drumlins that now straddle Lexington Street. It contains the Dale Mound Site which currently consists of one linear and one angular linear which is bent at right angles to itself. Historical records indicate the earlier presence of four mounds at this site but some were apparently destroyed in 1984 when the hillside was excavated for fill for reconstructing US Highway 51. The northernmost surviving linear was also truncated by this excavation process. This mound site has been catalogued as a group with a fifteen feet (15') no disturbance buffer. As part of the subdivision platting process, the Village created a twenty feet (20') buffer and environmental corridor around each mound.

The Woodland Commons Park mound site has been privately surveyed and also located and broadly evaluated by the Wisconsin Historical Society which did not provide any specific recommendations on maintenance. The following short term maintenance priorities are established for the mound site at Woodland Commons Park:

1. Remove immediately any evidence of human encroachment and inappropriate use of the area near the northernmost mound. Construct as soon as possible a low split rail fence to prevent future encroachment.

2. Complete a comprehensive site assessment including mapping, a tree inventory, and a risk assessment.
3. Complete Phase 1 of vegetation management consistent with Section VI of this policy.
4. Prepare a long term plan of phased maintenance.

### Taylor Road Conservancy Mound Site and Woodland Commons Mound Site



## **VIII. MONITORING AND EVALUATION OF MOUND SITES**

It is important that the Village make steady, annual progress in implementing these mound preservation and maintenance policies and goals. An example of an ongoing assessment grid has been created for potential use in keeping simultaneous track of the progress being made at all four mound sites (see Appendix A). Another example assessment grid, which is site-specific and more detailed, has also been created to monitor progress at each individual mound site (see Appendix B). Something similar to these example assessment grids should be updated annually and used by the Village Board (or a body to which it assigns the responsibility) to re-evaluate the status and current condition of all mound sites.

The Village should establish and update annually a five-year plan which sets forth clear goals for preservation, maintenance, and possible restoration of the mounds in each of the four sites. The annual update should be completed in time to set priorities and establish funding needs as part of the Village's budget process.

This policy should be reviewed at least every five years with an eye to evaluating its continued applicability to the various mound sites. As appropriate, the policy should be updated to reflect changes in community thinking or approach, new discoveries, methods, or technological applications, unexpected field results, or changes in available funding or labor resources.

## **IX. EDUCATION AND PUBLIC OUTREACH**

Indian Mound Conservation Park (IMCP) is managed by the Village and is registered as a Community Forest. The McFarland School Forest occupies 6.9 acres adjacent to the mound site and is currently used for field trips and classes including Native American History and the mound building culture. The potential exists for developing cooperative educational activities due to the proximity of the mound site to the schools. These entities share not only contiguous boundaries, but a strong commitment to fostering an informed and engaged citizenry. Their cooperative efforts provide a foundation for achieving the very desirable goal of education and public outreach. Effective education and public outreach at IMCP may encourage other Village civic or interest groups to become involved with the preservation and maintenance of the mounds.

Recommended objectives of an effective education and public outreach program would include:

1. To inform visitors about the human and natural history of the sites
2. To enhance existing cultural and historical resources with complementary educational activities (e.g. joint activities with the McFarland Historical Museum or the McFarland School District)
3. To foster teaching and learning related to Native American culture and history
4. To develop awareness, appreciation, knowledge, and skills related to sustainable care of the environment and the Indian mounds
5. To engage residents and students in experiential learning through field experiences

Desirable components of an education and public outreach program that would help achieve the above objectives might include trails and informational signage, classes/workshops, speakers, and perhaps an interpretive center. Because of the natural settings in which most of the mounds are located, it would be possible to easily integrate educational objectives related to the environment on such topics as ecology, forest management, native and invasive species, wildlife, birding,

nature writing, storm water management, and water quality. The environmental education objectives for the McFarland School District, which incorporate all of these suggested topics, have been developed and are outlined in the School Forest Education Plan.

## **X. CONCLUSION**

The Village Board believes that the recommendations contained in this policy document will advance McFarland a long way toward meeting desirable goals for preserving, maintaining, and restoring McFarland's Indian mounds. The Board is confident that, as interim goals are reached, ongoing evaluations completed, and new goals established, the Village will make continuous progress in establishing the optimum environment for protecting and preserving the mounds at all four of the sites.

In adopting these policies, the Village Board has been guided by several over-arching principles. These are the enormous sense of responsibility engendered by the presence of the Indian mounds, the profound desire to protect and preserve the mounds for future generations, and the recognition that McFarland, though restricted by small size and fiscal limitations, can and must increase its efforts to do what must be done in the interests of the Indian mounds.

## APPENDICES

Appendix A – General Assessment Grid (example) for all Four Mound Sites

Appendix B – Specific Assessment Grids (example) for Each Mound Site

Appendix C – *Assessment of Current Conditions and Recommendations for the Lewis Mound Group in Indian Mound Conservation Park* – John Broihahn, State Archeologist

Appendix D – *Restatement of the Lewis Mound Group Assessment* – Alan Lulloff

Appendix E – *Mound Preservation and Maintenance*, Ho-Chunk Department of Heritage Preservation

Appendix F – *Burials, Earthworks, and Mounds Preservation Policy & Plan*, WI Dept. of Natural Resources

Appendix G – *Proposed Protocols for Cultural Resources Protection and Preservation on Public and Private Lands In the Lower Wisconsin State Riverway*

Appendix H – *Indian Mounds: Cultural Resources Fact Sheet 2*, National Resource Conservation Service

Appendix I – *Fact Sheet: How Trees Benefit Mounds and The Oaks in Indian Mound Conservancy*, Alan R. Lulloff, P.E. CFM

August, 2010

1

## Sample All-Sites Assessment Grid

| McFarland Indian Mounds - All Sites Assessment Grid |                                     |                      |                              |                       |
|-----------------------------------------------------|-------------------------------------|----------------------|------------------------------|-----------------------|
| Long-term Goals                                     | Indian Mound Conservation Park<br>9 | Siggelkow Group<br>3 | Taylor Road Conservancy<br>1 | Woodland Commons<br>2 |
| Number of recognized mounds                         |                                     |                      |                              |                       |
| Maintenance and Preservation                        |                                     |                      |                              |                       |
| Completed archaeological & risk assessment          |                                     |                      |                              |                       |
| Completed tree inventory                            |                                     |                      |                              |                       |
| Optimal conditions determined                       |                                     |                      |                              |                       |
| Optimal conditions established                      |                                     |                      |                              |                       |
| Assessment and Evaluation                           |                                     |                      |                              |                       |
| Annual                                              |                                     |                      |                              |                       |
| Five-Year                                           |                                     |                      |                              |                       |
| Public Education/Information Activities             |                                     |                      |                              |                       |
| Speakers                                            |                                     |                      |                              |                       |
| Interpretive trails                                 |                                     |                      |                              |                       |
| Signs/maps                                          |                                     |                      |                              |                       |
| Recruitment/training of volunteers                  |                                     |                      |                              |                       |
| Official Status                                     |                                     |                      |                              |                       |
| Registered as National Landmark                     |                                     |                      |                              |                       |
| Registered as local landmark                        |                                     |                      |                              |                       |
| Grants applied for/received                         |                                     |                      |                              |                       |

Sample Assessment Grid  
Indian Mound Conservation Park

| Indian Mound<br>Conservation Park<br>Mounds                        | Hook | Linear 1 | Bear (effigy) | Oval | Conical 1 | Linear 2 | Conical 2 | Linear 3 | Linear 4 |
|--------------------------------------------------------------------|------|----------|---------------|------|-----------|----------|-----------|----------|----------|
| Maintenance/Preservation<br>2010-11                                |      |          |               |      |           |          |           |          |          |
| Continue/complete<br>trail relocation                              |      |          |               |      |           |          |           |          |          |
| Create brush barriers                                              |      |          |               |      |           |          |           |          |          |
| Phase I tree removal                                               |      |          |               |      |           |          |           |          |          |
| Treat all stumps                                                   |      |          |               |      |           |          |           |          |          |
| Continue removal of<br>invasive species                            |      |          |               |      |           |          |           |          |          |
| Continue removal of<br>woody brush                                 |      |          |               |      |           |          |           |          |          |
| Begin/continue seeding of<br>native species                        |      |          |               |      |           |          |           |          |          |
| Conduct annual<br>assessment one year<br>from beginning of Phase 1 |      |          |               |      |           |          |           |          |          |

Sample Assessment Grid  
Indian Mound Conservation Park

| Indian Mound<br>Conservation Park<br>Mounds                                      | Hook | Linear 1 | Bear (effigy) | Oval | Conical 1 | Linear 2 | Conical 2 | Linear 3 | Linear 4 |
|----------------------------------------------------------------------------------|------|----------|---------------|------|-----------|----------|-----------|----------|----------|
| Long Term Goals                                                                  |      |          |               |      |           |          |           |          |          |
| Mound clearly visible<br>with well defined shape                                 |      |          |               |      |           |          |           |          |          |
| Trails are outside the 15'<br>perimeter and prevent<br>undesireable foot traffic |      |          |               |      |           |          |           |          |          |
| invasive species are under<br>control                                            |      |          |               |      |           |          |           |          |          |
| Undesirable woody brush<br>is under control                                      |      |          |               |      |           |          |           |          |          |
| Desirable native species<br>are thriving                                         |      |          |               |      |           |          |           |          |          |
| Mound is covered with<br>desirable native species;<br>erosion is controlled      |      |          |               |      |           |          |           |          |          |
| Designated trees have<br>been removed                                            |      |          |               |      |           |          |           |          |          |
| Official Status                                                                  |      |          |               |      |           |          |           |          |          |
| Archaeological/SHS<br>Assessment                                                 |      |          |               |      |           |          |           |          |          |
| Registered as National<br>Landmark                                               |      |          |               |      |           |          |           |          |          |
| Registered as a Local<br>Landmark                                                |      |          |               |      |           |          |           |          |          |



Sample Assessment Grid  
Indian Mound Conservation Park

| Indian Mound<br>Conservation Park<br>Mounds   | Hook | Linear 1 | Bear (effigy) | Oval | Conical 1 | Linear 2 | Conical 2 | Linear 3 | Linear 4 |
|-----------------------------------------------|------|----------|---------------|------|-----------|----------|-----------|----------|----------|
| Grants applied<br>for/received                |      |          |               |      |           |          |           |          |          |
| Education/Public<br>Outreach                  |      |          |               |      |           |          |           |          |          |
| Begin education/public<br>outreach activities |      |          |               |      |           |          |           |          |          |

**Sample Evaluation Phase 1**  
**Indian Mound Conservation Park**

| Indian Mound Conservation<br>Park Mounds Evaluation<br>Phase 1    | Hook | Linear 1 | Bear (effigy) | Oval | Conical 1 | Linear 2 | Conical 2 | Linear 3 | Linear 4 |
|-------------------------------------------------------------------|------|----------|---------------|------|-----------|----------|-----------|----------|----------|
| Photograph each mound<br>where Phase 1 work has been<br>completed |      |          |               |      |           |          |           |          |          |
| Record specific maintenance<br>activities performed to date       |      |          |               |      |           |          |           |          |          |
| Record any detrimental results<br>of Phase 1 work                 |      |          |               |      |           |          |           |          |          |
| Record any positive results of<br>Phase 1 work                    |      |          |               |      |           |          |           |          |          |
| Recommend maintenance<br>priorities for Phase 2 work              |      |          |               |      |           |          |           |          |          |

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Sample Evaluation Phase 1  
Indian Mound Conservation Park

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## Sample Evaluation Phase 1

[illegible]

# Preliminary Assessment Grid - Siggelkow Park

| Siggelkow Park                                                                                                | Northern linear | SW linear | Remnant  |
|---------------------------------------------------------------------------------------------------------------|-----------------|-----------|----------|
| <b>Maintenance &amp; Preservation Goals - 2010-11</b>                                                         |                 |           |          |
| Photograph mounds prior to beginning work                                                                     |                 |           |          |
| Archaeological and risk assessment including mapping                                                          | Priority        | Priority  | Priority |
| Tree inventory                                                                                                | Priority        | Priority  | Priority |
| Begin Phase 1 tree removal                                                                                    |                 |           |          |
| <b>Long Term Goals</b>                                                                                        |                 |           |          |
| All mounds clearly visible with well defined shapes                                                           |                 |           |          |
| Trails provide views of mounds and prevent undesirable foot traffic                                           |                 |           |          |
| Invasive species are under control                                                                            |                 |           |          |
| Undesirable woody brush is under control                                                                      |                 |           |          |
| Desirable native species are thriving                                                                         |                 |           |          |
| Mounds are covered with desirable native species                                                              |                 |           |          |
| Erosion is controlled                                                                                         |                 |           |          |
| Hazardous, unhealthy, trees have been removed along with those designated for removal by a qualified arborist |                 |           |          |
| <b>Official Status</b>                                                                                        |                 |           |          |
| Archaeological/Historical Soc. Survey                                                                         | Priority        | Priority  | Priority |
| Registered as National Landmark                                                                               |                 |           |          |
| Registered as a Local Landmark                                                                                |                 |           |          |
| Grants applied for/received                                                                                   |                 |           |          |
| <b>Education/Public Outreach Goals 2010-11</b>                                                                |                 |           |          |
| Begin education/public outreach activities                                                                    |                 |           |          |

**1**  
**Evaluation Phase 1**  
**Siggelkow Park**

| Siggelkow Park                                                                                                                                                                                                                                                                                                                         | Northern Linear | SW Linear | Remnant |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------|---------|
| <p><b>Evaluation Phase #1</b></p> <p>photograph each mound where Phase 1 work has been completed</p> <p>record specific maintenance activities performed to date</p> <p>record any detrimental results of Phase 1 work</p> <p>record any positive results of Phase 1 work</p> <p>recommend maintenance priorities for Phase 2 work</p> |                 |           |         |

**Lewis Mound Group (47 DA74)  
McFarland Indian Mounds Park**

**Assessment of Current Conditions and Recommendations**

This site was listed on the National Register of Historic Places in 1984. The National Register boundary includes the entire hill ending near the base, or just above the private parcels with houses that surround the bluff. Because the site is listed on the National Register and is publicly owned, all projects occurring on the parcel must be reviewed by the Wisconsin Historical Society.

The site was cataloged as a cemetery under 157.70 in 1998. The mounds were cataloged individually with a 5.0 ft. buffer. Any ground disturbing activities, or potential ground disturbing activities, that occur on the mounds or within the 5.0 ft. buffer must be reviewed by the Wisconsin Historical Society.

We have been asked to provide information for long term planning associated with this site. The school is now managing the forest and they want to make sure the mounds are appropriately treated and I hope incorporated in the curriculum.

These comments are based upon on a 21 August 2007 and 26-27 September 2007 site visits.

Area A. Southwest Entrance - The two existing paths (east and northwest) come within 5.0 ft. and/or are cutting into the base of Mound #1 (the Hook Mound).

Recommendation: We suggest that the entrance be pushed west and that the two paths diverge further to the west. The East path should be moved south and the Northeast path should be moved northwest. Both paths should be at least 15.0 ft. away from the mound.

Area B. A volunteer path crossed Mound #1 at this point. It is now blocked on both sides by brush. No recent use or the re-development of the path was noted. The main path that runs on the north side of the mound has developed some alluvial fans that threatened to encroach on the mound.

Recommendation: Additional brush should be piled in this area to deter any re-routing of the path. The volunteer path will disappear over time. The main path should be stabilized to stop erosion and moved away from the mound so that it is at least 15.0 ft. distant. The existing paths should be obliterated and seeded.

Mound #1 (The Hook Mound). It is presently covered primarily with a light understory and ground vegetation. Several trees are growing along the east-west portion of the mound. There are some dead trees on the mound.

Recommendation: The dead trees and the trees growing on the mound should be removed. The area should be re-seeded with appropriate vegetation, or vegetation that will stabilize the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan.

Area C. The main path at this point cuts across the end of the linear mound (Mound #2).

Recommendation: The entire path should be pushed west and the east-west sections of the path around the mound should be moved north and south so that the path is at least 15.0 ft. away from the mound. The existing paths should be obliterated and seeded.

Area D. A volunteer path crossed Mound #2 at this point. It included both foot and probably bicycle travel. It is now blocked on both sides by brush. The brush is occasionally moved and the path used for foot and bike traffic. The main path that runs on the north side of the mound at this point has developed some alluvial fans.

Recommendation: The main path should be moved north and west so that it is at least 15.0 ft. from the mound. The path on the north side of the mound should be stabilized to prevent erosion. This may help prevent use of the volunteer path. This path should be obliterated and the area seeded. The volunteer path should be blocked with large logs and brush.

Mound #2 (Linear). There is an obvious depression in the mound caused by the volunteer path. No trees were observed on this mound. There are some dead trees on the mound.

Recommendation: The obvious depression in the mound should be repaired with clean soil—in this case clean soil means that the source and the soil have been checked for the presence of artifacts. The dead trees on the mound should be removed. This area and the remainder of the mound should be re-seeded with appropriate vegetation, or vegetation that will stabilize the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan.

Area E. The current path cuts into the back of the bear (Mound #3).

Recommendation: This path needs to be moved to the west and configured in such a way that erosion is controlled and it is at least 15.0 ft. from the mound.

Mound #3 (The Bear). Trees are growing near the head and feet of the bear. There are also trees growing along the edge of the mound

Recommendation: Trees growing near the head and feet of the bear should be removed as should the trees growing adjacent to the mound. This area and the remainder of the mound should be re-seeded with appropriate vegetation, or vegetation that will stabilize



the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan.

Area F. The main trail runs within 5.0 ft. of the mound.

Recommendation: This trail should be re-routed to the west to go around the mounds and not through the mounds. It should be at least 15.0 ft. from the mounds. The existing trail should be blocked and obliterated.

Mound #4. This conical mound is covered with low grassy and sedge vegetation. There are two trees growing near the base of the mound.

Recommendation: The trees near the base of the mound should be removed.

Area G. The main trail runs within 5.0 ft. of the mound.

Recommendation: This trail should be re-routed to the west to go around the mounds and not through the mounds. It should be at least 15.0 ft. from the mounds. The existing trail should be blocked and obliterated.

Mound #5. This conical mound is covered with low grassy and sedge vegetation.

Area H. Area H is the disturbance associated with the building of the earlier water tower. This concrete circular (22.0 ft dia.) base has a pile of soil on top of it.

Mound #6. This linear mound is covered with low grassy and sedge vegetation. A few small trees are present. Much larger trees are present along both longer sides of the mound.

Recommendation: The small trees on the mound and those lining the mound should be removed.

Area I. The main trail runs within 5.0 ft. of the mound.

Recommendation: This trail should be re-routed to the east so that it is at least 15.0 ft. away from the mounds. The existing trail should be blocked and obliterated.

Mound #7. One small tree is growing on the mound and woody plants are present.

Recommendation: The tree should be removed. The mound should be re-seeded with appropriate vegetation, or vegetation that will stabilize the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan.

Mound #8. Trees are present near the base of the mound. The current path is 7.0 ft. from the mound.

Recommendation: The trees near the base of the mound should be removed.

Other Burials. During pipeline work for the water tower in 1996, one human burial was unearthed. It was not associated with a mound, or mound remnant. The remains were removed and reburied. The reburial area is marked on the attached map. A minimum 15.0 ft. buffer should be maintained on all sides of the reburial.

Recommendation: A 15.0 ft. buffer should be established around the reburial.

Signage. We suggest that signage that introduces people to the Native history of the area, the importance of the mounds, and the protections provided under 157.70 be present at all entrances to the area. Marking each mound with a small sign may prevent disturbances and inappropriate use.

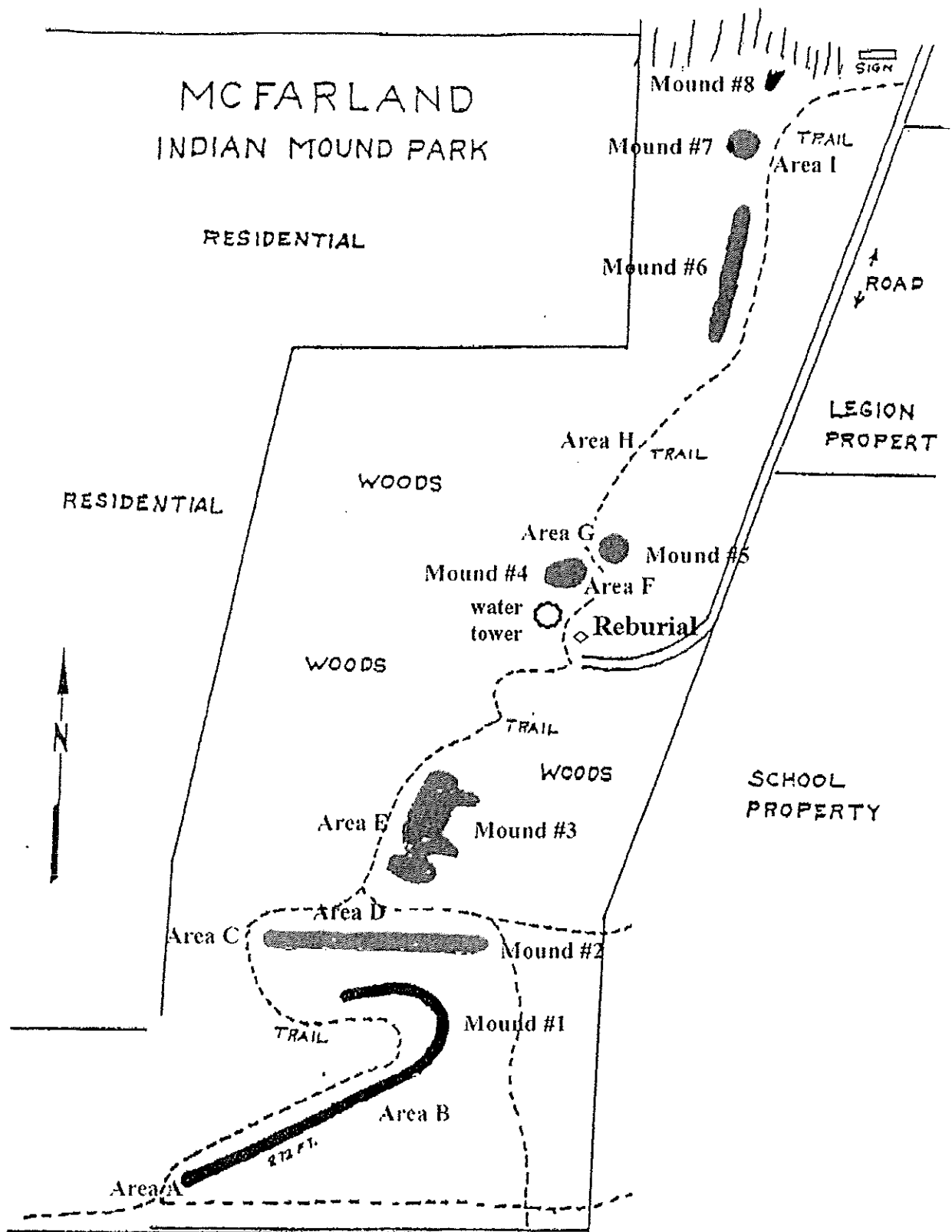
Tree removal. At this point in time, all of the trees growing on the mounds seem to be healthy and they are not in immediate danger of tipping over.

Removal of trees and shrubs from mounds and immediately adjacent areas (ca. 15.0 ft.) is generally desirable to protect them from windthrow and other damage, and to encourage growth of ground cover that prevents erosion. However, in some instances selected trees may be retained for forestry purposes or when significant, unavoidable mound damage might occur during tree removal; or for other management purposes.

All tree removal should be done during frozen ground. Trees growing on the mounds should be hand cut, or cut with a machine that can stay at least 15.0 ft. from the mounds. The trees should be cut close to the ground and stumps should be left intact. The stumps can be treated to prevent regrowth. During tree removal, trees should not be dropped or drag across the mounds, and machinery and other vehicles should not be driven across the mounds. The logs and other material should be hauled away or scattered or piled at least 15 ft. from the defined burial area or mound.

Vegetation. Vegetation replacement should be appropriate for the current use, or planned restoration.

Trails. All trails should be moved back at least 15.0 ft. from the mounds. The trails should be stabilized to prevent erosion. It may be desirable to cover the new trails with material that helps not only stabilize them but also clearly marks them as the "official" routes. When existing trails are removed, they need to be obliterated and/or blocked and vegetated.



# APPENDIX D

Lewis Mound Group (47 DA74) - McFarland Indian Mound Conservation Park  
Assessment of Current Conditions and Recommendations  
John Broihan - State Archaeologist - October 2007

| Area                                                                                                                                                                                                                                                                                                                                             | Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | WHS Indicates "Desirable" | Issues                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Area A.</b> Southwest Entrance - The two existing paths (east and northwest) come within 5.0 ft. and/or are cutting into the base of Mound #1 (the Hook Mound).                                                                                                                                                                               | <b>Recommendation:</b> We suggest that the entrance be pushed west and that the two paths diverge further to the west. The East path should be moved south and the Northeast path should be moved northwest. Both paths should be at least 15.0 ft. away from the mound.                                                                                                                                                                                                                                                                                |                           | None                                                                                                                                       |
| <b>Area B.</b> A volunteer path crossed Mound #1 at this point. It is now blocked on both sides by brush. No recent use or the re-development of the path was noted. The main path that runs on the north side of the mound has developed some alluvial fans that threatened to encroach on the mound.                                           | <b>Recommendation:</b> Additional brush should be piled in this area to deter any re-routing of the path. The volunteer path will disappear over time. The main path should be stabilized to stop erosion and moved away from the mound so that it is at least 15.0 ft. distant. The existing paths should be obliterated and seeded.                                                                                                                                                                                                                   |                           | None                                                                                                                                       |
| <b>Mound #1</b> (The Hook Mound). It is presently covered primarily with a light understory and ground vegetation. Several trees are growing along the east-west portion of the mound. There are some dead trees on the mound.                                                                                                                   | <b>Recommendation:</b> The dead trees and the trees growing on the mound should be removed. The area should be re-seeded with appropriate vegetation, or vegetation that will stabilize the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan.                                                                                                                                                                                              |                           | 4 large oaks                                                                                                                               |
| <b>Area C.</b> The main path at this point cuts across the end of the linear mound (Mound #2).                                                                                                                                                                                                                                                   | <b>Recommendation:</b> The entire path should be pushed west and the east-west sections of the path around the mound should be moved north and south so that the path is at least 15.0 ft. away from the mound. The existing paths should be obliterated and seeded.                                                                                                                                                                                                                                                                                    |                           | None                                                                                                                                       |
| <b>Area D.</b> A volunteer path crossed Mound #2 at this point. It included both foot and probably bicycle travel. It is now blocked on both sides by brush. The brush is occasionally moved and the path used for foot and bike traffic. The main path that runs on the north side of the mound at this point has developed some alluvial fans. | <b>Recommendation:</b> The main path should be moved north and west so that it is at least 15.0 ft. from the mound. The path on the north side of the mound should be stabilized to prevent erosion. This may help prevent use of the volunteer path. This path should be obliterated and the area seeded. The volunteer path should be blocked with large logs and brush.                                                                                                                                                                              |                           | None                                                                                                                                       |
| <b>Mound #2</b> (Linear). There is an obvious depression in the mound caused by the volunteer path. No trees were observed on this mound. There are some dead trees on the mound.                                                                                                                                                                | <b>Recommendation:</b> The obvious depression in the mound should be repaired with clean soil—in this case clean soil means that the source and the soil have been checked for the presence of artifacts. The dead trees on the mound should be removed. This area and the remainder of the mound should be re-seeded with appropriate vegetation, or vegetation that will stabilize the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan. |                           | Bicycles using mounds as jump ramps has been reoccurring problem. Note: WHS does not recommend removing any live oak trees near this mound |

| Area                                                                                                                                                                                   | Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                             | WHS Indicates "Desirable" | Issues                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Area E.</u> The current path cuts into the back of the bear (Mound #3).                                                                                                             | <u>Recommendation:</u> This path needs to be moved to the west and configured in such a way that erosion is controlled and it is at least 15.0 ft. from the mound.                                                                                                                                                                                                                                                                          |                           | Proper routing to manage stormwater runoff needed before trail route can be finalized.                                                                                                         |
| <u>Mound #3 (The Bear).</u> Trees are growing near the head and feet of the bear. There are also trees growing along the edge of the mound                                             | <u>Recommendation:</u> Trees growing near the head and feet of the bear should be removed as should the trees growing adjacent to the mound. This area and the remainder of the mound should be re-seeded with appropriate vegetation, or vegetation that will stabilize the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan. |                           | None                                                                                                                                                                                           |
| <u>Area F.</u> The main trail runs within 5.0 ft. of the mound.                                                                                                                        | <u>Recommendation:</u> This trail should be re-routed to the west to go around the mounds and not through the mounds. It should be at least 15.0 ft. from the mounds. The existing trail should be blocked and obliterated.                                                                                                                                                                                                                 |                           | None                                                                                                                                                                                           |
| <u>Mound #4.</u> This conical mound is covered with low grassy and sedge vegetation. There are two trees growing near the base of the mound.                                           | <u>Recommendation:</u> The trees near the base of the mound should be removed.                                                                                                                                                                                                                                                                                                                                                              |                           | 1 Burr Oak                                                                                                                                                                                     |
| <u>Area G.</u> The main trail runs within 5.0 ft. of the mound.                                                                                                                        | <u>Recommendation:</u> This trail should be re-routed to the west to go around the mounds and not through the mounds. It should be at least 15.0 ft. from the mounds. The existing trail should be blocked and obliterated.                                                                                                                                                                                                                 |                           | None                                                                                                                                                                                           |
| <u>Mound #5.</u> This conical mound is covered with low grassy and sedge vegetation.                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           |                                                                                                                                                                                                |
| <u>Area H.</u> Area H is the disturbance associated with the building of the earlier water tower. This concrete circular (22.0 ft dia.) base has a pile of soil on top of it.          |                                                                                                                                                                                                                                                                                                                                                                                                                                             |                           |                                                                                                                                                                                                |
| <u>Mound #6.</u> This linear mound is covered with low grassy and sedge vegetation. A few small trees are present. Much larger trees are present along both longer sides of the mound. | <u>Recommendation:</u> The small trees on the mound and those lining the mound should be removed.                                                                                                                                                                                                                                                                                                                                           |                           | 1 Oak - North End<br>3 Oaks - South End                                                                                                                                                        |
| <u>Area I.</u> The main trail runs within 5.0 ft. of the mound.                                                                                                                        | <u>Recommendation:</u> This trail should be re-routed to the east so that it is at least 15.0 ft. away from the mounds. The existing trail should be blocked and obliterated.                                                                                                                                                                                                                                                               |                           | Trail relocated off top of mound in late '80s<br>Moving trail down the slope to the east may prompt people to ignore trail and instead walk along top of linear mound as they had in the past. |

| Area                                                                                                                                                                                                                                                                                                                               | Recommendations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | WHS Indicates "Desirable"                                                                                                                                                                                                                                                                                                                                                                                                     | Issues                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Mound #7.</b> One small tree is growing on the mound and woody plants are present.                                                                                                                                                                                                                                              | <b>Recommendation:</b> The tree should be removed. The mound should be re-seeded with appropriate vegetation, or vegetation that will stabilize the surface of the mound and keep woody vegetation from returning. The visible outline of the mound should be preserved as part of the vegetation management plan.                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                               | Note: WHS does not recommend removing large oak tree near mound                                                                                |
| <b>Mound #8.</b> Trees are present near the base of the mound. The current path is 7.0 ft. from the mound.                                                                                                                                                                                                                         | <b>Recommendation:</b> The trees near the base of the mound should be removed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                               | None                                                                                                                                           |
| <b>Other Burials.</b> During pipeline work for the water tower in 1996, one human burial was unearthed. It was not associated with a mound, or mound remnant. The remains were removed and reburied. The reburial area is marked on the attached map. A minimum 15.0 ft. buffer should be maintained on all sides of the reburial. | <b>Recommendation:</b> A 15.0 ft. buffer should be established around the reburial.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                               | WHS needs to mark burial site so that buffer can be established                                                                                |
|                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Signage.</b> We suggest that signage that introduces people to the Native history of the area, the importance of the mounds, and the protections provided under 157.70 be present at all entrances to the area. Marking each mound with a small sign may prevent disturbances and inappropriate use.                                                                                                                       | Sign locations near mounds need to be approved by WHS.                                                                                         |
| <b>Tree removal.</b> At this point in time, all of the trees growing on the mounds seem to be healthy and they are not in immediate danger of tipping over.                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Removal of trees and shrubs from mounds and immediately adjacent areas (ca. 15.0 ft.) is generally desirable to protect them from windthrow and other damage, and to encourage growth of ground cover that prevents erosion. However, in some instances selected trees may be retained for forestry purposes or when significant, unavoidable mound damage might occur during tree removal, or for other management purposes. | What process will be used to evaluate which trees should be retained? There appears to be 8 to 10 oaks that should be evaluated for retention. |
|                                                                                                                                                                                                                                                                                                                                    | All tree removal should be done during frozen ground. Trees growing on the mounds should be hand cut, or cut with a machine that can stay at least 15.0 ft. from the mounds. The trees should be cut close to the ground and stumps should be left intact. The stumps can be treated to prevent regrowth. During tree removal, trees should not be dropped or drag across the mounds, and machinery and other vehicles should not be driven across the mounds. The logs and other material should be hauled away or scattered or piled at least 15 ft. from the defined burial area or mound. |                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                |

| Area | Recommendations | WHS Indicates "Desirable"                                                                                                                                                                                                                                                                                                                                                                   | Issues |
|------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|      |                 | <p><u>Vegetation.</u> Vegetation replacement should be appropriate for the current use, or planned restoration.</p>                                                                                                                                                                                                                                                                         |        |
|      |                 | <p><u>Trails.</u> All trails should be moved back at least 15.0 ft. from the mounds. The trails should be stabilized to prevent erosion. It may be desirable to cover the new trails with material that helps not only stabilize them but also clearly marks them as the "official" routes. When existing trails are removed, they need to be obliterated and/or blocked and vegetated.</p> |        |



*Ho-Chunk Department of Heritage Preservation*  
 Cultural Resources Division  
 P.O. Box 667  
 Black River Falls, WI 54615  
 (715) 284-7181/ (800) 561-9918 FAX (715) 284-7449

### Mound Preservation and Maintenance

Mound builders took great care in construction and maintaining their expressions of their religious faith. The most intimate human emotions were shared with the creator at these symbolic expressions of religion from birth to death.

It is through this intense faith that these mounds have endured nature's wrath for 1,000 years. Many were lost not to time, but to a new and indifferent people with religious intolerants that came and occupied this land. After the last 150 years, only a fraction remains of these sacred sites. The remaining mounds yet continue to endure and reflect the passion of faith that those who stood before them a thousand years ago.

The existing mounds continue to be threatened today by indifference. This lack of connection and respect for other religions is seen in how protected mounds are cared for. It is not uncommon to run power mowers over them that hack, and mutilate the delicate contours that were so patiently applied, or to allow trees and brush to grow that threatens the integrity and promotes deterioration of the mounds. Yet the caretakers of today would not plant trees in their house of worship or deface their family or church cemetery. It is with this concern to insure that these sacred sites remain for the next seven generations that the following educational guidelines are used in caring for these most sacred ancient sites.

#### Tree Maintenance

Tree removal: benefit: (1) promote light for growth of protective grass; (2) prevent tree falls and loss of integrity of mound.

Phase I. Remove all hazard dead leaning trees, decayed trees, trees with excessive branch loss.

Phase II. Remove all trees on mounds.

Phase III. Remove all trees within five feet of mounds.

Phase IV. Create an Oak savannah/White Pine grove or native grassland area.



1. Alternative: remove all low land trees that have surface roots and no taproots.

Note: 1. All cutting is done when ground is frozen to minimize ground disturbance.

2. No removal of stumps.

A new growth/suckers from stumps to be treated with herbicide, such as garlon, to limit growth of woody vegetation. Recommend painting or swabbing application method to reduce amount to herbicide used.

### **Ground Maintenance**

The best method applied by mound builders.

Natural means: Prescribe burn – setting the area to fire.

Benefit: reduces the woody plants;

          Lowers the ph;

          Promotes growth of protective grasses;

          Low cost.

Negative: not always possible due to fire hazards.

### **Mechanical**

Mowing alternatives: (1) hand mow at a high setting to minimize ground disturbance; (2) mow around the mounds regularly and push mow mounds only in early spring to promote grasses and to remove emergent seedlings.

Benefit: high grass on mounds – discourages pedestrian traffic and provides a protective cover.

Negative: labor costs.

Prepared by: Ho-Chunk Nation Heritage Preservation Department, Jay Toth, Archeologist, Randy Polema, Aquatic Biologist, and David Olson, Forestry Tech.

## WISCONSIN DEPARTMENT OF NATURAL RESOURCES BURIALS, EARTHWORKS, AND MOUNDS PRESERVATION POLICY & PLAN

*People have settled here, raised families here, worked here, and died here for thousands of years. Common people built this land, this place we call Wisconsin. They hunted mammoth along the edges of continental glaciers. They cleared the land and they raised crops. They built towns and cities. And they buried their dead ...*

The Department of Natural Resources (DNR) is the State's single largest owner of archaeological sites, historic structures, and other important cultural resources, including burial areas. The DNR *manages* these important cultural resources - physical records of our common past - on behalf of the people of Wisconsin.

Burial sites are universally considered sacred, and it is DNR policy that all such areas on DNR properties will be appropriately cared for, and will be treated with the respect they deserve.

Indian earthworks or "mounds" are by far the most conspicuous and numerous of burial features occurring within DNR properties. More mounds were built by American Indian communities in Wisconsin than in any other region of North America. Prior to EuroAmerican settlement, there may have been 15,000 to 20,000 mounds in the state - perhaps 4,000 of these remain today. The earliest mounds, dating as far back as 500 BC were round or "conical" in shape. At about AD 800, people began to build mounds in other forms as well, including linear-shaped, and "effigy" mounds made in the shape of birds, turtles, bears, panthers and other animals (more effigy mounds occur in Wisconsin than anywhere else in the world). Still later, a small number of platform or pyramidal mounds were constructed. Mounds may exist singly, or as "mound groups" of several to over 100 individual mounds, sometimes clustered as "sub-groups" within a larger group. Additionally, both Indian (prehistoric as well as historic) and non-Indian peoples (EuroAmerican settlers and others) have been buried in *non-mound* settings.

All of these sites are protected from disturbance under the State's burial sites law (Wisconsin Statutes s.157.70). An important feature of WS 157.70 stipulates that there may be no disturbance of the burial or within (a minimum of) five feet from the perimeter or base of a mound or other defined burial area. A buffer greater of 15 feet or greater is preferred, and is the DNR standard (exceptions considered in consultation with the Wisconsin Historical Society).

The DNR recognizes that it has a responsibility for the proper stewardship of all burial areas occurring on DNR properties, and has developed these standards to better care for these important places. The following standards apply to human burial sites of all forms – including non-mound burials; conical, linear, effigy and platform mounds; and other types of burial sites. This policy and standards do not apply to areas where cremated human remains have been recently deposited or dispersed. The policy and plan components apply to all DNR properties. Submerged burials require additional considerations; please consult with the Departmental Archaeologist for further guidance.

This policy and plan recognizes that the pace of implementation will reflect the availability of needed resources, including both staffing and funding. That noted, implementation of this policy is a priority for the Department, and should be realized sooner rather than later.

*For management purposes, it may be useful to think of burial areas as "preserves" which occur within a larger setting, and which have different management needs than other areas of the DNR property within which they occur.*

## DNR BURIAL SITE MAINTENANCE PLAN

### General Considerations

Each burial site is unique and should be assessed according to the condition of the burial area proper, general conditions of the site, location (including public accessibility/remoteness), and risk of damage. Features of this Burial Site Maintenance Plan can generally be applied to all burial sites (non-mound and mound), but may need tailoring to better accommodate the unique characteristics of specific burial sites.

Individual Bureaus and Property Managers should consider prioritizing which sites first need attention, and will generally be those considered to be "at risk" (e.g., due to erosion caused by pedestrian or vehicular traffic, or by natural forces), burial sites which are relatively accessible, and burial sites which occur in developed areas of State Parks and other high traffic or high profile areas.

As noted above, state law requires that there may be no disturbance of a burial or within (a minimum of) five feet from the perimeter or base of a mound or other defined burial area, and without a permit from the Director of the Wisconsin Historical Society (WHS). A **buffer** greater than fifteen feet is always preferred (as noted previously, and in consultation with WHS, fifteen feet is the DNR standard). However, *when they occur in "groups" or "sub-groups" (e.g., distinct clusters of burial features [e.g., mounds] which form a larger "group"), burial features should generally be maintained as a group or sub-group, with the buffer area extending out from a perimeter line which circumscribes the group or sub-group, rather than out from individual burial features.* Trails through such areas should be carefully planned to avoid impacts to burial features (see below also). Existing trails running through mound groups or other burial areas should be evaluated and re-routed, if necessary, to avoid adverse impacts to the burial area.

At this time, burial sites located in more remote areas and/or away from public use areas should not be signed and should remain in a more natural condition than described below – as appropriate, you may consider removing dead or diseased trees (to ground surface only – no stump removal), deadfall, brush, and small trees (≈10 inch diameter or less) occurring on or within ≈15 feet of the perimeter of defined non-mound burial sites or mound bases on such remote sites.

It may be desirable and efficient to organize **regional work teams** to implement vegetation control measures, especially for wooded areas. Development of such teams would be useful both for establishing local "experts" better able to recognize burial sites, as well as for creating capable and efficient functional units that can more expeditiously implement woody vegetation control and other maintenance measures.

The Departmental Archaeologist is available to provide training in the recognition of burial mounds and other burial sites.

### Archaeological Assessment

The first steps in the development of a maintenance plan for a mound or non-mound burial site are: (1) contact the Departmental Archaeologist to discuss the proposal and to determine if the site has been previously recorded with the Office of the State Archaeologist at the WHS; and (2) identify associated, extant records which may include detailed maps, descriptions, photographs of the burial area, and records of previous investigations. At the end of this process, copies of newly-developed, maps, photos, etc. should be provided to the Departmental Archaeologist.

After identifying and reviewing such information, it may be desirable to conduct an archaeological survey via pedestrian reconnaissance to identify extant mounds or other burial features. If one is not already available, an *accurate* map of the burial area should then be made, including (as appropriate) mound shapes, dimensions, mound-mound angle(s), presence of "spirit houses", depressions or other burial features, general condition (e.g., obvious looters pits, animal burrows, other actual/potential impacts), and relationship to nearby (relatively) prominent topographic features. DNR personnel, DNR-approved hired consultants, or DNR-approved cooperative partners may complete this mapping. Include GPS coordinates and elevations for each mound/burial feature as able (or at least first and last mounds in the group). All notes, maps and photos should include dates. *Any observed artifacts or bone materials observed at-surface should be immediately reported to the Departmental Archaeologist – do not attempt to remove them!*

### **Vegetation Assessment**

After completing the archaeological survey, conduct a vegetation assessment – if wooded, consult with the area DNR forester or plant ecologist at the outset of this assessment component. Include a description of the existing plant community, including endangered and threatened species and invasives, and a discussion of forest health (especially impacts of tree removal on mounds) if the area is wooded. Also identify the probable pre-modern vegetation, address suitable methods for restoration of the native plant community, and evaluate the sustainability of future vegetation. Note whether the use of fire is an appropriate and desirable vegetation management tool for mounds and adjacent areas.

### **Vegetation Control / Tree Removal**

Removal of trees and shrubs from mounds and immediately adjacent areas (within ≈15 feet of mound base) is generally desirable to protect them from windthrow and other damage, and to encourage growth of ground cover that helps prevent erosion. However, at some locations, selected trees may be retained for forestry purposes; when significant, unavoidable mound damage would occur during tree removal; or for other management purposes.

*During tree removal, avoid disturbing the burial site in any way. Do not drop trees on or drag them across the burial areas, drive machinery over the areas, or stage vehicles or material on them. Remove trees only when the ground is frozen. Stumps are to be left in place or cut to ground level (see below). Remove vegetative material by hauling it away or scattering or piling it at least 15 feet from the defined burial area or mound (consider trail development issues!). Ideally, volunteers must be supervised by a person with experience in the recognition of early burial sites, especially in the case of mound sites (also consult with the Departmental Archaeologist).*

**For burial areas that are overgrown with WOODY VEGETATION**, as needed (due to personnel, budget, or other constraints), scheduling of tree removal on burial sites can be done in phases (refer also to DNR "Chain Saw" policy), and would reasonably progress from more heavily visited areas to less visited areas. Using a phased approach:

**Phase I** involves the removal of trees that are dead, leaners, damaged, diseased, or insect infested; brush; trees less than ≈5 inches in diameter; herbaceous plants; and invasive species on or within ≈15 feet of a defined burial area or mound base.

**Phase II** involves removal of all trees that are less than ≈10 inches in diameter from the mounds, and the removal of all dead, down and hazardous trees on or within ≈15 feet of a defined burial area or mound base.

**Phase III** involves the removal of all remaining trees on or within ≈15 feet of a defined burial area or mound base.

**Stump removal** is prohibited; stumps may only be cut or ground only to ground level and, if needed, one should only utilize smaller equipment to grind/cut the stump, and should not penetrate below the "natural" surface and into the soil of a burial area/mound or adjacent areas (remember, per state law, there is to be no soil disturbance within at least five feet of a burial site/mound base).

**Chemical treatment** may be a necessary component of invasives and/or woody (including stumps) vegetation control. Ideally, herbicide application is selective and targeted rather than broadcast type (although broadcast spraying may be required to control or eradicate certain undesirable species).

**Grassy vegetation** (ideally no- or low-maintenance, preferably with native species) should be established to stabilize area soils and inhibit woody plant succession. Mowing and/or periodic, controlled burning may be useful in maintaining such cover (see also below).

**For burial areas covered by TURF-TYPE VEGETATION**, vegetation control typically consists of mowing, augmented, as needed, by periodic controlled burning. Be careful to AVOID having mowing equipment blades or deck "clip" or other wise cut into the burial area, especially when cutting on or over mounds. Consider that mounds do not need to be mowed with every mowing; indeed, it is desirable to not mow mounds routinely or cut the grass as short – this can help to minimize inadvertent impacts to mounds, as well as "highlight" mound shape and so make them more evident to the public (see also below). Mowing of mounds should not occur when soils are water-saturated. Hand-mowing of mounds is preferable.

## LONG TERM MAINTENANCE CONSIDERATIONS

Long term maintenance of burial areas focuses on developing and maintaining appropriate ground cover to prevent erosion and limit growth of new invasive and/or woody vegetation, and to prevent inadvertent impacts due to poor trail design or other unintentional or intentional damage. Species selection depends on soil and canopy conditions and should consist of native species commonly found in the area. Issues of public accessibility, the relative remoteness of the burial site, and the ability (or inability) to periodically monitor it must also be considered when contemplating selective revegetation. Ideally, vegetation suppression and subsequent revegetation efforts will result in an area plant mix which requires little or no routine maintenance.

All trail development proposals adjacent or proximal to burial sites on DNR properties must be reviewed by the Departmental Archaeologist prior to implementation (see also below).

Chemical treatment should be limited, but may be necessary in some circumstances, especially to control re-growth of invasives or woody vegetation. While broadcast spraying is generally discouraged on burial sites, it may be needed in order to control invasives or other undesirable species on or adjacent to burial areas.

As above, limit or avoid mowing on mounds because it can damage mound contours, cause soil compaction, result in edge diffusion, and encourage people to walk on the mounds. In some cases mowing may be necessary to promote a thick ground cover and control growth of woody plants and invasives. Mow once in the spring and once again in the fall, with the mower deck set

high to avoid ground disturbance. When mowing with a lawn tractor rather than a push mower, the use of a four wheel drive vehicle with low impact tires is recommended. An alternative to mowing mounds is to mow around them; again, this serves to highlight their shapes and reduce negative impacts. The equipment operator should be well trained and use extra caution to avoid cutting into the edges of the mounds.

In a prairie or oak savanna setting, **prescribed burns** may be conducted to control invasives and woody vegetation, as well as to enhance the growth of native plants. The use of fire will depend on local circumstances. Consult plant resource management professionals to determine if fire is appropriate and how frequently it should be used as a control measure. During burns, monitor installation of firebreaks and use of firefighting equipment to ensure that mounds are not disturbed.

## MOUND/BURIAL SITE RESTORATION

In some cases, the repair of damaged mounds or other burial areas may be appropriate, and requires consultation with a number of parties. The Departmental Archaeologist will coordinate restoration requests with the WHS, interested tribal governments, and other interested parties. A recommended general procedure is to: (1) record the nature and extent of the damage and current condition of the mound (include sketch map and photographs); (2) remove leaf litter from the damaged area; (3) lay geotextile fabric on the ground surface in the area of the damage, (4) scatter current year coins (year of restoration; nickel preferred) on the fabric to indicate the time of restoration, and (5) use hand tools to place new soil from an off-site location on the fabric to replace missing soil. The restored section will likely require seeding to inhibit erosion. Photographs should be taken once the restoration has been completed.

The "restoration" or "reconstruction" of burial sites/mounds that appear to have been completely destroyed requires similar consultation. Work may involve complete reconstruction of the site if its original location and configuration can be accurately established. *Note: even though the above-ground portion of a burial site (e.g., a "mound") may appear to be destroyed, associated sub-surface pit burials may remain intact – do not assume that a burial is completely destroyed just because the above-ground component is gone!*

Neither chalk nor lime should be applied to the ground surface to outline extant or destroyed mounds (among other things, this changes soils chemistry, and may adversely impact revegetation efforts).

## PUBLIC USE, TRAILS, SIGNS, AND FENCES

Burial/mound sites located in more **remote areas**, away from more readily monitored, higher traffic public use areas, should not be signed and should remain in a more natural condition. Such sites should not have trails built to, around, or proximal to them.

Except for maintenance, **pedestrian (or other) traffic should not be allowed on burial sites/mounds**. Do not locate signs, fence posts, picnic tables, or public events on them. For sites located in public use areas, erect signage indicating that the site is protected from disturbance by State law and, when appropriate, affirming the sacred nature of burial sites/mounds to Indian or other related communities, and directing people to stay on the trail and off the mounds or other burial site. **Signs** may also inform the public about the significance of mounds and the people who built them, and may include maps of a specific mound group or mound groups in the vicinity. Interpretive signage should be developed in consultation with the

Departmental Archaeologist, in cooperation with respective Bureau interpretive staff (e.g., for Parks, this would be the Chief Naturalist). Signs must be located a minimum of 15 feet away from the burial sites perimeter or mound base.

**Trails** may be established in the vicinity of burial sites, especially mounds, both to encourage public visitation and to direct associated traffic, but they must be located a minimum of five feet from the defined burial site perimeter or mound base (more than five feet is preferable). A trail does not need to be built to provide access to every mound in a group of mounds – too often, that kind of approach unnecessarily complicates trail design and compromises the long-term integrity of the mounds. The trunks of small diameter trees that have been removed from the burial areas/mounds may be used to mark the edges of trails. Use wood chips, shredded bark, or mowing for trail maintenance. Trail design should also take into account aesthetics, viewsheds, and erosion control; however, *avoiding impacts to the burial area is a primary consideration in any trail design proposal*. Developing trails in and around mound groups requires having an accurate map of mound(s) and mound groups!

**Fencing** may be considered to help direct and limit traffic flow, and to prevent the development of informal trails which may result in adverse burial site impacts. If needed, fencing should ideally be a "low-profile" type, such as a waist or mid-thigh high, split-rail fence. In some instances, barrier-type vegetation may be a desirable alternative or adjunct to fencing; selection of plant type(s) should be made in consultation with a DNR Forester or other plant specialist.

## APPROVALS AND RELATED ISSUES

The Departmental Archaeologist will review and approve all related signage, burial site de-vegetation, maintenance, restoration, or trail development and relocation proposals and, as indicated, will consult with interested third parties (e.g., individual families, tribal governments) when such burial areas are known to be associated with such parties.

Copies of all pertinent documentation, including maps, photos, etc., should be retained by the respective property manager, and two copies of these documents should be forwarded to the Departmental Archaeologist.

**LOWER WISCONSIN STATE RIVERWAY BOARD**  
**PROPOSED PROTOCOLS FOR**  
**CULTURAL RESOURCES PROTECTION AND PRESERVATION**  
**ON PUBLIC AND PRIVATE LANDS IN THE**  
**LOWER WISCONSIN STATE RIVERWAY**

**Introduction**

The Lower Wisconsin State Riverway (Riverway) encompasses nearly 80,000 acres along the final 92 miles of the Wisconsin River, beginning below the dam at Prairie du Sac and extending to the confluence with the Mississippi River near Prairie du Chien. The project encompasses bluffs, bottomlands, islands, sandbars, swamps, prairies and woods within the lower Wisconsin River valley. The project was created in 1989 to protect the scenic beauty and natural character of the valley, to provide a quality public use recreational area and to manage the corridor's resources for the long term benefit of the citizens of the State of Wisconsin. The Wisconsin Department of Natural Resources (WDNR) was charged with acquisition of lands within the project boundary from willing sellers, either fee title acquisition or scenic easement. Currently (April – 2006), over 46,000 acres within the project boundary are owned or controlled by WDNR.

**Cultural Resources**

The Riverway and surrounding lands contain an abundance of archeological and historical resources, many of which are located on state owned or managed lands. These resources include rock art, earthworks (effigy, conical and linear mounds), Native American habitation sites and agricultural fields, historic sites associated with Euro-Yankee exploration (missionaries, fur traders, etc.) as well as post-settlement farmsteads, cemeteries and ghost towns.

Of special note, the Riverway contains a high concentration of effigy mounds and numerous conical and linear mounds. The Town of Eagle, Richland County, is believed to have the highest concentration of bird forms (thunderbird, eagle, hawk, falcon, etc.) within the effigy mound region. Due to the mapping and surveying of earthworks by T.H. Lewis, C.E. Brown, S. Taylor and others in the mid to late 19<sup>th</sup> century and early 20<sup>th</sup> century, the previous existence of thousands of mounds is known. As we view the landscape in the early 21<sup>st</sup> century, there remain mounds in the Riverway but the once rich tapestry of tumuli that covered the prairies and hills has dwindled substantially and the extant earthworks created by the hand of a once thriving culture over 1000 years ago now are numbered in the dozens. Some of these mounds are on privately owned lands, some are on tribal lands and many are located on public lands. The Ho-Chunk Nation has stated that the effigy mound builders were their ancestors and the mound sites are sacred. The religious or spiritual aspects of these sites to the Ho-Chunk Nation and other Native Americans are important considerations in any discussion of protection or preservation.

With land ownership, there is an ethical responsibility for proper stewardship and, in the case of known archeological or historical sites; the burden of responsibility for stewardship is greater to assure proper protection of these unique features. The State of Wisconsin should be a leader in protecting and preserving these sites and should offer a model for other units of government and private citizens to emulate. Therefore, the following maintenance protocol is provided as a general guideline for proper stewardship of archeological sites containing effigy, conical and/or linear mounds.



## MOUNDS MAINTENANCE PROTOCOL

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### Site Assessment

A comprehensive site assessment is required at each site to evaluate the existing plant community and opportunity for restoration of the native plant community, to determine the conditions of the mounds, to determine the need for mapping, and to assess risks to the mounds. The assessment will identify those features which render each site unique and will influence the maintenance regimen selected.

#### Vegetative Survey

An initial survey of trees, shrubs and herbaceous is required to create an inventory to be used in management decisions. Notations should be made regarding listed species. An assessment of native plant community relicts should be recorded and an evaluation of the treatment necessary to restore the native plant community should be detailed. Tree canopy and ground cover should be noted. Comments regarding tree species and potential for adverse impact from disease or insect infestation should be included. The potential for use of fire at the site should be recorded. Following implementation of Phases I-III at the site, which may include the use of fire, another survey should be conducted to evaluate the response of the native plant community at the site.

#### Archeological Survey

An archeological survey of the site should be conducted both before and after phased work is implemented. At minimum, the number and type of mounds should be recorded and surface observations should be conducted. The condition of the mounds should be noted, such as whether the edges are well-defined or diffuse and whether the mounds are well-preserved or have been damaged. An additional walk through the site should be conducted following extensive tree removal or introduction of fire to the site. Artifacts found should be left at the site and not moved and should be reported to the DNR archeologist or Wisconsin Historical Society. **Artifacts may not be removed from the site!**

#### Mapping

While adequate maps of some mound groups are available, the vast majority of mound groups require mapping. New technologies are available that would enhance existing maps. Global Positioning System (GPS) coordinates for the mounds should be taken. Mapping is important to assure an accurate record of the site is maintained. Site assessment should include notations regarding proximity to water features, proximity to roads and other notable features of the site.

Mapping of sites on state owned lands also is important for fire control personnel. Heavy equipment operating in thick smoke or under night conditions may have difficulty seeing a mound or mound group. GPS coordinates for mounds will assist fire control personnel in avoiding disturbance of important cultural resources when engaged in firefighting.

Cooperative efforts between federal and state agencies, local units of government, the university or technical school system, the Ho-Chunk Nation or other tribal entities, or 501c(3) organizations should be encouraged. Funding for mapping of mound sites should be sought through agency budgets, local governmental budgets, grant resources and private donations.

## **MOUNDS MAINTENANCE PROTOCOL**

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### **Risk Assessment**

Each mound site should be assessed for inherent risks. Notations should be recorded regarding potential threats to the mound(s) from erosion (destabilized river banks, encroaching gullies); proximity to residential/commercial/industrial development, roads, agriculture, pedestrian or bicycle trails, playgrounds and parks; non-native invasive species and tree species of concern due to disease or insects. For example, property managers may wish to evaluate the number of ash trees at a site due to the potential for infestation by the emerald ash borer and the subsequent treatment recommended for infested areas (removal of all ash trees within ½ mile and removal of stumps and roots). Removal of all ash trees from the mounds or within 5 feet of the mounds may be considered a priority in areas where EAB infestation is incipient. Other species may come with a different suite of potential calamitous diseases or insect problems (Dutch elm, gypsy moth, oak wilt, etc.) Mounds associated with a "high risk" for damage should receive immediate attention to assure protection and preservation.

### **Mounds maintenance: A Phased Approach**

The phased approach to mounds maintenance in the Riverway was developed by the Ho-Chunk Nation and Lower Wisconsin State Riverway Board (LWSRB) in regard to a project to maintain the mound group identified as McClary #4 in the Town of Eagle, Richland County. The site was purchased by the Ho-Chunk Nation in 1994. Because the site is located within the Riverway boundary, a permit for vegetative removal from the LWSRB was required. The phased approach was developed in order to assess visual impacts when viewed from the river, as required by the Riverway law. The Ho-Chunk Nation successfully has implemented Phases I & II and is in the process of implementing Phase III. The phased approach (Phases I/II) has been utilized at state owned sites in the Riverway including the Dingman, Hamilton, Jonas and Bloyer mound groups. (NOTE: An LWSRB permit is required for maintenance of a known archeological site pursuant to RB 2.06, Wisconsin Administrative Code.)

The phased approach is designed for sites that have not been managed or maintained and are generally overgrown with trees and/or woody vegetation. Activities should occur when the ground is frozen or dry and the leaves are off the deciduous trees. Frozen ground conditions are preferred. Ground disturbance should be minimized at all times. (NOTE: Each mound or mound group is unique and should be assessed according to the condition of the mound(s), condition of the site and risk of damage.)

#### **Phase I**

Phase I involves removal of dead or down trees, trees which represent an imminent hazard to the mounds (leaners in danger of uprooting, storm damaged, diseased or insect infested), woody vegetation - trees and brush less than 5" diameter at breast height (DBH) - and non-native invasive species. Healthy trees larger than 5" DBH remain. Material should be taken off the mounds and scattered or piled 25 feet or more from the mound wherever possible. A minimum of 15 feet should be maintained between brush piles and the mound. Pole size material may be utilized for trail demarcation or material may be chipped and used on trails. In some cases, material may be removed and transported to a compost area or burn pile.

## **MOUNDS MAINTENANCE PROTOCOL**

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### **Phase II**

Phase II involves removal of all trees <14" DBH from the mound as well as continuing with brush removal efforts. Within 5 feet of the mound, all dead, down and hazard trees are removed.

### **Phase III**

Phase III involves removal of all trees, healthy or not and regardless of size, from the mound and from within 5 feet of the mound.

### **Phase IV**

Phase IV represents the long term maintenance of the site including establishment of appropriate ground cover to prevent or minimize erosion. Control of woody vegetation continues. Where feasible, restoration of the native plant community is encouraged. Seed should be collected from the adjacent area. Local genotype seed also may be purchased and planted. Ideally, seed would be hand broadcast planted following a fall prescribed burn. Attention should be paid to species selection when considering trees to be retained at a site in regard to long term canopy cover, suitability for the site, susceptibility to disease and/or insect infestation and longevity. Stump removal, if done at all, should only utilize small equipment to grind the stump and should not penetrate the soil of the mound.

## **Mounds maintenance: Other considerations**

### **Mowing**

Mowing should be limited or avoided. The use of native plants to establish ground cover is preferred. In some cases, occasional mowing may be appropriate. Where mowing does occur, the mower deck should be set at a high level to avoid ground disturbance, enhance vegetative growth and avoid erosion. Hand mowing (push mower) or mechanical mowing (lawn tractors) should be evaluated carefully. Compaction and exacerbation of edge diffusion should be avoided. If lawn tractors are used, 4WD or AWD vehicles with low impact tires are recommended to minimize compaction and ground disturbance. An alternative to mowing over the mounds is to mow around the mounds, preferably, maintaining a minimum 5-foot buffer area. Careful consideration should be given to mowing around the mounds to avoid ground disturbance and adverse impact to the mound edges. Any equipment operator should be trained thoroughly and should have extensive knowledge of the equipment being used at the site. An alternative to mowing is to use a hand held motorized brush cutter. As with any activity related to mounds maintenance, assessment of soil conditions is critical. Again, activities should only occur when the ground is frozen or dry to avoid compaction.

## MOUNDS MAINTENANCE PROTOCOL

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### Burning

The use of fire to control woody vegetation and to enhance the native plant community in a prairie or savanna ecosystem is a viable tool for the property manager. The use of fire as a tool should be made on an individual site basis. While restoration of the native plant community at each mound site is the ultimate goal, other factors may preclude the restoration effort, including the re-introduction of fire. Surveys of the site should be conducted prior to burning to assess the native plant community and to determine if artifacts are present on the surface. Additional surveys should be conducted following the controlled burning to look for artifacts and to determine the response of the native plant community to fire. The frequency of fire at a site should be determined following consultation with appropriate resource management professionals. Installation of firebreaks and use of firefighting equipment at a site should be carefully monitored.

### Chemicals

The use of chemical treatments to control woody vegetation or non-native invasive species should be limited but may be required in some circumstances. Removal of woody vegetation by hand, both initially and on a routine maintenance basis, is preferred. However, herbicide use may be required to control some species. The use of chemicals is an important decision for a site. The type of herbicide used is a critical component of the decision making process as is the application. In general, stump treatment of trees or woody vegetation with a small brush is preferred. Again, generally speaking, the broadcasting of chemicals is discouraged. A distinction should be made between chemical use on the mounds versus chemical use on the land adjacent to the mounds.

### Trails

Pedestrian traffic should not be allowed on the mounds! Trails should be established at those sites where public visitation either is likely or is encouraged. Trails should be located 10 feet or more from the mound where possible (a minimum of 5 feet). Small trees and large brush stems that have been removed from the mounds in phase I or II successfully have been used for trail demarcation. The use of wood chips, shredded bark or mowing may be considered for trail maintenance. Location and design of trails should consider proximity to mounds, aesthetics, viewsheds and erosion control.

### Signage

Signage at mound sites should be minimized but efforts should be made to educate and inform the public about the significance of the site and the people who constructed the earthworks. Maps of the mounds at specific sites or in a general context of other mound groups in the vicinity may be useful. A generic sign for selected sites that describes the effigy mound building culture and the types of mounds (effigy, linear or conical) may be appropriate. Affirmation of the sacred nature of the site to Native American peoples should be included in the signage. A strong statement about staying off the mounds and information on the burial sites preservation law should be included. Site specific signage should include a map of the site and information regarding the unique features of the site. In some circumstances, brochures or small maps could be provided to visitors.

## **MOUNDS MAINTENANCE PROTOCOL**

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### **Repair of damaged mounds**

Where appropriate, repair of mounds damaged by post Euro-Yankee settlement activities and/or natural causes may be considered. Coordination with the Wisconsin Historical Society (WHS), WDNR archeologist and Ho-Chunk Nation is required.

At the Dingman mound group in the Town of Eagle, Richland County, repair of three conical mounds was accomplished in May of 2005. The mounds were damaged by looters at an unknown point in time within the previous 150 years. Permission to execute the repairs was secured from the WHS, WDNR and Ho-Chunk Nation. The project was undertaken with supervision from the WDNR archeologist. Leaf litter was removed from the damaged area. Geotextile fabric was placed in the excavated area to present a barrier from the original soil and the new soil. Coins minted in 2005 (in this case, buffalo nickels) were placed on the fabric at points throughout the bottom of the disturbed area to indicate the time of introduction of the new soil. Soil was then placed in the damaged area by hand (bucket by bucket) until the mound was restored. The soil was obtained off-site to provide distinction between the original soils and the newly introduced soil. Ground cover was quickly established during the late spring and summer months. No erosion was evident during periodic monitoring. Significant canopy cover was present which may have assisted with erosion control during the time immediately following repairs.

### **Restoration of destroyed mounds**

Restoration of destroyed mounds (as opposed to repair of damaged mounds) should be discussed with WHS, the DNR archeologist, the Ho-Chunk Nation and other interested tribal governments. In some locations, establishment of chalk or lime outlines of destroyed mounds may enhance educational opportunities. In other cases, the actual reconstruction of a destroyed mound may be appropriate. Restoration of the Panther Spirit Mound near Mauston involved cooperative efforts by the Ho-Chunk Nation and students from the Mauston School District.

### **Volunteers**

Volunteers often are enlisted to assist with mounds maintenance activities, monitoring and education. In the Riverway, volunteer groups have provided hundreds of labor hours to protect significant archeological sites on state owned lands. Two prominent groups include Cultural Landscape Legacies, Inc. (CLL) and the Friends of the Lower Wisconsin (FLOW). CLL & FLOW volunteers provided equipment and labor to remove brush and trees and create trails at sites near Muscoda. In addition, one building was razed utilizing the CLL and FLOW labor force.

Volunteers require supervision and instruction. CLL has used the opportunity for education and sets aside time for volunteers to be instructed on the sanctity of the mounds to Native Americans and to discuss the effigy mound building culture. Use of volunteers requires a qualified team leader, either a person with an archeological/anthropological background or with experience in maintenance of archeological sites. The use of equipment by volunteers should be monitored closely. While well-meaning, most volunteers are not "expert" operators of mechanical equipment. Persons using chainsaws or mechanical brush cutters should have appropriate safety equipment and the number of persons using mechanical equipment should be limited to avoid safety issues.

## MOUNDS MAINTENANCE PROTOCOL

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### Conclusions

State officials and private landowners both have a tremendous responsibility to properly maintain the known archeological sites on lands within or adjacent to the Riverway (and elsewhere). The Lower Wisconsin State Riverway Board and Cultural Landscape Legacies recognized a unique opportunity exists to create a model of mound protection to be emulated statewide by other governmental units and by private landowners. This document is a result of efforts spearheaded by Riverway Board staff with the cooperation of many people on the mounds maintenance protocol committee.

The Riverway Board and Cultural Landscape Legacies also recognizes great potential exists for education of the general public on the mound building culture, the sacred aspects of the mounds and the importance of the mounds to contemporary Native Americans, including the Ho-Chunk Nation. A synergistic approach to the mounds protection and preservation effort with involvement of federal and state agencies, local governments, the educational system, tribal governments, nonprofit organizations and private landowners could result in a truly magnificent outcome, not only for the current generation but also for future generations.

*Proposal prepared by  
Mark E. Cupp, Executive Director  
Lower Wisconsin State Riverway Board  
Final revisions completed April 20, 2006*

Contact information: Mark Cupp  
P.O. Box 187  
Muscodia, WI 53573  
(608) 739-3188 or 1-800-221-3792  
[Mark.Cupp@wisconsin.gov](mailto:Mark.Cupp@wisconsin.gov)  
[www.lwr.state.wi.us](http://www.lwr.state.wi.us)  
[www.clfi.org](http://www.clfi.org)

Original draft and revisions reviewed by the Lower Wisconsin State Riverway  
Mound Maintenance Protocol Ad Hoc Committee (membership list attached)

**LOWER WISCONSIN STATE RIVERWAY  
MOUNDS MAINTENANCE PROTOCOL AD HOC COMMITTEE**

LOWER WISCONSIN STATE RIVERWAY BOARD

Mark Cupp, Executive Director

CULTURAL LANDSCAPE LEGACIES, INC.

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Frank Shadewald, Member & private landowner

HO-CHUNK NATION

Jay Toth, HCN Archeologist

NATIONAL PARK SERVICE  
EFFIGY MOUNDS NATIONAL MONUMENT

Tom Sinclair, Facilities Manager

NATURAL RESOURCES CONSERVATION SERVICE

Sam Skemp, District Conservationist  
Greg Yakle, District Conservationist &  
Ho-Chunk Liaison

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Steve Colden, DNR Riverway Manager  
Victoria Dirst, DNR Archeologist  
Brad Hutnik, DNR Riverway Forester  
Mark Martin, DNR Conservation Biologist  
Maggie Haas, Riverway LTE Forester  
Jacob Elder, Riverway LTE Forester

# Indian Mounds



Large Flat-Topped Mounds in Cultivated Field

## What Are Indian Mounds?

Indian mounds are the visible testament of the first Mississippians. Mounds are planned earthen architecture made by Native American people for a variety of reasons including ceremonial and domestic uses.

Many people today believe that any elevated area with artifacts is an Indian mound, but actual mounds only make up a small fraction of the known archaeological sites in Mississippi.

## How Were Mounds Made?

Construction of mounds was accomplished by heaping basket loads of soil and other materials onto natural land surfaces. Some mounds were built in multiple construction stages over long periods of time and others were built quickly in single episodes.

## Where Are Mounds Found?

Mounds are found in nearly every county in Mississippi, but they are most common in the Delta counties and along major waterways. Mounds tend to be located on high natural levees or on terraces adjacent to floodplains, but can also be found in upland areas—especially in the Loess Bluffs region.

Nearly all mounds are located on private land. Therefore, landowner cooperation is crucial for their long-term preservation.

## How Old are Mounds?

Indians first built mounds in the Lower Mississippi Valley by about 4000 B.C. Widespread construction of mounds, however, began around 100 B.C. Mounds continued to be built for another 1,800 years until around A.D. 1700.

## Characteristics:

- ◆ Conical Mounds
  - Rounded top
  - Usually small 3-10 feet tall
  - 50-100 feet diameter
  - Burial often primary purpose
  - Built during most time periods
- ◆ Rectangular Platform Mounds
  - Flat-topped pyramid
  - Often large, 15-60 feet tall
  - covering 0.1 to several acres
  - Platform for buildings
  - primary purpose
  - Often burial location of important individuals
  - 100 B.C.—A.D. 1700
- ◆ Mounds can stand alone or be in groups of 20 or more.
- ◆ Mounds can be associated with large villages, or have little evidence of habitation.
- ◆ About 1,100 mound sites are recorded in Mississippi. (There are about 26,000 archaeological sites.)



Conical Mound in Grass Cover



Cultural Resources Fact Sheet 2  
Cliff Jenkins, Cultural Resources Specialist



### How Were Mounds Used?

The purpose of some of the most ancient mounds is still shrouded in mystery, although it has been proposed that they possibly functioned as territorial markers.

People buried their dead in some of the mounds, while at other sites great temples were built atop the mounds.

The shape and size of the mound can give clues to its intended purpose. Conical mounds were frequently constructed primarily for mortuary purposes. Rectangular, flat-topped mounds were primarily built as a platform for a building such as a temple or residence for a chief. Many later mounds were used to bury important people.

Mounds are often believed to have been used to escape flooding. However, mounds are typically located on high natural levees or terraces above the flood plains, and many mounds were constructed in upland areas where flooding would not be a concern.

### Why Are Mounds Important?

Mounds are irreplaceable resources. Indian mounds and the archaeological deposits they contain are the only evidence we have for most of Mississippi's human history.

Each mound has a story to tell. Careful archaeological investigations at mounds provide valuable information about how people lived in the past.

Mounds provide many Native American people today with an important link to their culture and their past. Mounds that contain burials are particularly significant.

### Threats To Mounds

Development spreading into rural areas and some agricultural practices are the main threats to mounds. Deliberate destruction by looting is also a serious problem.

However, a lack of awareness is perhaps the most serious threat to the survival of many mounds. Because mounds lack the visual impact of other historic monuments, such as the cliff dwellings in the Southwest or antebellum homes, many people are unaware of why they are important.

### Are Indian Mounds Protected?

Protection of Indian mounds in Mississippi primarily relies on voluntary stewardship. State burial laws do provide some protection for mounds on private land by making it illegal to desecrate a cemetery or open graves.

Mounds on State and Federal property are protected by a number of laws and regulations. Severe penalties are imposed for illegal digging or removal of artifacts on public lands.



Destruction of the Blaine Mound, Hinds County

### Best Management Practices

Effective resource management comes from understanding the values of the mounds and ensuring that any decision tries to balance the effects of any management action so that negative effects are minimized and positive effects are maximized.

### Some recommended Best Management Practices for mounds:

- Document mounds located on your property in the State Archaeological Site File.
- Check the mound condition on a regular basis, and take action to stop destabilizing actions such as erosion.
- Contact professionals for help in dealing with your mound.
- Avoid ground disturbing activities and frequent traffic (pedestrian, vehicles and livestock) on mounds.
- Remove mounds from cultivation. Consider establishing permanent grass cover on the mound, and create a 30 foot buffer zone around the base of the mound.
- Mounds with tree cover: The possibility of wind thrown trees is a potential concern. Overturned trees can pull up large chunks of soil with the root system causing damage to cultural deposits. Root penetration of trees and scrub can also have a significant impact on archaeological deposits. However, removal of long established trees can be more detrimental to the mound than maintaining the existing cover.
  - Clear small underbrush from mounds. As needed, removal and reduction of scrub growth should be carried out with hand tools during the winter and concentrate on scrub with stems over 1 inch in diameter cutting as near the base as possible.
  - Scrub growth and brush piles can also attract burrowing animals which damage cultural deposits.

### For more information contact:

Cultural Resources Specialist  
Natural Resources Conservation Service  
McCoy Federal Building, Suite 1321  
100 W. Capitol Street  
Jackson, MS 39269  
(601)965-4139  
[www.ms.nrcs.usda.gov](http://www.ms.nrcs.usda.gov)



## Fact Sheet

### How Trees Benefit Mounds

This document is a summary of research on the relationship of trees and mounds. The information was compiled to provide information for the Village of McFarland policy on preservation and maintenance of mounds in the village.

**Trees Provide Erosion Protection** - The book Native American Mounds in Madison and Dane County makes the following statement regarding the mounds built by the Woodland mound builders in McFarland's Indian Mound Conservancy: "Situated on the ridge of a glacial drumlin, this group overlooks Lake Waubesa and Mud Lake to the west and south ...**These mounds are in very good condition...**". (Birmingham and Rankin, 1994)

This is consistent with a 1998 assessment of earthworks in the United Kingdom that states: "Many sites now under grass cover have been wooded at some stage in their land management history and they have better overall surface condition from this stabilizing cover of former woodland. Today we admire the condition of a particular earthwork but fail to recognize that this is historically due to a former woodland". (Jones, 1998)

Rain is one of the most efficient causal forces of erosion. Several studies have looked at the kinetic forces of rain drops and how they can physically dislodge soil particles (Evans, 1980; Imeson, 1984; Allen, 1991; Tamm, 1991). When rainfall occurs on a slope, a downward movement of any exposed soil particles will result, producing a slow but steady form of erosion. (Evans, 1980)

A woodland canopy with its increased evapotranspiration and interception, reduces the quantity of rainfall that reaches the soil compared with open ground or grassland. Where rain does reach the forest soil it has a reduced kinetic energy resulting from impacts with vegetation on its way through the canopy, and understory thus minimizing any soil movements from rain splash. (Wilson and Cooke, 1980)

The removal of trees from raised earthworks such as banks or burial mounds can have an adverse effect on the stability of the remaining soil. Soil consists of particles capable of moving past each other and allowing larger scale migration, especially on slopes. Shear strength is a function of the friction created between adjacent particles. A wet soil will have an increased volume that expands the spaces between particles thus reducing their friction and the soil shear strength (Biddle, 1998). The presence of roots within soil significantly increases its resistance to shearing (Waldron and Dakessian, 1981) by providing a lattice to support it. [Note: A good example of this is on the linear mound just south of the Bear Mound. The trail is cutting into the west end of the mound. The roots from two trees are helping minimize the damage by keeping the trail from cutting further into the mound.]

**Adverse Impacts of Tree Removal** - A US Dept of Agriculture – National Resource Conservation Service publication states: "The possibly of wind thrown trees is a concern. However, **removal of long established trees can be more detrimental to the mound than maintaining the existing cover.**" [www.ms.nrcs.usda.gov/technical/IndianMounds\\_2.pdf](http://www.ms.nrcs.usda.gov/technical/IndianMounds_2.pdf)

The author of the NRCS publication indicates that the physical process of removing long established trees causes substantial damage to the mounds and the surrounding environment. In addition to rutting which is very visible, soil compaction is a common problem. (Cliff Jenkins, 2010). This is consistent with damage that occurred in Indian Mound Conservation Park during some tree removal associated with oak wilt in 2005 and again in January 2010.

While the SHS does indicate that "Removal of trees from mounds and immediately adjacent areas is **generally desirable** to protect them from windthrow" ... At the same time, the SHS recognizes the potential risks associated with tree removal when it states: "However, at some locations, **selected trees may be retained ... when significant, unavoidable mound damage would occur during tree removal ...**"

Where the decision has been made to remove trees from sensitive sites, they are usually felled and the stumps left in the ground to rot, thus minimizing below ground disturbance. Tree removal and subsequent root death on a sloping soil ... may lead to a higher risk of soil erosion. Once a root has decayed, voids may be left within the soil. Water can drain through these channels and the surrounding soil will creep in from the sides. (Richardson, 1995; Biddle, 1998)

**Mitigating windthrow risk:** The Wisconsin State Historical Society risk assessment of the mounds in Indian Mound Conservancy states "all of the trees growing on the mounds seem to be healthy and not in immediate danger of tipping over."

While the SHS risk assessment indicates there is no immediate danger, there are ways to further minimize windthrow risks. Jones (1998) suggested that "the use of species that favor a more vertical root system, such as oak, may be beneficial in the stabilization of earth banks". Research conducted after a major storm in England in 1987 states: "Trees with a tap root (e.g. oaks) have a strong main root that descends vertically from the underside of the trunk. Tap root trees are much less susceptible to windthrow". Of the 4511 wind thrown trees surveyed, only 2.4 % were found to have tap roots (Cutler, Gasson and Farmer 1990).

This is consistent with the published Ho Chunk protocol on mound maintenance (p. 33 of the draft policy) which states that as an alternative to removing all trees: "remove all low land trees that have surface roots".

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**Subject:** FW: Village of McFarland - Policy for mound preservation and maintenance.

Hi Sayer,

I have now looked over the documents sent. Sorry for the delay – we’re right smack dab in the middle of our tribal budget work, as well as two grants we’re working to fulfill before spring.

Let’s see, I would consider the following when you begin to revisit these documents in earnest:

POLICY FOR PRESERVATION AND MAINTENANCE OF MCFARLAND’S INDIAN MOUNDS

- Try to eliminate the term “Indian” from the document
  - You can use terms such as, indigenous, native american, etc. if possible. Some federal regulations utilize the term indian though, so you’d want to conform to the prevailing terminology being discussed
  - The term indian mound could be re-termed burial mound (in accordance to 157.70) in some of the instances it is used
- The cultural importance should extend to all of us, as they are part of all of our history within the auspices of the four lakes region
- Increasing mound buffer sizes
  - Wisc. Stat. 157.70 increased the states recognized soil disturbance buffer area from 5’ to 10’
  - As land managers, I would want to increase the protection and preservation buffer to 25’ for the soil disturbance, tree & vegetation management processes
    - I believe the WHS asks for this as a consideration
- Review the ongoing documentation of the various phases of implementation
  - Review the changes to the management plan that were based off the initial implementation
- Place within the policy, the request to meet onsite with both the State Archaeologist & Ho-Chunk Nation THPO
  - Do a walk-through to discuss better administrative practices that can be instilled within the next review phase of the implemented plan
    - Create a 5 year revisit to the various documents
- Review the Photographic History of each mound
  - Share this information with both the State and HCN
- Instill an educational outreach program for the local community(s)
  - Create a “Friends of McFarland Burial Mounds” buy-in
  - Work with the Village School Programs to assist in various field activities
- Begin to focus on the fact; burial mound sites are in essence large mortuaries & sacred sites that carry much history and connection to that specific site (Compare to Arlington Cemetery), and that they are much more than just conservancy/park space
  - Land use should be viewed as Religious/Sacred/Cemetery sites first and foremost
- Include lidar imagery for each mound group
- I don’t agree with some of the Lower Wisconsin State Riverway Board policies for mound maintenance/management. We can discuss at a later date though

MOUNDS TREE INVENTORY

- I’d be interested in seeing the results from the work completed regarding the tree removals, along with the adjustment of the management of the mounds, buffer areas and other environmentals effected by this work.
  - If there’s been a file created to assist the management needs for the four mound sites, who would have this
- Was there a need to address the stumps left
  - Did sucker/volunteer trees begin to grow from the stumps, or were they treated
- What steps were taken to adjust for the woody material and invasive plants that come afterwards
  - Mowing, herbicides, hand removal, spring burns

## MOUNDS VEGETATION ASSESSMENT

- Was there going to be an ongoing process of development that directs what is being followed that can be adjusted for effects of the work needed
  - I didn't see too much information about the remnant prairie plant seed base, and what mixtures should be considered, that would assist the remnant source
  - I don't think I seen anything written regarding burrowing animal protocols on and around the mounds
- Will the vegetation on and around the mounds be mechanical and/or hand mowed – this is something that requires a firm understanding on soil disturbance protocols
- Is there the possibility of creating Programmatic Agreements with volunteer/interest groups to assume certain management/maintenance responsibilities
- How did tree management work effect the vegetation management protocols, and were there needed adjustments when the tree canopy was adjusted by the plans
  - Tree cutting distance from mounds for the tree management & vegetation management are different it seems – how did this become resolved

Of course these are only my thoughts on the matter, as I am sure there's a lot of administrative allowances being taking to address the maintenance and management of these sites that can be codified into the updated documents during the revisit of these.

I'll be anxious to come visit the sites with you folks soon now, as spring is just around the corner it seems. If it'd help some, we also manage mound sites and we could always meet onsite of one of these to talk shop on how to make it work more effectively, efficiently as well as educationally.

Again, I apologize for the late response. I hope this finds you all in good spirits.

Best regards,

Bill Quackenbush  
Tribal Historic Preservation Officer  
Cultural Resources Division Manager  
Ho-Chunk Nation of Wisconsin  
(715) 284-7181 Ext. 11121  
[Bill.Quackenbush@ho-chunk.com](mailto:Bill.Quackenbush@ho-chunk.com)



**McFarland**  
**SUMMARY SHEET**

**MEETING DATE:** Monday, November 13, 2023

**SECTION:** Business

**DEPARTMENT:** Public Works

**CONTACT:** Sayer Larson, Parks Superintendent

**AGENDA ITEM:** Presentation and discussion of the draft Urban Forestry Management Plan

**PREVIOUS ACTION:**

None.

**ISSUE SUMMARY:**

Great Lakes Urban Forestry Management was contracted for urban forestry management planning services for the Village in 2023. The project scope included items such as:

- Conduct an analysis of the 2022 tree inventory
- Projection of long-term species composition
- Specific long-term goals for all aspects of forestry production (planting, removals, pruning, etc.)
- Long-term budget projections
- Tree risk assessment policy creation
- Review, editing recommendations, and updating of existing forestry ordinances and operating procedures
- Storm response plan
- Creation of goals for the Villages project team for how the Urban Forest can be best managed to benefit the community
- Create a final management plan and present it to SNR Committee and Village Board

Steve Lane, Principal - Director of Urban Forestry Operations, will present an overview of the draft urban forestry management plan. The draft management plan is attached for review.

**FINANCIAL/BUDGET IMPACT:**

The Village has a contract to develop an urban forestry management plan with Great Lakes Urban Forestry Management. The cost of the plan is \$8,000, of which 50% will be funded by the 2023 Wi DNR Urban Forestry Grant.

**VILLAGE PLAN REFERENCE:**

None

**ORDINANCE REFERENCE:**

Tree related ordinances occur in Chapter 59 Article 59-II Trees and Shrubs.

**BOARD, COMMISSION OR COMMITTEE RECOMMENDATION:**



No action in this item at this time.

**ATTACHMENTS:**

1. Draft Urban Forestry Management Plan

## **OVERVIEW OF MCFARLAND'S URBAN FOREST MANAGEMENT PLAN**

McFarland, Wisconsin currently manages 3,452 trees throughout its Village terraces and rights of way, Village parks, on other Village-owned properties. There are also an estimated 750 open planting spaces on McFarland terraces and ROWs which represents significant potential for growth of the Urban Forest resource. The Village's trees were inventoried by a Forestry Consultant in 2022 and that data was used to construct this Urban Forestry Management Plan which will detail how these trees will be managed for the benefit of the Village of McFarland over the next 20 years, with a focus which begins in 2024, and projects out to 2044. This plan is intended to provide guidance to forestry staff as well as the Sustainability and Natural Resources Committee. It is also designed to increase public awareness and knowledge of the Village's urban forestry activities on terraces, ROWs, and other publicly owned and managed land in the Village of McFarland.

In terms of the condition of the Urban Forest in McFarland, there are both strengths and opportunities for improvement. One strength is the fact that there are 91 species represented which is good diversity for a municipal tree population of McFarland's size. The Maple genus, however, makes up over 22% of the population which is quite high, and this statistic certainly leaves much room for improvement. The overall condition of the population as a whole can be characterized as vigorous, with 96% of the Village's 3,452 trees falling into a condition category of average or better and this presents another strength. Also, the current budget being applied towards forestry management should likely be larger. At approximately \$55,000 per year, not including salaries/in-house labor, this is enough to fulfill basic needs, even a modest increase in budget would allow McFarland to accomplish much more.

In order to enhance the Urban Forestry program so it will create long term benefits to the community while reducing costs, the following Urban Forest Management Plan will address each one of these strengths and challenges and create goals and milestones for each. Below is a broad view of the direct goals to come in the 2024-2044 period. Further detail is given in the body of the Plan, with separate sections detailing specific Urban Forestry activities, and how we propose they are achieved, along with standards and Best Management Practices for each.

An urban forestry program has been created in this Plan which attempts to achieve the greatest benefit for the community, based on the available data we have from the inventory, as well as input from stakeholders and residents of the Village of McFarland.

However, all plans are subject to change based on new information, budgets, or other unforeseen circumstances. For this reason, it is asked that readers consider that this plan is to be an evolving document, and goals and strategies will be updated to fit new circumstances as needed.

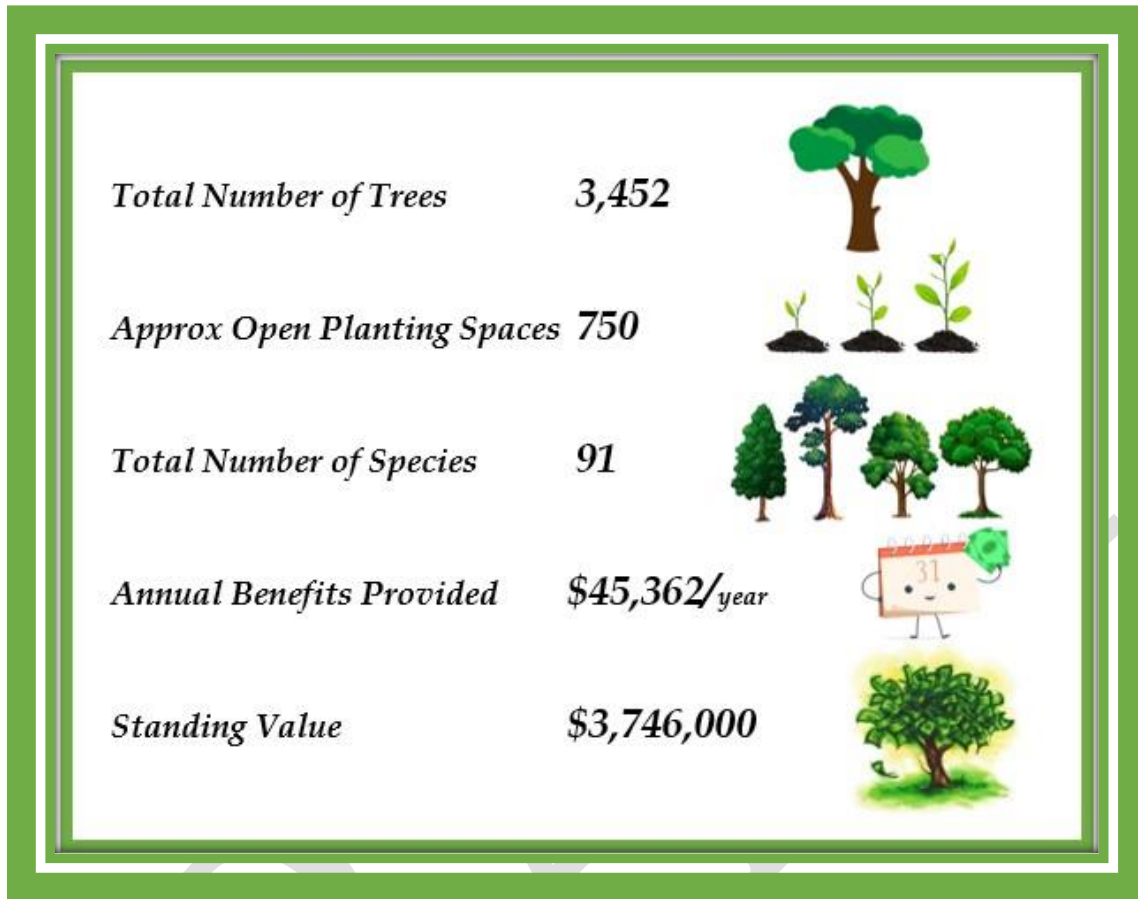
This Plan should be reviewed periodically, at which point the Village, its Sustainability and Natural Resources Committee, and its residents, business owners, and other stakeholders will have an opportunity to provide input and help improve the Plan during those periodic reviews. These strategies and goals are not absolute, but rather serve as guideposts to mark the road to success.



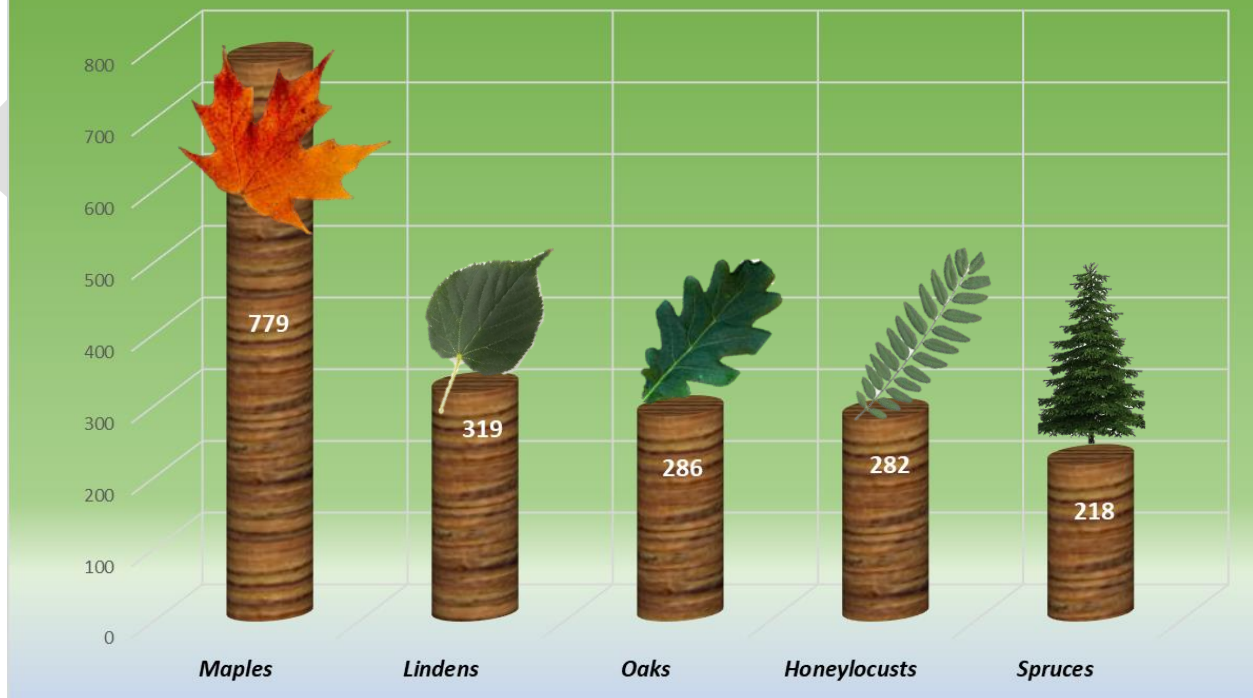
## MISSION STATEMENT

*It shall be the mission of this Urban Forest Management Plan to outline goals, budgets, and Arboricultural Best Management Practices for the management of the Urban Forest in the Village of McFarland, Wisconsin to increase canopy cover, maximize the benefits trees provide while minimizing cost, mitigate against climate change, and create a program to manage the Urban Forest Resource for the greatest public good in a manner that is both financially and programmatically sustainable, while maintaining flexibility for future adaptive management.*

**MCFARLAND'S URBAN FOREST: AT A GLANCE...**



***Top 5 Types of Trees in McFarland***



## **DIRECT GOALS**

Listed below are the direct goals of this Urban Forest Management Plan (herein referred to as “UFMP”, or “the Plan”), as well as a brief discussion of how they shall be met. Direct goals are those which this plan addresses very explicitly in describing pruning, removal, planting, and other activities. Every attempt was made to make these goals realistic and achievable, so they do not place an undue burden on the Village of McFarland, its residents, or its resources. Instead, the direct goals of this UFMP are to save money and provide greater benefits over time through proactive, as opposed to reactive, management. The Plan is also meant to be adaptive: New concepts, the introduction of new pests or pathogens, or changing climate (both social and meteorological) may all change the way the Urban Forest is viewed.

The Plan is intended to be reviewed periodically by the McFarland Village Board, its Sustainability and Natural Resources Committee (SNRC), and any other stakeholders. The review process should include evaluation of progress made towards these goals. Goals may be altered after the review, as conditions warrant. This UFMP is written with the understanding that organizations, stakeholders, and residents change over time, and therefore its goals require a degree of flexibility. Since trees represent a long term (50-80 year) commitment, this UFMP is intended to provide guidance and continuity through those changes, while also adapting to them as the need arises.

### **Create a Needs Analysis for the Current Tree Population**

Every tree population today is the result of decades of past management decisions. Over time, we increase our overall level of knowledge, skill, and efficiency in managing trees. Based on that new knowledge, we sometimes discover that decisions made decades ago may appear in retrospect to have been inappropriate, even though they seemed like a good idea at the time. It is the goal of this Plan to assess the current state of the Village of McFarland’s Urban Forest and examine its overall strengths and benefits, as well as look for opportunities for improvement to inform future decisions.



Each aspect of McFarland’s tree data has been analyzed: How many trees, what condition they are in, how old they are, what needs do they have, and more were all examined to create goals to improve the tree population for the benefit of the organization, its residents, and other stakeholders. Specific goals in terms of planting, removals, pruning, budgets, personnel, and maintenance are all addressed by acknowledging both strengths and opportunities, and suggesting how they might be used to the Village’s advantage. These strengths and opportunities will be the guiding principles for the management strategies and specific goals outlined in each section below. To avoid repeating past mistakes, the Plan shall also attempt to leave room for adaptive management, so the plan may be changed when appropriate.



## **Establish Goals in Order to Enhance Strengths and Realize Opportunities**

In order to accomplish anything, goals are necessary to help guide organizations through the process. Establishing or enhancing a highly functional forestry program will require a series of attainable goals to in order to be achieved. This UFMP seeks to accomplish those goals within a realistic budget and attainable timespan. As stated previously, goals are intended to change over time as the Village's capacity to manage the resource may increase or be reduced.

In each section of the Plan related to direct goals, language has been included which incorporates both a budget and a time frame in which those goals can be accomplished. The overarching goal will be to have McFarland use this UFMP to create a more sustainable and adaptable forestry program within a 5-10 year period.

This program will include tree planting, tree maintenance, and tree removal for McFarland's Urban Forest, so that the tree population will be healthy, and provide the greatest benefits and least risk to the community while maximizing benefits and minimizing risk. To learn more about the budgets, see the individual goals in each section below, or turn to the budget table on [page \\_\\_\\_\\_](#).

## **Update Village Ordinances for Enforcement of Tree Policies**

As part of the WDNR grant program, grant administrators and GLUFM working in tandem with McFarland staff and relevant community stakeholders, will begin the process of editing and improving ordinances governing trees in McFarland. These ordinances are meant to reinforce proper practices while discouraging improper practices and care, and are not meant to be overly punitive, but rather to encourage the community to engage in proper tree care practices for the benefit of all parties. These ordinances are common industry regulations, such as enforcing rules about what trees cannot be planted because they are low quality or invasive trees, or defining exactly what trees are the Village's and the homeowner's responsibility, among other things. A goal of the ordinance updates will also be to create more accountability for developers proposing construction in the Village. The goal of these ordinances is to increase canopy cover and to create a tree population which is diverse, healthy, and improving, providing the greatest benefit to the Village and its residents over the long term.

## **Increase Overall Diversity by 2044 Through Tree Planting**

Tree species diversity is one of the most important concepts in Urban Forestry today. The reason pests and diseases like Emerald Ash Borer (EAB) and Dutch Elm Disease were so devastating is that there were too many Ash and Elm trees. When EAB arrived, many communities' Ash population was 20% or more, resulting in mass tree loss. This can be avoided by planting a greater diversity of tree species, so that when new pests or pathogens are introduced, we only lose small amounts of specific tree species. Diversity leads to stability, and stability leads to reduced costs and increased benefits over time.

An achievable “Diversity Vision” has been created for 2044 which will see the tree population become far more diverse than it is at present. The current population includes a respectable 91 individual species and the diversity vision included in the Plan aims to reduce the number of trees that are over-represented and/or lower quality species while also seeking to increase the number of species that are under-represented or not present in the tree population.



Not only will trees be planted which are underrepresented or not present in the current population, they will also be planted in such a manner that selects the right tree for the right site. A direct goal will be to create a tree planting program where trees are matched to existing sites for the next 10+ years. Currently, McFarland plants approximately 40 trees each year, and this plan seeks to increase that number to an average of 175 trees per year over the course of this plan, to both be able to replace older declining trees, as well as to grow the tree population by a net of about 900 trees overall by 2044. Ideas such contract growing, creating in in house liner nursery, gravel bed, and others will be explored. To learn more about tree planting and reforestation, turn to [page \\_\\_](#).

### **Maintain an Acceptable / Unacceptable Species List**

The urban environment is a difficult place for a tree to live. Between road salts, urban pollutants, limited soil, and other challenges, not all trees will thrive in the urban environment. Trees which have very weak wood, which are known invasive species, which produce messy or foul-smelling fruits, or which create a public nuisance should also be avoided. Acceptable species are those which are adapted to our Midwest climate, are not invasive, and do not pose high risk. Included in this Plan is an “approved and unapproved” species list which will detail specific trees which may be planted on Village ROWs and other Village-owned properties, as well as in Village parks. The Village and Sustainability and Natural Resources Committee will review the list periodically to ensure that it is being maintained in accordance with the latest information on specific trees. For more information on what species can and cannot be planted in McFarland, see the Acceptable Species list in [Appendix\\_\\_](#).

### **Manage Tree Removals**

To prevent the spread of tree pests and pathogens, sometimes tree removal is unavoidable. To keep the residents of McFarland safe, a tree removal program has been created in this Plan which budgets for the safe removal of trees requiring removal in order to maintain public safety. Cost projections for tree removals have been made based on the number, age, and condition of trees in McFarland for the next 20 years, so that long term budgeting projections can be made.

Also included are ANSI and ISA safety standards, as well as suggested bid specifications to ensure the Village is hiring qualified contractors who will be held to the highest industry standards. For more information on McFarland’s proposed tree removal program, turn to [page \\_\\_](#).

### **Maintain and Enhance Cycle Pruning Program**

Properly pruned trees establish faster, grow quicker, and live longer lives than trees which are not pruned, or improperly pruned. Since large trees provide the greatest benefits to the community, pruning should be a critical part of the Urban Forestry program in McFarland. Pruning will be done primarily by in-house McFarland staff. Details will be discussed in the Tree Pruning section of this plan on **page \_\_\_\_**. The first goal will be to prune the trees which are in the greatest need of pruning.

As McFarland begins to increase its budgets and capacity for tree pruning, a goal of this plan is to enhance the cyclical pruning program. Currently, the Village prunes approximately 600-700 trees each year and a goal of this plan will be to gradually increase that number until the eventual goal will be to prune an average of 800-900 trees per year. The cyclical pruning program in place as part of this Plan will ensure that all trees on public property are pruned at a minimum every 5 years, increasing tree health and vigor while reducing costs associated with storm damage and tree failure.

### **Maintain an Accurate Tree Inventory on an Annual Basis**

Managing an urban forest requires a clear understanding of the trees, their ages, conditions, and locations, so that Village crews and contractors can perform work on these trees. A stem-by-stem tree inventory was completed in June of 2022. This inventory resulted in an unbiased assessment of all of the trees in Village parks and on public rights of way in the Village, and will serve as the data which will guide the forestry program throughout the next 20 years.



All inventories are a snapshot in time. With 3,452 trees on Village terraces and ROWs, the tree inventory should be maintained at a high level of accuracy so that it doesn't become out of date. It is also recommended that the inventory be updated periodically by a Forestry Consultant, to keep the information at its most current on a Village-wide scale. Maintaining this tree data at a high level is vital in the execution of this Management Plan.

The Village also plans to explore the implementation of a more user-friendly platform from which to keep the inventory updated on a day-to-day basis.

### **Explore an Increase In-House Staffing**

Skilled forestry and arboricultural related career positions are chronically understaffed in both the public-sector and private-sector and the Village of McFarland is no exception. At the time of this writing, the Village is expected to hire an additional FTE in April of 2024 which will help improve production in general, however the Village will continue to explore opportunities to increase in-house staffing which will help to decrease dependence on contractors which will lower forestry related costs overall.

### **Proper Mulching of All New Plantings**

As noted above, the urban environment is a difficult place for a tree to become established and to live a long, healthy life. Proper mulching can significantly increase a tree's ability to do this. Mulch helps to conserve water during the summer by preventing it from evaporating from the soil. It also helps prevent weeds from growing around the tree and competing for water and nutrients, and keeps lawn equipment such as weed whips away from the trunk where they can damage the tree. All new Village plantings will be properly mulched at the time of planting by the planting contractor.

Another intended outcome of this initiative will be to educate residents about proper mulching care, and notify them when poor mulching techniques are being used. Of particular concern is the practice known as "Volcano Mulching" which has the opposite effect of proper mulching and can severely damage a tree over time. For more information on proper mulching, turn to [page \\_\\_\\_\\_](#).

### **Incorporation of Best Management Practices in Tree Care Operations**

"Best Management Practices" is a term which means being on the cutting edge of your industry. All contractors working for the Village should be compliant with the latest industry Best Management Practices, based on the appendices in this report. The ANSI and ISA Best Management Practices shall be integral parts of any Request for Proposal (RFP) or bid documents when seeking qualified contractors. Full text of all referenced standards shall be made available to all Village employees and contractors performing tree care operations. This UFMP will be placed in the public domain for all residents to use as a reference. A longer-term public outreach and education program will be discussed further in the Additional Goals section.

### **Creation, Utilization, and Maintenance of a Tree Risk Assessment Policy**

Trees create great benefits, but they may also pose various degrees of risk. Tree limb failure can have catastrophic effects on people or property, and trees need to be well-managed and healthy to avoid that risk. A risk assessment policy has been created for the Village of McFarland as part of this Plan. This policy will aid in identifying, documenting, and designating for removal or mitigation, trees which may pose a threat to public safety in a timely manner. This will reduce the overall level of risk posed by trees, as well as exposure to liability from tree related incidents. Basic risk assessment language is included in this document, and a basic Tree Risk Assessment Policy has been created in [page \\_\\_\\_\\_](#), and the ISA Basic Tree Risk Assessment Form can be found in [Appendix \\_\\_\\_\\_](#).

### **Creation, Utilization, and Maintenance of a Storm Response Policy**

Since storms are inevitable, they must be a consideration in any municipal management regime and a decision making variable in managing municipal tree populations. Urban Forest Management should always include strategies for building a resilient forest and a resilient community. United States Forest Service's *Community Forest Storm Mitigation – A Guide for Communities* which was published in



the latter half of 2021 can be an excellent framework for the Village to build a comprehensive storm response policy tailored to the Village's exact needs.

### **Creation, Utilization, and Maintenance of a Pest & Disease Response Policy**

With invasive pests such as Emerald Ash Borer, Spongy Moth, and Spotted Lanternfly and diseases such as Oak Wilt either active or looming in Wisconsin, the development and implementation of a pest and disease response policy will enable the Village to have a standard strategy for dealing with active or yet unknown infestations and infections of known pests and pathogens.



### **Define Trees as Critical Stormwater Infrastructure**

Green infrastructure is rapidly becoming recognized as being just as important as grey infrastructure in many ways. Chief among these green infrastructure components are trees, and specifically the stormwater mitigation effects they provide. A mature tree can intercept or otherwise mitigate over 5,000 gallons of avoided runoff every year. On a population scale, McFarland's tree population of 3,452 trees is responsible for intercepting or avoiding over 609,7000 gallons of stormwater runoff each year. The loss of this resource due to storm damage, insect or pathogen invasion, or other such damage would have a critical impact on the local stormwater infrastructure. For this reason, a direct goal of this Management Plan will be to define trees as critical stormwater infrastructure, and that these assets should be compensated for when lost to unforeseeable events.

### **Increase Urban Tree Canopy from 27.72% to 30%**

Tree canopy is important to the community as a whole because more and larger trees provide greater benefits such as decreased heating and cooling costs, pollution reduction, and increased storm water uptake. Tree lined streets are more attractive to homebuyers and potential new businesses, which increases home values, home ownership, and tax revenue. All of these factors benefit the community, so a direct goal will be to increase tree canopy in the Village of McFarland. Currently, McFarland contains 27.72% tree canopy coverage, compared to other land cover types. Increases in tree canopy also come with increases in total benefits provided to the community.

We believe that an increase to 30% canopy cover is a realistic goal for McFarland by 2044. This will be accomplished by increasing the number of trees on publicly owned property, as well as improving tree care allowing trees to live longer, become larger, and create more canopy cover.

As we will show in the detailed portions of this Plan, these are real benefits that will help McFarland residents save money. For more information on Urban Tree Canopy, tree benefits, and other such information, turn to [pages \\_\\_\\_\\_](#).



## Collaborative Efforts Among Municipalities to Help Mitigate Climate Change Effects

Although McFarland is a relatively smaller Village in south-central Wisconsin, its role as part of the larger Madison region should not be understated. Collaborative efforts among municipalities in larger urban regions such as the Madison area can do a part in mitigating the effects of climate change. A proactive and effective strategy to mitigate a changing climate is to plant more trees, and in fact the United States Environmental Protection Agency lists tree planting as one of the more effective solutions to mitigate climate change through absorption of carbon dioxide (<https://www.epa.gov/heatislands/using-trees-and-vegetation-reduce-heat-islands>). Outside of their aesthetic value, trees have a great variety of environmental benefits, specifically offsetting climate change by producing a cooling effect in urban heat islands, and flood abatement by absorbing stormwater that otherwise would run off. Trees also act as long-term sinks for carbon dioxide, where carbon from the atmosphere becomes “sequestered” in the tree’s woody parts like the trunk and limbs as a result of photosynthesis, which is how trees create energy to grow.



Increasing tree canopy, not just at a municipal level, but at a regional level, creates greater sinks for carbon dioxide, reduces localized heating from the urban heat island effect, and reduces environmental issues stemming from flooding. It also provides a great habitat for birds, pollinators, and other beneficial wildlife that can enhance the urban environment. This will all be examined at several different points throughout this UFMP, in terms of examining the hard dollar benefits trees provide, looking at where trees can be planted to maximize their effect on heat islands and flooding, and looking at what species could be planted in the future as we are subject to higher average temperatures. For more information on using trees to mitigate climate change, turn to page [10](#).

## Tree Preservation/ Invasive Species Management



Sometimes trees can become damaged by construction activities, costing the Village money, and eliminating the benefit the tree had to the community. A basic tree survey and assessment should be conducted prior to the issuance of a permit for construction activities. A tree protection zone should be established and maintained during construction and the Village should monitor construction activities to ensure local ordinances are adhered to. Tree removal, for trees of a certain size on the approved species list, should require prior approval

by McFarland during site planning. The removal of low quality or invasive species is also recommended. This not only increases the amount of planting space, but also increases public safety.

A direct goal of this Urban Forestry Management plan is to preserve trees during construction, and reduce the amount of undesirable species within the Village of McFarland.

### **Increase Awareness of the Urban Forest in the Village of McFarland, and Engage Stakeholders**

The reason for the establishment and enhancement of an Urban Forestry program in McFarland is to improve the lives of the residents, business owners, and other stakeholders who want to see the Village be a healthier, happier community. In order to make this happen, McFarland is looking for partners in the community to provide support for this program. McFarland staff will explore to reaching out to local garden clubs, philanthropic organization, residents, and business owners to make the forestry program innovative and community based. In this manner, residents and business owners in McFarland can take ownership of this important and beneficial resource, and allow it to work for them, their families, businesses, and the good of the whole Village. For more on these innovative programs, and how you can get involved, turn to [pages \\_\\_\\_\\_](#).

### **Increase Stocking Density from 78% to 85%**

Currently, there are an estimated 750 open planting spaces on McFarland's streets, and the stocking density is good at approximately 78%. While 100% stocking density would be very difficult to achieve over the 20 year scope of this plan, and is not actually always desirable, we do believe that 85% stocking density is attainable and desirable. This will be done primarily by increased tree plantings in the coming years, and use of innovative strategies to fund increases in tree planting.



### **Explore the Use of American Forests Tree Equity Scores for Planting Prioritization**

A map of tree cover in any municipality in the United States is too often a map of race and income and McFarland intends to strive to change this trend within Village boundaries by using Tree Equity Scores derived from metrics developed by an organization known as American Forests. Tree Equity

Scores are ranked from 0-100 and are based on an evaluation of data including a neighborhood's existing tree canopy, population density, income, employment, surface temperature, race, age, and health. Trees are critical infrastructure that every person in every neighborhood deserves, and trees can help address damaging environmental inequities like air pollution. The Village can explore the use of Tree Equity Scores to prioritize plantings in areas with lower scores. For more information on Tree Equity Scores see [page \\_\\_\\_\\_](#).



## Continue Wood Utilization Program



As necessary tree removals occur, the Village generates a considerable amount of removed tree material some of which may be suitable for use as urban timber. Urban timber is defined as saw logs generated from urban tree removal operations. Larger and longer logs are suitable for dimensional lumber production, and smaller material may be used to produce many other products. A sample Urban Timber Harvesting specification in Appendix \_.

McFarland currently has an innovative program in place where saw logs generated by the Village are donated to McFarland High School where they are utilized by woodshop students to get hands on experience in using urban timber to create a variety of products, including furniture. Additionally, wood that is generated by the Village that is not suitable for saw logs is converted into firewood which is made available to McFarland residents at no cost. Any remaining wood chips are made available to residents or used in parks as mulch or path material. This program is a win-win for all involved as the high school students get experience that may inspire them to enter woodworking or carpentry fields, residents get free access to firewood and wood chips, and the Village produces virtually no waste of wood generated by tree removals. Collaborative programs similar to this could be a model for other municipalities to recycle wood.

## Additional Goals

There are no strategic timelines set forth here for these programs. As the direct goals of the Urban Forestry program in McFarland are met or exceeded, these are goals to be discussed by the Village of McFarland and its Sustainability and Natural Resources Committee as time and budgets become available. We believe that many of these programs represent some of the most progressive Urban Forestry policies in the current climate, and that they should all be seriously considered for implementation.

## Continuing Citizen Education (Urban Tree Alliance/Other Local Organizations)

There is an organization called the Urban Tree Alliance active in the Madison area. This organization is a non-profit which assists in educating people about trees, how to prune, plant, and manage them, and their benefits to society. There are other local organizations with which the Village could partner with as well, please see [page \\_\\_\\_\\_](#) for more details. Upon acceptance of this Plan, the Village might explore reaching out to Urban Tree Alliance or a similar local organization in order to establish a relationship, and assist in the creation of an educational program in order to engage the community.

McFarland could possibly hold several annual tree education sessions, perhaps to coincide with annual Spring and Fall planting cycles. These sessions may be taught by the Village Forester, other forestry staff, or other such qualified parties, and cover tree watering, fertilization, pruning, and the basics of how to spot insects and diseases. In addition, basic tree care pamphlets might be made



available at Village Hall, Public Works, and other Village staff offices in addition to website-based forestry information. The Village's Arbor Day annual celebration is an example of one such outreach events that could be enhanced to be more beneficial to the forestry department's programs and goals.

### **Establishment of Village of McFarland Propagation Nursery**

Consideration might be given to the establishment of a small propagation nursery on McFarland-owned land, perhaps on a park property. The Village of McFarland can grow a share of its own trees, using much smaller trees obtained from wholesale nurseries at a fraction of the cost of a full-sized tree. Small trees can be purchased wholesale, and then grown to maturity in McFarland.

Such programs have been successfully instituted in other communities, and represents a quality investment that results in cost savings over the long term. Trees can be purchased when small, or donated from residents, and grown to plantable size on Village-owned land.

We would recommend that the Village work with the Forestry Consultant, local nurserymen, and other strategic partners in order to explore this concept, and begin the planning phase in \_\_\_\_, with the goal of having a functional nursery by 2033. The amount of time required for the care of young trees is minimal, and at an average cost of \$350-\$400 per 2" DBH tree wholesale, the Village could save a significant amount of money in their tree planting program by pursuing this goal. In addition, not unlike a community garden, local residents could assist with the care of these nursery trees.

### **Contract Growing Program**

One of the keys to a successful Reforestation Plan or Tree Planting Program is the availability of high-quality nursery stock from local sources. Incorporated with the UFMP for the Village of McFarland is a diversity vision for 2044 that includes a great variety and diversity of different trees. A new approved species list has also been developed, as well as the tree species that are prohibited on public property. Having this information is an advantage for the Village, in that the nature of the urban forest in terms of species composition is already known. It is believed that a comprehensive tree planting plan will be an important part of this process as well.

This knowledge, however, does not guarantee the availability of those specific trees when the time arrives to fill a particular site.

One way to assure the availability of nursery stock the Village desires each year is to have trees contract grown by local nurseries, and reserved specifically for the Village of McFarland.

This way, the Village will not have to compete with the landscape industry, other local organizations responsible for tree planting, or local retailers. Trees are ordered in annual increments. Each year, McFarland will purchase the trees previously ordered for that year, and place an order for the following year. This gives the supplying nursery time to procure, plant, and bring the agreed upon trees to the size and branching habit specified.



As numbers of trees required for planting vary from year to year based on removal rates, budgets, and other factors, tree order projections should be made conservatively to avoid the possibility of cancellation of orders. In agreement with the supplying nursery, the Village would reserve the right to increase orders when budgets allow. Supplying nurseries should be located within a specified distance from the Village of McFarland, to ensure climatic zone compatibility and reduced transportation costs and planting stock exposure to the elements. Nurseries should be of sufficient production capacity to furnish all trees ordered in advance by the Village, as well as possible increases when necessary. Nurseries should be chosen not only on their capacity to produce stock, but to meet quality, form, and health standards as specified by the Village. The nursery should allow tagging by the Village Arborist or other representative as well.

A long-term tree planting contract may be developed alongside the nursery supply contract. This contract would specify all pick-up, transportation, planting, and spoil disposal procedures, as well as establish costs for planting trees. Trees should be evaluated one year after planting and assessed for health and survival. Responsibility for replacement of trees that have not survived the one year guarantee period is divided equally between the supplier, the planter, and the Village. Trees that are dug or balled improperly will be replaced by the nursery. Trees improperly handled or planted are replaced by the planter. Trees that do not survive because of lack of maintenance are replaced by the Village.

### **Private Property Tree Planting Incentive Programs**

Tree planting on private property could also be encouraged through public-private partnerships with local organizations and businesses. Though the Village has no formal jurisdiction to plant trees on private property, the benefits of tree planting on private property are substantial in terms of energy savings, storm water benefits, and other benefits. The Village should consider incentivizing residents and business owners to plant trees on their property. Offering a slight reduction in water and sewer bills for each tree planted has been successfully utilized, or other options more suitable to McFarland might be explored. Partnering with local nurseries to create a program where residents can purchase trees from that nursery at a reduced price may also be a way to encourage tree planting on private property.

Another idea which has been successfully implemented is having the Village purchase trees from a wholesale nursery at wholesale prices, and then have an annual tree sale to local residents. The Village resells the trees at a slight markup from the wholesale cost, but still less than retail, and uses the proceeds to fund its forestry initiatives. Such programs would encourage tree planting on private property by reducing tree costs to the residents.

### **Implementation of a McFarland Gravel Bed Program**

A gravel bed is an irrigated bed or pile of gravel where bare root or washed containerized stock is placed and safely held for up to 3-6 months. This system has been in use at commercial nurseries, municipalities, and universities for over 20 years. In a gravel bed, the above ground portion of the tree will not grow any faster than normal. The purpose of the gravel bed is to increase the fibrous root

system, prepare for planting at a later date and recover poor root systems. A gravel bed can provide many advantages over planting traditional bare root, balled and burlapped, and containerized stock. Such programs have been successfully instituted in other communities, and represents a quality investment that results in several benefits. Gravel beds can save the community money through the utilization of bare root stock, which is typically 1/2 the price of containerized trees and 1/4 the price of balled and burlap trees. Gravel beds can help increase species diversity because there are typically more species available as bare root stock than as containerized or balled & burlapped stock. Greater species diversity can reduce a community's vulnerability to insects and disease. Gravel beds allow bare root stock obtained in the spring to be planted throughout the growing season and into the fall. Communities can plant less expensive trees when they have the time and resources. A goal of this Plan could be to establish and enhance a gravel bed program in McFarland to provide more potential for the growth of the Village's urban forest in the future.

### **Implementation of a Staff Training & Development Program**

A longer term goal for the Village would be to develop and implement a simple ladder system for employee development, where opportunities for training, career enhancement, and continuing education could be provided to Village personnel as they reach milestones and thresholds in their employment experience. The Village will explore this opportunity and as the program evolves, the UFMP will be updated to include the developing details.

### **Strategic Partnerships**



Strategic partnerships are a very effective means of getting forestry projects funded when tax funding may present a shortfall, or when additional labor is needed. These typically involve either public-private partnerships or partnering with other public entities. Typically, the organizations seen participating in these programs include non-profits, local garden clubs, scout groups, rotary clubs, state departments of natural resources, and other such groups. This will be an ongoing goal, and continuing partnerships with new organizations shall always be sought.

### **Dane County Land & Water Resources Department/ Parks & Forestry Division**

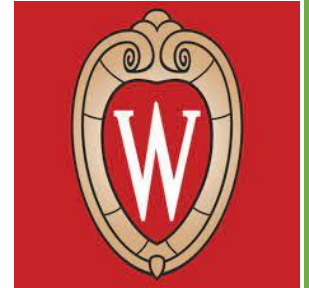
The Land & Water Resources Department strives to protect and enhance the natural, cultural, and historic resources of Dane County; provide the county's residents with a broad array of accessible, high quality resource-based recreational services and facilities; and support residents, communities, local governments and other agencies and organizations in their resource management and protection activities. One of the Department's goals is to implement stormwater management projects and as one of the primary goals of this UFMP is to define trees as critical stormwater infrastructure, Land & Water



Resources Department is a logical partner. Additionally, the Parks & Forestry Division could be a partner for educational opportunities.

### **UW-Madison**

The Department of Forest and Wildlife Ecology at the University of Wisconsin – Madison is a national leader in forest science and wildlife ecology research, teaching, and training. Their programs combine relevant course work with hands-on experience for an educational experience that not only educates students, but trains future leaders. The Department employs faculty, staff, and graduate students who maintain excellence in applied forest and wildlife ecology research. Partnering with UW-Madison could enable students to participate in educational opportunities and gain practical experience in urban forestry.



### **Madison Area Technical College**

The Tree Care Technician program at Madison Area Technical College prepares students for exciting careers in areas related to urban forestry. By partnering with MATC, the Village could benefit from the opportunity to work with students who are interested in gaining hands-on knowledge regarding urban forestry in McFarland.



**MADISON**  
AREA | TECHNICAL  
**COLLEGE**

### **Tree Canopy Collaborative**

The aim of the Tree Canopy Collaborative is to collectively maintain, protect, and expand public and private tree canopy across Dane County where ecologically appropriate. Within this aim, a particular focus is on ensuring equitable access to trees and their associated benefits for all residents. Partnership is fundamental to achieving success. The Collaborative is working collectively in Dane County to co-develop goals with local experts in order to recognize neighborhood opportunities, needs, and constraints.



### **Wisconsin Arborist Association**

The mission of the Wisconsin Arborist Association is to "To improve the practice of arboriculture and increase public appreciation of trees and urban forests." WAA is a professional organization made up of certified arborists from throughout the state of Wisconsin. The association strives to further the education of certified arborists and can serve as a valuable resource to reach the goals of this plan.



### **Urban Wood Network- Wisconsin Chapter**

The Urban Wood Network was developed in 2017 to formally unite unique urban wood industry groups and efforts under the common mission of growing professional and consumer confidence in the urban wood industry through





information, collaboration, and connection. Since the early 2000's, the founding groups behind the Urban Wood Network program have worked diligently to unite, promote, and demonstrate urban wood utilization. Now the ever-growing network of urban wood industry professionals and state-specific chapters are provided access to consistent messaging/marketing tools and a useful platform for collective experience, support, and connectivity to help the industry thrive.

### Urban Tree Alliance

The Urban Tree Alliance is a Madison-based urban forestry not-for-profit focused on growing and diversifying the local canopy through tree planting, resource management, and research. Their mission is to preserve and grow the urban forest canopy in a sustainable and innovative manner in partnership with the public. The Urban Tree Alliance is committed to providing Madison-area residents with the knowledge, skills and resources they need to grow and maintain a healthy, resilient urban forest. They support homeowners in caring for trees on their property, and empower groups to tackle community forestry projects. The Urban Tree Alliance could be a valuable partner for McFarland.



### Wisconsin Department of Natural Resources

The WDNR's mission is to protect, perpetuate, restore, conserve, and manage the forest and related resources of Wisconsin, both public and private. To that end, they have an abundance of resources, staff, and a network of partners which can help McFarland accomplish the goals laid out in this plan, including funding for such things as tree planting or local education and outreach.



### Master Gardeners

Master Gardeners are trained volunteers who dedicate their time and skills to make their community a more beautiful place. They are horticultural experts who serve their communities through service projects and delivery of educational programs and could assist McFarland in coordinating educational events.



### McFarland Garden Club

The McFarland Garden Club promotes an interest in gardening and the beautification of the landscape in the community. McFarland Garden Club is active in the community and in partnership with local organizations it contributes to the beauty of McFarland through donations and volunteer service. Trees are an essential part of gardening, and spreading the word about the importance of trees can be accomplished through local volunteers like those at the Garden Club and may serve as a resource for education and other environmental initiatives.





### E.D. Locke Public Library

The Library is a place where people congregate and learn. As such this would be a first rate location to advertise opportunities for public outreach education about urban forestry, as well as stocking and showcasing books related to urban forestry and its related disciplines.



### Local school districts

Urban Forestry is by and large an unknown profession, but there are many aspects of STEM concepts that go into it: GIS Mapping, chemistry, physics, biology, and math are all essential facets of Arboriculture. A relationship with local school districts would be a reciprocal relationship, where students could engage in study projects based around trees, and citizen science. This type of program may develop interest in or even promote careers in the green industry.



### Local Boy and Girl Scout Troops

The mission of the Boy Scouts of America is to prepare young people to make ethical and moral choices over their lifetimes by instilling in them the values of the Scout Oath and Law and the mission of the Girl Scouts of the USA is to build girls of courage, confidence, and character, who make the world a better place.



Both organizations foster a dedication to education, community service, and volunteerism and a partnership with the Village could be a beneficial relationship for all entities involved.

### McFarland Sparks 4-H Club

4-H is delivered by Cooperative Extension – a community of more than 100 public universities across the nation that provides experiences where young people learn by doing. For more than 100 years, 4-H has welcomed young people of all beliefs and backgrounds, giving kids a voice to express who they are and how they make their lives and communities better. 4-H would be a valuable partner, particularly for community service projects involving the Village's urban forest.



### Rotary Club

Rotary is a global network of 1.2 million neighbors, friends, leaders, and problem-solvers who come together to make positive, lasting change in communities at home and abroad while developing personal relationships and having fun. The members of the Rotary Club of McFarland are an active, diverse group of individuals with a common interest in making the community and the world a better place for everyone. The Village could partner with the Rotary Club in organizing educational events.



### **McFarland Lions Club**

The mission of Lions Club International is to empower Lions clubs, volunteers, and partners to improve health and well-being, strengthen communities, and support those in need through humanitarian services and grants that impact lives globally, and encourage peace and international understanding. The McFarland Lions Club could be an important resource for community volunteer events.



### **Friends of McFarland Parks**

The Friends of McFarland Parks is a local non-profit organization formed in 2006 to help promote, maintain and improve the parks in McFarland, WI. The group has undertaken multiple environmental initiatives, such as removal of invasive species and restoration of prairie land. The organization is most active in overseeing the McFarland Community Garden. Friends of McFarland Parks is a logical partner to assist in the goals of this UFMP.



## **Personnel**

In order to streamline Urban Forestry Operations, tasks will be assigned to various staff and contractors/consultants. Below is an overview of personnel involved in forestry related tasks in the Village of McFarland.

### **Director of Public Works**

The Village Urban Forestry Program is within the scope of the Department of Public Works. The Director of Public Works, or their designee, exercise authority related to decision-making concerning pruning, removal, and planting of Village Trees.

### **Streets/Water Superintendent**

This position assists with storm response management situations.

### **Parks Superintendent**

The Parks Superintendent oversees the management of the Village's urban forest. This position is appointed as the Village Forester per the essential job functions within the position description of the Parks Superintendent.

### **Village Forester**

The Village Forester is responsible for performing duties in accordance with Section 59-21, or as amended, within the Village Code of Ordinances including tree trimming, emerald ash borer response plan, and other duties as outlined in the code. The Village Forester will exercise authority and perform responsibilities related to forest health, storm response, and hazardous tree removal.

## Parks and Public Works Crewpersons

Crewpersons perform tasks related to forest health, storm response, and hazardous tree removals, with guidance received from the Village Forester.

## Tree Care Contractors

Tree Care Contractors are utilized by the Village Forester for essential tree care services that exceed the capabilities and equipment of the Village as required.

## Sustainability and Natural Resources Committee

The Sustainability and Natural Resources Committee, as established by Village Ordinance, advises on maintaining a healthy and diverse urban forestry program while fulfilling the requirements as a certified Tree Village, USA. This committee is comprised of 5 citizen members and 2 Village Trustees.

## Emergency Contact for Tree Related Issues

The Department of Public Works has a 24-hour on-call number 608.212.2625. This would be for non-life-threatening situations (eg: tree blocking road). 911 should be utilized for life threatening situations.

## State of the Urban Forest

Using the tree inventory data collected for the Village of McFarland, it was determined that there are a total of 3,452 trees on Village Owned rights of way and in Village owned parks, along with an estimated 750 open planting spaces. It is important to note that the statistics that follow include all inventoried trees and both the ROW and park trees were analyzed as one population. The charts and statistics in this portion of the Management Plan illustrate that the tree population in McFarland can be characterized as being in overall above average condition and the stocking density is good, at 78%. The species diversity in McFarland is quite good as well with 91 individual species represented. Based on the following data in the Management Plan, the Village of McFarland will be equipped to use this valuable information to address short term concerns, long term management considerations, and overall planning objectives.

### Basic Statistics – Managed Trees

|                             |                      |
|-----------------------------|----------------------|
| Number of Trees Inventoried | 3,452                |
| Total Number of Species     | 91                   |
| Total Diameter Inches       | 32,478"              |
| Average Tree Diameter       | 9.41"                |
| Average Tree Condition      | 2.72 (Above Average) |

## Condition Statistics

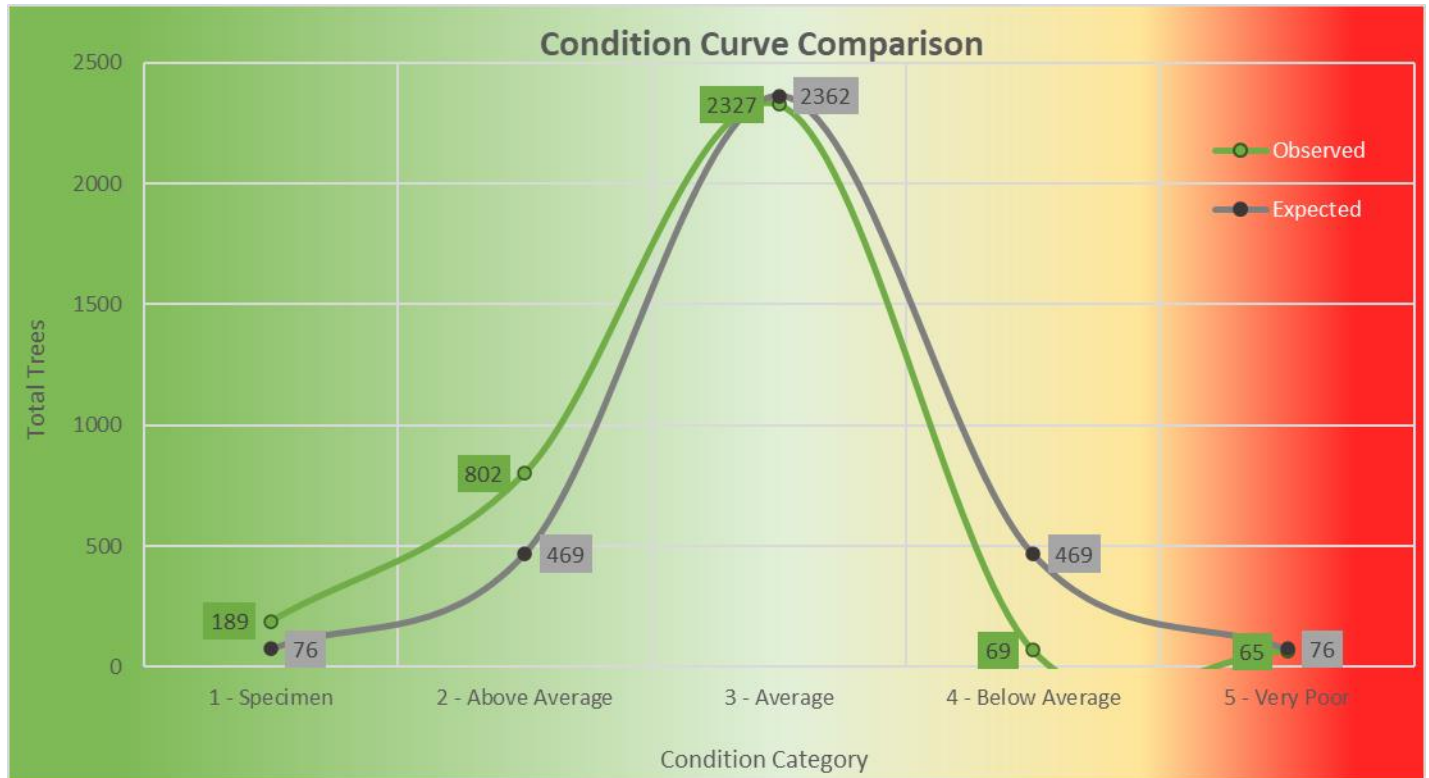
During the tree inventory, a condition rating was collected for each tree based on the parameters below.

| Rating category | Condition Components                                                                                                                                                                                                                   |                                                                                                                                                                              |                                                                                                                                        | Percent Rating |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                 | Health                                                                                                                                                                                                                                 | Structure                                                                                                                                                                    | Form                                                                                                                                   |                |
| Excellent       | High vigor and nearly perfect health with little or no twig dieback, discoloration, or defoliation.                                                                                                                                    | Nearly ideal and free of defects.                                                                                                                                            | Nearly ideal for the species. Generally symmetric. Consistent with the intended use.                                                   | 81% to 100%    |
| Good            | Vigor is normal for the species. No significant damage due to diseases or pests. Any twig dieback, defoliation, or discoloration is minor.                                                                                             | Well-developed structure. Defects are minor and can be corrected.                                                                                                            | Minor asymmetries/ deviations from species norm. Mostly consistent with the intended use. Function and aesthetics are not compromised. | 61% to 80%     |
| Fair            | Reduced vigor. Damage due to insects or diseases may be significant and associated with defoliation but is not likely to be fatal. Twig dieback, defoliation, discoloration, and/or dead branches may comprise up to 50% of the crown. | A single defect of a significant nature or multiple moderate defects. Defects are not practical to correct or would require multiple treatments over several years.          | Major asymmetries/deviations from species norm and/or intended use. Function and/or aesthetics are compromised.                        | 41% to 60%     |
| Poor            | Unhealthy and declining in appearance. Poor vigor. Low foliage density and poor foliage color are present. Potentially fatal pest infestation. Extensive twig and/or branch dieback.                                                   | A single serious defect or multiple significant defects. Recent change in tree orientation. Observed structural problems cannot be corrected. Failure may occur at any time. | Largely asymmetrical/abnormal. Detracts from intended use and/or aesthetics to a significant degree.                                   | 21% to 40%     |
| Very Poor       | Poor vigor. Appears to be dying and in the last stages of life. Little live foliage.                                                                                                                                                   | Single or multiple severe defects. Failure is probable or imminent.                                                                                                          | Visually unappealing. Provides little or no function in the landscape.                                                                 |                |
| Dead            |                                                                                                                                                                                                                                        |                                                                                                                                                                              |                                                                                                                                        | 0% to 5%       |

For the data analysis portion of this report, the original condition ratings were extrapolated into Great Lakes Urban Forestry Management's data collection parameters. The GLUFM rating criteria is as follows:

|                    |                                                                                                                                                                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Condition 1</b> | <b>Specimen</b> – Tree has no observable defects, wounds, diseases, and has perfect form for the species. Since younger trees are generally trouble free, a condition 1 tree must by the Forestry Consultant's definition be a minimum of 16" DBH. These are legacy trees, and as such are rare. |
| <b>Condition 2</b> | <b>Above Average</b> – Tree may have a small amount of deadwood, or a very limited number of minor defects. The overall form of the tree must be good, and consistent for the species. These trees, by the Forestry Consultant's definition, must be a minimum of 8" DBH.                        |
| <b>Condition 3</b> | <b>Average</b> – Tree has moderate amounts of deadwood, wounds, or other defects, but is generally healthy. A wide variety of forms is acceptable for this group, which is meant to define the middle ground around which better or worse trees can be defined.                                  |
| <b>Condition 4</b> | <b>Below Average</b> – Tree has defects, deadwood, wounds, disease, etc. which are likely to cause a need for removal. Very poor form or architecture can put an otherwise healthy tree in this category as well.                                                                                |
| <b>Condition 5</b> | <b>Very Poor</b> – Tree must be removed. Defects are too far advanced for the tree to be reasonably saved. Like condition 1 trees, these are rare, as generally trees approaching this level are removed before they deteriorate to this level.                                                  |

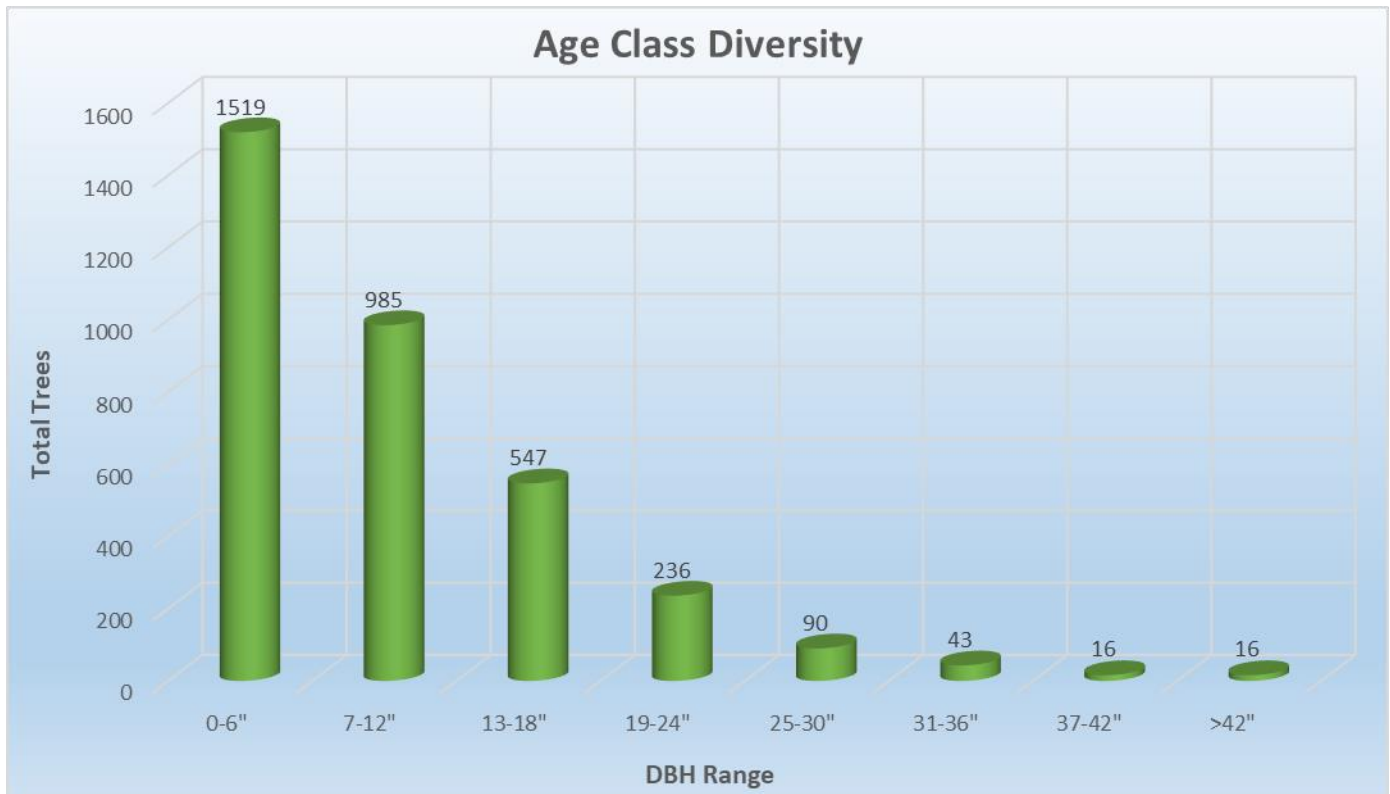




The chart above represents the distribution of trees in each of the 5 categories. We have included the tree condition ratings observed in the field, as well as a curve representing an “average” distribution so that comparisons can be made. The green line represents what was observed in the field, and the grey line represents an average or “normal” tree population.

As is evidently illustrated on the chart above, the tree population in McFarland is currently in above average condition based on the extrapolated condition ratings calculated from the Village’s inventory data.

## Age Class Analysis



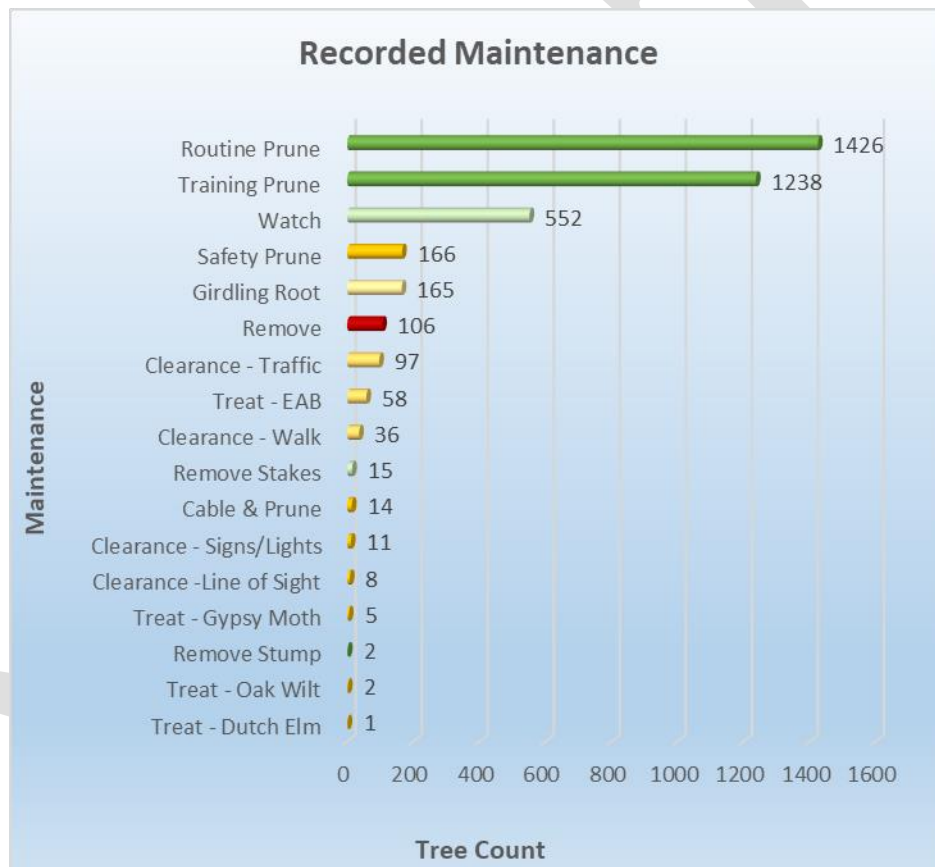
In terms of the ages of trees in McFarland, we have split the tree population into 8 “classes” of 6” diameter increments. This tells us how many trees are in each “age class”. Because trees are measured by Diameter at Breast Height (DBH) as a standard measure, this breakdown can help show where trees are in their life cycles. Some trees like Cottonwood and Silver Maple grow in diameter very quickly, up to 1” per year or possibly more. Other slower growing trees such as Oak and Hickory may only add ¼” or less every year. As a broad generalization, it can be said that most trees on average grow at around ½” per year.

This age class analysis chart illustrates a somewhat typical trend in the overall age spread of a tree population seen in a municipal setting. We often see many trees being younger to middle aged and a relatively lower number of trees in the older age categories. The McFarland tree population is largely younger with 73% of the tree population measuring between 12” DBH or less. As shown above, almost 44% of the total population has a DBH of 6” or less which we generally consider to be less than about 15 years old. Nearly 29% of McFarland’s trees have a DBH of 7-12” which are generally considered to be about 15-25 years old. The 13-18” DBH category makes up 16% of the population and is considered to be approximately 25-35 years old. Moving to the 19-24” DBH category there is a steep drop in numbers and this category makes just 7% of the population. Those trees are generally mature trees over 35-45 years old.

Trees measuring over 24” DBH account for the remaining 5% of the total tree population. The 165 trees in the 25”+ DBH categories are considered to be about 45-50+ years old. A number of these may

be nearing the end of their natural life. It should be mentioned that the number of trees in the 30"+ categories are often lower due to the natural senescence and ensuing decline of trees in urban settings. A fairly equal number of trees in each age classification is, within reason, desirable and indicative of a consistent focus on tree planting and tree maintenance in McFarland over the years and shows that the right trees are being planted in the correct locations. Also, the estimated 750 planting spaces gives McFarland an opportunity to focus on tree planting going forward. As the younger trees continue to grow, McFarland will have an opportunity over time to bring the age classes to a more balanced level.

### Maintenance Based on Inventory Data



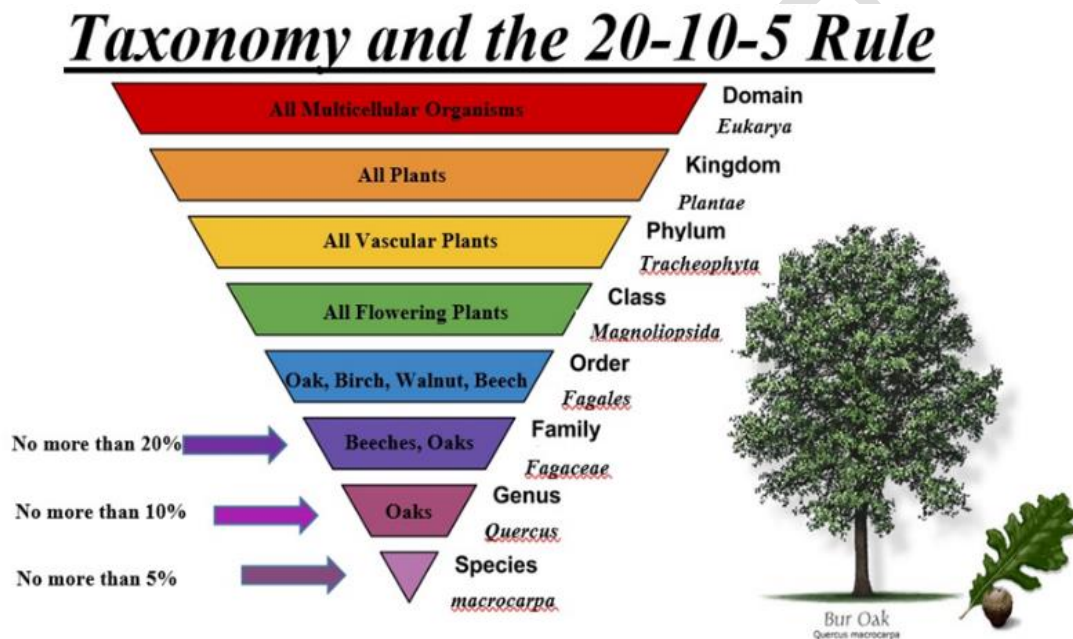
The chart above illustrates the maintenance needs recorded in the Village's inventory data. It is important to mention that this chart reflects the data originally collected during the inventory. Significant removal work of approximately 100 trees has already occurred and is not yet reflected in this data analysis.

As the data is kept updated going forward, McFarland can use the inventory to query specific issues and prioritize mitigation actions. This chart illustrates an interesting overview of the overall health, defects, and maintenance needs of McFarland's tree population.



## Diversity Analysis

Taxonomy is the method by which scientists classify plants, animals, and other life forms into distinct categories. A species is unique. There is only one type in that category, such as Bur Oak (*Quercus macrocarpa*), which refers to only one specific type of tree. A genus, however, is a group that may contain multiple species. All Oak trees, for instance, are in the genus *Quercus*. The further down the taxonomic ladder you go, the more similar things become.



The more similar tree species are to each other, the higher the likelihood that an insect or pathogen can exploit every species of that genus. Emerald Ash Borer is a classic example of this, as it affected every tree species in the ash genus. The most effective prevention of tree loss we have is to limit the number of trees planted that a new pest or pathogen can affect. While diversity at the species level is important, it is also important to achieve diversity on the genus and family levels, so that a large selection of trees are planted.

The “20-10-5” rule for McFarland’s future tree plantings is recommended, which states that no more than 20% of any one family, 10% of any one genus, and 5% of any one species shall be planted during any one planting cycle. It will also be a long-term direct goal of the forestry program to have the tree population as a whole in compliance with the 20-10-5 Rule, although it may not be possible by the 2044 date used in this document. This level of taxonomic diversity is consistent with today’s arboricultural industry standards (see above graphic).

The old paradigm of urban forestry was to create tree lined streets and parks in which every tree was the same type, shape, age, and height. This was thought to produce a uniform appearance. Urban foresters have now learned that once a pest or pathogen is introduced into a monoculture planting such as this, an epicenter of infestation is created that may cause serious damage, both ecologically and financially. Diversity in the urban forest helps to prevent and reduce the impacts of pests and

pathogens. There are three aspects of diversity in the urban forest. We will examine these in detail, below.

### **Taxonomic (Species) Diversity**

Why is it important to plant a diverse set of trees at the species, Genus, and Family levels? Simply put, it is to ensure that we will not fall victim to mass tree loss from pests and pathogens in the future. The reason Emerald Ash Borer (EAB) was such a devastating expense for many organizations was because their tree populations were composed of over 20% Ash trees. When these trees died and had to be removed, those organizations lost 20% of their trees.

This comes with the obvious expenses of having to remove these trees and replace them. But it also comes with hidden expenses as well, namely the loss of the ecological services that those trees provided: Homes cost more to heat and cool, storm water infrastructure falls under heavier pressure, and increases in pollutants and greenhouse gases may be observed. For all of these reasons, a more diverse group of trees needs to be planted, such that we are never at risk of losing more than 5-10% of our trees at any given time due to a pest or pathogen.

As will be discussed in further detail below, the tree population in McFarland is by far dominated by Maple species. In decreasing numbers, the remaining of the top 5 include Lindens, Oaks, Honeylocusts, and Spruces.

### **Spatial Diversity**

Spatial diversity is the concept of mixing tree species over the whole geographic area. The easiest way to slow the spread of any new pest or pathogen is to increase the distance between potential host trees. Every pest or disease, such as EAB or Dutch Elm Disease (DED), has a limited area to which it can spread in a given time frame. The more difficult it is to get to the next host tree, the less of a problem the pest or pathogen becomes, and the easier quarantine becomes.

In addition to the functional benefits provided by increasing spatial diversity, organizations which have implemented diverse planting over the past several decades have demonstrated that such diversity yields an arboretum-like landscape that is both functional and aesthetically pleasing. At present, the Spatial Diversity in McFarland is moderate due to the presence of a significant percentage of Maples in the tree population. During the tree planting planning phase, extra care should be taken to ensure that new plantings are done in a manner that yields a highly spatially diverse tree population, and creation of areas of low spatial diversity (monocultures) will be avoided.

### **Age-Class Diversity**

Age-class diversity is also an important consideration. A healthy natural forest has trees of many ages. Young, intermediate and mature trees allow for regeneration, replacement and vigor in the overall forest community. A mixture of tree species, locations, and ages will lead to great diversity, which insulates a natural forest against pest and pathogen outbreaks. The Urban Forest is no different. The outdated urban forestry paradigm promoted even-aged tree plantings, so that all trees were approximately the same size and age. However, once these trees begin to decline, most will

require removal and replanting simultaneously. This can leave an entire street segment or neighborhood without shade and aesthetics for a long time.

The current approach of the urban forestry community is to strategically plant trees on streets or in neighborhoods over a longer timeframe. With this strategy, trees will grow to maturity in different stages, and decline at different times. When declining trees are eventually removed, there will always be a variety of age classes and tree sizes on a block or in a neighborhood. This reduces the pressure to plant trees in an area immediately after tree removal, helping to manage costs. A mixed age-class planting ensures that mature trees are always present in a neighborhood. It also will allow for strategic planting of smaller or medium-sized trees.

An additional benefit of mixed-age plantings is the ability to plant shade-loving trees as well as sun-loving trees. When a street or neighborhood is newly planted with trees of the same age, all the trees are essentially in full sun. This reduces the ability to plant shade-loving trees, as they have a tendency to dry out in the summer sun. With mixed-age stands, shade-tolerant, trees may be planted underneath the canopy of larger, mature trees. This approach will be used for future tree removal and replacement and help to create an Urban Forest that has mature trees, middle aged trees, and young trees in similar quantities.

### Current Tree Population

| <u>SPECIES</u>    | <u>COUNT</u> | <u>% OF TOTAL</u> | <u>AVG DBH</u> | <u>AVG COND</u> |
|-------------------|--------------|-------------------|----------------|-----------------|
| AMERICAN HORNBEAM | 34           | 0.98%             | 4.53           | 2.97            |
| AMERICAN REDBUD   | 32           | 0.93%             | 2.94           | 2.59            |
| ARBOR VITAE       | 152          | 4.40%             | 5.27           | 2.76            |
| ASH-AMERICAN      | 18           | 0.52%             | 12.17          | 3.28            |
| ASH-GREEN         | 58           | 1.68%             | 16.66          | 3.48            |
| ASH-SPP           | 3            | 0.09%             | 14.33          | 5.00            |
| ASH-WHITE         | 26           | 0.75%             | 18.12          | 3.31            |
| ASPEN-SPP         | 1            | 0.03%             | 7.00           | 2.00            |
| BIRCH-RIVER       | 12           | 0.35%             | 10.25          | 2.92            |
| BIRCH-SPP         | 13           | 0.38%             | 7.08           | 2.69            |
| BIRCH-WHITE       | 21           | 0.61%             | 11.00          | 2.90            |
| BLACK LOCUST      | 16           | 0.46%             | 19.19          | 2.69            |
| BOXELDER          | 19           | 0.55%             | 13.89          | 3.16            |
| BUCKEYE-OHIO      | 29           | 0.84%             | 1.59           | 2.55            |
| BUCKTHORN-ALDER   | 3            | 0.09%             | 4.67           | 3.33            |
| CATALPA           | 1            | 0.03%             | 2.00           | 3.00            |
| CHERRY-AMUR       | 9            | 0.26%             | 2.56           | 2.33            |
| CHERRY-BLACK      | 12           | 0.35%             | 14.92          | 3.08            |
| CHERRY-SPP        | 11           | 0.32%             | 6.36           | 3.00            |
| CHESTNUT-SPP      | 1            | 0.03%             | 7.00           | 3.00            |
| COTTONWOOD        | 29           | 0.84%             | 32.93          | 2.93            |
| CRABAPPLE-SPP     | 185          | 5.36%             | 6.97           | 2.96            |

**VILLAGE OF MCFARLAND URBAN FORESTRY MANAGEMENT PLAN**

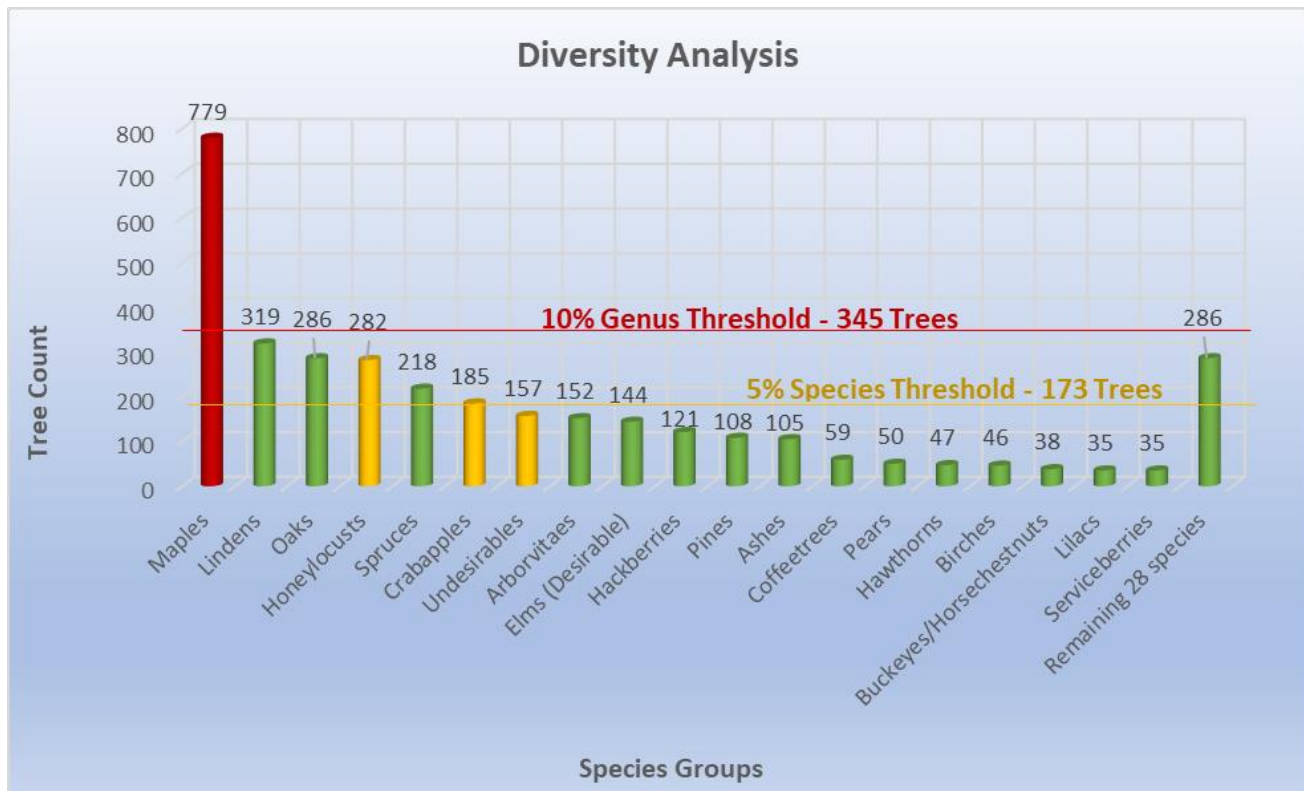
|                     |     |       |       |      |
|---------------------|-----|-------|-------|------|
| DOGWOOD-SPP         | 3   | 0.09% | 3.00  | 3.00 |
| DOUGLAS FIR         | 4   | 0.12% | 14.00 | 2.75 |
| EASTERN REDCEDAR    | 15  | 0.43% | 9.07  | 2.67 |
| ELM-AMERICAN        | 6   | 0.17% | 20.17 | 3.00 |
| ELM-HYBRID          | 133 | 3.85% | 9.05  | 2.62 |
| ELM-RED             | 5   | 0.14% | 20.80 | 3.00 |
| ELM-SIBERIAN        | 51  | 1.48% | 15.92 | 3.04 |
| FIR-BALSAM          | 4   | 0.12% | 8.75  | 2.75 |
| GINKGO              | 31  | 0.90% | 2.42  | 2.65 |
| HACKBERRY           | 121 | 3.51% | 4.56  | 2.60 |
| HAWTHORN-SPP        | 42  | 1.22% | 3.45  | 2.88 |
| HAWTHORN-WASHINGTON | 5   | 0.14% | 6.20  | 3.00 |
| HAZELNUT-TREE       | 18  | 0.52% | 2.94  | 2.72 |
| HICKORY-BITTERNUT   | 1   | 0.03% | 20.00 | 3.00 |
| HICKORY-SHAGBARK    | 9   | 0.26% | 18.11 | 3.00 |
| HONEYLOCUST         | 282 | 8.17% | 11.91 | 2.62 |
| HORSECHESTNUT       | 9   | 0.26% | 3.11  | 2.22 |
| IRONWOOD            | 8   | 0.23% | 4.88  | 2.75 |
| JUNIPER-SPP         | 29  | 0.84% | 7.76  | 2.55 |
| KATSURATREE         | 4   | 0.12% | 4.75  | 3.00 |
| KENTUCKY COFFEETREE | 59  | 1.71% | 2.66  | 2.19 |
| LARCH               | 1   | 0.03% | 12.00 | 2.00 |
| LILAC-JAPANESE      | 35  | 1.01% | 4.69  | 2.54 |
| LINDEN-AMERICAN     | 89  | 2.58% | 9.55  | 2.52 |
| LINDEN-LITTLELEAF   | 217 | 6.29% | 10.94 | 2.79 |
| LINDEN-SILVER       | 2   | 0.06% | 1.50  | 2.00 |
| LINDEN-SPP          | 11  | 0.32% | 1.82  | 2.18 |
| LONDON PLANETREE    | 12  | 0.35% | 2.00  | 2.50 |
| MAGNOLIA-SPP        | 3   | 0.09% | 5.33  | 2.67 |
| MAPLE-AMUR          | 33  | 0.96% | 5.58  | 2.88 |
| MAPLE-FREEMAN       | 254 | 7.36% | 5.74  | 2.59 |
| MAPLE-JAPANESE      | 1   | 0.03% | 2.00  | 3.00 |
| MAPLE-MIYABEI       | 9   | 0.26% | 7.67  | 2.11 |
| MAPLE-NORWAY        | 216 | 6.26% | 11.20 | 2.81 |
| MAPLE-RED           | 109 | 3.16% | 5.74  | 2.50 |
| MAPLE-SILVER        | 76  | 2.20% | 24.47 | 2.96 |
| MAPLE-SPP           | 14  | 0.41% | 3.71  | 2.57 |
| MAPLE-SUGAR         | 67  | 1.94% | 9.97  | 2.90 |
| MOUNTAIN ASH-SPP    | 4   | 0.12% | 2.25  | 2.25 |
| MULBERRY-SPP        | 13  | 0.38% | 10.08 | 3.00 |
| OAK-BURR            | 46  | 1.33% | 13.39 | 2.48 |
| OAK-ENGLISH         | 6   | 0.17% | 3.50  | 3.00 |

# VILLAGE OF MCFARLAND URBAN FORESTRY MANAGEMENT PLAN

|                    |     |       |       |      |
|--------------------|-----|-------|-------|------|
| OAK-HILLS          | 4   | 0.12% | 6.50  | 2.25 |
| OAK-PIN            | 5   | 0.14% | 12.40 | 1.40 |
| OAK-RED            | 99  | 2.87% | 7.87  | 2.38 |
| OAK-SCHUETTS       | 3   | 0.09% | 2.67  | 3.00 |
| OAK-SPP            | 12  | 0.35% | 3.42  | 2.50 |
| OAK-SWAMP WHITE    | 75  | 2.17% | 6.65  | 2.03 |
| OAK-WHITE          | 36  | 1.04% | 24.22 | 2.75 |
| PEAR-CALLERY       | 44  | 1.27% | 7.82  | 3.05 |
| PEAR-SPP           | 6   | 0.17% | 6.17  | 2.83 |
| PINE-AUSTRIAN      | 11  | 0.32% | 12.64 | 3.09 |
| PINE-RED           | 11  | 0.32% | 15.09 | 3.00 |
| PINE-SCOTCH        | 2   | 0.06% | 11.50 | 3.00 |
| PINE-SPP           | 7   | 0.20% | 2.43  | 3.00 |
| PINE-WHITE         | 77  | 2.23% | 13.14 | 2.40 |
| POPLAR-WHITE       | 3   | 0.09% | 31.00 | 1.67 |
| SERVICEBERRY-SPP   | 35  | 1.01% | 2.80  | 2.74 |
| SMOKETREE-AMERICAN | 1   | 0.03% | 1.00  | 2.00 |
| SPRUCE-BLACK HILLS | 7   | 0.20% | 4.43  | 3.00 |
| SPRUCE-BLUE        | 113 | 3.27% | 11.82 | 2.99 |
| SPRUCE-NORWAY      | 25  | 0.72% | 10.80 | 2.44 |
| SPRUCE-WHITE       | 73  | 2.11% | 7.77  | 2.66 |
| SWEETGUM           | 1   | 0.03% | 9.00  | 3.00 |
| TULIPTREE          | 2   | 0.06% | 9.50  | 3.50 |
| UNKNOWN            | 13  | 0.38% | 1.92  | 2.92 |
| WALNUT-BLACK       | 29  | 0.84% | 17.03 | 2.90 |
| WILLOW-SPP         | 11  | 0.32% | 20.00 | 3.27 |
| YEW-SPP            | 5   | 0.14% | 2.40  | 2.60 |

As shown in the table above, the Village of McFarland Tree population consists of 91 distinct tree species, accounting for 3,452 total trees. The above table shows the percent of the total population each species makes up, as well as the average Trunk Diameter. This population is shown graphically below:





In general, the McFarland tree population has overall good diversity with 91 different species represented. However, one genus, which includes all Maple species, accounts for 23% of McFarland's tree population. It is quite common for Maple species to be the highest represented species in municipalities and in other urban settings because they are typically an adaptable and hardy shade tree. However, if a pest or pathogen that attacks only the Maple genus were introduced into our region, McFarland could potentially lose nearly a quarter of its tree population.

Honeylocusts alone makes up over 8% of McFarland's entire population and is followed by Freeman Maple, Littleleaf Linden, Norway Maple, and Crabapple each over the 5% species threshold and making nearly 34% of the entire population represented by 5 singular species.

Spruce trees also make up a significant portion of the population and are particularly susceptible to a number of pathogens and should be monitored for the presence or progression of these diseases. The 157 trees that were classified in the "Undesirables" tree category consist of species that are invasive and/or have fast-growing or weak-wooded characteristics that make them unwanted in the urban landscape such as Willow, Poplar, Mulberry, Siberian Elm, Black Locust, Black Cherry, Cottonwood, and Boxelder.

It should generally be said that reducing the number of Maples overall while increasing lesser represented species should be a strategic goal, and our Diversity Vision will help to accomplish this.

With an estimated 750 available planting spaces, a long term tree planting plan would be an valuable tool for McFarland to pursue. Such a plan would not only further improve overall diversity, but also maximize the lifespan of trees on the terraces by carefully matching tree species requirements and

tolerances with each individual planting site. Trees that are well adapted to their growing conditions will establish more quickly, require less maintenance, be healthier overall, and more resistant to disease and insect problems. By matching the right trees with the right planting spaces using a tree planting plan, the Village of McFarland can help protect its investment in each new tree.

Although McFarland's diversity is good overall (with the exception of those discussed above), the Village has a number species to choose from which are commercially available and underrepresented in their population. As mentioned above, this UFMP will lay out strategies to even further improve diversity, and we will examine the specific species recommended in the "Future of the Urban Forest" Section below.

### **i-Tree Report / Urban Tree Canopy Assessment**

i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides Urban Forestry analysis and benefits assessment tools. The i-Tree tools help communities of all sizes to strengthen their forest management and advocacy efforts by quantifying the structure of trees and forests, and the environmental services that trees provide.

The i-Tree suite calculates hard dollar values that trees provide to communities. Trees provide "ecological services" that save homeowners money, such as in heating and cooling costs, where large trees help shade houses in the summer, saving on air conditioning and electricity bills, and provide windbreaks during the winter, saving on heating and natural gas costs. They also provide CO<sub>2</sub> uptake, reducing the effects of climate change, as well as air quality improvements by the absorption of urban pollutants. Trees also absorb stormwater, which reduces strain on stormwater infrastructure, and saves money in replacement costs. Finally, trees contribute up to 15% of the total value of a property, so they have monetary aesthetic benefits as well.

Using the data from the tree inventory, an i-Tree report has been prepared the Village of McFarland. Below you will find reports on the Net annual benefits of the tree population, replacement values, and breakdown of benefits per species. We performed an i-Tree Eco analysis which focuses primarily on ecological benefits. The results of these analyses are below, and full tables and the i-Tree Report are available.

### **i-Tree Eco Analysis Results**

A summary of the iTree Eco report for the McFarland tree population is provided below in several formats, as summary tables, and with a bullet point list somewhat longer:

## VILLAGE OF MCFARLAND URBAN FORESTRY MANAGEMENT PLAN

|                              |                 |
|------------------------------|-----------------|
| Pollution Removal            | \$4,350         |
| Carbon Sequestration         | \$5,270         |
| Avoided Runoff               | \$5,450         |
| Building Energy Savings      | \$14,500        |
| Carbon Avoided               | \$6,070         |
| Oxygen Production            | \$9,722         |
| <b>TOTAL ANNUAL BENEFITS</b> | <b>\$45,362</b> |

|                                |                    |
|--------------------------------|--------------------|
| Carbon Storage                 | \$176,000          |
| Replacement Value              | \$3,570,000        |
| <b>TOTAL STANDING BENEFITS</b> | <b>\$3,746,000</b> |

The above tables are further summarized in the table below:

|                             |                      |
|-----------------------------|----------------------|
| <b>Annual Values</b>        |                      |
| Benefits to Residents       | \$29,570/year        |
| Benefits to Environment     | \$15,792/year        |
| <b>SUBTOTAL (Each Year)</b> | <b>\$45,362/year</b> |
| <b>Standing Values</b>      |                      |
| As a Commodity              | \$3,570,000          |
| As an Ecological Resource   | \$176,000            |
| <b>SUBTOTAL</b>             | <b>\$3,746,000</b>   |

As can be seen from the above tables, the tree population in the Village of McFarland currently provides approximately \$45,362 in benefits every year, directly related to trees and their effect on homes, businesses, and the environment. It should be noted that the annual budget for all forestry activities recommended in this plan, projected for the calendar year 2024, will total approximately \$79,045 per year, so the benefits from the tree population are worth over half of what the cost put into them will be. We will examine this further below. In addition, the total standing value as a commodity and an ecological resource of the whole tree population is \$3,746,000.

These benefits can be viewed as “income” to McFarland’s residents, and so long as the trees are well maintained, they will continue to provide these benefits, and more. As trees grow, they also increase their benefits! For example, a 3” diameter tree provides less than \$50/year in benefits, whereas a 20” tree can provide up to \$500 per year. The goal is to increase benefits even more, where the tree population pays for itself and even yields “profits”!

The replacement value of trees was also calculated. Currently, the standing value of all trees in the Village of McFarland population is \$3,570,000. This value is calculated using the industry standard reference, the *9<sup>th</sup> Edition Guide to Tree and Landscape Appraisal*, which is published by the Board of Tree and Landscape Appraisers.



The i-Tree Eco data looks at the value of the trees in the absence of the effect of homes or businesses, and looks at trees more from an ecological perspective, mostly what the tree's value is in sequestering and storing Carbon. These numbers are based on peer reviewed science in both Arboriculture as well as Climatology and other disciplines.

The goal of this Urban Forestry Management Plan is to create a tree population which maximizes all of these ecological services to McFarland residents by increasing the number of trees in Village, and how long they live, while minimizing costs in order to create a healthy, well maintained, and vibrant tree population. Below are several examples of Ecological Services provided by trees:

**Energy Savings:** During the summer when temperatures are warm, trees create shade, and temperatures are cooler in the shade. Cooler temperatures cause air conditioners to have to work less, which reduces the amount of energy a household uses. During the winter when temperatures are cold, winter winds cool your home quickly. Trees act as windbreaks, causing heating systems to use less natural gas, saving energy and money.

**Carbon Dioxide (CO<sub>2</sub>):** The amount of CO<sub>2</sub> which is put into the atmosphere each year has a direct correlation with global climate change. That change causes more severe storms, greater drought conditions, and many other costly outcomes. Reducing CO<sub>2</sub> from our atmosphere lessens these effects. Trees uptake CO<sub>2</sub> and act as a carbon sink, putting carbon into long term storage in its woody tissues, removing it from our atmosphere, creating a net benefit to society, and saving money.

**Air Quality:** Industrial processes and vehicle emissions put pollutants into our air. These pollutants can cause or worsen health conditions such as heart disease, asthma, and lung disease. In addition, these pollutants can mix with water in the atmosphere and create nitric and sulfuric acid, causing acid rain, which can destroy fisheries and contaminate water supplies. Trees absorb these compounds with their leaves and other tissues, and prevent them from remaining in the atmosphere. Reductions in these pollutants results in overall better health, reducing the cost of healthcare to society, and saving communities money.

**Storm water:** The cost of delivering fresh water to homes, as well as removing and treating wastewater and storm water is considerable. One of the greatest costs comes when these systems are overwhelmed, such as during flooding, which can cause millions of dollars of damage to homes and vehicles, or when these systems need to be replaced. Fortunately, trees take water from the soil and put it back into the atmosphere through the process of transpiration. Therefore, the more trees an organization has, the less flooding is an issue, and the less strain is put on storm water infrastructure, resulting in fewer repairs and replacements. In addition, tree canopy slows rainfall's effects on flooding by "intercepting" it with leaves and branches, delaying how quickly rainfall can become floodwater. All of this adds up to savings for an organization.

**Aesthetic/Economic:** Up to 15% of the value of a property can be attributed to its trees and other landscaping. Tree lined streets are much more appealing to homebuyers than streets devoid of trees, resulting in increased home sales, and therefore increased tax revenue, or increased tax revenue with which to fund initiatives relating to trees, attract new businesses, etc.

## Urban Tree Canopy Assessment

Based on data available from the US Forest Service and Wisconsin Department of Natural Resources, the total Urban Tree Canopy of McFarland can be determined.

This is expressed as the percent of the Village covered by tree canopy from an aerial view. This assessment included 5 total land cover types, including trees, grass and shrub, bare soil, water, buildings, roads/railroads, and other paved surfaces. The result of this tree canopy assessment was that McFarland contains 27.72% total tree canopy. The map of the canopy assessment appears [on the next page](#).

|                 |        |
|-----------------|--------|
| Buildings/Roads | 35.40% |
| Grass/Shrub/Ag  | 30.90% |
| Tree Canopy     | 27.72% |
| Bare Soil       | 5.32%  |
| Water           | 0.66%  |

The tree inventory itself was only conducted on publicly owned land such as terraces, boulevards, parks etc. Detailed information on each tree is not included in this assessment, only total coverage. Aerial images were used to estimate how much tree and other land cover types were in the Village using a software which is similar to Google Earth or other aerial imagery viewers.

The goal is to increase the total tree canopy in McFarland to 30% by 2044. This goal has been estimated by analyzing data from many different urban tree populations in the Chicago and Northwest Indiana regions, and is based on preliminary data from the Chicago Region Trees Initiative's (CRTI) Forest Composition Workgroup.

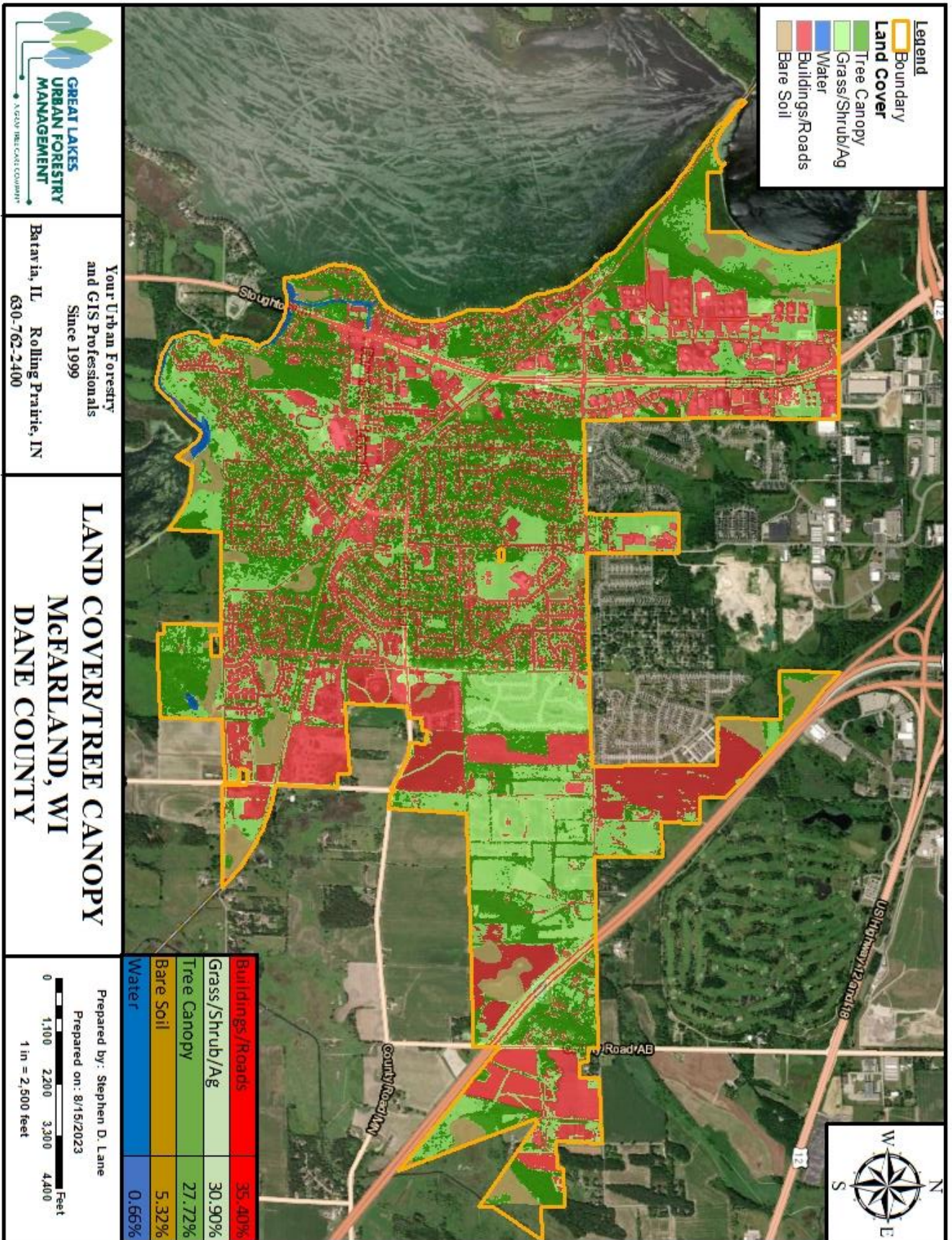
We believe this is an attainable goal over this time period. McFarland as a whole has an overall moderate amount of tree canopy, and it is fairly average compared to other similar suburban communities of Chicagoland. The goal set is a modest, but reasonable, increase, which will still yield beneficial results.

This will be accomplished through increasing the number of trees on the Village's terraces as well as other Village-owned properties. It will also be accomplished by maintaining the existing tree population in a proactive fashion, by enhancing the Urban Forestry program in McFarland. This will ensure that existing trees will live longer as they are given appropriate care.

Tree planting and maintenance will also be encouraged on private property, by incentivizing residents and business owners to plant trees through public-private partnerships. Outreach and education will also be provided to residents through events such as Arbor Day and Earth Day celebrations. This goal will be monitored by using aerial imagery analysis like the analysis presented below. Every 10 years, the imagery will be assessed, and a new canopy cover percentage will be calculated for McFarland.



# VILLAGE OF MCFARLAND URBAN FORESTRY MANAGEMENT PLAN

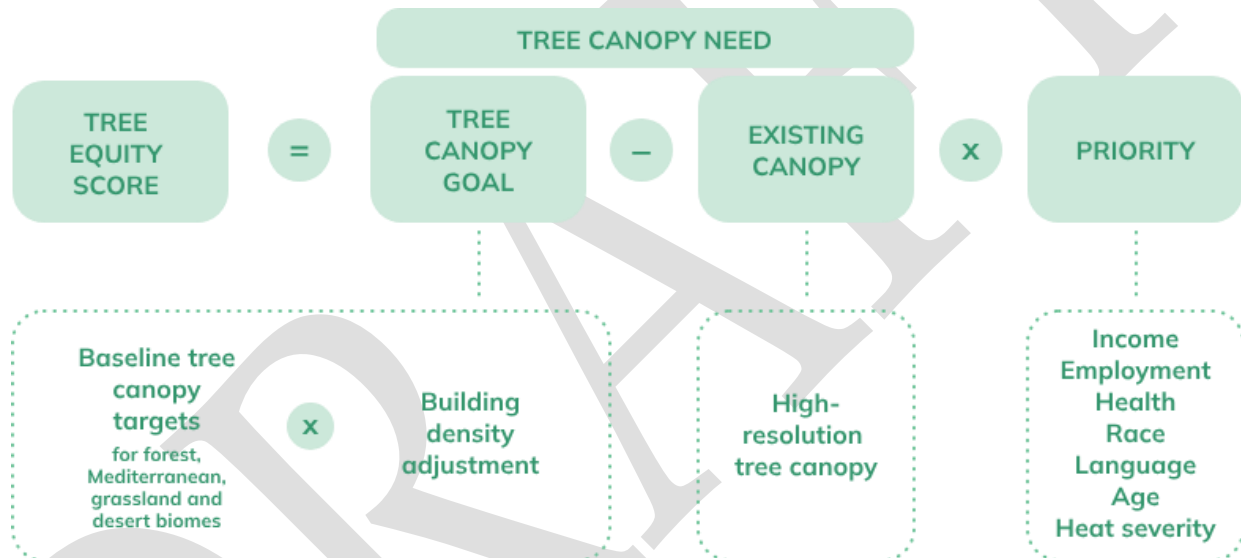


## Tree Equity Scores

Tree Equity Score measures how well the benefits of trees are reaching communities living on low-incomes, communities of color and others disproportionately impacted by extreme heat and other environmental hazards.

Tree Equity Score is a nationwide, block group-level score ranging from 0-100 that highlights inequitable access to trees. The lower the score, the greater priority for tree planting. A score of 100 means the block group has met a minimum standard for tree cover appropriate for the area's natural biome and built environment.

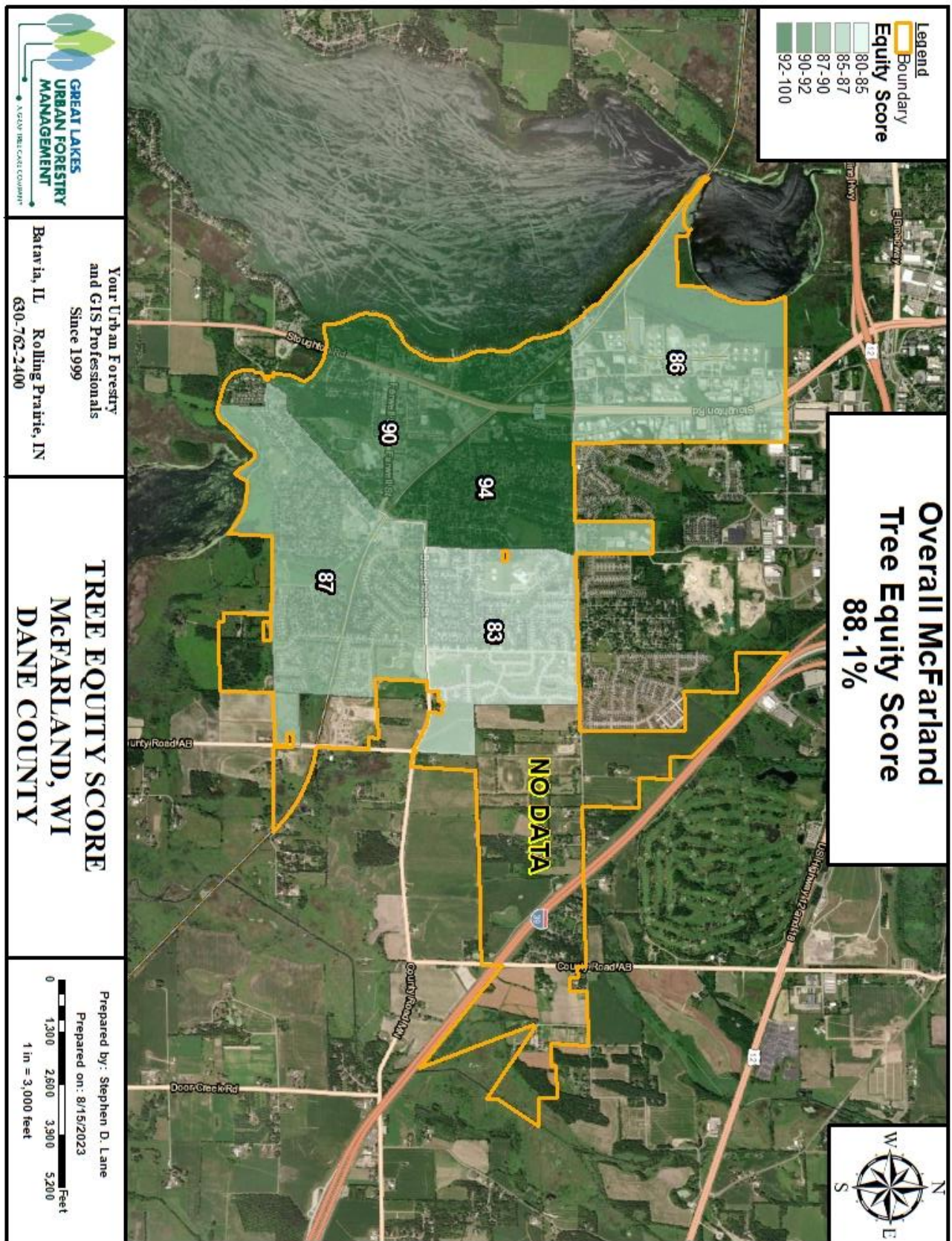
Achieving Tree Equity in cities provides numerous benefits to public health, water, air quality, climate and community wellbeing. The tree canopy benefits measures utilize the power of i-Tree Landscape and research funded by American Forests on job creation.



As shown on the map below, McFarland's Overall Tree Equity Score is 88.1% and no census tract throughout the Village has a Tree Equity Score of less than 83. These are overall very good numbers, but leaves the Village with a bit of room for improvement.

The tree equity census tract data can help the Village evaluate and prioritize areas with the greatest need by using convenient mapping tools. It will also help the Village gain valuable insights to increase its impact through tree planting and protection and guide engagement with residents. More information on Tree Equity Scores can be found at: <https://www.treeequityscore.org/>





## The Future of the Urban Forest

In this section, a vision of what the tree population of McFarland could become by 2044 was created, and compared with the current population. Using the existing data, and the diversity vision, we will then define exactly how McFarland can move from where it is now to where it could be.

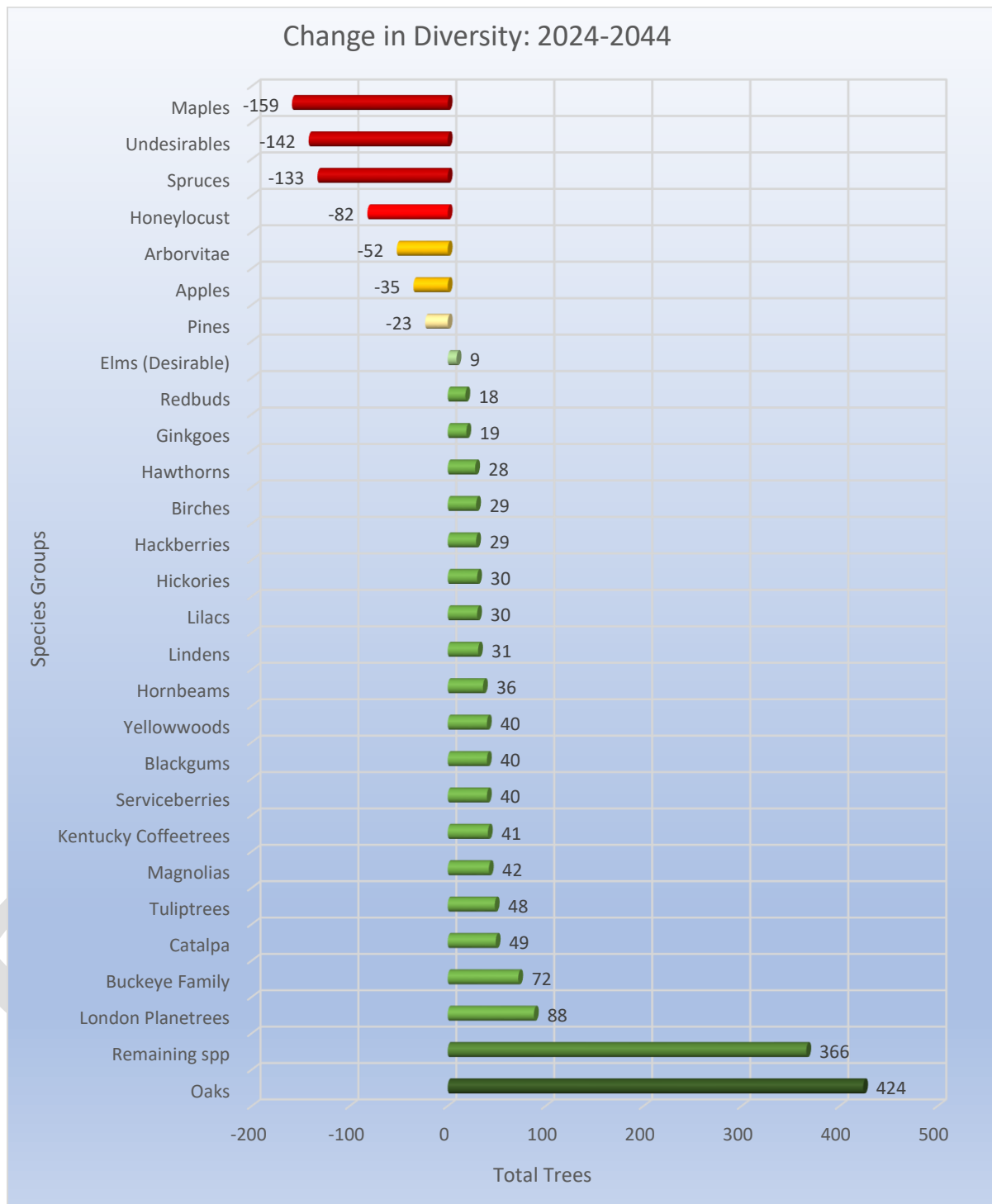
### Change in Species Composition 2024 – 2044

The full calculations for this change in diversity were performed by hand, not using automated software. Local knowledge of the trees, their conditions, what is growing well and what isn't were all used and yielded this very customized forest composition change list. These goals are meant as general guideposts, and not absolutes. Be aware that this Plan, and the species composition goals, are meant to be adaptively managed over time, and as new information becomes available.

| SPECIES             | COUNT 2024 | COUNT 2044 | SPECIES             | COUNT 2024 | COUNT 2044 | SPECIES             | COUNT 2024 | COUNT 2044 |
|---------------------|------------|------------|---------------------|------------|------------|---------------------|------------|------------|
| HONEYLOCUST         | 282        | 200        | HAZELNUT-TREE       | 18         | 20         | DOGWOOD-SPP         | 3          | 15         |
| MAPLE-FREEMAN       | 254        | 200        | BLACK LOCUST        | 16         | 25         | MAGNOLIA-SPP        | 3          | 15         |
| LINDEN-LITTLELEAF   | 217        | 175        | EASTERN REDCEDAR    | 15         | 25         | OAK-SCHUETTS        | 3          | 30         |
| MAPLE-NORWAY        | 216        | 100        | MAPLE-SPP           | 14         | 5          | POPLAR-WHITE        | 3          | 0          |
| CRABAPPLE-SPP       | 185        | 150        | BIRCH-SPP           | 13         | 15         | LINDEN-SILVER       | 2          | 30         |
| ARBOR VITAE         | 152        | 100        | MULBERRY-SPP        | 13         | 0          | PINE-SCOTCH         | 2          | 10         |
| ELM-HYBRID          | 133        | 150        | UNKNOWN             | 13         | 0          | TULIPTREE           | 2          | 50         |
| HACKBERRY           | 121        | 150        | BIRCH-RIVER         | 12         | 30         | ASPEN-SPP           | 1          | 10         |
| SPRUCE-BLUE         | 113        | 90         | CHERRY-BLACK        | 12         | 0          | CATALPA             | 1          | 50         |
| MAPLE-RED           | 109        | 100        | LONDON PLANETREE    | 12         | 100        | CHESTNUT-SPP        | 1          | 10         |
| OAK-RED             | 99         | 125        | OAK-SPP             | 12         | 30         | HICKORY-BITTERNUT   | 1          | 10         |
| LINDEN-AMERICAN     | 89         | 125        | CHERRY-SPP          | 11         | 15         | LARCH               | 1          | 20         |
| PINE-WHITE          | 77         | 50         | LINDEN-SPP          | 11         | 20         | MAPLE-JAPANESE      | 1          | 10         |
| MAPLE-SILVER        | 76         | 25         | PINE-AUSTRIAN       | 11         | 5          | SMOKETREE-AMERICAN  | 1          | 10         |
| OAK-SWAMP WHITE     | 75         | 125        | PINE-RED            | 11         | 20         | SWEETGUM            | 1          | 30         |
| SPRUCE-WHITE        | 73         | 50         | WILLOW-SPP          | 11         | 0          | AMUR MAACKIA        | 0          | 30         |
| MAPLE-SUGAR         | 67         | 100        | CHERRY-AMUR         | 9          | 10         | ASPEN-QUAKING       | 0          | 20         |
| KENTUCKY COFFEETREE | 59         | 100        | HICKORY-SHAGBARK    | 9          | 20         | BEECH-EUROPEAN      | 0          | 20         |
| ASH-GREEN           | 58         | 20         | HORSECHESTNUT       | 9          | 30         | BEECH-AMERICAN      | 0          | 10         |
| ELM-SIBERIAN        | 51         | 10         | MAPLE-MIYABEI       | 9          | 50         | BLACKGUM            | 0          | 40         |
| OAK-BURR            | 46         | 75         | IRONWOOD            | 8          | 30         | BUCKEYE-YELLOW      | 0          | 20         |
| ASH-WHITE           | 44         | 15         | PINE-SPP            | 7          | 5          | BUCKEYE-RED         | 0          | 20         |
| PEAR-CALLERY        | 44         | 5          | SPRUCE-BLACK HILLS  | 7          | 20         | DOGWOOD-CORNELIAN   | 0          | 20         |
| HAWTHORN-SPP        | 42         | 40         | ELM-AMERICAN        | 6          | 3          | HAWTHORN-COCKSPUR   | 0          | 20         |
| OAK-WHITE           | 36         | 75         | OAK-ENGLISH         | 6          | 40         | PAGODATREE          | 0          | 20         |
| LILAC-JAPANESE      | 35         | 65         | PEAR-SPP            | 6          | 15         | HICKORY-SHELLBARK   | 0          | 10         |
| SERVICEBERRY-SPP    | 35         | 75         | ELM-RED             | 5          | 0          | HORNBEAM-EUROPEAN   | 0          | 20         |
| HORNBEAM-AMERICAN   | 34         | 50         | HAWTHORN-WASHINGTON | 5          | 15         | MAGNOLIA-CUCUMBER   | 0          | 10         |
| MAPLE-AMUR          | 33         | 20         | OAK-PIN             | 5          | 40         | MAPLE-PAPERBARK     | 0          | 10         |
| AMERICAN REDBUD     | 32         | 50         | YEW-SPP             | 5          | 15         | OAK-CHINQUAPIN      | 0          | 50         |
| GINKGO              | 31         | 50         | DOUGLAS FIR         | 4          | 15         | OAK-SHINGLE         | 0          | 50         |
| BUCKEYE-OHIO        | 29         | 40         | FIR-BALSAM          | 4          | 15         | OAK-CRIMSON SPIRE   | 0          | 30         |
| COTTONWOOD          | 29         | 5          | KATSURATREE         | 4          | 15         | PERSIMMON           | 0          | 20         |
| JUNIPER-SPP         | 29         | 30         | MOUNTAIN ASH-SPP    | 4          | 15         | PLUM-AMERICAN       | 0          | 20         |
| WALNUT-BLACK        | 29         | 10         | OAK-HILLS           | 4          | 40         | WITCH HAZEL-EASTERN | 0          | 10         |
| SPRUCE-NORWAY       | 25         | 20         | ASH-SPP             | 3          | 1          | WITCH HAZEL-OZARK   | 0          | 10         |
| BIRCH-WHITE         | 21         | 30         | BUCKTHORN-ALDER     | 3          | 1          | ZELKOVA             | 0          | 30         |
| BOXELDER            | 19         | 0          |                     |            |            | YELLOWWOOD          | 0          | 40         |

|  |                              |
|--|------------------------------|
|  | Plant in Abundance           |
|  | Plant in Limited Quantities  |
|  | Maintain Existing Population |
|  | Reduce Population Size       |

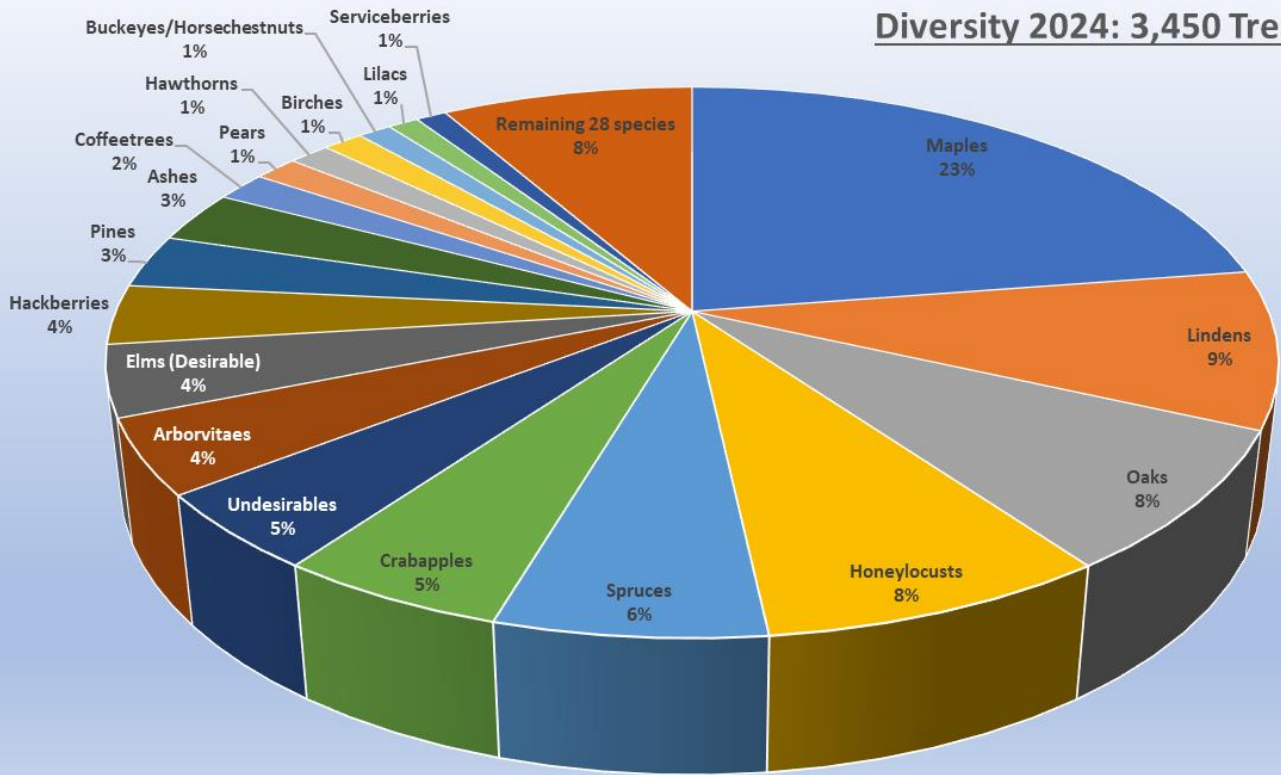
# Change in Species Composition 2024 - 2044



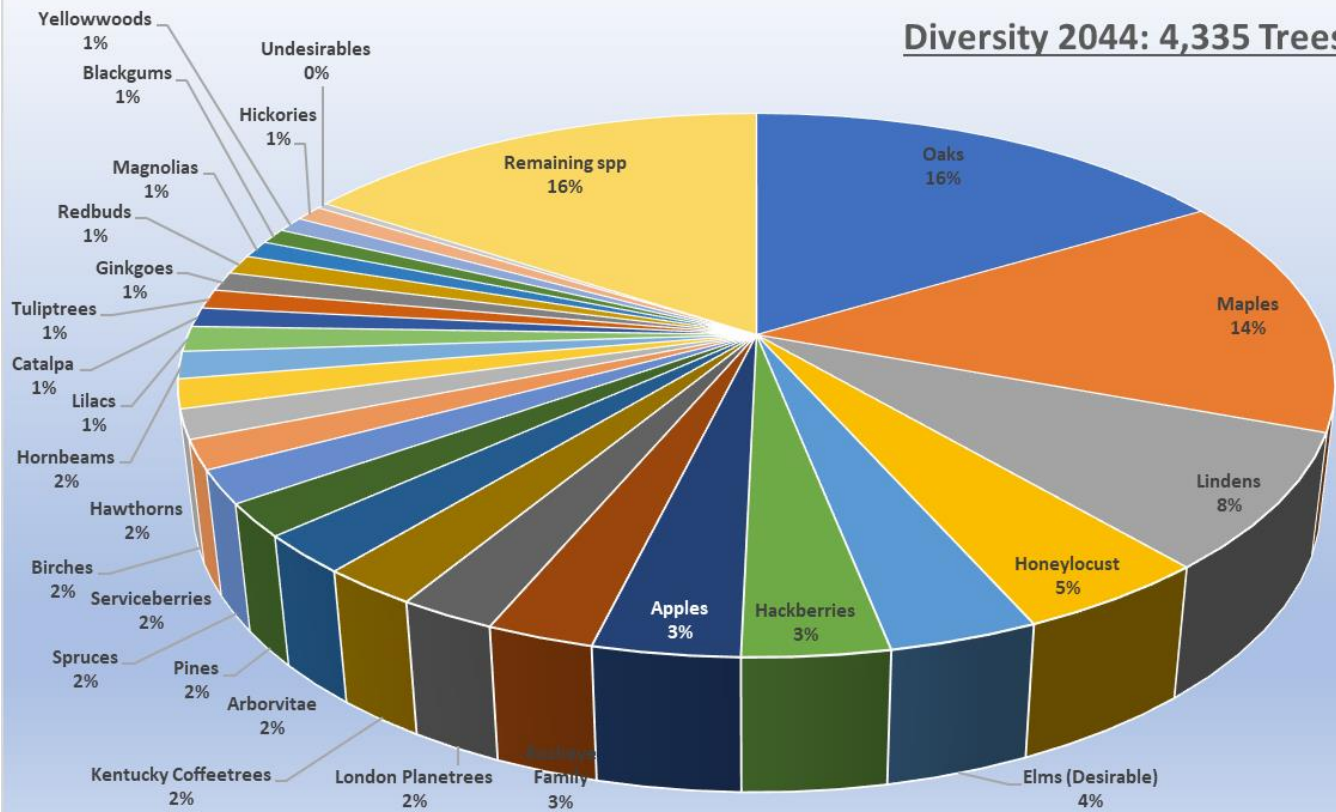


## VILLAGE OF MCFARLAND URBAN FORESTRY MANAGEMENT PLAN

**Diversity 2024: 3,450 Trees**



**Diversity 2044: 4,335 Trees**





As can be seen from the above several pages of charts showing the change in species composition over the next 20 years, there will broadly be a move away from the overrepresented or low quality species discussed above, and a variety of different species, those which are underrepresented or not present in the tree population, will be planted. This will lead to an overall increase from 3,452 to 4,335 trees total on the Village's ROWs, as well as a change from the current total of 91 species to a total of 108 species. This will result in a more robust and resilient Urban Forest which is resistant to pest and pathogen outbreaks.

### **The Benefits of Larger, Healthier Trees**

Larger trees provide greater benefits to the community: They create more shade to offset cooling costs, absorb more storm water, create greater buffers against cool winter winds for heating costs, and absorb and sequester more carbon than smaller trees do. For the 2044 vision of the tree population, a variety of methods were used to arrive at a reasonable age-class distribution. We used the current population structure, and anticipated high rates of survival based on new planting practices which would involve a "right tree/right site" approach, as well as increased survivorship of existing trees due to better management and care practices. Predicted growth, survivorship, and eventual tree losses are based on current species composition and future plantings and removals. This allowed the creation of a vision of what the tree population, including species and size, will look like 20 years from now.



It can be seen from the above chart that the existing tree population (grey bars) shows a predominantly younger tree population with gradual decreases in numbers of trees through the 13-18" category and a steep drop in numbers in the larger age class categories. The projected age class

chart shows an a steady in the larger age class category over the course of this Plan, and also projects more trees surviving into the older age classes, where they will provide the greatest benefits in terms of ecological services to the community. The table to the right shows this data in a tabular format.

This was based on the fact that increased levels of care for existing trees would enable them to survive longer. The graph and table show a general expectation of how the changes in tree diameters might change over the next 20 years based on the methods to be applied in this Urban Forestry Management Plan. The numbers themselves were projected by hand, based on our prior experience, and the methods detailed below. If these projections hold, McFarland could see a 20-30% increase in overall annual benefits as trees age into larger age classes.

For projections of future age classes of trees, a ½" per year growth rate was roughly estimated by assuming that it would take an average tree 10 years to go from one age class to the next (6" = appx 10 years growth). Also used were the number of trees to be planted and removed annually, as calculated below in the Tree Planting and Tree Removal sections. These numbers were arrived at based on all the above, as well as the best professional opinion of the Forestry Consultant. As time goes by, these projections will likely change. These are rough estimates for the purposes of this Plan.

The overall increase in size of the tree population and diameters of the individual trees will yield a much greater dollar figure when it comes to the ecological services provided, and provide residents with a greater sense of being in an arboretum-like setting when they are enjoying the urban forest.

### Return on Investment

### Return on Investment

Return On Investment (ROI) for an individual tree is strongly favorable over the life of a tree in terms of investment in planting, care, and removal versus the ecological benefits the tree provides. As we strive to justify the expenditures on trees and tree care, it is important that organizations and their staff are aware of this.

Below, we have provided an ROI calculation sheet. This sheet breaks the lifetime of an average tree down into three phases, based on the anticipated costs of pruning in the budgets sections below. These phases are the young (3-12" DBH), mature (13-24" DBH), and full grown (25-36") ranges shown below.

Data was taken from the i-Tree algorithm, and applied towards the average benefits provided by a typical tree at each of these life stages, and multiplies it out over the 20 year period each phase accounts for. We also looked at costs for planting, watering, routine maintenance, emergency

|        | 2024 | 2034 | 2044 |
|--------|------|------|------|
| 0-6"   | 1519 | 1000 | 1000 |
| 7-12"  | 985  | 1300 | 950  |
| 13-18" | 547  | 850  | 1200 |
| 19-24" | 236  | 450  | 700  |
| 25-30" | 90   | 150  | 300  |
| 31-36" | 43   | 75   | 115  |
| 37-42" | 16   | 25   | 50   |
| >42"   | 16   | 10   | 20   |

maintenance, and eventual removal of that tree over 60 years. The sample calculations are pictured below.

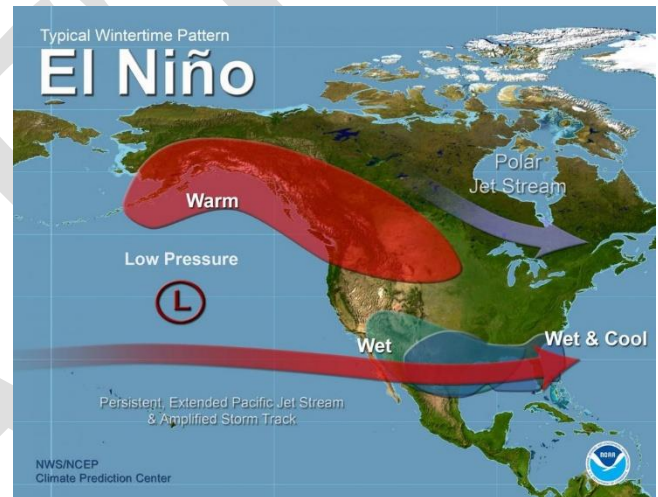
|                                   |                       |                |
|-----------------------------------|-----------------------|----------------|
| Initial Purchase and Installation | \$575                 | \$575          |
| Pruning 15x Over 60 yr Lifetime   | 15 @ \$75/prune       | \$1,125        |
| Emergency Maintenance             | 1 @ \$250             | \$250          |
| Eventual Cost of Removal          | \$850                 | \$850          |
| <b>SUBTOTAL</b>                   |                       | <b>\$2,800</b> |
|                                   |                       |                |
| Annual Benefits                   | \$30.78/yr @ 60 years | \$1,847        |
| Replacement Value                 | \$1,610               | \$1,160        |
| Carbon Storage                    | \$92                  | \$92           |
| <b>SUBTOTAL</b>                   |                       | <b>\$3,099</b> |
|                                   |                       |                |
| <b>Return on Investment</b>       |                       | <b>10.68%</b>  |



## Trees and Climate Change

According to the United States Environmental Protection Agency, National Oceanic and Atmospheric Administration, Metropolitan Mayors Caucus, and a variety of other national and international reputable scientific and humanities-oriented sources, climate change will cause significant suffering over the coming hundreds to thousands of years. Increases in carbon dioxide, methane, and other greenhouse gasses in the atmosphere trap heat from the sun and will create a generally warming climate. Though it should be said that “climate change” means more than just warming trends.

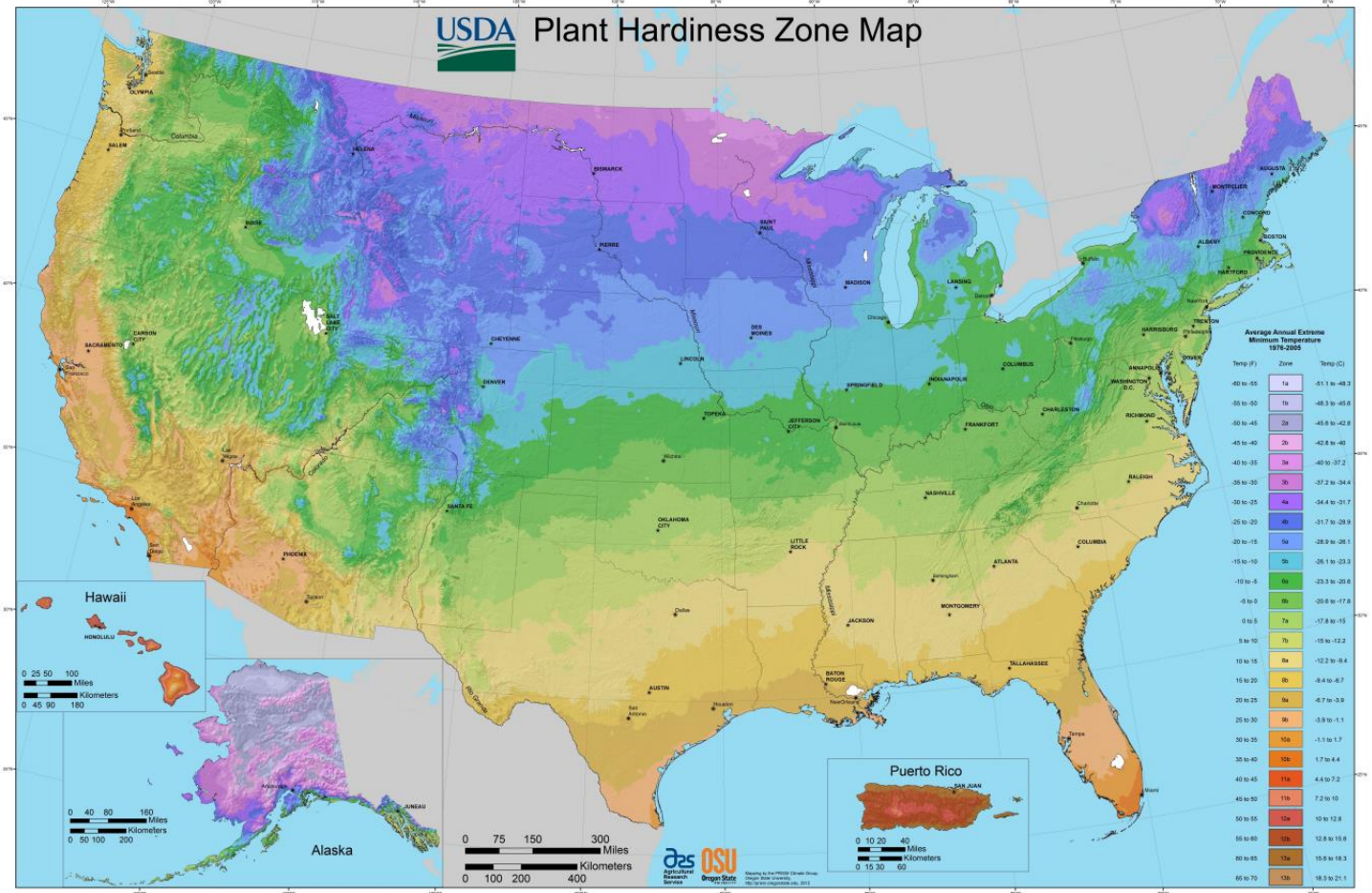
Though the general trend will be towards a warmer climate, the transition process will be very chaotic, and will be one of more “extremes”: hotter summers, colder winters, worse storm seasons, and the like will be the trend for quite some time before the full effects of a warming trend are realized. This is due to the immense complexity of the planet’s climate, and all of the “teleconnections” which exist. Teleconnections are effects on one part of the planet from a corresponding change in another part. The most “famous” of these is the “El Nino” phenomenon, where changing ocean temperatures near the Galapagos islands strongly influences the amount of rainfall or drought in all North America. But there are literally dozens of these known teleconnections across the globe, and changing climate impacts all of them.



All of the organizations involved with changing climate and the carbon dioxide inputs that drive it have the same message: planting more trees, particularly in areas predisposed to changes in climate, will aid in pulling CO<sub>2</sub> from the atmosphere and reducing the impact of climate change. So the number of trees we are planting is important, both on public as well as private land. But the types of trees we are planting matters as well. The US Forest Service is already starting programs of planting climate sensitive tree species outside of their historic natural ranges in anticipation of an overall warmer climate (<https://www.fs.usda.gov/ccrc/story/helping-forests-keep-pace-climate-change>).

When it comes to tree planting in anticipation of climate change for urban environments in our area, we need to be careful, however. While the general trend is towards warming, the “extremes” side of this makes for a difficult decision. While summers may be warmer and support trees which are adapted to warmer conditions overall, our winters will still reach down into the -30° F and even colder range for extended periods. And cold weather is the limiting factor for what can be planted in an area. See the USDA Hardiness Zone map on the following page for a more detailed explanation. It shows the **coldest** temperatures which can be expected in an area, not the **warmest** ones. So before we start planting trees in south-central Wisconsin that are more native to more southern states, we must understand that we need to plan for the coldest temperature, not the warmest per se.





All of that said, we should start planting trees now at least on a somewhat experimental basis that will be more tolerant of a warmer climate. Below are some suggestions of trees which the Village could plant which are just outside of our climate region, and may be successful over the coming 30 years or so, depending how effective we are at combatting climate change using other methods:

|                                                             |                                                          |                                                           |                                                            |
|-------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------|
| <b>Southern Catalpa</b><br>( <i>Catalpa bignoniodes</i> )   | <b>Southern Hackberry</b><br>( <i>Celtis laevigata</i> ) | <b>Swamp Chestnut Oak</b><br>( <i>Quercus michauxii</i> ) | <b>Cherrybark Oak</b><br>( <i>Quercus pagoda</i> )         |
| <b>Water Hickory</b><br>( <i>Carya aquatica</i> )           | <b>Pecan Hickory</b><br>( <i>Carya illinoensis</i> )     | <b>Sourwood</b><br>( <i>Oxydendrum arborea</i> )          | <b>Mimosa Tree</b><br>( <i>Albizia julibrissin</i> )       |
| <b>Carolina Silverbell</b><br>( <i>Halesia Carolina</i> )   | <b>Crapemyrtle spp</b><br>( <i>Lagerstroemia spp</i> )   | <b>Flowering Dogwood</b><br>( <i>Cornus florida</i> )     | <b>Sweetbay Magnolia</b><br>( <i>Magnolia virginiana</i> ) |
| <b>Southern Magnolia</b><br>( <i>Magnolia grandiflora</i> ) | <b>American Holly</b><br>( <i>Ilex opaca</i> )           | <b>Oklahoma Redbud</b><br>( <i>Cercis reniformis</i> )    | <b>Ornamental Cherries</b><br>( <i>Prunus spp</i> )        |

All of these species grow in more southern climates and some are certainly more risky than others. Crape Myrtle for instance is barely tolerant of the climate in southern Illinois, while Southern Hackberry can already be planted in more northern climates with reliable success. But nonetheless they are good species to keep on our radar for experimental plantings.

## Positive Tree Benefits for the Environment

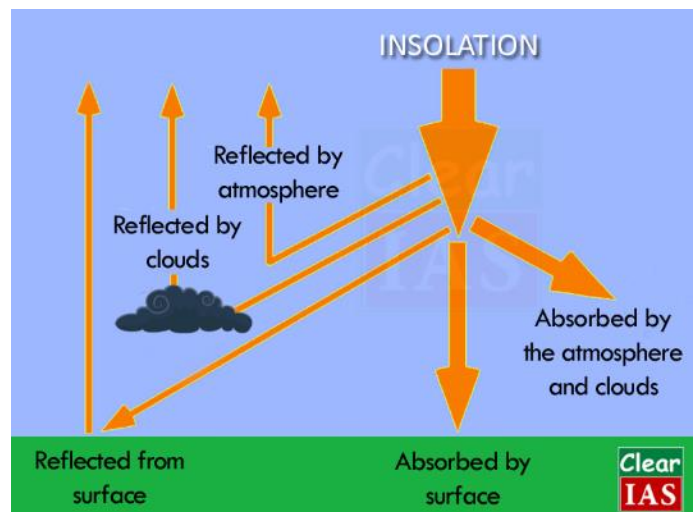
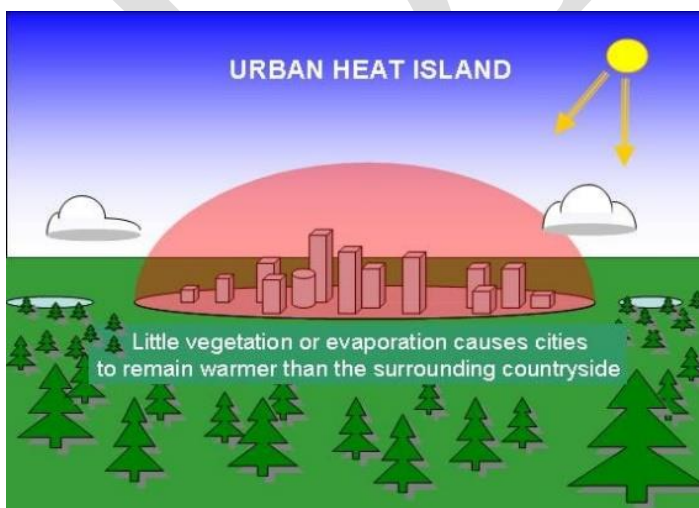
When it comes to trees and climate change, let's move on to some of the immensely positive benefits that trees provide. Here, we are focusing on 2 topics, those being the climate change and the urban heat island effect, as well as flooding prevention and stormwater benefits, since this was one of the primary focuses of this grant, and also some of the more important benefits trees provide.

### **Climate Change / Urban Heat Island Mitigation**

First, let's define a few terms: **Climate Change** is change in the climate, both human-induced as well as naturally occurring, that disrupts what we perceive to be the normal operation of climate. It should be noted here that climate is different than weather. Weather is the day-to-day meteorology such as rain on Tuesday and sunny on Wednesday. Climate is what the long-term averages are for an area, such as average June temperatures in the mid 70's with 2-3 inches of rain. The term **Global Warming** has been misapplied many times when speaking about climate change. Yes, increases in carbon dioxide emissions lead in general to a warmer climate, which comes with very specific problems. But the climate change we are seeing currently is one of extremes: higher highs, lower lows, more severe storms, etc. The important part is that during this process of change, year to year weather becomes more unpredictable as the climate changes to generally a warmer one.

The **Urban Heat Island Effect** is a separate but related issue. Trees and other green plants contain chlorophyll, a naturally occurring compound which is custom built by nature for absorbing the sun's energy and converting it to sugars by photosynthesis. And what an energy the sun has. The amount of energy from the sun hitting the Earth at any given time is approximately 1,350 Watts per square meter, which is a LOT of energy to absorb. When an area has fewer plants, and a lot of asphalt and other dark surfaces, this produces a lot of heat.

Think about it, if you wear a dark shirt when the sun is shining, you feel hotter than if you were wearing a white shirt. That is because different colors absorb things differently, and light colors reflect light while dark colors absorb it, and absorbing more light leads to more heat. So asphalt and other urban surfaces create local heating above normal atmospheric heating.

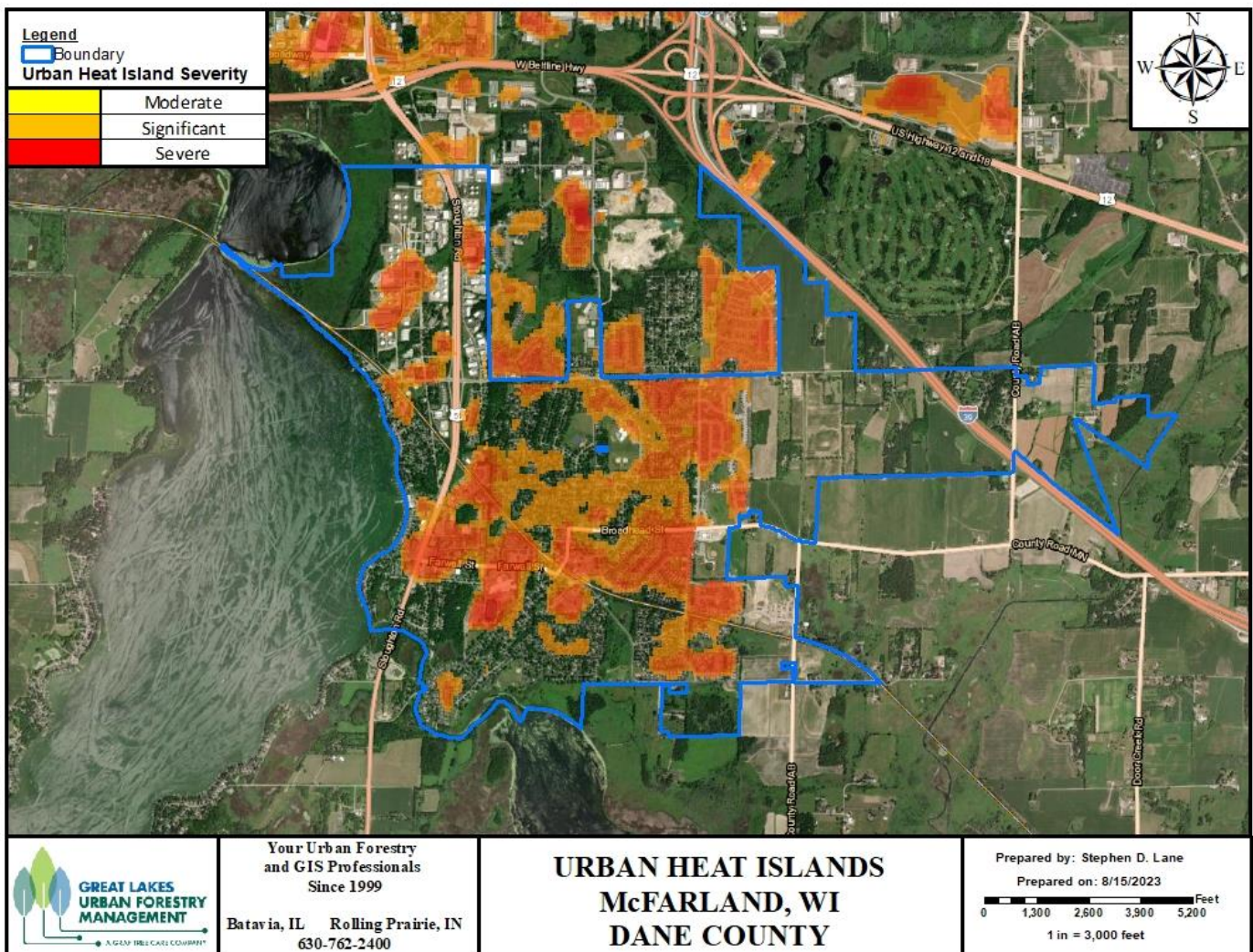




## VILLAGE OF MCFARLAND URBAN FORESTRY MANAGEMENT PLAN

All of this is of course just scratching the surface of a set of very complex issues. But essentially, when we have a generally warming climate, combined with this urban heat island effect, it can dramatically raise temperatures in urban areas, leading to a variety of issues. This is where trees become a major factor in making things better. Not only do they absorb carbon dioxide from the atmosphere, which helps to reduce the effects of climate change, but especially in urban areas, if we can plant trees over areas of asphalt and dark surfaces, this will keep the sun from hitting those surfaces, and instead direct the sun's energy to photosynthesis in the tree's leaves. The combined effects of these things will lead to reductions in warming.

For the Village of McFarland, below is a map of the urban heat island areas. The darker red or orange areas represent greater heat island effects, but do not represent specific "degree based" deviations, and areas of no shading mean no deviation from long term averages:



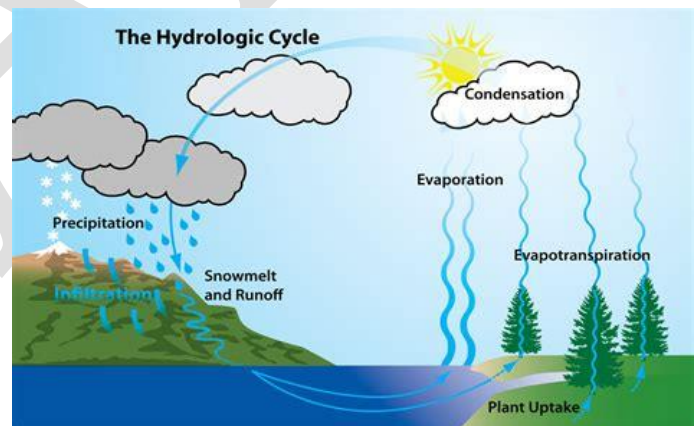
As can be seen from this map, some of the greatest heat island effects are along the transportation corridors, as well as the industrial areas where greenspace is lower overall. These are the areas where tree planting will create the greatest cooling effects.

Planting trees not just on Village owned property, but also encouraging residents and business owners to plant trees on their own property is a long-term goal of this management plan, and one of the big reasons is to offset the effects of climate change and the urban heat island effect. It should also be remembered that the climate is global, and there are no walls that separate cities, states, countries, etc. So, when one area warms, it has effects on the whole climate system. Conversely, when an area has more trees and vegetation planted, those benefits do not just stay confined to that area but benefit the whole planet. Trees are truly an example of acting locally and impacting globally.

### Reduction in Flooding / Storm Effects

Once again, let's define a few terms here. First, the Earth has what is called a **Hydrologic Cycle**, which is pictured in a simple form to the right. All of the water that has ever existed on Earth was here when the Earth first formed around 5 billion years ago and has simply been recycled ever since then. Water stored in the oceans and lakes evaporates into the atmosphere where it forms clouds, and then rains down, either into the ocean to start again, or over land, where things get more complicated. When rain falls over land, several different things can happen to it that determine what happens next in the cycle.

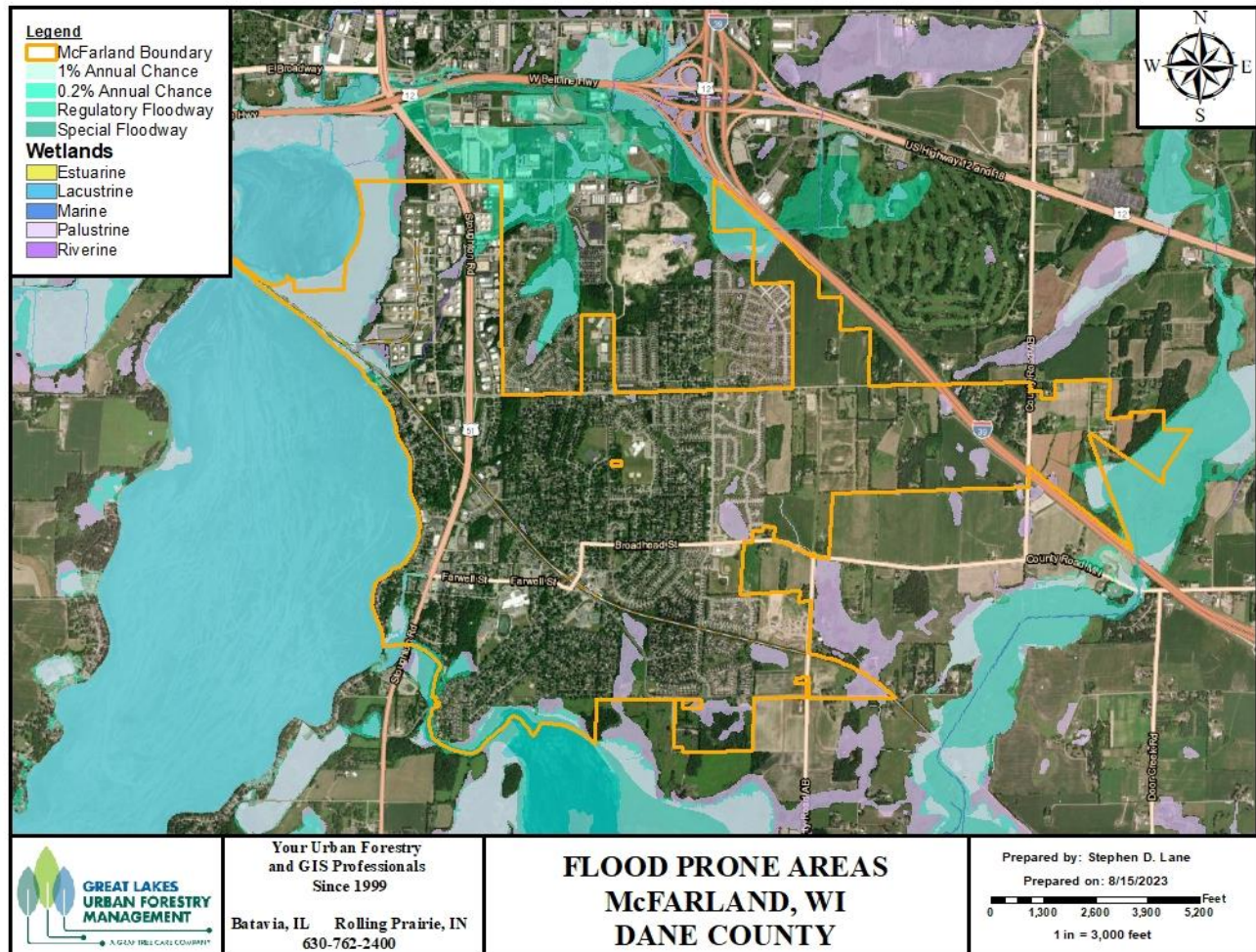
If the rain falls onto the soil surface, some of that water **percolates** into the soil where it moves as groundwater (water under the soil surface). However, when there is so much rain that the soil becomes saturated like a wet sponge that cannot hold any more water, then any additional rainfall becomes **runoff**, which "runs off" over the top of the land surface. This is what we traditionally call **floodwater**.



When an area floods, the consequences can be enormous in terms of economic impact and the impact to humans and wildlife. And there is another side of this story as well. Most communities have what is called **stormwater infrastructure** to handle this water. Storm drains are things we all see regularly which are meant to handle this water. But those systems are expensive to maintain, and the more water they handle, the more often they need repair or replacing. So what can we do to reduce this floodwater? Plant more trees.

Trees do something called **transpiration**, which effectively means that their roots soak up excess water in the soil, and they release it through their leaves back to the atmosphere. So the more trees we plant, the greater the reduction in flooding, and the less our stormwater infrastructure is taxed, and the less economic and social suffering there has to be as a result of flooding. On the following page is a map showing flood prone areas in McFarland:





What is important to note from the above map is not what the exact colors mean, just know that these colors all show either known wetlands, water bodies, or flood prone areas near McFarland. Tree planting in proximity to any of these locations will help to transpire extra water out of the soil and prevent occasional excess stormwater runoff from occurring. In particular, there are trees which are naturally adapted to growing in wetter soils, and these trees can really move a lot of water out of the ground, especially as they age. A mature tree can move as much as 6,500 gallons of water per year out of the system. Multiply that by thousands of trees, and you can see how quickly this adds up to a big difference. (<https://www.epa.gov/sites/default/files/2015-11/documents/stormwater2streettrees.pdf>)

The important thing to note is that tree planting efforts should take the proximity to these flood prone areas into account, as well as the areas which appear to be drier and more drought prone where there is no shading on the map. And just like climate change is not confined to a single area, neither is stormwater and flooding. Whatever floodwater is not absorbed in one area moves downstream to another area. So by reducing runoff in McFarland, it will help all downstream communities. And again, the more communities we can get to take action on this, the more flooding and runoff will be reduced.

## Tree Removals

The first step towards attaining McFarland's forestry goals will be to remove trees which are diseased, dying, or present a hazard. Typically, municipal inventories reveal between 3-5% of the tree population requiring some form of removal, so based on the current population of 3,452 trees and the projected 2044 population of 4,335. Approximately 50-75 trees will require removal annually.

In order to attain the goals set forth in the Diversity Standards, the background rate of tree removal will be approximately 50-75 trees per year. From 2029 forward, reevaluation of the tree population on an annual or semiannual basis by the Village Forester or Forestry Consultant will specify which trees require removal. These numbers, detailed below, are meant to be placeholders for budget calculations and diversity standards. This does not require that 50-75 trees be removed each year, this is simply a projection based on the existing inventory data.

For purposes of projection, costs have been estimated using a rate of \$25/ diameter inch for tree removal and stump grinding, which is a conservative estimate based on current market pricing. Rates could certainly be found lower than this in a competitive bid process or using in-house labor. As is the case with all cost projections for this Plan, no cost increase is assumed for the first 5 years, and a 3% annual cost increase is assumed thereafter. This is also a conservative estimate based on the Consumer Price Index, and actual costs are likely to be lower than projected. In addition, for trees in year 6 and beyond, these are anticipated averages of trees to be removed. Exact numbers of trees to be removed may be more or less.

| Milestones          | 2024                            | 2025                            | 2026                            | 2027                            | 2028                            | 2034-2044                       |
|---------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Trees Removed       | 50                              | 55                              | 60                              | 65                              | 70                              | 75                              |
| Diameter Inches     | 600"                            | 610"                            | 620"                            | 630"                            | 640"                            | 650"                            |
| Notes               | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates |
| Removal Cost (2024) | \$15,000                        | \$15,250                        | \$15,500                        | \$15,750                        | \$16,000                        | \$16,250                        |
| Removal Cost (CPI)  | \$15,000                        | \$15,250                        | \$15,500                        | \$15,750                        | \$16,000                        | \$18,688                        |

As the table above illustrates, there will be a gradual increase in the number of annual removals over the initial 5 year period. These cost estimates were prepared for the long-term removals, based on the tree inventory data. As this is a program to be adaptively managed, these budget tables can be revisited periodically to reflect actual costs being paid.

### Tree Removal Activities

#### **Safe Removal of a Tree to an Appropriate Flush Cut**

Tree removal can be dangerous, but when performed by professionals is very safe. Therefore, all tree removal activities on McFarland's public property shall be performed under the guidance of a Certified Arborist or Arborist Trainee. This may be the supervision of the Village Arborist, or a staff Certified Arborist alongside a contractor. The safe removal of a tree involves the safe removal and

lowering of all portions of the tree according to all relevant ANSI standards and Best Management Practices. The stump must be flush cut such that the highest portion of the cut is no greater than two inches from the highest part of the ground surface to prevent a tripping hazard on public property.

### **Stump Grinding**

Within a reasonable amount of time following the removal, stumps and surface roots should be removed using an approved stump grinding machine, such that the stump is ground to a minimum depth of 6 inches, and no surface roots are visible. If the site is to be planted with a new tree, that depth should be increased to 12 inches below the soil surface. This will ensure that a new tree may be successfully planted, and that no re-sprouting will occur from the old stump. The depths to which the stump must be ground may be altered by the Village of McFarland depending on needs for specific circumstances or contracts. Until such time as the planting space is fully restored, the stump hole should be filled and compacted to ground level using the debris resulting from the stump removal.

### **Planting Site Restoration**

Once the tree has been safely removed and the stump has been ground out, the open planting space must be fully restored if a tree is not scheduled to be planted in or adjacent to the old hole. Site restoration consists of removing the stump chips from the hole, filling it with a quality mineral topsoil, tamping down to match the surrounding grade, spreading grass seed over the top of the topsoil, and using straw or similar material to protect the seed. This will ensure that grass grows back to restore the aesthetics and function of the terrace, and prevent tripping hazards from the removal scar.

### **Reasons for Tree Removal**

Removal of trees on public spaces is an unavoidable reality of managing large tree populations. When the trunk, branches or roots fail, a standing tree can cause personal injury or property damage, and even small dead trees can be an eyesore and reduce property values. Old trees can hold great sentimental value, and many people become attached to them. However, there are times when their presence creates a public hazard, and it is at those times that action must be taken to ensure public safety. It's also important to remember that the removal of a tree today is the promise of a new tree for tomorrow!

Removal of trees on Village of McFarland public property shall always be at the discretion of the Village Arborist and/or Forestry Consultant. Trees will never be removed without a sound reason from the Village or Forestry Consultant. Residents may request a tree to be removed for reasons NOT covered below, and these requests will be reviewed by the Village Arborist or Forestry Consultant. Removal requests may be granted and paid for under the annual forestry budget. However, trees with a greater need for removal based on public safety will always hold a higher priority. Under no circumstances will the Village of McFarland be responsible for trees which are not in the right of way.



## Dead or Dying

If a tree is biologically dead or nearly dead, it will require removal. Trees which are standing dead, have approximately 50% dead crown or greater, or have less than approximately 40% structurally sound wood in the cross-section of the trunk shall be removed as expediently as practical. These determinations shall be at the discretion of the Village Arborist or Forestry Consultant.

## Diseased or Infested

Diseases are caused by viral, fungal, or bacterial pathogens. Infestations are caused by insects or other small animals. Dutch Elm Disease and Oak Wilt, for example, are fungal diseases that kill Elm and Oak trees when they are infected. Emerald Ash Borer is an insect which kills Ash trees by infesting them. The prompt removal of diseased or infested trees limits the exposure of other nearby trees. The removal of 1 tree may save dozens of others. Trees deemed to be diseased or infested by the Village Arborist or Forestry Consultant shall be removed as expediently as possible in order to slow the spread of such insects and diseases.

## High or Extreme Risk

“Tree Risk” is the potential of a tree or tree part to impact a nearby person or piece of property and cause property damage or personal injury. This topic is of great interest in Arboriculture today, and insurance companies are becoming increasingly involved in the process of assessing and managing the risk posed by trees. Litigation involving trees is a perennial concern for public entities. All trees in McFarland were assessed for a basic level of risk during the initial inventory, and a number of trees were found to be at elevated or substantial risk levels. If such risk can only be safely mitigated by tree removal, as opposed to pruning or other measures, then their timely removal is critical because of potential exposure of the public or property to potential harm.

The Village Arborist, Forestry Consultant or any other TRAQ Qualified Risk Assessor must assess the tree and prepare a Tree Risk Assessment Report which will document the details of the situation, prior to removal. Often, risk can be mitigated by removing a portion of the tree, or other corrective measures. If the entire tree is deemed to be at high or extreme risk of failure, however, the entire tree shall be removed as a means of reducing its residual risk to zero.

## Emergency / Storm Damage Removals

A tree shall be removed if it has been severely damaged and/or compromised by lightning, wind, or other such weather event. “Storm-damaged” shall be generally defined as a tree which has lost 33% or more of its crown, has a large crack or other wound in the trunk, has a lean of greater than ten degrees from vertical, has sustained a lightning strike, or other such issues directly related to storm events. The Village Arborist or Forestry Consultant shall determine the need for removal of a tree in these cases, although in an emergency situation such as a tree impacting



a person, vehicle, home, power lines, or other such emergency, the Village may perform any actions necessary to abate public hazards so long as they are in compliance with all relevant Arboricultural standards and practices.

### **Damage from Construction or Vehicle Strike**

The Village Arborist or Forestry Consultant shall assess trees that have been impacted by a vehicle strike or piece of construction equipment. If the tree has suffered physical damage or extreme root compaction and is likely to decline and become high risk, it will be scheduled for removal in order to maintain public safety. That decision will be based on the best professional judgement of the Forestry Consultant or Village Forester.

### **Reasonable Resident Request**

If a tree has non-terminal pest or pathogen issues, moderately poor structure or is in somewhat poor condition, a resident may request the removal of the tree. Such requests will be reviewed by the Village Arborist and/or Forestry Consultant, and evaluated on a case-by-case basis. This policy does not apply to healthy, structurally sound trees that are simply unwanted. If the tree shows significant potential to decline or pose a threat in the near term, the Village may agree to the removal within the next five years. Also, note that young and/or healthy trees will generally not be considered eligible for this program. Priority will always be given to trees in danger of threatening public safety. Additionally, trees that are removed based on this policy would require a replacement tree to be planted on the ROW or terrace.

### **Interference with Utility or Signage**

A tree shall be removed if it is interfering with the function or visibility of official traffic control devices or has impacted above or belowground utilities in a manner that cannot be mitigated by pruning or other measures. In these cases, it is likely that no new tree will be planted in these sites.

### **Overplanted and Underperforming**

No healthy tree shall be removed for the sole reason of having been overplanted. As a result of this UFMP, McFarland will be enhancing their use of industry best management practices for diversity in the urban forest, with the goal of building a diverse urban forest. Overplanted species listed as being in poor condition will be reviewed to assess further decline or recovery. Those trees in noticeable decline shall be removed at the discretion of the Village Arborist and/or Forestry Consultant. This will be used as a preventative measure so that these trees do not continue to decline to a point where they become hazardous, and not used as a reason to remove an otherwise healthy tree.

### **Basic Village Tree Removal Requirements and Standards**

All of the following requirements and standards shall be met during tree removal activities as matter of local policy. For a more detailed view of the specific ANSI and ISA standards, please see **Appendix\_\_**:

## Village of McFarland

1. All personnel directly involved with process of chainsaw operation, climbing, bucket truck operation, and rigging limbs shall be provided with sufficient training and experience to perform such duties while employed by the Village of McFarland, as either Public Works and Forestry staff, or performing work as a contractor employed by the Village.
2. Only qualified utility arborists may perform tree removal operations within ten feet of an electric utility line. Village of McFarland employees or contractors may complete the process of trunk removal and stump grinding only if the remaining portion of the tree is greater than ten feet from a transmission line.
3. The Village will not remove healthy trees in order to meet diversity goals, unless the tree poses a risk to persons or property.
4. The Village of McFarland shall not perform or assist, programmatically or financially, with the removal of trees on private property. Public/Private tree ownership is defined by Ordinance as having 51% or greater of its trunk diameter within the public right of way.

## Tree Planting

Whereas tree removal is necessary to promote public safety, planting of new trees must happen in order to increase our diversity and canopy cover. At present, the Village of McFarland has an estimated 750 open planting spaces on its terraces. As a means of attaining the goals of increasing canopy cover to 30% and increasing overall diversity, this plan calls for the planting of about 2,100 trees over the coming 20 years. This plan has a direct goal of planting trees where they have the best chances to establish and thrive based on their specific sites and species requirements.

For the goals and milestones shown below, the program began with being able to replace trees called out for removal above and also to begin planting in open spaces on the Village's terraces. A goal of this plan is to set a plateau of approximately 175 new plantings per year. This plan anticipates plantings to outpace removals by 2 to 1.

For the costs of planting, \$325 per tree (installed) has been used. This is a conservative estimate based on retail costs, and the Village may be able to perform planting at a more favorable rate. We examine money saving proposals in further detail in the Strategic Partnerships section.

| Milestones           | 2024     | 2025     | 2026     | 2027     | 2028     | 2034-2044    |
|----------------------|----------|----------|----------|----------|----------|--------------|
| Trees Planted        | 100      | 110      | 120      | 130      | 140      | 150/year avg |
| Planting Cost (2024) | \$32,500 | \$35,750 | \$39,000 | \$42,250 | \$45,500 | \$48,750     |
| Planting Cost (CPI)  | \$32,500 | \$35,750 | \$39,000 | \$42,250 | \$45,500 | \$56,063     |

## **The Importance of Planning Your Tree Planting**

### **Right Tree in the Right Site**

Urban Forestry has an unfortunate history of not planning carefully for tree planting. Whatever was readily available, inexpensive, urban tolerant, and grew fast was seen as desirable, and often planning of tree plantings was left to developers or nurseries and plantsmen. With our history of invasive insects and diseases in the Midwest region, and knowing these will only get worse in the future, it is more crucial than ever that we have a process to plan our tree plantings.

This process should involve assessing each site to be planted in much the same way we would assess a tree, except that in this case, we look for factors such as available above and below ground growing space, how much light the tree receives, amount of soil moisture present, and possibly other factors such as soil pH and texture. Once this information is collected, planting sites can be matched with trees which are well suited to those sites. Matching the right tree to the right site like this will result in trees which establish faster, grow more vigorously, live longer, and provide far greater benefits. Even a simpler version of this process is better than nothing. When you have your species list for each site assembled, it makes bidding nurseries and plantsmen much easier since you already have a plan in hand.

Playing an active role in your tree planting planning also allows for meeting diversity standards such as the taxonomic, spatial, and age class diversity principles outlined above and attempts to get the tree population into compliance with the “20-10-5 Rule”. With approximately 750 planting sites to be assessed, tree planting planning can be phased off each year as the planting budget takes shape and diversity is evaluated. Being targeted about species selection also allows the use of species which are slightly more difficult to find appropriate sites for. These species that are considered “less urban tolerant” can still be planted when the appropriate site is found! We anticipate that over the timeline of this plan, that nearly all of these spaces will be planted.

The success of a tree depends on where and how it is planted. The Village Arborist or Urban Forestry Consultant should assess planting sites before trees are purchased and installed each year, to ensure the correct tree is being planted for the correct site. Each tree planted represents a 25-75+ year commitment, and this planning helps to increase the benefits the community can reap from this commitment. A list of acceptable species to be planted for all land use types appears in **Appendix \_\_**.

### **Nursery Stock Procurement**

Nursery stock quality is yet another aspect of planning which can help a tree establish, survive, and thrive to provide great benefits to the community. The Village Forester or an Urban Forestry consultant should inspect and select every tree which is to be planted on Village property to minimize the possibility of installing lower quality nursery stock. Specifications should be for material no smaller than 1.5” caliper, with good form for the species, planted as either balled and burlapped or minimum 5-gallon containerized stock.



Currently, the industry is recovering from a nursery stock shortage due to high demand to replace Ash trees lost to Emerald Ash Borer, which impacted the availability of some species. We strongly recommend to not to accept substitutions in the requested species lists, as many nurseries are still attempting to substitute overplanted trees for some of the higher diversity species which may still difficult to obtain. It is recommended to have an approved substitution prepared for each requested tree species. A list of species and acceptable substitutes has been included in **Appendix \_\_\_\_**.

### **Tree Transport and Planting**

Proper transport and planting procedures determine a tree's success after planting. Even healthy trees from the field, if improperly transported, may dry out during transport, or have structural damage to root balls incurred. When it comes time to plant, trees planted too deeply will suffer from root compaction and trunk decay.

Trees planted without properly dug holes may suffer from stunting. Trees planted without proper removal of packaging materials may develop girdling roots. Trees planted too high may have surface root desiccation. Trees improperly staked or with improper trunk protection may suffer from trunk wounds or girdling of the entire trunk. The standards and Best Management Practices for tree transport and planting are detailed later in this section, as well as **Appendix \_\_\_\_**.



### **Tree Spacing and Visibility Requirements**

Minimum tree spacing between large, medium, or small sized deciduous shade trees should be appropriate for the species and conform to Village of McFarland standards. It is generally specified this be no less than 50 feet between plantings of large to medium mature height trees and 25 feet between plantings of small mature height trees. This will allow trees to grow to their full potential without heavy competition for water and nutrients with neighboring trees, and without limited space for crown growth. In addition, no tree should be planted within 25 feet of the intersection of two streets from either corner measured on the property line and 15 feet of a driveway or alley. For known below ground utilities, trees should not be planted within 6 feet of a fire hydrant, water stop box or gas shut-off. Trees may be planted under aboveground powerlines, but must be from the "Small" selections listed in the Approved Species list in **Appendix \_\_\_\_**. No evergreen species shall be considered acceptable for terrace planting as they can obscure views of the road and may lead to accidents. Evergreens are acceptable for municipal campuses, parks, and other Village-owned properties.

### **Watering**

Watering of newly planted trees is essential to their establishment, growth, and survival, particularly during the first 2 years of their lives. Since watering is not included in our budget figures, this responsibility may have to fall on the property owners. It is highly recommended that when a tree site is selected for planting, that a basic letter be mailed to property owners describing how much

water to give a tree, and when it should be given. Such simple information can make the difference between a tree dying from drought stress, a tree dying from overwatering, and a happy, healthy tree.

### **Challenges of Urban Plantings**

Urban planting sites are a difficult environment for a tree to thrive in, and based on long term data, it is expected that 5-10% of new plantings fail each planting cycle. The Village's contracts for tree planting should include a one to two-year replacement warranty for any new trees that fail to thrive in their new environment. Urban tree plantings can pose an uphill battle in many ways, due to limited soil volume, salt runoff, airborne pollutants, and other factors. New planting mortality is to be expected, despite best efforts to prevent such an outcome, but the planning measures outlined above will help to mitigate annual new planting mortality.

### **Tree Planting Requirements and Standards**

#### **Village of McFarland**

1. Planting sites shall be determined and monitored using the Village's tree inventory, in conjunction with staff and Forestry Consultant input.
2. New planting sites should be planted in accordance with specifications in McFarland's Municipal Ordinance Article 59-II.
3. Choice of species for planting should be done so according to the Village's taxonomic, spatial, and age-class diversity goals. A diverse and resilient urban forest minimizes exposure to financial, environmental, and health risks while maximizing aesthetics, environmental benefits, and ecosystem services to its residents.
4. All planting stock shall be regionally grown in planting zones 4 or 5A.
5. Acceptable nursery stock shall conform to the following standards:
  - A. Minimum of 1.5-inch caliper, measured at six inches from the trunk flare
  - B. Root ball conforms to ANSI Z60.1 Standards for Nursery Stock
  - C. Architecture consistent for the species, cultivar, or variety in question
  - D. No included bark or other such narrow branch attachments, unless consistent with species or variety
  - E. Free of pests or pathogens
  - F. Approved species list for the Village of McFarland
6. Planting and digging of certain species shall only occur at certain times of year, in accordance with nursery industry best management practices and professional judgement. These times are subject to the professional opinions of both the Village of McFarland and its approved contractors.

7. The property owner has the responsibility to locate underground utilities before digging.. Diggers Hotline, or another similar utility locating service shall be contacted, and all utilities located a minimum of three days before planting is scheduled to begin.
8. A minimum of a one-year replacement guarantee shall be extended from approved nurseries and plantsmen for all new plantings rated to hardiness zone five or lower.

## Tree Pruning

When maintaining a tree population for its greatest benefits and lowest risk, tree pruning is one of the most cost-effective maintenance activities which can be performed. Pruning provides several important services for a tree: It reduces the risk of failure, provides clearance for utilities or other structures, reduces wind resistance and wind damage, maintains overall tree health, and improves overall aesthetics.

The most critical needs of the Village of McFarland should be prioritized and the projections below are broad estimates. For the next 5 years, it is recommended that McFarland slowly increase the number of trees pruned each year as the population steadily grows. For a 5 year pruning cycle for the estimated tree population of 4,335 total trees by 2043, it is anticipated that approximately 900 trees per year will require pruning to maintain this cycle.

For cost estimates associated with these activities, several assumptions were made:

First, because young trees (12" and less in diameter) are easy to prune, it is assumed that Village staff can prune all trees less than 12", and \$50 per tree was used as an estimate for this group, based on average cost in the industry at this time. For medium (12"-24") and large (24"+) trees, average figures of \$100 and \$150 per tree (respectively) were used, once again based on average cost in the industry (see tables below). Consistent with other budget tables, a 3% annual CPI increase was added for every year thereafter.

Currently, McFarland prunes approximately 600-700 trees per year primarily using in-house labor. The budget estimates below are fairly conservative, as is the case with all budget projections in this Plan.

| Milestones   | 2024             | 2025             | 2026             | 2027             | 2028             | 2034-2044                                           |
|--------------|------------------|------------------|------------------|------------------|------------------|-----------------------------------------------------|
| Trees Pruned | 600              | 650              | 700              | 750              | 800              | 900/year avg                                        |
| Notes        | 600 Cycle Prunes | 650 Cycle Prunes | 700 Cycle Prunes | 750 Cycle Prunes | 800 Cycle Prunes | Approximately 900 Cycle Prunes / year in perpetuity |
| Cost (2024)  | \$29,045         | \$32,475         | \$35,900         | \$39,300         | \$42,800         | \$52,320                                            |
| Cost (CPI)   | \$29,045         | \$32,475         | \$35,900         | \$39,300         | \$42,800         | \$60,168                                            |

Provided below is a series of estimates based on the change in composition of the Urban Forest over time. As larger underperforming trees are removed and smaller trees planted in their place, the size breakdown of the Urban Forest will change. Given this expected change in the average size of trees,

we have included several breakdowns below estimating costs as the composition of the Urban Forest changes. Please note these are estimates, and should be reviewed periodically to ensure accuracy.

#### 2024 Cost Breakdown – Pruning 600 Trees/Year by 2024

|                 | <u>Total Trees</u> | <u>Avg %</u> | <u>Cost/Tree</u> | <u>Pruned/year</u> | <u>Cost/year</u>    |
|-----------------|--------------------|--------------|------------------|--------------------|---------------------|
| Evergreen       | 535                | 15.50%       | \$20             | 93                 | \$ 1,859.79         |
| Large (>24")    | 162                | 4.69%        | \$150            | 28                 | \$ 4,223.64         |
| Medium (13-24") | 626                | 18.13%       | \$75             | 109                | \$ 8,160.49         |
| Small (1-12")   | 2129               | 61.67%       | \$40             | 370                | \$ 14,801.85        |
|                 |                    |              |                  |                    | <b>\$ 29,045.77</b> |

#### 2029 Cost Breakdown – Pruning 800 Trees/Year by 2029

|                 | <u>Total Trees</u> | <u>Avg %</u> | <u>Cost/Tree</u> | <u>Pruned/year</u> | <u>Cost/year</u>    |
|-----------------|--------------------|--------------|------------------|--------------------|---------------------|
| Evergreen       | 600                | 15.38%       | \$20             | 123                | \$ 2,461.54         |
| Large (>24")    | 300                | 7.69%        | \$150            | 62                 | \$ 9,230.77         |
| Medium (13-24") | 900                | 23.08%       | \$75             | 185                | \$ 13,846.15        |
| Small (1-12")   | 2100               | 53.85%       | \$40             | 431                | \$ 17,230.77        |
|                 |                    |              |                  |                    | <b>\$ 42,769.23</b> |

#### 2044 Cost Breakdown – Pruning 900 Trees/Year by 2044

|                 | <u>Total Trees</u> | <u>Avg %</u> | <u>Cost/Tree</u> | <u>Pruned/year</u> | <u>Cost/year</u>    |
|-----------------|--------------------|--------------|------------------|--------------------|---------------------|
| Evergreen       | 650                | 14.99%       | \$20             | 135                | \$ 2,698.96         |
| Large (>24")    | 435                | 10.03%       | \$150            | 90                 | \$ 13,546.71        |
| Medium (13-24") | 1250               | 28.84%       | \$75             | 260                | \$ 19,463.67        |
| Small (1-12")   | 2000               | 46.14%       | \$40             | 415                | \$ 16,609.00        |
|                 |                    |              |                  |                    | <b>\$ 52,318.34</b> |

### Pruning Activities

#### Maintenance or Enhancement of a Pruning Cycle

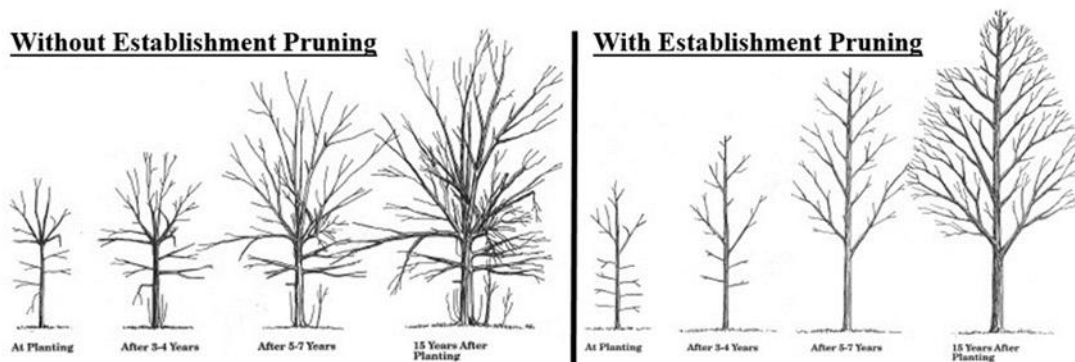
Initially, the Village should prioritize the trees that may have been identified as requiring priority pruning, regardless of where they are located to prioritize public safety before routine maintenance. After these trees are pruned, McFarland should aim to enhance its 5 year pruning cycle based on the size of its tree population as it steadily grows through 2044. With approximately 4,335 Village trees total by 2044, this would mean that over a 5 year period, approximately 900 trees would require pruning each year. As noted above, the number of trees as well as their overall sizes will be changing over that time period, hence above tables showing adaptive management of the tree pruning program. We believe this is a realistic goal based on communications with Village staff.

Though tree pruning may seem expensive, the cost of maintaining trees is significantly less than the costs associated with trees damaging property or injuring residents. The benefits trees provide when healthy and well maintained can be prolonged and significantly increased, as shown in the

projections above. A cycle pruning program is the hallmark of an effective forestry program, and it is highly recommended that McFarland begin to budget for this essential expense.

### Pruning of Young Trees

For the purposes of this Plan, a young tree is considered to be under 12" DBH. Young trees are still trying to acclimate to their sites. The pruning of young trees has different goals and outcomes than the pruning of larger, mature trees. Standard nursery stock has been meticulously pruned for four to ten years to have a single trunk, and the specific branching patterns which are considered common to the various tree species. Without proper establishment pruning, these trees might have multiple trunks, poor branch structure, and overall poor form and architecture. Pruning of young trees to establish proper form is one of the most cost-effective maintenance activities which can be performed. It is an inexpensive task that does not require a great time commitment, and saves thousands of dollars in pruning and maintenance costs later in the tree's life. As mentioned above, due to not having to climb trees or use dangerous equipment, young trees may be pruned by Village staff, or even well-trained residents, with proper training from the Forestry Consultant or a similarly qualified organization, and with the approval of the Sustainability and Natural Resources Committee.



### Pruning of Mature Trees

A mature tree, for the purposes of this Plan, is considered to be greater than 12" in diameter. Mature trees are established in and acclimated to their sites. The pressure these trees face from their environment generally comes from above-ground factors such as pests, pathogens, man-made structures, other trees, windstorms or lightning strikes, as well as some below ground factors like girdling roots, limited soil volume, or poor soil quality. Pruning is performed to mitigate the above-ground issues, as well as balance out any below ground issues when possible. Natural aging and limb dieback are additional reasons these trees are pruned.

Pruning of mature trees may mitigate a short-term risk, such as after a storm, or pruning may be done to maintain a tree's long-term health and structure. In the wild, trees lose limbs frequently. This is called self-pruning. Allowing trees to self-prune over time is not advisable in an urban setting. Safety factors may arise, and the process of self-pruning may bring up aesthetic issues in an urban



environment. Mature public trees should only be pruned by professional Certified Arborists, and done in accordance with industry Best Management Practices and accepted ISA and ANSI standards.

### **Private Property Trees**

The Village of McFarland shall not be responsible for the pruning of trees located on private property. The Village reserves the right to prune portions of trees overhanging public property, but is under no legal obligation to do so, and will perform such pruning at the discretion of the Village Arborist and/or Forestry Consultant.

### **Reasons for Pruning**

#### **Establishment Pruning**

Establishment pruning of newly planted trees is the single most cost-saving measure in tree care, as it establishes good form and branch structure for the life of the tree. Establishment pruning should be performed a minimum of one time prior to the tree reaching six inches in diameter. Once established, the tree will only require periodic cycle pruning to maintain an appropriate form for the urban forest and to maintain health and keep the tree free of dead limbs.

#### **Cycle Pruning**

A Best Management Practice in Urban Forestry is that trees should be pruned on a cyclical basis as preventative maintenance. No tree should go more than seven years without proper pruning. Cycle pruning ensures that dead branches, storm damaged limbs, or unsightly growth are removed before becoming hazardous or bad for the health of the tree. Cyclical pruning also ensures the proper leaf to stem ratio, which provides structural support for the tree. It also ensures that pruning stays relatively inexpensive, as severe issues do not have time to develop. Cycle pruning is a maintenance activity which if performed regularly, actually needs to be performed less often!

#### **Emergency / Storm Damage Pruning**

Emergency pruning is nearly always necessary to mitigate severe risk after storm events, such as limbs which have fallen and are blocking traffic, have impacted a structure, are interfering with a utility, or are hanging and in imminent danger of doing any of the above. Emergency and Storm Damage Pruning should be conducted at the discretion of the Village, with the best interests of the public in mind. This is one of the few occasions on which the recommendations of this Plan may be temporarily suspended. When life or property are in imminent danger due to conditions associated with a downed tree or tree part, the Village may take whatever remedial action is practical and reasonable to mitigate such imminent risk.

#### **Sanitation Pruning**

When a tree has been diagnosed as having been diseased or infested with a pest or disease, sanitation pruning may be employed to maintain the tree while removing the diseased or infested portions. This technique is only effective when the host tree is infected/infested with certain pests and pathogens, and only in a localized area of the tree. With more widespread cases of disease or insect infestation,

removal will be the most cost-effective and safest option to avoid endangering other nearby trees, as these pests and diseases tend to spread, particularly when there is more of the same species nearby.

### **Removal of High Risk Limbs**

At times, a tree as a whole may not pose a high risk, but a single limb may have defects that make it hazardous. At these times, the removal of such limbs or parts may render the tree to be low risk again, without causing permanent damage to the tree.

### **Tree Pruning Requirements and Standards**

#### **Village of McFarland**

1. All activities directly related to the operation of a chainsaw, bucket truck, limb rigging, or tree climbing shall be performed by a qualified employee, or under the supervision of a certified arborist or arborist trainee.
2. No pruning or maintenance activity that takes place within ten feet of a power transmission line shall be accomplished by a Village of McFarland employee unless certified as a qualified Utility Arborist.
3. No cabling, bracing, or other such support systems shall be installed in Village-owned trees, either by the Village of McFarland, its residents, or any contractors. Exception may be made by obtaining prior written approval of the Village.
4. No heading, pollarding or espalier pruning shall be conducted on Village-owned trees, and no wound dressings shall be used under any circumstances, without a permit and prior written approval of the Village of McFarland.
5. The need for pruning and maintenance of individual trees and terraces shall be at the discretion of the Village of McFarland and its designated contractors.
6. No more than 25% of a tree's crown shall be removed during pruning operations to preserve the health of the tree. Any more than 25% of the crown being removed put the tree in danger of severe dieback, and removal should be considered at that point.

### **Other General Maintenance**

#### **Maintenance Activities**

##### **Retaining a Consultant**

The task of establishing or enhancing a robust Urban Forestry program can be difficult. There may be many new challenges and learning curves, contracts to renegotiate, bid documents to create, resident concerns to manage, and other responsibilities which may require the assistance of a professional.





The Forestry Consultant may be involved in sourcing and interviewing contractors and vendors for tree pruning, removal, and planting operations, assisting in maintaining the tree inventory, training Village staff on tree health and risk assessments, assisting in explaining policies to homeowners, preparing contract and bid specifications, and teaching residents how to help the Village in caring for their trees. The importance of this early relationship cannot be overstated, no matter how large or small the organization.

### **Chemical Applications**

Trees, like people, sometimes contract pests and pathogens. Often these pests and pathogens can be controlled with a simple chemical application just as illnesses in humans can be controlled with medication. This practice is called Plant Health Care. When financially practical, chemical control for common pests or pathogens may be utilized as a preventative or curative method, and increase the aesthetics and benefits of the tree population.

At present, the Village has an Ash tree treatment program implemented where approximately 40-50 Ash trees are being treated to control Emerald Ash Borer infestation. The Village may explore performing this plant health care application in-house.



Residents of McFarland may not perform chemical applications on any Village trees.

### **Water Management**

The importance of water in the establishment, growth, and survivorship of trees cannot be overstated. Most trees adapted to our climate zone (USDA Zone 5a) are also adapted to the amount of moisture we have in an average year. However, younger trees with less expansive root systems are susceptible to prolonged drought. Young trees need supplemental watering, which is an essential maintenance activity and can prevent newly planted tree mortality.

As we anticipate 2,100 additional trees being planted over the course of the next 20 years, this concept becomes very important. A general rule would be to expect to pay somewhere on the order of \$50/tree for the first 2 years of its life to water it several times throughout the first 2 growing seasons. So, with planting 150 trees per year, there would be 300 trees requiring water at any given time, for a total cost of around \$15,000 each year. Once again however, these numbers can be highly variable. A watering program paid for by the Village, using contracted labor, is likely beyond the scope of current budgets. There is always an option to rely on well-informed residents to water trees. Upon receiving a newly planted tree on the terrace in front of their homes, residents should be supplied with an informational pamphlet which explains how often to water their new tree during the first 2-3 years. It is also suggested that the Village, perhaps acting in conjunction with the Forestry Consultant, hold basic tree maintenance classes open to all residents.

## Mulch

Proper application of mulch is a necessary and cost-effective maintenance activity. Mulch has many benefits, including reducing weed growth in the root zone, protecting the tree trunk and root flare from lawn maintenance equipment, allowing water to move into the soil, reducing evaporation and drought stress, and creating a naturally fertile soil environment. Turf grass typical of terraces competes for water and nutrients, and mulch reduces this competition.

### Improper Mulching



### Proper Mulching



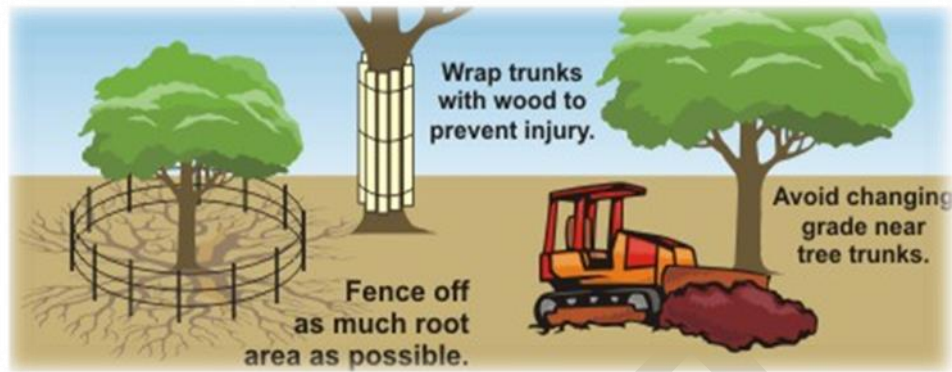
But not all mulching is beneficial. The practice known as “Volcano Mulching” is the practice of piling mulch against the trunk in excess of 3” deep. This causes moisture build up against the trunk, and can cause decay of the trunk tissue, and possibly death. Material such as crushed limestone, red volcanic rock, or rubber pellets can alter the soil chemistry in an undesirable way, and cause dieback or tree death.

Fortunately, mulch is a commodity most communities can get for free so long as they are pruning and removing trees each year. As part of its successful wood utilization program, McFarland provides wood chips produced through tree maintenance and removal to Village residents at no cost. Any additional available chips are used as mulch or path material in Village parks. This arrangement works well for everyone.

All newly planted trees should have mulch applied appropriately. A goal for McFarland should be to mulch all trees 12” DBH and smaller, but for now, mulch for all newly planted trees, and preventing volcano mulching should be a primary concern.

## Tree Preservation and Management During Construction

In many municipalities, ordinances exist to protect trees and shrubs from construction activities. The intent of these ordinances is to protect the benefits those tree and shrubs provide to the community. Trees and shrubs may be privately owned but are also community resources that provide benefits such as aesthetics, storm water benefits, energy savings, carbon sequestration and increased property values. Therefore, tree and shrub protection and preservation during construction represents an investment in the community! Ensuring the protection and preservation of these trees while minimizing burdens to businesses, developers, and residents is essential to a healthy urban forest.



Tree protection and preservation during periods of construction involves protecting trees from damage caused by construction activities. This damage includes physical and chemical damage to the trunk, branches, and roots. Damage may be caused by equipment such as backhoes, skid steers, or other appendage-type equipment. The effects of damage to the visible above ground portions of the tree can be obvious, as when branches are broken. But hidden effects such as root compaction or improper grading may not become evident for years until the tree begins to die back. The standards set forth below and in [Appendix \\_\\_\\_\\_](#) are industry standards with a proven record of success.

### **Tree Preservation Requirements and Standards**

#### **Village of McFarland**

1. A tree survey shall be performed by a qualified individual prior to the beginning of any development activities. The survey shall detail the size, species, and condition of each tree six inches DBH and greater OR managed landscape tree (intentionally planted, non-volunteer tree) of any size.
2. The Tree Survey and a Tree Protection Plan shall be submitted to the Village of McFarland and all relevant architects, engineers, and workers, detailing the following:
  - A. Trees to be removed
  - B. Trees to be preserved
  - C. Location and size of the Tree Protection Zone (TPZ) for each tree
3. The Tree Protection Zones for each tree shall be visibly delineated by the site engineer, using orange snow fencing or other high visibility exclusion material. When such a delineation is not possible, all workers on site shall be made aware of the TPZ verbally.

### **SAMPLE Tree Risk Assessment Policy**

Trees provide ecosystem and aesthetic benefits, but all trees also pose some degree of risk. Determining the acceptable level of risk, along with effectively managing that risk, is a key priority for urban forestry operations. As a tree manager, the Village of McFarland always must always assume some degree of risk. It is up to the Village to track that risk to ultimately decide how to take



steps to mitigate trees which pose such risk in a manner which is responsible both economically as well as in the interest of public safety.

### **Levels of Risk Assessment – An Overview**



These Risk Assessment Levels are based on the International Society of Arboriculture's (ISA) Tree Risk Assessment Qualification (TRAQ) protocols, as well as the ANSI A300 Part 9 (Tree Risk Assessment) Standards. The TRAQ forms can be found in **Appendix \_\_\_\_** at the end of this report. All trees in McFarland were assessed for a basic level of risk during the inventory. These assessments were rapid assessments, and do not represent any formal level of TRAQ risk assessment, and

are not legally binding. They are solely intended to provide McFarland with data showing a need for a more detailed assessment of individual trees such as those listed below.

#### **Level 1 Assessment**

Also called a "limited visual assessment", whereby a tree has a basic analysis of obvious physical defects and condition. The assessor walks or drives by the tree, assesses it quickly for defects, evaluates the risk posed by the subject tree, and reports the results of the assessment to the tree owner. Often, prior to a recommendation, a more detailed (Level 2 or Level 3) assessment will be required to gather additional data.

#### **Level 2 Assessment**

A Level 2 Assessment, also called a "basic assessment", is a report detailing the information collected during a detailed visual inspection of the tree and the surrounding site. Such an inspection requires a 360 degree walk around, and may include the use of simple tools, such as binoculars, magnifying lenses, mallets, probes, and trowels or shovels. The goal is to get a more complete picture of the tree in its environment, as well as previous histories of failures, and a root to branch evaluation of not only the tree but also potential "targets" which falling tree limbs may impact. Targets are things such as structures, people, vehicles, or other things which may be damaged or injured by trees.



#### **Level 3 Assessment**

A Level 3 Assessment, also called an "advanced assessment", provides detailed information about specific tree parts, targets, and risk associated with each potential interaction. By definition, it requires specialized equipment known as "advanced tools", such as bucket trucks, resistance drills, sonic tomographs, and other such equipment. This is the most detailed and time-intensive type of assessment, and is typically only performed when a decision to retain or remove a tree is very

difficult, as would be the case for a high quality tree near a potential target that has significant defects, the extent of which are not known, but must become known before making a decision.

### **Considerations in Assessing Risk**

The following are meant for the reader to gain additional insight into the TRAQ process. Once again, TRAQ inspections were not performed on Village trees during the inventory data collection, but this information will help the reader understand the terminology better, and help inform staff and residents as to how and why these inspections are performed.

### **Likelihood of Tree Part Failure**

Like it sounds, this is a process of determining how likely a tree part is to fail, and then how likely that failure is to impact a target. Likelihood of failure is an assessment of the tree's defects, and the load on those defects, like weight, gravity, ice, or wind. The parts impacted are generally the roots, root plate, trunk, branches, or potentially whole tree failure at multiple points.

### **Likelihood of Tree Failure Impacting a Target**

Determining the likelihood of impacting a target is figuring out the occupancy rate, or the amount of time that targets (particularly people or high value property) are within the fall zone. A large tree in the middle of a field could fail with little impact, but that same tree in a playground might have serious consequences. In many roadways, motor traffic is present day and night. All of the Village's inventoried 3,452 trees are in rights-of-way adjacent to roads, where failure of a tree not only impacts motorists, but it also has a potential effect on pedestrian traffic and utilities within right-of-way also.



### **Consequences of a Tree Failure Impacting a Target**

The potential consequences of the tree failure impacting a target are a cumulative function of both the "value" of the target (person vs car) and the consequences to that target if the tree fails. Whereas the previous step was concerned with occupancy rates, this step looks at the consequences of the impact, and assumes that the target is always present. To follow with the above example, it is assumed that if a terrace tree were to fail, that a car, utility line, and person are all underneath it at the time of failure, and the consequences to those targets is evaluated. Consequences are generally considered to be "minor" for targets that can be easily replaced or repaired, and step up through 4 levels with the highest level being "severe", which would constitute severe injury to a person, or even a fatality (see the table below).

### **Weather**

Every tree, no matter how healthy, can fail from wind, lightning strikes, ice loading or soil saturation. "Normal" weather can cause tree or tree part failures for trees which have existing defects, like deadwood, cavities, or poor architecture. Extreme weather events, by contrast, can cause the failure

of perfectly healthy trees. For all Tree Risk Assessments, Risk should be assessed assuming “normal” weather conditions. Though it should be noted that “normal” weather conditions for south central Wisconsin do include gusty winds, thunderstorms, snow, and even an occasional ice storm. It is the extremes of these events that should be considered abnormal.

### **SAMPLE Village of McFarland Tree Risk Assessment Policy**

The Village of McFarland has created this policy to maintain an acceptable level of risk from its tree population(s). In order to maintain a high level of public safety, while mitigating undue burden, the Village shall adopt the following risk assessment protocols:

1. The Village of McFarland maintains a tree inventory detailing the species, size, and condition of all trees on Village Terraces, as well as a basic level of risk posed by each tree. This UFMP recommends that the trees listed as being in elevated risk categories during the initial inventory be audited on an ad hoc basis. During these audits, the Village Arborist and/or Forestry Consultant should inspect these trees and identify trees potentially posing an unacceptable level of risk. Such trees identified shall either be scheduled for a more detailed risk assessment (Level 2 or 3), or shall be mitigated, either by pruning, bracing, or removal, as soon as practical following the assessment.
2. During subsequent years, staff shall perform limited visual assessments on an ad hoc basis by driving by trees during the normal course of daily operations. Trees which may appear to present an elevated risk level shall be scheduled for a more detailed risk assessment (Level 2 or 3), or shall be mitigated, either by pruning, bracing, or removal, as soon as practical following the assessment.
3. Upon notification from a resident of a concern about a potentially high-risk tree, the Village Arborist and/or Urban Forestry Consultant perform a Level 1 limited visual inspection within (14) business days of the notification by the resident. If a Level 2 or Level 3 Risk Assessment is required based on that inspection, it shall be performed within an additional (14) business days. a decision shall be made by the Village Arborist and/or Forestry Consultant as to what the appropriate mitigation measures are, if any.
4. All trees determined to be in need of mitigating actions (removal, pruning, etc.) should be documented in writing by the Village Arborist and/or Urban Forestry Consultant. The documentation shall include the date the assessment was performed, the species, size, and condition of the tree, and a brief narrative detailing which parts of the tree are likely to fail, the likelihood of failure, the likelihood of impacting a target, the consequences of tree or tree part failure, and the overall tree risk rating, per the ISA’s TRAQ system of risk assessment.
5. A minimum branch diameter of three (3) inches, by ocular estimate, shall be the standard to which this risk assessment policy applies. Assessing all branches smaller than three inches represents an undue burden to the Village.

TRAQ Forms can be found in **Appendix \_\_\_** at the end of this report.

## TRAQ Tree Risk Assessment Matrices

### **Likelihood of Tree Failure Impacting Target**

| <u>Likelihood of Tree Failure</u> | <u>Likelihood of Impacting Target</u> |                 |                 |                 |
|-----------------------------------|---------------------------------------|-----------------|-----------------|-----------------|
|                                   | Very Low                              | Low             | Medium          | High            |
| <b>Imminent</b>                   | Unlikely                              | Somewhat Likely | Likely          | Very Likely     |
| <b>Probable</b>                   | Unlikely                              | Unlikely        | Somewhat Likely | Likely          |
| <b>Possible</b>                   | Unlikely                              | Unlikely        | Unlikely        | Somewhat Likely |
| <b>Improbable</b>                 | Unlikely                              | Unlikely        | Unlikely        | Unlikely        |

### **Risk Rating Matrix**

| <u>Likelihood of Failure and Impact</u> | <u>Consequences</u> |          |             |          |
|-----------------------------------------|---------------------|----------|-------------|----------|
|                                         | Negligible          | Minor    | Significant | Severe   |
| <b>Very Likely</b>                      | Low                 | Moderate | High        | Extreme  |
| <b>Likely</b>                           | Low                 | Moderate | High        | High     |
| <b>Somewhat Likely</b>                  | Low                 | Low      | Moderate    | Moderate |
| <b>Unlikely</b>                         | Low                 | Low      | Low         | Low      |



## Projected Budget

The budget numbers below, as mentioned several times through this Urban Forestry Management Plan, are figures based on current industry rates for the services listed which are proposed for this plan. From there, generally the budget increases slightly each year, and projects through 2044, at which time, including CPI, the budget will have increased approximately 78% from the current level of approximately \$79,045 in 2024 to approximately \$140,668 by 2044. This represents a necessary budget increase for such an increase in values of the Urban Forest.

| REMOVALS | Milestones          | 2024                            | 2025                            | 2026                            | 2027                            | 2028                            | 2034-2044                       |
|----------|---------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|          | Trees Removed       | 50                              | 55                              | 60                              | 65                              | 70                              | 75                              |
|          | Diameter Inches     | 600"                            | 610"                            | 620"                            | 630"                            | 640"                            | 650"                            |
|          | Notes               | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates | Removals From Inventory Updates |
|          | Removal Cost (2024) | \$15,000                        | \$15,250                        | \$15,500                        | \$15,750                        | \$16,000                        | \$16,250                        |
|          | Removal Cost (CPI)  | \$15,000                        | \$15,250                        | \$15,500                        | \$15,750                        | \$16,000                        | \$18,688                        |

| PLANTINGS | Milestones           | 2024     | 2025     | 2026     | 2027     | 2028     | 2034-2044    |
|-----------|----------------------|----------|----------|----------|----------|----------|--------------|
|           | Trees Planted        | 100      | 110      | 120      | 130      | 140      | 150/year avg |
|           | Planting Cost (2024) | \$32,500 | \$35,750 | \$39,000 | \$42,250 | \$45,500 | \$48,750     |
|           | Planting Cost (CPI)  | \$32,500 | \$35,750 | \$39,000 | \$42,250 | \$45,500 | \$56,063     |

| PRUNING | Milestones   | 2024             | 2025             | 2026             | 2027             | 2028             | 2034-2044                                           |
|---------|--------------|------------------|------------------|------------------|------------------|------------------|-----------------------------------------------------|
|         | Trees Pruned | 600              | 650              | 700              | 750              | 800              | 900/year avg                                        |
|         | Notes        | 600 Cycle Prunes | 650 Cycle Prunes | 700 Cycle Prunes | 750 Cycle Prunes | 800 Cycle Prunes | Approximately 900 Cycle Prunes / year in perpetuity |
|         | Cost (2024)  | \$29,045         | \$32,475         | \$35,900         | \$39,300         | \$42,800         | \$52,320                                            |
|         | Cost (CPI)   | \$29,045         | \$32,475         | \$35,900         | \$39,300         | \$42,800         | \$60,168                                            |

| FORESTRY CONSULTANT | Milestones  | 2024                                            | 2025                                            | 2026                                            | 2027                                            | 2028                                            | 2034-2044                                       |
|---------------------|-------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|-------------------------------------------------|
|                     | Notes       | Inventory Updates / Risk Management/ Appraisals | Inventory Updates / Risk Management/ Appraisals | Inventory Updates / Risk Management/ Appraisals | Inventory Updates / Risk Management/ Appraisals | Inventory Updates / Risk Management/ Appraisals | Inventory Updates / Risk Management/ Appraisals |
|                     | Cost (2024) | \$2,500                                         | \$2,500                                         | \$5,000                                         | \$5,000                                         | \$5,000                                         | \$5,000                                         |
|                     | Cost (CPI)  | \$2,500                                         | \$2,500                                         | \$5,000                                         | \$5,000                                         | \$5,000                                         | \$5,750                                         |

| TOTALS | TOTALS - 2024 \$ | \$79,045 | \$85,975 | \$95,400 | \$102,300 | \$109,300 | \$122,320 |
|--------|------------------|----------|----------|----------|-----------|-----------|-----------|
|        |                  |          |          |          |           |           |           |
|        | TOTALS - CPI 3%  | \$79,045 | \$85,975 | \$95,400 | \$102,300 | \$109,300 | \$140,668 |

## Summary / Conclusion

TBD based on edits from Village

DRAFT

## Glossary of Terms

**Aerial Device:** Any piece of equipment expressly intended to elevate a human worker above the level at which they typically stand with their feet on the ground surface. Can include but is not limited to bucket trucks, scissor lifts, etc

**Aggressive:** A floral or faunal organism which is native (endemic) to the United States or northern Indiana, but which is known to outcompete other more desirable organisms

**Arborist:** An individual engaged in the profession of arboriculture who is educated, trained and licensed to provide for or supervise the management of trees and other woody plants

**Arborist Trainee:** Any person working under the direct supervision of an Arborist or Certified Arborist

**Balled and Burlapped:** A tree, shrub, or other plant prepared for transplanting by allowing the roots to remain covered by a ball of soil around which canvas or burlap is tied and secured with a basket.

**Bare Root:** Harvested plants from which the soil or growing medium has been removed

**Best Management Practices (BMP):** Methods or techniques found to be the most effective and practical means in achieving an objective while making the optimum use of resources.

**Caliper:** Standard nurseryman's measure of tree diameter (size). Caliper measurement of the trunk shall be taken six inches above the ground up to and including four-inch caliper size. If the caliper at six inches above the ground exceeds four inches, the caliper should be measured at 12 inches above the ground.

**Certified Arborist:** An individual who has sufficient experience in the field of Arboriculture, and has been certified by the International Society of Arboriculture as being a Certified Arborist

**Border Trees:** Trees whose trunks, when measured at DBH, are situated on both Public and private property

**Branch Collar:** The branch collar is the point where a branch joins the trunk or another branch. This is the area the arborist chooses to make a proper cut.

**Climbing Line:** Any rope or other such material explicitly intended for bearing the weight of a human being

**Collected Plants:** Trees or shrubs which have been sourced from private property for the intent of transplanting elsewhere

**Compacted Soil:** A high-density soil lacking structure and porosity, characterized by restricted water infiltration and percolation (drainage), and limited root penetration

**Consumer Price Index:** an index of the variation in prices paid by typical consumers for retail goods and other items

**Containerized:** A tree, shrub, or other plant prepared for transplanting, or grown in, a solid-walled container such as a plastic pots or wooden boxes

**Contracted Staff:** People working for the Village as part of an independently owned and operated private company which performs work for the Village, but who are not directly employed by the Village

**Controlling Authority:** An agency, organization, or corporate entity with the legal authority and/or obligation to manage individual trees or tree populations

**Crew Leader:** Any personal who has by direction or implication been chosen to lead a team of In-House or Contracted Staff

**Crown:** The upper part of a tree, measured from the lowest branch, including all branches and foliage

**Critical Root Zone (CRZ):** The minimum volume of roots necessary for a tree to have health and stability

**Cycle Pruning:** The process of routine maintenance pruning of trees, not related to storm damage or other hazard or emergency related-pruning, that occurs on a set and predictable time scale set forth by the Village

**Deadwood:** Wood on a tree or shrub which is no longer biologically living and becomes brittle or prone to failure

**Decline/Declining:** Trees or shrubs which are experiencing symptoms of a general decline on health due to age, pest, or pathogen related issues

**Desirable:** A Tree or other plant whose characteristics are sought after due to ecology, aesthetics, or public safety

**Diameter or DBH:** Diameter at Breast Height. A standard forestry measure of tree diameter (size), measured at 4.5' above ground level on the uphill side of a tree using a Diameter Tape or Biltmore Stick

**Diggers Hotline (811):** The Wisconsin underground utility locating service

**Digging Machine(s):** Any piece of mechanical equipment whose express purpose is to remove soil and plants from their current locations

**Diseased:** The status of a tree which has been negatively impacted by a pathogen, bacterial, fungal, viral, or similar lower life forms

**Drip Line:** The soil surface delineated by the branch spread of a single plant or group of plants

**Drought:** A period of two weeks or greater, during which there is less than one inch of rainfall, when the average daytime temperature during that same period exceeds 75 degrees Fahrenheit.

**Dutch Elm Disease:** A fungal pathogen which causes the decline and death of specific species of Elm trees

**Dying:** A tree which is in the process of biological death due to senescence, disease, infestation, or other such malady from which there is very little to no hope of long-term survival

**EAB:** Emerald Ash Borer. An invasive beetle pest which affects all Ash trees

**Establishment Pruning:** The pruning of a young tree in order to establish proper form and branching habit

**Established Trees:** Those trees which have been permanently planted for a period of no less than 6 months, and which have permanent roots established in the soil

**Failure (tree failure):** Breakage of stem or branches, or loss of mechanical support in the root system

**Feeder Root:** Any portion of the below ground portions of the tree whose purpose is to absorb water and nutrients

**Floodplain:** Land which has been determined to be periodically inundated with water from a nearby moving or static water body, such as a lake or river. Determined by the Federal Emergency Management Agency

**Flush Cut:** Either a pruning cut or final cut to remove a stump, for which the maximum acceptable distance from the ground or the branch bark ridge shall be no greater than 2 inches

**Full-Time:** An employee who has regular employment through the Village and whose work hours exceed 36 hours in a week, and who is employed year-round.

**Fungal:** Any of a group of spore-producing organisms feeding on organic matter, including molds, yeast, mushrooms, and toadstools

**Grade:** The level or pitch of a certain piece of land, as defined by the trees or shrubs which inhabit it

**Hardscape:** The nonliving or man-made fixtures of a planned outdoor area, such as sidewalks, retaining walls, street lamps, etc

**Hazard:** A known and documented state of imperiling public safety

**Healthy Tree:** Any tree which is successfully adapting to it's environment, and shows no signs of disease, pests, pathogens, or other such maladies, as determined by the Village or Forestry Consultant(s)

**Host:** An organism which is susceptible to a known pest or pathogen

**Infested:** The status of a tree which has been negatively impacted by pests

**In-House Staff:** Staff directly employed by the Village of McFarland, on either a full-time or Part-Time Basis

**Invasive:** A floral or faunal organism which is not native (endemic) to the United States or northern Indiana

**Job Site:** Any geographic location where a person or persons will be performing activities related to the care and maintenance of Village of McFarland property

**Liner Nursery:** A privately owned plant propagation facility which specializes in the growth of small trees which are intended to be planted for growth into a full form

**Managed:** A tree or shrub which is in an area of the Village which is routinely mowed and managed. Not a wild forest grown tree or shrub, or area containing such trees and shrubs

**Manufacturer's Recommendations:** Any expressly written instruction manual for a given piece of equipment that details how said equipment is supposed to be managed or maintained

**Mineral Soil:** Any substrate which is composed of a variety of rocks and minerals in various states of decomposition, leading to the development of a substance on which living plants may live

**Mitigation:** The process of diminishing risk

**Monoculture:** A population of trees in close proximity to one another which is comprised of 3 species or less of trees and shrubs which is prone to pest or pathogen outbreak

**Natural Resources:** Flora, fauna, and other such living and non-living parts of the environment which the Village of McFarland maintains

**Nursery Stock:** Woody Perennials which are of a "Tree Form" growth habit and are supplied by a nursery contractor for planting. Not established trees.

**Parks Department Property:** Land which, by deed or title, belongs to the Village of McFarland

**Parkway Tree:** Any woody plant within a Publicly-Owned right-of-way, or any other property owned or managed by the Village of McFarland

**Part-Time:** An employee who has regular employment through the Village and whose work hours are less than 36 hours in a week, and who is employed year-round

**Pathogen:** A fungus, virus, or other such microscopic organism which causes decline or death of trees

**Pest:** An insect or other macrofaunal organism which causes decline or death of trees

**Private Property:** Land which, by deed or title, does not belong to the Village of McFarland

**Public Safety:** The welfare and protection of the general public

**Reforestation:** The process by which trees are planted to replace trees which have been removed

**Rigging Line:** Any rope or other such material explicitly intended for bearing the weight of a tree limb. Not to be used for supporting a human being

**Right-of-Way (ROW):** The publicly-owned land on which a road, drainage ditch, trail, or other public access is built

**Risk:** A situation involving potential exposure to danger or endangering public safety

**Root Protection Zone (RPZ):** The area on the ground surrounding a tree in which excavation, compaction, and other construction-related activities should be avoided or mitigated

**Saddle:** A piece of equipment expressly intended to hold a human being above ground level with the assistance of a rope or other such device

**Sanitation Pruning:** The removal of tree limbs that have become diseased or infested, in order to prevent the spread of disease or infestation from spreading throughout the rest of the tree e.g., Dutch Elm Disease, Black Knot Fungus, etc.

**Seasonal Employees:** Those employees retained by the Village for less than 6 months out of the calendar or budget year

**Shrub:** Any woody perennial which has a multi-stemmed growth habit not consistent with being considered a tree. Can be subject to interpretation by McFarland Staff.

**Sound Wood:** Structurally sound, non-decayed, non-compromised wood in the trunk or Scaffold Branches

**Staff:** Those employees retained by the Village on a full-time basis with benefits provided

**Structural Root:** Any portion of the below ground portions of the tree whose purpose is to stabilize the plant against the forces of wind and gravity

**TRAQ:** Tree Risk Assessment Qualification. The International Society of Arboriculture's formal status of an individual who is qualified to assess the risk that trees may bring to the general public

**Tree Protection Zone (TPZ):** The area surrounding a tree in which excavation and other construction-related activities should be avoided

**Tree Risk:** The likelihood and consequences of failure of a tree or tree parts

**Tree Risk Assessment:** A systematic process used to identify, analyze, and evaluate tree risk

**Underperforming:** Trees which have systematic health and vigor issues resulting in poor health, architecture, or other such maladies as determined by Village staff

**Undesirable:** A tree which is not desired in the landscape due to ecological, aesthetic, or public safety reasons, as determined by McFarland Staff

**Unmanaged:** A tree or shrub which is in an area of the Village of McFarland which is not routinely mowed and managed. A wild forest grown tree or shrub, or area containing such trees and shrubs



**Urban Wood:** Any tree or other woody perennial material which has been harvested for the sole purpose of long term storage in the form of furniture, recreational material, etc. Differentiated from “Reclaimed Wood”

**Utility Arborist:** A person explicitly trained in the management of trees and other plants in relation to energized power lines. Someone who is licensed to work with conflicts between trees and such energized power lines.

## Appendix A: Acceptable and Unacceptable Species

Species not appearing on this list can be approved or disallowed by consensus of the Sustainability and Natural Resources Committee acting under the supervision of the Village Arborist and/or Forestry Consultant.

| NOT APPROVED     | APPROVED SPECIES     |                    |                   |                  |
|------------------|----------------------|--------------------|-------------------|------------------|
| Any Size         | Large Trees          | Medium Trees       | Small Trees       | Evergreens       |
| AILANTHUS        | BALDCYPRESS          | ALDER              | AMERICAN REDBUD   | ARBOR VITAE      |
| AMUR CORKTREE    | BEECH-AMERICAN       | AMUR MAACKIA       | APPLE-CRAB        | DOUGLAS FIR      |
| ASH-EUROPEAN     | BEECH-EUROPEAN       | BIRCH-RIVER        | APPLE-EDIBLE      | EASTERN REDCEDAR |
| ASH-GREEN        | BUCKEYE-OHIO         | BIRCH-WHITE        | BUCKEYE-RED       | FIR-CONCOLOR     |
| ASH-WHITE        | BUCKEYE-YELLOW       | BLACKGUM           | CHERRY-ORNAMENTAL | HEMLOCK-SPP      |
| BOXELDER         | CATALPA              | ELM-CHINESE        | DOGWOOD-SPP       | JUNIPER-COMMON   |
| BUCKTHORN        | CHESTNUT-CHINESE     | HARDY RUBBER TREE  | HAWTHORN-COCKSPUR | PINE-AUSTRIAN    |
| BURNING BUSH     | DAWN REDWOOD         | HAZELNUT-TURKISH   | HAWTHORN-SPP      | PINE-MUGO        |
| CHERRY-BLACK/PIN | ELM-HYBRID           | HORNBEAM-AMERICAN  | HYDRANGEA-PEEGEE  | PINE-WHITE       |
| COTTONWOOD       | GINKGO*              | HORNBEAM-EUROPEAN  | LILAC-SHRUB       | SPRUCE-BLUE      |
| ELM-AMERICAN     | HACKBERRY            | IRONWOOD           | LILAC-TREE        | SPRUCE-NORWAY    |
| ELM-SIBERIAN     | HICKORY-SPP          | KATSURA            | MAGNOLIA-SAUCER   | SPRUCE-SPP       |
| HONEYSUCKLE      | HONEYLOCUST          | MAPLE-HEDGE        | MAPLE-AMUR        | YEW              |
| MAPLE-NORWAY     | HORSECHESTNUT        | MAPLE-MIYABEI      | MAPLE-JAPANESE    |                  |
| MAPLE-SILVER     | KENTUCKY COFFEETREE* | MAPLE-PAPERBARK    | PEACH/NECTARINE   |                  |
| MULBERRY-SPP     | LARCH                | MAPLE-SHANTUNG     | PLUM-SPP          |                  |
| PEAR-CALLERY     | LINDEN-AMERICAN      | MAPLE-TRIFLORUM    | ROSE OF SHARON    |                  |
| POPLAR-SPP       | LINDEN-LITTLELEAF    | OAK-CHINKQUAPIN    | SERVICEBERRY-SPP  |                  |
| POPLAR-WHITE     | LONDON PLANETREE     | OAK-ENGLISH        | SMOKETREE         |                  |
| PRINCESS TREE    | MAGNOLIA-CUCUMBER    | OAK-SHINGLE        | WITCH HAZEL       |                  |
| RUSSIAN OLIVE    | MAPLE-SUGAR          | PERSIAN IRONWOOD   |                   |                  |
| WALNUT-ANY       | OAK-BLACK            | YELLOWWOOD         |                   |                  |
|                  | OAK-BURR             | GOLDEN RAIN TREE   |                   |                  |
|                  | OAK-PIN              | MOUNTAIN ASH       |                   |                  |
|                  | OAK-RED              | PEAR-EDIBLE        |                   |                  |
|                  | OAK-SWAMP WHITE      | SASSAFRASS         |                   |                  |
|                  | OAK-WHITE            | SEVENTH SON FLOWER |                   |                  |
|                  | PAGODATREE           |                    |                   |                  |
|                  | PERSIMMON            |                    |                   |                  |
|                  | SWEETGUM             |                    |                   |                  |
|                  | SYCAMORE             |                    |                   |                  |
|                  | TULIPTREE            |                    |                   |                  |
|                  | ZELKOVA              |                    |                   |                  |
|                  |                      | * - Male Only      |                   |                  |

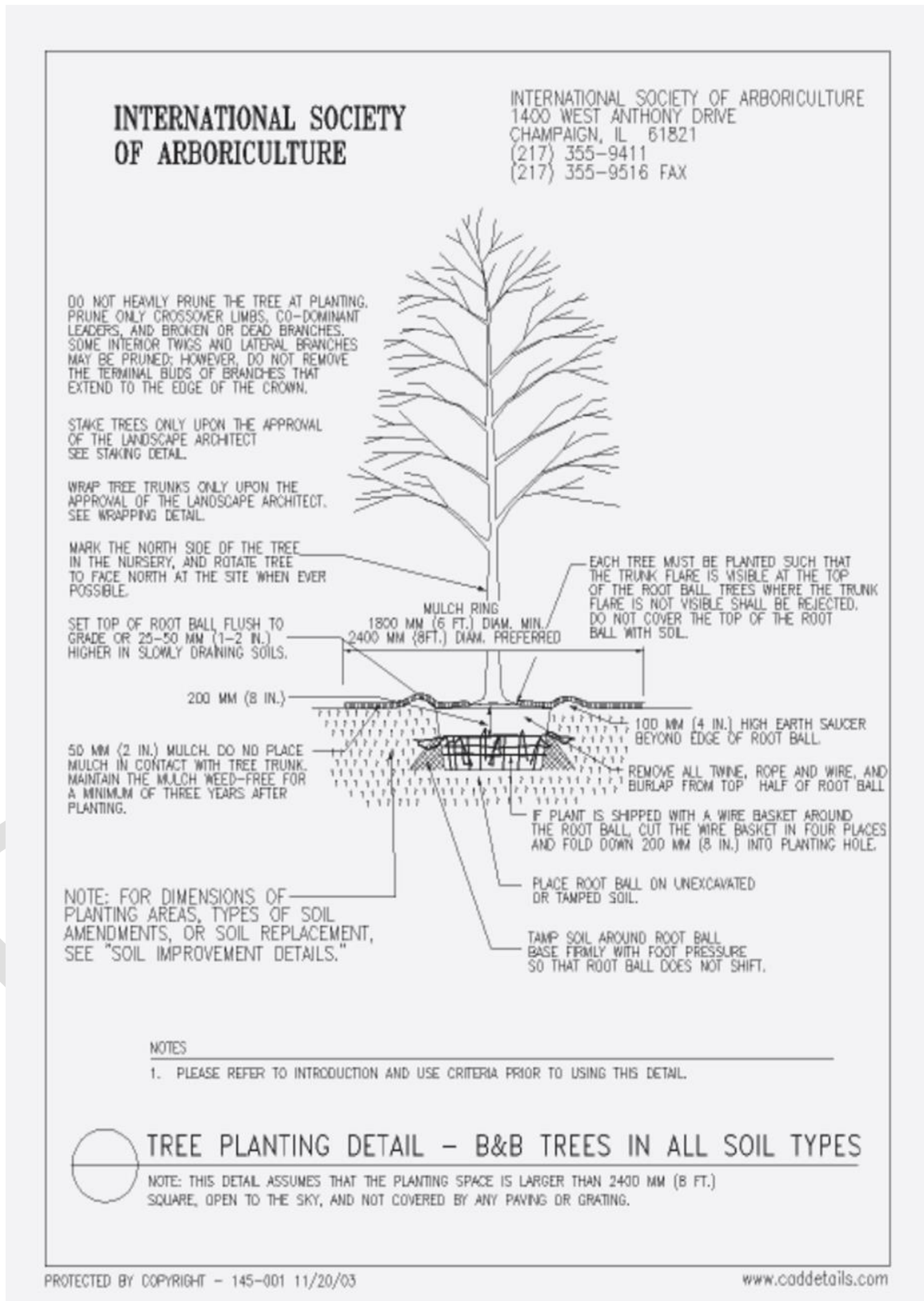
## Appendix B: Additional Comments on Species

| SPECIES             | COMMENTS                                               | SPECIES               | COMMENTS                                              |
|---------------------|--------------------------------------------------------|-----------------------|-------------------------------------------------------|
| AILANTHUS           | NOT APPROVED                                           | LILAC-SHRUB           | Parks Only                                            |
| ALDER-SPP           |                                                        | LILAC-TREE            | Improved varieties, tree form only                    |
| AMERICAN HORNBEAM   |                                                        | LINDEN-AMERICAN       |                                                       |
| AMERICAN REDBUD     |                                                        | LINDEN-LITTLELEAF     |                                                       |
| AMUR MAACKIA        |                                                        | LINDEN-SILVER         |                                                       |
| APPLE-CRAB SPP      | Apple Scab resistant varieties only                    | LINDEN-SPP            |                                                       |
| APPLE-EDIBLE        | Parks Only                                             | LONDON PLANETREE      | Prefer 'Exclamation!', 'Bloodgood' not allowed        |
| APRICOT             | NOT APPROVED                                           | MAGNOLIA-CUCUMBER     |                                                       |
| ARBOR VITAE         | Parks only                                             | MAGNOLIA-SAUCER       | Scale resistant varieties only                        |
| ASH-BLUE            | NOT APPROVED                                           | MAGNOLIA-SHRUB        | Star Magnolia or similar Magnolia pruned to tree form |
| ASH-GREEN           | NOT APPROVED                                           | MAPLE-AMUR            | Parks only unless pruned to tree form                 |
| ASH-WHITE           | NOT APPROVED                                           | MAPLE-AUTUMN BLAZE    | Or other similar Acer x freemannii                    |
| ASPEN               | Improved varieties only                                | MAPLE-BLACK           |                                                       |
| BALDCYPRESS         | Prefer 'Shawnee Brave'                                 | MAPLE-HEDGE           |                                                       |
| BEECH-AMERICAN      |                                                        | MAPLE-JAPANESE        | Small growing space only                              |
| BEECH-SPP           | Prefer 'Tricolor' or 'Riversii'                        | MAPLE-MIYABEI         | Prefer 'State Street'                                 |
| BIRCH-RIVER         | Prefer Single stem only                                | MAPLE-NORWAY          | NOT APPROVED                                          |
| BIRCH-SPP           | Sweet Birch, Yellow Birch, or other new introductions  | MAPLE-PAPERBARK       |                                                       |
| BIRCH-WHITE         | Bronze Birch Borer resistant only, prefer 'Whitespire' | MAPLE-RED             | Improved varieties only                               |
| BLACK LOCUST        | Improved varieties only, prefer 'Purple Robe'          | MAPLE-SILVER          | NOT APPROVED                                          |
| BLACKGUM            |                                                        | MAPLE-SUGAR           | Prefer 'Green Mountain'                               |
| BOXELDER            | NOT APPROVED                                           | MOUNTAIN ASH          | Improved varieties only                               |
| BUCKEYE-OHIO        |                                                        | MOUNTAIN ASH-EUROPEAN | Improved varieties only                               |
| BUCKEYE-RED         | Prefer 'Ft. McNair' or Bottlebush                      | MULBERRY-SPP          | NOT APPROVED                                          |
| BUCKEYE-YELLOW      |                                                        | OAK-BURR              |                                                       |
| BUCKTHORN           | NOT APPROVED                                           | OAK-CHESTNUT          |                                                       |
| BURNING BUSH        | NOT APPROVED                                           | OAK-CHINKQUAPIN       |                                                       |
| CAROLINA SILVERBELL | Protected sites only                                   | OAK-ENGLISH           |                                                       |
| CATALPA             |                                                        | OAK-PIN               |                                                       |
| CHERRY-BLACK        | NOT APPROVED                                           | OAK-RED               |                                                       |
| CHERRY-PURPLE LEAF  |                                                        | OAK-SWAMP WHITE       |                                                       |
| CHERRY-SPP          | Ornamental, Black Knot resistant varieties only        | OAK-WHITE             |                                                       |
| COTTONWOOD          | NOT APPROVED                                           | OTHER                 | Open for new introductions                            |
| DAWN REDWOOD        |                                                        | PAGODATREE            |                                                       |
| DOGWOOD-SPP         | Hardy varieties only                                   | PEACH                 | Parks only                                            |
| DOUGLAS FIR         | Parks only                                             | PEAR-CALLERY          | NOT APPROVED                                          |
| EASTERN REDCEDAR    | Parks only                                             | PEAR-EDIBLE           | Parks Only                                            |
| ELM-AMERICAN        | NOT APPROVED                                           | PERSIAN IRONWOOD      | Medium growing space only                             |
| ELM-HYBRID          | Hardy varieties only                                   | PERSIMMON             | American variety preferred (Diospyros virginiana)     |
| ELM-RED             | NOT APPROVED                                           | PINE-AUSTRIAN         | Parks Only                                            |
| ELM-SIBERIAN        | NOT APPROVED                                           | PINE-SCOTCH           | Parks only                                            |
| ELM-SPP             | New cultivar introductions                             | PINE-WHITE            | Parks only                                            |
| EUONYMUS            | Eastern Wahoo ONLY no non-native varieties             | PLUM-SPP              | Parks Only                                            |
| FIR-SPP             | Parks only                                             | PUSSYWILLOW           | Parks only                                            |
| FRINGETREE          |                                                        | ROSE OF SHARON        |                                                       |
| GINKGO              | Male only                                              | SASSAFRAS             |                                                       |
| GOLDEN RAINTREE     |                                                        | SERVICEBERRY-SPP      | Prefer 'Autumn Brilliance'                            |
| HACKBERRY           |                                                        | SEVENTH SON FLOWER    |                                                       |
| HARDY RUBBER TREE   |                                                        | SHRUB-SPP             | Parks only, open for new introductions                |
| HAWTHORN-SPP        | Thornless varieties only                               | SMOKETREE             | American variety preferred, small growing space only  |
| HICKORY-BITTERNUT   |                                                        | SPRUCE-BLUE           | Parks only                                            |
| HICKORY-SHAGBARK    |                                                        | SPRUCE-NORWAY         | Parks only                                            |
| HONEYLOCUST         | Prefer 'shademaster' or 'inermis'                      | SPRUCE-SPP            | Parks only                                            |
| HONEYSUCKLE         | NOT APPROVED                                           | SUMAC                 | Parks only                                            |
| HORNBEAM-EUROPEAN   |                                                        | SWEETGUM              | Prefer 'Happidaze'                                    |
| HORSECHESTNUT       |                                                        | SYCAMORE              | In natural areas only, London Planetree preferred     |
| HYDRANGEA-PEEGEE    |                                                        | TULIPTREE             |                                                       |
| IRONWOOD            |                                                        | VIBURNUM              | Tree form only                                        |
| JUNIPER-COMMON      | Parks Only                                             | WALNUT-BLACK          | NOT APPROVED                                          |
| KATSURA             |                                                        | WILLOW-SPP            | NOT APPROVED                                          |
| KENTUCKY COFFEETREE | Fruitless varieties only                               | YELLOWWOOD            |                                                       |
| LARCH               |                                                        | YEW                   | Parks Only                                            |
|                     |                                                        | ZELKOVA               | Prefer 'Green Vase'                                   |

## Appendix C: Species Substitutions

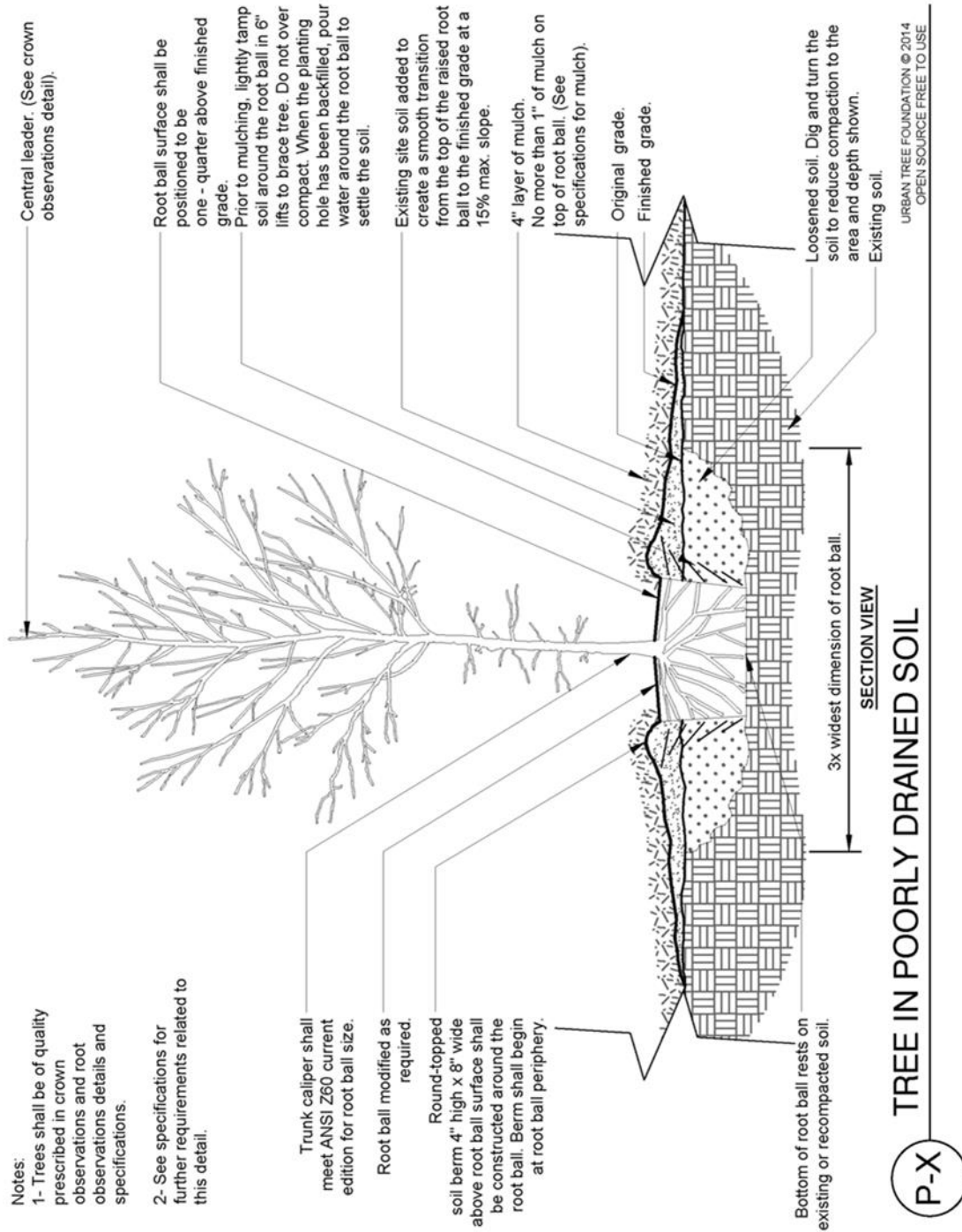
| Species                         | Planting Time | Acceptable Substitutes            |
|---------------------------------|---------------|-----------------------------------|
| Alder, Black/Speckled           | Spring        | River Birch, Planetree            |
| Amur Maackia                    | Spring        | Yellowwood, Shingle Oak           |
| Baldcypress                     | Spring        | Larch, Dawn Redwood               |
| Beech, European                 | Spring        | Red Oak, Buckeye                  |
| Birch, River (Multi Stem)       | Spring        | Alder, Swamp White Oak            |
| Birch, White                    | Spring        | River Birch, Alder                |
| Black Locust (Purple Robe)      | Any           | Honeylocust, Kentucky Coffeetree  |
| Blackgum                        | Spring        | Sweetgum, Dogwood                 |
| Buckeye, Ohio (Autumn Splendor) | Any           | Horsechestnut, Catalpa            |
| Buckeye, Red                    | Spring        | Dogwood, Hawthorn                 |
| Buckeye, Yellow                 | Spring        | Planetree, Sweetgum               |
| Catalpa                         | Any           | Kentucky Coffeetree, Tuliptree    |
| Cherry, Sargent                 | Spring        | Red Buckeye, Tree Lilac           |
| Chestnut, Chinese               | Spring        | Turkish Hazelnut, Persimmon       |
| Crabapple (Larger)              | Any           | Tree Lilac, Hawthorn              |
| Dawn Redwood                    | Spring        | Baldcypress, Larch                |
| Dogwood, Cornelian              | Spring        | Tree Lilac, Hawthorn              |
| Dogwood, Pagoda                 | Spring        | Sargent Cherry, Smoketree         |
| Douglas Fir                     | Spring        | Concolor Fir, Spruce              |
| Elm, Hybrid (Larger)            | Any           | Hackberry, Hardy Rubbertree       |
| Fir, Concolor                   | Spring        | Douglas Fir, Spruce               |
| Ginkgo (Standard)               | Any           | Tuliptree, Catalpa                |
| Golden Raintree                 | Spring        | Katsura, Magnolia                 |
| Hackberry, Common               | Any           | Hybrid Elm, Hardy Rubbertree      |
| Hardy Rubber Tree               | Any           | Tuliptree, Zelkova                |
| Hawthorn, 'Inermis'             | Any           | Crab Apple, Dogwood               |
| Hawthorn, Winterking            | Any           | Tree Lilac, Smoketree             |
| Hazelnut, Turkish               | Spring        | Persimmon, Catalpa                |
| Hickory, Bitternut              | Spring        | Oak spp, Beech spp                |
| Hickory, Shagbark               | Spring        | Oak spp, Beech spp                |
| Hornbeam, American              | Spring        | Ironwood, Hawthorn                |
| Hornbeam, European (Columnar)   | Spring        | English Oak (columnar)            |
| Horsechestnut (Baumani)         | Any           | Buckeye, Catalpa                  |
| Ironwood                        | Spring        | American Hornbeam, Hawthorn       |
| Katsura                         | Spring        | Magnolia, Seventh Son Flower      |
| Kentucky Coffeetree             | Any           | Honeylocust, Black Locust         |
| Larch                           | Spring        | Baldcypress, Dawn Redwood         |
| Lilac, Japanese Ivory Silk      | Any           | Hawthorn, Sargent Cherry          |
| Linden, Greenspire              | Any           | Kentucky Coffeetree, Hybrid Elm   |
| Linden, Redmond                 | Any           | Catalpa, Hackberry                |
| Locust, Skyline                 | Any           | Kentucky Coffeetree, Black locust |
| London Planetree                | Spring        | Sweetgum, Blackgum                |
| Magnolia, Cucumber              | Spring        | Yellow Buckeye, Catalpa           |
| Magnolia, Saucer                | Spring        | Persian Ironwood, Katsura         |
| Magnolia, Star                  | Spring        | Sargent Cherry, Smoketree         |
| Maple, Autumn Blaze             | Any           | Black Maple, Shantung Maple       |
| Maple, Black                    | Any           | Shantung Maple, Autumn Blaze      |
| Maple, Paperbark                | Spring        | Triflorum Maple, Tree Lilac       |
| Maple, Shantung                 | Any           | Sugar Maple, Miyabei Maple        |
| Maple, Sugar                    | Any           | Autumn Blaze, Shantung Maple      |
| Maple, Triflorum                | Spring        | Paperbark Maple, Tree Lilac       |
| Mountain Ash                    | Spring        | Black Locust, Hawthorn            |
| Oak, Burr                       | Spring        | Shingle Oak, Swamp White Oak      |
| Oak, English (Columnar)         | Any           | European Hornbeam                 |
| Oak, English (Standard)         | Any           | White Oak, Burr Oak               |
| Oak, Red                        | Spring        | Black Oak, Chinquapin Oak         |
| Oak, Shingle                    | Spring        | Chinquapin Oak, English Oak       |
| Oak, Swamp White                | Spring        | London Planetree, Burr Oak        |
| Oak, White                      | Spring        | Burr Oak, English Oak             |
| Oak, Chinquapin                 | Spring        | Shingle Oak, Red Oak              |
| Persian Ironwood                | Spring        | Seventh Son Flower, Katsura       |
| Persimmon                       | Spring        | Turkish Hazelnut, Zelkova         |
| Pine, Limber                    | Spring        | Spruce, Concolor Fir              |
| Pine, Red                       | Spring        | Douglas Fir, Eastern Redcedar     |
| Poplar, Hybrid                  | Any           | London Planetree, Baldcypress     |
| Redbud                          | Any           | Serviceberry, Hawthorn            |
| Redcedar, Eastern               | Spring        | Spruce, Douglas Fir               |
| Serviceberry                    | Any           | Redbud, Tree Lilac                |
| Seventh Son Flower              | Spring        | Persian Ironwood, Katsura         |
| Smoketree                       | Spring        | Magnolia, Seventh Son Flower      |
| Sourwood                        | Spring        | Blackgum, Sweetgum                |
| Spruce, Black Hills             | Spring        | Eastern Redcedar, Concolor Fir    |
| Spruce, Blue                    | Spring        | Eastern Redcedar, Douglas Fir     |
| Spruce, Norway                  | Spring        | Eastern Redcedar, Concolor Fir    |
| Spruce, Serbian                 | Spring        | Eastern Redcedar, Douglas Fir     |
| Sweetgum                        | Spring        | Yellow Buckeye, Larch             |
| Tuliptree                       | Any           | Zelkova, Ginkgo                   |
| Yellowwood                      | Spring        | Amur Maackia, Shingle Oak         |
| Zelkova                         | Spring        | Tuliptree, Ginkgo                 |

## Appendix D: Balled and Burlapped Planting Detail



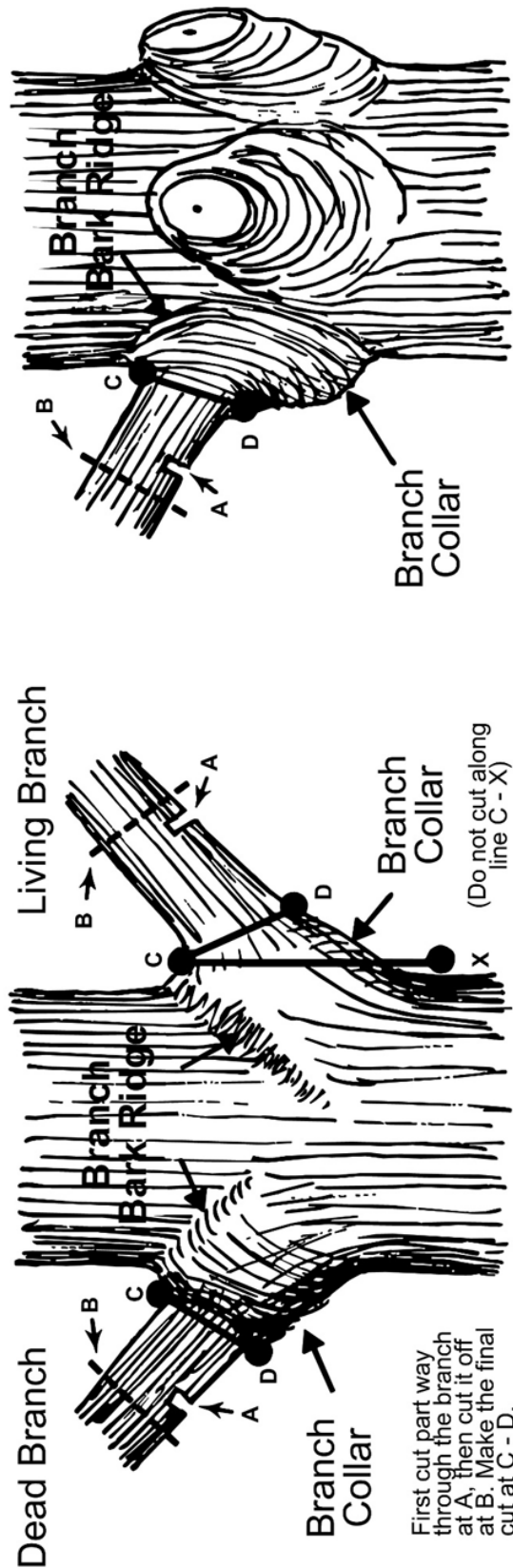


## Appendix E: Containerized Planting Detail



## Appendix F: Tree Pruning Detail

# Proper Pruning Principles



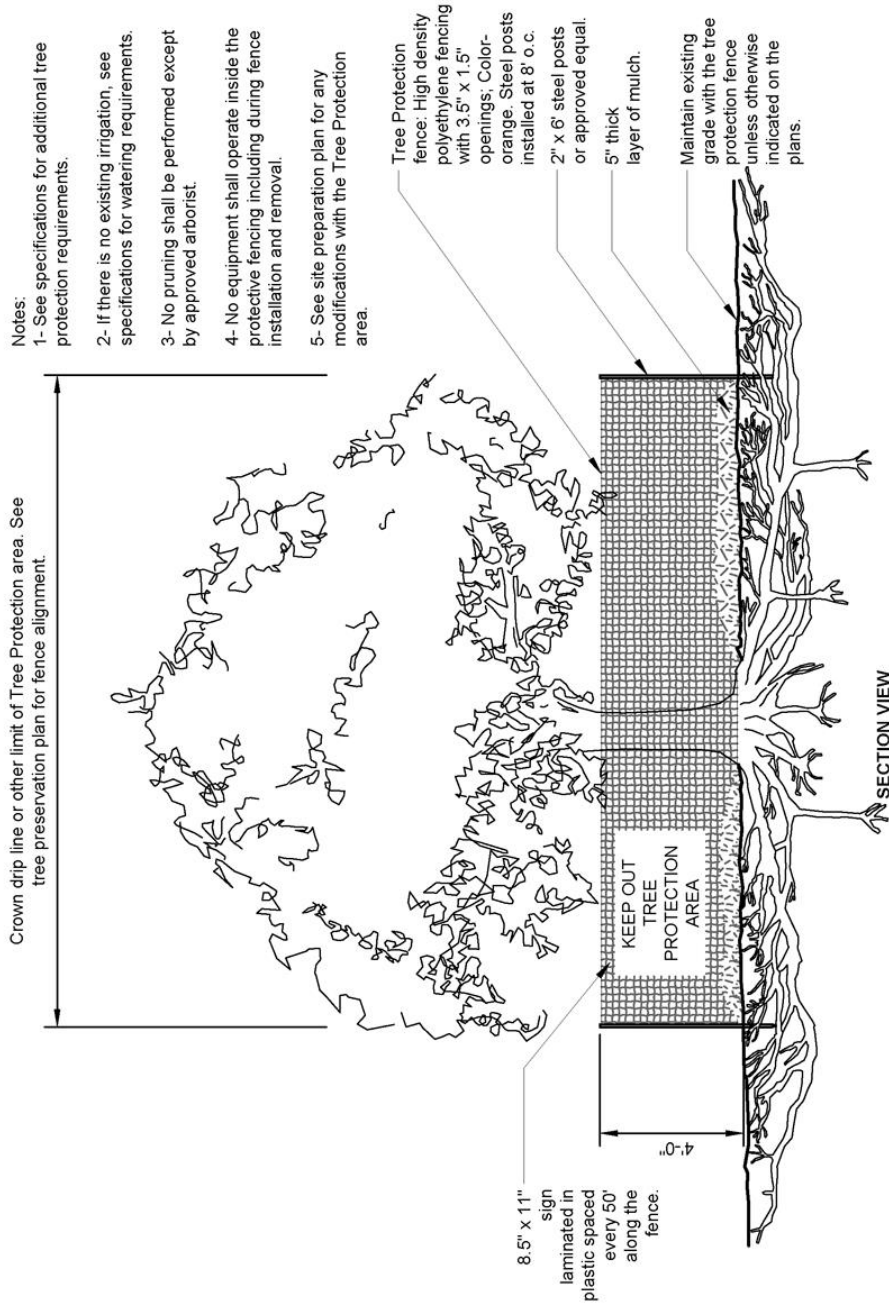
Hardwoods

Conifers





## Appendix G: Tree Protection Detail



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OPEN SOURCE FREE TO USE

TREE PROTECTION



## Appendix H: ISA Tree Risk Assessment Form (TRAQ Level 2-Basic)

# ISA Basic Tree Risk Assessment Form

Client \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_  
 Address/Tree location \_\_\_\_\_ Tree no. \_\_\_\_\_ Sheet \_\_\_\_\_ of \_\_\_\_\_  
 Tree species \_\_\_\_\_ dbh \_\_\_\_\_ Height \_\_\_\_\_ Crown spread dia. \_\_\_\_\_  
 Assessor(s) \_\_\_\_\_ Time frame \_\_\_\_\_ Tools used \_\_\_\_\_

| Target Assessment |                    |                         |                       |                         |                                                                              |                           |
|-------------------|--------------------|-------------------------|-----------------------|-------------------------|------------------------------------------------------------------------------|---------------------------|
| Target number     | Target description | Target zone             |                       |                         | Occupancy rate<br>1 – rare<br>2 – occasional<br>3 – frequent<br>4 – constant | Practical to move target? |
|                   |                    | Target within drip line | Target within 1 x Ht. | Target within 1.5 x Ht. |                                                                              |                           |
| 1                 |                    |                         |                       |                         |                                                                              |                           |
| 2                 |                    |                         |                       |                         |                                                                              |                           |
| 3                 |                    |                         |                       |                         |                                                                              |                           |
| 4                 |                    |                         |                       |                         |                                                                              |                           |

## Site Factors

History of failures \_\_\_\_\_ Topography Flat ☐ Slope ☐ \_\_\_\_\_ % Aspect \_\_\_\_\_  
 Site changes None ☐ Grade change ☐ Site clearing ☐ Changed soil hydrology ☐ Root cuts ☐ Describe \_\_\_\_\_  
 Soil conditions Limited volume ☐ Saturated ☐ Shallow ☐ Compacted ☐ Pavement over roots ☐ \_\_\_\_\_ % Describe \_\_\_\_\_  
 Prevailing wind direction \_\_\_\_\_ Common weather Strong winds ☐ Ice ☐ Snow ☐ Heavy rain ☐ Describe \_\_\_\_\_

## Tree Health and Species Profile

Vigor Low ☐ Normal ☐ High ☐ Foliage None (seasonal) ☐ None (dead) ☐ Normal \_\_\_\_\_ % Chlorotic \_\_\_\_\_ % Necrotic \_\_\_\_\_ %  
 Pests \_\_\_\_\_ Abiotic \_\_\_\_\_  
 Species failure profile Branches ☐ Trunk ☐ Roots ☐ Describe \_\_\_\_\_

## Load Factors

Wind exposure Protected ☐ Partial ☐ Full ☐ Wind funneling ☐ \_\_\_\_\_ Relative crown size Small ☐ Medium ☐ Large ☐  
 Crown density Sparse ☐ Normal ☐ Dense ☐ Interior branches Few ☐ Normal ☐ Dense ☐ Vines/Mistletoe/Moss ☐ \_\_\_\_\_  
 Recent or planned change in load factors \_\_\_\_\_

## Tree Defects and Conditions Affecting the Likelihood of Failure

### — Crown and Branches —

Unbalanced crown ☐ LCR \_\_\_\_\_ %  
 Dead twigs/branches ☐ \_\_\_\_\_ % overall Max. dia. \_\_\_\_\_  
 Broken/Hangers Number \_\_\_\_\_ Max. dia. \_\_\_\_\_  
 Over-extended branches ☐  
**Pruning history**  
 Crown cleaned ☐ Thinned ☐ Raised ☐  
 Reduced ☐ Topped ☐ Lion-tailed ☐  
 Flush cuts ☐ Other \_\_\_\_\_  
 Main concern(s) \_\_\_\_\_

Cracks ☐ \_\_\_\_\_ Lightning damage ☐  
 Codominant ☐ \_\_\_\_\_ Included bark ☐  
 Weak attachments ☐ \_\_\_\_\_ Cavity/Nest hole \_\_\_\_\_ % circ.  
 Previous branch failures ☐ \_\_\_\_\_ Similar branches present ☐  
 Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐  
 Conks ☐ Heartwood decay ☐ \_\_\_\_\_  
 Response growth \_\_\_\_\_

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐ \_\_\_\_\_  
 Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐ \_\_\_\_\_

### — Trunk —

Dead/Missing bark ☐ Abnormal bark texture/color ☐  
 Codominant stems ☐ Included bark ☐ Cracks ☐  
 Sapwood damage/decay ☐ Cankers/Galls/Burls ☐ Sap ooze ☐  
 Lightning damage ☐ Heartwood decay ☐ Conks/Mushrooms ☐  
 Cavity/Nest hole \_\_\_\_\_ % circ. Depth \_\_\_\_\_ Poor taper ☐  
 Lean \_\_\_\_\_ ° Corrected? \_\_\_\_\_  
 Response growth \_\_\_\_\_  
 Main concern(s) \_\_\_\_\_

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐  
 Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

### — Roots and Root Collar —

Collar buried/Not visible ☐ Depth \_\_\_\_\_ Stem girdling ☐  
 Dead ☐ Decay ☐ Conks/Mushrooms ☐  
 Ooze ☐ Cavity ☐ \_\_\_\_\_ % circ.  
 Cracks ☐ Cut/Damaged roots ☐ Distance from trunk \_\_\_\_\_  
 Root plate lifting ☐ Soil weakness ☐  
 Response growth \_\_\_\_\_  
 Main concern(s) \_\_\_\_\_

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐  
 Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

# VILLAGE OF MCFARLAND URBAN FORESTRY MANAGEMENT PLAN

| Risk Categorization |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|---------------------|-----------|-----------------------|-----------|---------------|---------------|-------------------|------------|----------|----------|----------|----------|-----|--------|------|----------------------------------|----------|--------------|-------------|------------|-------|-------------------------------------|-------------|--------|--|
| Condition number    | Tree part | Conditions of concern | Part size | Fall distance | Target number | Target protection | Likelihood |          |          |          |          |     |        |      |                                  |          | Consequences |             |            |       | Risk rating of part (from Matrix 2) |             |        |  |
|                     |           |                       |           |               |               |                   | Failure    |          |          |          | Impact   |     |        |      | Failure & Impact (from Matrix 1) |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   | Improbable | Possible | Probable | Imminent | Very low | Low | Medium | High | Unlikely                         | Somewhat | Likely       | Very likely | Negligible | Minor |                                     | Significant | Severe |  |
| 1                   |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
| 2                   |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
| 3                   |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
| 4                   |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |
|                     |           |                       |           |               |               |                   |            |          |          |          |          |     |        |      |                                  |          |              |             |            |       |                                     |             |        |  |

Matrix 1. Likelihood matrix.

| Likelihood of Failure | Likelihood of Impacting Target |                 |                 |                 |
|-----------------------|--------------------------------|-----------------|-----------------|-----------------|
|                       | Very low                       | Low             | Medium          | High            |
| Imminent              | Unlikely                       | Somewhat likely | Likely          | Very likely     |
| Probable              | Unlikely                       | Unlikely        | Somewhat likely | Likely          |
| Possible              | Unlikely                       | Unlikely        | Unlikely        | Somewhat likely |
| Improbable            | Unlikely                       | Unlikely        | Unlikely        | Unlikely        |

Matrix 2. Risk rating matrix.

| Likelihood of Failure & Impact | Consequences of Failure |          |             |          |
|--------------------------------|-------------------------|----------|-------------|----------|
|                                | Negligible              | Minor    | Significant | Severe   |
| Very likely                    | Low                     | Moderate | High        | Extreme  |
| Likely                         | Low                     | Moderate | High        | High     |
| Somewhat likely                | Low                     | Low      | Moderate    | Moderate |
| Unlikely                       | Low                     | Low      | Low         | Low      |

Notes, explanations, descriptions \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Mitigation options \_\_\_\_\_ Residual risk \_\_\_\_\_  
 \_\_\_\_\_ Residual risk \_\_\_\_\_  
 \_\_\_\_\_ Residual risk \_\_\_\_\_  
 \_\_\_\_\_ Residual risk \_\_\_\_\_

Overall tree risk rating Low ☐ Moderate ☐ High ☐ Extreme ☐ Work priority 1 ☐ 2 ☐ 3 ☐ 4 ☐  
 Overall residual risk Low ☐ Moderate ☐ High ☐ Extreme ☐ Recommended inspection interval \_\_\_\_\_  
 Data ☐ Final ☐ Preliminary Advanced assessment needed ☐ No ☐ Yes-Type/Reason \_\_\_\_\_  
 Inspection limitations ☐ None ☐ Visibility ☐ Access ☐ Vines ☐ Root collar buried Describe \_\_\_\_\_

This datasheet was produced by the International Society of Arboriculture (ISA) and is intended for use by Tree Risk Assessment Qualified (TRAQ) arborists – 2013

## Appendix I: ANSI Z133.1 Standards – Applies to All Sections

All of the ANSI Z133.1 safety standards shall apply to all tree care operations outlined in the Urban Forestry Management Plan. Listed below is a basic overview of the standard, and it is not verbatim. A full text of this manual will be made available to all Village of McFarland employees and contractors involved with tree care operations.

1. All tools and equipment utilized during tree care operations, including those not specifically mentioned below, shall be inspected and maintained by qualified personnel in accordance with the manufacturer's care instructions.
2. All staff shall be trained in the proper use, inspection, and maintenance of said equipment.
3. Certified arborists or arborist trainees shall conduct job briefings daily prior to tree care operations of any kind and the information shall be communicated to all workers.
4. All activities performed on any job site for any activity outlined in this Urban Forestry Management Plan shall comply with all applicable OSHA guidelines and standards.
5. Traffic and pedestrian control shall be established around the job site prior to the beginning of tree care operations.
6. Emergency contact information and a safety kit conforming to the ANSI Z308.1 standards shall be made available to all workers. All employees shall have basic instruction on the use of CPR and First Aid.
7. Personal Protective Equipment (PPE) shall be required when there is a reasonable probability of injury or illness on the job site. Such a determination will be made by the Certified Arborist or Arborist Trainee prior to the beginning of tree care operations each day, and PPE shall be made available. PPE shall be well-maintained in accordance with the manufacturer's requirements.
8. Head protection shall conform to ANSI Z89.1, face and eye protection shall conform to ANSI Z87.1, respiratory protection shall comply with ANSI Z88.2, and leg protection shall always be worn when using a chainsaw.
9. Flammable liquids shall be kept a minimum of ten feet from open sources of flame or high heat and shall be stored in approved containers.
10. All Village staff and contractors working near electrical hazards shall be qualified to do so and shall be educated in the full ANSI standards for Electrical Hazards and Line Clearance.
11. Vehicles and mobile equipment shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements and shall be equipped with all standard safety devices, decals, and instructions, and shall be operated within all federal, state, and local motor vehicle codes and ordinances.



12. Aerial devices shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements, and shall be equipped with all standard safety devices, decals, and instructions.
13. Aerial devices shall be stabilized by wheel chocks, outriggers, or stabilizers as necessary for the device, and shall never be used to lift, hoist, or lower logs or equipment unless specifically designed to do so.
14. Aerial devices shall be equipped with fall protection devices and permanent load ratings, both in accordance with ANSI/SIA 92.2 or 92.5, as applicable to the specific aerial device.
15. No aerial device shall be allowed to make contact with electrical conductors, and minimum safe distances shall be maintained in accordance with the ANSI Z133.1 Standard.
16. All brush chippers shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements, and shall be equipped with all standard safety devices, decals, and instructions.
17. Sprayers and related plant health care equipment shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements, and shall be equipped with all standard safety devices, decals, and instructions.
18. Sprayer tanks or other similar enclosed spaces shall not be entered unless performed through a confined-space entry plan in accordance with OSHA 1910.46 Requirements, including air-quality testing, training, and PPE.
19. Chain saws and other similar portable power tools shall not be operated unless the manufacturer's safety devices are in proper working order. Such safety devices shall not be removed or modified.
20. Forestry staff shall have a minimum of two points of attachment to the tree or aerial device while operating a chainsaw at all times, unless the hazard posed by the second point of attachment poses a greater hazard than utilizing one point of attachment.
21. A visual hazard assessment, including a root collar inspection, shall be performed by a certified arborist or arborist trainee prior to climbing, entering, or performing work in or on any tree, and a second crew member shall be within visual or voice communication at all times during arboricultural operations that are in excess of 12 feet from the ground surface.
22. All ropes, saddles, carabiners, and other similar climbing equipment shall be: a) approved for use in the tree care industry by the manufacturer, b) have a minimum breaking strength or load capacity of 5,000 lbs., c) be inspected before each use, d) Equipment shall be removed from service when it shows signs of excessive wear or deterioration.

23. All pruning, removal, and rigging operations shall have a designated drop zone where limbs, trunks, and tools can be dropped from aloft without impacting pedestrians or passersby. A visual or verbal communication system between the employee aloft and the employee(s) on the ground shall be established to determine when the employee aloft will safely drop tree parts or tools.
24. Any tree parts which cannot be safely dropped or controlled from aloft shall have a separate rigging line tied to them to help control their fall. The tree shall be inspected for structural stability prior to the establishment of a rigging system in the tree. When trees appear to have defects that could jeopardize the ability to safely use a rigging system to drop or control a limb, an alternate plan shall be implemented.
25. All equipment utilized in rigging shall meet the load ratings for the limb being rigged, and a qualified employee, trained in proper rigging procedure shall determine the rigging procedure and equipment to be utilized. Any equipment which has been damaged or overloaded shall be removed from service.
26. When felling (removing) a tree, a crew leader shall make the determination of what equipment is necessary, and how many crew members are to be directly involved in drop zone operations. A well-established escape route shall be planned for involved workers prior to the beginning of felling operations. Any non-involved workers shall be beyond twice the height of the trunk or tree being removed during felling operations.
27. Notches shall be used on all trees and trunks greater than five inches in diameter during felling operations, and should conform to the standards set forth in the ANSI Z133.1 Standard.
28. Loose clothing, ropes, lanyards, and saddles shall not be worn during any tree care activity where the risk of entanglement with tools or machinery is possible, particularly with brush chippers.

## Appendix J: Tree Planting Standards (ANSI/ISA BMP)

### ANSI Z60.1

1. All root ball and container sizes for all balled and burlapped stock shall conform to the Z60.1 standards for width and depth, such that they encompass enough of the fibrous root system as necessary for the full recovery of the plant upon installation.
2. All bare root stock shall conform to ANSI Z60.1 standards for minimum root spread.
3. All containerized stock shall conform to ANSI Z60.1 standards for plant and container size, as specified by the Village, and shall be healthy, vigorous, well-rooted and established in the container in which it is growing. The root system shall reach the sides of the container, but shall not have excessive growth encircling the inside of the container.
4. All collected plants (those grown on unmanaged land) shall be so designated, and shall be considered to be nursery-grown stock when they have been successfully reestablished in a nursery row and grown under regular nursery cultural practices for a minimum of two growing seasons.
5. The trunk or stem of the plant shall be in the center of the ball or container, with a 10% overall variance in location.
6. The use of digging machines in both the packaging and installation of trees is considered an acceptable nursery practice.

### ANSI A300 – Part 6

1. Planting sites and work sites shall be inspected for hazards by the Village prior to the beginning of work each day. If portions of the work site are outside of the original scope of work, the controlling authority shall be notified immediately.
2. Location of utilities, obstructions, and other such hazards above and below ground shall be taken into account prior to planting and transplanting operations. These include, but are not limited to, gas, electric, sewer, communication, drainage, and signage.
3. The following shall be taken into consideration prior to transport and planting: Requirements of individual trees, compass orientation of field-grown trees, site feasibility assessments, soil assessment, and drainage assessment.
4. Tools for planting and transplanting shall be properly labelled or purchased for their intended use, and be maintained in accordance with the manufacturer's recommendations
5. The system used to move and store the plant shall minimize desiccation and other damage to the crown, trunk or rootball, and the health and vigor of the plant shall be maintained during these periods.



6. The hole to be dug for all new plantings shall be a minimum of 150% larger than the rootball or container diameter, as deep as the root flare of the tree to be planted, and shall have sides from which soil has been loosened in order to aid in root penetration.
7. For balled and burlapped trees, all rootball supporting materials shall be removed from the upper third of the rootball, and removed from the planting hole prior to final backfilling.
8. Prior to planting, container root balls shall be managed by approved methods such as, shaving the root ball, slicing the root ball, and redirecting or removing encircling roots.
9. Backfill shall comprise of either the same soil created when the hole was excavated, or a similarly amended mixture to meet a specific objective, and shall be applied in a layered fashion to reduce future settling and prevent air pockets.
10. Mulch shall be applied at a depth of two to four inches, near - but not touching - the trunk of the tree, and extending to the perimeter of the planting.
11. Support systems such as guy-wires or stakes shall not be installed except where needed.

#### ISA BMP Manual – Tree Planting

1. Timing of planting shall be determined based on the species, and the best professional opinion of the employees of or contractors working for the Village of McFarland.
2. All employees and contractors employed by or working for the Village of McFarland shall be familiar with the following types of planting types, and when it is appropriate to use each:
  - A. **Bare-Root:** Field-grown, and dug without soil during the dormant season
  - B. **Ball and Burlap:** Field grown and packaged with a soil ball, using burlap, twine, and a retaining basket of some kind
  - C. **Tree Spade:** Transplanted using a mechanical tree spade to hold the soil ball during transport
  - D. **In-Ground Fabric Bag:** Field grown with the root mass contained in a semi-permeable fabric bag
  - E. **Container Grown:** Grown above ground in containers of various shapes, sizes, and materials
3. Trees packaged with root balls must have their first structural root within two inches of the soil surface. Trees with deeper structural roots will not perform well when transplanted, and should be avoided when selecting nursery stock.

4. Trees with root balls shall be handled by the ball, not the stem, to ensure no damage occurs to the root-soil interface or to the stem itself.
5. Trees with leaves shall be transported with a fabric tarp to minimize desiccation, and have had their root balls wetted prior to transport.
6. Sites shall be tested for drainage, nutrient levels, and pH prior to planting (or prior to species selection, if possible).
7. Container stock shall be removed from its container. For balled and burlapped trees, wrappings shall be left on until the tree is in the hole; wrapping shall then be removed from the third to fourth of the wire basket and burlap from the top of the ball. For all types, ensure any encircling (girdling) roots are removed, and root ball is shaved as necessary.
8. As soil is added, wet and tamp each layer down to ensure good moisture and reduction of air bubbles.
9. Do not prune trees at time of planting, unless to remove dead, dying, diseased, or cracked branches, as it may take away from root development to have the tree attempt to heal these above-ground wounds.
10. The use of trunk wrap may be considered in areas with harsh winters, specifically on trees with thin bark, such as London Planetree and certain Maple species.

## Appendix K: Tree Pruning Standards (ANSI/ISA BMP)

### ANSI A300 - Part 1

1. A designated Arborist or Arborist Trainee shall visually inspect each tree before beginning work. If any condition is observed above and beyond the original scope of work, said condition shall be reported to the controlling authority before any work begins.
2. Pruning cuts which remove a branch at its point of origin shall be made close to the trunk or parent branch without cutting into the branch-bark collar or leaving a stub.
3. Pruning cuts made to reduce the length of a limb or parent stem shall be made at a slight angle relative to the remaining stem, and not damage the remaining stem. If pruning to a lateral branch, the lateral should be large enough to assume the terminal role.
4. Final cuts shall be made such that the result is a flat surface, with the adjacent bark firmly attached.
5. Not more than 25% of the foliage shall be removed during an annual growing season, depending on the tree species, size, age, and condition. If more frequent pruning due to utilities, vistas, or health considerations is necessary, removal of the tree should be considered as an alternative to pruning.

### ISA BMP Manual

1. All employees or contractors directly involved with the pruning of trees shall be familiar with the following pruning types and how they are to be used in conjunction with one another:
  1. **Pruning to Clean:** Selective removal of dead, diseased, detached, cracked, and broken branches
  2. **Pruning to Thin:** Selective removal of small live branches to reduce crown density
  3. **Pruning to Raise:** Selective removal of branches to provide vertical clearance
  4. **Pruning to Reduce:** Selective removal of branches and stems to decrease the height or spread of a tree or shrub
  5. **Structural Pruning:** Selective removal of live branches and stems to influence the orientation, spacing, growth rate, strength of attachment, and ultimate size of branches and stems
  6. **Pruning to Restore:** Selective removal of branches, sprouts, and stubs from trees and shrubs which have been topped, severely headed, vandalized, lion-tailed, storm damaged, or otherwise damaged
2. Every effort shall be made to time pruning of individual tree species to be done in accordance with best management practices for the tree species in question. All pruning work shall be done so at the discretion of the Village of McFarland and its approved contractors.

## Appendix L: Tree Protection (ANSI/ISA BMP)

### ANSI A300 – Part 5

1. Tree management plans and specifications for tree management shall be written and administered by a certified arborist qualified in the management of trees and shrubs during site planning, development, and construction. Such activities may include, but are not limited to: demolition, grading, building construction, walkway or roadway construction, excavation, trenching and boring, or other such activity which has the potential to negatively impact trees.
2. The management of trees and shrubs shall be incorporated into the following phases of the site development process:
  - A. Planning
  - B. Design
  - C. Pre-Construction
  - D. Construction
  - E. Landscape
  - F. Post-Construction
3. During the Planning phase, an assessment of tree and shrub resources on the site shall be performed by a certified arborist. The assessment shall identify the species, condition, and size of each tree and shall be incorporated into the site design. Trees to be retained or protected shall appear on site design maps. Trees on neighboring property which could also be impacted should also be considered.
4. During the design phase, a tree management report shall be developed for trees to be conserved on the site, and shall be included in the construction plans and specifications, which may include, but are not limited to:
  - A. Trees to be retained
  - B. Tree and Root Protection Zones
  - C. Tree Protection Zone barriers
  - D. Tree Protection plans
  - E. Soil erosion control
  - F. Soil compaction controls
  - G. Staging and storage areas
  - H. Other relevant on-site activities

5. Grading and demolition plans shall include all trees to be retained and removed, as well as the tree protection plans for working around trees to be retained. Plans shall also include equipment routes for avoiding the TPZ. Consequences for non-compliance shall be specified.
6. During the pre-construction phase, all tree protection plans shall be effectively communicated to all parties involved with the site development, and tree protection zone barriers shall be in place prior to the beginning of any construction activities.
7. The TPZ shall be delineated around all trees to be protected during construction, and shall be based on the size, species, and condition of the tree and its root system. Six to 18 times the diameter of the tree is generally considered to be acceptable. Deviations from this diameter may be made at the discretion of a certified arborist. Activities which could damage tree roots or compact soil should be avoided in the TPZ.
8. Fencing or other visible barriers to the TPZ shall be installed prior to site clearing, grading, and demolition, and maintained throughout the construction and landscaping phase. When this is not feasible, alternate methods may be considered.
9. During the construction phase, compliance with tree protection plans shall be monitored by a certified arborist, and any damage to tree barriers or trees, or non-compliance shall be reported to the project manager or owner, or other controlling authority.
10. When removing vegetation or pavement during demolition, equipment used adjacent to the TPZ shall be specified to avoid damage to the tree and the surrounding soil, and soil protection measures shall be in place prior to vehicle or heavy traffic in or near the TPZ.
11. Storage or disposal of construction materials or hazardous materials shall not occur in the TPZ.
12. Fill within the TPZ shall not be permitted without mitigation to allow for proper air and water availability to existing roots. If fill cannot be avoided in the TPZ, compaction of fill shall be avoided, and consideration shall be given to a permanent well installation to protect the tree and its roots.
13. During the landscape, irrigation, and lighting phase, levels of compliance shall be documented and reported by a certified arborist. Non-compliance shall be reported to the project manager.
14. During the post-construction phase, a remedial and long-term maintenance plan shall be specified for existing and new landscaping, to ensure success of preservation efforts and newly planted landscaping.
15. Pruning shall be considered to reduce wind sail when necessary. It should not be considered to compensate for root loss.
16. Mulch shall be applied to as much of the tree protection zone as possible, in order to create a favorable soil environment for root recovery after construction activities.

**ISA BMP Manual**

1. A cost-benefit analysis shall be conducted during the planning phase. In some cases, money may be better invested in tree planting post-construction.
2. The species and age of tree shall be evaluated by a certified arborist, so that trees in good condition with desirable characteristics are preserved, but those in poor condition or with undesirable characteristics are not.
3. A tree inventory and tree management report shall be conducted during the planning phase, and a certified arborist shall work closely with developers to ensure best management practices are being met for both parties.
4. Effort shall be made to retain groups of trees, such that there is a wind and solar buffer around the highest quality trees if possible.
5. The Critical Root Zone (CRZ) is the area around the tree trunk where roots essential for tree health and stability are located. A Tree Protection Zone (TPZ) is an arborist-defined area around the tree which should include the CRZ, as well as additional area to ensure future stability and growth. The TPZ is subject to the professional opinion of the certified arborist.
6. An attempt shall also be made to preserve native soil for landscape planting as native soil with horizons and development is preferred over fill or black dirt.
7. If a sufficient TPZ cannot be established, a 6-12" layer of hardwood mulch, 3/4-inch plywood mat over a four-inch layer of hardwood mulch, or other such measures shall be temporarily installed over the CRZ in order to prevent root and soil compaction.
8. Trunk protection shall be installed on trees very close to construction activities, and should consist of 2x4 or 2x6 planks, strapped snugly to the tree trunk with wire or other strapping, preferably with a closed-cell foam between the trunk and the planks.
9. When roots over one inch cannot be avoided, they shall be pruned, not left torn or crushed. Acceptable methods of pruning are:
  - A. Excavation using supersonic air tools, pressurized water, or hand tools, followed by selective root cutting
  - B. Cutting through the soil along a predetermined line with a tool designed to cut roots
  - C. Mechanically excavating the soil and selectively pruning remaining roots.
10. Wells, tree islands, retaining walls, and other such structures or strategies shall be considered as alternatives to any cut/fill work in the CRZ or TPZ.
11. Monitoring shall take place during construction and post-construction phases, and any non-compliance should be reported to the proper controlling authority right away, so that timely remediation or mitigation efforts may be undertaken.

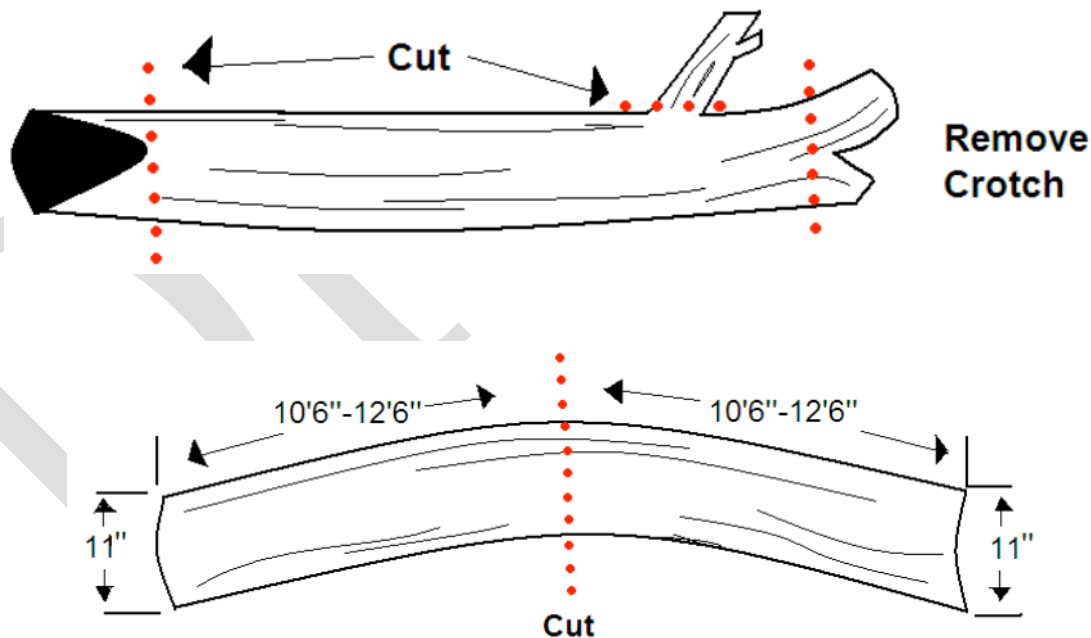


## Appendix M: Urban Timber Harvesting

### Log Removal Specification for Urban Timber Harvesting

This tree removal standard shall not take precedence over applicable industry safe work practices and shall be implemented by a qualified arborist, urban forest manager, and /or practitioner who, through related training or on-the-job experience, or both, are familiar with the standards, practices and hazards of recovering urban forest products and the equipment used in such operations. Additionally:

- Logs shall be felled to obtain minimum 8', 10', or 12' lengths with an additional 6" of trim on each log to a minimum diameter of 11" inside the bark. Maximum log length shall be 20'6".
- If a tree must be removed in sections, every effort should be made to retain the lowest log, at the longest possible length that can be safely felled.
- Branches should be trimmed flush with the bole/trunk, root flares should be trimmed flush with the bole/trunk, and the ends of the log should be square.
- Logs shall be flush cut with no crotches or splits. All obvious defects such as decay, large holes, and rot shall be removed.
- Logs with significant sweep shall be cut in order to eliminate as much sweep as possible while yielding the longest possible straight logs to ensure logs are flush for proper milling.





**VILLAGE OF  
McFarland  
SUMMARY SHEET**

**MEETING DATE:** Monday, November 13, 2023

**SECTION:** Business

**DEPARTMENT:** Community Development

**CONTACT:** Andrew Bremer, Comm & Eco Dev Director, Kong Thao, Associate Planner

**AGENDA ITEM:** Discussion and action to recommend the Village Board accept the Village of McFarland Community Center Net Zero Energy Predesign Report.

**PREVIOUS ACTION:**

April 19, 2023 - SNR Committee recommended approval to the Village Board for HGA's energy planning services.

April 25, 2023 - Village Board approves HGA as consultants for energy planning services.

**ISSUE SUMMARY:**

The packet includes a Net Zero Energy Predesign draft report for the proposed new Community Center. The report is a detailed analysis to determine the feasibility of turning the Municipal Center into a net zero energy building as part of the planned Community Center remodeling project. The U.S. Department of Energy defines net zero energy as the following: "An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy." The report serves to inform the Village Board's decision regarding the final design of the building, including recommendations reflecting the Master Campus Plan 2023 for a second story addition. The associated report discusses options for rooftop solar, geothermal, EV infrastructure, and funding sources. This report is similar to the one that HGA drafted for the Public Safety Center. The Village Staff will utilize the report as part of the RFP for architectural design services for the new Community Center. One difference between this project and the PSC, is that HGA study came after the Village had already selected an architect for the project. By completing this report before the Village hires an architect, the Village will be better positioned to communicate our project goals from the start. The Village Board is anticipated to release the RFP for the Community Center project in November, with design services occurring through 2024, bidding for construction in 2025 and construction occurring in 2025 through 2026. Each of these steps requires further Village Board discussion and action. The attached study demonstrates that it would be feasible to make the Community Center a net zero building.

**FINANCIAL/BUDGET IMPACT:**

The 2023 Capital Improvement Budget includes \$25,000 in C&ED Department funds for Comprehensive Energy Planning. The balance of the project costs (\$23,500) allocated budget funding in 2023 for Facility Management within the capital budget for the design of the Community Center.



**VILLAGE PLAN REFERENCE:**

2022-2023 Strategic Plan, Goal B Public Infrastructure, Action IV - Completion of a Village wide energy audit and planning to implement energy efficiencies within operations.

2021 Sustainability Plan

- Near-Term Energy Action - Conduct energy audits of all municipal facilities to identify potential energy efficiency improvements.
- Energy Goal - Municipal percentage of total energy consumed generated from renewables per year = 50% by 2030 and 100% by 2040.

**ORDINANCE REFERENCE:**

**BOARD, COMMISSION OR COMMITTEE RECOMMENDATION:**

Motion, and second, to recommend the Village Board accept the Village of McFarland Community Center Net Zero Energy Predesign Report.

**ATTACHMENTS:**

1. McFarland Community Center Report 11.8.23



# VILLAGE OF MCFARLAND NEW COMMUNITY CENTER NET ZERO ENERGY PREDESIGN REPORT

November 2023

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# Acknowledgements

HGA would like to thank the Village staff and others for their work on this report. Additionally, we would like to recognize the Sustainability & Natural Resource Committee and the members of the Village Board for their support and leadership of this project.

## Village Staff

Kong Thao

Andrew Bremer

Matt Schuenke

## The Sustainability and Natural Resource Committee

## Members of the Village Board

## HGA Staff

Alex Harris

Michael Barnett

Amanda Wendling

Adam Jablonski



# Executive Summary

The Village of McFarland is renovating their Municipal Center into a new Community Center. The multi-purpose building will be up to 60,000 SF and include 2 stories. The current facility is located at the corner of Milwaukee Street and Long Street. The original Municipal Building was constructed in 2002.

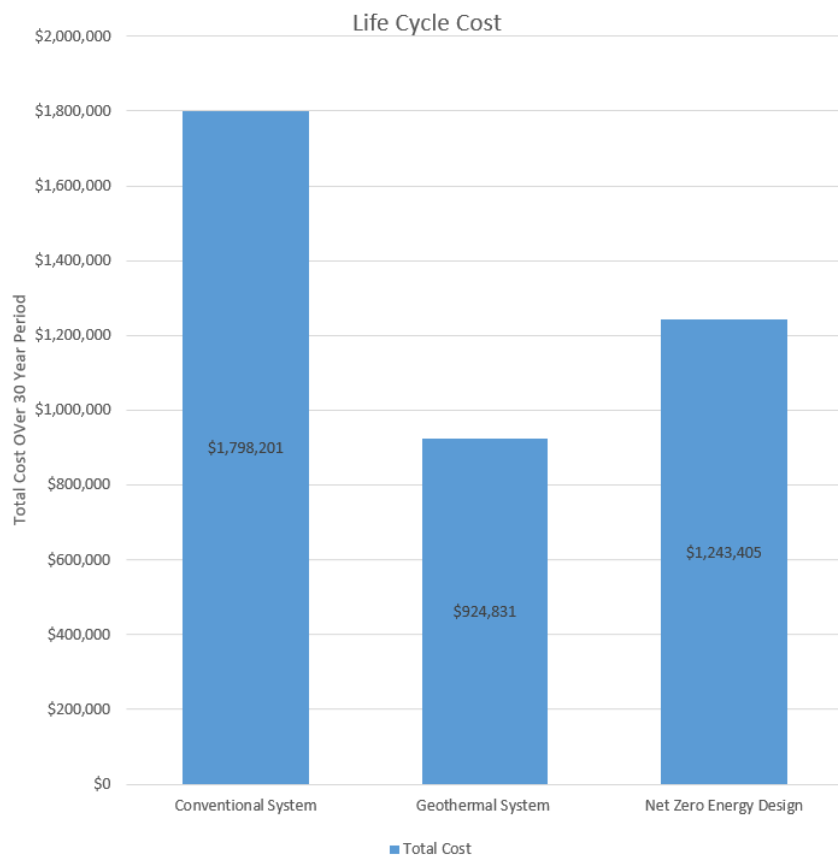
The Village is looking to continue its commitment to sustainability through the renovations at the new community center. Based on these goals, the Village engaged HGA to develop a net zero energy predesign plan for the facility. By taking a proactive approach to the design of the energy elements of the renovated facility prior to engagement of an Architect, the energy goals are more likely to be achieved.

Additionally, the current incentives associated with the Inflation Reduction Act provide a tremendous opportunity for the Village to leverage its current capital budget to achieve these lofty sustainability and energy performance goals with minimal first cost impacts. Additional information about these incentives and rebates are expanded on in the report.

HGA explored options to achieve net zero energy for the Community Center project for the Village of McFarland. The options included are solar photovoltaic systems, geothermal energy systems, and general sustainable building design features. In addition to energy and carbon emissions reductions, HGA also evaluated first costs and life cycle costs with and without incentives to help inform the Village's decisions.

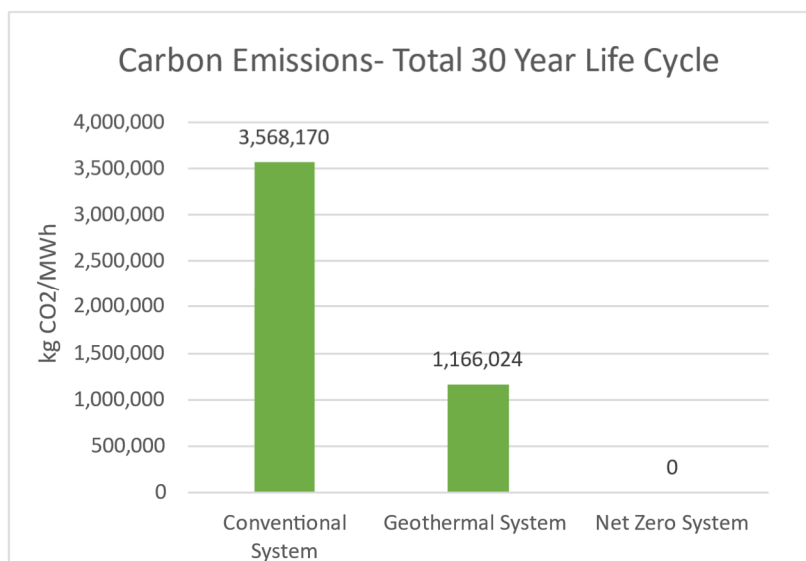
Based on our analysis, it is feasible for the New Community Center to achieve net zero energy and net zero carbon, while also achieving life cycle costs less than a conventional building. The figures below summarize the life cycle costs and life cycle carbon emissions associated with the new proposed facility.

Figure 1: Life Cycle Costs of 3 Building Types



As indicated below in figure 2, a facility incorporating both geothermal HVAC systems and solar PV result in a net zero energy and carbon facility. A facility with geothermal and no solar PV reduces the carbon emissions by over 67% when compared to a conventional system utilizing natural gas for heating.

Figure 2: 30 Year Life Cycle Net Carbon Emissions of 3 Building Types



In addition to incorporating high performance building improvements, HGA also evaluated incorporating electric vehicle charging infrastructure at the site. Additional information on grants and incentives are in the body of the report.

A Battery Energy Storage System (BESS) was also evaluated for the facility but was not recommended at this time due to high costs and early adopter challenges associated with the technology. However, designing the facility as “battery ready” is possible and can future proof the facility for this technology when more mature.

# Introduction

The Village of McFarland is renovating their Municipal Center into a new Community Center. The new Community Center will include youth and senior services and the Administration, Senior Outreach, Communications & Technology, and Community & Economic Development Departments. The multi-purpose building will be up to 60,000 SF. The current facility is located at the corner of Milwaukee Street and Long Street. The original Municipal Building was constructed in 2002. The building systems are detailed in the most recent SEH Building assessment report. Generally speaking, the building is of traditional construction and contains conventional mechanical, electrical and plumbing systems. The HVAC system consists of natural gas fired boilers producing hot water for variable air volume (VAV) boxes. VAV's are fed from DX and gas fired roof top units. The building performance is consistent with a code minimum facility built in the early 2000's.

The new Public Safety Center was constructed in 2022 and 2023 and opened in the fall of 2023. The Public Safety Building was designed and constructed to net zero energy standards including a geothermal (ground source heat pump) HVAC system and solar PV array sized to produce as much energy as the building uses. The Village is looking to continue its commitment to sustainability through the renovations at the new community center. Based on these goals, the Village engaged HGA to develop a net zero energy predesign plan for the facility. By taking a proactive approach to the design of the energy elements of the renovated facility prior to engagement of an Architect, the energy goals are more likely to be achieved.

Additionally, the current incentives associated with the Inflation Reduction Act provide a tremendous opportunity for the Village to leverage its current capital budget to achieve these lofty sustainability and energy performance goals. Additional information about these incentives and rebates are expanded on in the report.

HGA explored options to achieve net zero energy for the Community Center project for the Village of McFarland. The options included are solar photovoltaic systems, geothermal energy systems, and general sustainable building design features. In addition to energy and carbon emissions reductions, HGA also evaluated first costs and life cycle costs with and without incentives to help inform the Village's decisions.

The U.S. Department of Energy defines net zero energy as the following: "An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy".

$$\frac{\textit{Building Energy Consumed}}{\textit{year}} = \frac{\textit{Renewable Energy Produced}}{\textit{year}}$$

**Building Energy Consumed** = energy used as recorded by the electric and natural gas meters that are connected to the grid through the local utility (Alliant Energy). This energy is used to heat, cool, light and power the building loads.

**Renewable Energy Produced** = energy produced onsite (at the building) or offsite from renewable resources (Solar Photovoltaic for example). Over the course of a year, this renewable energy must offset the energy consumption of the building to reach the net zero energy goal.



Figure 3- Conceptual site plan from 2023 McFarland Municipal Campus Plan

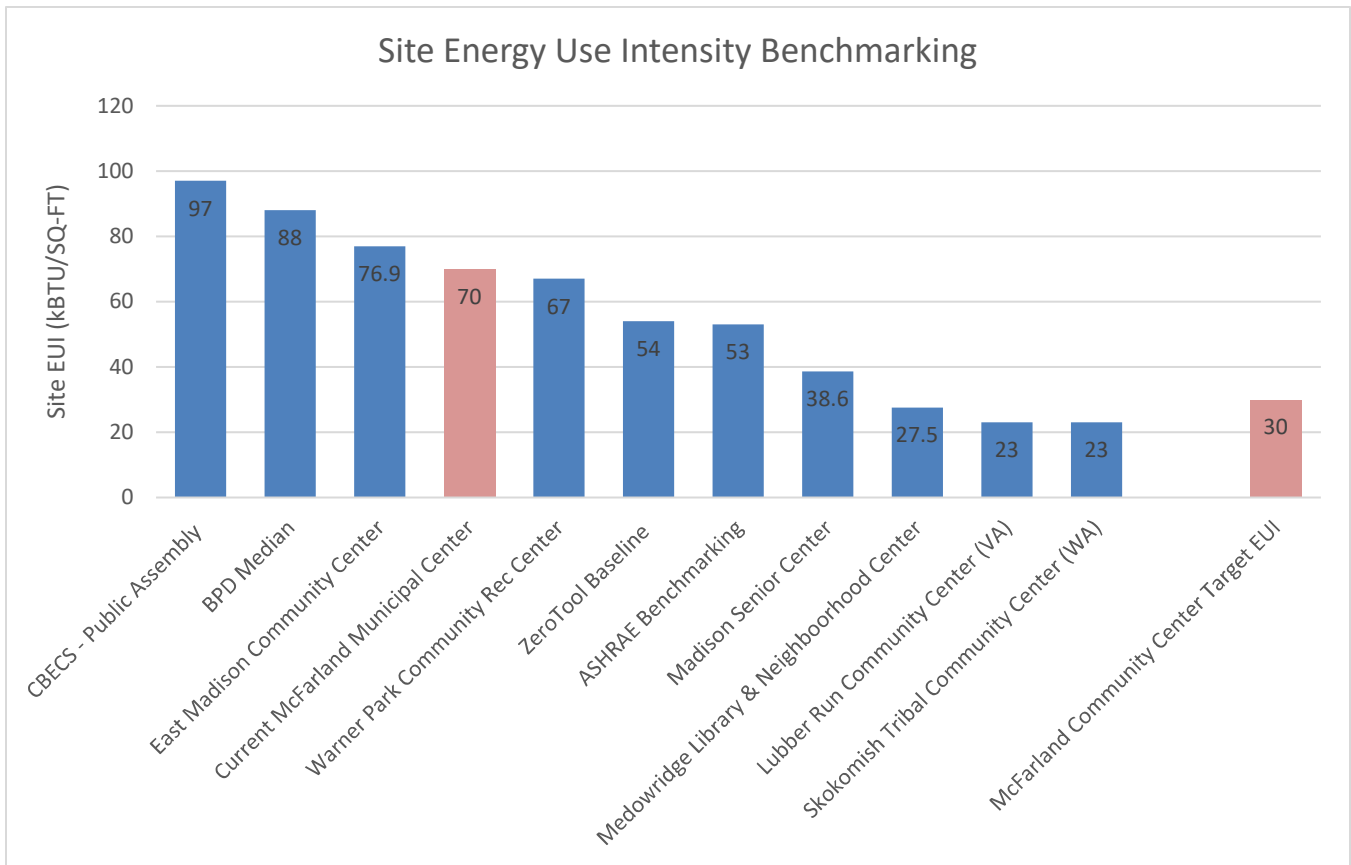
# Energy Benchmarking

The first step to determine the net zero energy feasibility for the new Community Center was to predict the energy use of the proposed building. HGA used a combination of benchmarking, baseline comparisons, and energy modeling to predict the energy use of McFarland's new Community Center. This allowed the team to set an energy utilization intensity goal for the project. Energy use intensity (EUI) is the metric used for describing the building energy use per area. The traditional unit of measure of site energy use intensity is kBtu/ft<sup>2</sup>.

HGA utilized a combination of publicly available benchmarks for other community center buildings. The table below provides additional context for the comparable buildings used in the benchmarking exercise.

*Table 1: Summary of Benchmark Sources*

| Database / Building                                                              | Description                                                                                                                                                                  |
|----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2018 Commercial Buildings Energy Consumption Survey (CBECS)<br>– Public Assembly | CBECS is a national database that is comprised of a sample of building's energy consumption                                                                                  |
| Building Performance Database                                                    | Dept. of Energy building energy consumption database for "Other education and Public Assembly" between 20,000 ft <sup>2</sup> and 90,000 ft <sup>2</sup> in climate zone 6A. |
| City of Madison – East Madison Community Center                                  | Local community center with conventional HVAC systems                                                                                                                        |
| Current McFarland Municipal Center                                               | Existing performance as currently used                                                                                                                                       |
| City of Madison Warner Park Community Center                                     | 30,000 ft <sup>2</sup> facility constructed in 1999 with conventional HVAC systems                                                                                           |
| Zero Tool Baseline                                                               | Architecture 2030 tool based on CBECS database to compare EUI targets of similar building types                                                                              |
| ASHRAE Benchmarking                                                              | ASHRAE/IES Standard 100 provides criteria for reduced energy consumption through improved energy efficiency and performance in existing buildings.                           |
| Madison Senior Center                                                            | 20,000 ft <sup>2</sup> facility constructed in 2000                                                                                                                          |
| City of Madison Meadowridge Library and Community Center                         | Geothermal Community Center                                                                                                                                                  |
| Lubber Run Community Center (VA)                                                 | From New Building Institute comprehensive list of zero energy commercial buildings.                                                                                          |
| Skokomish Tribal Community Center (WA)                                           | From New Building Institute comprehensive list of zero energy commercial buildings.                                                                                          |
| New McFarland Community Center                                                   | Target EUI for new facility                                                                                                                                                  |



*Figure 4: Target energy use intensity (site energy) comparisons and the proposed Community Center project*

Based on the current performance of the building, other area community centers, and other net zero energy building usage, the team set the project target EUI at 30 kBtu/ft<sup>2</sup>/yr site energy. A reduction of the energy use intensity from the current building causes offsetting 100% of energy usage with energy generation more achievable. Figure 2 above compares EUI data from similar projects, in blue, to the Community Center's current energy use and target EUI, in red.



# Energy Efficiency Opportunities

HGA evaluated the building envelope, mechanical systems, lighting, plumbing equipment and future kitchen equipment for the most cost-effective energy efficiency improvements to meet the EUI goal developed in the benchmarking section.

As part of the net zero predesign process, HGA performed energy modeling studies for the Community Center. An energy model helps to show relative differences in design alternatives and to determine the impact of various improvements on building performance. HGA used Design Builder energy modeling software to develop these models and perform energy and thermal calculations to estimate building energy consumption. These comparisons can then inform decisions about improvements.

## Envelope Improvements

| Improvement                | Budget Cost | Utility Savings (\$/yr) | Simple Payback |
|----------------------------|-------------|-------------------------|----------------|
| Upgraded Window Assembly   | \$39,000    | \$780                   | 50 years       |
| Additional Wall Insulation | \$35,000    | \$652                   | 54 years       |
| Additional Roof Insulation | \$70,000    | \$1,780                 | 39 years       |

### Window Assembly

The building's existing window assemblies are original to the building but appear to be in good condition. The energy model investigates effect of replacing the windows (circa 2001) with an assumed U-value of 0.52 with a lower U-value window. The new window used meets current energy codes and had a U-value of 0.32. The energy model shows that this upgrade would reduce the EUI of the new community center by 2%.

Upgrading the glazing was evaluated at \$15/ft<sup>2</sup>. Replacing all the glazing would upgrade 2,600 ft<sup>2</sup> of glazing, costing the project \$39,000 for a reduction of 0.6 kBtu/ft<sup>2</sup> energy usage. At a utility cost of \$.089/kWh this would save \$780 per year and would offer a simple payback of 50 years.



Figure 5 Existing glazing

## Wall Insulation

The existing exterior walls are constructed of 8" CMU, 2" of rigid insulation, 1 3/4" air gap, and 4" face brick and assumed to have an assembly R value of R-16. The energy model investigated adding 2" of spray foam insulation to the existing construction creating an assembly of R-20. The energy model shows that this would reduce the EUI of the new community center by 1%.

Increasing the wall insulation was evaluated at \$1/inch/ft<sup>2</sup>. Adding a total of 2" of spray foam insulation to the 17,800 ft<sup>2</sup> of wall area would cost the project \$35,000 for a reduction of 0.3 kBtu/ft<sup>2</sup> energy usage. At a utility cost of \$.089/kWh this would save \$652 per year and would offer a simple payback of 54 years.

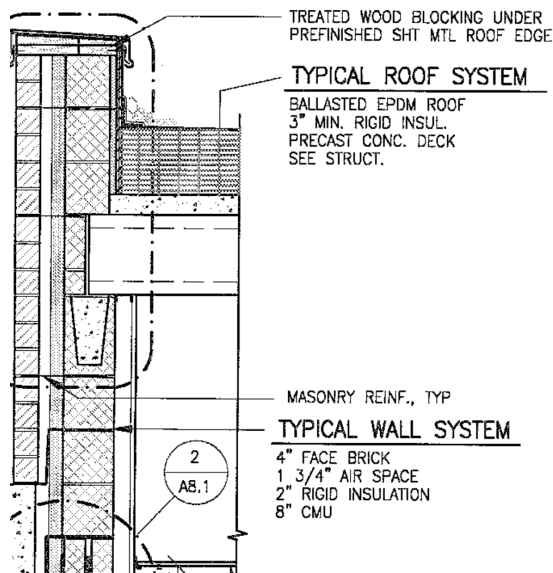


Figure 6 Diagram of original wall and roof construction.

## Roof Insulation

The existing roof is a ballasted EPDM roof with 3" minimum of insulation above deck. The roof is in poor condition and in need of replacement. The energy model investigated the benefit of increasing the insulation when replacing the roof. The existing roof was estimated to have an R value of R-18 and the increased insulation used an R value of R-30. The energy model shows that this would reduce the EUI of the new community center by 1%.

Increasing the roof insulation was evaluated at \$1/inch/ft<sup>2</sup>. Replacing the roof like for like with the existing roof would be included in the project construction cost. Adding an additional 2" of insulation to the 42,000 ft<sup>2</sup> of roof area would cost the project \$70,000 for a reduction of 0.3 kBtu/ ft<sup>2</sup> energy usage. At a utility cost of \$.089/kWh this would save \$1,782 per year and would offer a simple payback of 39 years.



*Figure 7 Existing Roof Structure*

Mechanical Systems

To achieve net zero energy the building energy use must not consume more energy than the site can produce. In this case the maximum building energy use is defined by the size of the rooftop solar. Using energy modeling HGA investigated the different types of mechanical systems that would be able to meet this energy use requirement.

Geothermal

A geothermal system was modeled as the main alternative to the existing natural gas heating systems. The major components of this system include:

- Vertical geothermal borefield
- Dedicated outdoor air system (DOAS)
- Distributed water to air heat pumps

The model showed that the building used 30 kBtu/ ft² which keeps the energy usage within the limitations of rooftop solar energy generation.

Geothermal borefield feasibility was analyzed using test bore information from the new Public Safety Building a mile from the Community Center site. Tables 4 and 5 indicate the borefield size and configuration using the results from the thermal conductivity test, existing mechanical loads, and outputs from the energy model.

Building loads were determined by combining assumptions from the energy model and existing building operation data. A peak cooling load of 100 tons and a peak heating load of 1,400 MBH was assumed for a building of this size.

Table 2 - Design Data Used for the Borefield

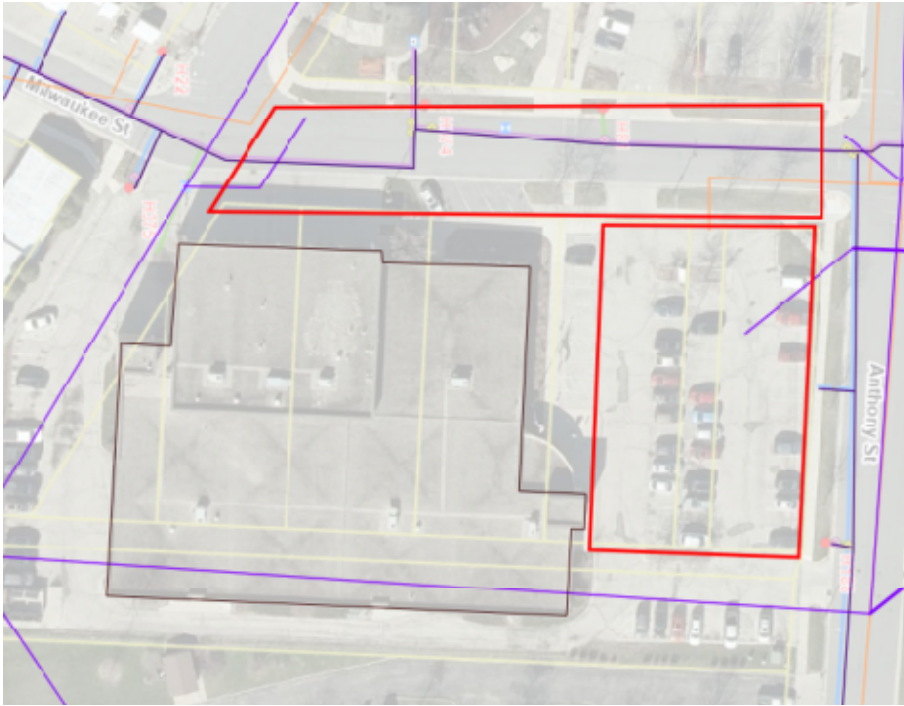
| Design Data                          |                            |
|--------------------------------------|----------------------------|
| Building Area                        | 42,000 ft²                 |
| Peak Cooling Load                    | 800 MBH                    |
| Peak Heating Load                    | 1000 MBH                   |
| Minimum Grout Thermal Conductivity   | 1.00 BTU/H-FT-°F           |
| Heat Pump Entering Water Temperature | 87°F Cooling, 30°F Heating |
| Heat Transfer Liquid                 | 30% Propylene Glycol       |

Table 3 - Geothermal Borefield Construction Data

| Borefield Data                 |                    |
|--------------------------------|--------------------|
| Number of Geothermal Bores     | 40                 |
| Depth of Bores                 | 400 ft             |
| Maximum Bore Diameter          | 6 inches o.c.      |
| Minimum Bore Spacing           | 20 ft o.c.         |
| Bore Pipe Diameter             | 1.25 inches o.c.   |
| Pipe Material & Classification | HSPE SDR 11 PE4710 |



**Figure 8** shows feasible areas in red that could support the geothermal borefield. The existing parking lot is a good candidate as it offers easy access to the building spaces and contains very few existing utilities. Other feasible areas include the closed section of Milwaukee St that is being reworked as a part of the Community Center plaza project. The borefield location would require only the use of the plaza area OR the parking lot. In either location, the borefield would not interfere with the ability to continue to use the space for their intended functions.



*Figure 8 - Geothermal borefield options on project site*

Based on drilling conditions at the site, the opinion of cost to install a borefield and lateral piping to the building is \$35/LF. This amounts to a total borefield cost of \$560,000 but this depends on market pricing of materials and trade labor at the time of construction.

**Other Mechanical Options**

To consider other mechanical systems, they must be as or more efficient than the modeled geothermal system discussed above. Using the outputs from the energy model the below table identifies the efficiencies of the distributed heat pumps required to contribute to the overall efficiency of the mechanical systems selection without having to increase the amount of on-site energy generation.

*Table 4 Heat Pump Efficiencies*

| Heat Pump Efficiency Required          |      |
|----------------------------------------|------|
| Heating COP (at 87° EWT & 75°/63° EAT) | 3.2  |
| Cooling EER (at 30° EWT & 70° EAT)     | 16.0 |

The below table details industry accepted values for other mechanical system options. As the efficiency decreases from the values above the EUI of the building will increase and require additional solar generation above what is available from the roof array. Based on the fact that the goal was net zero and geothermal (ground source heat pump) technology was the only system that met the owner's goals, no other HVAC systems were evaluated. Additionally, air source heat pumps are not incentivized through the Inflation Reduction Act, which further improves the economics of the geothermal HVAC retrofit.

*Table 5 Mechanical System Efficiencies*

| Typical System Efficiencies |             |             |
|-----------------------------|-------------|-------------|
| System                      | Heating COP | Cooling EER |
| Air to Air Heat Pump COP    | 3.8         | 13          |
| Gas Fired Hydronic Boiler   | 0.9         | N/A         |
| Electric Resistance Heat    | 1           | N/A         |
| Air Cooled Chiller          | N/A         | 2.4         |
| DX Cooling                  | N/A         | 9.8         |

## Electrical Systems

The existing electrical system is at 208V-3 phase, with a 1,200A main service panel. Given the additional geothermal electrical loads and the size of the solar PV system needed, the electrical service and infrastructure of the building will likely need to be upgraded. This could include a transition to 480V-3 phase service from the utility, and a main service panel in the 3,000 amp size range.



*Figure 9- Existing main service panel is likely too small for the NZE electrical systems and generation*

A budget placeholder of \$200,000 has been added to the financial estimate at this time, but this will likely need to be developed during the scope of the design to refine and optimize electrical system.

## **Lighting**

Existing interior and exterior florescent tube lighting is to be replaced with LED lighting. This will reduce the lighting power density and the amount of energy used by the lighting. The model used a lighting power density assumption of 0.5 W/ft<sup>2</sup>. This offers an EUI reduction of 5 kBtu/ft<sup>2</sup> and a utility savings of \$5,500 per year. The installation of code required occupancy sensors and daylighting controls will offer additional savings by reducing energy consumption in unoccupied spaces.

## **Plumbing**

To meet net zero requirements, it is recommended to select an electric option for water heating such as an air source heat pump or water source heat pump tied into the geothermal system. An electric option would both reduce energy use and eliminate the need for a natural gas connection. The energy model used an air source heat pump domestic hot water heater to achieve the energy reduction target. Operational savings of electric heat pump water heating is largely dependent on the difference in electric and gas costs.

## **Kitchen**

Any cooking equipment planned for the kitchen spaces is also recommended to be selected as electric instead of the traditional gas equipment. Electric cooking options eliminate the need for a gas connection and allow energy used by the kitchen to be offset by the solar PV system. We recommend using high efficiency electric appliances that qualify for Energy Star rates and use new technologies such as induction stovetops.



# On-Site Energy Generation

## Solar Photovoltaic Systems

To achieve net zero energy the building energy use must offset energy consumed onsite with energy produced through onsite renewable generation. The most cost-effective method for producing renewable energy onsite is solar photovoltaic (PV) systems. Rooftop mounted and carport mounted solar PV are strategies suggested for the Community Center Building project.

### Roof Mounted Solar Photovoltaic System

HGA reviewed the roof plan and master plan documents to see what size of solar PV system was feasible at the existing building site. Both the one story and two-story plans were reviewed to ensure there was enough roof area in either design to provide enough solar to offset the energy use.

Based on the available area in each design it was estimated that the roof could fit a maximum of 365 kW-dc on the one-story option or 340 kW-dc on the two-story option. These systems would produce around 440,000 kwh/yr or 412,000 kwh/yr respectively on an average solar year. Models show this would offset between 37 and 35 kBtu/ft<sup>2</sup>/yr of energy use from the building. Recently solar installations have been reporting generation around 2% less than models due to changes in weather conditions that are not reflected in historical data. This report uses the more conservative value of 35 kBtu/ ft<sup>2</sup>/yr and 1,200 kwh/kw.

**Figure 10** and **Figure 11** show the modeled Community Center roof design used to help determine the size and production of the roof mounted solar PV system. **Table 6** lists the design assumption made for the solar PV systems.



*Figure 10- Conceptual one-story roof area (left) and two-story roof are (right), 2023 McFarland Municipal Campus Plan*

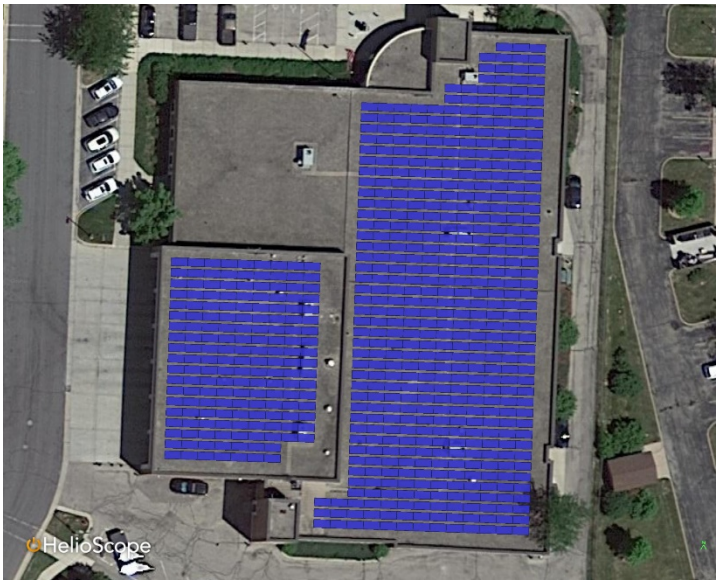


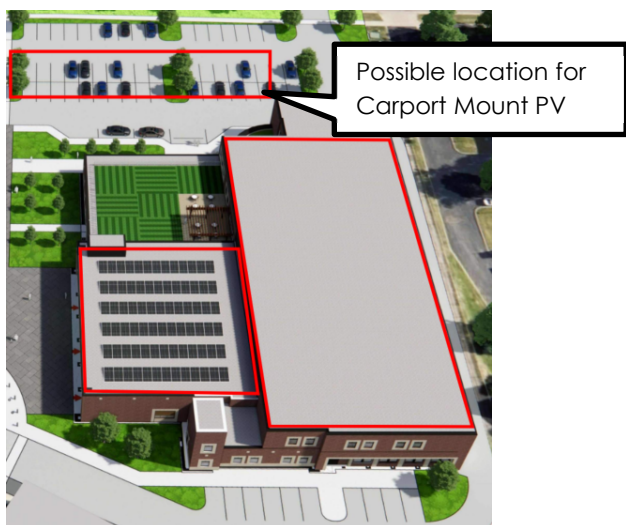
Figure 11- Helioscope solar PV modeling helps estimate the size and production of a proposed system, model shown here for the Community Center.

Table 6- Design assumptions made for the solar PV system proposed for the Community Center project.

| PV System Parameter | Modeled Assumption    |
|---------------------|-----------------------|
| Array Tilt Angle    | 10°                   |
| Array Orientation   | 182°                  |
| Panel Wattage       | 530 W                 |
| Roof Setback        | 4 ft                  |
| Cost                | \$1.80/W              |
| PV Inverters        | 25 kW, 208V (qty: 12) |

### Carport Mounted Solar Photovoltaic System

If additional solar capacity is needed the parking areas on the community center site may be a good candidate for carport solar arrays. These arrays offer additional energy generation as well as shaded parking locations that can protect vehicles from the sun or snow accumulation.



*Figure 12 - Proposed locations for carport mounted solar PV systems for the Community Center*

Because of the structure, design and labor needed to construct covered parking solar PV, these systems are more expensive than a rooftop or ground mounted solar system. However, the additional benefit of covered parking spots onsite is worth the premium price for some project teams.

| Solar PV System   | Typical Costs |
|-------------------|---------------|
| Flat Roof Mounted | \$1.80/Watt   |
| Ground Mount      | \$2.00/Watt   |
| Carport Mounted   | \$4.00/Watt   |



*Figure 13-Example structure detail and lighting concept, similar layout to what is being proposed*

## Solar Photovoltaic System Conclusion

The Community Center can accommodate at least a 340kW-dc system with a rooftop system. This system would be able to offset an EUI of 35 kBtu/ft<sup>2</sup>. To meet the net zero goal the building HVAC, lighting, and water heating systems must not exceed that EUI. If building system are selected that consume more energy than the roof can provide, then additional carport PV would need to be considered to offset the additional energy use and maintain the net zero goal. For the budget of the solar PV system \$1.80/kW DC was used to calculate the \$615,000 number.

Alliant Energy now has some additional options for interconnecting the solar PV system. The traditional behind the meter installation is still feasible. However, there is also an additional option to connect part or all of the system in front of the meter while still maintaining ownership of the system. There is a separate tariff for this arrangement that currently provides for potentially better economics when compared to selling behind the meter solar generation back to the utility. As part of the design process, it is suggested that the optimal arrangement be analyzed and incorporated into the design. At this time, HGA recommends that as the solar design develops the Village analyze a combination of both behind the meter and in front of the meter options to achieve the most favorable economics over the long term. Neither of these arrangements would require Alliant or a third party to own the solar PV system.

# Design Team Assistance

Based on the design team's and HGA's past project experience with net zero energy building projects, a few key additional services are needed to ensure a successful implementation of these strategies and goals.

## Net Zero Energy Consulting Services

This would include design team guidance on achieving net zero energy goals. Tools and strategies used would include energy modeling, optimization of MEP systems, envelope analysis, and incentive program support. This would ensure that the design seamlessly incorporates the NZE technologies, takes full advantage of all grant program opportunities and is able to achieve the EUI/NZE goals.

## Solar PV Design Services

The solar PV system needed to make the building NZE would be designed and integrated into the electrical systems of the building. This includes working with the electrical, structural, and mechanical engineers to coordinate the solar PV system into the documents and specifications. A performance specification is created for the solar PV contractor to bid on and support is given to the construction team as they work through the solar PV installation.

## Commissioning

Commissioning of the building is a critical step in ensuring the net zero energy goals are carried through design, construction and operational phases. With the additional systems needed for the net zero energy goals, commissioning ensures that the construction team is supported in installing and controlling the systems that both use energy and produce energy onsite.

Measurement and verification of the net zero energy goals is also a key element of the commissioning after construction. The commissioning group tracks the building energy performance against goals and projections as well as trouble shooting system performance during the warranty phase.





# Net Zero Energy Budget

The table below lists the items mentioned throughout the report that contribute to the most cost-effective solution to accomplish the buildings net zero goal. The budget numbers listed in this report are an opinion of costs based on similar past project and not a detailed cost estimate from contractors.

*Table 7- Budget costs for accomplishing net zero energy goals*

| Budget Item                       | Budget             |
|-----------------------------------|--------------------|
| Solar PV System 340 kW (Rooftop)  | \$615,000          |
| HVAC Upgrades                     |                    |
| Geothermal Borefield              | \$560,000          |
| Envelope Upgrades                 | \$144,000          |
| Upgraded Window Assembly          | \$39,000           |
| Additional Wall Insulation        | \$35,000           |
| Additional Roof Insulation        | \$70,000           |
| Electrical Service Upgrades       | \$200,000          |
| Additional Design Services        | \$45,000           |
| Commissioning                     | \$55,000           |
| <b>Total First Cost</b>           | <b>\$1,619,000</b> |
|                                   |                    |
| <b>Possible Incentives</b>        |                    |
| Focus on Energy New Construction  | \$30,000           |
| Focus on Energy Solar PV          | \$50,000           |
| Inflation Reduction Act- ITC @25% | \$722,500          |
| Inflation Reduction Act-179D      | \$31,000           |
| <b>Total Incentives</b>           | <b>\$833,500</b>   |
|                                   |                    |
| <b>Net First Cost</b>             | <b>\$785,500</b>   |

## Estimated Payback of Net Zero Energy

*Table 8- Simple payback for NZE system*

| System Type                   | Estimated Utility Costs<br>\$/yr |
|-------------------------------|----------------------------------|
| Traditional HVAC and no solar | \$43,000/yr                      |
| Geo, Solar PV and NZE         | \$21,000/yr                      |
| <b>Savings</b>                | <b>\$22,000/yr</b>               |
|                               |                                  |
| Simple Payback                | 29 yr                            |

The simple payback may not be a useful tool in evaluating the NZE decision, as it does not account for the increasing cost of utility bills and the time value of money and labor. To understand a full picture of how the NZE components will change the cost of ownership to the Village for the Community Center we use a Life Cycle Cost Analysis.

Life Cycle Cost Analysis

The Life Cycle Cost method is used to assess the cost of a Net Zero building design in comparison with other systems over the buildings lifetime. The analysis looked at the various costs of constructing, maintaining, and operating the Community Center in three scenarios, Conventional, Geothermal, and NZE.

The conventional scenario assumed the building was served by rooftop units (RTU), hydronic heating and DX cooling. The geothermal system assumes the building is retrofit with a distributed heat pump system and a ground source heat exchanger. The system does remain eligible for a number of the incentives shown in the table above and this is reflected in its cost. The Net Zero system details what is described above and adds solar to the geothermal system option as well as additional incentives.

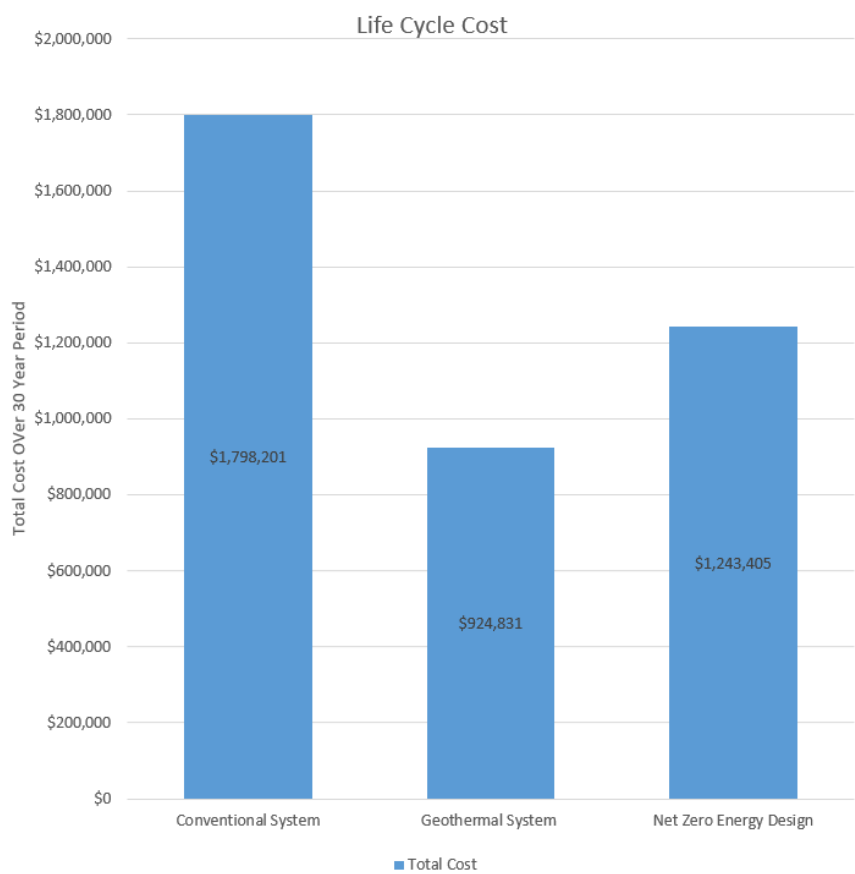


Figure 14- 30 Year Life Cycle Cost System Comparison



Carbon Emissions Comparison

The following tables and figures compare estimates on the carbon emissions produced by each system type for the Community Center over a 30-year period. Emission data was used from NREL Cambium Tool. The NREL Cambium Tool was developed by the National Renewable Energy Laboratory and includes forecasted electricity emissions data by state based on various forecasts. The scenarios utilized for this analysis includes the 95% Decarbonization Scenario by 2050 and used the average emissions rate (AER-Combustion) for Wisconsin. The table below summarizes the base carbon emission factors utilized for this analysis.

Table 9 Carbon Emissions Factors

| Carbon Emissions Factor<br>(kg CO <sub>2</sub> /MWh) |      |                   |      |
|------------------------------------------------------|------|-------------------|------|
|                                                      | 2023 | Average 2024-2053 | 2050 |
| Electricity                                          | 363  | 95                | 14   |
| Natural Gas                                          | 181  | 181               | 181  |

The first year of operation, operation in 2050, and total 30 years of operational carbon are shown in the graphs below. The conventional system produces the most carbon since it uses both electricity and gas. The geothermal system greatly reduces the amount of carbon produced since it eliminates the gas usage and reduces the amount of energy used overall. The net zero energy theoretically will produce no carbon over its lifetime as the energy used by the building is also produced on site.

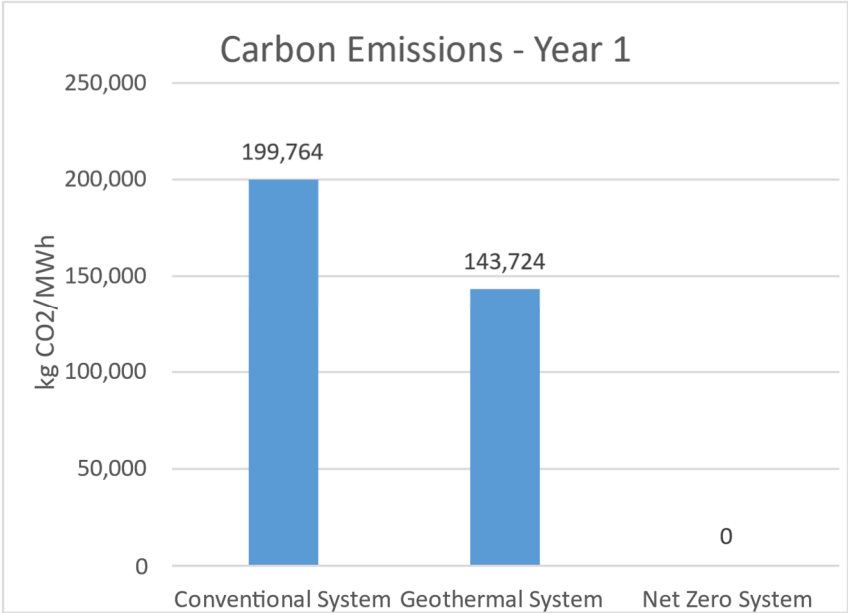


Figure 15 Carbon Emissions System Comparison- Year 1

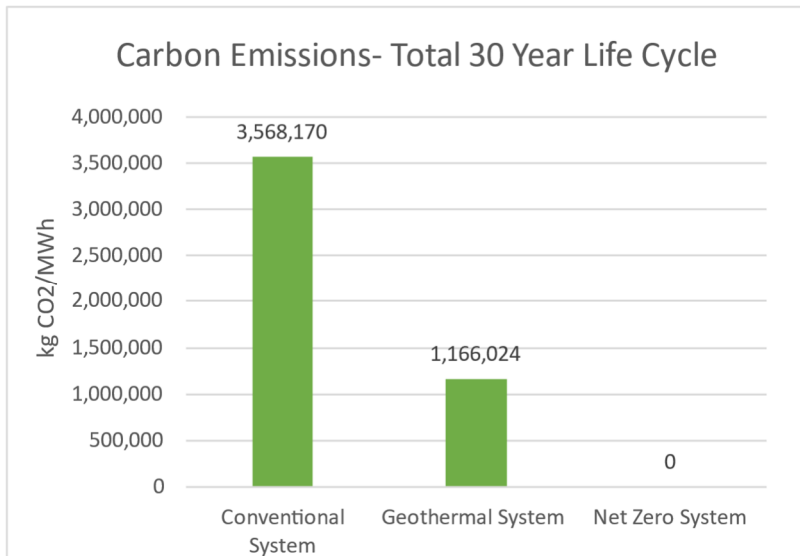


Figure 16: Carbon Emissions System Comparison- 30 Year Total

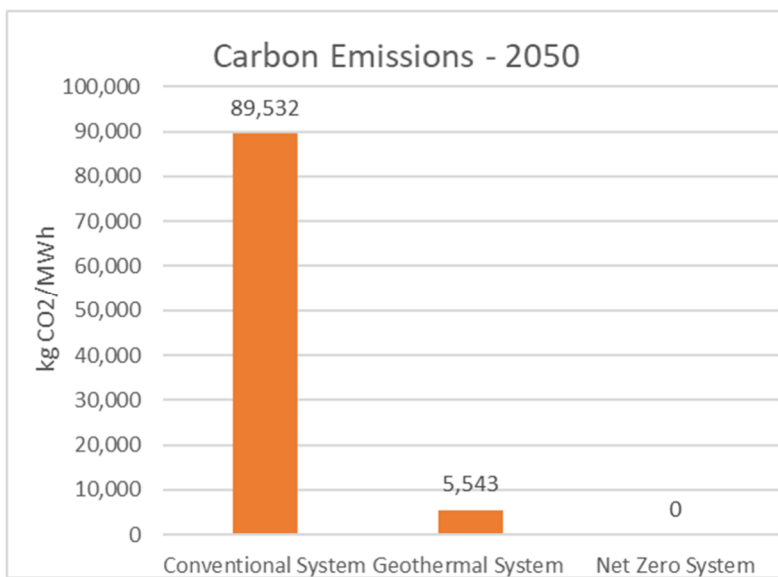


Figure 17: Carbon Emissions System Comparison- 2050

## Incentive Programs

This section of the report expands on the numerous incentives and rebates that are available to the Village to offset the potential increased first costs of a net zero energy building.

### Inflation Reduction Act – ITC

Program Availability: 2023 through 2033 with ramp down in 2034 and 2035

The Inflation Reduction Act offers the opportunity for direct pay incentives to the village for including energy efficient systems in the design of the project. The legislation would allow up to 30% of the cost of systems including geothermal and solar technologies. If the project is funded through tax exempt bonds, then the direct pay incentive would be approximately 25%. The direct pay incentives would apply to both the geothermal system and all the associated HVAC equipment served by the geothermal system. The solar PV system would also be covered under the IRA direct pay incentive. In many cases the direct pay incentives can reduce the first costs of the geo and solar system to the process of comparable traditional HVAC systems.

Additional information on the IRA direct pay incentive can be found at <https://daneclimateaction.org/what-you-can-do/Federal-Funding-for-business>

### Inflation Reduction Act -179D

Program Availability: 2023 through 2031

While the Village cannot directly utilize the 179D tax deduction, it can sign over this tax deduction to its design consultants. The deduction can be up to \$5/ft<sup>2</sup> based on the actual energy savings achieved through the renovation. The Village can work with its consultants to assign the deduction to its consultants in exchange for services or reduced fees. HGA has worked with clients in the past to leverage the 179D for either future services or reduction in design related fees. HGA would suggest that the Village include some language about the 179D assignment and potential benefits to the Village in its RFP to the design team for this project.

### Focus on Energy New Construction Program

Program Availability: Unknown but likely some form of program will be available for the foreseeable future

The new Community Center qualifies for the Focus on Energy New Construction program. This program incentivizes the owner and design team for choosing energy efficiency measures to be part of the new building design. For a building the size of the Community Center, the incentive will range from \$20,000 to \$40,000 depending on strategies selected.

## Focus on Energy Renewable Energy Program

Program Availability: Unknown but likely some form of program will be available for the foreseeable future

The solar PV system qualifies for the Focus on Energy Renewable Energy program. A PV system of 365 kW would qualify for the 300kW to 500kW tier of incentives, valued at approximately \$50,000 in 2023 rates. This incentive must be applied for in advance, during the year of project completion. The incentive value may vary a small amount based on 2022 grant year rates. There is a reservation code and incentive budget.

## Green Bond

Program Availability: Available for the foreseeable future

Assuming the community center upgrades will be financed through a bond, the Village can work with its bond underwriters to determine the feasibility of issuing a green bond to fund these improvements. Typically, green bonds can be handled through the Village's regular bond broker and will enable the project to be financed at a lower interest rate than it would have otherwise. In many cases, the interest rate savings are comparable to the first costs increased in the higher performance energy systems.

# Additional Considerations

## Battery Storage System

Lithium-ion battery storage systems are becoming more popular as prices drop, due in part to improved manufacturing and increased competition. There are numerous ways a battery storage system can be used at a facility; to increase electric reliability, generate utility grid revenue, store excess renewable energy, and lower utility demand charges.

The new PSB opted to include provisions to make the facility battery ready. Space for the exterior concrete pad, conduit routing to the pad, and a battery breaker were planned for the future of the facility.

## Store Excess Solar Energy

During a sunny day, the battery system can be used to store excess solar energy production that would normally be sold back to the utility at a reduced rate. This stored energy could be used later during night or peak utility cost times.

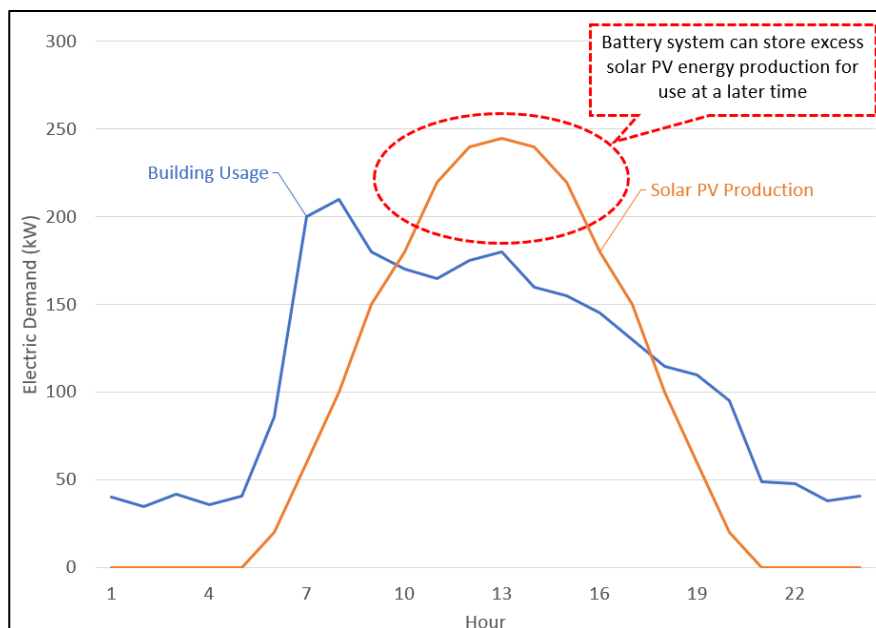
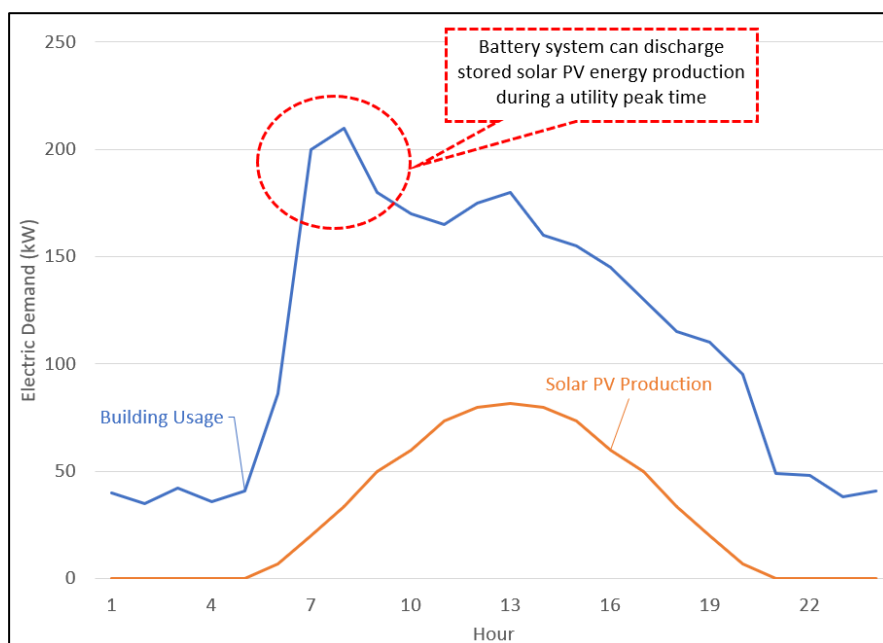


Figure 18- Example building usage and solar production graph during a typical sunny day

## Peak Shaving

During a cloudy day the battery system can be used to shave a utility peak that would increase demand costs. The battery can use stored solar energy or off-peak energy to be used when electric utility costs are at their highest, and manage the demand charges that a facility will incur.

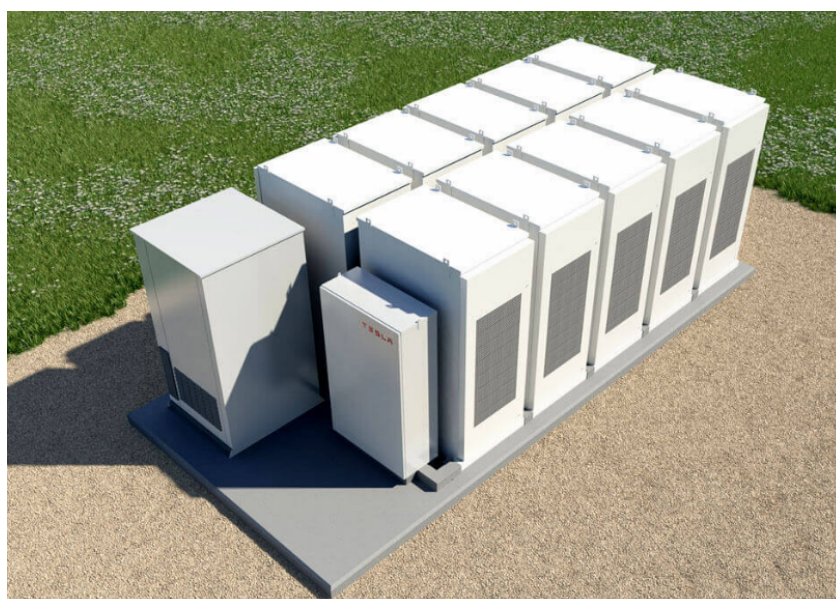


*Figure 19 - Example building usage and solar production graph during a typical cloudy day*

### Battery Power Backup

Batteries can increase electric resiliency by providing back-up electric power during loss of building utility connection. These battery systems can be used in tandem with a conventional dual fuel gas generator, or as a standalone means of providing emergency power in an electric utility outage.

Depending on the emergency backup requirements of the new Community Center and the electrical design of the system, a battery storage system could be incorporated to provide back-up power or the ability to generate solar energy during utility outages.



*Figure 20- Example of a building battery storage system*

Battery Ready Design

Based on HGA's recent experience with battery projects, we would recommend that a battery system not be included in the renovation project. We have seen a significant increase in battery project costs in recent months. Additionally, recent project experience has shown that the industry is still nascent and the potential savings are not being achieved in actual implementation.

If the village is still interested in the facility being future proofed for a future installation, the project can still be designed for a battery installation in the future with a few simple provisions. These include:

- Designate an outdoor location for future battery including costs for a concrete pad.
- Running cable conduit to locations during construction for the future battery
- Including a spot for the battery system to land on the Solar PV electrical subpanel
- Configuring the 1-line electrical design for the batteries future use

These provisions would add minimal extra cost in the current design package (similar provisions to getting the design ready for solar PV) but may save considerable of money in the future if a battery is later integrated into the building electrical systems.

Table 10: Summary of Battery Energy Storage Economics

| Battery Energy Storage System (BESS) | Budget Cost | Utility Savings | Simple Payback |
|--------------------------------------|-------------|-----------------|----------------|
| BESS 100kW/200kwh (10 year lifespan) | \$500,000   | \$10,000        | 50 years       |
|                                      |             |                 |                |
| IRA 30% Savings                      | \$150,000   | -               | -              |
|                                      |             |                 |                |
| Total Cost                           | \$350,000   | \$10,000        | 35 years       |

EV Charging Infrastructure

As part of this project scope, HGA was also tasked with identifying potential options to partner with EV charge operators, such as a third party or utility, to install DC fast chargers and or level 2 chargers on the Community Center through federal funding or potentially through PSC OEI grant money.

The renovations at the site do allow for a fresh look at how EV charging can be holistically designed into the project. With the proliferation of EV sales and the lag in charging infrastructure to support charging, the Village can play a role in meeting this need, while also charging users for this service. There are several multifamily apartment buildings adjacent to the future Community Center, so this site may be ideally situated to not only serve building users, but also serve nearby village residents who would otherwise not have access to charging infrastructure. The EV stations would also serve visitors of the Community Center, Library, and downtown businesses.

Level 2 charging is the most common type of charger offered in a commercial setting. The site could utilize a bank of level 2 chargers. However, level 2 chargers typically take many hours to recharge a car and typically provide around 25 miles of range per hour of charging. While level 2 chargers are ideally suited for building users that may be onsite for multiple hours, they are too low power to meet the needs



of an EV user looking to recharge their vehicle over a short visit to the library or city hall. Typically, a lower power DC fast charger would be utilized for this application, such as a 50kW charger.

If the Village is interested in installing robust charging infrastructure at the site, there are numerous opportunities to leverage incentives and rebates. Please see additional information below on the potential grant opportunities associated with EV charging infrastructure.

### **Federal Highway Administration Charging and Fueling Infrastructure Discretionary Grant Program**

The Bipartisan Infrastructure Law established a competitive grant program of over \$2.5 billion over the 5-year program to support local governments implement EV charging infrastructure. Dane County partnered with a group of cities and villages, including McFarland, on the FY 2022 grant application which was due June 13, 2023. There will be another grant period in FY 2023. This would provide an opportunity for the Village to apply for a grant for charging infrastructure at the Community Center site. Prior to applying for the grant, collaboration with Alliant Energy is advised to determine if 480V power is located in this area to support DC fast charging infrastructure, or if additional electrical infrastructure, such as transformers, would be required.

Additional information about this program can be found here...  
<https://www.fhwa.dot.gov/environment/cfi/>

### **Wisconsin PSC Office of Energy Innovation Grant Funding**

There is one more round of grant funding through the PSC OEI funding this coming January of 2024. This program does offer grants to municipalities looking to install EV charging infrastructure. This could be an opportunity to combine both a solar carport and EV charging into one application. If there was engagement with the adjacent community to leverage this location as a neighborhood charging hub, HGA believes that this would be a strong candidate to receive funding. However, the current timeline for the facility does not align with the design and construction process for the new community center.



# HGA

7475 Hubbard Avenue, Suite 201  
Middleton, WI 53562

608.554.5333  
HGA.COM



**VILLAGE OF  
McFarland  
SUMMARY SHEET**

**MEETING DATE:** Monday, November 13, 2023

**SECTION:** Business

**DEPARTMENT:** Community Development

**CONTACT:** Andrew Bremer, Comm & Eco Dev Director, Kong Thao, Associate Planner

**AGENDA ITEM:** Discussion and action to recommend the Village Board accept the Comprehensive Energy Plan Report.

**PREVIOUS ACTION:**

April 19, 2023 - SNR Committee recommended approval to the Village Board for HGA's energy planning services.

April 25, 2023 - Village Board approves HGA as consultants for energy planning services.

**ISSUE SUMMARY:**

The report is a detailed analysis of all village-owned buildings, fleet, and property to determine the Village's existing carbon footprint and a path to achieving 100% net zero carbon emissions.

The energy data collected from Alliant Energy and MG&E helped HGA establish energy baselines and trends. The report serves to guide Village Board and Village Staff decisions on energy efficient opportunities, installation of sustainable features, and cost savings. These timelines are preliminary suggestions from the consultant and are not firm commitments to any particular project or project implementation date. It is worth noting that it will be to the Village's benefit to implement as many improvements as possible that qualify for Inflation Reduction Act Direct Pay incentives prior to the program phasing out in 2032.

**FINANCIAL/BUDGET IMPACT:**

The 2023 Capital Improvement Budget includes \$25,000 in C&ED Department funds for Comprehensive Energy Planning. The balance of the project costs (\$23,500) allocated budget funding in 2023 for Facility Management within the capital budget for the design of the Community Center.

**VILLAGE PLAN REFERENCE:**

2022-2023 Strategic Plan, Goal B Public Infrastructure, Action IV - Completion of a Village wide energy audit and planning to implement energy efficiencies within operations.

2021 Sustainability Plan

- Near-Term Energy Action - Conduct energy audits of all municipal facilities to identify potential energy efficiency improvements.
- Energy Goal - Municipal percentage of total energy consumed generated from renewables per year = 50% by 2030 and 100% by 2040.



**ORDINANCE REFERENCE:**

**BOARD, COMMISSION OR COMMITTEE RECOMMENDATION:**

Motion, and second, to recommend the Village Board accept the Village of McFarland Comprehensive Energy Plan Report.

**ATTACHMENTS:**

1. McFarland Comprehensive Energy Plan\_Final\_Draft\_v2\_11-9-2023



McFarland Comprehensive Energy Plan  
Report  
November 2023

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## 2.0 Acknowledgements

**Table 1: Team Information**

| Name                       | Group                | Title                                                            |
|----------------------------|----------------------|------------------------------------------------------------------|
| <b>Mike Barnett</b>        | HGA                  | Senior Project Manager                                           |
| <b>Adam Jablonski</b>      | HGA                  | Building Performance Engineer                                    |
| <b>Alex Harris</b>         | HGA                  | Sustainability Project Manager                                   |
| <b>Dewmi Pathinisekara</b> | HGA                  | Building Performance Intern                                      |
| <b>Andrew Bremer</b>       | Village of McFarland | Community & Economic Development Director                        |
| <b>Kong Thao</b>           | Village of McFarland | Associate Planner                                                |
| <b>Matt Schuenke</b>       | Village of McFarland | Village Administrator                                            |
| <b>Lee Igl</b>             | Village of McFarland | Public Works Director                                            |
| <b>Sayer Larson</b>        | Village of McFarland | Parks Superintendent                                             |
| <b>Heidi Cox</b>           | Village of McFarland | Public Library Director                                          |
| <b>Mike Flaherty</b>       | Village of McFarland | Sustainability & Natural Resource Committee, Village Chairperson |
| <b>Carolyn Clow</b>        | Village of McFarland | Sustainability & Natural Resource Committee, Village President   |
| <b>Kitty Brussock</b>      | Village of McFarland | Sustainability & Natural Resource Committee                      |
| <b>Bruce Fischer</b>       | Village of McFarland | Sustainability & Natural Resource Committee                      |
| <b>Angela Freedman</b>     | Village of McFarland | Sustainability & Natural Resource Committee                      |
| <b>Nina Schultz</b>        | Village of McFarland | Sustainability & Natural Resource Committee                      |
| <b>Judy Taber</b>          | Village of McFarland | Sustainability & Natural Resource Committee                      |

### 3.0 Executive Summary

#### Overview

In the Summer of 2023 HGA (further known as 'the consultant') was contracted by The Village of McFarland to develop a Comprehensive Energy Plan (CEP) for the entire Village of McFarland building portfolio totaling over 173,000 square feet and 54 vehicle fleet.

The Village of McFarland is looking to significantly reduce carbon emissions over the next 10 years. The intention of this report is to serve as a guide for project strategies and funding decisions for capital infrastructure projects over the next 10+ years.

#### Village of McFarland Energy and Carbon Footprint

In the baseline year of 2022, The Village of McFarland portfolio of buildings consumed 1,277,822 kWh of electricity, generated 33,029 kWh and consumed 50,310 Therms of natural gas. Converted to a common unit of energy (kBtu) shows that more natural gas energy than electrical energy was consumed by The Village of McFarland. Table 2 below shows the consumption by fuel type.

**Table 2: Energy Consumption and Percentage by Fuel Type**

| Fuel Type    | Consumption <sup>1</sup> | Electricity Generation | Net Consumption | kBtu                   | kBtu Percent of Total |
|--------------|--------------------------|------------------------|-----------------|------------------------|-----------------------|
| Electricity  | 1,106,857 kWh            | 33,029 kWh             | 1,073,828 kWh   | 3,663,901 <sup>2</sup> | 32%                   |
| Natural Gas  | 43,329 Therms            | N/A                    | 50,310 Therms   | 5,029,793 <sup>3</sup> | 38%                   |
| Gasoline     | 16,717 Gallons           | N/A                    | 16,717 Gallons  | 2,009,596 <sup>4</sup> | 18%                   |
| Diesel       | 10,341 Gallons           | N/A                    | 10,341 Gallons  | 1,420,724 <sup>5</sup> | 12%                   |
| <b>Total</b> |                          |                        |                 | <b>12,354,266</b>      | <b>100%</b>           |

Each unit of electricity (kWh) and unit of natural gas (Therm) has an associated carbon value. Below in Table 3 are the conversion factors used to estimate the carbon footprint associated with the Village of McFarland's portfolio of buildings.

<sup>1</sup> This total does not include the electricity and natural gas use from the new McFarland Public Safety Center that is currently under construction. A complete year of data was not available for this building and recorded consumption at this facility is not likely representative of actual building operation.

<sup>2</sup> Conversion – 1 kWh = 3,412 kBtu

<sup>3</sup> Conversion – 1 Therm = 99,976 kBtu

<sup>4</sup> Conversion – 1 gallon gasoline = 120,214 kBtu

<sup>5</sup> Conversion – 1 gallon diesel = 137,381 kBtu

**Table 3: 2023 Carbon Conversion Factors by Fuel Type**

| Fuel Type   | Carbon Conversion Factor | Source                            |
|-------------|--------------------------|-----------------------------------|
| Electricity | 1,097.6 lbs CO2/MWh      | EIA.gov and nrel.gov <sup>6</sup> |
| Natural Gas | 11.684 lbs CO2/Therm     | EPA.gov <sup>7</sup>              |
| Gasoline    | 19.59 lbs CO2/Gallon     | EPA.gov <sup>8</sup>              |
| Diesel      | 22.44 lbs CO2/Gallon     | EPA.gov <sup>9</sup>              |

Applying the factors to the Village of McFarland's portfolio shows that despite electricity's lower kBtu usage compared to natural gas, it makes up a larger portion of the carbon footprint. Electricity accounts for 53% of McFarland's Carbon Emissions and Natural gas accounts for 23%, with transportation and small engine fuels accounting for the remaining 24%, as shown in Table 4 below.

**Table 4: Carbon Footprint by Fuel Type**

| Fuel Type    | 2022 Pounds CO2/year | Percent of Total |
|--------------|----------------------|------------------|
| Electricity  | 1,178,634            | 52.5%            |
| Natural Gas  | 506,277              | 22.6%            |
| Gasoline     | 327,524              | 14.6%            |
| Diesel       | 232,095              | 10.3%            |
| <b>Total</b> | <b>2,244,530</b>     | <b>100.0%</b>    |

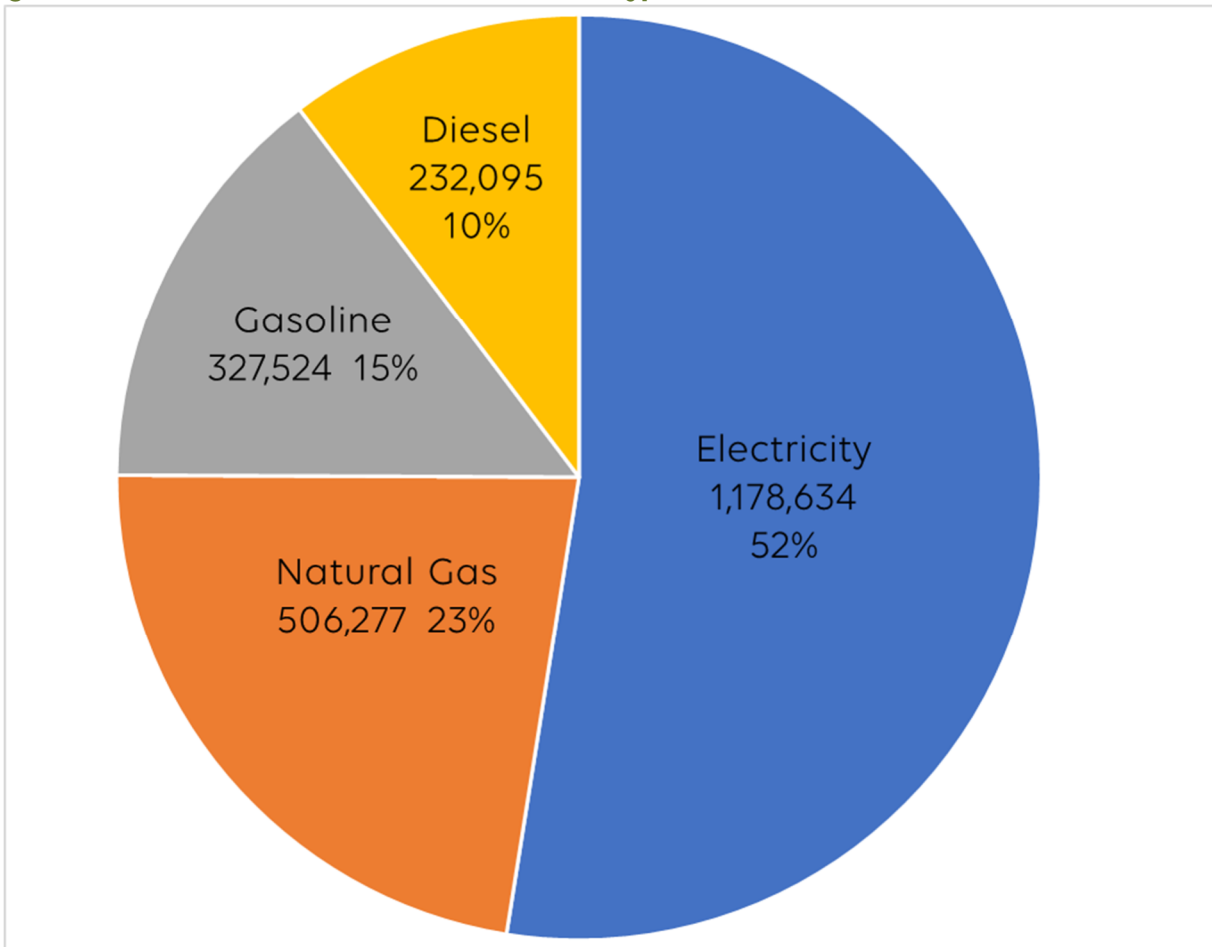
<sup>6</sup> Carbon factor for the year 2022 was estimated by using the 2021 recorded carbon intensity per kWh for the state of Wisconsin from EPA.gov (1,246 lbs/MWh) and determining a linear relationship from 2021 to the 2024 carbon intensity forecast for the state of Wisconsin from NREL Cambium forecasting tool for AER load CO2 emissions from combustion (800.9 lbs/MWh)

<sup>7</sup> 0.0053 metric tons per Therm x 2,204.62 lbs per metric ton - <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

<sup>8</sup> <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references>

<sup>9</sup> Ibid

**Figure 1: Carbon Emission Pounds and Percent Fuel Type - 2022**



Additional detail about carbon emissions can be found in the Energy and Emissions information section.

## Timelines to 100% Net Zero Carbon Emissions

The consultant developed a timeline to achieve 100% Net Zero carbon emissions. The complete list of strategies, including costs and benefits, is included in the “Costs Analysis and Capital Spending Plan” section. A summary of the most significant categories of decarbonization strategies includes the following:

- HVAC retrofits, lighting upgrades and other infrastructure upgrades that increase energy performance.
- Major renovations to existing facilities to increase facility square footage while overhauling mechanical systems to increase energy performance and decrease carbon emissions, largely through beneficial electrification.
- Installation of on-site photovoltaic at many facilities.
- Upgrade select fleet vehicles to electric powered vehicles (EV's).
- Reduced carbon intensity of grid electricity associated with changing utility generation mix.
- Renewable energy credits and carbon offsets for remaining emissions currently accounting for 36% of current emissions in 2035.

After review of all facilities, a list of energy conservation, renewable energy generation, and fleet electrification measures were developed that are recommended to be implemented by the Village of McFarland between now and the year 2035. These measures were organized by system type and summarized in Table 5 and Table 6 below. These tables include the RECS associated with the proposed McFarland / Alliant Energy Customer Hosted Renewable Program solar installation to fully account for all costs, energy savings, and carbon savings. A complete list of measures is available in Table 48 at the end of this report.

**Table 5: Energy Savings by Measure Type**

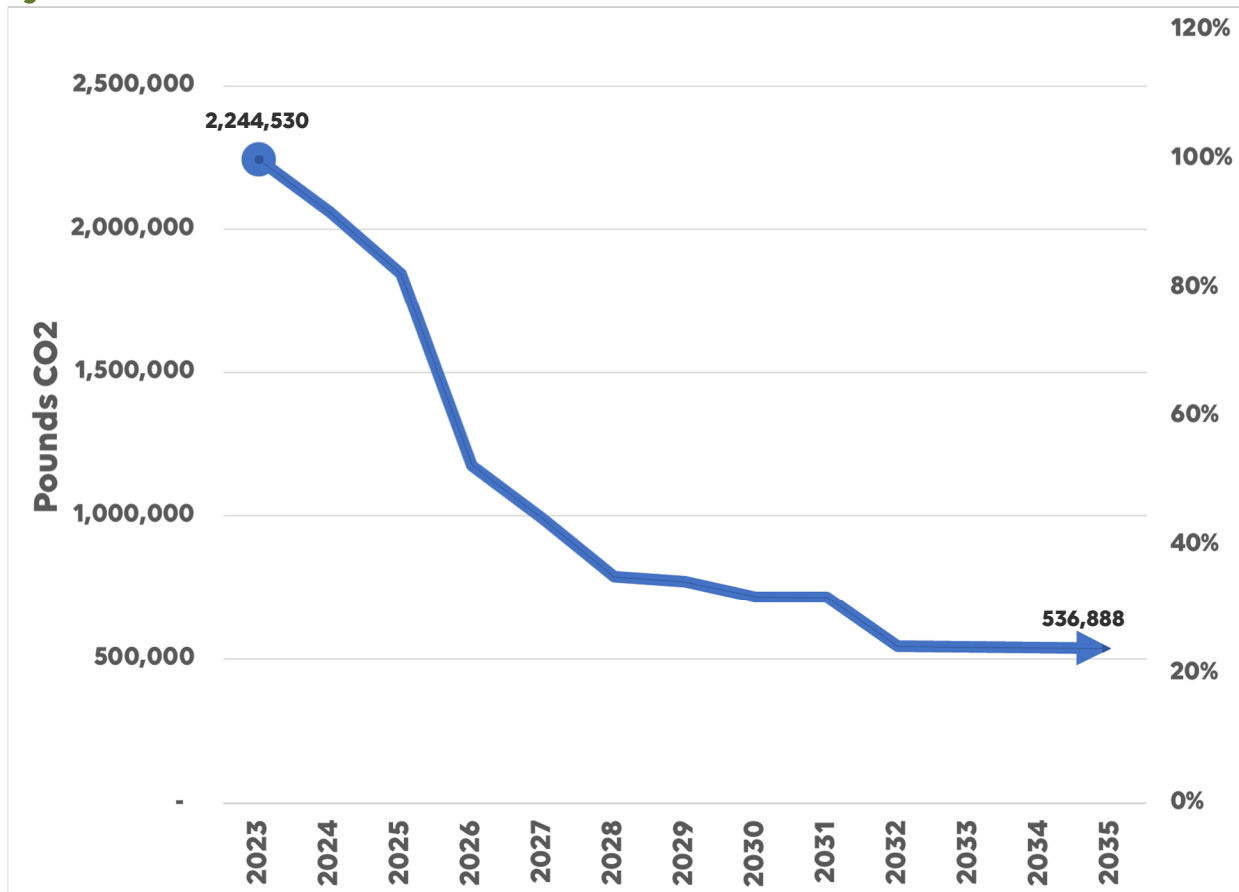
| Measure Type          | Electricity Savings/Offset (kWh) | Natural Gas Savings (Therms) | Gasoline Savings (Gallons) |
|-----------------------|----------------------------------|------------------------------|----------------------------|
| Lighting Upgrades     | 17,880                           | -                            | -                          |
| HVAC Upgrades         | 165,702                          | 31,944                       | -                          |
| Window/Envelope       | 5,802                            | 392                          | -                          |
| Fleet Electrification | -65,369                          | -                            | 10,376                     |
| Retrocommissioning    | 29,010                           | 2,351                        | -                          |
| Misc. Other           | 2,670                            | -                            | -                          |
| Solar PV              | 759,500                          | -                            | -                          |
| VoM/Alliant RECs      | 1,324,000                        |                              |                            |
| <b>Total</b>          | <b>2,239,196</b>                 | <b>34,686</b>                | <b>10,376</b>              |

**Table 6: Cost and Carbon Savings by Measure Type**

| Measure Type          | Carbon Savings – 2035 (lbs) | Measure Cost – Without Incentives | Measure Cost – With Incentives |
|-----------------------|-----------------------------|-----------------------------------|--------------------------------|
| Lighting Upgrades     | 4,218                       | \$143,925                         | \$140,361                      |
| HVAC Upgrades         | 412,337                     | \$1,241,700                       | \$927,401                      |
| Window/Envelope       | 5,946                       | \$300,000                         | \$300,000                      |
| Fleet Electrification | 187,870                     | \$977,500                         | \$842,500                      |
| Retrocommissioning    | 34,308                      | \$20,000                          | \$16,245                       |
| Misc. Other           | 630                         | \$500                             | \$500                          |
| Solar PV              | 179,166                     | \$1,244,100                       | \$926,855                      |
| VoM/Alliant RECs      | 312,331                     | \$4,460                           | \$4,460                        |
| <b>Total</b>          | <b>824,475</b>              | <b>\$3,932,185</b>                | <b>\$3,158,321</b>             |

The graphs below in Figure 2 illustrate the carbon emissions associated with the village as the recommended capital projects are implemented, while at the same time accounting for the electricity grid carbon intensity decreasing as the grid becomes cleaner. This represents a 76% reduction in carbon emissions. These figures do not account for any carbon offsets or renewable energy credits, such as those collected through the proposed McFarland / Alliant Energy Customer Hosted Renewable Program solar installation. The RECs shown in Table 6 are not included in the graph below to illustrate the potential impact of capital improvement projects and investments made to the infrastructure owned by the village. A second set of figures are included which include the impacts of Renewable Energy Credits associated with this project.

**Figure 2: CO<sub>2</sub> Emissions Timeline - Without Recs**



As indicated in the figure above, the most significant drop in emissions occurs between 2024 and 2026 when major energy conservation measures are estimated to take place.

Figure 3 shows the carbon footprint reduction by measure type. This chart compares the baseline carbon footprint from 2022 and the impact of the measures in the year 2035 and the resulting carbon footprint. HVAC measures such as the proposed Net Zero Energy Community Center and geothermal upgrades at the Library contribute to the largest carbon reduction. Changes to the cleanliness of the grid also contribute significantly to the overall carbon footprint reduction.



**Figure 3: 2035 Carbon Footprint Impacts by Measure Type**

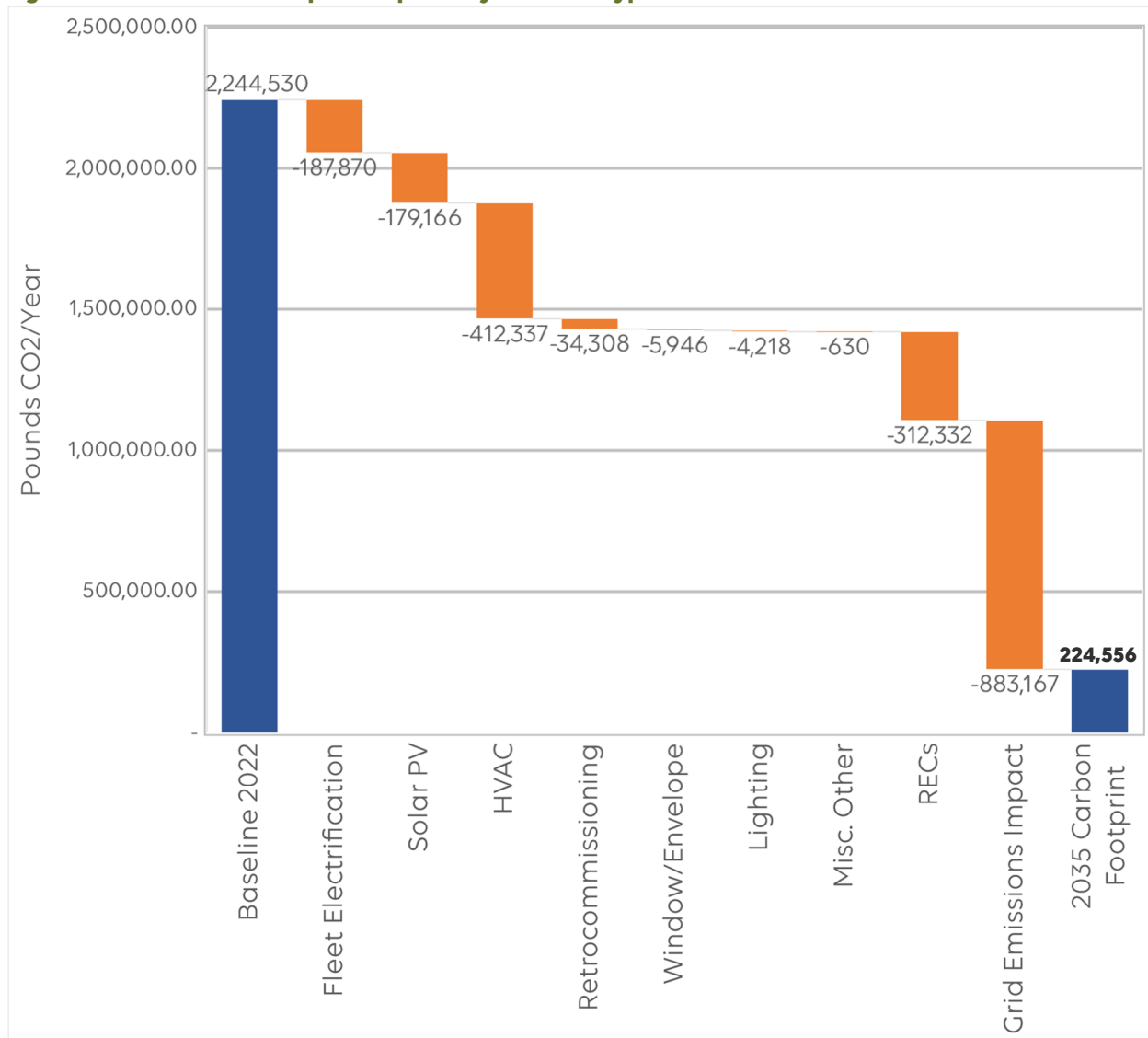
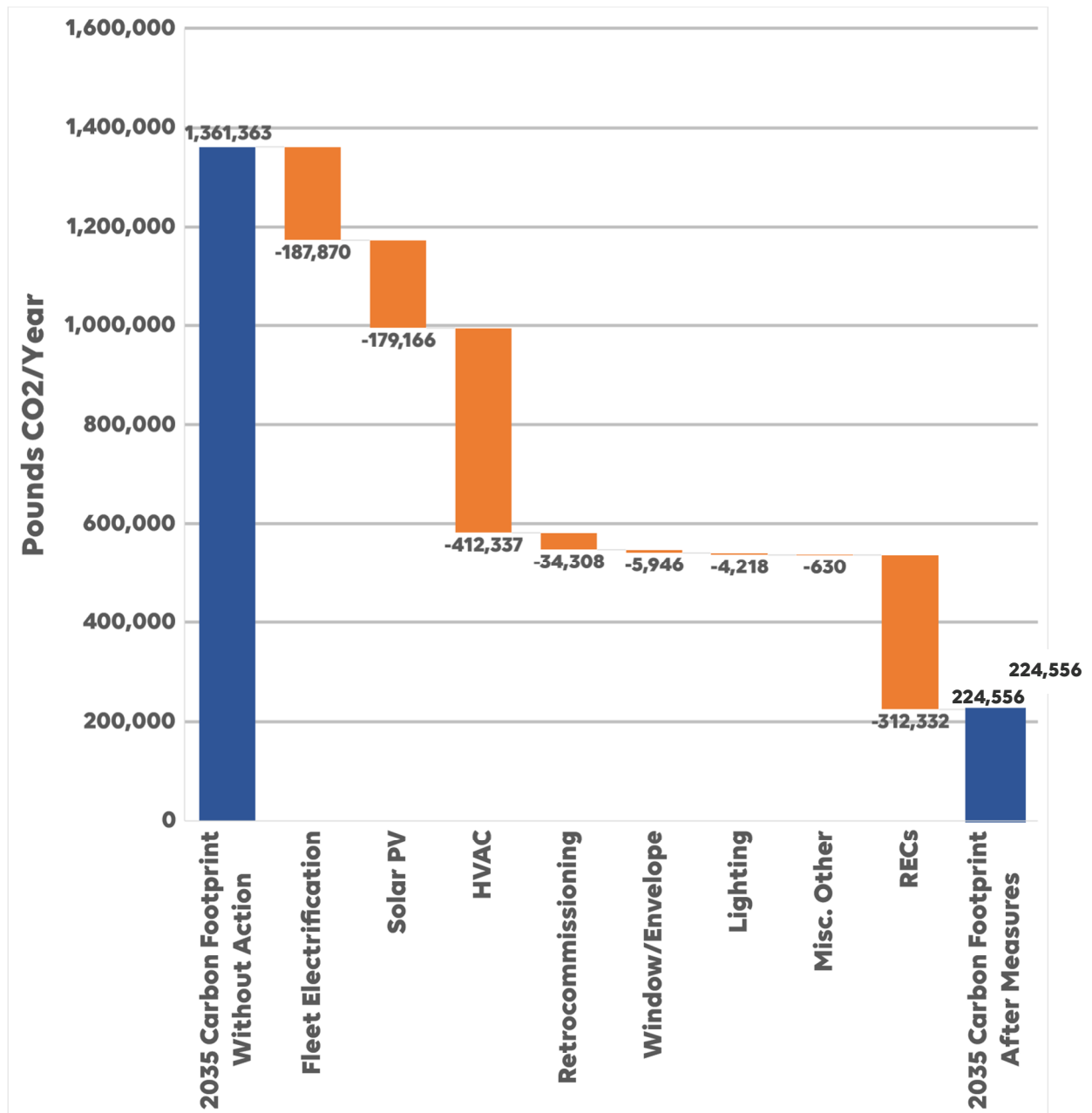


Figure 4 shows the 2035 carbon footprint if no electrification, energy savings, and renewable energy projects are undertaken by the Village of McFarland. This shows the impact of the grid becoming cleaner over time, and the measures that could be completed by the Village.

**Figure 4: 2035 Carbon Footprint Before and After Measure Implementation**



**Figure 5: CO<sub>2</sub> Emissions Timeline by Fuel Type – Without Recs**

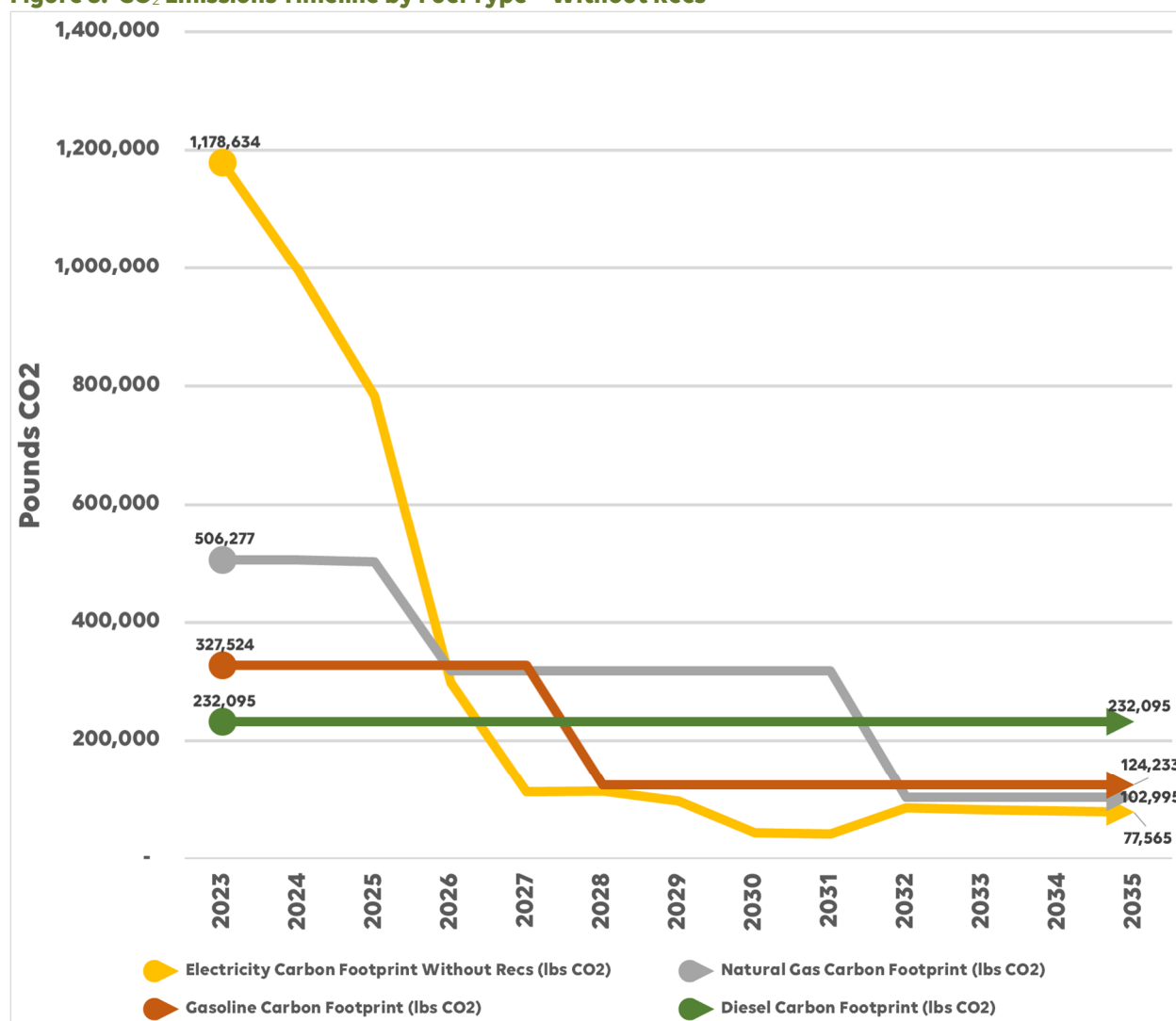


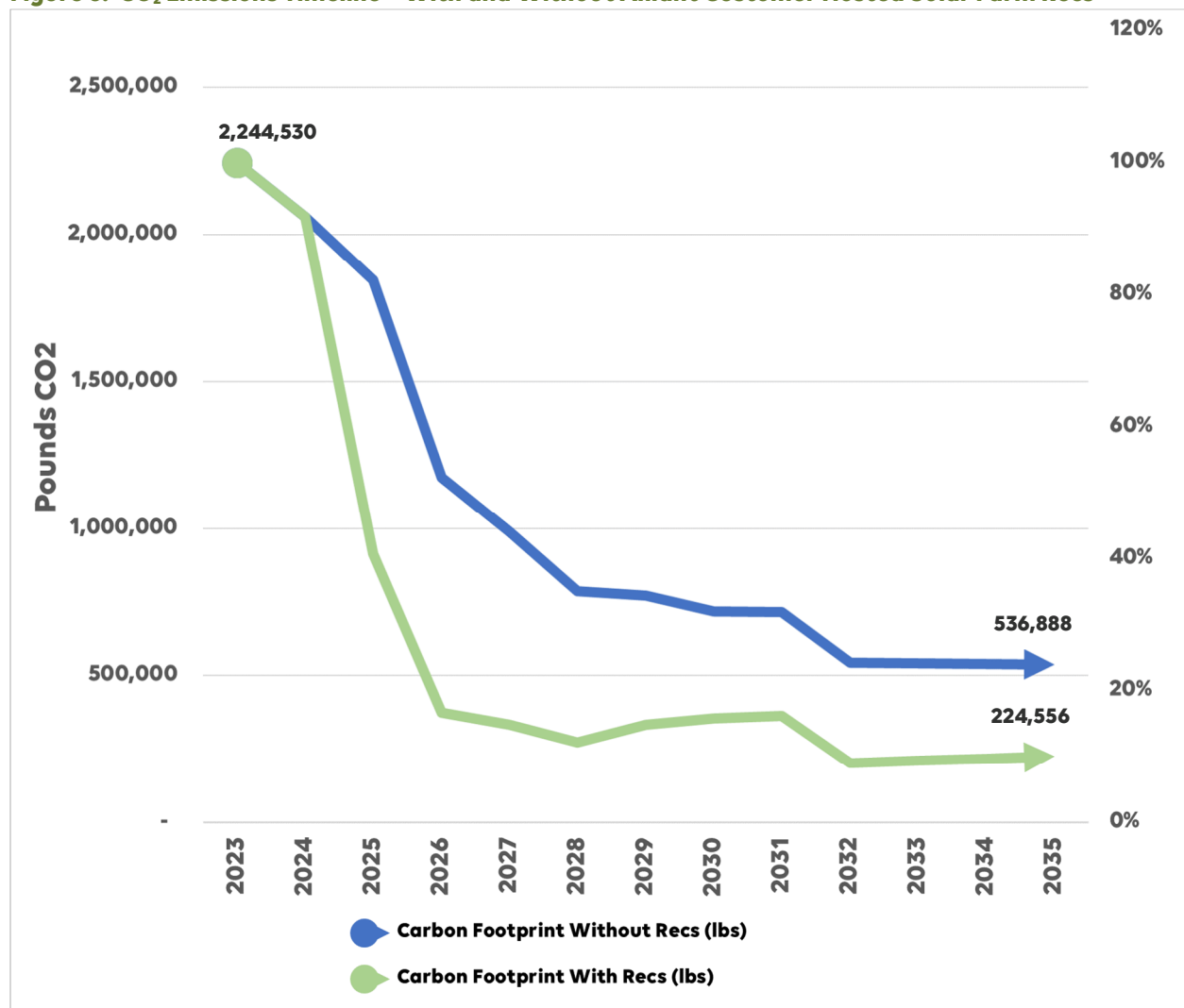
Figure 5 above indicates where the carbon emission reductions are achieved. Onsite solar PV installations and electricity conservation strategies account for largest reduction in carbon footprint but major building electrification and vehicle electrification projects also contribute to natural gas and gasoline carbon footprint reductions, respectively. No changes to the diesel fleet were planned so the carbon footprint remains constant over the study period. Diesel vehicles are usually high specialized equipment with very specific uses that need to be closely studied to inform electrification recommendations. Information on the annual mileage, diesel consumption, and use cases for each vehicle would need to be gathered in order to calculate expected costs and carbon savings.

As discussed later in the report, ICLEI and the Greenhouse Gas Protocol reporting requirements require total carbon emissions to be reported in 2 formats, with carbon offsets and without carbon offsets. This reporting methodology allows the public more transparency in

understanding how an organization is achieving its carbon reduction goals. Direct carbon reductions are considered significantly more impactful than carbon offsets and RECs. The end goal is to achieve zero carbon emissions without the need for REC's or carbon offsets.

In the graphs below, RECs associated with the Alliant solar farm are incorporated into the overall carbon emissions total. It is assumed that the Alliant RECs would be 60% of the total project RECs, or approximately 1,324 MWH of RECs per year. Figure 6 below shows a comparison of the total carbon footprint through 2035 with and without RECs. From the baseline, CO2 emissions would be reduced 76% without the RECs and 90% with the RECs

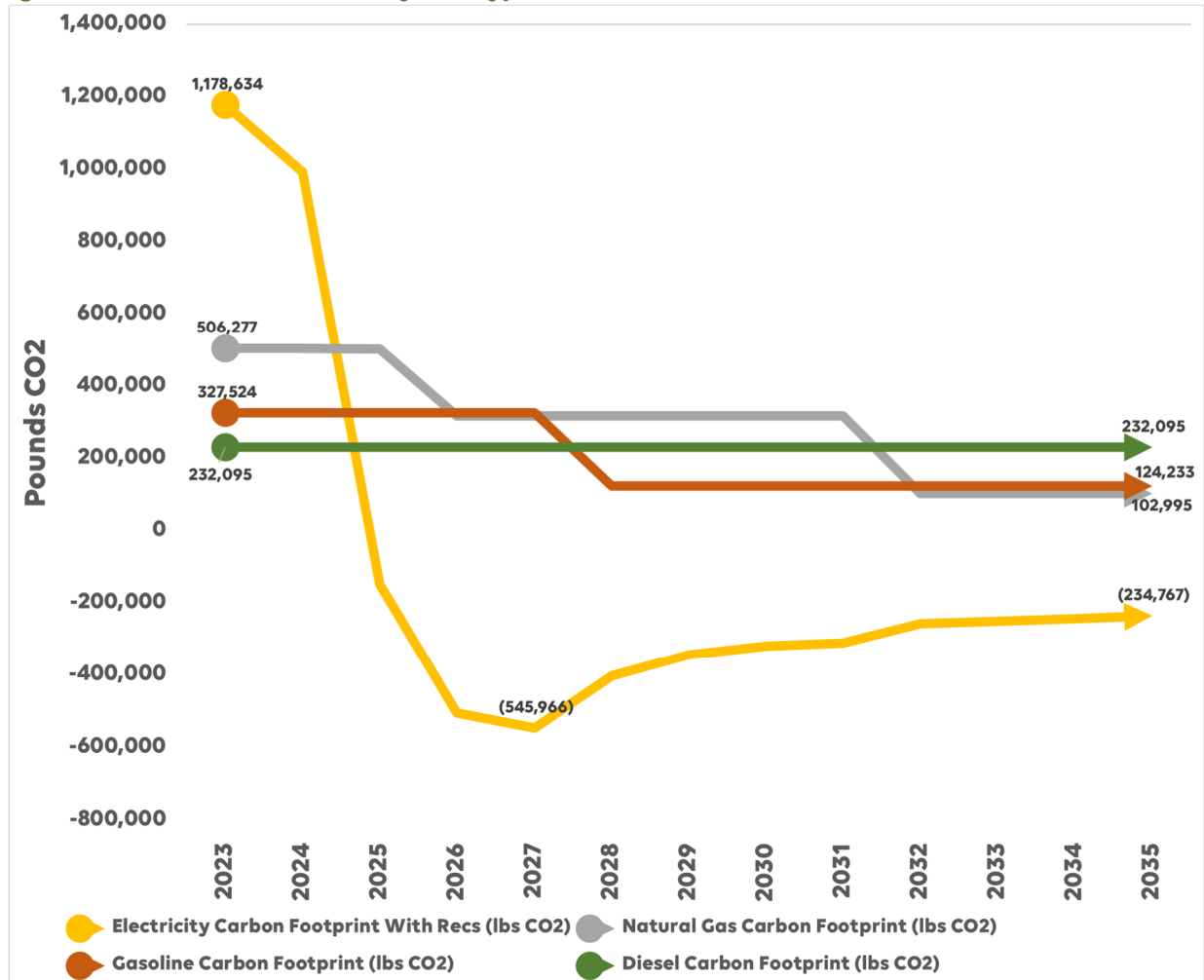
**Figure 6: CO<sub>2</sub> Emissions Timeline – With and Without Alliant Customer Hosted Solar Farm Recs**



The RECs purchased by the Village of McFarland will impact the carbon footprint of electricity. Figure 7 below shows the carbon footprint by fuel type with RECs included. The carbon footprint

of electricity is negative beginning in 2025 with a maximum negative carbon footprint occurring in 2027. The carbon footprint goes negative due to the additional onsite solar that is installed at all sites identified in Table 48 including the new proposed net zero Community Center as being eligible for solar which reduces the overall electricity consumption of the Village. The carbon footprint begins to increase to approximately negative 235,000 pounds per year in 2035. This increase is due to electrification projects like the geothermal upgrades at the Library and fleet electrification increasing electricity use and the grid becoming cleaner which as a result, the purchased RECs do not have as large of an impact per kWh year over year.

**Figure 7: CO<sub>2</sub> Emissions Timeline by Fuel Type – With Recs**



## Recommendations and Next Steps

The consultant recommends considering all energy efficiency measures, renewable energy projects, facility renovation projects, and carbon offset purchases described in this report. The timeline should be reviewed internally, and consensus should be reached about an appropriate timeline for implementation based on budget.

## 4.0 Introduction

### Project Overview

In July of 2023 HGA (further known as ‘the consultant’) was contracted by The Village of McFarland to develop a Comprehensive Energy Plan (CEP) for the entire Village of McFarland building portfolio totaling over 173,000 square feet and a fleet of 54 vehicles.

The Village of McFarland is looking to significantly reduce carbon emissions over the next 10 years. The intention of this report is to serve as a guide for project strategies and funding decisions for capital infrastructure projects over the next 10+ years.

### Project Schedule

**Table 7: Project Schedule**

| TASK                               | MILESTONE                                   | TIMELINE         |
|------------------------------------|---------------------------------------------|------------------|
| Task 1 –<br>Preliminary Assessment | Kick-off Meeting                            | Early July 2023  |
|                                    | Benchmark Building Energy Use               | July 2023        |
|                                    | Building Survey                             | July/August 2023 |
|                                    | Preliminary Assessment Report               | August 2023      |
| Task 2 –<br>Draft Recommendations  | Draft CEP Report                            | August 2023      |
| Task 3 -<br>Final Report           | Final Report Staff Review                   | September 2023   |
|                                    | Sustainability & Natural Resource Committee | November 2023    |
|                                    | Closing Meeting                             | November 2023    |
|                                    | Final Report/Stakeholder Meetings           | November 2023    |

### Facility Energy-Related Emissions Scope and Framework

At the time of this report, carbon accounting practices might be considered nascent and evolving rapidly in terms of available guidelines, procedures, and a lack of widely adopted standards. Facility emissions calculations and factors utilized for this report generally followed

industry accepted practices detailed in the ICLEI Local Government Operations Protocol. The ICLEI document provides a framework for local government for quantifying and reporting greenhouse gas emissions. Ultimately the Village should aspire toward a holistic view of decarbonization in their operations, including Scope 1, 2, and 3 emissions as defined by the EPA.<sup>10</sup> This study is focused on reducing Scope 1 natural gas consumed by buildings, preparing Village buildings to reduce Scope 1 fleet vehicle emissions through electrification, and reducing scope 2 purchased electricity emissions.

Emissions accounting guidelines and standards are rapidly evolving as corporations respond to stricter requirements from both the Securities Exchange Commission (SEC) and the European Union (EU) on the rigor with which carbon emissions are reported. While developing detailed emission accounting procedures for the Village was not part of this project scope, adopting best practices on emissions accounting standards that provide relevance, completeness, consistency, transparency, and accuracy are paramount to any organization's sustainability and decarbonization efforts.

As renewable energy credits and carbon offsets become a significant portion of organizations short-term decarbonization strategies, emissions standards such as the Greenhouse Gas Protocol<sup>11</sup> are now requiring emissions reporting using a dual reporting methodology where emissions are reported using a location-based method and a market-based method. This methodology allows organizations to provide transparency to the level of emissions reductions that have been achieved through carbon offsets and Renewable Energy Credits (RECs) versus more conventional emission reductions accounted for in the ICLEI protocol such as decreased grid-wide emissions factors, onsite renewable energy systems or energy efficiency improvements. Leading edge organizations such as Google and Microsoft are evaluating carbon emissions on a higher resolution time scale. Rather than looking at net annual emissions, emissions are being accounted for on an hourly basis. To support similar efforts, the Midwest Renewable Energy Tracking System (M-RETS) has enabled its system to integrate hourly values to associated RECs in 2019.<sup>12</sup>

As the Village looks to make investment decisions on projects that reduce total emissions on a wide variety of investments, from facility improvements to fleet electrification projects, adopting best practices in carbon accounting is necessary to enable a deeper understanding of how specific projects can provide meaningful impacts to the Village's carbon reduction goals. The GHG Protocol for Project Accounting may be another standard that provides guidance on such questions.<sup>13</sup>

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<sup>10</sup> [Greenhouse Gases at EPA | US EPA](#)

<sup>11</sup> <https://ghgprotocol.org/scope-2-guidance>

<sup>12</sup> <https://www.mrets.org/hourlydata/>

<sup>13</sup> <https://ghgprotocol.org/project-protocol>



## 5.0 Building Energy Use

### Building Benchmarking

Table 8 below highlights both the quantity and connection of utility meters for the Village of McFarland's portfolio of buildings. With the exception of three buildings at McDaniel Park, each individual building is served by a single electric and gas meter. Alliant and Madison Gas and Electric (MG&E) serve McFarland facilities with generally one utility serving both electric and gas. In two cases, Alliant and MG&E both provide utilities to a single facility.

**Table 8: Utility Meter Summary by Building**

| Building                             | Square Footage | Utility Company                             | Electric Meter              | Gas Meter |
|--------------------------------------|----------------|---------------------------------------------|-----------------------------|-----------|
| <b>Municipal Buildings</b>           |                |                                             |                             |           |
| McFarland Public Safety Center       | 58,000         | Alliant                                     | 1 meter                     | 1 meter   |
| McFarland Municipal Center           | 38,150         | Alliant                                     | 1 meter                     | 1 meter   |
| McFarland Public Works building      | 29,338         | Alliant                                     | 1 meter                     | 1 meter   |
| McFarland ED Locke Public Library    | 18,775         | Alliant                                     | 1 meter                     | 1 meter   |
| <b>Parks Department</b>              |                |                                             |                             |           |
| William McFarland Park Shelter       | 5,715          | Alliant – Natural gas<br>MG&E - Electricity | 1 meter                     | 1 meter   |
| Brandt Park Shelter                  | 4,238          | Alliant                                     | 1 meter                     | None      |
| McFarland Lewis Park Shelter         | 3,425          | Alliant                                     | 1 meter                     | 1 meter   |
| Egner Park Shelter <sup>14</sup>     | 0              | Alliant                                     | 1 meter                     | None      |
| McDaniel Park Shelters & Facilities  | 1,320          | Alliant                                     | 1 meter serving 3 buildings | None      |
| McFarland Dog Park Shelter           | 1,200          | Alliant                                     | 1 meter                     | None      |
| Farwell St Gazebo/Arnold Larson Park | 816            | Alliant                                     | 1 meter                     | None      |
| Bocce Courts                         | N/A            | MG&E                                        | 1 meter                     | None      |

<sup>14</sup> Egner Park Shelter and Well House #4 occupy the same building and share the same electric meter. Square footage for Egner Park Shelter was included with Well House #4

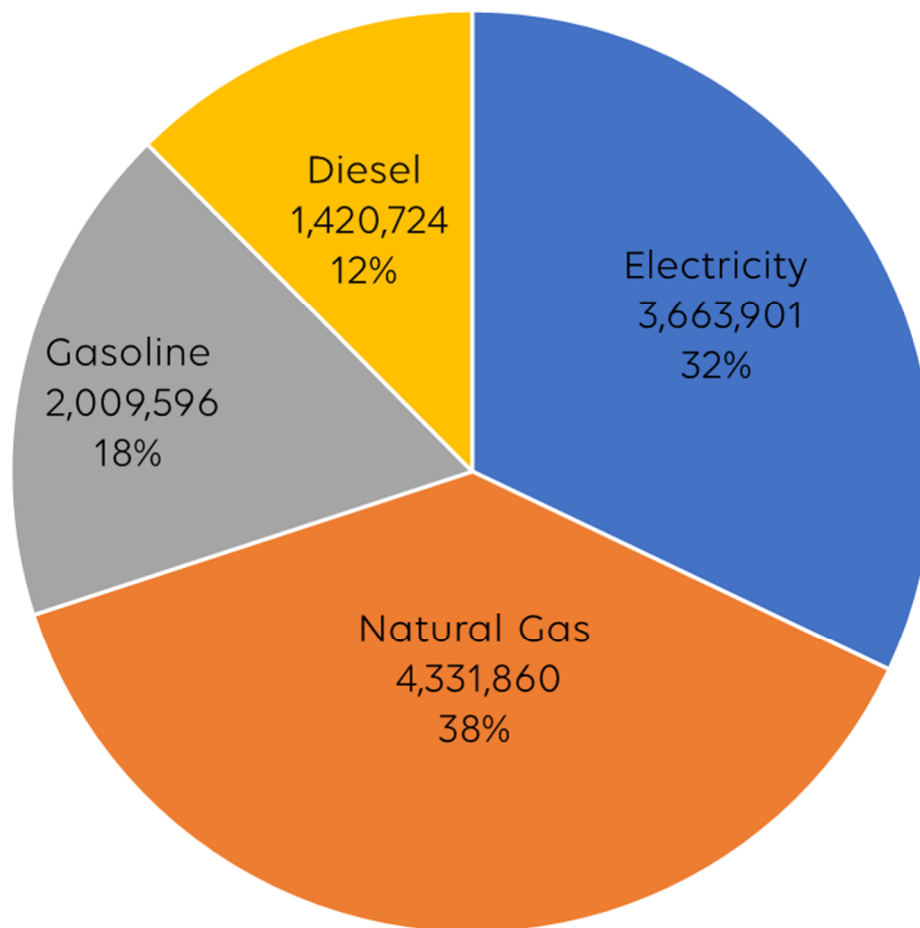
| Building                                     | Square Footage | Utility Company                             | Electric Meter | Gas Meter |
|----------------------------------------------|----------------|---------------------------------------------|----------------|-----------|
| <b>Well Houses</b>                           |                |                                             |                |           |
| Well House #1                                | 400            | Alliant                                     | 1 meter        | 1 meter   |
| Well House #3                                | 1,580          | Alliant                                     | 1 meter        | 1 meter   |
| Well House #4                                | 1,500          | Alliant                                     | 1 meter        | 1 meter   |
| <b>Lift Stations</b>                         |                |                                             |                |           |
| Lift Station #1                              | N/A            | Alliant – Electricity<br>MG&E – Natural gas | 1 meter        | 1 meter   |
| Lift Station #2                              | N/A            | Alliant                                     | 1 meter        | None      |
| Lift Station #3                              | N/A            | Alliant                                     | 1 meter        | None      |
| Lift Station #4                              | N/A            | Alliant                                     | 1 meter        | None      |
| Lift Station #5                              | 864            | MG&E                                        | 1 meter        | None      |
| <b>Water Towers</b>                          |                |                                             |                |           |
| Holscher Road Water Tower                    | 4,119          | Alliant                                     | 1 meter        | None      |
| Burma Road Water Tower                       | 2,297          | Alliant                                     | 1 meter        | None      |
| <b>Street Lighting</b>                       |                |                                             |                |           |
| US Highway 51 Lighting                       | N/A            | Alliant                                     | 1 meter        | None      |
| 6001 Exchange Street Lighting                | N/A            | Alliant                                     | 1 meter        | None      |
| Siren at Public Works Building               | N/A            | Alliant                                     | 1 meter        | None      |
| McFarland Gateway Sign                       | N/A            | MG&E                                        | 1 meter        | None      |
| Bashford Street Flasher                      | N/A            | Alliant                                     | 1 meter        | None      |
| 5204 Farwell Street Flasher                  | N/A            | Alliant                                     | 1 meter        | None      |
| 4905 Farwell Street Flasher                  | N/A            | Alliant                                     | 1 meter        | None      |
| Creamery Rd Flasher                          | N/A            | Alliant                                     | 1 meter        | None      |
| McFarland Municipal Center - Street lighting | N/A            | MG&E                                        | 1 meter        | None      |

**Table 9: 2022 Village of McFarland Building Utility Consumption**

| Metric                                                                               | Site Energy       | Cost      |
|--------------------------------------------------------------------------------------|-------------------|-----------|
| Electricity – Consumed kWh                                                           | 1,106,857 kWh     | \$139,528 |
| Electricity – Generated kWh                                                          | 33,029 kWh        | \$3,632   |
| Natural Gas Therms                                                                   | 43,329 Therms     | \$37,088  |
| Total Calculated <u>Source</u><br>CO <sub>2</sub> Emissions (lbs/year) <sup>15</sup> | 1,684,911 Lbs CO2 | N/A       |

Figure 8 shows the percent of energy consumption by fuel type by converting each fuel to a common unit - kBtu

**Figure 8: kBtu Energy Consumption and Percent by Fuel Type**



<sup>15</sup> This total does not include the carbon emission for gasoline and diesel powered vehicles

## Energy and Emissions Information

### Electricity

McFarland is served by both Alliant Energy and MG&E for electricity, depending on the building. Carbon emissions factors were calculated using the 2021 recorded carbon intensity per kWh for the state of Wisconsin from EPA.gov (1,246 lbs/MWh) and determining a linear relationship from 2021 to the 2024 carbon intensity forecast for the state of Wisconsin from the National Renewable Energy Lab (NREL) Cambium forecasting tool for AER load CO<sub>2</sub> emissions from combustion (800.9 lbs/MWh). The idealized linear emissions reduction between 2021 and 2024 allowed for a calculated 2022 emissions factor of 1,097.6 pounds per MWh.

**Table 10: Electricity Carbon Emissions Factors**

| Year                                | Carbon Emissions (lbs/MWh) |
|-------------------------------------|----------------------------|
| 2021 Actual – EIA.gov <sup>16</sup> | 1,246                      |
| 2024 Predicted – NREL <sup>17</sup> | 800.9                      |
| <b>2022 Report Year Estimated</b>   | <b>1,097.6</b>             |

For the purposes of the study, the utility emissions factor for electricity generation was required to be forecast over a 12-year period to 2035. Predicted emissions data from NREL for the state of Wisconsin for average emission rate (AER) load CO<sub>2</sub> emissions from combustion based on the 95% decarbonization by 2050 scenario. Predicted data from NREL is available in two-year increments from 2024 through 2030 and then in 5-year increments from 2030 through 2050.

**Table 11: NREL Cambium 95% Decarbonization by 2050 Predicted Emissions Factors by Year**

| Year | Carbon Emissions (lbs/MWh) | Carbon Emissions (lbs/kWh) |
|------|----------------------------|----------------------------|
| 2021 | 1,246.0                    | 1.2460                     |
| 2024 | 800.9                      | 0.8009                     |
| 2026 | 605.4                      | 0.6054                     |
| 2028 | 389.6                      | 0.3896                     |
| 2030 | 273.6                      | 0.2736                     |
| 2035 | 235.9                      | 0.2359                     |
| 2040 | 183.2                      | 0.1832                     |

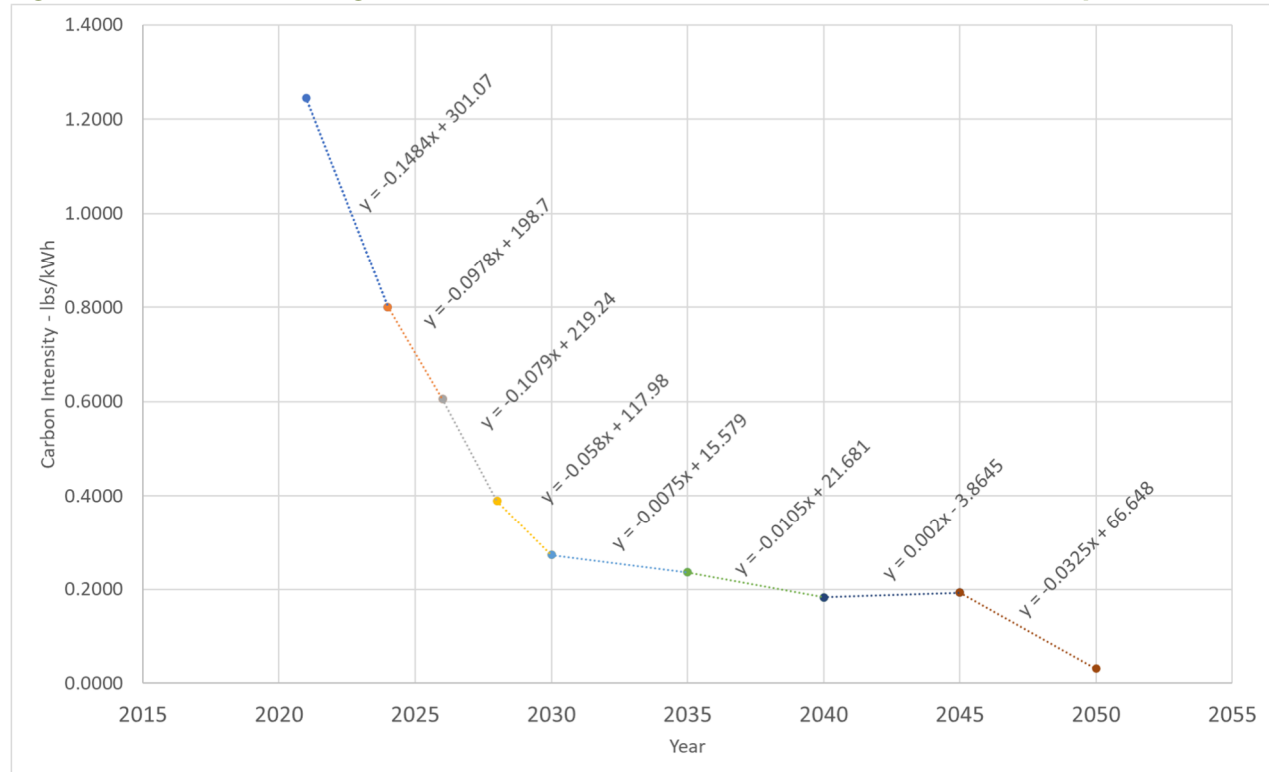
<sup>16</sup> <https://www.eia.gov/electricity/state/wisconsin/>

<sup>17</sup> <https://scenarioviewer.nrel.gov/?project=82460f06-548c-4954-b2d9-b84ba92d63e2&mode=view&layout=Default>

| Year | Carbon Emissions<br>(lbs/MWh) | Carbon Emissions<br>(lbs/kWh) |
|------|-------------------------------|-------------------------------|
| 2045 | 193.1                         | 0.1931                        |
| 2050 | 30.6                          | 0.0306                        |

For the analysis, the consultant found a linear equation defining the relationship between each increment of predicted data shown in Figure 9.

**Figure 9: Carbon Forecasting lbs/kWh - eGrid and Cambium Sources - Linear Relationships**



The linear equations were then used to estimate the carbon factors for years between the provided NREL increments shown Table 12 below through the year 2035.

**Table 12: Actual, Predicted, and Estimated Carbon Emissions by Year through 2035**

| Year | Carbon Emissions<br>(lbs/kWh) | Notes                     |
|------|-------------------------------|---------------------------|
| 2021 | 1.246                         | EIA Actual emissions data |
| 2022 | 1.0976                        | HGA Estimated             |
| 2023 | 0.9493                        | HGA Estimated             |
| 2024 | 0.8009                        | NREL Predicted data       |
| 2025 | 0.7032                        | HGA Estimated             |
| 2026 | 0.6054                        | Predicted data            |

| Year | Carbon Emissions<br>(lbs/kWh) | Notes               |
|------|-------------------------------|---------------------|
| 2027 | 0.4975                        | HGA Estimated       |
| 2028 | 0.3896                        | NREL Predicted data |
| 2029 | 0.3316                        | HGA Estimated       |
| 2030 | 0.2736                        | NREL Predicted data |
| 2031 | 0.2661                        | HGA Estimated       |
| 2032 | 0.2585                        | HGA Estimated       |
| 2033 | 0.251                         | HGA Estimated       |
| 2034 | 0.2434                        | HGA Estimated       |
| 2035 | 0.2359                        | NREL Predicted data |

Table 13 summarizes the Alliant Energy and MG&E electric rate structures used by the Village of McFarland.

**Table 13: Alliant Energy and MG&E Electric Rate Structure Summary<sup>18</sup>**

| Rate Structure                     | Facility Charge (Per Day)                  | Customer Demand Charge \$/kW | Demand Time Period (ON Peak)*                                                                       | Energy Charge \$/kWh                                                                                                   |
|------------------------------------|--------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Alliant Energy</b>              |                                            |                              |                                                                                                     |                                                                                                                        |
| <b>CG-2 TOD</b>                    | \$1.15                                     | \$2.20                       | High Rate (Summer) 11 a.m. to 7 p.m. High Rate (Winter) 5 p.m. to 9 p.m. Low Rate 11 p.m. to 6 a.m. | High Rate: \$0.08604<br>Regular Rate: \$0.06500<br>Low Rate: \$0.05190                                                 |
| <b>GS-1</b>                        | 1PH - \$0.5589<br>3PH - \$0.8384           | N/A                          | N/A                                                                                                 | \$0.12400                                                                                                              |
| <b>RG-1</b>                        | 1PH - \$0.4932<br>3PH - \$0.7398           | N/A                          | N/A                                                                                                 | \$0.13091                                                                                                              |
| <b>PGS-3 (Parallel Generation)</b> | 20kW-200kW - \$0.3205<br>>200kW - \$0.6411 | N/A                          | N/A                                                                                                 | High Rate: \$0.10280<br>Regular Rate: \$0.07680<br>Low Rate: \$0.05990<br><br>Sell Rate - \$0.11248 during high period |

<sup>18</sup> Wisconsin Electric Power Company WI Service Rates:  
<https://www.we-energies.com/pdfs/etariffs/wisconsin/elecateswi.pdf#pagemode>

| Rate Structure                  | Facility Charge (Per Day)                            | Customer Demand Charge \$/kW | Demand Time Period (ON Peak)* | Energy Charge \$/kWh |
|---------------------------------|------------------------------------------------------|------------------------------|-------------------------------|----------------------|
| <b>Madison Gas and Electric</b> |                                                      |                              |                               |                      |
| <b>CG-5</b>                     | \$0.78584                                            | N/A                          | N/A                           | \$0.13819            |
| <b>SL-1</b>                     | \$3.20 per lamp per month + addl. Based on lamp type | N/A                          | N/A                           | \$0.07280            |
| <b>SL-3</b>                     | \$3.20 per lamp per month + addl. Based on lamp type | N/A                          | N/A                           | \$0.07280            |

## Natural Gas

Similar to electricity, both Alliant Energy and MG&E serve natural gas to different buildings in the Village of McFarland. The emission factor for natural gas was 11.684 lbs/therm for both utilities.<sup>19</sup>

Table 14 summarizes the Alliant and MG&E natural gas rate structures used by the Village of McFarland

**Table 14: Alliant Energy and MG&E Natural Gas Rate Structure Summary<sup>20</sup>**

| Rate Structure        | Total Facility Charge Per Day | Energy Charge \$/Therm |
|-----------------------|-------------------------------|------------------------|
| <b>Alliant Energy</b> |                               |                        |
| <b>GG-1</b>           | \$0.4113                      | \$0.5942               |
| <b>GC-1F</b>          | \$0.4741                      | \$0.6364               |
| <b>GC-2F</b>          | \$3.00                        | \$0.7789               |
| <b>MG&amp;E</b>       |                               |                        |
| <b>GSD-1</b>          | \$0.80                        | \$0.2056               |

<sup>19</sup> <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

<sup>20</sup> Wisconsin Electric-Gas Operations Gas Service Rates:

[https://www.we-energies.com/pdfs/tariffs\\_volXVI/WEGOTariffbk\\_volXVI.pdf#pagemode](https://www.we-energies.com/pdfs/tariffs_volXVI/WEGOTariffbk_volXVI.pdf#pagemode)



## Energy Use Intensity

Energy use intensity is a metric to help understand energy consumption per square foot per year (kBtu/sq.ft./year). This is a useful metric because it allows comparison of relative energy performance between buildings of different sizes. Table 15 summarizes the energy use intensity for each building in McFarland portfolio organized from largest to smallest building by square footage for year 2022. Note that this table does not include any facilities or places which do not have a measurable square footage such as street lighting or most lift stations. The new McFarland Public Safety Center is not included in this list because an EUI is not able to be calculated for this facility, given that a full 12 months of energy use are not available yet. However, it is anticipated that as a net zero designed energy facility the EUI is zero or even negative!

**Table 15: Site Energy Use Intensity by Building and Fuel Type**

| <b>Building Name</b>                 | <b>Square Feet</b> | <b>Site Electric EUI (kBtu/SqFt/year)</b> | <b>Site Natural Gas EUI (kBtu/SqFt/year)</b> | <b>Total EUI (kBtu/SqFt/year)</b> |
|--------------------------------------|--------------------|-------------------------------------------|----------------------------------------------|-----------------------------------|
| McFarland Municipal Center           | 38,150             | 28.2                                      | 41.5                                         | 69.7                              |
| McFarland Public Works Building      | 29,338             | 4.1                                       | 25.0                                         | 29.1                              |
| McFarland E.D. Locke Public Library  | 18,775             | 35.1                                      | 83.4                                         | 118.6                             |
| William McFarland Park               | 5,715              | 9.0                                       | 21.3                                         | 30.3                              |
| Brandt Park                          | 4,238              | 8.0                                       | 0.0                                          | 8.0                               |
| Holscher Road Water Tower            | 4,119              | 0.4                                       | 0.0                                          | 0.4                               |
| McFarland Lewis Park                 | 3,425              | 7.0                                       | 31.5                                         | 38.4                              |
| Burma Road Water Tower               | 2,297              | 7.0                                       | 0.0                                          | 7.0                               |
| Well House #3                        | 1,580              | 269.6                                     | 47.5                                         | 317.1                             |
| Well House #4 / Egner Park Shelter   | 1,500              | 293.7                                     | 16.3                                         | 310.0                             |
| Egner Park Shelter <sup>21</sup>     | 0                  | N/A                                       | N/A                                          | N/A                               |
| McDaniel Park                        | 1,320              | 30.3                                      | 0.0                                          | 30.3                              |
| McFarland Dog Park (Urso Park)       | 1,200              | 197.2                                     | 0.0                                          | 197.2                             |
| Lift Station #5                      | 864                | 76.2                                      | 76.5                                         | 152.7                             |
| Farwell St Gazebo/Arnold Larson Park | 816                | 12.7                                      | 0.0                                          | 12.7                              |
| Well House #1                        | 400                | 403.8                                     | 137.5                                        | 541.2                             |

<sup>21</sup> Egner Park Shelter and Well House #4 occupy the same building and share the same electric meter. Square footage and EUI metrics for Egner Park Shelter were included with Well House #4.

## Energy Star Portfolio Manager

Energy Star Portfolio Manager (ESPM) is a free, EPA-created online tool which is commonly used by building owners to measure and track energy usage data for a single building or portfolio of buildings. That entered data can then be used to benchmark a building's energy performance and compare it against similar usage type buildings via the calculated Energy Utilization Index (EUI). The raw utility data from MG&E and Alliant data was provided by the Village of McFarland and entered in to ESPM.

Energy Star Portfolio Manager also provides an Energy Star Score for eligible building types. None of the buildings are eligible for an Energy Star Score currently. For the Library, Municipal Center, and Public Works Building, the building types selected for these properties are not eligible for an Energy Star Score because there is only short list of 20 different building types available for an Energy Star Score<sup>22</sup>. Utility bill tracking and an EUI calculation are still available for these building, just not the Energy Star Score. The Public Safety Center does not have a full 12 months of energy use data yet, so an Energy Star Score is not available for this building at this time either. Table 16 shows the building, Energy Star Building Type, and Energy Star EUI for all properties entered into Energy Star Portfolio Manager.

**Table 16: Energy Star Portfolio Manager Detail Summary**

| Building                  | Energy Star Building Type | 2023 Energy Star Score | Energy Star Source EUI | Notes                                                 |
|---------------------------|---------------------------|------------------------|------------------------|-------------------------------------------------------|
| E.D. Locke Public Library | Library                   | N/A                    | 118.6                  | Building type not available for an Energy Star score. |
| Municipal Center          | Mixed Use Property        | N/A                    | 69.7                   | Building type not available for an Energy Star score. |
| Public Safety Center      | Fire Station              | N/A                    | N/A                    | Not enough energy data for Energy Star Score          |
| Public Works Building     | Public Service - Other    | N/A                    | 29.8                   | Building type not available for an Energy Star score. |

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<sup>22</sup> List of building types available for an Energy Star Score - [https://www.energystar.gov/buildings/benchmark/understand\\_metrics/score\\_details](https://www.energystar.gov/buildings/benchmark/understand_metrics/score_details)

## 6.0 Building Equipment Surveys and Recommendations

The following section provides a brief description of each building's energy systems, outlines key recommendations and includes references to other relevant documents and report. The proposed Energy Conservation Measures (ECM's) for each building are mentioned for each building section. Some select village wide ECMs are mentioned below. Costs and savings of specific measure are included in Table 48.

### McFarland Public Works

**Table 17– Energy Efficiency Opportunities for McFarland Public Works**

| Property                               | Energy Efficiency Opportunity                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>McFarland Public Works Building</b> | <ul style="list-style-type: none"><li>• Replace any linear fluorescent lights with LED lights.</li></ul>                                                                                                                                                                                                                                                             |
| <b>Well House 1</b>                    | <ul style="list-style-type: none"><li>• Replace any linear fluorescent lights with LED lights.</li></ul>                                                                                                                                                                                                                                                             |
| <b>Well House 3</b>                    | <ul style="list-style-type: none"><li>• Replace any linear fluorescent lights with LED lights.</li><li>• Review temperatures and control strategies of AC and heating equipment to ensure the space is not being overcooled in the summer when not necessary and space is heated adequately to prevent pipe freezing but not over-heating space in winter.</li></ul> |
| <b>Well house 4</b>                    | <ul style="list-style-type: none"><li>• Replace any linear fluorescent lights with LED lights.</li><li>• Review temperatures and control strategies of AC and heating equipment to ensure the space is not being overcooled in the summer when not necessary and space is heated adequately to prevent pipe freezing but not over-heating space in winter.</li></ul> |
| <b>Lift Station 5</b>                  | <ul style="list-style-type: none"><li>• Replace any linear fluorescent lights with LED lights.</li><li>• Review temperatures and control strategies of heating equipment to ensure the space is heated adequately to prevent pipe freezing but not over-heating space in winter.</li></ul>                                                                           |

**Table 18– Renewable Energy Opportunities for McFarland Public Works**

| Property                               | Renewable Opportunity                                                                                                |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>McFarland Public Works Building</b> | <ul style="list-style-type: none"><li>• Additional Solar PV on roof</li></ul>                                        |
| <b>Well House 1</b>                    | <ul style="list-style-type: none"><li>• None</li></ul>                                                               |
| <b>Well House 3</b>                    | <ul style="list-style-type: none"><li>• Solar PV on roof. Flat roof could be a good candidate for solar PV</li></ul> |
| <b>Well house 4</b>                    | <ul style="list-style-type: none"><li>• Solar PV in the field South of the shelter. Solar PV on roof.</li></ul>      |
| <b>Lift Station 5</b>                  | <ul style="list-style-type: none"><li>• Potential for solar PV on roof.</li></ul>                                    |

## McFarland Public Works Building- 5115 Terminal Dr, McFarland, WI 53558

This facility consists of one main building with office and vehicle storage, repair, and shop space. The large interior vehicle storage, repair, and shop space is heated with one gas fired make-up-air unit and ceiling mounted radiant heaters. The office space makes up approximately 15% of the building's square footage. This area is heated and cooled with two residential style central AC and furnaces which were recently replaced. There are three additional buildings on this site which are only used for storage and are not heated or cooled. There is an existing 23 kW DC solar PV array on the roof of the main building which produced approximately 33,000 kWh of electricity in 2022 which is about 48% of the total electric consumption of the facility. The existing PV array only occupies a small portion of the roof so adding additional solar PV at this facility could allow this facility to produce more electricity on-site than it consumes.

**Figure 10: McFarland Public Works Building**



**Table 19: Public Works Building Summary**

| <b>System</b>                                           | <b>Description</b>                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Building Schedule</b>                                | 6:00am – 5:00pm on weekdays, varies by week based on public works project and seasonal fluctuations.                                                                                                                                                                                                  |
| <b>HVAC Systems</b>                                     | Office – central AC with gas heat<br><br>Vehicle storage, repair, shop – Gas fired make-up air unit and gas fired radiant heaters. Make-up air unit is manually timer operated. No AC unit.<br><br>Storage buildings - None                                                                           |
| <b>Interior - Lighting and Lighting Control Systems</b> | Vehicle storage, repair, shop – linear fluorescent lighting with occupancy sensor controls. The Director of Public Works noted that the lights in this area were not quite adequate when the garage doors are closed.<br><br>Office – Linear LED lights with occupancy sensor controls in all spaces. |
| <b>Exterior - Lighting and Lighting Control Systems</b> | Exterior lights appeared to be LED but not able to confirm. Lights are all operated by dusk-to-dawn photocell sensors.                                                                                                                                                                                |
| <b>Domestic Hot Water</b>                               | Natural gas hot water serves the restroom sinks in the shop area.                                                                                                                                                                                                                                     |
| <b>Planned changes to facility</b>                      | Looking to extend the vehicle storage, repair, shop further west which likely won't happen for 5 or more years.                                                                                                                                                                                       |



## Well House #1 - 5412 Long St, McFarland, WI 53558

This is a small brick single room building which houses the pump. This is the smallest pump and smallest well house that McFarland operates. This well house may be decommissioned in 2026 after the Village builds a new Well House #5 (6040 Prairie Wood Drive) in 2025.

**Figure 11: Well House #1**



**Table 20: Well House #1 Summary**

| System                                                  | Description                                                                                                                           |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Building Schedule</b>                                | N/A. This building is visited generally weekly for routine check-up and when maintenance is needed. No staff are permanently on-site. |
| <b>HVAC Systems</b>                                     | Gas fired unit heater, ventilation fan, no AC                                                                                         |
| <b>Interior - Lighting and Lighting Control Systems</b> | Manually operated linear fluorescent lights.                                                                                          |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED fixtures with dusk-to-dawn photocell control                                                                                      |
| <b>Domestic Hot Water</b>                               | None                                                                                                                                  |
| <b>Planned changes to facility</b>                      | None                                                                                                                                  |

## Well House #3- 5001 N Autumn Ln, McFarland, WI 53558

This is a small brick two-room building which houses the pump in one room and is used for general public works storage in the other room. This is the largest and most frequently visited well house because of the on-site storage that is often accessed.

**Figure 12: Well House #3**



**Table 21: Well House #3 Summary**

| System                                                  | Description                                                                                                                                              |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Building Schedule</b>                                | N/A. This building is visited generally weekly for routine check-up and when maintenance is needed. No staff are permanently on-site.                    |
| <b>HVAC Systems</b>                                     | Gas fired unit ducted central heat for the main pump room, ventilation fan, window AC unit in this room. Secondary storage room is not heated or cooled. |
| <b>Interior - Lighting and Lighting Control Systems</b> | Manually operated linear fluorescent lights with occupancy sensor.                                                                                       |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED fixtures with dusk-to-dawn photocell control                                                                                                         |
| <b>Domestic Hot Water</b>                               | None                                                                                                                                                     |
| <b>Planned changes to facility</b>                      | None                                                                                                                                                     |

### Well House #4- 5703 Bird Song Ct, McFarland, WI 53558

This is a small brick three-room building with wood siding which houses the pump in one room, chemical storage in another room, and a water testing room in the last room. This building is located at Egner Park and has an awning on one side for use as a park shelter. The interior and exterior of the building are showing some signs of wear.

**Figure 13: Well House #4**



**Table 22: Well House #4 Summary**

| System                                                  | Description                                                                                                                           |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Building Schedule</b>                                | N/A. This building is visited generally weekly for routine check-up and when maintenance is needed. No staff are permanently on-site. |
| <b>HVAC Systems</b>                                     | Gas fired unit heaters in the pump and water sampling room and an electric unit heater in the chemical storage room.                  |
| <b>Interior - Lighting and Lighting Control Systems</b> | Manually operated linear fluorescent lights with occupancy sensor.                                                                    |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED fixtures with dusk-to-dawn photocell control                                                                                      |
| <b>Domestic Hot Water</b>                               | None                                                                                                                                  |
| <b>Planned changes to facility</b>                      | None                                                                                                                                  |



## Lift Station 5- 5541 Holscher Rd, McFarland, WI 53558

This is a small brick two-room building which houses lift station controls and backup generator in one room and storage in the other room. This is a relatively new building.

**Figure 14: Lift Station #5**



**Table 23: Lift Station 5 Summary**

| System                                                  | Description                                                                                                                           |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Building Schedule</b>                                | N/A. This building is visited generally weekly for routine check-up and when maintenance is needed. No staff are permanently on-site. |
| <b>HVAC Systems</b>                                     | Gas fired unit heaters                                                                                                                |
| <b>Interior - Lighting and Lighting Control Systems</b> | Manually operated linear fluorescent lights with occupancy sensor.                                                                    |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED fixtures with dusk-to-dawn photocell control                                                                                      |
| <b>Domestic Hot Water</b>                               | Small electric instantaneous hot water heater serves a single sink.                                                                   |
| <b>Planned changes to facility</b>                      | None                                                                                                                                  |

## McFarland E.D. Locke Public Library

The E.D. Locke Public Library is a single-story 18,775 sq.ft. standalone building that was built in 2005. It is served by Alliant for both electricity and natural gas. The Library employs 15 both full and part time employees. Staff generally arrive 7:30-8:00am most days and leave approximately 15 minutes after close.

A few near-term opportunities for energy efficiency were identified at the Library, but the bulk of the recommended changes expected to take place happen when major renovations are expected to take place in approximately 10 years. Future plans for this building are to add an additional story to the building which will require a major overhaul of the HVAC system. At this time, it is recommended to switch this facility to geothermal heating and cooling and eliminate natural gas usage which would have the largest impact on building energy use and carbon footprint.

It is recommended that this work be completed prior to the expiration of the Inflation Reduction Act which is planned for 2032, in order to reduce the overall project costs for the Village. Additionally, all the work associated with the new proposed Community Center should plan for a future Library expansion and associated geothermal field.

**Table 24: Energy Efficiency Opportunities at McFarland Public Library**

|                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>E.D. Locke Public Library</b>                     | <ul style="list-style-type: none"><li>• Retrocommissioning effort for the HVAC building automation system and lighting control system.<ul style="list-style-type: none"><li>◦ Verify all equipment including control valves, pumps, and other HVAC equipment are functioning optimally.</li><li>◦ Implement temperature setback schedules.</li><li>◦ Implement outdoor air schedules to reduce or eliminate outdoor air from being brought in when the building is unoccupied.</li><li>◦ Review sequences of operation to ensure that equipment is scheduled and operate in optimal ways for energy conservation.</li></ul></li><li>• Add daylighting control to automatically dim lights near windows when enough natural light is available.</li><li>• Replace windows with high efficiency low-E glazing</li></ul> |
| <b>Future plans and recommended facility changes</b> | <ul style="list-style-type: none"><li>• Expand Library by adding a second story</li><li>• Eliminate natural gas use for domestic hot water</li><li>• Replace all existing HVAC system with geothermal heating and cooling</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

**Table 25: Renewable Energy Opportunities at McFarland Public Library**

|                                  |                                                                                                                                  |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>E.D. Locke Public Library</b> | <ul style="list-style-type: none"> <li>Solar PV on roof. Roof could support up to approximately 101.5 kW of solar PV.</li> </ul> |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------|

**Figure 15: E.D. Locke Public Library**



**Table 26: E.D. Locke Public Summary**

| System                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>Building Schedule</b> | Monday - Thursday                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9:00am – 8:00pm  |
|                          | Friday - Saturday                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 9:00am – 5:30pm  |
|                          | Sunday                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 12:00pm – 4:00pm |
| <b>HVAC Systems</b>      | <ul style="list-style-type: none"> <li>Two air handling units and two separate condensing units original to the facility.</li> <li>Cooling is DX expansion and heating is through a combination of in-floor radiant heat and VAVs with hot water reheat.</li> <li>Approximately 20 VAV boxes serve the facility.</li> <li>Hot water is supplied by two natural gas boilers which were installed in May 2023.</li> <li>At the same time as the boiler upgrades, a new relief air system was installed which operates dampers in a plenum space to relieve excess building pressure. JDR Engineers and JM Brennan completed this work.</li> <li>No dehumidification system is currently operating. One is installed but has been disconnected because it no longer works likely due to calcification from hard water being used.</li> <li>One air handling unit is suspended from the ceiling which make maintenance access difficult. The other AHU is located on a mezzanine level which also make access for repair or potential replacement a challenge.</li> </ul> |                  |

| System                                                  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | <ul style="list-style-type: none"> <li>The HVAC system is scheduled to run 24 hours per day to maintain a constant setpoint. No schedules or reset controls based on occupancy have been implemented.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Interior - Lighting and Lighting Control Systems</b> | <ul style="list-style-type: none"> <li>These are a mixture of linear LED troffer fixtures, suspended linear LED fixtures, LED pendant lights, and compact fluorescent can lights.</li> <li>Interior lights are on a building automation system with the ability to set schedules.</li> <li>Occupancy sensor controls are also in a handful of areas of the building. The Library Director reported that the lighting automated control system and occupancy sensor controls were not in use, however, and instead the lights are operated manually by staff and are turned on when they arrive and turned off when they leave for the day.</li> </ul>                                                                              |
| <b>Exterior - Lighting and Lighting Control Systems</b> | <ul style="list-style-type: none"> <li>Exterior lighting includes LED parking lot lights, pathway lighting, and architectural lighting and is controlled by the building-wide lighting automation system. Photo sensor controls exterior lights on from dusk to dawn.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Domestic Hot Water</b>                               | <ul style="list-style-type: none"> <li>Natural gas hot water heater was installed in 2019.</li> <li>A water softener is used for all domestic hot water.</li> <li>There is no hot water recirculation and the Library Director noted that it takes a very long time for hot water to reach faucets on the far end of the facility relative to the water heater.</li> </ul>                                                                                                                                                                                                                                                                                                                                                         |
| <b>Planned changes to facility</b>                      | <ul style="list-style-type: none"> <li>A rough 10-year plan is being designed to expand the Library. This expansion would likely be done by adding a second story.</li> <li>In the shorter term, new windows are desired by the facility. The existing windows are not low-E and allow allot of solar heat gain in certain areas of the facility. Condensation is noted inside on some of the windows in winter. The windows are also causing book tags and furniture near the window to fade in the sunlight. The existing windows are original to the facility, so they are approaching 20 years old.</li> <li>The roof is original to the building and is being repaired in the near future – exact timeline unknown</li> </ul> |



## McFarland Parks

Table 27 outlines all possible opportunities for energy savings at each park.

**Table 27: Energy Efficiency Opportunities at McFarland parks**

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>McDaniel Park</b>                         | <ul style="list-style-type: none"> <li>Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers)</li> </ul>                                                                                                                                                                                                                                                                                             |
| <b>Brandt Park</b>                           | <ul style="list-style-type: none"> <li>Replace any linear fluorescent lights with LED lights</li> <li>Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers)</li> </ul>                                                                                                                                                                                                                              |
| <b>William McFarland Park</b>                | <ul style="list-style-type: none"> <li>Reduce hot water temp if temp exceeds 130F</li> <li>Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers).</li> <li>Add temperature setbacks to thermostat schedules when the building is unoccupied</li> <li>Add lockout controls to prevent the HVAC system from running in the main area of the building when the large garage doors are open.</li> </ul> |
| <b>McFarland Dog Park (Urso Park)</b>        | <ul style="list-style-type: none"> <li>Verify thermostat settings on the electric unit heaters in each room. These are believed to drive the majority of the electricity use at the facility.</li> <li>Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers)</li> </ul>                                                                                                                             |
| <b>Highland Oaks Park</b>                    | <ul style="list-style-type: none"> <li>None</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>McFarland Lewis Park</b>                  | <ul style="list-style-type: none"> <li>Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers).</li> <li>Add temperature setbacks to thermostat schedules when the building is unoccupied.</li> </ul>                                                                                                                                                                                                 |
| <b>Farwell St Gazebo/ Arnold Larson Park</b> | <ul style="list-style-type: none"> <li>Ensure that the electric unit heater in the storage building is either off if not needed or set to a minimum temperature needed to condition that space should that heater be used.</li> <li>Recommend not using the heater since the building is minimally insulated.</li> </ul>                                                                                                                                                                                         |

**Table 28: Renewable Energy Opportunities at McFarland parks**

|                                              |                                                                                                                                                                                         |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>McDaniel Park</b>                         | <ul style="list-style-type: none"><li>• Solar PV on main restroom/concession building roof</li><li>• Solar canopy on north end of park near Yahara bike trail</li></ul>                 |
| <b>Brandt Park</b>                           | <ul style="list-style-type: none"><li>• Solar PV on roof</li></ul>                                                                                                                      |
| <b>William McFarland Park</b>                | <ul style="list-style-type: none"><li>• Solar PV on roof</li></ul>                                                                                                                      |
| <b>McFarland Dog Park (Urso Park)</b>        | <ul style="list-style-type: none"><li>• Solar PV on roof</li></ul>                                                                                                                      |
| <b>Highland Oaks Park</b>                    | <ul style="list-style-type: none"><li>• Solar PV on roof. A modest sized solar PV system at this location would easily offset all annual electricity consumption at the park.</li></ul> |
| <b>McFarland Lewis Park</b>                  | <ul style="list-style-type: none"><li>• Solar PV on roof</li></ul>                                                                                                                      |
| <b>Farwell St Gazebo/ Arnold Larson Park</b> | <ul style="list-style-type: none"><li>• Limited roof area for solar PV. Possible room on site for a solar PV canopy if additional park shelter space is desired.</li></ul>              |

## McDaniel Park- 4806 McDaniel Ln, McFarland, WI 53558

This park houses one main restroom and concessions building and two park shelters. Both park shelters have power, but one of the shelter's power is capped and currently not in use. The other park shelter has lighting and a small number of electrical outlets. Exterior parking lot and pathway lighting is LED. In the winter, the park restroom and concession facility are closed.

**Figure 16: McDaniel Park Shelters**



**Table 29: McDaniel Park Summary**

| System                                                  | Description                                                                           |
|---------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Schedule</b>                                         | 6:00am – 10:00 PM daily, closed in winter                                             |
| <b>HVAC Systems</b>                                     | No heating or cooling at park, exhaust fans on occupancy sensor controls in restroom. |
| <b>Interior - Lighting and Lighting Control Systems</b> | LED lighting with occupancy sensor controls                                           |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED lighting with automatic dusk-to dawn control                                      |
| <b>Domestic Hot Water</b>                               | Electric hot water service for restroom and concession area                           |
| <b>Planned changes to facility</b>                      | Add electrical outlets and lighting to one existing park shelter                      |

## Brandt Park- 4601 Siggelkow Rd, McFarland, WI 53558

The facility houses one restroom, a concession area and two baseball diamonds with LED lighting, with a scheduled control system. The concession area was reported to be used frequently when the building is rented out by the public. The facility's exterior and interior has mostly LED lighting and the concession area has T8 linear fluorescent lighting. Park is closed for the winter.

**Figure 17: Brandt Park shelter and baseball diamond**



**Table 30: Brandt Park Summary**

| System                                                  | Description                                                                                                                                                           |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Schedule</b>                                         | 6:00am – 10:00 PM daily, closed in winter                                                                                                                             |
| <b>HVAC Systems</b>                                     | No heating or cooling at park.                                                                                                                                        |
| <b>Interior - Lighting and Lighting Control Systems</b> | LED lighting, with occupancy sensor controls in the restroom. T8 linear fluorescent in concession area.                                                               |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED lighting with automatic dusk-to-dawn control. LED lighting in baseball fields with a scheduled control system and manual overrides, and are on only during games. |
| <b>Domestic Hot Water</b>                               | Electric hot water service for restroom and concession area                                                                                                           |
| <b>Planned changes to facility</b>                      | Update to restrooms planned for 2024                                                                                                                                  |



## William McFarland Park- 4820 Marsh Rd, McFarland, WI 53558

The facility houses restrooms, storage area and a concessions area. The park includes unlit soccer fields and pickleball courts. There is LED lighting throughout interiors and exteriors, with lights in the pickleball courts. The park is open all winter.

**Figure 18: William McFarland Park shelter**



**Table 31: William McFarland Park Summary**

| System                                                  | Description                                                                                                                                                                                                    |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Schedule</b>                                         | 6:00am – 10:00 PM daily, park opened in winter                                                                                                                                                                 |
| <b>HVAC Systems</b>                                     | One air handling unit with DX cooling and gas fired heat. Thermostat is set to 72 in the summer and about 62 in the winter.                                                                                    |
| <b>Interior - Lighting and Lighting Control Systems</b> | LED lighting, with occupancy sensor controls in restrooms                                                                                                                                                      |
| <b>Exterior - Lighting and Lighting Control Systems</b> | Park LED lighting with automatic dusk-to dawn control. Pickleball court lighting is controlled by public when in use and are on a 30 minute increment timer. They can be turned on only from dusk until 9.45PM |
| <b>Domestic Hot Water</b>                               | Electric hot water service for restroom, storage, and concession area                                                                                                                                          |
| <b>Planned changes to facility</b>                      | A skate park is being added currently and will not require any additional power. The soccer fields to be converted to baseball diamonds but it is unknown if it will be powered.                               |

## McFarland Dog Park- 6201 Elvehjem Rd, McFarland, WI 53558

The facility houses a restroom and dog wash area. There are LED lights on the interior and exterior. The park is open in the winter. The park was reported to be one of the largest consumers of electricity of any of the park buildings even though it is one of the smallest.

**Figure 19: McFarland Dog Park shelter and parking lot**



**Table 32: McFarland Dog Park (Urso Park) Summary**

| System                                                  | Description                                                  |
|---------------------------------------------------------|--------------------------------------------------------------|
| <b>Schedule</b>                                         | 6:00am – 10:00 PM daily, park opened in winter               |
| <b>HVAC Systems</b>                                     | Electric unit heaters in the restrooms and dog wash area.    |
| <b>Interior - Lighting and Lighting Control Systems</b> | LED lighting with motion sensors.                            |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED lighting controlled with dusk-to dawn photocell sensors. |
| <b>Domestic Hot Water</b>                               | Electric hot water service for restrooms and dog wash area.  |
| <b>Planned changes to facility</b>                      | None                                                         |

## Highland Oaks Park- 5945 Osborn Dr, McFarland, WI 53558

This facility will be a new addition in 2024, therefore it isn't included in our list. Currently the site only houses a park and shelter that has no power and no electricity use. Restrooms and electricity service to be added to the new facility in 2024.

**Figure 20: Highland Oaks Park**



**Table 33: Highland Oaks Park Summary**

| System                                                  | Description                                                                                                                                                             |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Schedule</b>                                         | 6:00am – 10:00 PM daily                                                                                                                                                 |
| <b>HVAC Systems</b>                                     | None                                                                                                                                                                    |
| <b>Interior - Lighting and Lighting Control Systems</b> | None                                                                                                                                                                    |
| <b>Exterior - Lighting and Lighting Control Systems</b> | None                                                                                                                                                                    |
| <b>Domestic Hot Water</b>                               | None                                                                                                                                                                    |
| <b>Planned changes to facility</b>                      | Electricity and lighting will be added to the park shelter and a single stall restroom will be added in 2024. A new playground will also be installed at the same time. |



## Lewis Park Shelter- 5012 Highland Dr, McFarland, WI 53558

The facility houses restrooms, storage area, and a concession area. It includes LED lighting throughout all interiors and exteriors. The park and shelter are open all winter.

**Figure 21: McFarland Lewis Park**



**Table 34: McFarland Lewis Park Summary**

| System                                                  | Description                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Schedule</b>                                         | 6:00am – 10:00 PM daily, park opened in winter                                                                                                                                                                                                                                                                          |
| <b>HVAC Systems</b>                                     | No cooling.<br>Gas fired in floor heating throughout building.<br>One “air exchanger” used to bring in fresh air. This unit was off at the time of the site visit. The Park Superintendent noted that this “air exchanger” does not temper the air before fresh air enters space. Not able to verify during site visit. |
| <b>Interior - Lighting and Lighting Control Systems</b> | LED lighting, with occupancy sensors in restrooms                                                                                                                                                                                                                                                                       |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED lighting on exterior and parking lot, which are on dusk until dawn. There are six pole mounted lights in the field which are used for the ice rinks in the winter. These lights are only on in the winter from dusk until park close.                                                                               |
| <b>Domestic Hot Water</b>                               | Gas fired hot water heater serves restrooms.                                                                                                                                                                                                                                                                            |
| <b>Planned changes to facility</b>                      | None                                                                                                                                                                                                                                                                                                                    |

## Farwell St. Gazebo and Arnold Larson Park

The facility includes one main gazebo with pole mounted lights in the parking lot and along foot paths. There is also a large storage shed used by the parks department, which has power going to it, but the power was currently off at the entrance to the building. It is reported that the electricity/ lighting is rarely- if ever, turned on at the shed.

**Figure 22: Farwell St Gazebo/ Arnold Larson Park and shed**



**Table 35: Farwell St Gazebo/ Arnold Larson Park Summary**

| System                                                  | Description                                                                                                                                                                                                                                         |
|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Schedule</b>                                         | 6:00am – 10:00 PM daily                                                                                                                                                                                                                             |
| <b>HVAC Systems</b>                                     | A large electric resistance heater was in the storage shed but power to that building was not on at the time of the site visit.                                                                                                                     |
| <b>Interior - Lighting and Lighting Control Systems</b> | LED lighting throughout the whole gazebo                                                                                                                                                                                                            |
| <b>Exterior - Lighting and Lighting Control Systems</b> | LED lighting throughout parking lot, and footpath lighting. All lights are controlled by photocell sensors and run from dusk to dawn. This park is lit with Christmas lights during the winter. The controls strategy of these lights is not known. |
| <b>Domestic Hot Water</b>                               | None                                                                                                                                                                                                                                                |
| <b>Planned changes to facility</b>                      | A distant plan in the next five years or so is to add a restroom and electric outlets to the west side of the park. The electric outlets would be used by food trucks and vendors during street fairs and farmers market type events.               |

## 7.0 Proposed Net Zero Energy Community Center

The U.S. Department of Energy defines net zero energy as the following: “An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy”.

A comprehensive net zero energy predesign assessment of the current Municipal Center, which will become the new proposed Community Center, was completed by the consultant as part of a separate project. The complete report of results of this effort can be found in the “Village of McFarland New Community Net Zero Energy Predesign Report”. This report provides details of potential future expansion plans for this facility, upgrades to the HVAC system, adding solar PV, and other energy savings measures that would allow this building to achieve net zero status.

The results of this report were included in the list of energy savings measures and renewable energy projects that can move the Village of McFarland towards reducing its carbon footprint. The following tables summarize the results from this report.

The new proposed Community Center is expected to increase in size slightly, as shown in Table 35

**Table 35 : Municipal Center and New Community Center Square Footage**

| <b>Municipal Center Square Footage</b> | <b>New Community Center Square Footage</b> |
|----------------------------------------|--------------------------------------------|
| 38,150                                 | 42,822                                     |

The list of recommended improvements made to the building to achieve net zero are as follows.

- New glazing on whole facility.
- Additional wall insulation.
- Replace existing HVAC system with geothermal heating and cooling.
- Replace interior and exterior fluorescent lighting with LED lighting.
- Replace natural gas domestic hot water heaters with electric.
- Replace natural gas kitchen equipment with electric.
- Solar PV onsite energy generation

As shown in Table 36 , electricity consumption increases with the upgrades to the size of the facility and new mechanical systems. This would be completely offset by the on-site solar PV generation. Natural gas consumption was planned to be removed completely in the new Community Center which results in 100% gas savings. The resulting facility will have net zero carbon emissions associated with its operational energy!

**Table 36 : Current Municipal Center and new Community Center Energy Use**

| Fuel Type                     | Existing Public Safety Center | New Community Center | Savings       |
|-------------------------------|-------------------------------|----------------------|---------------|
| Electricity Consumption (kWh) | 315,680 kWh                   | 395,933 kWh          | -80,253 kWh   |
| Solar PV Generation (kWh)     | 0 kWh                         | 412,000 kWh          | 412,000 kWh   |
| Natural Gas (Therms)          | 15,823 Therms                 | 0 Therms             | 15,823 Therms |

## 8.0 Fleet Vehicles and Electrification

Electric vehicles are becoming increasingly popular as battery technology improves, charging infrastructure expands, and more makes and models are available. Upgrading to electric vehicles reduces the use of gasoline and can be charged using sustainable sources which could have a positive impact on the Village of McFarland's carbon footprint.

Limited information on annual mileage, how each vehicle is used, maintenance records, and planned future updates to the fleet were not known at the time of this report. A more in-depth study of the fleet and building infrastructure for electric vehicle charging should be conducted early in the process to a major shift to an electric vehicle fleet.

The Village of McFarland owns and operates a fleet of 51 gasoline and diesel-powered vehicles. McFarland owns and operates one electric vehicle for the Police Department. Two vehicles were removed from McFarland's inventory and two new vehicles were added in 2023. The average age across McFarland's range of vehicles is 9.25 years.

Table 36 details McFarland's vehicle inventory, assumed fuel type<sup>23</sup>, equipment age, and McFarland's acquisition year.

**Table 36: McFarland Vehicle Inventory**

| Description <sup>24</sup>                        | Fuel Type | Vehicle Year | Year Acquired |
|--------------------------------------------------|-----------|--------------|---------------|
| <b>Public Works</b>                              |           |              |               |
| 2013 Chevy Pick Up Truck                         | Gasoline  | 2013         | 2013          |
| 2014 7400 International - Dump/Plow-Patrol Truck | Diesel    | 2015         | 2014          |
| 2014 Ford F150 reg cab 4x2 pick up               | Gasoline  | 2014         | 2014          |

<sup>23</sup> Fuel type was not noted in the vehicle equipment list provided by The Village of McFarland. Fuel type was assumed based on the vehicle description.

<sup>24</sup> Vehicle descriptions were provided by the Village of McFarland.

| Description <sup>24</sup>             | Fuel Type   | Vehicle Year | Year Acquired |
|---------------------------------------|-------------|--------------|---------------|
| 2015 Ford F-150                       | Gasoline    | 2015         | 2015          |
| 2019 White Ford                       | Gasoline    | 2019         | 2019          |
| 2020 Ford F550 All Tech Bucket Truck  | Diesel      | 2020         | 2020          |
| 2020 INTL Blue Truck                  | Diesel      | 2020         | 2019          |
| 2020 White F250                       | Diesel      | 2020         | 2020          |
| 2020 White Ford Transit Van           | Gasoline    | 2020         | 2020          |
| 2022 Blue Tandem Axel Dump Truck INTL | Diesel      | 2022         | 2021          |
| 2022 White Pickup Truck               | Gasoline    | 2022         | 2022          |
| Chevrolet 4WD Pick-up                 | Gasoline    | 1996         | 1996          |
| DPW Patrol Truck                      | Gasoline    | 2012         | 2011          |
| DPW Pick-up Truck                     | Gasoline    | 2010         | 2011          |
| DPW Pick-up Truck                     | Gasoline    | 2007         | 2006          |
| Ford F-250 Pick Up                    | Diesel      | 2002         | 2002          |
| Ford F350 Pick Up                     | Diesel      | 2000         | 2000          |
| Ford F450                             | Diesel      | 2016         | 2016          |
| Ford Interceptor                      | Gasoline    | 2016         | 2016          |
| Ford Ranger 4 x 2 Pickup              | Gasoline    | 2003         | 2002          |
| Ford Ranger Pick Up                   | Gasoline    | 2008         | 2008          |
| Ford SUV                              | Gasoline    | 2016         | 2016          |
| International Thymco Street Sweep     | Diesel      | 2014         | 2014          |
| White Ford F250                       | Diesel      | 2022         | 2022          |
| White Ford F250 Pickup Truck          | Diesel      | 2023         | 2023          |
| International Truck                   | Diesel      | 2017         | 2017          |
| <b>Police Department</b>              |             |              |               |
| 2022 Ford Mach E                      | Electricity | 2022         | 2022          |
| 2013 Ford Explorer                    | Gasoline    | 2013         | 2013          |
| 2015 Ford Explorer                    | Gasoline    | 2015         | 2015          |
| 2023 Ford Silver Supercrew            | Gasoline    | 2023         | 2023          |
| Black Sport Utility Truck             | Gasoline    | 2022         | 2022          |
| Ford Explorer                         | Gasoline    | 2016         | 2015          |

| Description <sup>24</sup>                              | Fuel Type | Vehicle Year | Year Acquired |
|--------------------------------------------------------|-----------|--------------|---------------|
| Ford Explorer Detective Gray unmarked car              | Gasoline  | 2018         | 2018          |
| Ford Interceptor                                       | Gasoline  | 2016         | 2016          |
| Ford Police Interceptor                                | Gasoline  | 2020         | 2020          |
| Polaris Ranger UTV                                     | Gasoline  | 2017         | 2018          |
| <b>Fire Department</b>                                 |           |              |               |
| 2014 Pierce Tanker Fire Truck                          | Diesel    | 2015         | 2015          |
| 2022 Red Ford Expedition                               | Gasoline  | 2022         | 2022          |
| Antique Fire Truck                                     | Diesel    | 1942         | 1988          |
| Argo ATV11                                             | Gasoline  | 2007         | 2007          |
| Fire Truck Car 2                                       | Gasoline  | 2018         | 2018          |
| Fire Truck F250                                        | Diesel    | 2008         | 2008          |
| Ford Explorer                                          | Gasoline  | 2017         | 2017          |
| Ford Explorer                                          | Gasoline  | 2016         | 2016          |
| Pierce Pumper                                          | Diesel    | 2018         | 2018          |
| Pumper Fire Truck, Pierce                              | Diesel    | 2006         | 2006          |
| Red Ford Pierce Utility Fire Truck                     | Diesel    | 2020         | 2021          |
| Red/Black Aerial Ladder Fire Truck                     | Diesel    | 2022         | 2022          |
| <b>Emergency Services</b>                              |           |              |               |
| Ford F-550 Ambulance                                   | Diesel    | 2014         | 2015          |
| Ford F-550 Red Ambulance                               | Diesel    | 2019         | 2019          |
| <b>Community &amp; Economic Development Department</b> |           |              |               |
| Inspector vehicle                                      | Gasoline  | 2014         | 2014          |

Mileage and fuel consumption for individual vehicles was not provided, but the total annual purchased gasoline and diesel across the whole fleet made it possible to calculate the carbon footprint.

**Table 37: McFarland Fleet Fuel Consumption and Carbon Footprint**

| Fuel            | Gallons | kBtu      | Carbon Footprint (lbs) |
|-----------------|---------|-----------|------------------------|
| <b>Gasoline</b> | 16,717  | 2,009,596 | 327,524                |
| <b>Diesel</b>   | 10,341  | 1,420,724 | 232,095                |
| <b>Total</b>    | 27,058  | 3,430,320 | 559,619                |

**Table 38: Average Fuel Consumption per Vehicle**

| Fuel            | Gallons | Number of Vehicles | Average Gallons of Gasoline per year <sup>25</sup> |
|-----------------|---------|--------------------|----------------------------------------------------|
| <b>Gasoline</b> | 16,717  | 29                 | 576                                                |
| <b>Diesel</b>   | 10,341  | 21                 | 492                                                |

With the limited detail on each individual vehicle, the consultant identified possible vehicles suitable for electrification by looking at fuel type and intended purpose of each vehicle. For this study, only gasoline powered vehicles were identified as candidates for electrification. All passenger vehicles and light trucks (such as Ford Rangers) were selected as possible electrification candidates. Approximately half of the regular sized pickup trucks like the Ford F-150s were also identified as possible electrification candidates. As a result, 18 of the 29 gasoline powered vehicles were identified as electrification targets for this study.

No changes to the diesel fleet were planned during this study. Diesel vehicles are usually high specialized equipment with very specific uses that need to be closely studied to inform electrification recommendations. Information on the annual mileage, diesel consumption, and use cases for each vehicle would need to be gathered to calculate expected costs and carbon savings. With rapidly advancing battery technology and reduction in prices of electric vehicles, replacing diesel fleet vehicles may be possible within the window of the study of 2035. It is recommended to continually monitor the market offerings suitable large commercial electric vehicles intended to replace diesel vehicles that fit specific use cases.

The total pounds of carbon saved was estimated using the average annual gallons of fuel consumed per vehicle as shown below.

---

<sup>25</sup> This estimate assumes that all gasoline was used by vehicles listed on the fleet inventory list. This figure does not account for gasoline that is used in lawnmowers, generators, and other small engine equipment which was not included in the fleet inventory. It also does not include employee's use of personal vehicles for business travel that was reimbursed by the Village



**Table 39: Average Fuel Consumption per Vehicle**

| <b>Gasoline vehicles</b> | <b>Annual Gallons Gasoline Saved Per Vehicle</b> | <b>Total Gallons of Gasoline Saved</b> | <b>Total Pounds CO2 saved per year</b> |
|--------------------------|--------------------------------------------------|----------------------------------------|----------------------------------------|
| 18                       | 576                                              | 10,375.96                              | 203,291                                |

**Table 40: Vehicles Identified for Possible Electrification**

| <b>Vehicle Description</b>                             | <b>Vehicle Year</b> | <b>Vehicle Age (Years)</b> |
|--------------------------------------------------------|---------------------|----------------------------|
| <b>Public Works</b>                                    |                     |                            |
| 2013 Chevy Pick Up Truck                               | 2013                | 10                         |
| 2014 Ford F150 reg cab 4x2 pick up                     | 2014                | 9                          |
| 2015 Ford F-150                                        | 2015                | 8                          |
| 2022 White Pickup Truck                                | 2022                | 1                          |
| Chevrolet 4WD Pick-up                                  | 1996                | 27                         |
| DPW Patrol Truck                                       | 2012                | 11                         |
| Ford Ranger 4 x 2 Pickup                               | 2003                | 20                         |
| Ford Ranger Pick Up                                    | 2008                | 15                         |
| Ford SUV                                               | 2016                | 7                          |
| <b>Police Department</b>                               |                     |                            |
| 2013 Ford Explorer                                     | 2013                | 10                         |
| 2015 Ford Explorer                                     | 2015                | 8                          |
| Ford Explorer Detective Gray unmarked car              | 2018                | 5                          |
| Ford Interceptor                                       | 2016                | 7                          |
| Ford Police Interceptor                                | 2020                | 3                          |
| <b>Fire Department</b>                                 |                     |                            |
| Fire Truck Car 2                                       | 2018                | 5                          |
| Ford Explorer                                          | 2017                | 6                          |
| Ford Explorer                                          | 2016                | 7                          |
| <b>Community &amp; Economic Development Department</b> |                     |                            |
| Inspector vehicle                                      | 2014                | 9                          |

To estimate total electrified fleet mileage per year, the consultant assumed that all vehicles average 17.5<sup>26</sup> miles per gallon. With the previously calculated 576 average gallons used per vehicle at 17.5 miles per gallon, each vehicle was estimated to travel approximately 10,088 miles each, and 181,579 miles for all 18 electric vehicles.

**Table 41: Estimated Milage of Electrified Vehicles**

| Gasoline vehicles | Annual Gallons Gasoline Used Per Vehicle | Average MPG | Total Estimated Electrified Miles |
|-------------------|------------------------------------------|-------------|-----------------------------------|
| 18                | 576.44                                   | 17.5        | 181,579                           |

Adding 18 electric vehicles will increase to the total electrical consumption of the Village of McFarland. To estimate this added electrical load, the total estimated electrified miles (181,579) was divided by the average kWh per mile traveled of 0.36 kWh/mile<sup>27</sup> resulting in an increased annual electrical consumption of 65,369 kWh.

**Table 42: Estimated Milage of Electrified Vehicles**

| Total Estimated Electrified Miles | kWh/Mile | Total kWh Consumption of Electrified Fleet |
|-----------------------------------|----------|--------------------------------------------|
| 181,579                           | 0.36     | 65,369                                     |

**Table 43: Estimated Cost of Gas and Electric Vehicles**

| Vehicle Type               | Vehicles | Annual Consumption | Cost Per Unit                 | Annual Cost     |
|----------------------------|----------|--------------------|-------------------------------|-----------------|
| Gasoline                   | 18       | 181,579 gallons    | \$3.650 /gallon <sup>28</sup> | \$37,872        |
| Electric                   | 18       | 65,369 kWh         | \$0.126 / kWh                 | \$8,240         |
| <b>Annual Cost Savings</b> |          |                    |                               | <b>\$29,632</b> |

Upfront costs of electric vehicles are higher than traditional internal combustion vehicles. Additional costs associated with the charging infrastructure must also be considered when investing in an electric vehicle fleet. The Commercial Clean Vehicle Credit is available for non-tax paying entities and can reduce the upfront cost of each vehicle by \$7,500<sup>29</sup>. This premium cost of an electric vehicle compared to the cost of an internal combustion vehicle is called the

<sup>26</sup> Energy.gov – Average Fuel Economy by Major Vehicle Category - <https://afdc.energy.gov/data/10310>. Light truck/van MPG was used for all vehicles.

<sup>27</sup> EPA.gov - 36 kWh per 100 miles traveled = 0.36 kWh/mile <https://www.epa.gov/greenvehicles/comparison-your-car-vs-electric-vehicle#:~:text=For%20a%20E2%80%9Ctypical%20E2%80%9D%20electric%20vehicle,emission%20factor%20from%20eGRID%202020.>

<sup>28</sup> Current gas average for Wisconsin – updated 9-14-2023 - <https://gasprices.aaa.com/?state=WI>

<sup>29</sup> <https://www.irs.gov/credits-deductions/commercial-clean-vehicle-credit>

incremental cost. Table 44 shows the average cost of various internal combustion and electric vehicle types and the incremental cost of an electric vehicle from the Department of Energy.

**Table 44: Electric Vehicle Incremental Cost<sup>30</sup>**

| Vehicle Type | Conventional Internal Combustion Cost | Electric Vehicle Cost | EV Incremental Cost |
|--------------|---------------------------------------|-----------------------|---------------------|
| Midsize Car  | \$28,500                              | \$37,000              | \$8,500             |
| Midsize SUV  | \$33,500                              | \$47,500              | \$14,000            |
| Pickup Truck | \$36,000                              | \$55,500              | \$19,500            |

Another cost associated with investing in an electric vehicle fleet is the cost of the charging infrastructure. For the purposes of this study, the consultant estimated that one Level 2<sup>31</sup> charger would be installed per vehicle at a cost of \$5,000 each.

Table 45 summarizes the vehicle types, comparative costs of conventional internal combustion and electric vehicles and the total incremental cost of the electric vehicles. The EV vehicle and charging infrastructure cost includes a \$7,500 rebate through the Commercial Clean Vehicle Credit Program.

**Table 45: Electric Vehicle Fleet Cost By Department**

| Vehicle Description                | Vehicle Type | Conventional Internal Combustion Cost | EV Vehicle + Charging Infrastructure Cost | Total Incremental Cost |
|------------------------------------|--------------|---------------------------------------|-------------------------------------------|------------------------|
| <b>Public Works</b>                |              |                                       |                                           |                        |
| 2013 Chevy Pick Up Truck           | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |
| 2014 Ford F150 reg cab 4x2 pick up | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |
| 2015 Ford F-150                    | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |
| 2022 White Pickup Truck            | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |
| Chevrolet 4WD Pick-up              | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |
| DPW Patrol Truck                   | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |
| Ford Ranger 4 x 2 Pickup           | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |

<sup>30</sup> <https://www.energy.gov/sites/default/files/2022-12/2022.12.23%20Incremental%20Purchase%20Cost%20Methodology%20and%20Results%20for%20Clean%20Vehicles.pdf>

<sup>31</sup> <https://www.epa.gov/greenvehicles/plug-electric-vehicle-charging#:~:text=And%20Level%20is%20similar,and%20other%20high%2Dpowered%20appliances.&text=You%20can%20plug%20your%20car,PEV%20via%20the%20240V%20outlet.>

| Vehicle Description                                  | Vehicle Type | Conventional Internal Combustion Cost | EV Vehicle + Charging Infrastructure Cost | Total Incremental Cost |
|------------------------------------------------------|--------------|---------------------------------------|-------------------------------------------|------------------------|
| Ford Ranger Pick Up                                  | Pickup Truck | \$36,000                              | \$53,000                                  | \$17,000               |
| Ford SUV                                             | Midsize SUV  | \$33,500                              | \$45,000                                  | \$11,500               |
| <b>Public Works Total</b>                            |              | <b>\$321,500</b>                      | <b>\$469,000</b>                          | <b>\$147,500</b>       |
| <b>Police Department</b>                             |              |                                       |                                           |                        |
| 2013 Ford Explorer                                   | Midsize SUV  | \$33,500                              | \$45,000                                  | \$11,500               |
| 2015 Ford Explorer                                   | Midsize SUV  | \$33,500                              | \$45,000                                  | \$11,500               |
| Ford Explorer Detective Gray unmarked car            | Midsize Car  | \$28,500                              | \$34,500                                  | \$6,000                |
| Ford Interceptor                                     | Midsize SUV  | \$33,500                              | \$45,000                                  | \$11,500               |
| Ford Police Interceptor                              | Midsize SUV  | \$33,500                              | \$45,000                                  | \$11,500               |
| <b>Police Department Total</b>                       |              | <b>\$162,500</b>                      | <b>\$214,500</b>                          | <b>\$52,000</b>        |
| <b>Fire Department</b>                               |              |                                       |                                           |                        |
| Fire Truck Car 2                                     | Midsize Car  | \$28,500                              | \$34,500                                  | \$6,000                |
| Ford Explorer                                        | Midsize SUV  | \$33,500                              | \$45,000                                  | \$11,500               |
| Ford Explorer                                        | Midsize SUV  | \$33,500                              | \$45,000                                  | \$11,500               |
| <b>Fire Department Total</b>                         |              | <b>\$95,500</b>                       | <b>\$124,500</b>                          | <b>\$29,000</b>        |
| <b>Community and Economic Development Department</b> |              |                                       |                                           |                        |
| Inspector vehicle                                    | Midsize Car  | \$28,500                              | \$34,500                                  | \$6,000                |
| <b>Building Inspector Total</b>                      |              | <b>\$28,500</b>                       | <b>\$34,500</b>                           | <b>\$6,000</b>         |
| <b>Overall Total</b>                                 |              | <b>\$608,000</b>                      | <b>\$842,500</b>                          | <b>\$234,500</b>       |

## 9.0 Solar PV Study

During the site visits and from study of aerial photography, many Village buildings were identified as good candidates for rooftop solar PV. Other opportunities such as parking lot canopy or ground mount PV were identified at some sites as well. During the on-site visits at each site, consideration for various site conditions such as roof condition, aerial obstructions, and shading from trees and nearby buildings helped inform the recommendation for pursuing solar PV at each site.

**Helioscope is a solar PV modeling tool used to estimate PV size and potential annual production (kWh) where a 3D model of a solar PV system is built on top of a view from Google Maps. The model can include the building or structure, solar panels, and nearby shading objects such as trees and other buildings. This is a powerful design tool that was used to explore solar opportunities at all Village buildings.**

Figure 23 and Figure 24 are examples of the Helioscope models that were created for each site.

Table 46 Summarizes the total solar system sizes that were identified at all buildings owned by the Village of McFarland. Detail of each location and solar PV array is available in Table 47.

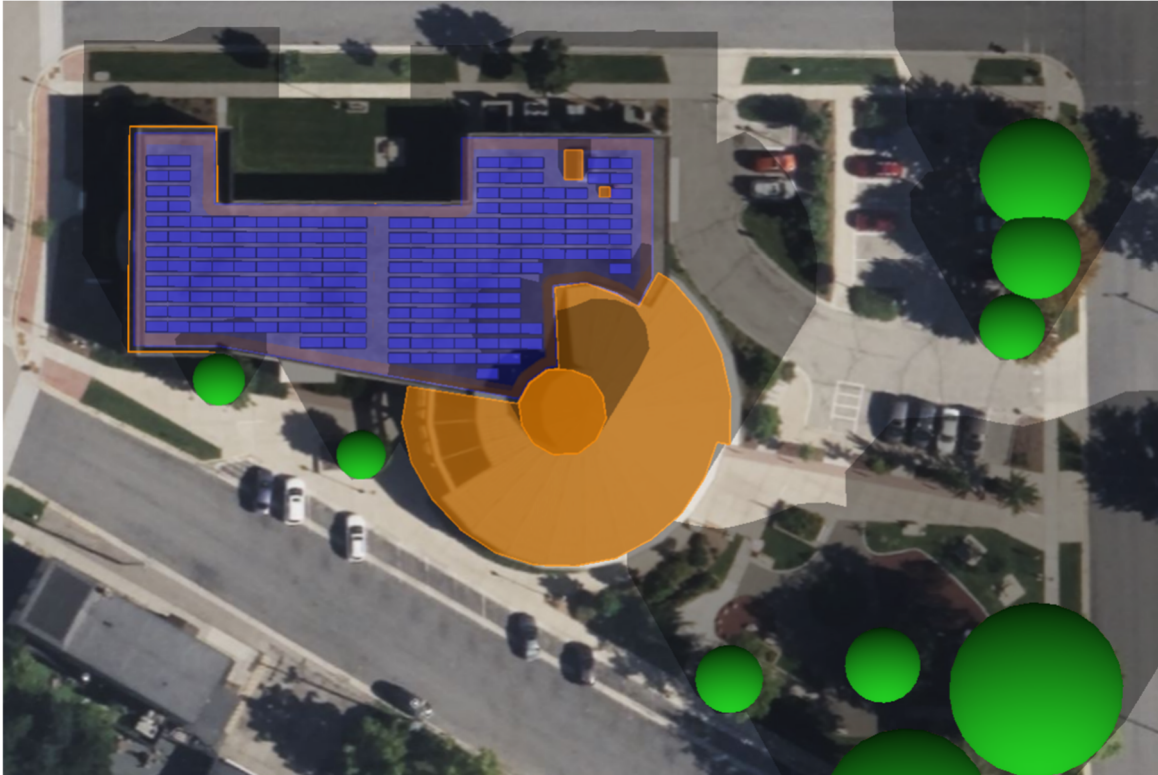
**Table 46: Total Solar Potential**

| Sum of All Solar Sizes (kW DC) | Annual Production (kWh) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|--------------------------------|-------------------------|------------------------|-------------------------------|------------------------|
| 598 kW                         | 795,500                 | \$926,855              | \$101,833.71                  | 10                     |

All facilities were analyzed for solar PV capacity. The E.D. Locke Public Library and the McFarland Dog park below are shown as examples of the types of analysis that went into each facility.

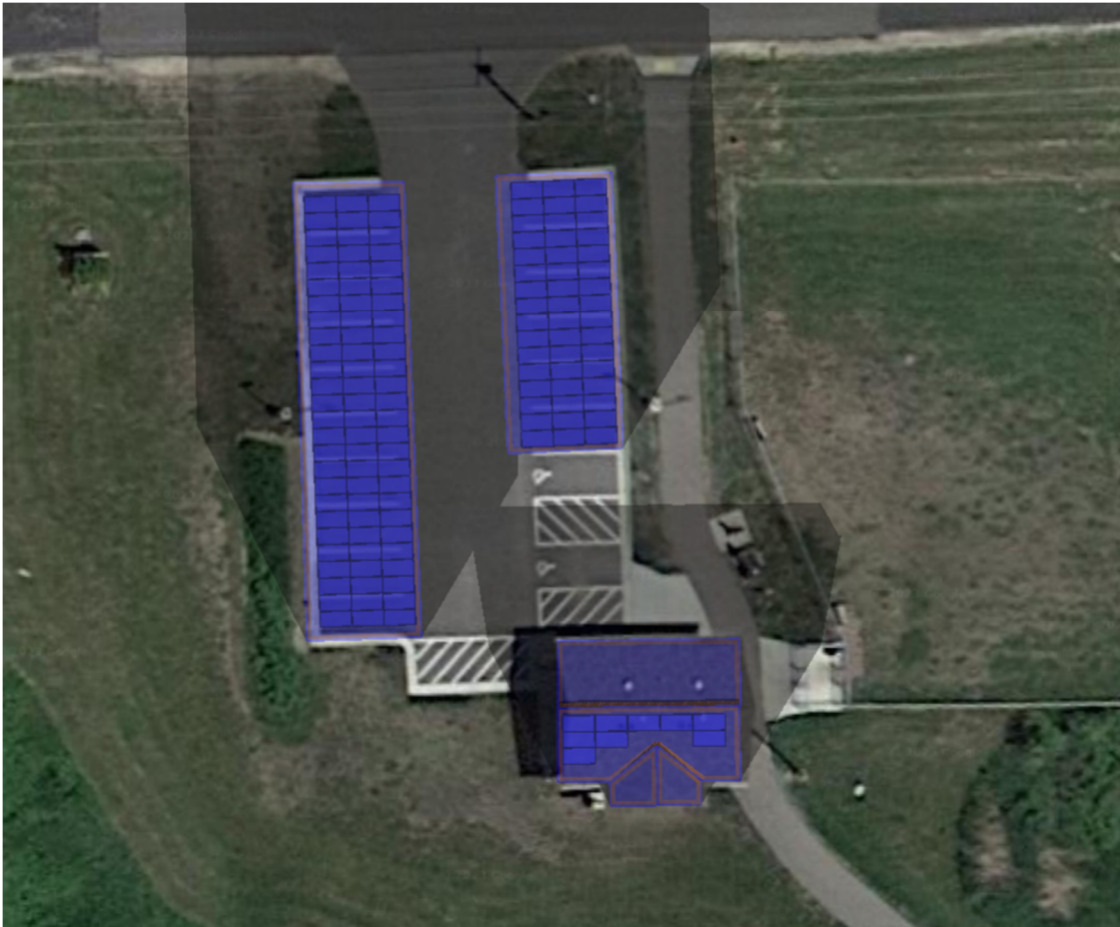
The E.D. Locke Public Library shows good potential for solar PV on the flat roof. The blue rectangles represent solar panels and the orange area is the front lobby which was modeled to identify any areas of shading this structure may produce on the solar panels to the North. The trees shown in green also were added for shading consideration.

**Figure 23: Helioscope Model of E.D. Locke Public Library**



The McFarland Dog Park offers just a small amount of area for solar PV on the existing structure but a site like this with a large, clear parking lot also offers the opportunity for carport solar PV. A system like this is often more expensive per Watt than roof mounted solar PV but comes with the added benefits of shading for cars in the summer and protection from snow on cars and the parking lot in the winter. Both of these perks suiting this park well which operates and is used all year round.

**Figure 24: Helioscope model of McFarland Dog Park**



On-site solar PV at sites like the ones that the Village of McFarland owns are typically installed in a configuration called “behind the meter” where the solar PV is tied directly into the main electrical panel at the facility which is located downstream from the utility meter. This configuration allows the electricity production to feed directly into the building offsetting electricity purchased from the grid. This configuration typically also allows excess electricity not used on-site to be sold back to the electricity company further offsetting that buildings consumption and overall electric bill.

Up front cost and anticipated payback period are important factors when considering on-site solar PV. A cost analysis was conducted to estimate initial up-front costs and payback period.



Solar PV system typically have a lifespan of 20 to 25 years, so a payback period of less than 15 years is typically most desirable. Costs were estimated at \$2.00 per Watt for roof mounted, and \$3.00 per watt for carport solar, but with the Inflation Reduction Act tax credits, this was reduced to \$1.49/Watt. And \$2.24/Watt respectively. This is from a 25.5% cost reduction that is available through the IRA, which includes a 30% cost reduction which is reduced to 25.5% if funding is through tax-exempt bonds. Most solar projects were planned around the 2025 to 2026 timeline except for the Library in which the PV was anticipated to be installed once the new second story addition is added. Solar PV projects were targeted early in the energy planning window because offsetting as much electricity from the grid prior to electrification projects is crucial for maximizing the carbon reduction early on. Electricity from the grid is relatively carbon intense, so before recommending switching from natural gas to electricity such as in the case of the Library and proposed new Community Center geothermal projects, it is ideal to receive as much electricity as possible from carbon-free sources such as solar PV.

**Table 47: Renewable Energy Generation Measures**

| Building                       | Proposed Implementation Year | Measure Description                                                                        | Savings (kWh) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|--------------------------------|------------------------------|--------------------------------------------------------------------------------------------|---------------|------------------------|-------------------------------|------------------------|
| <b>Parks Department</b>        |                              |                                                                                            |               |                        |                               |                        |
| McDaniel Park                  | 2026                         | Solar PV on main restroom/concession building roof – 13.0 kW DC                            | 14,700        | \$19,370               | \$2,137                       | 9                      |
| McDaniel Park                  | 2026                         | Solar canopy on north end of park near Yahara bike trail or parking lot canopy – 203 kW DC | 263,000       | \$302,470              | \$38,240                      | 8                      |
| Brandt Park                    | 2025                         | Solar PV on roof – 11.3 kW DC                                                              | 13,800        | \$16,837               | \$2,049                       | 8                      |
| William McFarland Park         | 2025                         | Solar PV on roof – 13.0 kW DC                                                              | 16,600        | \$19,370               | \$2,447                       | 8                      |
| McFarland Dog Park (Urso Park) | 2025                         | Solar PV on roof and parking lot canopy – 51.7 kW DC                                       | 58,400        | \$115,550              | \$7,414                       | 16                     |
| Lewis Park                     | 2025                         | Solar PV on roof – 5.7 kW DC                                                               | 7,540         | \$8,493                | \$1,186                       | 7                      |
| <b>Public Works</b>            |                              |                                                                                            |               |                        |                               |                        |

| Building                            | Proposed Implementation Year | Measure Description                                      | Savings (kWh) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|-------------------------------------|------------------------------|----------------------------------------------------------|---------------|------------------------|-------------------------------|------------------------|
| McFarland Public Works Building     | 2025                         | Additional Solar PV on roof – 69.7 kW DC                 | 78,700        | \$101,171              | \$4,477                       | 23                     |
| Well House #3                       | 2025                         | Solar PV on roof – 12.4 kW DC                            | 15,900        | \$18,476               | \$2,011                       | 9                      |
| Well House #4 / Egner Park Shelter  | 2026                         | Solar PV in the field South of the shelter – 108.0 kW DC | 150,900       | \$160,920              | \$25,053                      | 6                      |
| Lift Station #5                     | 2025                         | Solar PV on roof – 5.4 kW DC                             | 5,260         | \$8,046                | \$756                         | 11                     |
| <b>Library</b>                      |                              |                                                          |               |                        |                               |                        |
| McFarland E.D. Locke Public Library | 2032                         | Solar PV On Roof                                         | 134,700       | \$156,152              | \$16,114                      | 10                     |

## 10.0 Implementation Details of Energy Conservation Measures

The consultant developed an extensive list of energy efficiency measures to achieve a 76% CO<sub>2</sub> reduction by 2035 without RECs and a 90% reduction with RECs. These measures are focused primarily on investments that will reduce energy consumption while maintaining or improving occupant comfort. Project cost, energy savings, and annual cost savings allowed for an estimated simple payback period calculation. This is a comprehensive list and includes some measures that do not appear to have a favorable simple payback period. Despite this, those measures were still included in this list to show overall total possible energy and carbon reduction potential. The planned schedule was built by focusing on inexpensive yet impactful projects early on with larger capital projects happening later when funding is available.

At all parks department buildings, opportunities were mostly found in replacing old lighting, unplugging unused equipment and some small HVAC controls project at William McFarland Park. Urso Park saw the largest potential for energy savings where large electric heaters in the restrooms and dog wash area were noted to be the primary driver of electricity use and were over-heating the building during the winter months. From talking with park staff, it sounds like this was a known issue and may have been remedied already, but special attention should be kept on energy use through the winter.

Similar opportunities were noted at Public Works buildings – lighting upgrades at the main Public Works Building and the well houses and lift stations were consistent findings. At the main Public Works Building, Well House #4, and Lift Station #5, HVAC temperature setback, control strategies, and efficient operation should be explored through a retrocommissioning (RCx) effort. Focus on Energy offers incentives for such projects which is included in the cost estimates for these measures.

A retrocommissioning effort is also recommended for the Library. The Library was found to operate largely without any set schedules, temperature setbacks and have been in-use without any major review of the HVAC sequence of operation since the facility was opened. The windows were observed to be at or near end of life and a replacement cost and energy savings was also included. A 10-year master plan for this building includes a second story addition at which time switching over to a completely new ground source heat pump (geothermal) heating and cooling system is recommended.

**Table 48: Energy Conservation Measures**

| Building                | Proposed Implementation Year | Measure Description                                                                                                                                                | Savings (kWh) | Savings (Therms) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|-------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|------------------------|-------------------------------|------------------------|
| <b>Parks Department</b> |                              |                                                                                                                                                                    |               |                  |                        |                               |                        |
| McDaniel Park           | 2025                         | Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers) | 585           | -                | \$100                  | \$85                          | 5                      |
| Brandt Park             | 2025                         | Replace any linear fluorescent lights with LED lights                                                                                                              | 224           | -                | \$170                  | \$33                          | 1                      |
| Brandt Park             | 2025                         | Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers) | 496           | -                | \$100                  | \$74                          | 1                      |
| William McFarland Park  | 2025                         | Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers) | 755           | -                | \$100                  | \$111                         | 1                      |

| Building                       | Proposed Implementation Year | Measure Description                                                                                                                                                | Savings (kWh) | Savings (Therms) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|--------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|------------------------|-------------------------------|------------------------|
| William McFarland Park         | 2025                         | Add temperature setbacks to thermostat schedules when the building is unoccupied                                                                                   | 1,417         | 184              | \$500                  | \$396                         | 4                      |
| William McFarland Park         | 2025                         | Add lockout controls to prevent the HVAC system from running in the main area of the building when the large garage doors are open.                                | 3,021         | -                | \$2,000                | \$445                         | 5                      |
| McFarland Dog Park (Urso Park) | 2025                         | Verify thermostat settings on the electric unit heaters in each room. These are believed to drive the majority of the electricity use at the facility.             | 34,675        | -                | \$200                  | \$4,402                       | 1                      |
| McFarland Dog Park (Urso Park) | 2025                         | Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers) | 693           |                  | \$100                  | \$88                          | 5                      |
| Lewis Park                     | 2025                         | Review plug loads to ensure nothing is plugged in and running when the facility is closed for long durations (e.g. refrigerators, dehumidifiers, battery chargers) | 140           |                  | \$100                  | \$22                          | 3                      |

| Building                        | Proposed Implementation Year | Measure Description                                                                                                                                                                                                                               | Savings (kWh) | Savings (Therms) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|---------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|------------------------|-------------------------------|------------------------|
| Lewis Park                      | 2025                         | Add temperature setbacks to thermostat schedules when the building is unoccupied                                                                                                                                                                  | -             | 184              | \$500                  | \$196                         | 5.1                    |
| <b>Public Works</b>             |                              |                                                                                                                                                                                                                                                   |               |                  |                        |                               |                        |
| McFarland Public Works Building | 2026                         | Replace linear fluorescent lights with LED lights.                                                                                                                                                                                                | 12,924        | -                | \$128,535              | \$735                         | 174.8                  |
| Well House #1                   | 2025                         | Replace linear fluorescent lights with LED lights.                                                                                                                                                                                                | 64            | -                | \$34                   | \$8                           | 4.0                    |
| Well House #3                   | 2025                         | Replace linear fluorescent lights with LED lights.                                                                                                                                                                                                | 384           | -                | \$136                  | \$49                          | 2.8                    |
| Well House #3                   | 2025                         | Review temperatures and control strategies of AC and heating equipment to ensure the space is not being overcooled in the summer when not necessary and space is heated adequately to prevent pipe freezing but not over-heating space in winter. | 2,497         | 38               | \$2,342                | \$358                         | 6.5                    |



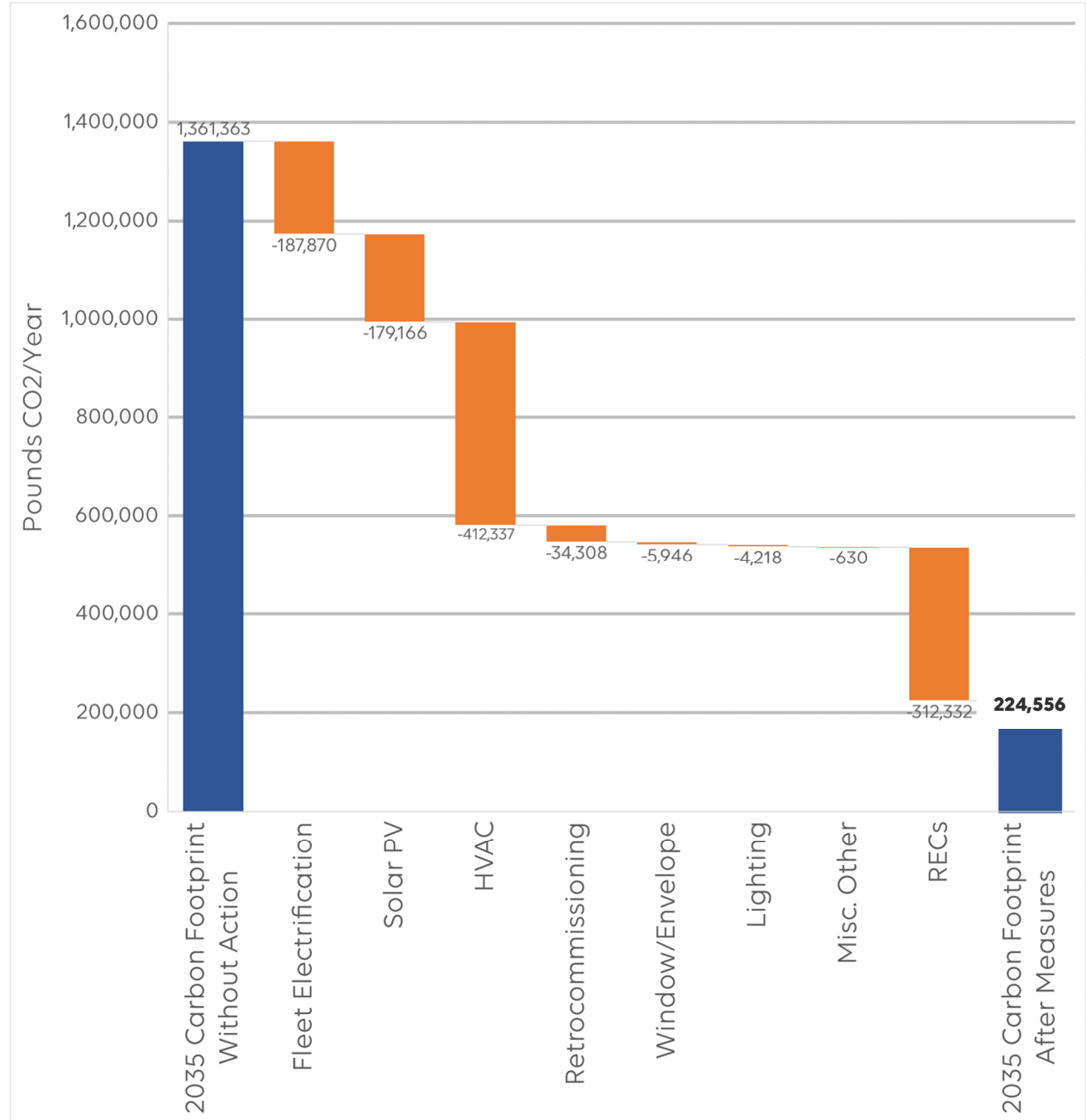
| Building                           | Proposed Implementation Year | Measure Description                                                                                                                                                                                                                               | Savings (kWh) | Savings (Therms) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|------------------------|-------------------------------|------------------------|
| Well House #4 / Egner Park Shelter | 2025                         | Replace linear fluorescent lights with LED lights.                                                                                                                                                                                                | 192           | -                | \$102                  | \$32                          | 3                      |
| Well House #4 / Egner Park Shelter | 2025                         | Review temperatures and control strategies of AC and heating equipment to ensure the space is not being overcooled in the summer when not necessary and space is heated adequately to prevent pipe freezing but not over-heating space in winter. | 2,582         | 12               | \$2,350                | \$448                         | 5                      |
| Lift Station #5                    | 2024                         | Replace linear fluorescent lights with LED lights.                                                                                                                                                                                                | 224           | -                | \$119                  | \$32                          | 3                      |
| Lift Station #5                    | 2024                         | Review temperatures and control strategies of heating equipment to ensure the space is heated adequately to prevent pipe freezing but not over-heating space in winter.                                                                           | -             | 33               | \$2,414                | \$45                          | 54                     |
| <b>Library</b>                     |                              |                                                                                                                                                                                                                                                   |               |                  |                        |                               |                        |
| E.D. Locke Public Library          | 2025                         | Retrocommissioning effort for the HVAC building automation system and lighting control system.<br>o Verify all equipment including control valves,                                                                                                | 29,010        | 2,351            | \$20,000               | \$5,363                       | 3.                     |

| Building                  | Proposed Implementation Year | Measure Description                                                                                                                                                                                                                                                                                                                                                   | Savings (kWh) | Savings (Therms) | Estimated Measure Cost | Estimated Annual Cost Savings | Simple Payback (Years) |
|---------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|------------------------|-------------------------------|------------------------|
|                           |                              | pumps, and other HVAC equipment are functioning optimally.<br>o Implement temperature setback schedules.<br>o Implement outdoor air schedules to reduce or eliminate outdoor air from being brought in when the building is unoccupied.<br>o Review sequences of operation to ensure that equipment is scheduled and operate in optimal ways for energy conservation. |               |                  |                        |                               |                        |
| E.D. Locke Public Library | 2026                         | Add daylighting control to automatically dim lights near windows when enough natural light is available.                                                                                                                                                                                                                                                              | 3,868         | -                | \$11,265               | \$463                         | 24.                    |
| E.D. Locke Public Library | 2032                         | Whole building geothermal retrofit. New HVAC                                                                                                                                                                                                                                                                                                                          | (210,236)     | 15,670           | \$1,231,000            | \$(12,537)                    | (73)                   |
| E.D. Locke Public Library | 2025                         | New glazing – Low solar gain windows                                                                                                                                                                                                                                                                                                                                  | 5,802         | 392              | \$300,000              | \$1,009                       | 297                    |

# 11.0 Future Opportunities

The carbon reduction timeline presented in Figure 4 and shown below in Figure 25 shows a 2035 carbon footprint of 224,556 pounds per year after all measures and have been purchased and completed. This represents a 90% drop in carbon from the baseline year of 2022.

Figure 25: 2035 Carbon Footprint with and Without Action



The Village of McFarland could become a net zero carbon community with continued effort identifying and implementing carbon reduction opportunities. For example, no diesel reduction measures were targeted in this report, but aggressive fleet vehicle electrification of the heavy-duty diesel equipment would significantly impact the carbon footprint.

Lawn mowers, trimmers, chainsaws, and other small gas engine equipment could be replaced with electric counterparts. Electric tools and even riding lawnmowers have become a lot more common with improved battery technology. This could also be a unique opportunity to couple electric fleet vehicles with electric tools where the electric tools can be charged onboard the vehicles in between use. Besides the carbon benefits of such tools, reduced noise, and maintenance costs could be a bonus for the maintenance workers and the community.

The survey of the Public Works Building identified solar PV as the sole carbon reduction measure, mainly due to the absence of long-term planned changes or upgrades at this facility. To enhance carbon reduction efforts, the consultant recommends pursuing ambitious strategies when the facility undergoes significant renovations or plans for a new facility. A primary focus should involve transitioning away from natural gas heating, especially in the garage area, which is the primary energy end use at this facility. With the implementation of fleet electrification, substantial electrical renovations may become necessary to support the charging infrastructure. This presents an excellent opportunity to consider additional carbon reduction upgrades within the facility during that time.

