



**AGENDA**  
CHARTER TOWNSHIP OF MERIDIAN  
PLANNING COMMISSION – REGULAR MEETING  
August 10, 2020 7PM

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1. CALL MEETING TO ORDER
2. PUBLIC REMARKS
3. APPROVAL OF AGENDA
4. APPROVAL OF MINUTES
  - A. July 27, 2020 Regular Meeting
5. COMMUNICATIONS
  - A. Stand & Janet Hunley RE: PUD #20014 (Okemos Land Investment LLC)
  - B. Indian Lakes Estates HOA RE: SUP #20011 (Andev Group, LLC)
6. PUBLIC HEARINGS
  - A. Planned Unit Development #20014 (Okemos Land Investment LLC), develop Silverleaf planned unit development consisting of 150 detached single family homes on approximately 94 acres located on the north side of Bennett Road, west of Hulett Road.
7. UNFINISHED BUSINESS
  - A. Special Use Permit #20051 (1732 Hamilton Road LLC), establish motor vehicle repair shop at 1732 Hamilton Road.
8. OTHER BUSINESS
  - A. Mixed Use Planned Unit Development (MUPUD) ordinance review.
9. REPORTS AND ANNOUNCEMENTS
  - A. Township Board update.
  - B. Liaison reports.
10. PROJECT UPDATES
  - A. New Applications - None
  - B. Site Plans Received - None
  - C. Site Plans Approved
    1. Site Plan Review #20-03 (Buddy's Rendezvous Pizzeria LLC), demolish existing restaurant and construct new 7,069 square foot Buddy's Pizza restaurant at 2010 Grand River Avenue.
11. PUBLIC REMARKS
12. ADJOURNMENT

**Zoom meeting ID: 872 0006 8286**  
**Zoom password: 5151**

**AGENDA page 2**  
CHARTER TOWNSHIP OF MERIDIAN  
PLANNING COMMISSION MEETING  
August 10, 2020 7PM

**TENTATIVE PLANNING COMMISSION AGENDA**  
**August 24, 2020**

1. PUBLIC HEARINGS - None
2. UNFINISHED BUSINESS
  - A. Planned Unit Development #20014 (Okemos Land Investment LLC), develop Silverleaf planned unit development consisting of 150 detached single family homes on approximately 94 acres located on the north side of Bennett Road, west of Hulett Road.
3. OTHER BUSINESS
  - A. Mixed Use Planned Unit Development (MUPUD) ordinance review.

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Individuals with disabilities requiring auxiliary aids or services should contact: Principal Planner Peter Menser, 5151 Marsh Road, Okemos, MI 48864 or 517.853.4576 - Ten Day Notice is Required.  
Meeting Location: Zoom web conferencing application  
Meeting ID: 872 0006 8286 Password: 5151

Providing a safe and welcoming, sustainable, prime community.



**CHARTER TOWNSHIP OF MERIDIAN  
PLANNING COMMISSION  
REGULAR MEETING MINUTES**

**DRAFT**

**July 27, 2020**

**Meeting held virtually using the Zoom web conferencing application**

**7:00 P.M.**

**PRESENT: Commissioners Premoe, Trezise, Richards, McConnell, Hendrickson, Cordill, Shrewsbury, and Clark**

**ABSENT: None**

**STAFF: Director of Community Planning & Development Mark Kieselbach, Economic Development Director Ken Lane, Principal Planner Peter Menser, Information Technology Director Stephen Gebes, Multimedia Producer Samantha Diehl.**

**1. CALL MEETING TO ORDER**

Chair Hendrickson called the regular meeting to order at 7:00 P.M.

**2. PUBLIC REMARKS -None**

**3. APPROVAL OF AGENDA**

Commissioner Cordill moved to approve the agenda.  
Seconded by Commissioner McConnell.

**4. APPROVAL OF MINUTES**

**A. June 13, 2020 Regular Meeting**

Commissioner Richards moved to approve the amended minutes.  
Seconded by Commissioner Premoe.

Commissioner McConnell noted a minor change to 7.B to include the work "to" in the second sentence of the second paragraph.

A friendly amendment was made by Commissioner Premoe.

VOICE VOTE: Motion approved unanimously.

**5. COMMUNICATIONS**

Chair Hendrickson noted the two communications were submitted in the July 27, 2020 meeting packet.

**6. PUBLIC HEARINGS**

**A. Special Use Permit #20051 (1732 Hamilton Road LLC), establish motor vehicle repair shop at 1732 Hamilton Road.**

Chair Hendrickson opened the public hearing at 7:04 p.m.

Principal Planner Menser provided an overview of the Special Use Permit request. The applicant opened the business in October 2019 and did not realize they needed to request a Special Use Permit to operate on site as Auto Tech of Okemos. The public hearing was delayed because of COVID19 and the business has been in operation since last fall. The Planning Commission must decide if the business can remain open or if they will need to close and relocate if the special use permit is not approved, as they opened without Township approval.

Comments from the applicant:

Robert McCarthy, Attorney for 1732 Hamilton Road, representing Jonathan Brown, managing member of Auto Tech of Okemos, stated they have no concerns with the criteria listed for the Special Use Permit and the requirements. Mr. McCarthy stated there are no gas islands on the property, no plans to have outdoor sales of items, and the exterior doors will be closed at all times when service work is being done on vehicles.

Robert McCarthy noted the building has a history of conducting mechanical repairs on snowblowers, lawn mowers and pool part repairs and the footprint of the building will not change. Mr. McCarthy stated 5 or 6 vehicles will be serviced daily and there are 3 or 4 employees working on site. The site is not a body shop, just a repair shop. Mr. McCarthy and Jonathan Brown would be available to answer questions.

Public Comments:

None

Planning Commission Discussion:

- What is the plan for storage and removal of oil on site? A 50-gallon drum for oil products will be stored in the building and the contents will be removed monthly by a separate company.
- The staff memo notes Hamilton Road has multiple lanes however currently there is one lane each way with a turn lane however, this business should not impact the traffic.
- Oil changes will be an irregular occurrence in service at this location and should not impact the local oil change businesses in the area.
- Odor and noise mitigation concerns were raised for the proposed business because of the neighborhood to the southwest. The attorney stated the shop would have doors closed in their three bays when working on vehicles and they are not a body shop so there will be no odor issues. He further noted there have been no problems since Auto Tech of Okemos opened last October and this is not a high-volume shop.
- The buildings history shows similar work on the site for many years and the C-2 zoning allows for business in the area.
- This is a good use of the building and concerns raised do not seem to be an issue.

A straw poll indicated the Planning Commission would be in support of recommending approval of the proposed Special Use Permit #20051. A resolution will be provided for the August 10, 2020 Planning Commission meeting.

Chair Hendrickson closed the public hearing at 7:34 p.m.

**7. UNFINISHED BUSINESS - None**

**8. OTHER BUSINESS – None**

**9. REPORTS AND ANNOUNCEMENTS**

A. Township Board update.

Principal Planner Menser provided a summary of the July 21, 2020 Zoom Township Board meeting. The next Township Board meeting will be Thursday, August 6, 2020.

B. Liaison reports.

- Commissioner Cordill attended the Corridor Improvement Authority meeting on July 22, 2020.
- Commissioner McConnell provided an update on the Environmental Commission working groups.

Chair Hendrickson asked about an update on the Okemos Village Project and Ken Lane, Economic Development Director with Meridian Township, provided an update. He noted the project has been delayed due to COVID19 and issues with financing; however, there is promise of new updates coming soon as regular meetings are taking place. Demolition of Bottom's Up, Okemos Ace Hardware, The Tuba Museum, and the music store plan to take place by the end of 2020 and anticipate new construction to begin in 2021.

Commissioner Premoe asked about the Farmer's Market and the New Market on the Green is scheduled to finish construction on August 25, 2020. The current site for the Farmer's market in the Meridian Mall parking lot, near the future site, has been working out well.

Kingman's of Grand Rapids bought the Toys R Us store and they plan to open this fall.

Chair Hendrickson reviewed the Planning Commission 2020 Goals and the group discussed what items they would like to tackle next. The Mixed-Use Plan Unit Development Ordinance overview will be added to the agenda for the August 10, 2020 Planning Commission meeting. Principal Planner Menser will provide a current version of the ordinance and the group will tackle the ordinance at the August 24, 2020 Planning Commission meeting.

**10. PROJECT UPDATES**

A. New Applications- None

B. Site Plans Received - None

C. Site Plans Approved – None

**11. PUBLIC REMARKS - None**

**12. ADJOURNMENT**

Commissioner Premoe moved to adjourn the meeting.

Supported by Commissioner Shrewsbury.

VOICE VOTE: Motion carried unanimously.

Chair Hendrickson adjourned the regular meeting at 7:54 p.m.

Respectfully Submitted,

Debbie Budzynski, Recording Secretary

**Peter Menser**

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**From:** STANLEY A. HUNLEY <STANLEY.HUNLEY@cmsenergy.com>  
**Sent:** Tuesday, July 28, 2020 11:58 AM  
**To:** Planning Commision (DG)  
**Subject:** Comments Regarding Planned Unit Development (PUD) #20014

Hello, we are Stan and Janet Hunley and we reside at The Vistas in College Fields (2790 Carnoustie Drive in Okemos), just south of the proposed development. We received a notice in the mail yesterday regarding the PUD and, while we are not for or against the PUD, we would like to request that if the development goes forward it would be desirable to maintain the line of trees along the north side of Bennett Road to help preserve the natural beauty of the area. This natural setting was here when we moved in and it would be a shame to lose such a lovely view and have it replaced with views of other homes. We believe that future homeowners of the PUD would appreciate a natural screen that shields them from seeing the traffic on Bennett Road as well. We certainly respect the rights of property owners to do what they want with their property but this would be a courteous thing to do for our neighborhood and would help to maintain the natural beauty of the area.

Thank you for your consideration,

Stan and Janet Hunley  
2790 Carnoustie Drive  
Okemos, MI 48864  
[hunley2005@comcast.net](mailto:hunley2005@comcast.net)

# LOOMIS

LOOMIS, EWERT, PARSLEY, DAVIS & GOTTING P.C.  
ATTORNEYS AT LAW

JAMES R. NEAL  
MICHAEL G. OLIVA  
MICHAEL H. RHODES  
JEFFREY S. THEUER<sup>1</sup>  
KEVIN J. RORAGEN  
TED S. ROZEBOOM  
SARA L. CUNNINGHAM  
JAMES F. ANDERTON, V<sup>2</sup>  
MIKHAIL MURSHAK<sup>3,4,6</sup>  
DOMINIC R. RIOS  
ALAN G. ABOONA<sup>6</sup>  
AMIA A. BANKS

OF COUNSEL:  
KARL L. GOTTING PLLC  
JEFFREY L. GREEN  
RICHARD W. PENNING  
MICHAEL A. HOLMES  
PAULA K. MANIS PLLC  
KELLY REED LUCAS  
YING BEHER  
WARREN T. DEAN<sup>5</sup>  
JACK L. HOFFMAN<sup>7</sup>  
HOLLY L. JACKSON<sup>7</sup>

JACK C. DAVIS  
(1938-2020)

**KEVIN J. RORAGEN**  
[kjroragen@loomislaw.com](mailto:kjroragen@loomislaw.com)  
PHONE: 517-482-2400

<sup>1</sup> ALSO LICENSED IN MD  
<sup>2</sup> ALSO LICENSED IN FL  
<sup>3</sup> ALSO LICENSED IN CT  
<sup>4</sup> ALSO LICENSED IN NY  
<sup>5</sup> ALSO LICENSED IN OH  
<sup>6</sup> ALSO LICENSED BY USPTO  
<sup>7</sup> GRAND RAPIDS OFFICE

August 3, 2020

Mr. Scott Hendrickson, Chair  
Meridian Township Planning Commission  
5151 Marsh Rd.  
Okemos, MI 48864

Re: Special Use Permit ("SUP") #20011/ 20021 [Andev Group, LLC]

Chair Hendrickson:

This office represents Indian Lakes Estates Homeowners' Association ("ILEHA") regarding the above-referenced SUP #20011 which was approved by the Township Planning Commission at its June 22, 2020 meeting. ILEHA appreciates that the Planning Commission has addressed some of its members' concerns regarding this proposed development - notably concerns regarding access and stormwater management. However, my clients continue to have substantial questions and concerns regarding both the process and substance surrounding the Planning Commission's approval of this SUP, which we would like to share with you in this correspondence.

First, we would like to point out a significant procedural defect in the Commission's approval of this SUP. During the Commission's consideration of this matter, it was initially moved (and seconded) to adopt the staff-prepared Resolution approving SUP #20011, which included a number of proposed conditions. During the ensuing discussion, three issues were raised: stormwater drainage, access to public transit, and an updated natural features survey. A motion was made to amend the staff-prepared Resolution to include an additional condition of approval that the developer share final engineering calculations with ILEHA. This amendment was voted on and approved.

LANSING OFFICE:  
124 W. ALLEGAN STREET,  
SUITE 700  
LANSING, MI 48933-1784  
517-482-2400

GRAND RAPIDS OFFICE:  
180 MONROE AVE NW,  
SUITE 400  
GRAND RAPIDS, MI 49503  
616-330-1200

As the discussion of the main question continued -- adoption of the Resolution approving the SUP, there was another motion made (and seconded) to propose a further amendment of the Resolution, to add a condition requiring the developer to complete an update to the natural features survey. Discussion of this proposed amendment followed.

After lengthy discussion of this amendment, Commissioner Premoe made a motion to "end debate and move the previous question." This motion was approved. The Planning Commission then proceeded to an immediate vote on the main question, the Resolution to approve the SUP, without ever voting on the prior amendment to require an updated natural features survey. The Resolution was adopted by a vote of 6-2, but without the proposed updated natural features survey, which was never voted on.

As Roberts' Rules of Order makes clear, in American practice a motion to end debate and call the previous question, if adopted, immediately terminates any further discussion or debate of the question then pending and requires an immediate vote on that question. The motion does not cut off any pending amendments – it is simply a motion to end debate and to proceed to an immediate vote on the *then currently pending question*<sup>1</sup>, which in this case should have been the proposed amendment requiring an updated natural features survey. Unfortunately, the Planning Commission believed, erroneously, that this motion required them to proceed to an immediate vote on the main question, without further consideration of or vote upon the pending amendment. The result is that, due to this procedural error, the Resolution was adopted and the SUP approved without ever taking a vote on the proposed natural features amendment, which my clients and others feel is very important and significant. This open proposal needs to be resolved, not only for the sake of correct parliamentary procedure, but also because of its substantive importance, both to the Township and to my clients.

The Township has adopted and published several documents that highlight its desire to preserve natural systems and wildlife. For example, the Greenspace Plan states, "There is a desire that growth come not at the expense of water quality, natural systems, and wildlife, rather, that new development be used as a tool to permanently protect key natural and cultural resources and enhance the Township's sense of place." The 2017 Master Plan also states, "The central planning goal for these past several decades has been to maintain and improve the quality of life for Township residents, particularly the quality of residential life . . . and the rich and diverse natural environment." In this case, however, Andev submitted a Natural Features Report to the Planning Commission which was conducted in November of 2016. As was pointed out by my clients and others, for this type of survey, this is not the time of year that would yield the most accurate or meaningful results.

The study included with the SUP application was also nearly four years old. While soils and topography are probably the same, there could have been considerable changes to wildlife and wetlands because of the difference in time and seasons.

Additionally, this site is actually part of a larger corridor that extends along the Red Cedar River and connects with Herron Creek. In fact, this site is the precise connecting point of these two

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<sup>1</sup> See "The Previous Question" at <http://www.rulesonline.com/rror-05.htm#29> (last accessed 7/31/2020).

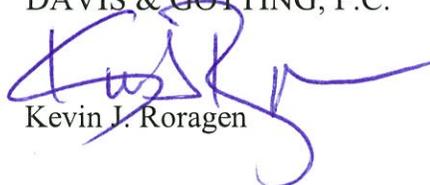
important natural green corridors and one additional following the Mud Lake drain. This is probably what makes the site so attractive to unusual wildlife. This unique wildlife is not currently accounted for in the existing 2016 natural features survey.

It would seem to be a fairly straightforward matter to require Andev to complete an updated natural features survey, and that the current SUP application is not complete without an accurate and meaningful survey. Many of ILEHA's members took the time to address this issue not only with testimony but by preparing and submitting extensive written correspondence and materials to the Commission. To have those legitimate issues effectively dismissed based on a procedural error by the Commission makes my clients feel as if their concerns are not taken seriously and that they are being side-stepped by the Township.

As the process of considering further approvals for this proposed development continues in the Township, it is of extreme importance to my clients that their concerns and efforts are listened to and heard by Township officials, and not simply brushed aside. Our intention is not to slow or stop the development of parcel, but rather to ensure that the real and significant issues of my clients, who are long term residents of the Township, are considered and taken seriously as the development begins.

Very truly yours,

LOOMIS, EWERT, PARSLEY,  
DAVIS & GOTTING, P.C.



Kevin J. Roragen

KJR/mjf

cc: Ron Styka, Township Supervisor  
Township Board members  
Township Planning Commission members  
Frank Walsh, Township Manager  
Mark Kieselbach, Director, Community Planning & Development  
Peter Menser, Principal Planner



**To: Planning Commission**

**From: Peter Menser, Principal Planner**

**Date: August 4, 2020**

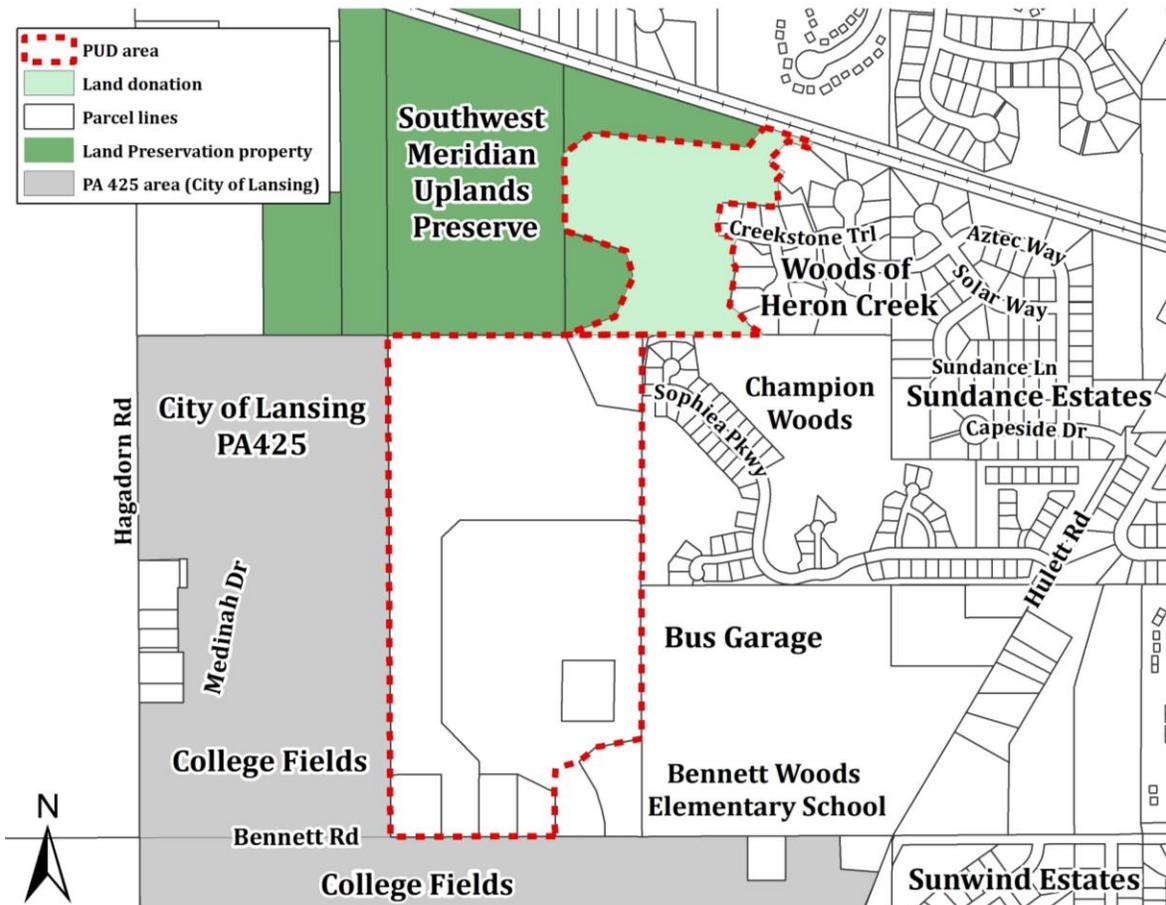
**Re: Planned Unit Development #20014 (Okemos Land Investment LLC), develop Pine Village PUD consisting of 150 single family residential lots on approximately 94 acres located on the north side of Bennett Road, west of Hulett Road.**

Okemos Land Investment LLC has submitted a planned unit development (PUD) proposal for a project identified as Silverleaf. The overall PUD proposal includes the construction of 150 detached single family homes on approximately 94 acres located on the north side of Bennett Road, west of Hulett Road. The majority of the development is proposed as site condominiums, whereby a person owns their individual lot and shares ownership of common space with the rest of the owners in the development. Responsibility for maintenance of the property varies, but typically an owner is responsible for maintaining their own lot, much like a traditional subdivision. The cul-de-sac proposed along Bennett Road is depicted as a conventional condominium, which is where a person owns just the home itself and the surrounding area is common space.

The property is zoned RAA (Single Family-Medium Density), subject to the seven conditions voluntarily offered by the property owner during the rezoning of the property in early 2020. The area proposed for a PUD is comprised of five parcels and portions of two other parcels, all of which would be required to be combined prior to development. The parcels proposed for the PUD are identified in the table below:

Property/Parcel I.D.	Acreage	Street Frontage
2862 Bennett Road Parcel I.D. #33-02-02-29-300-008	1.8 acres	264 feet
2824 Bennett Road Parcel I.D. #33-02-02-29-300-020	1.52 acres	201 feet
2806 Bennett Road Parcel I.D. #33-02-02-29-300-021 (portion)	1.28 acres	200 feet
2800 Bennett Road Parcel I.D. #33-02-02-29-300-026	2.02 acres	0 feet
Parcel I.D. #33-02-02-29-300-025 (portion)	30.2 acres	263 feet
Parcel I.D. #33-02-02-29-300-023	37.6 acres	198 feet
Parcel I.D. #33-02-02-29-251-009	22.3 acres	65 feet Creekstone Ln. 60 feet Sophiea Pkwy.

The PUD area is depicted in the map below:



The intent of the PUD ordinance is to permit greater flexibility and more creative design of residential developments than is possible under conventional zoning regulations. The PUD ordinance allows a developer to propose a residential project with diverse housing types and different lot dimensions and yard setbacks as those prescribed in the underlying zoning district. Lot size, yards, frontage requirements, setbacks, building height, and type and size of dwelling unit restrictions are generally waived in a PUD. In exchange for the flexible standards, a minimum of 50% of the project area, excluding wetlands and floodplains, must be preserved as open space.

**2019 Rezoning**

At its January 7, 2020 meeting the Township Board approved the rezoning (REZ #19060) of approximately 96.74 acres from RR (Rural Residential), RAA (Single Family-Low Density), and RAAA (Single Family-Low Density) to RAA and PO (Professional and Office). The approval resulted in 93 acres being rezoned to RAA and three acres rezoned to PO. The rezoning was approved with seven conditions voluntarily offered by the property owner, which are as follows:

**Planned Unit Development #20014 (Okemos Land Investment LLC)**  
**Planning Commission (August 10, 2020)**  
**Page 3**

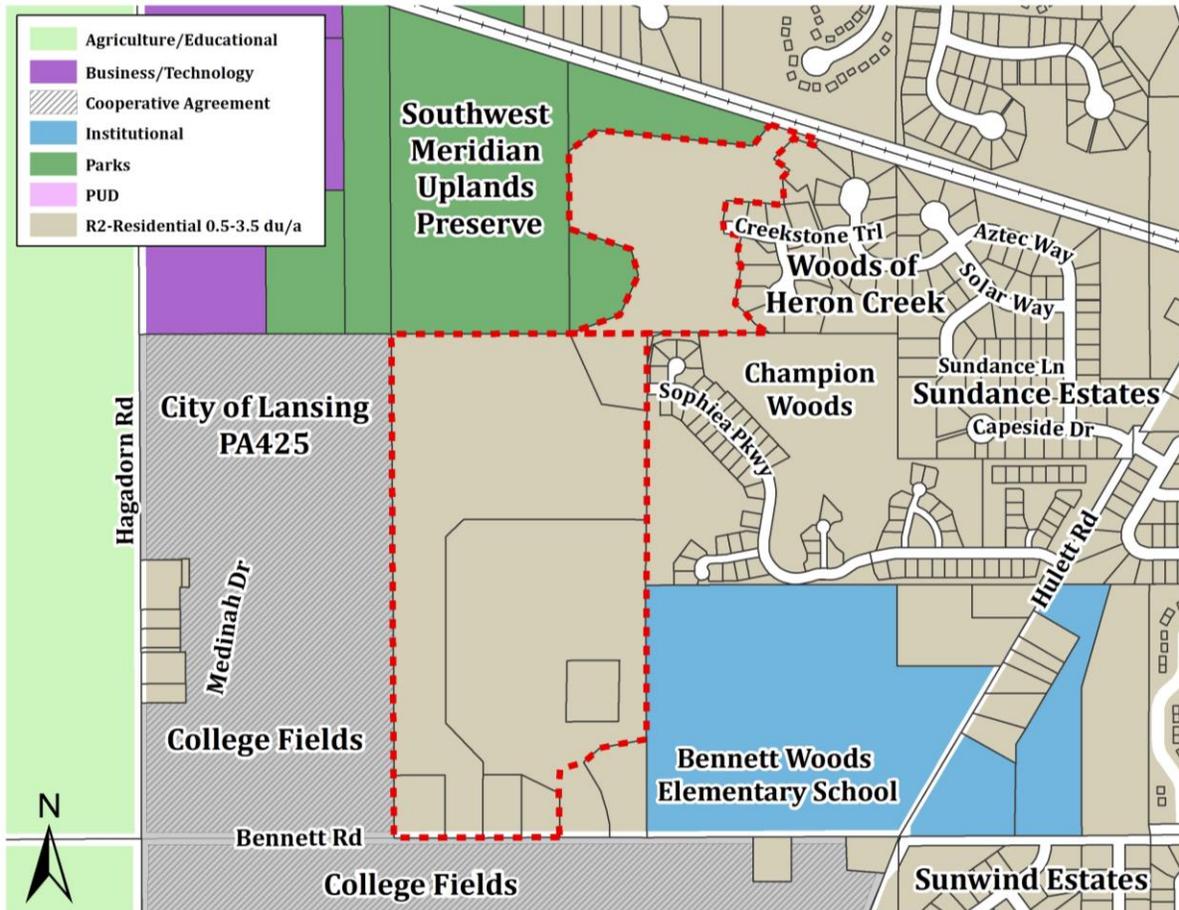
1. 93 acres of RAA zoning is to be a PUD. Three acres are to be zoned PO.
2. Maximum of 150 single family detached homes.
3. No vehicular connection to Champion Woods or Woods of Heron Creek for perpetuity. An emergency only access will connect Silverleaf to Sophiea Parkway in Champion Woods. This will be a 20' asphalt pathway with bollards to prevent normal vehicular traffic.
4. A 75' minimum distance between homes in Champion Woods and homes in Silverleaf.
5. The northern approximately 20 acres to be dedicated as open space to Meridian Township.
6. A 3-acre site will be zoned P.O. The office space will not exceed 20,000 sq. ft. No apartments will be built in the P.O. zoned site. This will be on Bennett Road at the southeast corner of the property abutting the Schultz Veterinary Clinic.
7. The storm drainage will be designed to avoid impact on Champion Woods and Woods of Heron Creek. Mayberry Homes will cooperate with the resolution of the existing drainage issues with Champion Woods and Woods of Heron Creek.

The rezoning conditions run with the land and apply to the current owners and any future owners of the properties. Township Board approval is needed to amend or remove the rezoning conditions. The PUD as proposed would apply to the approximately 94 acres rezoned to RAA and not to the property rezoned to PO. Development of the three acres of PO would take place separately from the PUD proposal.

**Master Plan**

The property is designated on the Future Land Use Map from the 2017 Master Plan as R-2 Residential, 0.5-3.5 dwelling units per acre (du/a). With 150 lots on 94 acres, the density of the proposed development at 1.60 du/a falls within the R-2 Master Plan designation.

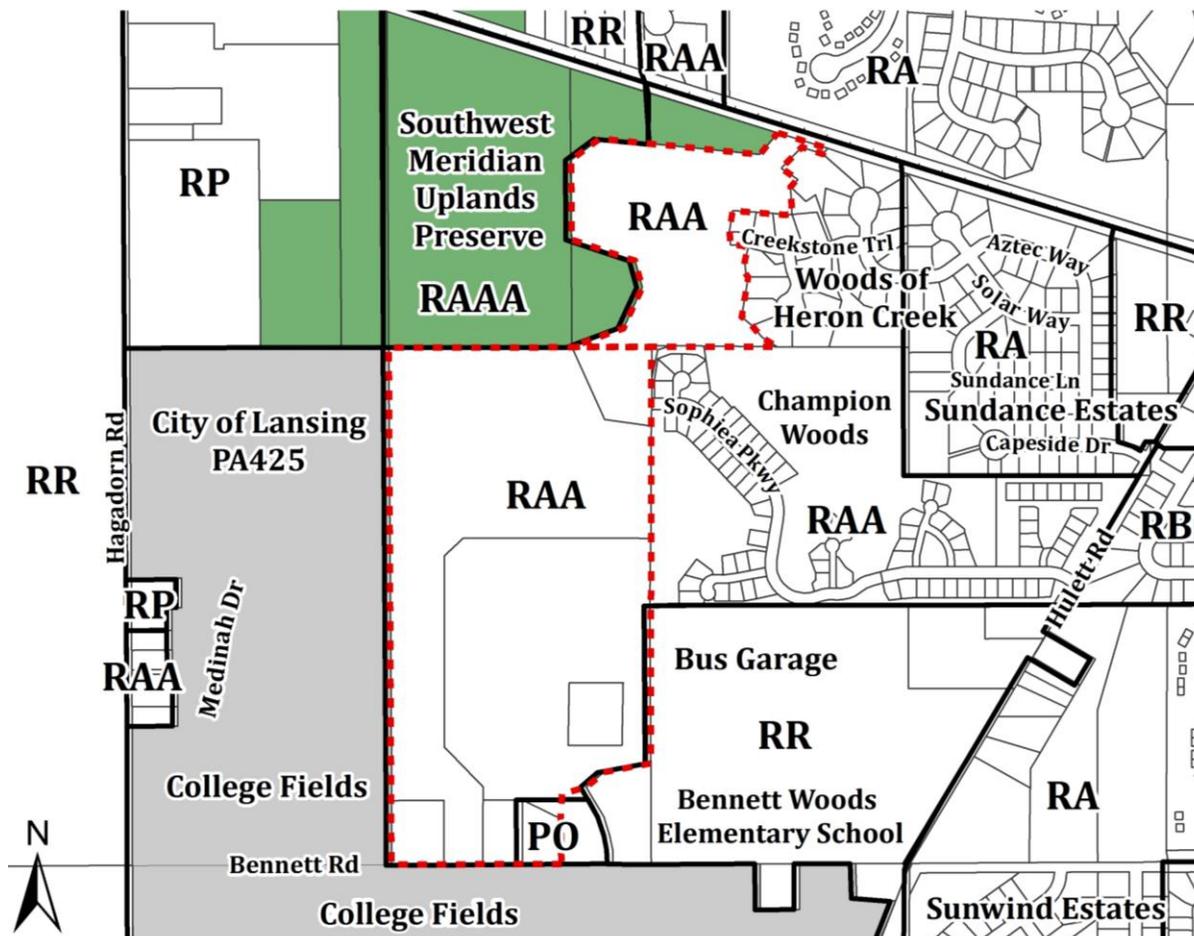
FUTURE LAND USE MAP



Zoning

The property proposed for development is located in the RAA (Single Family-Low Density) zoning district. A PUD is allowed in any residential zoning district on any sized property. All uses in all residential zoning districts are allowed in a PUD, which means any type and mix of housing (detached or attached single family dwellings or multiple family dwellings) are permitted. Detached single family homes are proposed.

ZONING MAP



Physical Features

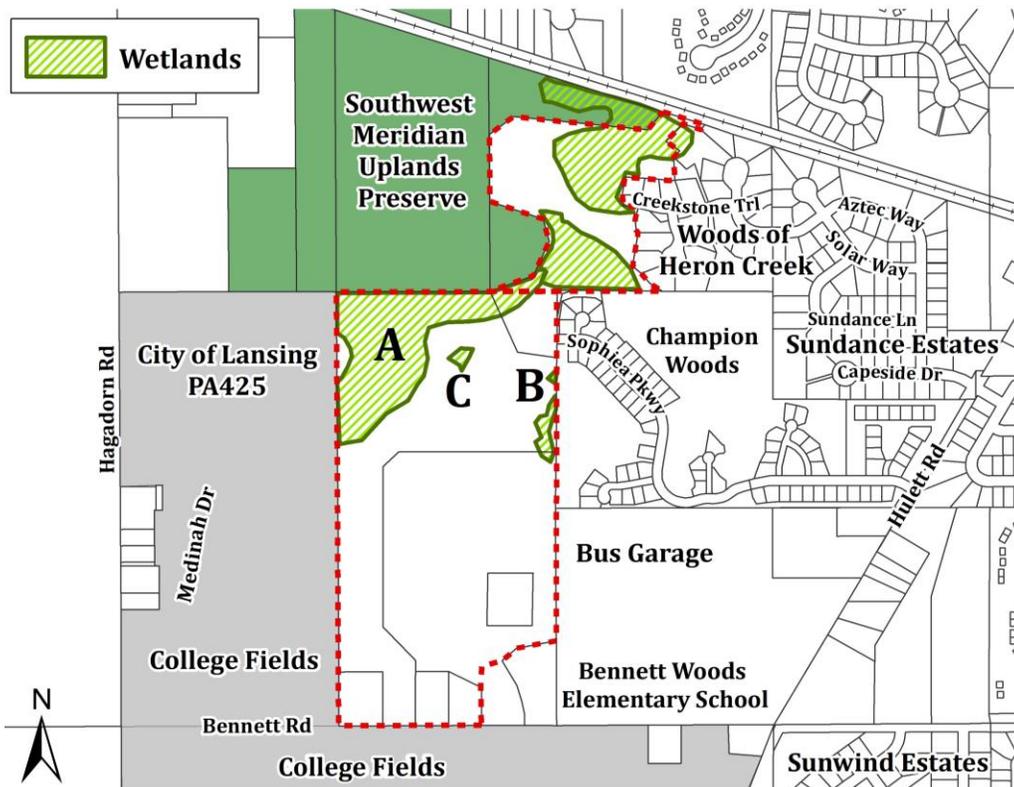
The site is mostly undeveloped. Three of the parcels fronting on Bennett Road are developed with single family homes and related accessory buildings. A natural features inventory and impact assessment prepared by Marx Wetlands, LLC was submitted as required, which includes a review of existing vegetation, soils, topography, wildlife, and a tree inventory.

**Wetlands**

Wetlands on the southern portion of the property were delineated by the Township’s wetland consultant in 2017. The wetlands on the northern portion of the property were delineated by Marx Wetlands, LLC in April of 2020 and verified by the Township’s consultant shortly thereafter. The delineation of the southern area identified three wetlands, designated by letters A, B, and C. Of the three wetlands delineated, only Wetland A is regulated by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and Meridian Township based on its size (9.06 acres) and the distance from a regulated water body (river, stream/drain, or inland lake). Wetland B (0.83 acre) is not regulated by EGLE but could be regulated by Meridian Township if it was proposed for filling and determined by the Township Board to be essential to the preservation of the natural resources of the Township. Wetland C (0.16 acre) is not regulated by the Township or EGLE as it is below the 0.25 acre standard established for regulation in the Wetland Protection ordinance.

Regulated wetlands equal to or greater than two acres in size require a 40 foot setback from the delineated boundary and wetlands greater than one quarter acre but smaller than two acres require a 20 foot setback. The applicant is proposed to fill Wetland C, which is unregulated, to facilitate development of the property. No impacts to Wetlands A, B, or any wetlands on the northern 20 acres of the site are proposed.

**WETLAND MAP**



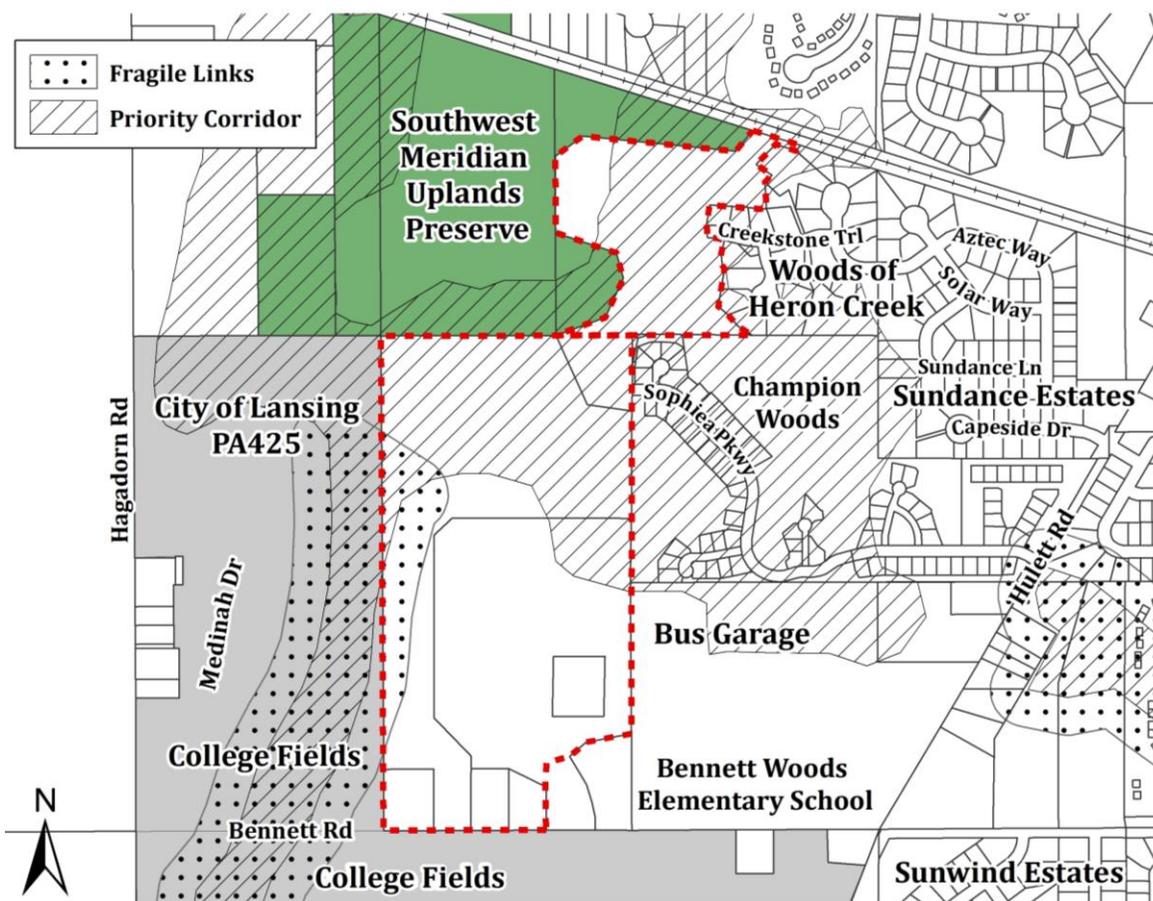
### Floodplain

The Flood Insurance Rate Map (FIRM) for Meridian Township indicates there are areas of both floodway and floodway fringe on portions of the property. The Herron Creek Drain and associated floodway runs south to north on the western edge of the subject site. The site plan submitted by the applicant depicts the location of the floodplain in the context of the proposed development. No work is being proposed in floodplain areas.

### Greenspace Plan

The Township Greenspace Plan shows a Priority Conservation Corridor (PCC) and Fragile Link on portions of the property. A PCC is a network of ecologically significant open spaces. A Fragile Link describes an area where the PCC is exceptionally narrow or fragmented. The Greenspace Plan is a guide used by staff to identify areas of potential environmental features but was not adopted as a Township ordinance.

**GREENSPACE MAP**



## **Streets and Traffic**

The subject site is located on the north side of Bennett Road. Bennett Road is a two-lane road designated as a Collector Street on the Street Setbacks and Service Drives Map in the zoning ordinance. The most recent (2017) traffic count information from the Ingham County Road Department (ICRD) for Bennett Road between Hulett Road and Hagadorn Road showed a total of 6,010 vehicles in a 24 hour period.

The 2017 Master Plan shows a proposed seven foot wide pathway along the north side of Bennett Road. The applicant will be required to construct the portion of the pathway located along the Bennett Road property frontage if the PUD is approved.

A detailed traffic study prepared by Fleis and Vandenbrink was submitted examining traffic generation, access management, safety, and sight distance for the proposed development. The study examines traffic generation under existing conditions (no development), background traffic (future traffic without the development), and future traffic (future traffic with the development). Findings of the study for future traffic show increased delays in the AM and PM peak hours at the intersection of Hagadorn Road and Bennett Road for some turning movements. To mitigate those issues the study recommends installation of a westbound right-turn overlap signal and signal timing optimization. With these improvements, traffic future conditions are projected to operate at an acceptable level of service (LOS D or better). The study also suggests that a left-turn treatment (installation of passing lane or center turn lane) is warranted on Bennett Road at the westernmost site entrance.

## **Utilities**

Municipal water and sanitary sewer is available in the vicinity of the subject site and would have to be extended to serve the proposed development. The location and capacity of utilities for any proposed development will be reviewed in detail by the Department of Public Works and Engineering during the Site Plan Review process.

## **Staff Analysis**

The applicant has requested to develop the Silverleaf PUD, a single family residential neighborhood with 150 lots. In a PUD request the Planning Commission makes a recommendation on the project and the Township Board makes the final decision.

When reviewing the project the Planning Commission should consider whether or not the project meets the purpose and minimum PUD performance objectives found in Sections 86-439(a) and (b) of the Code of Ordinances, the appropriateness of the requested waivers, and the general restrictions and standards for a PUD as outlined in Section 86-439(c) of the Code of Ordinances. The following is a summary of the project's consistency with the provisions of the PUD ordinance.

*Density:* To determine the maximum number of residential dwelling units in a PUD the applicant is first required to submit a yield plan that shows the number of lots that could be developed on the property as if it were a typical platted subdivision. The yield plan is reviewed using the standards established in the subdivision regulations. If the yield plan is deemed to be acceptable, the number of units depicted in the plan can be used as a baseline for the number of units in the PUD. The submitted yield plan shows 122 lots.

For properties with wetlands or floodplain, as is the case with the Silverleaf proposal, a formula is applied whereby the number of lots depicted in the yield plan is multiplied by the percent of the site covered by wetlands and floodplain (expressed as a decimal) plus one. There are 26.87 acres of wetland/floodplain in the PUD project area, which is 93.90 total acres in size. Applying this formula, the number of lots allowed in Silverleaf is 156.

The PUD ordinance also allows the maximum density to be increased by up to 25% with the provision of unique and extraordinary amenities such as preservation of woodlots, provisions of lakes, provision of recreational facilities, provision of affordable housing, or other amenities deemed acceptable. The density bonus would have given the developer 39 additional lots in the project, for a total of 195. Since the 2019 rezoning limited the number of units to no more than 150, the applicant is not seeking the density bonus for this project.

*Open space:* In a PUD a minimum of 50% of the project area, excluding wetlands and floodplains, must be preserved as “common open space,” which is defined as “a parcel or parcels of land or an area of water or a combination of land and water designed and intended for the use or enjoyment of the residents of the PUD or of the general public.” The ordinance prohibits proposed streets, rights-of-way, and open parking areas or commercial areas from counting towards the 50% open space requirement. It further notes that features such as recreational trails, picnic areas, children's play areas, greenways, or linear parks may be included in a common open space. All common open space is required by ordinance to be protected in perpetuity by establishment of a restrictive covenant or other such mechanism.

With a total of 67.03 acres of developable area, the proposed PUD is required to preserve at least 50 percent of the site, or 33.5 acres, as open space. The submitted PUD plan provides 35.05 acres of open space. Approximately 20 acres of the open space, which includes the entirety of the northern portion of the project area, is slated to be donated to Meridian Township.

*Phasing:* The submitted site plan shows that five phases are proposed for the development of the PUD. Phasing is proposed as follows:

- Phase 1: 29 units (lots 1-29)
- Phase 2: 42 units (lots 30-71)
- Phase 3: 21 units (Lots 72-92)
- Phase 4: 30 units (Lots 93-122)
- Phase 5: 28 units (Lots 123-150)

*Streets/Circulation Facilities:* The PUD ordinance encourages public streets but does allow private streets when they are designed to allow sufficient access for emergency vehicles (police, fire, ambulance) to the dwelling units they will serve. The streets in the proposed PUD are private with a 60 foot right-of-way, with the only exception being a cul-de-sac near Bennett Road showing a 42 foot right-of-way. If private streets are proposed and approved, easements of sufficient width acceptable to the Ingham County Road Department (ICRD) are required to be granted to the Township in order to accommodate possible future dedication. The private streets in the proposed development must be designed to meet ICRD standards. Final approval of the streets in the PUD is subject to approval by the ICRD and Meridian Township Engineering Department.

*Street Access:* The Fire Code contains a provision limiting the number of lots on a single access to 30. The development as proposed includes two access streets, both on Bennett Road. Additionally, breakaway bollards will be installed at the end of Morning Vista Lane so that emergency vehicles and residents, in an emergency situation, can temporarily enter or exit the site via Sophiea Parkway.

*Sidewalks:* The Township requires sidewalks for internal circulation with a minimum of five feet in width. The submitted site plan shows five foot wide sidewalks along both sides of each street in the PUD.

### **Waivers**

The PUD ordinance generally waives the standard requirements for lot size, yards, frontage requirements, setbacks, building height, and type and size of dwelling unit, provided the purpose and intent of the ordinance are incorporated into the overall development plan. The PUD ordinance is intended to provide flexibility for the Planning Commission and Township Board to set appropriate standards during the review process. Based on the submitted site plan the applicant is requesting the following waivers for the Silverleaf PUD.

*Lot size:* The underlying RAA zoning district requires parcels have a minimum lot area of 13,500 square feet. The submitted PUD has lots ranging from 3,500 square feet (Units 82-90) to 12,489 square feet (Unit 56) in size.

*Lot frontage:* The underlying RAA zoning district requires parcels have a minimum of 90 feet of lot frontage (90 feet for corner lots). The submitted PUD has lots ranging from 37.3 feet of lot width (Unit 128) to 121.9 feet (Unit 62).

*Setbacks:* The yard setbacks for the underlying RAA zoning district and the proposed PUD are summarized in the table below.

	RAA zoning	Proposed setback
Front yard setback	25 feet from street right-of-way (based on street classification)	10 feet from street right-of-way
Side yard setback	10 feet	5 feet
Rear yard setback	30 or 40 feet depending on lot depth	10 feet, 5 feet for deck/patio

The Planning Commission may consider the proposed setbacks and determine whether they are appropriate or whether additional setbacks should be established. Planning staff preference is for one building envelope with no exceptions for decks or patios to further encroach into the rear yard. The additional five foot rear yard encroachment for a deck/patio should be removed to avoid homeowners constructing a home up to the rear building envelope and then not having room leftover for a yard and to avoid future owners having to amend the PUD to add decks that encroach into the common area/open space.

If the project is approved by the Township Board, the applicant will be required to submit for Site Plan Review before any work on the site can begin. Site Plan Review is a detailed staff-level analysis of the project which includes reviews of storm water, utilities, landscaping, grading, and other issues to ensure compliance with all applicable ordinances as well as confirmation of approvals from local agencies such as the Ingham County Drain Commissioner’s Office and Road Department. The applicant must begin construction of the PUD within two years of a final site plan approval. The Planning Commission may grant one, one-year extension of the PUD if requested prior to its expiration.

**Planning Commission Options**

The Planning Commission may recommend approval, approval with conditions, or denial of the proposed PUD. A resolution will be provided at a future meeting.

**Attachments**

1. Application and attachments.
2. Site plan prepared by Kebs, Inc. dated May 11, 2020 (Revision Date July 30, 2020) and received by the Township on July 30, 2020.
3. Yield plan prepared by Kebs, Inc. dated April 1, 2020 (Revision Date July 30, 2020) and received by the Township on July 30, 2020.
4. Traffic study prepared by Fleis & Vanderbrink dated March 5, 2020 and received by the Township on May 28, 2020.
5. Natural Features Inventory and Impact Assessment prepared by Marx Wetlands, LLC dated April 27, 2020.
6. Wetland delineation report for southern portion of property prepared by Township wetland consultant Fisbeck dated December 19, 2017.

**Planned Unit Development #20014 (Okemos Land Investment LLC)**  
**Planning Commission (August 10, 2020)**  
**Page 12**

7. Wetland delineation report for northern portion of property prepared by Marx Wetlands, LLC dated April 23, 2020.
8. Wetland verification report for northern portion of property prepared by Township wetland consultant Fishbeck dated May 27, 2020.
9. Conceptual review letter from Ingham County Drain Commissioner's Office dated June 26, 2020.
10. Review letter from Meridian Township Chief Engineer Younes Ishraidi dated June 10, 2020.
11. Letter from Meridian Township Director of Parks and Recreation LuAnn Maisner dated May 20, 2020.
12. Letter from Okemos Public Schools Superintendent John J. Hood dated May 13, 2020.

G:\Community Planning & Development\Planning\PLANNED UNIT DEVELOPMENTS (PUD)\2020\PUD 20014 (Bennett Holding LLC)\PUD 20014 (Bennett Holding LLC)\PUD 20014.pc1.docx

**CHARTER TOWNSHIP OF MERIDIAN  
PLANNING DIVISION  
5151 MARSH ROAD, OKEMOS, MI 48864  
PHONE: (517) 853-4560  
FAX: (517) 853-4095**

**Planned Unit Development Permit Application**

- A. Owner/Applicant Okemos Land Investment LLC  
Address of applicant 1650 Kendale Blvd, Ste 200, East Lansing, MI 48823  
Telephone: Work 517-371-5000 Home Cell 248-303-0455  
Fax \_\_\_\_\_ Email dstraub@mayberryhomes.com
- B. Applicant's Representative, Architect, Engineer or Planner responsible for request:  
Name / Contact Person David Straub  
Address 1650 Kendale Blvd, Ste 200, East Lansing, MI 48823  
Telephone: Work 517-371-5000 Home Cell 248-303-0455  
Fax \_\_\_\_\_ Email dstraub@mayberryhomes.com
- C. Site address/location North side of Bennett Rd, between Hulett Rd and Hagadorn  
Legal description (Attach additional sheets if necessary) Attached  
Parcel number 33-02-02-29-251-009 Site acreage 93.90  
33-02-02-29-300(008, 020, 021, 023, 025, 026)
- D. Date of preapplication conference with Director of Community Planning and Development \_\_\_\_\_  
Total acres of property 93.90  
Acres in floodplain 12.03 Percent of total 12.8%  
Acres in wetland not in floodplain 14.75 Percent of total 15.7%  
Total dwelling units 150  
Total units/acre 1.60  
Dwelling unit mix  
Number single family detached 150 for Rent **Condo**  
Number duplex \_\_\_\_\_ for Rent Condo  
Number townhouse \_\_\_\_\_ for Rent Condo  
Number garden apt. style \_\_\_\_\_ for Rent Condo  
Number other \_\_\_\_\_ for Rent Condo  
Will commercial be included? (circle one) yes **no** acres \_\_\_\_\_  
Will all or part of property be platted? (circle one) yes **no**  
Percent open space provide exclusive of wetland/floodplain 52.2%

*I (we) hereby grant permission for member of the Charter Township of Meridian Planning Commission, Township staff members and the Township's representatives or experts the right to enter onto the above described property (or as described in the attached information) in my (our) absence for the purpose of gathering information including but not limited to the taking and the use of photographs. (Note to Applicant(s): This is optional and will not affect any decision on your application.)*

David Straub  
Signature of Applicant(s)

May 4, 2020  
Date

\_\_\_\_\_  
Signature of Applicant(s)

\_\_\_\_\_  
Date

**PUD Permit Application**

**Page 2**

- E. Required Data: (check if attached)
- Site location map  X
  - Site plan  X
  - Site analysis  X
  - Schematic storm sewer layout  X
  - Preliminary phasing plan  X
  - Reproducible contour map  X
  - Traffic study/analysis (if required)  X
  - Natural features analysis (if required)  X

David Straub  
Signature of Applicant

May 4, 2020  
Date

David Straub  
Print Name

Fee: \$2,400.00

Received by/Date: \_\_\_\_\_



May 4, 2020

Community Planning and Development  
Meridian Township  
5151 Marsh Road  
Okemos, MI 48864

RE: Silverleaf Condominium P.U.D.

This document is intended to provide a written site analysis, indicating the principal factors which influenced the design decisions regarding the plan. Mayberry Homes is confident that the proposed Silverleaf PUD meets the Meridian Township Zoning Ordinance. The following key elements were thoughtfully considered in our proposed PUD:

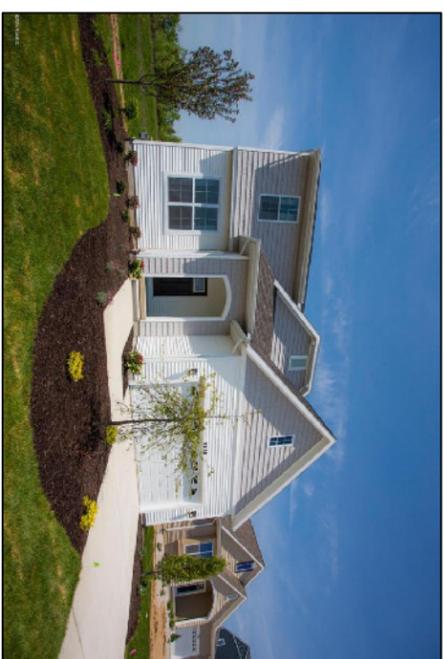
1. The Yield Plan suggests that Copper Creek could include up to 154 homes. The proposed PUD represents 150 homes
2. All homes will be Energy Star Certified
3. Landscaping, signage, lighting, and building materials are all intended to be of a high design quality and aesthetically pleasing
4. 95% of the homes back up to open space. The PUD exceeds the 50% open space requirement
5. Maintenance of existing wetlands and maximizing open space strives to preserve existing nature corridors. A Natural Features Inventory and Impact Assessment is included in our submittal package
6. All wetlands, parks and open space will be protected by the condominium documents
7. Soils conditions encountered ranged from topsoil and sand within 1' of the ground surface to clay at depths required for development. The soils are very suitable for development
8. Historically, part of the property was used for sand mining operations. A thoughtful study of the rolling topography will be applied to the community design
9. The property is located between a golf course to the west and school facilities to the east. Residential developments are located to the south and northeast
10. A traffic study is included in our submittal package and indicates no material impact to the pedestrian or vehicular circulation systems
11. The northern approximately 20 acres will be dedicated as open space to Meridian Township

Sincerely,

David Straub, Mayberry Homes, LLC

# SILVERLEAF CONDOMINIUM

## SAMPLE BUILDING ELEVATIONS



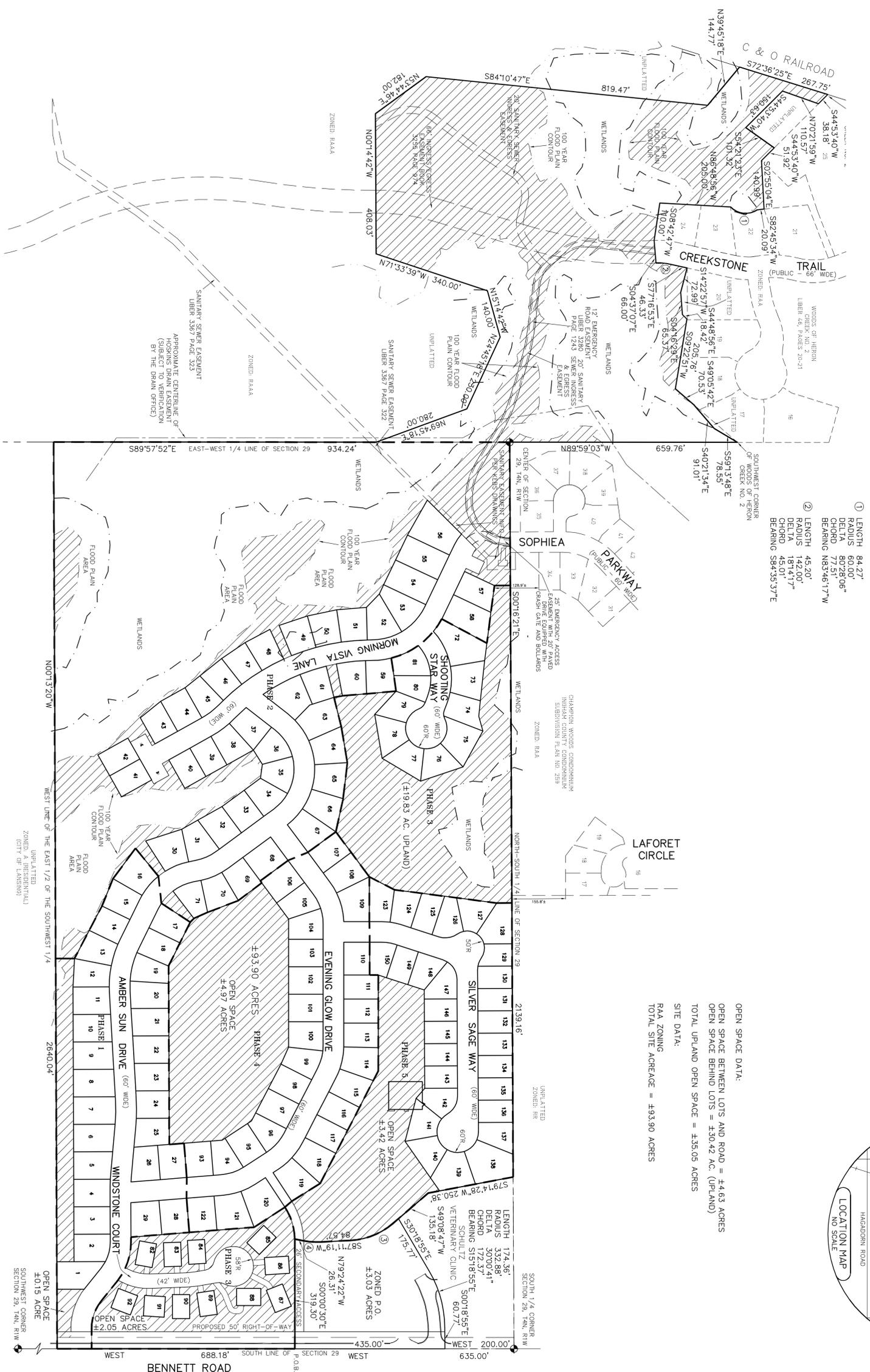


**OWNER/DEVELOPER:**  
 MAYBERRY HOKES  
 1650 KENDALE BOULEVARD  
 EAST LANSING, MI 48823  
 PH: (517) 371-5000  
 CONTACT: BOB SCHROEDER

**ENGINEER/SURVEYOR:**  
 KEBS, INC.  
 2116 HASLETT RD.  
 HASLETT, MI 48840  
 PH: (517) 339-1014  
 FAX: (517) 339-8047

# OPEN SPACE PLAN SILVERLEAF CONDOMINIUM

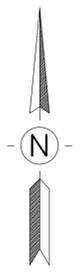
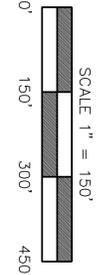
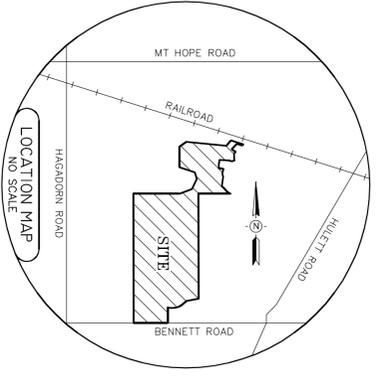
A SUBDIVISION OF PART OF THE NORTHEAST 1/4,  
 NORTHWEST 1/4 & SOUTHWEST 1/4 OF SECTION 29,  
 T4N, R1W, MERIDIAN TOWNSHIP, INGHAM COUNTY, MICHIGAN



- ① LENGTH 84.27'  
 RADIUS 60.00"  
 DELTA 89.2806"  
 CHORD 77.51'  
 BEARING N83.4917°W
- ② LENGTH 45.20'  
 RADIUS 142.00"  
 DELTA 181.417"  
 CHORD 45.01'  
 BEARING S84.3537°E

OPEN SPACE DATA:  
 OPEN SPACE BETWEEN LOTS AND ROAD = ±4.63 ACRES  
 OPEN SPACE BEHIND LOTS = ±30.42 AC. (UPLAND)  
 TOTAL UPLAND OPEN SPACE = ±35.05 ACRES

SITE DATA:  
 PAA ZONING  
 TOTAL SITE AREA = ±93.90 ACRES



= UPLAND OPEN SPACE AREA

- ③ LENGTH 136.11'  
 RADIUS 205.00"  
 DELTA 133.63"  
 CHORD 133.63"  
 BEARING S68.1003°W
- ④ LENGTH 50.30'  
 RADIUS 215.00"  
 DELTA 132.419"  
 CHORD 50.19"  
 BEARING N86.0632°W

DATE  
 DANE B. PASCOE  
 PROFESSIONAL SURVEYOR NO. 54434

REVISIONS	COMMENTS
05/11/20	ORIGINAL
07/30/20	UPROFIT DENSITY CALCULATIONS

**KEBS, INC.** ENGINEERING AND LAND SURVEYING  
 2116 HASLETT ROAD, HASLETT, MI 48840  
 PH: 517-339-1014 WWW.KEBS.COM

Meridian Office - Ph: 269-781-8800

DRAWN BY: KOB  
 FIELD WORK BY: ---  
 SHEET 2 OF 2

SECTION 29, T4N, R1W  
 JOB NUMBER: 87297/SUB

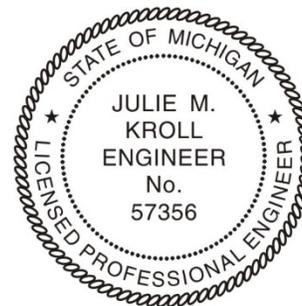
1:\87\87297\4\87297-PLD.dwg



# SILVERLEAF DEVELOPMENT TRAFFIC IMPACT STUDY

MERIDIAN TOWNSHIP, MICHIGAN

MARCH 5, 2020



PREPARED FOR:



1650 KENDALE BLVD. SUITE 200  
EAST LANSING, MICHIGAN 48823

PREPARED BY:



27725 STANSBURY BLVD., SUITE 195  
FARMINGTON HILLS, MI 48834

### Notice and Disclaimer

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The opinions, findings, and conclusions expressed herein are those of Fleis & VandenBrink Engineering, Inc. and do not necessarily reflect the official views or policy of the Meridian Township, or the Michigan Department of Transportation (MDOT), which makes no warranty, either implied or expressed, for the information contained in this document; neither does it assume legal liability or responsibility for the accuracy, completeness or usefulness of this information. Any products, manufacturers or trademarks referenced in this document are used solely for reference purposes.

Agency Review	Date	Comments

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## REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO). (2018). *A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS*. WASHINGTON DC.

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INSTITUTE OF TRANSPORTATION ENGINEERS. (2017). *TRIP GENERATION MANUAL, 10TH EDITION*. WASHINGTON DC.

NATIONAL RESEARCH COUNCIL (U.S.) TRANSPORTATION RESEARCH BOARD. (2016). *HIGHWAY CAPACITY MANUAL, 6TH EDITION (HCM6)*. WASHINGTON, D.C.: TRANSPORTATION RESEARCH BOARD.

PAPACOSTAS, & PREVEDOUROS. (2001). *TRANSPORTATION ENGINEERING AND PLANNING*.

STOVER, V. G., & KOEPKE, F. J. (2006). *TRANSPORTATION AND LAND DEVELOPMENT (VOL. 2ND EDITION)*. WASHINGTON DC: INSTITUTE OF TRANSPORTATION ENGINEERS (ITE).

## EXECUTIVE SUMMARY

This report presents the results of a Traffic Impact Study (TIS) for the proposed residential development in Meridian Township, Michigan. The project site is located adjacent to the north side of Bennett Road between Hagadorn Road and Hulett Road as shown on **Figure E1**. The proposed development includes the construction of 150 single-family residential homes. The development includes two proposed access driveways on Bennett Road.

**FIGURE E1: SITE LOCATION**



This TIS has been completed at the request of Meridian Township to identify the impacts (if any) of the proposed development on the proposed site access point and the permitting of the site access. The scope of the study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice, methodologies published by the Institute of Transportation Engineers (ITE) and the requirements of Meridian Township. Additionally, F&V obtained input regarding the scope of work from Meridian Township Planning Department. In accordance with Township Ordinance, a Traffic Impact Study (TIS) is required for site plan approval.

### EXISTING OPERATIONS (2020)

- The existing conditions analysis included the evaluation of the existing 2020 operations at the study intersections.
- The study intersections currently operate well, at LOS D or better. There are brief periods of vehicle queuing during the AM peak hour of the adjacent street due to traffic impacts from Okemos High School. These are experienced during the 15-30 minute prior to the start of school.

**BACKGROUND OPERATIONS (2027 WITHOUT DEVELOPMENT)**

- The background conditions analysis included the evaluation of the background 2027 operations at the study intersections. This analysis included increased traffic volumes calculated with a background growth rate and the trips generated by the proposed office development adjacent to the site on Bennett Road.
- The study intersections are expected to continue operating well, at LOS D or better with the addition of background growth. There continue to be brief periods of vehicle queuing during the AM peak hour of the adjacent street due to the adjacent operations of Okemos High School.

**FUTURE OPERATIONS (2027 WITH DEVELOPMENT)**

The results of the future conditions analysis show increased delays for the following intersection approaches and movements with the addition of the site generated traffic volumes.

**Bennett Road & Hagadorn Road**

- The northbound shared through/right-turn approach is expected to operate at LOS F during the AM peak hour. A review of network simulations shows extensive (500-ft) queue lengths during the AM peak hour. The poor LOS and queue lengths are attributed to the high volume of northbound vehicles and school traffic generated by both Bennett Woods Elementary and Okemos High School.
- The westbound right-turn lane is expected to operate at LOS E during the AM peak hour. A review of network simulations shows queue lengths of approximately 200-ft; however, the queues are not present throughout the duration of the entire AM peak hour.
- The eastbound single lane approach (left-through-right) is expected to operate at LOS E during the PM peak hour.

In order to improve traffic operations to a LOS D or better for all approaches and movements at the study intersections under future conditions **with the proposed development**, mitigation measures were investigated.

- **Westbound Right-turn Overlap Signal**

*An overlap can be considered where a dedicated right turn lane is provided, and the right-turn operations can be signalized with a right turn arrow. The right-turn arrow operates concurrently with the southbound left-turn phase, but also allows movement when adjacent through movement is green.*

- **Signal timing optimization**

*The signal currently operates with a 90 sec and 70 sec cycle length during the AM and PM peak hours, respectively. The optimized cycle length at this intersection with the right-turn overlap phase is 110 sec and 90 sec during the AM and PM peak hours, respectively.*

The results of the analyses with the recommended improvements is summarized in **Table E1** and show that recommended improvements will mitigate the impact of the proposed site generated traffic.

**Table E1: Future Intersection Operations with Improvements**

Intersection	Control	Approach	Future Conditions (2027)				Future Conditions (2027) with Improvements			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1	Hagadorn Road & Bennett Road	EB	29.0	C	58.8	E	45.1	D	34.5	C
		WBTL	33.2	C	27.2	C	52.7	D	27.8	C
		WBR	59.7	E	29.8	C	50.0	D	17.6	B
		NBL	10.0	B	13.7	B	8.7	A	15.3	B
		NBTR	58.1	F	28.3	C	30.3	C	29.4	C
		SBL	20.8	C	21.5	C	19.8	B	21.2	C
		SBTR	14.1	B	16.8	B	12.3	B	17.9	B
		Overall	44.2	D	28.5	C	34.7	C	24.3	C

## ACCESS MANAGEMENT

### Site Driveway Turn Lane Analysis

- No right-turn lane or treatment is warranted at either Site Drive.
- A left-turn treatment (passing lane or center turn lane) is warranted at the proposed W. Site Drive.

### Intersection Sight Distance Analysis

- There will be adequate intersection sight distance at the proposed site drive intersections on Bennett Road.

## SAFETY STUDY

A crash analysis was conducted in the vicinity of the proposed site driveway locations. F&V reviewed crash data from the Michigan Traffic Crash Facts (MTCF) historical crash database for the most recent three years (January 1, 2016 to December 31, 2018) of available data for the proposed driveway location. The results of the analysis indicate that **one crash** occurred on Bennett Road that was related to the roadway segment operations.

- Bennett Road at Private Drive, Rear End Left-Turn, No Injuries

## ADJACENT SCHOOL OPERATIONS

The peak hours for the proposed development were compared to the peak hour operations of Okemos High School and Bennett Woods Elementary School and are summarized in **Table E2**. This comparison shows the AM peak hour of the adjacent street corresponds to the peak hour of Okemos High School. The peak operations of Bennett Woods Elementary School occur after the peak hour for the proposed development. During the PM peak hour, the peak operations of the proposed development occur after both schools have dismissed for the day.

**Table E2: School and Site Generated Peak Hours**

	AM Peak Hour	PM Peak Hour
Bennett Road & Site Generated Traffic	7:15-8:15 AM	4:45-5:45 PM
Okemos High School	7:45 AM Start	2:45 PM Dismissal
	7:15-8:15 AM	2:15-3:15 PM
Bennett Woods Elementary	8:45 AM Start	3:45 PM Dismissal
	8:15-9:15 AM	3:15-4:15 PM

## RECOMMENDATIONS

*The recommendations of this TIS are as follows:*

### 1. Bennett Road & Hagadorn Road

- Westbound Right-turn Overlap Signal
- Signal timing optimization

### 2. Bennett Road & W. Site Driveway

- Provide a Left-turn treatment (passing lane or center turn lane) on Bennett Road.

## 1 INTRODUCTION

This report presents the results of a Traffic Impact Study (TIS) for the proposed residential development in Meridian Township, Michigan. The project site is located adjacent to the north side of Bennett Road between Hagadorn Road and Hulett Road as shown on **Figure 1**. The proposed development includes the construction of 150 single-family residential homes. The development includes two proposed access driveways on Bennett Road. In accordance with Township Ordinance, a Traffic Impact Study (TIS) is required as part of the site plan approval process. This TIS is consistent with Township requirements and the most current edition of the handbook titled *Evaluating Traffic Impact Studies: A Recommended Practice for Michigan Communities*.

This TIS has been completed at the request of Meridian Township to identify the impacts (if any) of the proposed development on the proposed site access point and the permitting of the site access with the Ingham County Department of Roads (ICDR). The scope of the study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice, methodologies published by the Institute of Transportation Engineers (ITE) and the requirements of Meridian Township. Additionally, F&V obtained input regarding the scope of work from Meridian Township Planning Department.

The purpose of this study is to identify the traffic related impacts, if any, of the proposed development project on the adjacent road network. Specific tasks undertaken for this study include the following:

### 1. Study Area

- a. Conduct a site visit and collect a field inventory of the existing geometries, lane use, and traffic control at the study intersections.
- b. Provide a description of the study area including: surrounding land uses, intersection and roadway geometries, speed limits, functional classifications and traffic volume data (where available). In addition, a study area site map showing the site location and the study intersections will also be provided.

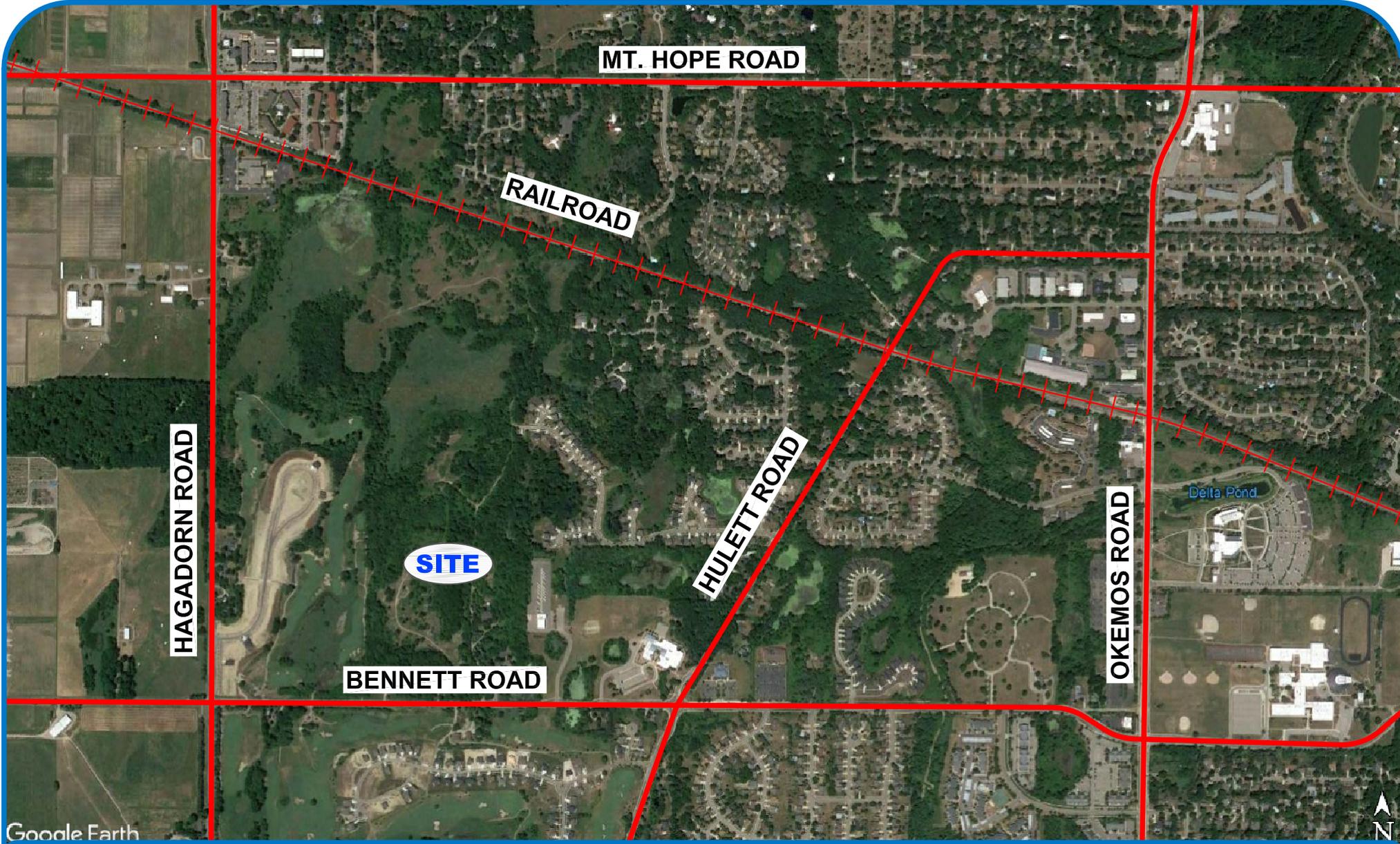
### 2. Proposed Land Use

- a. Obtain and review the proposed site plan which includes the proposed land uses, densities, and desired site access locations.
- b. A description of the current and proposed land use, including characteristics such as the number of units, will be accompanied with a complete project site plan (with buildings identified as to proposed use). A schedule for construction of the development and proposed development stages will also be provided.

### 3. Existing Conditions (2020)

Provide an analysis of the traffic-related impacts of the proposed development at the following study intersections:

- Hagadorn Road & Bennett Road
  - Hulett Road & Bennett Road
  - The proposed site driveways
- a. Obtain weekday AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak period turning movement counts at the study interste drivections from Mayberry Homes that was previously performed.
  - b. Identify the Existing AM and PM peak hour traffic volumes at the study intersections based on the existing traffic volume data.
  - c. Calculate the Existing vehicle delays, LOS, and vehicle queues at the study intersections during the AM and PM. The analysis will be performed at each of the study intersections. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6th Edition, the latest edition of Transportation Research Board's Highway Capacity Manual. Operational analysis performed at the roundabout intersection will be performed using Rodel.
  - d. Identify improvements (if any) for the study road network that would be required to accommodate the existing traffic volumes.



Google Earth



**FIGURE 1**  
**SITE LOCATION MAP**  
SILVERLEAF DEVELOPMENT - MERIDIAN TOWNSHIP, MI

LEGEND

 SITE LOCATION



NORTH  
SCALE: NOT TO SCALE

#### 4. Future Background Growth

- a. Calculate the future background traffic volumes based on an appropriate traffic growth determined from local or statewide data to the project build-out year and/or any applicable background developments in the vicinity of this project as identified by the Meridian Township.

#### 5. Background Conditions (2027 No Build)

- a. Calculate the **Background (without the proposed development)** vehicle delays, LOS, and vehicle queues at the study intersections during the AM and PM peak periods. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6<sup>th</sup> Edition, the latest edition of Transportation Research Board's Highway Capacity Manual. Operational analysis performed at the roundabout intersection will be performed using Rodel.
- b. Any state, local, or private transportation improvement projects in the project study area that will be underway in the build-out year and traffic that is generated by other proposed developments in the study area will be included as background conditions.
- c. Identify improvements (if any) for the study road network that would be required to accommodate the background traffic volumes.

#### 6. Trip Generation

- a. Forecast the number of AM and PM peak hour trips that would be generated by the proposed development based on data published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 10<sup>th</sup> Edition* and/or local development data as approved for use in the study by Meridian Township.
- b. A table will be provided in the report outlining the categories and quantities of land uses, with the corresponding trip generation rates or equations, and the resulting number of trips.

#### 7. Trip Distribution and Traffic Assignment

- a. Assign the trips that would be generated by the proposed development to the adjacent road network based on existing traffic patterns. The distribution of the estimated trip generation to the adjacent street network and nearby intersections shall be included in the report and the basis will be explained. The distribution percentages with the corresponding volumes will be provided in a graphical format.
- b. Combine the site-generated traffic assignments with the background traffic forecasts to establish the Future AM and PM peak hour traffic volumes.

#### 8. Future Conditions (2027 Buildout)

- a. Calculate the **Future (with the proposed development)** vehicle delays, LOS, and vehicle queues at the study intersections. Intersection analysis shall include LOS determination for all approaches and movements. The LOS will be based on the procedures outlined in the HCM 6<sup>th</sup> Edition, the latest edition of Transportation Research Board's Highway Capacity Manual. Operational analysis performed at the roundabout intersection will be performed using Rodel.
- b. Identify improvements (if any) for the study road network that would be required to accommodate the site-generated traffic volumes.

#### 9. Access Management

- a. Evaluate the Meridian Township and Ingham County Road Department (ICRD) auxiliary lane warrants at the proposed site driveway intersections to determine the need for left- and right-turn lanes on Bennett Road.
- b. Perform a vertical sight distance analysis at the proposed site driveway intersections on Bennett Road.

#### 10. Safety Study

- a. Perform a crash analysis on Bennett Road at the proposed site driveway location. Crash data analysis will include the most recent three (3) years of available data.

The scope of this study was developed based on Fleis & VandenBrink's (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice and information published by the Institute of Transportation Engineers (ITE). In addition, Meridian Township provided input regarding the scope of work for this study. The study analyses were completed using Synchro/SimTraffic (Version 10) and Rodel (Roundabout Analysis Software). Sources of data for this study included Traffic Engineering Associates

(TEA) and information provided by Meridian Township, MDOT and ITE. All background information is provided in **Appendix A**.

## 2 BACKGROUND DATA

### 2.1 EXISTING ROAD NETWORK

Vehicle transportation for the proposed development is provided via Bennett Road, located adjacent to the south side of the project site location. Additional roadways included in the analysis include Hulett Road and Hagadorn Road, located to the east and west of the site respectively. The lane use and traffic control at the study intersections are shown on **Figure 2** and the study roadways are further described below. For the purpose of this study, all minor streets and driveways are assumed to have an operating speed of 25 miles per hour (mph).

**Bennett Road** runs in the east and west directions with a posted speed limit of 45 mph adjacent to the site. Bennett Road is under the jurisdiction of ICDR and is classified a *Major Collector*. The study segment has an AADT of approximately 5,450 vehicles per day (TRICO 2018). Bennett Road has a typical two-lane cross section in the vicinity of the site location, with one lane in each direction. The intersection with Hagadorn Road is signalized and there is a single lane roundabout at the intersection with Hulett Road.

**Hagadorn Road** runs in the north and south directions with a posted speed limit of 50 mph. Hagadorn Road is under the jurisdiction of ICDR and the study section of the roadway is classified a *Minor Arterial*. The study segment has an AADT of approximately 11,000 vehicles per day (TRICO 2018). The study section of Hagadorn Road has a typical two-lane cross section with one lane in each direction. The roadway widens at the signalized intersection with Bennett Road to provide exclusive left-turn lanes.

**Hulett Road** runs in the north and south directions east of the site and is under the jurisdiction of ICDR north of Bennett Road the roadway is classified as a *Local Road* and has a posted speed limit of 35 mph. South of Bennett Road the roadway is classified a *Major Collector* and has a speed limit of 45 mph with AADT of approximately 3,300 vehicles per day (TRICO 2018).

### 2.2 EXISTING TRAFFIC VOLUMES

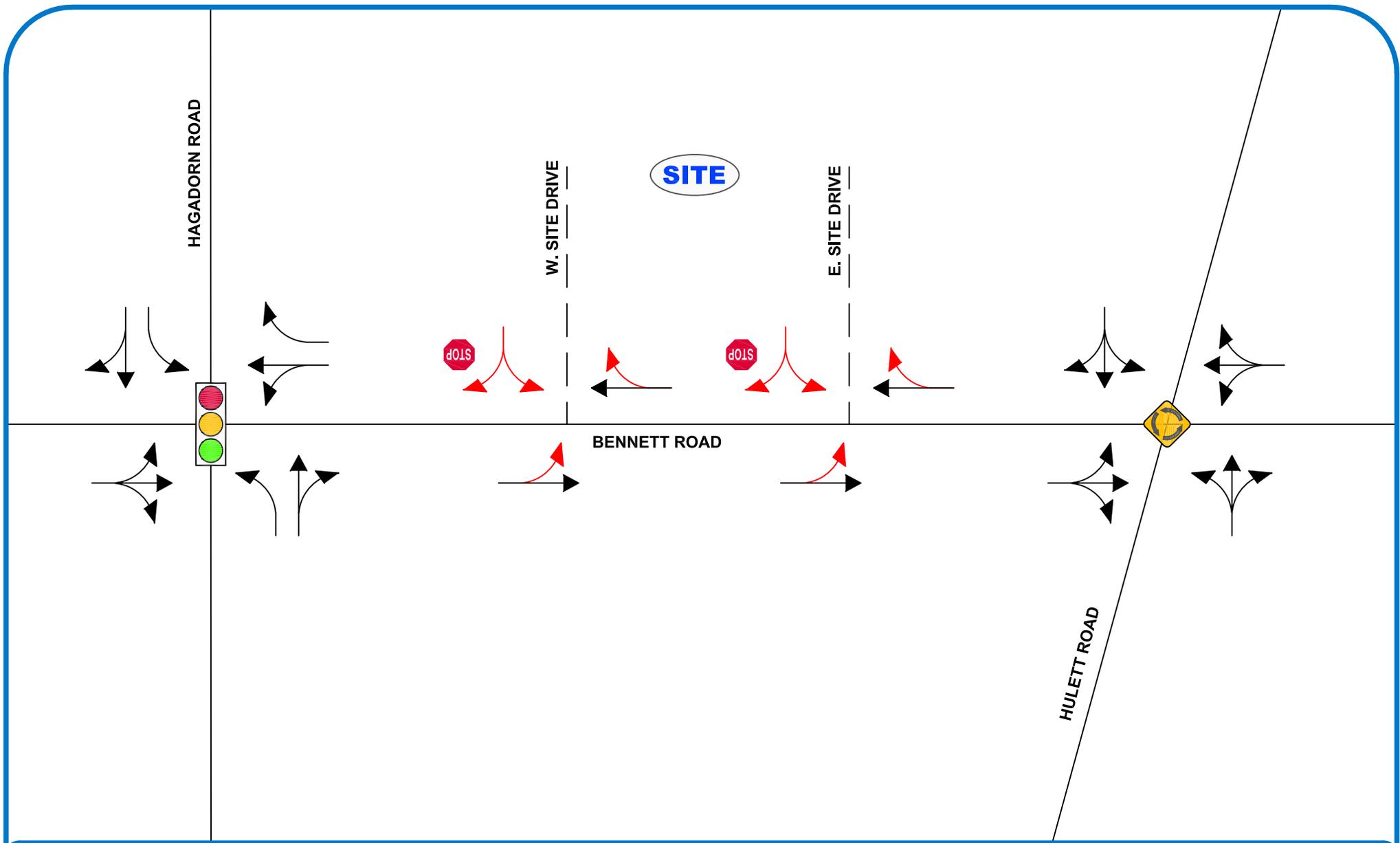
The existing weekday turning movement count data used in this study were performed by Traffic Engineering Associated (TEA) and C&A Associates in September 2018. Historical traffic volume data was reviewed in order to determine a background growth rate to calculate the existing 2020 traffic volumes; however, traffic volume data in this area was not sufficient to calculate an effective background growth rate. Therefore, regional planning information was reviewed to determine a background growth rate for this study.

The Tri-County Regional Planning Long Range Transportation Plan was reviewed and the data for Meridian Township was evaluated to determine the projected regional growth projected for the next 10 years. The results of this analysis are summarized in **Table 1** and show that an average growth of 0.14% is anticipated for Meridian Township. MDOT recommends a minimum 0.5% annual background growth rate to be used in traffic engineering studies. Therefore, a 0.5% background growth rate was used to calculate the existing 2020 traffic volumes for use in this study..

**Table 1: TRICO Regional Growth Rates (2020-2030)**

Tri-County Regional Planning L RTP Projections (2010-2045)	Year 2020	Year 2030	Annual Growth Rate
Population	39,799	40,203	0.10%
Households	18,133	18,622	0.27%
Retail Employment	6,249	6,200	-0.08%
Non-Retail Employment	20,048	20,577	0.26%
Average Annual Growth Rate			0.14%

Peak Hour Factors (PHFs) were also calculated for each study intersection approach. The traffic generated by Okemos High School and Bennett Woods Elementary School has an impact on the PHFs. Therefore, select turning movements that are impacted by the schools used the movement PHF during the AM peak hour to consider the impact of the school peak hour traffic volumes at the study intersection.



**FIGURE 2**  
**LANE USE AND TRAFFIC CONTROL**  
 SILVERLEAF DEVELOPMENT - MERIDIAN TOWNSHIP, MI

**LEGEND**

-  SIGNALIZED INTERSECTION
-  UNSIGNALIZED INTERSECTION
-  ROUNDABOUT INTERSECTION
-  ROADS
-  PROPOSED ROADS
-  LANE USE
-  PROPOSED LANE USE
-  NORTH
- SCALE: NOT TO SCALE

The peak hour volumes for each intersection were utilized for this study and the volumes were balanced upward through the study network, and through volumes were carried along the main study roadways. At locations where access is provided between study intersections, “dummy” intersections were used to account for sink and source volumes, and through volumes were carried along the main study roadways. The AM and PM peak hours of existing network traffic were identified to generally occur between 7:15 AM to 8:15 AM and 4:45 PM to 5:45 PM, respectively, for a typical weekday. The traffic volume data are included in **Appendix A** and the existing peak hour volumes are summarized on **Figure 3**.

### 2.3 ADJACENT SCHOOL OPERATIONS

The adjacent operations of Okemos High School and Bennett Woods Elementary School were reviewed to determine the impact the schools generated traffic volumes have on the adjacent roadway network and the impact on the proposed development operations.

The peak hour for the proposed residential development occurs during the peak hour for the adjacent street. The data collection performed for this analysis calculated the peak hours to occur between 7:15 AM to 8:15 AM and 4:45 PM to 5:45 PM. Outside of these hours, the site generated traffic volumes are less, therefore in order to evaluate the impact of the site generated traffic on the adjacent roadway network the peak hours of the site are evaluated. These peak hours were compared to the peak hour operations of Okemos High School and Bennett Woods Elementary School and are summarized in **Table 2**. This comparison shows the AM peak hour of the adjacent street corresponds to the peak hour of Okemos High School. The peak operations of Bennett Woods Elementary School occur after the peak hour for the proposed development. During the PM peak hour, the peak operations of the proposed development occur after both schools have dismissed for the day.

**Table 2: School and Site Generated Peak Hours**

	AM Peak Hour	PM Peak Hour
Bennett Road & Site Generated Traffic	7:15-8:15 AM	4:45-5:45 PM
Okemos High School	7:45 AM Start	2:45 PM Dismissal
	7:15-8:15 AM	2:15-3:15 PM
Bennett Woods Elementary	8:45 AM Start	3:45 PM Dismissal
	8:15-9:15 AM	3:15-4:15 PM

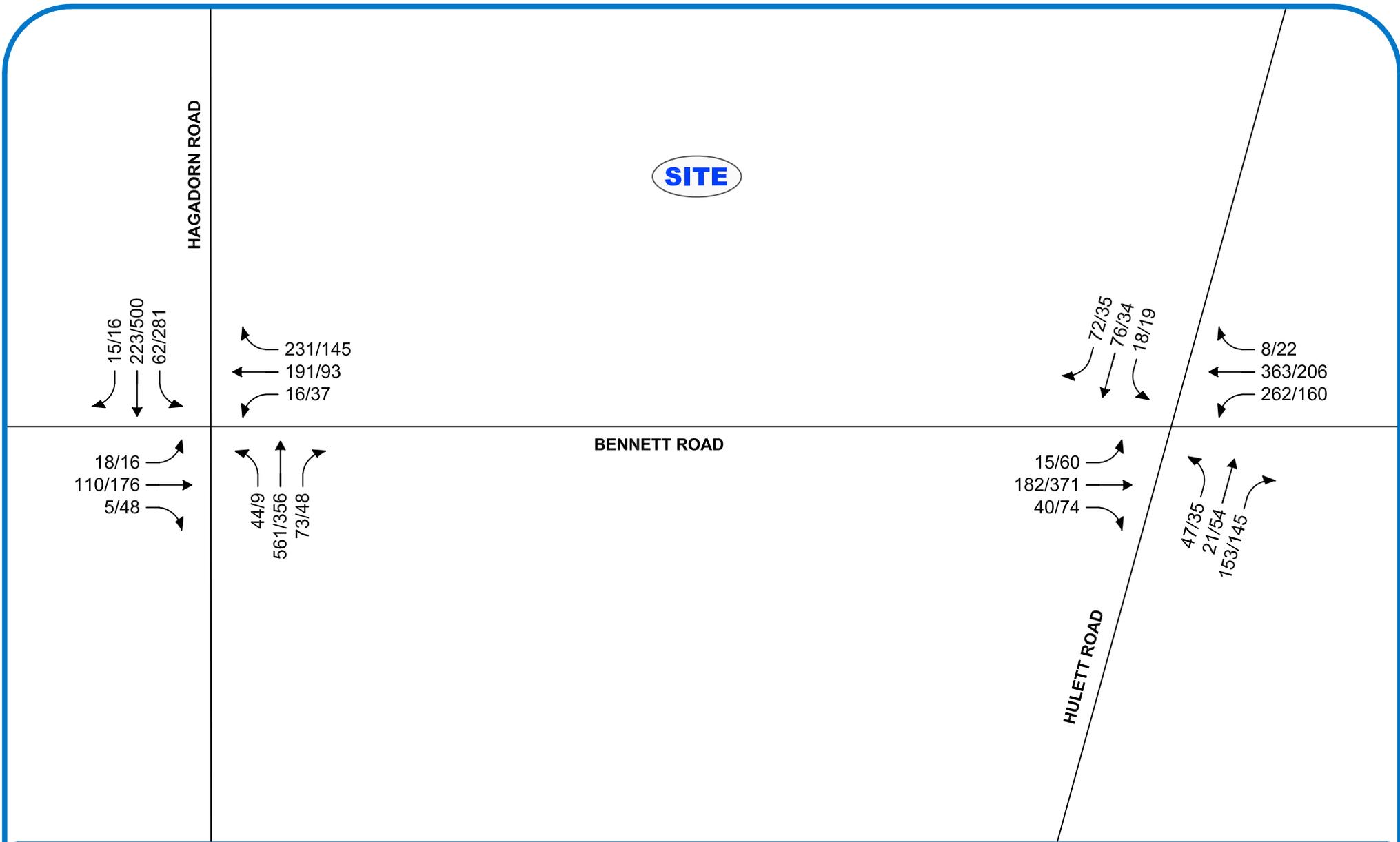
The Township has raised concerns about the pick-up/drop-off (PUDO) operations of Bennett Woods Elementary School and the impact on Bennett Road. The school has a published traffic operations plan, however if this plan does not sufficiently address their current operations it is recommended that a complete safety and operations review is performed and recommendations are implemented for this site to ensure that the school operates safely and efficiently.

## 3 ANALYSIS

### 3.1 EXISTING CONDITIONS

The existing AM and PM peak hour vehicle delays and Levels of Service (LOS) were calculated at the Bennett Road & Hagadorn Road intersection using Synchro traffic analysis software. The Bennett Road & Hulett Road roundabout intersection was evaluated using Rodel (Roundabout Analysis Software). The results of the analysis of existing conditions were based on the existing lane use and traffic control shown on **Figure 2**, the existing traffic volumes shown on **Figure 3**, and the methodologies presented in the Highway Capacity Manual 6<sup>th</sup> Edition (HCM6).

Descriptions of LOS “A” through “F” as defined in the HCM, are provided in **Appendix B** for unsignalized intersections. Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. The results of the analysis of existing conditions are presented in **Appendix B** and are summarized in **Table 3**. Microsimulations were also conducted at the study intersections using SimTraffic to further evaluate the network performance.



# FIGURE 3 EXISTING TRAFFIC VOLUMES

SILVERLEAF DEVELOPMENT - MERIDIAN TOWNSHIP, MI

### LEGEND

- ROADS
- PROPOSED ROADS
- TRAFFIC VOLUMES (AM/PM)



**Table 3: Existing Intersection Operations**

Intersection	Control	Approach	Existing Conditions (2020)				
			AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	
1	Hagadorn Road & Bennett Road	Signalized	EB	29.4	C	32.9	C
			WBTL	31.9	C	23.8	C
			WBR	48.2	D	25.6	C
			NBL	8.8	A	12.9	B
			NBTR	35.6	D	23.3	C
			SBL	17.4	B	14.2	B
			SBTR	12.8	B	16.4	B
Overall	32.2	C	21.5	C			
2	Hulett Road & Bennett Road	Roundabout	EB	4.7	A	6.1	A
			WB	6.7	A	4.8	A
			NB	4.0	A	4.7	A
			SB	5.3	A	3.8	A
			Overall	5.7	A	5.2	A

The results of the existing conditions analysis show that all approaches and movements at the study intersections are currently operating acceptably at a LOS D or better. The results of the SimTraffic analysis show brief periods of vehicle queueing on the northbound Hagadorn Road approach and the westbound Hulett Road approach at Bennett Road. The queues were brief, occurring during the peak 15 minutes prior to the start of school at Okemos High School.

### 3.2 BACKGROUND CONDITIONS

In order to determine the applicable traffic growth rate for the existing traffic volumes to the project buildout year of 2027 the background growth rate of 0.5% per year was applied to the existing 2020 traffic volumes collected to forecast the background 2027 traffic volumes conditions **without the proposed development**.

In addition to background traffic growth, Meridian Township identified the following proposed development within the project influence area that was considered as background conditions. The trip generation associated with the proposed development is summarized in **Table 4**.

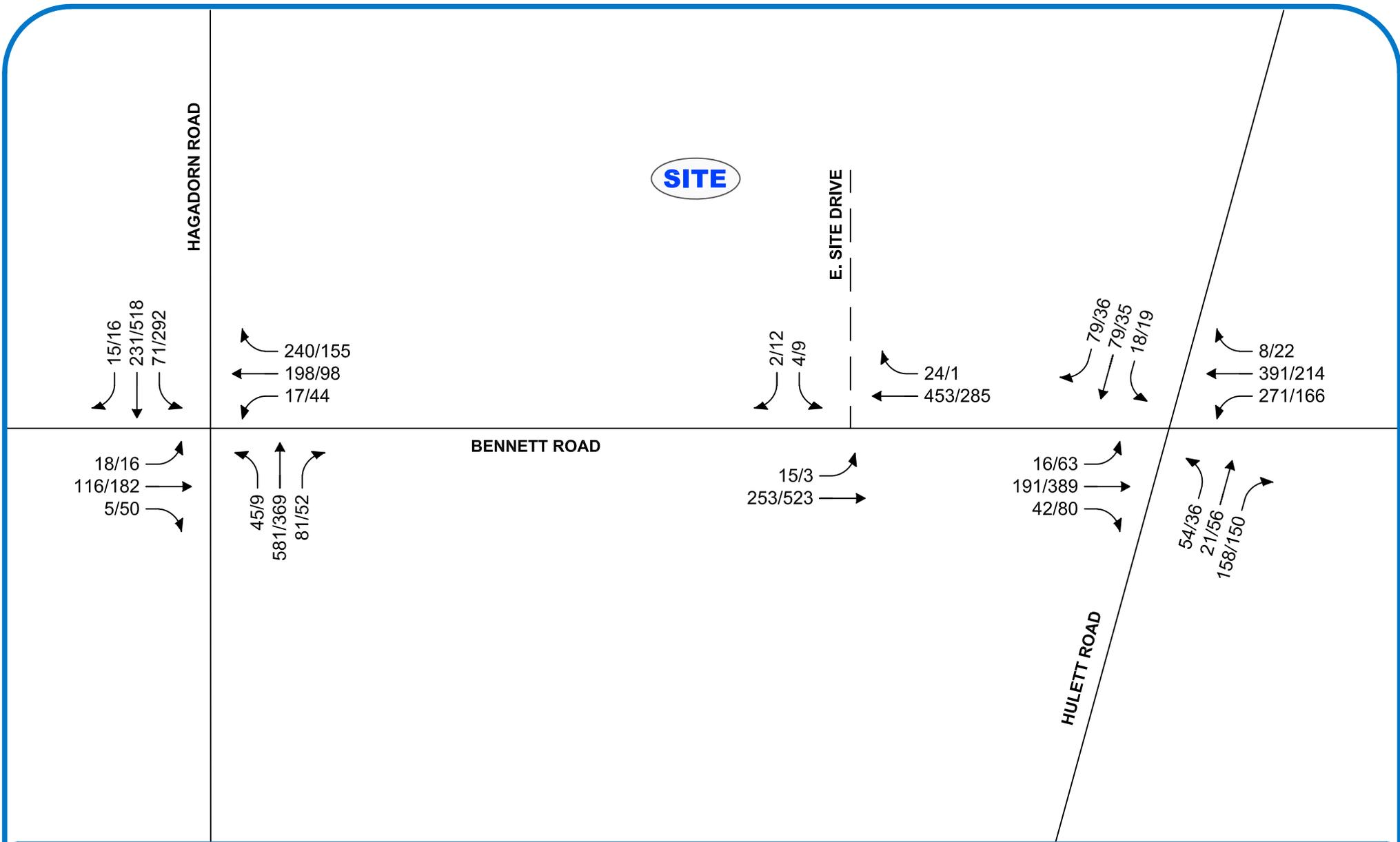
**Table 4: Office Building (Bennett Road) Site Trip Generation**

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
General Office Building	710	20,000	SF	223	39	6	45	4	21	25

The number of AM and PM peak hour vehicle trips that would be generated by the background development was forecast and assigned to the study roadway network based on the existing traffic patterns. After applying the background growth rate to the existing traffic volumes shown on **Figure 3**, the site-generated traffic volumes from the background developments were added in order to determine the total background traffic volumes **without the proposed development**, as shown on **Figure 4**.

Future peak hour vehicle delays and LOS **without the proposed development** were calculated based on the future lane use and traffic control shown on **Figure 2**, the background traffic volumes shown on **Figure 4**, and the methodologies presented in the HCM. The results of the analysis of background conditions are presented in **Appendix C** and are summarized in **Table 5**.

The results of the background conditions analysis indicate that all study intersection approaches and movements will continue to operate in a manner similar to existing conditions.



# FIGURE 4 BACKGROUND TRAFFIC VOLUMES

SILVERLEAF DEVELOPMENT - MERIDIAN TOWNSHIP, MI

### LEGEND

-  ROADS
-  PROPOSED ROADS
-  TRAFFIC VOLUMES (AM/PM)



**Table 5: Background Intersection Operations**

Intersection	Control	Approach	Existing Conditions (2020)				Background Conditions (2027) <i>without development</i>				
			AM Peak		PM Peak		AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
1	Hagadorn Road & Bennett Road	Signalized	EB	29.4	C	32.9	C	29.5	C	34.2	C
			WBTL	31.9	C	23.8	C	32.4	C	24.3	C
			WBR	48.2	D	25.6	C	50.7	D	26.5	C
			NBL	8.8	A	12.9	B	9.2	A	13.4	B
			NBTR	35.6	D	23.3	C	47.3	D	25.3	A
			SBL	17.4	B	14.2	B	19.8	B	16.3	C
			SBTR	12.8	B	16.4	B	13.2	B	17.2	B
	<b>Overall</b>		<b>32.2</b>	<b>C</b>	<b>21.5</b>	<b>C</b>	<b>37.8</b>	<b>D</b>	<b>22.8</b>	<b>C</b>	
2	Hulett Road & Bennett Road	Roundabout	EB	4.7	A	6.1	A	4.9	A	6.4	A
			WB	6.7	A	4.8	A	7.3	A	4.9	A
			NB	4.0	A	4.7	A	4.0	A	4.9	A
			SB	5.3	A	3.8	A	5.6	A	3.9	A
			<b>Overall</b>	<b>5.7</b>	<b>A</b>	<b>5.2</b>	<b>A</b>	<b>6.0</b>	<b>A</b>	<b>5.4</b>	<b>A</b>

**3.3 SITE TRIP GENERATION**

The number of Weekday AM and PM peak hour and daily vehicle trips that would be generated by the proposed development was forecast based on data published by ITE in the *Trip Generation Manual, 10<sup>th</sup> Edition*. The site trip generation forecast is summarized in **Table 6**.

**Table 6: Site Trip Generation**

Land Use	ITE Code	Amount	Units	Average Daily Traffic (vpd)	AM Peak Hour (vph)			PM Peak Hour (vph)		
					In	Out	Total	In	Out	Total
Single-Family Detached	210	150	DU	1,510	28	83	111	95	55	150

**3.4 SITE TRAFFIC ASSIGNMENT**

The vehicular trips that would be generated by the proposed development were assigned to the study roads based on the proposed site access plan, the existing peak hour traffic patterns in the adjacent roadway network, and the methodologies published by ITE. The adjacent street traffic volumes were used to develop the trip distribution. To determine the trips distribution for residential developments using the adjacent street traffic, it is assumed that the trips in the AM are home-to-work based trips, and in the PM are work-to-home based trips. Therefore, the global residential trip distribution is based on trips leaving the residential development in the AM, and exiting the study network, then entering the study network and returning to the development in the PM. The ITE trip distribution methodology assumes that new trips will return to their direction of origin. The site trip distributions used in the analysis are summarized in **Table 7**.

**Table 7: Site Trip Distribution**

To / From	Via	AM	PM
North	Hagadorn Road	39%	37%
	Hulett Road	2%	4%
South	Hagadorn Road	12%	19%
	Hulett Road	18%	11%
East	Bennett Road	17%	18%
West	Bennett Road	12%	11%
<b>Total</b>		<b>100%</b>	<b>100%</b>

The vehicular traffic volumes shown in **Table 5** were distributed to the roadway network according to the distribution shown in **Table 6**. In addition, 25% of the egress vehicles from the site were assumed as diverted link trips and were assumed to drop-off students at Bennett Woods Elementary School prior to continuing onto their destination.

The projected site generated trips are shown on **Figure 5** and were added to the background traffic volumes shown on **Figure 2** to calculate the future peak hour traffic volumes with the proposed development shown on **Figure 6**.

### 3.5 FUTURE CONDITIONS

The future peak hour vehicle delays and LOS *with the proposed development* were calculated based on the existing lane use and traffic control shown on **Figure 2**, the proposed site access plan, the future traffic volumes shown on **Figure 5**, and the methodologies presented in the HCM6. The results of the future conditions analysis are presented in **Appendix C** and are summarized in **Table 8**.

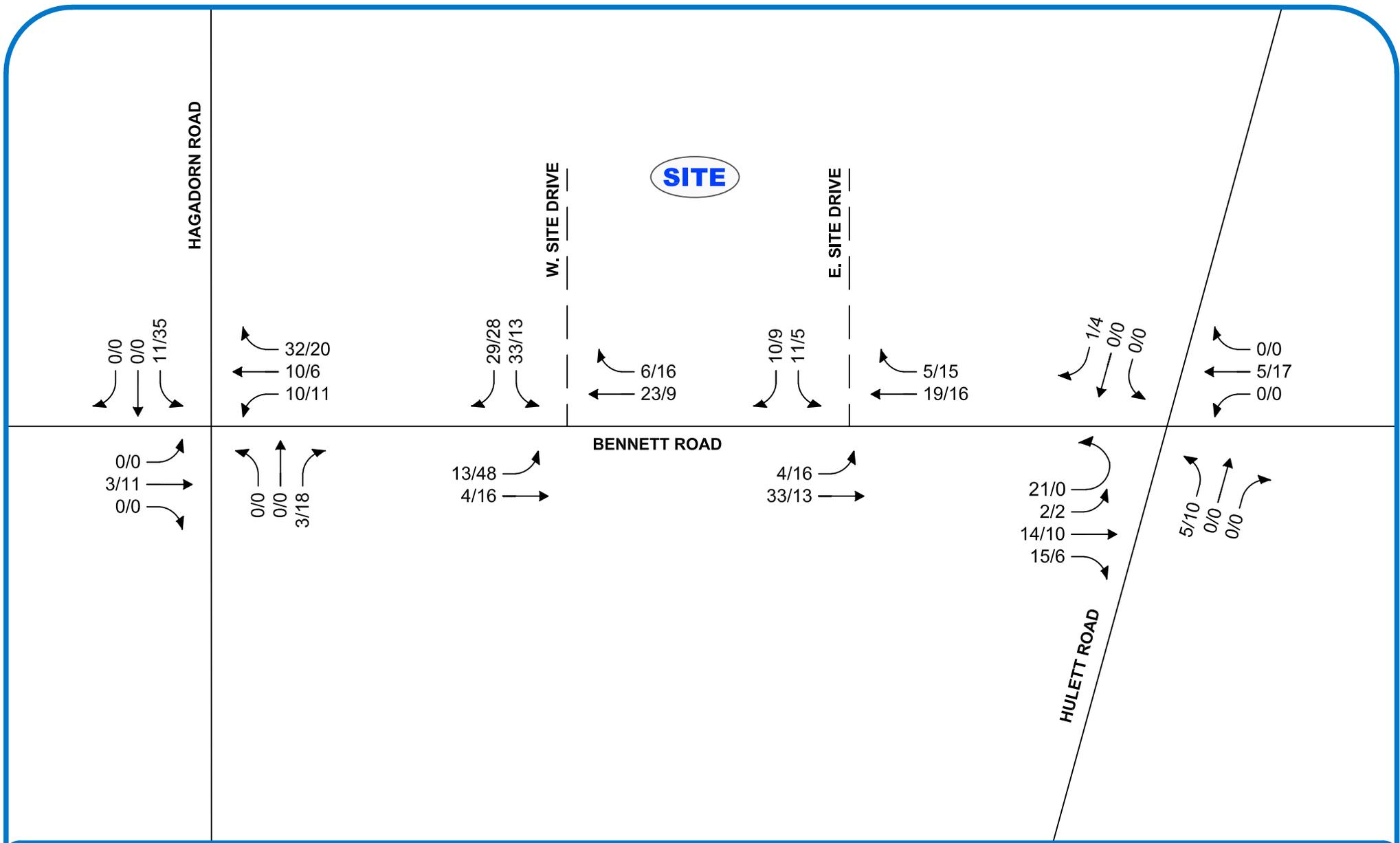
**Table 8: Future Intersection Operations**

Intersection	Control	Approach	Background Conditions (2027) <i>without development</i>				Future Conditions (2027) <i>with development</i>			
			AM Peak		PM Peak		AM Peak		PM Peak	
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS
Hagadorn Road & Bennett Road	Signalized	EB	29.5	C	34.2	C	29.0	C	58.8	E
		WBTL	32.4	C	24.3	C	33.2	C	27.2	C
		WBR	50.7	D	26.5	C	59.7	E	29.8	C
		NBL	9.2	A	13.4	B	10.0	B	13.7	B
		NBTR	47.3	D	25.3	A	58.1	F	28.3	C
		SBL	19.8	B	16.3	C	20.8	C	21.5	C
		SBTR	13.2	B	17.2	B	14.1	B	16.8	B
<b>Overall</b>	<b>37.8</b>	<b>D</b>	<b>22.8</b>	<b>C</b>	<b>44.2</b>	<b>D</b>	<b>28.5</b>	<b>C</b>		
Hulett Road & Bennett Road	Roundabout	EB	4.9	A	6.4	A	5.2	A	6.6	A
		WB	7.3	A	4.9	A	7.7	A	5.0	A
		NB	4.0	A	4.9	A	4.2	A	5.0	A
		SB	5.6	A	3.9	A	5.8	A	4.0	A
		<b>Overall</b>	<b>6.0</b>	<b>A</b>	<b>5.4</b>	<b>A</b>	<b>6.3</b>	<b>A</b>	<b>5.6</b>	<b>A</b>
W. Site Driveway & Bennett Road	STOP (Minor Street)	EBL					8.8	A	8.2	A
		SB					18.5	C	15.1	C
E. Site Driveway & Bennett Road	STOP (Minor Street)	EBL					8.9	A	8.1	A
		SB					17.7	C	14.9	B

The results of the future conditions analysis show increased delays for the following intersection approaches and movements with the addition of the site generated traffic volumes.

#### Bennett Road & Hagadorn Road

- The northbound shared through/right-turn approach is expected to operate at LOS F during the AM peak hour. A review of network simulations shows extensive (500-ft) queue lengths during the AM peak hour. The poor LOS and queue lengths are attributed to the high volume of northbound vehicles and school traffic generated by both Bennett Woods Elementary and Okemos High School.
- The westbound right-turn lane is expected to operate at LOS E during the AM peak hour. A review of network simulations shows queue lengths of approximately 200-ft, however the queues are not present throughout the entire AM peak hour.
- The eastbound single lane shared left-through-right approach is expected to operate at LOS E during the PM peak hour.



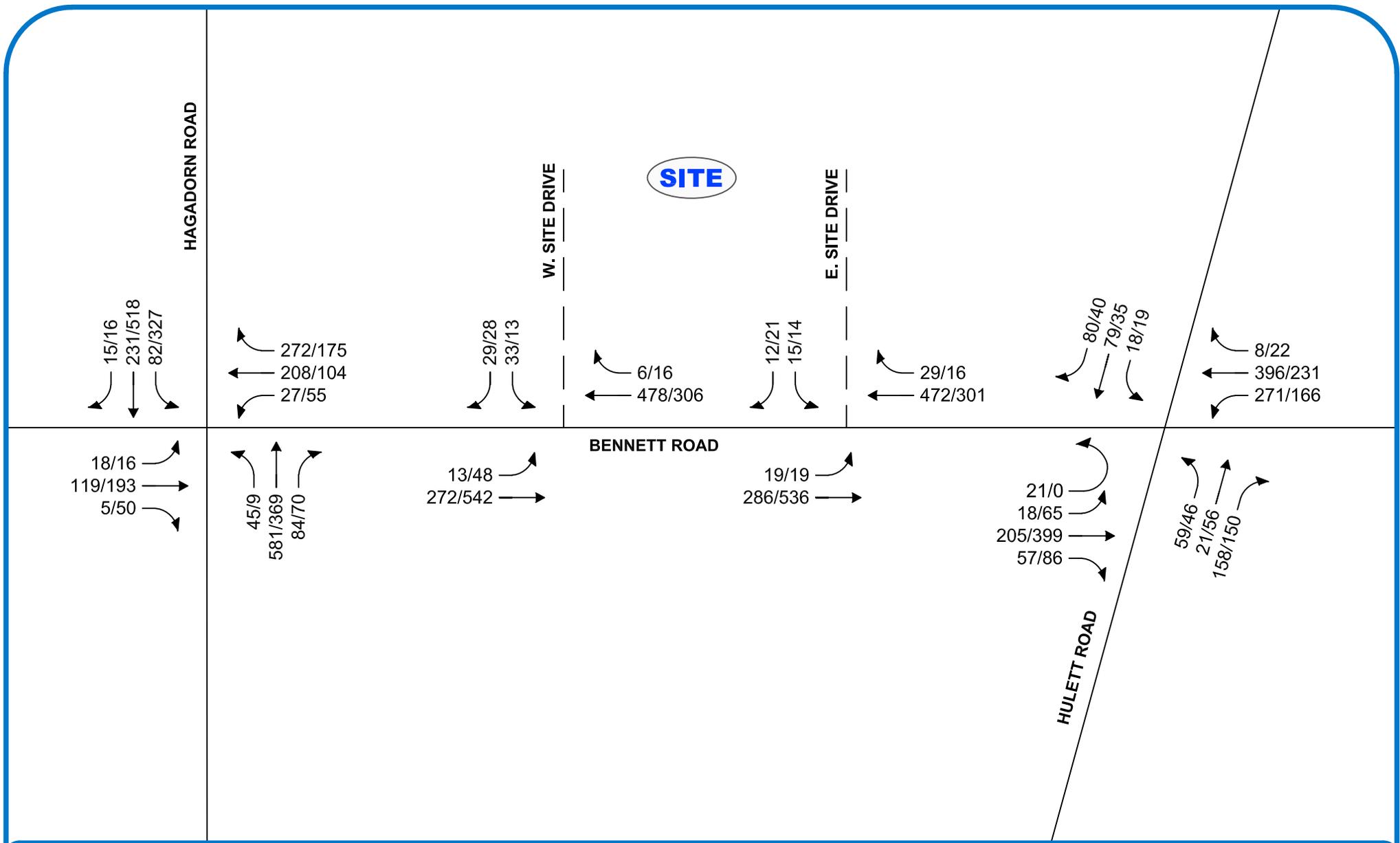
# FIGURE 5 SITE-GENERATED TRAFFIC VOLUMES

SILVERLEAF DEVELOPMENT - MERIDIAN TOWNSHIP, MI

### LEGEND

- ROADS
- PROPOSED ROADS
- TRAFFIC VOLUMES (AM/PM)





**FIGURE 6**  
**FUTURE TRAFFIC VOLUMES**  
 SILVERLEAF DEVELOPMENT - MERIDIAN TOWNSHIP, MI

**LEGEND**

- ROADS
- PROPOSED ROADS
- TRAFFIC VOLUMES (AM/PM)



### 3.6 FUTURE IMPROVEMENTS

In order to improve traffic operations to a LOS D or better for all approaches and movements at the study intersections under future conditions **with the proposed development**, mitigation measures were investigated.

#### Bennett Road & Hagadorn Road

- Westbound Right-turn Overlap Signal

*An overlap can be considered where a dedicated right turn lane is provided, and the right-turn operations can be signalized with a right turn arrow. The right-turn arrow operates concurrently with the southbound left-turn phase, but also allows movement when adjacent through movement is green.*

- Signal timing optimization

*The signal currently operates with a 90 sec and 70 sec cycle length during the AM and PM peak hours, respectively. The optimized cycle length at this intersection with the right-turn overlap phase is 110 sec and 90 sec during the AM and PM peak hours, respectively.*

The results of the analyses with the recommended improvements is summarized in **Table 9** and show that recommended improvements will mitigate the impact of the proposed site generated traffic.

**Table 9: Future Intersection Operations with Improvements**

Intersection	Control	Approach	Future Conditions (2027)				Future Conditions (2027) with Improvements				
			AM Peak		PM Peak		AM Peak		PM Peak		
			Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	Delay (s/veh)	LOS	
1	Hagadorn Road & Bennett Road	Signalized	EB	29.0	C	58.8	E	45.1	D	34.5	C
			WBTL	33.2	C	27.2	C	52.7	D	27.8	C
			WBR	59.7	E	29.8	C	50.0	D	17.6	B
			NBL	10.0	B	13.7	B	8.7	A	15.3	B
			NBTR	58.1	F	28.3	C	30.3	C	29.4	C
			SBL	20.8	C	21.5	C	19.8	B	21.2	C
			SBTR	14.1	B	16.8	B	12.3	B	17.9	B
			Overall	44.2	D	28.5	C	34.7	C	24.3	C

### 3.7 ACCESS MANAGEMENT

#### 3.7.1 Site Driveway Turn Lane Analysis

The Ingham County Road Department “Rules, Standards, and Procedures for Driveways, Banners, and Parades Upon or Over Ingham County Road Commission Right of Way” includes warranting criteria for determining the need for left- and right-turn lanes at the proposed site driveway. The results of the analysis are provided in **Appendix D** and indicate the following:

Site Driveway Intersections	Left-Turn Warranted	Right-Turn Warranted
W. Site Drive	Yes	No
E. Site Drive	No	No

- No right-turn lane or treatment is warranted at either Site Drive.
- A left-turn treatment (passing lane or center turn lane) is warranted at the proposed W. Site Drive.

#### 3.7.2 Intersection Sight Distance Analysis

The vertical sight distance was reviewed at the proposed site drive intersections. According to *Section 9.5 – Intersection Sight Distance* of the AASHTO design manual *A Policy on Geometric Design of Highways and Streets, 7<sup>th</sup> Edition (2018)*, an intersection sight distance of 555 feet is required for a left turn from a complete

stop and a sight distance of 480 feet is required for a right turn from a stopped position at the study intersection based on the existing 45 mph speed limit (50 mph design speed).

The AASHTO manual states that the “vertex (decision point) of the departure sight triangle on the minor road should be 14.5 ft from the edge of the major-road traveled way”. This gives an accurate depiction of driver behavior when making a turn from a minor roadway. The results of the sight distance analysis show that there is adequate sight distance at the proposed intersection location. A vertical sight distance analysis was performed to determine if the grade changes on Bennett Road would create sight distance limitations at the proposed site driveway locations. The intersection sight distance measurements are shown on **Figure 7** and summarized below.

**W. Site Drive:** The results of the analysis show that there are no concerns with the horizontal sight distance. This section of Bennett Road is straight with no horizontal curves. The vertical sight distance analysis shows that to the west of the site driveway there is a 2-ft dip in the roadway, however with driver’s eye height at 3.5-ft there is no sight loss. To the east of the sight there is a gradual vertical curve, however there is adequate sight distance prior to the crest of the vertical curve. Therefore, this driveway provides adequate intersection sight distance.

**E. Site Drive:** The results of the analysis show that there are no concerns with the horizontal sight distance. This section of Bennett Road is straight with no horizontal curves. The vertical sight distance analysis shows that to the proposed driveway is located at the crest of the vertical curve and there is adequate sight distance both east and west of the driveway. Therefore, this driveway provides adequate intersection sight distance.

### 3.8 SAFETY STUDY

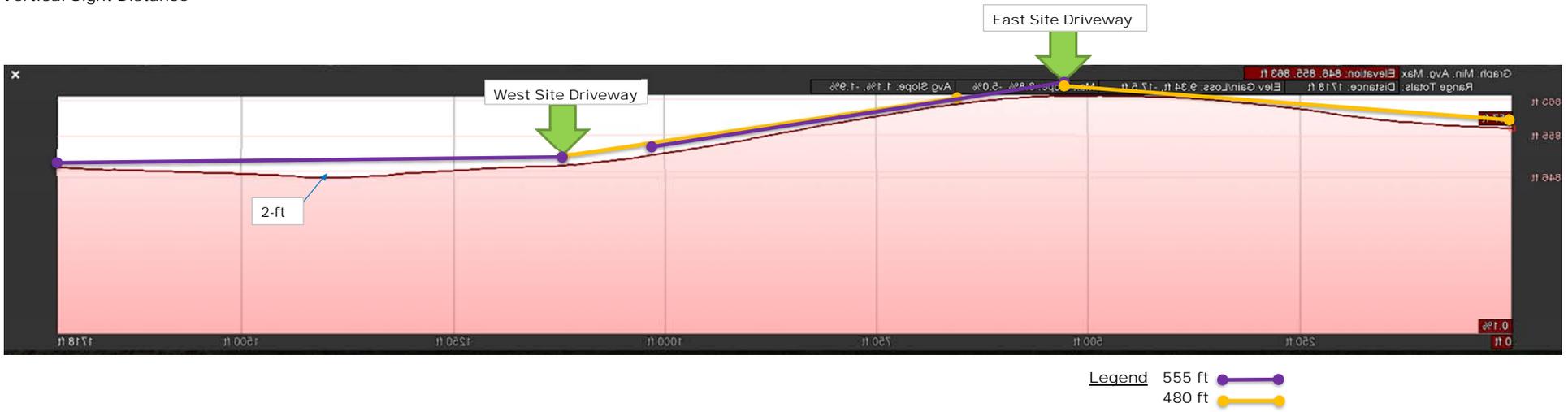
A crash analysis was conducted in the vicinity of the proposed site driveway locations. F&V reviewed crash data from the Michigan Traffic Crash Facts (MTCF) historical crash database for the most recent three years (January 1, 2016 to December 31, 2018) of available data for the proposed driveway location. The results of the analysis indicate that **one crash** occurred on Bennett Road that was related to the roadway segment operations.

- Bennett Road at Private Drive, Rear End Left-Turn, No Injuries

It is expected with the additional left-turning vehicles associated with the proposed development an increase in rear end crashes may be experienced on this segment of Bennett Road. Therefore, in concurrence with the Left-turn warrant criteria, a left-turn passing lane or center left-turn lane is recommended at the proposed W. Site Driveway to reduce the crash potential associated with left-turning vehicles in a single-lane.

Figure 7: Intersection Sight Distance

Intersection Sight Distance  
Vertical Sight Distance



Horizontal Sight Distance



## 4 CONCLUSIONS

The conclusions of this Traffic Impact Study are as follows:

### 4.1 EXISTING OPERATIONS (2020)

- The existing conditions analysis included the evaluation of the existing 2020 operations at the study intersections.
- The study intersections currently operate well, at LOS D or better. There are brief periods of vehicle queuing during the AM peak hour of the adjacent street due to traffic impacts from Okemos High School. These are experienced during the 15-30 minute prior to the start of school.

### 4.2 BACKGROUND OPERATIONS (2027 WITHOUT DEVELOPMENT)

- The background conditions analysis included the evaluation of the background 2027 operations at the study intersections. This analysis included increased traffic volumes calculated with a background growth rate and the trips generated by the proposed office development adjacent to the site on Bennett Road.
- The study intersections are expected to continue operating well, at LOS D or better with the addition of background growth. There continue to be brief periods of vehicle queuing during the AM peak hour of the adjacent street due to the adjacent operations of Okemos High School.

### 4.3 FUTURE OPERATIONS (2027 WITH DEVELOPMENT)

The results of the future conditions analysis show increased delays for the following intersection approaches and movements with the addition of the site generated traffic volumes.

- The northbound shared through/right-turn approach is expected to operate at LOS F during the AM peak hour. A review of network simulations shows extensive (500-ft) queue lengths during the AM peak hour. The poor LOS and queue lengths are attributed to the high volume of northbound vehicles and school traffic generated by both Bennett Woods Elementary and Okemos High School.
- The westbound right-turn lane is expected to operate at LOS E during the AM peak hour. A review of network simulations shows queue lengths of approximately 200-ft; however, the queues are not present throughout the duration of the entire AM peak hour.
- The eastbound single lane approach (left-through-right) is expected to operate at LOS E during the PM peak hour.

In order to improve traffic operations to a LOS D or better for all approaches and movements at the study intersections under future conditions **with the proposed development**, mitigation measures were investigated.

- **Westbound Right-turn Overlap Signal**

*An overlap can be considered where a dedicated right turn lane is provided, and the right-turn operations can be signalized with a right turn arrow. The right-turn arrow operates concurrently with the southbound left-turn phase, but also allows movement when adjacent through movement is green.*

- **Signal timing optimization**

*The signal currently operates with a 90 sec and 70 sec cycle length during the AM and PM peak hours, respectively. The optimized cycle length at this intersection with the right-turn overlap phase is 110 sec and 90 sec during the AM and PM peak hours, respectively.*

### 4.4 ACCESS MANAGEMENT

#### Site Driveway Turn Lane Analysis

The Ingham County Road Department “Rules, Standards, and Procedures for Driveways, Banners, and Parades Upon or Over Ingham County Road Commission Right of Way” includes warranting criteria for determining the need for left- and right-turn lanes at the proposed site driveway. The results of the analysis are provided in **Appendix D** and indicate the following:

- No right-turn lane or treatment is warranted at either Site Drive.

- A left-turn treatment (passing lane or center turn lane) is warranted at the proposed W. Site drive.

### Intersection Sight Distance Analysis

The intersection sight distance was reviewed at the proposed Site Drive intersection on Bennett Road according to *Section 9.5 – Intersection Sight Distance* of the AASHTO design manual *A Policy on Geometric Design of Highways and Streets, 7<sup>th</sup> Edition (2018)*. The results of the analysis indicate the following:

- There will be adequate intersection sight distance at the proposed site drive intersections on Bennett Road.

## 4.5 SAFETY STUDY

A crash analysis was conducted in the vicinity of the proposed site driveway locations. F&V reviewed crash data from the Michigan Traffic Crash Facts (MTCF) historical crash database for the most recent three years (January 1, 2016 to December 31, 2018) of available data for the proposed driveway location. The results of the analysis indicate that **one crash** occurred on Bennett Road that was related to the roadway segment operations.

- Bennett Road at Private Drive, Rear End Left-Turn, No Injuries

## 4.6 ADJACENT SCHOOL OPERATIONS

The AM peak hour operations of Okemos High School occur during the peak hour for the proposed development. The AM peak hour operations of Bennett Woods Elementary School occur after the peak hour for the proposed development. During the PM peak hour, the peak operations of the proposed development occur after both schools have dismissed for the day.

## 5 RECOMMENDATIONS

*The recommendations of this Traffic Impact Study are as follows:*

### 1. Bennett Road & Hagadorn Road

- Westbound Right-turn Overlap Signal
- Signal timing optimization

### 2. Bennett Road & W. Site Driveway

- Provide a left-turn treatment (passing lane or center turn lane) on Bennett Road.

## **Appendix A**

# **BACKGROUND INFORMATION**

# Traffic Engineering Associates, Inc.

PO Box 100  
Saranac, MI 48881  
517-627-6028

Location: Bennett Rd. & Hagadorn Rd.  
County/City: Meridian Twp., Ingham Cty  
Weather: Sunny  
Counted By: DES

File Name : Bennett & Hagadorn - AM  
Site Code : 09111801  
Start Date : 9/11/2018  
Page No : 1

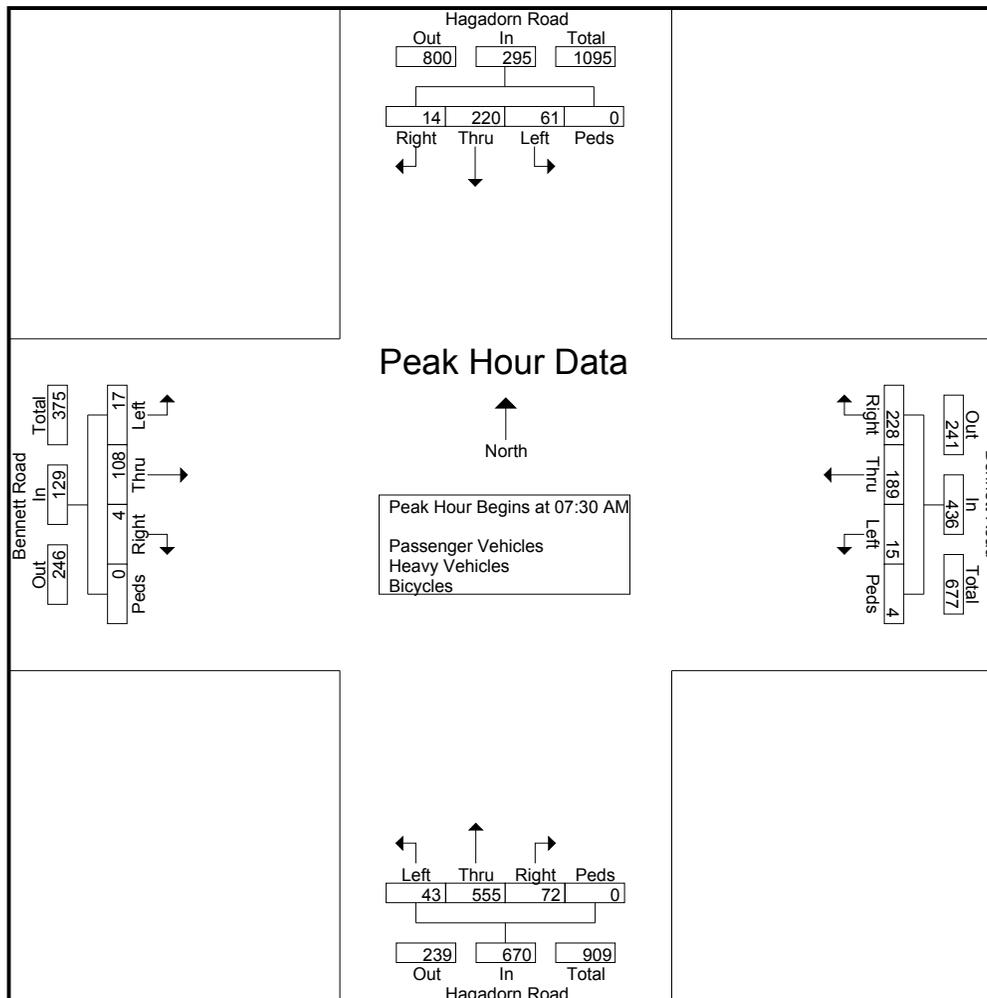
### Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

Start Time	Hagadorn Road From North					Bennett Road From East					Hagadorn Road From South					Bennett Road From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	8	32	1	0	41	1	27	24	0	52	4	40	4	1	49	2	10	0	0	12	154
07:15 AM	15	37	8	0	60	5	24	37	0	66	7	94	14	0	115	2	18	0	0	20	261
07:30 AM	12	64	2	0	78	9	66	63	0	138	12	162	41	0	215	3	34	1	0	38	469
07:45 AM	17	52	5	0	74	3	61	55	2	121	13	163	14	0	190	7	28	0	0	35	420
<b>Total</b>	52	185	16	0	253	18	178	179	2	377	36	459	73	1	569	14	90	1	0	105	1304
08:00 AM	15	61	1	0	77	0	27	52	0	79	11	134	9	0	154	4	22	2	0	28	338
08:15 AM	17	43	6	0	66	3	35	58	2	98	7	96	8	0	111	3	24	1	0	28	303
08:30 AM	4	7	0	0	11	9	38	89	0	136	3	63	4	0	70	5	32	2	0	39	256
08:45 AM	5	6	0	0	11	5	32	93	1	131	1	4	0	0	5	3	16	5	0	24	171
<b>Total</b>	41	117	7	0	165	17	132	292	3	444	22	297	21	0	340	15	94	10	0	119	1068
<b>Grand Total</b>	93	302	23	0	418	35	310	471	5	821	58	756	94	1	909	29	184	11	0	224	2372
Approch %	22.2	72.2	5.5	0		4.3	37.8	57.4	0.6		6.4	83.2	10.3	0.1		12.9	82.1	4.9	0		
Total %	3.9	12.7	1	0	17.6	1.5	13.1	19.9	0.2	34.6	2.4	31.9	4	0	38.3	1.2	7.8	0.5	0	9.4	
Passenger Vehicles	93	302	21	0	416	35	306	471	5	817	57	749	75	1	882	29	183	11	0	223	2338
% Passenger Vehicles	100	100	91.3	0	99.5	100	98.7	100	100	99.5	98.3	99.1	79.8	100	97	100	99.5	100	0	99.6	98.6
Heavy Vehicles	0	0	2	0	2	0	1	0	0	1	0	7	19	0	26	0	1	0	0	1	30
% Heavy Vehicles	0	0	8.7	0	0.5	0	0.3	0	0	0.1	0	0.9	20.2	0	2.9	0	0.5	0	0	0.4	1.3
Bicycles	0	0	0	0	0	0	3	0	0	3	1	0	0	0	1	0	0	0	0	0	4
% Bicycles	0	0	0	0	0	0	1	0	0	0.4	1.7	0	0	0	0.1	0	0	0	0	0	0.2

Start Time	Hagadorn Road From North					Bennett Road From East					Hagadorn Road From South					Bennett Road From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	12	64	2	0	78	9	66	63	0	138	12	162	41	0	215	3	34	1	0	38	469
07:45 AM	17	52	5	0	74	3	61	55	2	121	13	163	14	0	190	7	28	0	0	35	420
08:00 AM	15	61	1	0	77	0	27	52	0	79	11	134	9	0	154	4	22	2	0	28	338
08:15 AM	17	43	6	0	66	3	35	58	2	98	7	96	8	0	111	3	24	1	0	28	303
<b>Total Volume</b>	61	220	14	0	295	15	189	228	4	436	43	555	72	0	670	17	108	4	0	129	1530
<b>% App. Total</b>	20.7	74.6	4.7	0		3.4	43.3	52.3	0.9		6.4	82.8	10.7	0		13.2	83.7	3.1	0		
<b>PHF</b>	.897	.859	.583	.000	.946	.417	.716	.905	.500	.790	.827	.851	.439	.000	.779	.607	.794	.500	.000	.849	.816

Location: Bennett Rd. & Hagadorn Rd.  
 County/City: Meridian Twp., Ingham Cty  
 Weather: Sunny  
 Counted By: DES

File Name : Bennett & Hagadorn - AM  
 Site Code : 09111801  
 Start Date : 9/11/2018  
 Page No : 2



# Traffic Engineering Associates, Inc.

PO Box 100  
Saranac, MI 48881  
517-627-6028

Location: Bennett Rd. & Hagadorn Rd.  
County/City: Meridian Twp., Ingham Cty.  
Weather: Sunny  
Counted By: DES

File Name : Bennett & Hagadorn - PM  
Site Code : 09121801  
Start Date : 9/12/2018  
Page No : 1

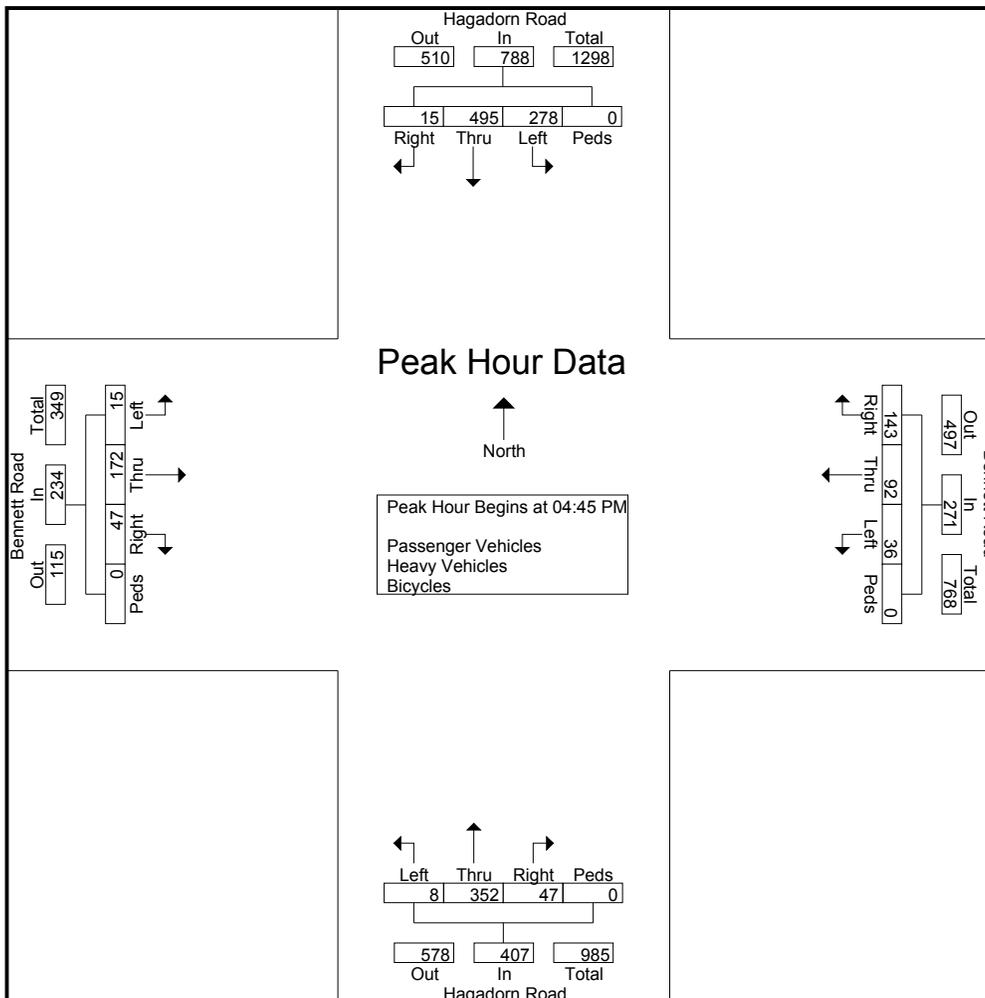
### Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

Start Time	Hagadorn Road From North					Bennett Road From East					Hagadorn Road From South					Bennett Road From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	26	76	11	0	113	10	25	27	0	62	2	74	2	0	78	2	19	10	0	31	284
04:15 PM	38	105	3	0	146	8	27	28	0	63	3	91	8	0	102	4	27	2	0	33	344
04:30 PM	46	101	4	0	151	7	25	29	0	61	1	76	10	0	87	4	32	9	0	45	344
04:45 PM	60	103	4	0	167	10	15	27	0	52	2	66	18	0	86	3	32	5	0	40	345
<b>Total</b>	<b>170</b>	<b>385</b>	<b>22</b>	<b>0</b>	<b>577</b>	<b>35</b>	<b>92</b>	<b>111</b>	<b>0</b>	<b>238</b>	<b>8</b>	<b>307</b>	<b>38</b>	<b>0</b>	<b>353</b>	<b>13</b>	<b>110</b>	<b>26</b>	<b>0</b>	<b>149</b>	<b>1317</b>
05:00 PM	60	129	6	0	195	7	28	42	0	77	2	86	9	0	97	5	49	15	0	69	438
05:15 PM	82	146	4	0	232	8	33	41	0	82	2	112	6	0	120	4	62	10	0	76	510
05:30 PM	76	117	1	0	194	11	16	33	0	60	2	88	14	0	104	3	29	17	0	49	407
05:45 PM	62	81	2	0	145	6	11	21	0	38	1	72	5	0	78	1	31	5	0	37	298
<b>Total</b>	<b>280</b>	<b>473</b>	<b>13</b>	<b>0</b>	<b>766</b>	<b>32</b>	<b>88</b>	<b>137</b>	<b>0</b>	<b>257</b>	<b>7</b>	<b>358</b>	<b>34</b>	<b>0</b>	<b>399</b>	<b>13</b>	<b>171</b>	<b>47</b>	<b>0</b>	<b>231</b>	<b>1653</b>
<b>Grand Total</b>	<b>450</b>	<b>858</b>	<b>35</b>	<b>0</b>	<b>1343</b>	<b>67</b>	<b>180</b>	<b>248</b>	<b>0</b>	<b>495</b>	<b>15</b>	<b>665</b>	<b>72</b>	<b>0</b>	<b>752</b>	<b>26</b>	<b>281</b>	<b>73</b>	<b>0</b>	<b>380</b>	<b>2970</b>
<b>Apprch %</b>	<b>33.5</b>	<b>63.9</b>	<b>2.6</b>	<b>0</b>		<b>13.5</b>	<b>36.4</b>	<b>50.1</b>	<b>0</b>		<b>2</b>	<b>88.4</b>	<b>9.6</b>	<b>0</b>		<b>6.8</b>	<b>73.9</b>	<b>19.2</b>	<b>0</b>		
<b>Total %</b>	<b>15.2</b>	<b>28.9</b>	<b>1.2</b>	<b>0</b>	<b>45.2</b>	<b>2.3</b>	<b>6.1</b>	<b>8.4</b>	<b>0</b>	<b>16.7</b>	<b>0.5</b>	<b>22.4</b>	<b>2.4</b>	<b>0</b>	<b>25.3</b>	<b>0.9</b>	<b>9.5</b>	<b>2.5</b>	<b>0</b>	<b>12.8</b>	
Passenger Vehicles	449	857	35	0	1341	67	178	248	0	493	15	662	71	0	748	26	278	72	0	376	2958
% Passenger Vehicles	99.8	99.9	100	0	99.9	100	98.9	100	0	99.6	100	99.5	98.6	0	99.5	100	98.9	98.6	0	98.9	99.6
Heavy Vehicles	0	0	0	0	0	0	1	0	0	1	0	3	1	0	4	0	0	1	0	1	6
% Heavy Vehicles	0	0	0	0	0	0	0.6	0	0	0.2	0	0.5	1.4	0	0.5	0	0	1.4	0	0.3	0.2
Bicycles	1	1	0	0	2	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	6
% Bicycles	0.2	0.1	0	0	0.1	0	0.6	0	0	0.2	0	0	0	0	0	0	1.1	0	0	0.8	0.2

Start Time	Hagadorn Road From North					Bennett Road From East					Hagadorn Road From South					Bennett Road From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	60	103	4	0	167	10	15	27	0	52	2	66	18	0	86	3	32	5	0	40	345
05:00 PM	60	129	6	0	195	7	28	42	0	77	2	86	9	0	97	5	49	15	0	69	438
05:15 PM	82	146	4	0	232	8	33	41	0	82	2	112	6	0	120	4	62	10	0	76	510
05:30 PM	76	117	1	0	194	11	16	33	0	60	2	88	14	0	104	3	29	17	0	49	407
<b>Total Volume</b>	<b>278</b>	<b>495</b>	<b>15</b>	<b>0</b>	<b>788</b>	<b>36</b>	<b>92</b>	<b>143</b>	<b>0</b>	<b>271</b>	<b>8</b>	<b>352</b>	<b>47</b>	<b>0</b>	<b>407</b>	<b>15</b>	<b>172</b>	<b>47</b>	<b>0</b>	<b>234</b>	<b>1700</b>
<b>% App. Total</b>	<b>35.3</b>	<b>62.8</b>	<b>1.9</b>	<b>0</b>		<b>13.3</b>	<b>33.9</b>	<b>52.8</b>	<b>0</b>		<b>2</b>	<b>86.5</b>	<b>11.5</b>	<b>0</b>		<b>6.4</b>	<b>73.5</b>	<b>20.1</b>	<b>0</b>		
PHF	.848	.848	.625	.000	.849	.818	.697	.851	.000	.826	1.00	.786	.653	.000	.848	.750	.694	.691	.000	.770	.833

Location: Bennett Rd. & Hagadorn Rd.  
County/City: Meridian Twp., Ingham Cty.  
Weather: Sunny  
Counted By: DES

File Name : Bennett & Hagadorn - PM  
Site Code : 09121801  
Start Date : 9/12/2018  
Page No : 2



# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 1

### Groups Printed- Cars - Buses

Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00	1	9	14	0	24	22	20	0	0	42	6	3	7	0	16	2	26	7	0	35	117
07:15	8	33	17	0	58	112	51	0	0	163	8	0	28	0	36	0	30	15	0	45	302
07:30	2	23	23	0	48	81	116	2	0	199	16	6	44	0	66	3	70	4	0	77	390
07:45	4	11	20	0	35	38	116	1	0	155	13	11	49	0	73	9	42	9	0	60	323
Total	15	76	74	0	165	253	303	3	0	559	43	20	128	0	191	14	168	35	0	217	1132
08:00	3	8	11	0	22	28	76	4	0	108	9	3	30	0	42	2	38	11	0	51	223
08:15	13	5	24	0	42	13	67	5	0	85	21	5	45	0	71	7	33	6	0	46	244
08:30	7	8	47	0	62	21	121	4	8	154	50	10	25	6	91	14	45	8	3	70	377
08:45	1	8	24	0	33	19	88	2	7	116	21	3	23	6	53	13	54	16	3	86	288
Total	24	29	106	0	159	81	352	15	15	463	101	21	123	12	257	36	170	41	6	253	1132
09:00	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5
Total	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5
15:45	9	3	7	20	39	29	40	4	38	111	13	11	38	2	64	21	81	22	41	165	379
Total	9	3	7	20	39	29	40	4	38	111	13	11	38	2	64	21	81	22	41	165	379
16:00	7	11	1	0	19	45	39	4	5	93	8	12	42	0	62	5	24	21	2	52	226
16:15	4	13	10	0	27	42	55	0	1	98	13	9	30	0	52	8	59	16	0	83	260
16:30	4	7	8	2	21	30	37	5	2	74	6	9	35	2	52	2	64	8	0	74	221
16:45	5	11	5	0	21	52	48	7	0	107	10	9	56	0	75	15	66	15	1	97	300
Total	20	42	24	2	88	169	179	16	8	372	37	39	163	2	241	30	213	60	3	306	1007
17:00	6	7	11	2	26	32	55	2	1	90	12	10	29	1	52	11	83	19	0	113	281
17:15	5	8	12	0	25	37	50	3	0	90	6	19	24	1	50	18	107	15	1	141	306
17:30	2	7	6	0	15	37	41	9	0	87	6	15	34	0	55	15	109	24	0	148	305
17:45	3	7	6	0	16	25	29	4	0	58	8	20	33	0	61	16	83	23	0	122	257
Total	16	29	35	2	82	131	175	18	1	325	32	64	120	2	218	60	382	81	1	524	1149

# C & A Engineers

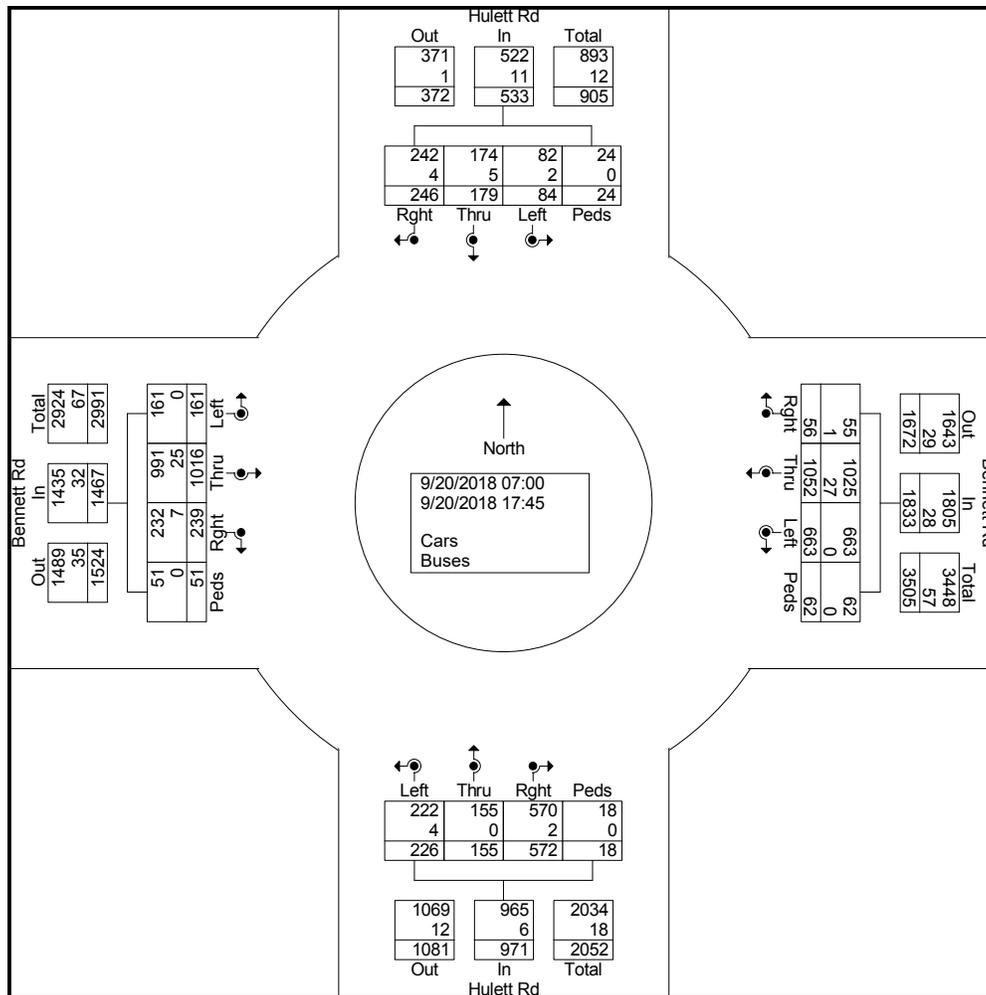
10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 2

Groups Printed- Class 1 - Class 2

	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Grand Total	84	179	246	24	533	663	1052	56	62	1833	226	155	572	18	971	161	1016	239	51	1467	4804
Apprch %	15.8	33.6	46.2	4.5		36.2	57.4	3.1	3.4		23.3	16	58.9	1.9		11	69.3	16.3	3.5		
Total %	1.7	3.7	5.1	0.5	11.1	13.8	21.9	1.2	1.3	38.2	4.7	3.2	11.9	0.4	20.2	3.4	21.1	5	1.1	30.5	
Cars	82	174	242	24	522	663	1025	55	62	1805	222	155	570	18	965	161	991	232	51	1435	4727
% Cars	97.6	97.2	98.4	100	97.9	100	97.4	98.2	100	98.5	98.2	100	99.7	100	99.4	100	97.5	97.1	100	97.8	98.4
Buses	2	5	4	0	11	0	27	1	0	28	4	0	2	0	6	0	25	7	0	32	77
% Buses	2.4	2.8	1.6	0	2.1	0	2.6	1.8	0	1.5	1.8	0	0.3	0	0.6	0	2.5	2.9	0	2.2	1.6

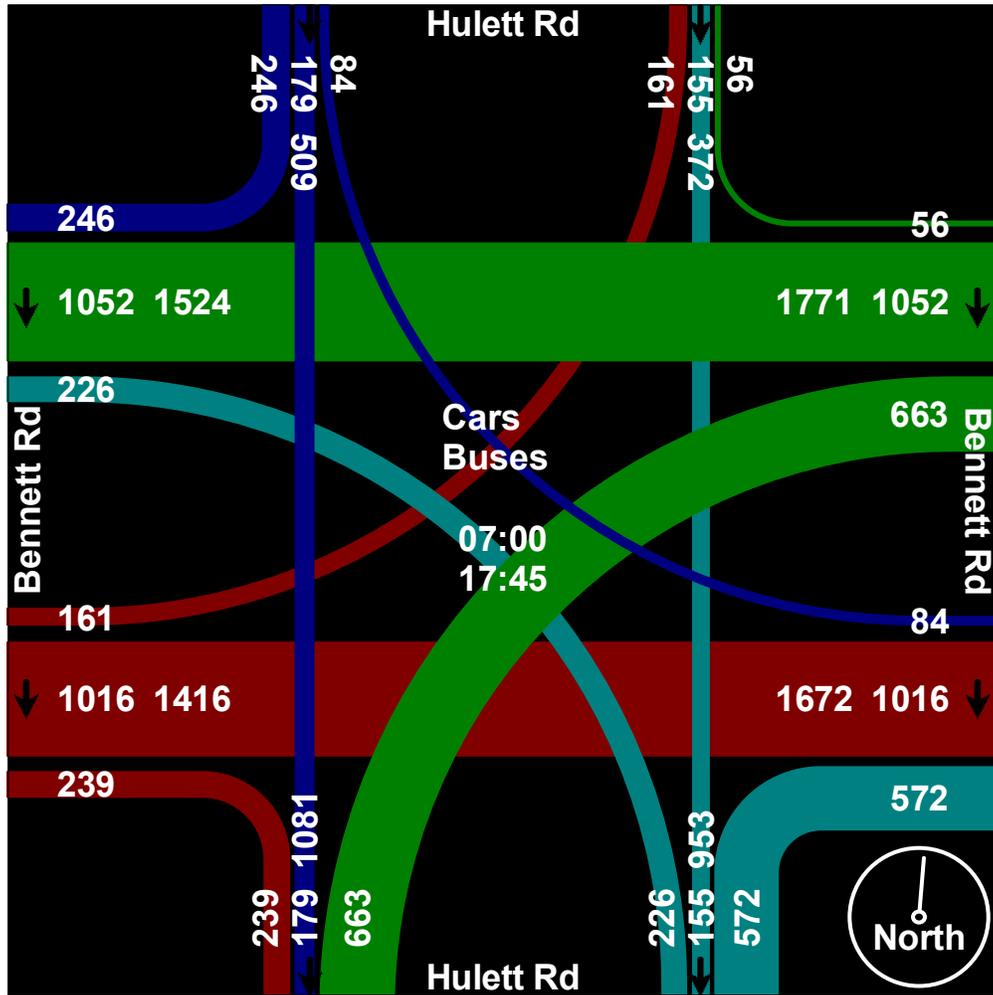


# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 3



# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 4

Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:00 - Peak 1 of 1																					

# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 5

### Groups Printed- Cars

Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Rght	Peds	App. Total	Left	Thru	Rght	Peds	App. Total	Left	Thru	Rght	Peds	App. Total	Left	Thru	Rght	Peds	App. Total	
07:00	1	9	14	0	24	22	20	0	0	42	6	3	7	0	16	2	19	7	0	28	110
07:15	8	31	16	0	55	112	49	0	0	161	8	0	28	0	36	0	22	14	0	36	288
07:30	2	23	23	0	48	81	113	2	0	196	16	6	44	0	66	3	68	3	0	74	384
07:45	4	11	20	0	35	38	114	1	0	153	13	11	49	0	73	9	42	9	0	60	321
Total	15	74	73	0	162	253	296	3	0	552	43	20	128	0	191	14	151	33	0	198	1103
08:00	3	8	10	0	21	28	76	4	0	108	9	3	30	0	42	2	38	11	0	51	222
08:15	13	5	24	0	42	13	67	5	0	85	21	5	45	0	71	7	31	5	0	43	241
08:30	7	5	47	0	59	21	121	3	8	153	50	10	25	6	91	14	43	8	3	68	371
08:45	1	8	24	0	33	19	87	2	7	115	19	3	23	6	51	13	54	16	3	86	285
Total	24	26	105	0	155	81	351	14	15	461	99	21	123	12	255	36	166	40	6	248	1119
09:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
15:45	8	3	7	20	38	29	36	4	38	107	12	11	37	2	62	21	77	19	41	158	365
Total	8	3	7	20	38	29	36	4	38	107	12	11	37	2	62	21	77	19	41	158	365
16:00	7	11	1	0	19	45	37	4	5	91	7	12	41	0	60	5	24	20	2	51	221
16:15	3	13	9	0	25	42	51	0	1	94	13	9	30	0	52	8	59	16	0	83	254
16:30	4	7	7	2	20	30	33	5	2	70	6	9	35	2	52	2	64	8	0	74	216
16:45	5	11	5	0	21	52	46	7	0	105	10	9	56	0	75	15	66	15	1	97	298
Total	19	42	22	2	85	169	167	16	8	360	36	39	162	2	239	30	213	59	3	305	989
17:00	6	7	11	2	26	32	55	2	1	90	12	10	29	1	52	11	83	19	0	113	281
17:15	5	8	12	0	25	37	50	3	0	90	6	19	24	1	50	18	107	15	1	141	306
17:30	2	7	6	0	15	37	41	9	0	87	6	15	34	0	55	15	109	24	0	148	305
17:45	3	7	6	0	16	25	29	4	0	58	8	20	33	0	61	16	83	23	0	122	257
Total	16	29	35	2	82	131	175	18	1	325	32	64	120	2	218	60	382	81	1	524	1149

# C & A Engineers

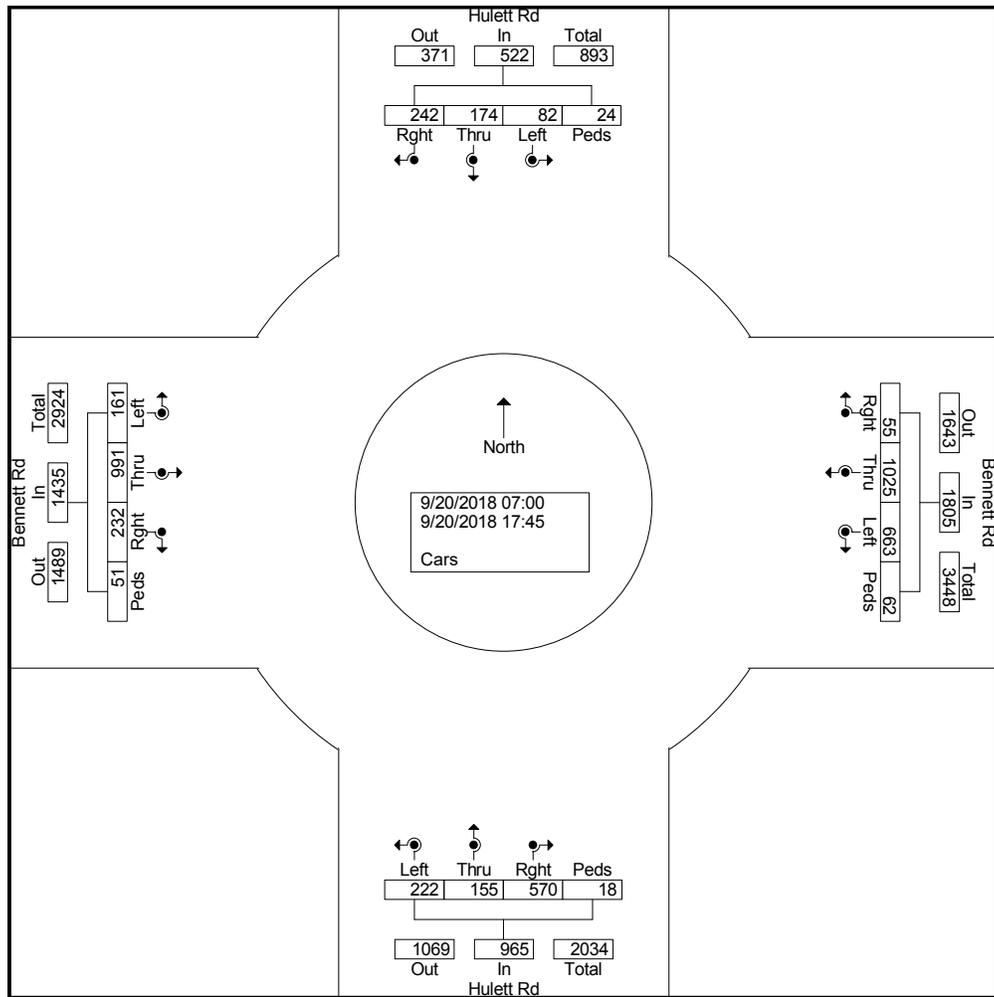
10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 6

Groups Printed- Cars

	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Grand Total	82	174	242	24	522	663	1025	55	62	1805	222	155	570	18	965	161	991	232	51	1435	4727
Apprch %	15.7	33.3	46.4	4.6		36.7	56.8	3	3.4		23	16.1	59.1	1.9		11.2	69.1	16.2	3.6		
Total %	1.7	3.7	5.1	0.5	11	14	21.7	1.2	1.3	38.2	4.7	3.3	12.1	0.4	20.4	3.4	21	4.9	1.1	30.4	

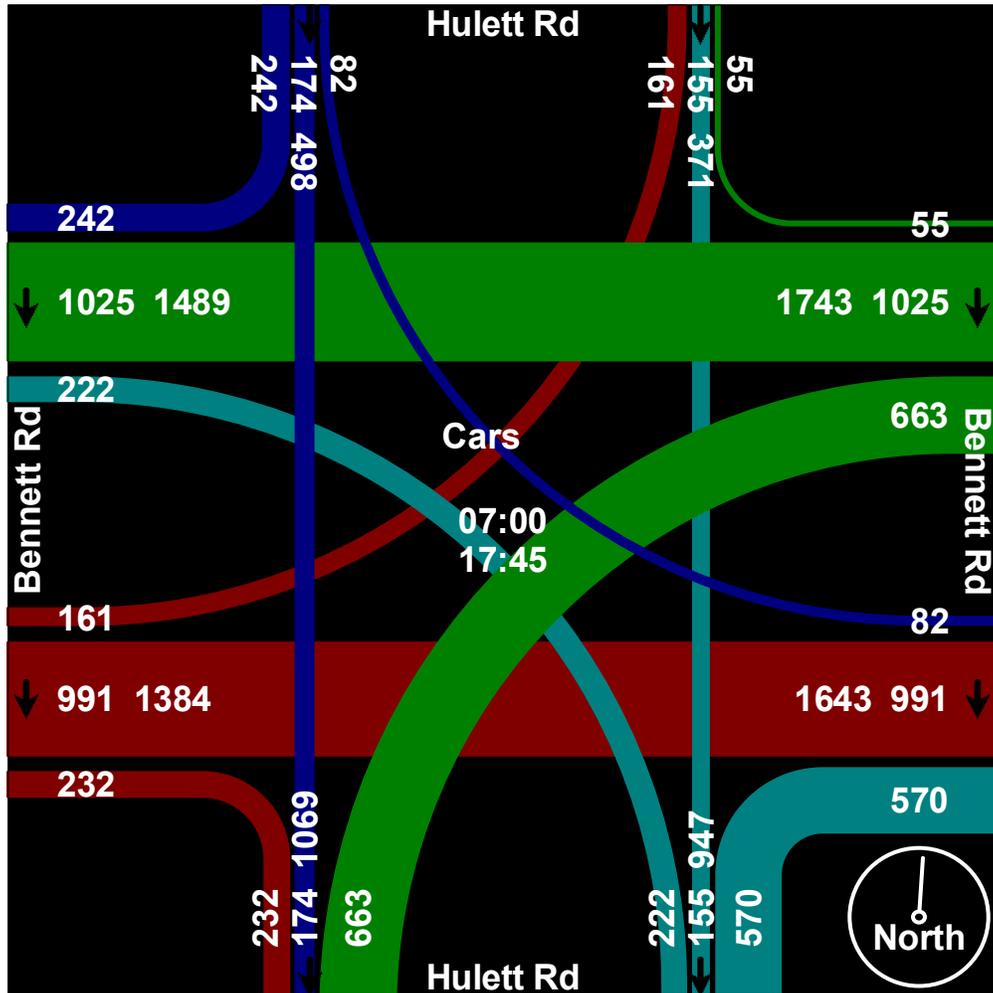


# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 7



# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 8

Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:00 - Peak 1 of 1																					

# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 9

### Groups Printed- Buses

Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7	7
07:15	0	2	1	0	3	0	2	0	0	2	0	0	0	0	0	0	8	1	0	9	14
07:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	1	0	3	6
07:45	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	2
<b>Total</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>2</b>	<b>0</b>	<b>19</b>	<b>29</b>
08:00	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	3	3
08:30	0	3	0	0	3	0	0	1	0	1	0	0	0	0	0	0	2	0	0	2	6
08:45	0	0	0	0	0	0	1	0	0	1	2	0	0	0	2	0	0	0	0	0	3
<b>Total</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>5</b>	<b>13</b>
09:00	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>
15:45	1	0	0	0	1	0	4	0	0	4	1	0	1	0	2	0	4	3	0	7	14
<b>Total</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>4</b>	<b>3</b>	<b>0</b>	<b>7</b>	<b>14</b>
16:00	0	0	0	0	0	0	2	0	0	2	1	0	1	0	2	0	0	1	0	1	5
16:15	1	0	1	0	2	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	6
16:30	0	0	1	0	1	0	4	0	0	4	0	0	0	0	0	0	0	0	0	0	5
16:45	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	2
<b>Total</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>18</b>

# C & A Engineers

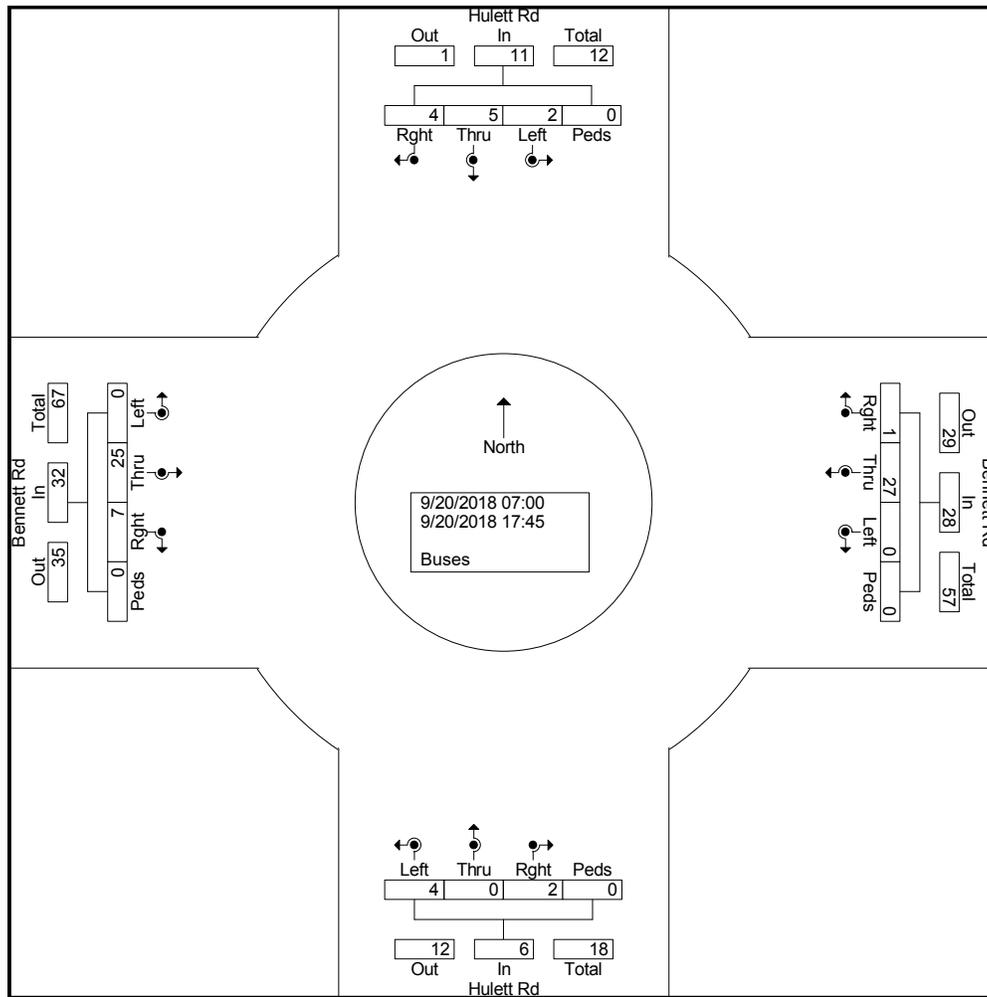
10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 10

### Groups Printed- Buses

	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Grand Total	2	5	4	0	11	0	27	1	0	28	4	0	2	0	6	0	25	7	0	32	77
Apprch %	18.2	45.5	36.4	0		0	96.4	3.6	0		66.7	0	33.3	0		0	78.1	21.9	0		
Total %	2.6	6.5	5.2	0	14.3	0	35.1	1.3	0	36.4	5.2	0	2.6	0	7.8	0	32.5	9.1	0	41.6	

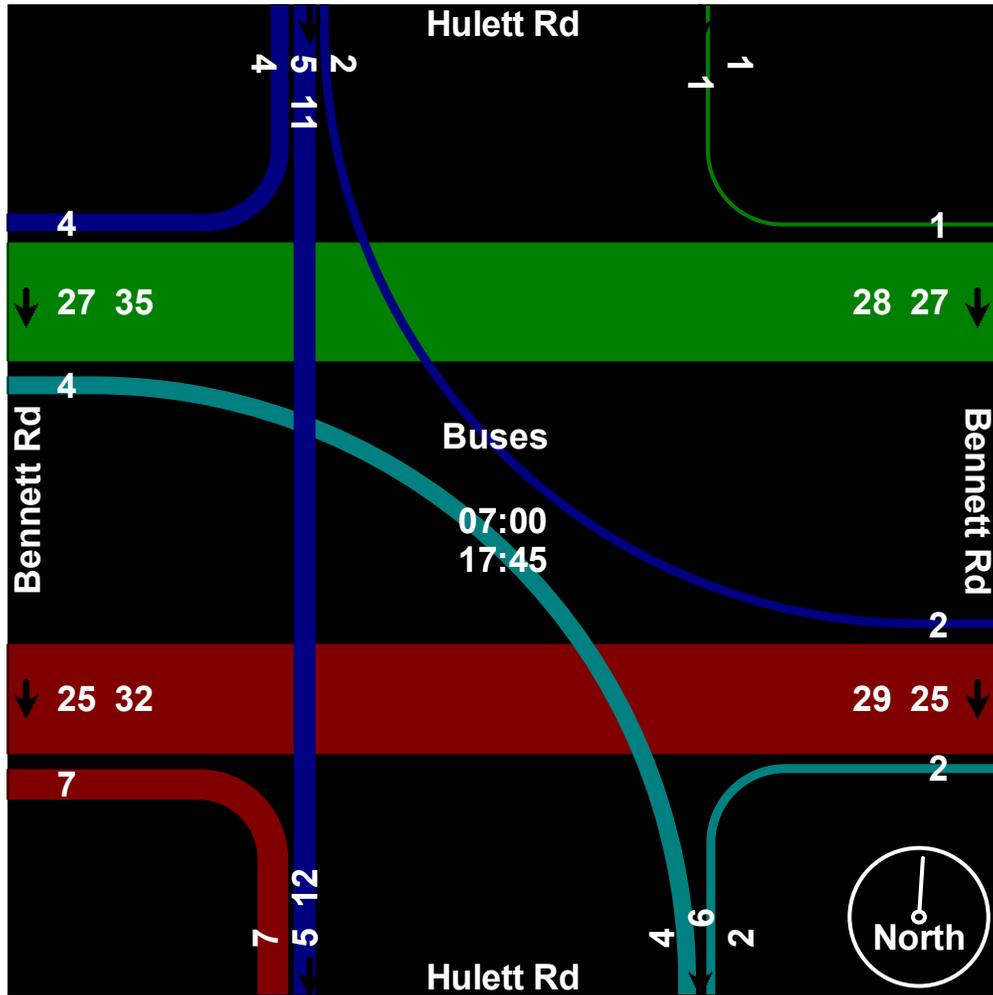


# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 11



# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 12

Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:00 - Peak 1 of 1																					

# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 13

### Groups Printed- Trucks

Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
08:15	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
16:15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	2
Total	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	2
17:15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1

# C & A Engineers

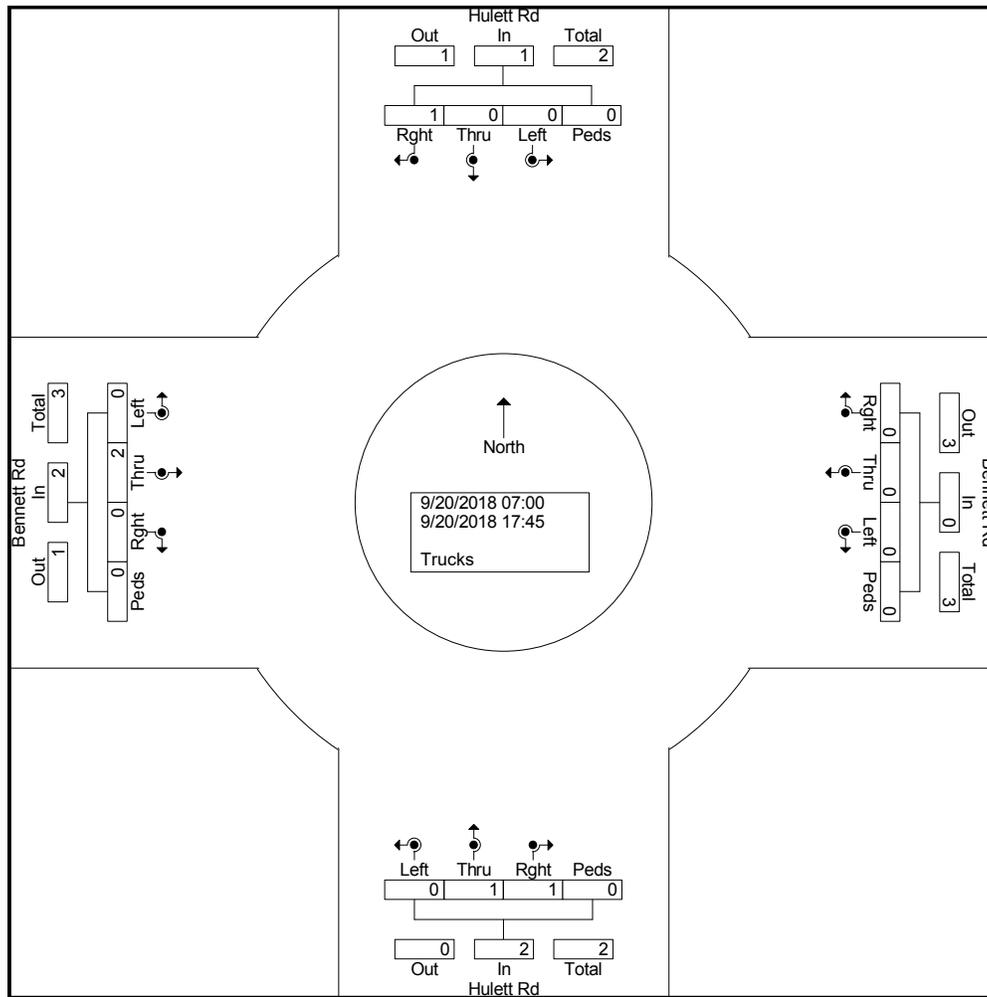
10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 14

Groups Printed- Trucks

	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Grand Total	0	0	1	0	1	0	0	0	0	0	0	1	1	0	2	0	2	0	0	2	5
Apprch %	0	0	100	0		0	0	0	0		0	50	50	0		0	100	0	0		
Total %	0	0	20	0	20	0	0	0	0	0	0	20	20	0	40	0	40	0	0	40	

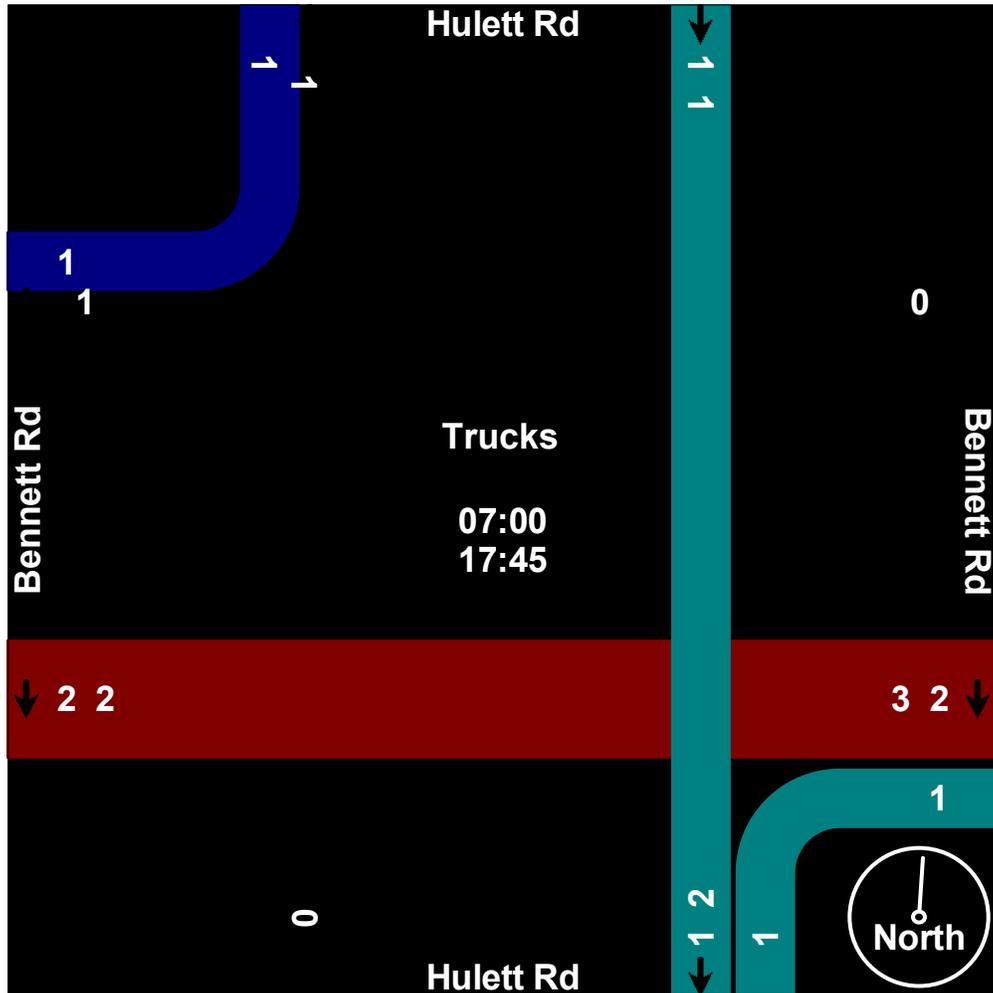


# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 15



# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 16

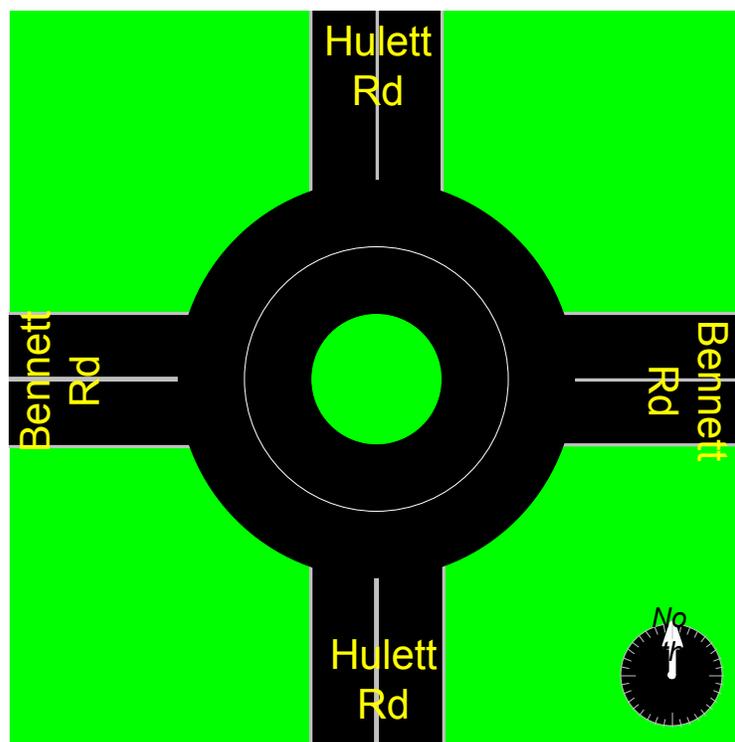
Start Time	Hulett Rd From North					Bennett Rd From East					Hulett Rd From South					Bennett Rd From West					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 to 07:00 - Peak 1 of 1																					

# C & A Engineers

10722 Corkery Ln  
Grand Ledge, Michigan, 48837  
517-898-8152

LOCATION: BENNETT/HULETT ROUNDABOUT  
MERIDIAN TWP, INGHAM COUNTY, MI  
WEATHER: Rain-AM/Sunny-PM  
ANALYST: NG

File Name : Bennett and Hulett TMC  
Site Code : 00000000  
Start Date : 9/20/2018  
Page No : 17





## ADVANCED TIMING PARAMETERS FORM

SYSTEM INFORMATION	LEFT-TURN PHASING						RING AND BARRIER STRUCTURE																																																																													
<b>Controller Type:</b> <input type="checkbox"/> EPAC <input type="checkbox"/> Other:	<b>System Type:</b> <input type="checkbox"/> Closed Loop <input type="checkbox"/> Stand By <input type="checkbox"/> Group 1 <input type="checkbox"/> Group 2 Address: <input type="checkbox"/> TBC <input type="checkbox"/> TBC/GPS <input type="checkbox"/> None <input type="checkbox"/> Other:	Phase # / Description	<i>Permissive-Protected</i>		<i>Protected-Only</i>		R1	B1			B2			B3			B4																																																																			
			Lead	Lag	Split	Lead		Lag																																																																												
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<b>VEHICULAR AND PEDESTRIAN DETECTION</b>												<b>DISAPPEARING LEGEND CASE SIGNS</b>																																																																								
<i>Vehicular Detection</i>												<i>Pedestrian Detection</i>																																																																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 15%;">Approach</th> <th colspan="3" style="text-align: center;">Movements and Call Delay (s)</th> <th colspan="3" style="text-align: center;">Type</th> <th colspan="6" rowspan="2" style="text-align: center;">Push-Button Crossing Locations</th> </tr> <tr> <th style="width: 5%;">Left</th> <th style="width: 5%;">Thru</th> <th style="width: 5%;">Right</th> <th style="width: 5%;">Loop</th> <th style="width: 5%;">Video</th> <th style="width: 5%;">Other</th> </tr> </thead> <tbody> <tr><td> </td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td colspan="6" rowspan="6"></td></tr> <tr><td> </td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td></tr> </tbody> </table>																		Approach	Movements and Call Delay (s)			Type			Push-Button Crossing Locations						Left	Thru	Right	Loop	Video	Other		<input type="checkbox"/>								<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>																														
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DIAL	SPLIT	CYCLE												Maximum Mode																																																																						
DIAL	SPLIT	CYCLE												Correction Mode																																																																						
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DIAL	SPLIT	CYCLE												Yield Period																																																																						
If Phone Drop, Phone #						<b>ADDITIONAL OVERLAP DATA</b>																																																																														
												<i>Load Bays</i>	<i>Phases Overlapped</i>			<i>T.G. (s)</i>	<i>Y (s)</i>	<i>R (s)</i>	<i>-G/Y</i>	<i>+GRN</i>																																																																
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If Slave, Master Location:						PREPARED BY:                      DATE:						LOCATION:																																																																								
						Master Spot # :						<input type="checkbox"/> MDOT <input type="checkbox"/> County <input type="checkbox"/> City <input type="checkbox"/> Consultant						CONTROL SECTION-SPOT #																																																																		

## PREEMPTION INFORMATION FORM

Preemption Description:																	Preempt System Data																																														
Preempt # =	Time (s)	Phases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16																																													
SEL Ped Cl		Vehicle	Track																<input type="checkbox"/> Locking  <input type="checkbox"/> Non-Locking	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Ring</td> <td style="width: 10%;">1</td> <td style="width: 10%;">2</td> <td style="width: 10%;">3</td> <td style="width: 10%;">4</td> <td colspan="3"></td> </tr> <tr> <td>MIN GRN/WLK (s)</td> <td></td><td></td><td></td><td></td><td colspan="3"></td> </tr> <tr> <td>Priority</td> <td>PE/FL</td> <td>PE1/2</td> <td>PE2/3</td> <td>PE3/4</td> <td>PE4/5</td> <td>PE5/6</td> </tr> <tr> <td>Status</td> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td colspan="7">REMARKS :</td> </tr> </table>							Ring	1	2	3	4				MIN GRN/WLK (s)								Priority	PE/FL	PE1/2	PE2/3	PE3/4	PE4/5	PE5/6	Status							REMARKS :						
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## Level of Service Criteria for Stop Sign Controlled Intersections

The level of service criteria are given in Table 17-2. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. . . .

Exhibit 17-2. Level of Service Criteria for TWSC Intersections

LEVEL OF SERVICE	AVERAGE CONTROL DELAY (sec/veh)
A	$\leq 10$
B	$> 10$ and $\leq 15$
C	$> 15$ and $\leq 25$
D	$> 25$ and $\leq 35$
E	$> 35$ and $\leq 50$
F	$> 50$

Average total delay less than 10 sec/veh is defined as Level of Service (LOS) A. Follow-up times of less than 5 sec have been measured when there is no conflicting traffic for a minor street movement, so control delays of less than 10 sec/veh are appropriate for low flow conditions. To remain consistent with the AWSC intersection analysis procedure described later in this chapter, a total delay of 50 sec/veh is assumed as the break point between LOS E and F.

The proposed level of service criteria for TWSC intersections are somewhat different from the criteria used in Chapter 16 for signalized intersections. The primary reason for this difference is that drivers expect different levels of performance from different kinds of transportation facilities. The expectation is that a signalized intersection is designed to carry higher traffic volumes than an unsignalized intersection. Additionally, several driver behavior considerations combine to make delays at signalized intersections less onerous than at unsignalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, where drivers on the minor approaches to unsignalized intersections must remain attentive to the task of identifying acceptable gaps and vehicle conflicts. Also, there is often much more variability in the amount of delay experienced by individual drivers at unsignalized than signalized intersections. For these reasons, it is considered that the total delay threshold for any given level of service is less for an unsignalized intersection than for a signalized intersection. . . .

LOS F exists when there are insufficient gaps of suitable size to allow a side street demand to cross safely through a major street traffic stream. This level of service is generally evident from extremely long total delays experienced by side street traffic and by queueing on the minor approaches. The method, however, is based on a constant critical gap size - that is, the critical gap remains constant, no matter how long the side street motorist waits. LOS F may also appear in the form of side street vehicles' selecting smaller-than-usual gaps. In such cases, safety may be a problem and some disruption to the major traffic stream may result. It is important to note that LOS F may not always result in long queues but may result in adjustments to normal gap acceptance behavior. The latter is more difficult to observe on the field than queueing, which is more obvious.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council

## Level of Service for Signalized Intersections

Level of service for signalized intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average stopped delay per vehicle for a 15-min analysis period. The criteria are given in Exhibit 16-2. Delay may be measured in the field or estimated using procedures presented later in this chapter. Delay is a complex measure and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the  $v/c$  ratio for the lane group in question.

**LOS A** describes operations with very low delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

**LOS B** describes operations with delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of average delay.

Exhibit 16-2. Level-of-Service Criteria for Signalized Intersections

LEVEL OF SERVICE	STOPPED DELAY PER VEHICLE (SEC)
A	$\leq 10.0$
B	$> 10.0$ and $\leq 20.0$
C	$> 20.0$ and $\leq 35.0$
D	$> 35.0$ and $\leq 55.0$
E	$> 55.0$ and $\leq 80.0$
F	$> 80.0$

**LOS C** describes operations with delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

**LOS D** describes operations with delay greater than 35 and up to 55 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high  $v/c$  ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

**LOS E** describes operations with delay greater than 55 and up to 80 sec per vehicle. This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high  $v/c$  ratios. Individual cycle failures are frequent occurrences.

**LOS F** describes operations with delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. It may also occur at high  $v/c$  ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Source: Highway Capacity Manual, 2010. Transportation Research Board, National Research Council

## **Appendix B**

# **EXISTING TRAFFIC CONDITIONS**

HCM 6th Signalized Intersection Summary  
1: Hagadorn & Bennett

Existing Conditions 2020  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	110	5	16	191	231	44	561	73	62	223	15
Future Volume (veh/h)	18	110	5	16	191	231	44	561	73	62	223	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	129	6	20	242	292	53	660	166	65	235	16
Peak Hour Factor	0.85	0.85	0.85	0.79	0.79	0.79	0.83	0.85	0.44	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	67	289	12	61	377	337	670	717	180	249	871	59
Arrive On Green	0.21	0.21	0.21	0.21	0.21	0.21	0.06	0.50	0.50	0.06	0.50	0.50
Sat Flow, veh/h	86	1359	58	71	1773	1585	1781	1442	363	1781	1731	118
Grp Volume(v), veh/h	156	0	0	262	0	292	53	0	826	65	0	251
Grp Sat Flow(s),veh/h/ln	1503	0	0	1844	0	1585	1781	0	1805	1781	0	1849
Q Serve(g_s), s	0.3	0.0	0.0	0.0	0.0	15.0	1.1	0.0	35.8	1.4	0.0	6.6
Cycle Q Clear(g_c), s	11.1	0.0	0.0	10.8	0.0	15.0	1.1	0.0	35.8	1.4	0.0	6.6
Prop In Lane	0.13		0.04	0.08		1.00	1.00		0.20	1.00		0.06
Lane Grp Cap(c), veh/h	368	0	0	438	0	337	670	0	898	249	0	931
V/C Ratio(X)	0.42	0.00	0.00	0.60	0.00	0.87	0.08	0.00	0.92	0.26	0.00	0.27
Avail Cap(c_a), veh/h	426	0	0	503	0	394	734	0	898	303	0	931
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.6	0.0	0.0	30.4	0.0	32.1	8.8	0.0	19.7	16.8	0.0	12.1
Incr Delay (d2), s/veh	0.8	0.0	0.0	1.5	0.0	16.1	0.0	0.0	16.0	0.5	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	0.0	0.0	4.7	0.0	6.8	0.4	0.0	16.2	0.5	0.0	2.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.4	0.0	0.0	31.9	0.0	48.2	8.8	0.0	35.6	17.4	0.0	12.8
LnGrp LOS	C	A	A	C	A	D	A	A	D	B	A	B
Approach Vol, veh/h		156			554			879			316	
Approach Delay, s/veh		29.4			40.5			34.0			13.7	
Approach LOS		C			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	11.8	48.3		24.4	11.3	48.8		24.4				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 8	* 42		* 21	* 8	* 42		* 21				
Max Q Clear Time (g_c+I1), s	3.4	37.8		13.1	3.1	8.6		17.0				
Green Ext Time (p_c), s	0.0	2.0		0.4	0.0	1.3		1.0				

Intersection Summary

HCM 6th Ctrl Delay	32.2
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th Signalized Intersection Summary  
1: Hagadorn & Bennett

Existing Conditions 2020  
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	176	48	37	93	145	9	356	48	281	500	16
Future Volume (veh/h)	16	176	48	37	93	145	9	356	48	281	500	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	229	62	45	112	175	11	419	56	331	588	19
Peak Hour Factor	0.77	0.77	0.77	0.83	0.83	0.83	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	70	273	71	129	266	320	345	605	81	498	890	29
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.02	0.37	0.37	0.14	0.49	0.49
Sat Flow, veh/h	61	1352	350	294	1318	1585	1781	1616	216	1781	1802	58
Grp Volume(v), veh/h	312	0	0	157	0	175	11	0	475	331	0	607
Grp Sat Flow(s),veh/h/ln	1764	0	0	1612	0	1585	1781	0	1831	1781	0	1860
Q Serve(g_s), s	5.0	0.0	0.0	0.0	0.0	6.6	0.3	0.0	14.6	7.0	0.0	16.4
Cycle Q Clear(g_c), s	11.4	0.0	0.0	5.1	0.0	6.6	0.3	0.0	14.6	7.0	0.0	16.4
Prop In Lane	0.07		0.20	0.29		1.00	1.00		0.12	1.00		0.03
Lane Grp Cap(c), veh/h	414	0	0	395	0	320	345	0	686	498	0	918
V/C Ratio(X)	0.75	0.00	0.00	0.40	0.00	0.55	0.03	0.00	0.69	0.67	0.00	0.66
Avail Cap(c_a), veh/h	427	0	0	407	0	333	630	0	686	571	0	918
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.7	0.0	0.0	23.2	0.0	23.9	12.9	0.0	17.6	11.8	0.0	12.7
Incr Delay (d2), s/veh	7.2	0.0	0.0	0.6	0.0	1.7	0.0	0.0	5.7	2.4	0.0	3.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.0	0.0	2.0	0.0	2.4	0.1	0.0	6.1	2.2	0.0	6.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.9	0.0	0.0	23.8	0.0	25.6	12.9	0.0	23.3	14.2	0.0	16.4
LnGrp LOS	C	A	A	C	A	C	B	A	C	B	A	B
Approach Vol, veh/h		312			332			486			938	
Approach Delay, s/veh		32.9			24.8			23.1			15.6	
Approach LOS		C			C			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	15.5	31.3		19.9	7.6	39.3		19.9				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 12	* 25		* 14	* 12	* 25		* 14				
Max Q Clear Time (g_c+I1), s	9.0	16.6		13.4	2.3	18.4		8.6				
Green Ext Time (p_c), s	0.3	1.7		0.1	0.0	1.9		0.7				

Intersection Summary

HCM 6th Ctrl Delay	21.5
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

**Intersection: 1: Hagadorn & Bennett**

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	166	232	191	199	530	68	138
Average Queue (ft)	73	112	76	32	204	26	44
95th Queue (ft)	135	195	137	112	431	55	98
Link Distance (ft)	200	3260			599		894
Upstream Blk Time (%)	0				1		
Queuing Penalty (veh)	0				0		
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		3	0		20		1
Queuing Penalty (veh)		7	1		9		0

**Intersection: 2: Hulett Rd & Bennett**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	87	335	68	100
Average Queue (ft)	36	99	22	36
95th Queue (ft)	77	299	55	77
Link Distance (ft)	534	300	106	108
Upstream Blk Time (%)		14	0	1
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 17

**Intersection: 1: Hagadorn & Bennett**

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	214	269	226	58	254	161	199
Average Queue (ft)	122	82	55	6	133	75	82
95th Queue (ft)	211	178	126	37	223	129	158
Link Distance (ft)	200	3266			599		894
Upstream Blk Time (%)	3						
Queuing Penalty (veh)	0						
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		5			15	3	3
Queuing Penalty (veh)		8			1	14	9

**Intersection: 2: Hulett Rd & Bennett**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	133	99	85	60
Average Queue (ft)	52	32	37	18
95th Queue (ft)	106	75	73	48
Link Distance (ft)	515	300	106	108
Upstream Blk Time (%)			0	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Intersection: 101: Bennett & Dummy Node**

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

**Network Summary**

Network wide Queuing Penalty: 32

## **Appendix C**

# **BACKGROUND TRAFFIC CONDITIONS**

HCM 6th Signalized Intersection Summary  
1: Hagadorn & Bennett

Background Conditions 2027  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	116	5	17	198	240	45	581	81	71	231	15
Future Volume (veh/h)	18	116	5	17	198	240	45	581	81	71	231	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	136	6	22	251	304	54	684	184	75	243	16
Peak Hour Factor	0.85	0.85	0.85	0.79	0.79	0.79	0.83	0.85	0.44	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	65	297	12	63	386	346	659	697	188	217	868	57
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.06	0.49	0.49	0.07	0.50	0.50
Sat Flow, veh/h	81	1358	55	78	1764	1585	1781	1420	382	1781	1736	114
Grp Volume(v), veh/h	163	0	0	273	0	304	54	0	868	75	0	259
Grp Sat Flow(s),veh/h/ln	1493	0	0	1842	0	1585	1781	0	1802	1781	0	1850
Q Serve(g_s), s	0.3	0.0	0.0	0.0	0.0	15.9	1.2	0.0	40.4	1.7	0.0	7.0
Cycle Q Clear(g_c), s	11.7	0.0	0.0	11.4	0.0	15.9	1.2	0.0	40.4	1.7	0.0	7.0
Prop In Lane	0.13		0.04	0.08		1.00	1.00		0.21	1.00		0.06
Lane Grp Cap(c), veh/h	374	0	0	448	0	346	659	0	885	217	0	925
V/C Ratio(X)	0.44	0.00	0.00	0.61	0.00	0.88	0.08	0.00	0.98	0.35	0.00	0.28
Avail Cap(c_a), veh/h	417	0	0	497	0	389	720	0	885	262	0	925
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.7	0.0	0.0	30.6	0.0	32.3	9.1	0.0	21.4	18.9	0.0	12.4
Incr Delay (d2), s/veh	0.8	0.0	0.0	1.8	0.0	18.4	0.1	0.0	26.0	0.9	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	0.0	0.0	5.0	0.0	7.4	0.4	0.0	20.3	0.6	0.0	2.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.5	0.0	0.0	32.4	0.0	50.7	9.2	0.0	47.3	19.8	0.0	13.2
LnGrp LOS	C	A	A	C	A	D	A	A	D	B	A	B
Approach Vol, veh/h		163			577			922			334	
Approach Delay, s/veh		29.5			42.0			45.1			14.7	
Approach LOS		C			D			D			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.1	48.3		25.1	11.4	49.1		25.1				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 8	* 42		* 21	* 8	* 42		* 21				
Max Q Clear Time (g_c+I1), s	3.7	42.4		13.7	3.2	9.0		17.9				
Green Ext Time (p_c), s	0.0	0.0		0.4	0.0	1.3		0.8				

Intersection Summary

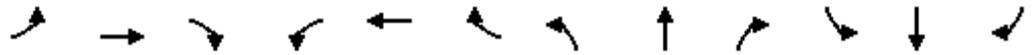
HCM 6th Ctrl Delay	37.8
HCM 6th LOS	D

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th Signalized Intersection Summary  
1: Hagadorn & Bennett

Background Conditions 2027  
PM Peak Hour



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Traffic Volume (veh/h)	16	182	50	44	98	155	9	369	52	292	518	16
Future Volume (veh/h)	16	182	50	44	98	155	9	369	52	292	518	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	236	65	53	118	187	11	434	61	344	609	19
Peak Hour Factor	0.77	0.77	0.77	0.83	0.83	0.83	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	69	278	73	135	250	327	329	593	83	484	890	28
Arrive On Green	0.21	0.21	0.21	0.21	0.21	0.21	0.02	0.37	0.37	0.14	0.49	0.49
Sat Flow, veh/h	59	1348	356	316	1213	1585	1781	1604	225	1781	1804	56
Grp Volume(v), veh/h	322	0	0	171	0	187	11	0	495	344	0	628
Grp Sat Flow(s),veh/h/ln	1763	0	0	1529	0	1585	1781	0	1830	1781	0	1860
Q Serve(g_s), s	5.3	0.0	0.0	0.0	0.0	7.2	0.3	0.0	15.8	7.4	0.0	17.5
Cycle Q Clear(g_c), s	11.9	0.0	0.0	6.1	0.0	7.2	0.3	0.0	15.8	7.4	0.0	17.5
Prop In Lane	0.07		0.20	0.31		1.00	1.00		0.12	1.00		0.03
Lane Grp Cap(c), veh/h	420	0	0	385	0	327	329	0	676	484	0	918
V/C Ratio(X)	0.77	0.00	0.00	0.44	0.00	0.57	0.03	0.00	0.73	0.71	0.00	0.68
Avail Cap(c_a), veh/h	422	0	0	386	0	328	610	0	676	545	0	918
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	26.0	0.0	0.0	23.5	0.0	24.1	13.3	0.0	18.4	12.5	0.0	13.1
Incr Delay (d2), s/veh	8.2	0.0	0.0	0.8	0.0	2.4	0.0	0.0	6.9	3.7	0.0	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	0.0	2.2	0.0	2.6	0.1	0.0	6.7	2.5	0.0	6.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.2	0.0	0.0	24.3	0.0	26.5	13.4	0.0	25.3	16.3	0.0	17.2
LnGrp LOS	C	A	A	C	A	C	B	A	C	B	A	B
Approach Vol, veh/h		322			358			506			972	
Approach Delay, s/veh		34.2			25.5			25.0			16.9	
Approach LOS		C			C			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	16.0	31.3		20.4	7.6	39.7		20.4				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 12	* 25		* 14	* 12	* 25		* 14				
Max Q Clear Time (g_c+I1), s	9.4	17.8		13.9	2.3	19.5		9.2				
Green Ext Time (p_c), s	0.3	1.6		0.0	0.0	1.8		0.7				

Intersection Summary

HCM 6th Ctrl Delay	22.8
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

**Intersection: 1: Hagadorn & Bennett**

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	190	267	216	145	598	71	120
Average Queue (ft)	81	112	90	31	237	30	47
95th Queue (ft)	152	201	166	103	524	61	100
Link Distance (ft)	200	3260			599		894
Upstream Blk Time (%)	1				4		
Queuing Penalty (veh)	0				0		
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		4	0		23	0	1
Queuing Penalty (veh)		10	1		11	0	0

**Intersection: 2: Hulett Rd & Bennett**

Movement	EB	WB	NB	SB	B7
Directions Served	LTR	LTR	LTR	LTR	T
Maximum Queue (ft)	116	343	101	118	4
Average Queue (ft)	36	145	27	43	0
95th Queue (ft)	83	371	68	89	3
Link Distance (ft)	534	300	106	108	190
Upstream Blk Time (%)		28	0	1	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

**Zone Summary**

Zone wide Queuing Penalty: 22

**Intersection: 1: Hagadorn & Bennett**

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	220	274	229	31	323	197	258
Average Queue (ft)	123	83	54	5	145	86	98
95th Queue (ft)	208	185	119	23	255	154	187
Link Distance (ft)	200	3266			599		894
Upstream Blk Time (%)	6						
Queuing Penalty (veh)	0						
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		4			20	4	4
Queuing Penalty (veh)		7			2	24	13

**Intersection: 2: Hulett Rd & Bennett**

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	153	120	87	53
Average Queue (ft)	61	28	40	15
95th Queue (ft)	122	69	73	44
Link Distance (ft)	515	300	106	108
Upstream Blk Time (%)			0	
Queuing Penalty (veh)			0	
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

**Zone Summary**

Zone wide Queuing Penalty: 47

## **Appendix D**

# **FUTURE TRAFFIC CONDITIONS**

HCM 6th Signalized Intersection Summary  
1: Hagadorn & Bennett

Future Conditions 2027  
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	119	5	27	208	272	45	581	84	82	231	15
Future Volume (veh/h)	18	119	5	27	208	272	45	581	84	82	231	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	140	6	34	263	344	54	684	191	86	243	16
Peak Hour Factor	0.85	0.85	0.85	0.79	0.79	0.79	0.83	0.85	0.44	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	64	317	12	76	395	374	641	672	188	206	849	56
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.06	0.48	0.48	0.07	0.49	0.49
Sat Flow, veh/h	74	1342	53	128	1674	1585	1781	1407	393	1781	1736	114
Grp Volume(v), veh/h	167	0	0	297	0	344	54	0	875	86	0	259
Grp Sat Flow(s),veh/h/ln	1469	0	0	1802	0	1585	1781	0	1800	1781	0	1850
Q Serve(g_s), s	0.4	0.0	0.0	0.0	0.0	18.6	1.3	0.0	42.0	2.0	0.0	7.3
Cycle Q Clear(g_c), s	13.5	0.0	0.0	13.1	0.0	18.6	1.3	0.0	42.0	2.0	0.0	7.3
Prop In Lane	0.13		0.04	0.11		1.00	1.00		0.22	1.00		0.06
Lane Grp Cap(c), veh/h	393	0	0	471	0	374	641	0	860	206	0	905
V/C Ratio(X)	0.43	0.00	0.00	0.63	0.00	0.92	0.08	0.00	1.02	0.42	0.00	0.29
Avail Cap(c_a), veh/h	397	0	0	476	0	379	699	0	860	244	0	905
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.2	0.0	0.0	30.5	0.0	32.8	10.0	0.0	22.9	19.5	0.0	13.3
Incr Delay (d2), s/veh	0.7	0.0	0.0	2.6	0.0	27.0	0.1	0.0	35.1	1.3	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.8	0.0	0.0	5.7	0.0	9.4	0.4	0.0	23.2	0.8	0.0	2.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.0	0.0	0.0	33.2	0.0	59.7	10.0	0.0	58.1	20.8	0.0	14.1
LnGrp LOS	C	A	A	C	A	E	B	A	F	C	A	B
Approach Vol, veh/h		167			641			929			345	
Approach Delay, s/veh		29.0			47.4			55.3			15.8	
Approach LOS		C			D			E			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.4	48.3		27.1	11.4	49.3		27.1				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 8	* 42		* 21	* 8	* 42		* 21				
Max Q Clear Time (g_c+I1), s	4.0	44.0		15.5	3.3	9.3		20.6				
Green Ext Time (p_c), s	0.1	0.0		0.3	0.0	1.3		0.1				

Intersection Summary

HCM 6th Ctrl Delay	44.2
HCM 6th LOS	D

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	1.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	13	272	478	6	33	29
Future Vol, veh/h	13	272	478	6	33	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	76	76	78	78	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	17	358	613	8	36	32

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	621	0	-	0	1009
Stage 1	-	-	-	-	617
Stage 2	-	-	-	-	392
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	960	-	-	-	266
Stage 1	-	-	-	-	538
Stage 2	-	-	-	-	683
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	960	-	-	-	260
Mov Cap-2 Maneuver	-	-	-	-	260
Stage 1	-	-	-	-	526
Stage 2	-	-	-	-	683

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	18.5
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	960	-	-	-	333
HCM Lane V/C Ratio	0.018	-	-	-	0.202
HCM Control Delay (s)	8.8	0	-	-	18.5
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.7

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	19	286	472	29	15	12
Future Vol, veh/h	19	286	472	29	15	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	76	76	78	78	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	25	376	605	37	16	13

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	642	0	-	0	1050 624
Stage 1	-	-	-	-	624 -
Stage 2	-	-	-	-	426 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	943	-	-	-	252 485
Stage 1	-	-	-	-	534 -
Stage 2	-	-	-	-	659 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	943	-	-	-	243 485
Mov Cap-2 Maneuver	-	-	-	-	243 -
Stage 1	-	-	-	-	516 -
Stage 2	-	-	-	-	659 -

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	17.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	943	-	-	-	312
HCM Lane V/C Ratio	0.027	-	-	-	0.094
HCM Control Delay (s)	8.9	0	-	-	17.7
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3

# HCM 6th Signalized Intersection Summary

Future Conditions 2027

## 1: Hagadorn & Bennett

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	193	50	55	104	175	9	369	70	327	518	16
Future Volume (veh/h)	16	193	50	55	104	175	9	369	70	327	518	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	251	65	66	125	211	11	434	82	385	609	19
Peak Hour Factor	0.77	0.77	0.77	0.83	0.83	0.83	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	64	238	59	134	199	323	335	556	105	482	903	28
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.02	0.36	0.36	0.16	0.50	0.50
Sat Flow, veh/h	40	1169	289	310	980	1585	1781	1529	289	1781	1804	56
Grp Volume(v), veh/h	337	0	0	191	0	211	11	0	516	385	0	628
Grp Sat Flow(s),veh/h/ln	1498	0	0	1289	0	1585	1781	0	1818	1781	0	1860
Q Serve(g_s), s	5.2	0.0	0.0	0.0	0.0	8.4	0.3	0.0	17.3	8.5	0.0	17.5
Cycle Q Clear(g_c), s	14.0	0.0	0.0	8.8	0.0	8.4	0.3	0.0	17.3	8.5	0.0	17.5
Prop In Lane	0.06		0.19	0.35		1.00	1.00		0.16	1.00		0.03
Lane Grp Cap(c), veh/h	361	0	0	333	0	323	335	0	661	482	0	931
V/C Ratio(X)	0.93	0.00	0.00	0.57	0.00	0.65	0.03	0.00	0.78	0.80	0.00	0.67
Avail Cap(c_a), veh/h	361	0	0	333	0	323	612	0	661	514	0	931
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	27.8	0.0	0.0	24.8	0.0	25.1	13.6	0.0	19.4	13.2	0.0	12.9
Incr Delay (d2), s/veh	31.0	0.0	0.0	2.4	0.0	4.7	0.0	0.0	8.9	8.2	0.0	3.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.0	0.0	0.0	2.8	0.0	0.4	0.1	0.0	7.6	3.5	0.0	6.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	58.8	0.0	0.0	27.2	0.0	29.8	13.7	0.0	28.3	21.5	0.0	16.8
LnGrp LOS	E	A	A	C	A	C	B	A	C	C	A	B
Approach Vol, veh/h		337			402			527			1013	
Approach Delay, s/veh		58.8			28.6			28.0			18.6	
Approach LOS		E			C			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	17.0	31.3		20.4	7.6	40.7		20.4				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 12	* 25		* 14	* 12	* 25		* 14				
Max Q Clear Time (g_c+I1), s	10.5	19.3		16.0	2.3	19.5		10.8				
Green Ext Time (p_c), s	0.2	1.4		0.0	0.0	1.8		0.6				

### Intersection Summary

HCM 6th Ctrl Delay	28.5
HCM 6th LOS	C

### Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Vol, veh/h	48	542	306	16	13	28
Future Vol, veh/h	48	542	306	16	13	28
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	84	84	87	87	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	57	645	352	18	14	30

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	370	0	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.12	-	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.218	-	-
Pot Cap-1 Maneuver	1189	-	-
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1189	-	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	15.1
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1189	-	-	-	400
HCM Lane V/C Ratio	0.048	-	-	-	0.111
HCM Control Delay (s)	8.2	0	-	-	15.1
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0.2	-	-	-	0.4

Intersection						
Int Delay, s/veh	0.7					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↶	↷		↶	
Traffic Vol, veh/h	19	536	301	16	14	21
Future Vol, veh/h	19	536	301	16	14	21
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	84	84	87	87	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	23	638	346	18	15	23

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	364	0	-	0	1039 355
Stage 1	-	-	-	-	355 -
Stage 2	-	-	-	-	684 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1195	-	-	-	255 689
Stage 1	-	-	-	-	710 -
Stage 2	-	-	-	-	501 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1195	-	-	-	247 689
Mov Cap-2 Maneuver	-	-	-	-	247 -
Stage 1	-	-	-	-	689 -
Stage 2	-	-	-	-	501 -

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	14.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1195	-	-	-	402
HCM Lane V/C Ratio	0.019	-	-	-	0.095
HCM Control Delay (s)	8.1	0	-	-	14.9
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3

**Intersection: 1: Hagadorn & Bennett**

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	169	260	215	199	614	80	114
Average Queue (ft)	80	124	99	37	238	32	43
95th Queue (ft)	144	211	179	129	474	62	92
Link Distance (ft)	200	1267			599		894
Upstream Blk Time (%)	0				1		
Queuing Penalty (veh)	0				0		
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		5	1		25	0	1
Queuing Penalty (veh)		15	3		12	0	0

**Intersection: 2: Hulett Rd & Bennett**

Movement	EB	WB	NB	SB	B7
Directions Served	ULTR	LTR	LTR	LTR	T
Maximum Queue (ft)	117	345	77	125	10
Average Queue (ft)	42	144	27	44	1
95th Queue (ft)	87	356	63	93	10
Link Distance (ft)	528	300	106	108	190
Upstream Blk Time (%)		25	0	1	
Queuing Penalty (veh)		0	0	0	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

**Intersection: 3: Bennett & W. Site Drive**

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	51	72
Average Queue (ft)	5	31
95th Queue (ft)	28	61
Link Distance (ft)	1267	777
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 4: Bennett & E. Site Drive**

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	70	52
Average Queue (ft)	7	22
95th Queue (ft)	37	47
Link Distance (ft)	414	594
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Zone Summary**

Zone wide Queuing Penalty: 31

**Intersection: 1: Hagadorn & Bennett**

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	227	332	174	65	319	195	338
Average Queue (ft)	129	108	65	8	153	98	115
95th Queue (ft)	229	306	148	40	261	170	251
Link Distance (ft)	200	1267			599		894
Upstream Blk Time (%)	17						
Queuing Penalty (veh)	0						
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		8	0		21	8	5
Queuing Penalty (veh)		15	0		2	45	19

**Intersection: 2: Hulett Rd & Bennett**

Movement	EB	WB	NB	B9	SB
Directions Served	LTR	LTR	LTR	T	LTR
Maximum Queue (ft)	154	110	129	9	70
Average Queue (ft)	60	37	46	0	23
95th Queue (ft)	118	86	93	6	57
Link Distance (ft)	2055	300	106	218	108
Upstream Blk Time (%)			1		
Queuing Penalty (veh)			0		
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

**Intersection: 3: Bennett & W. Site Drive**

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	62	52
Average Queue (ft)	13	23
95th Queue (ft)	48	50
Link Distance (ft)	1267	541
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Intersection: 4: Bennett & E. Site Drive**

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	47	40
Average Queue (ft)	5	21
95th Queue (ft)	24	45
Link Distance (ft)	403	448
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

**Zone Summary**

Zone wide Queuing Penalty: 81

HCM 6th Signalized Intersection Summary  
1: Hagadorn & Bennett

Future Conditions 2027 With Improvements

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	119	5	27	208	272	45	581	84	82	231	15
Future Volume (veh/h)	18	119	5	27	208	272	45	581	84	82	231	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	140	6	34	263	344	54	684	191	86	243	16
Peak Hour Factor	0.85	0.85	0.85	0.79	0.79	0.79	0.83	0.85	0.44	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	43	198	8	62	312	418	717	789	220	265	987	65
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.05	0.56	0.56	0.06	0.57	0.57
Sat Flow, veh/h	28	968	37	121	1528	1585	1781	1407	393	1781	1736	114
Grp Volume(v), veh/h	167	0	0	297	0	344	54	0	875	86	0	259
Grp Sat Flow(s),veh/h/ln	1033	0	0	1648	0	1585	1781	0	1800	1781	0	1850
Q Serve(g_s), s	1.1	0.0	0.0	0.0	0.0	22.2	1.3	0.0	45.1	2.1	0.0	7.6
Cycle Q Clear(g_c), s	20.2	0.0	0.0	19.1	0.0	22.2	1.3	0.0	45.1	2.1	0.0	7.6
Prop In Lane	0.13		0.04	0.11		1.00	1.00		0.22	1.00		0.06
Lane Grp Cap(c), veh/h	248	0	0	374	0	418	717	0	1010	265	0	1052
V/C Ratio(X)	0.67	0.00	0.00	0.79	0.00	0.82	0.08	0.00	0.87	0.32	0.00	0.25
Avail Cap(c_a), veh/h	248	0	0	374	0	418	740	0	1010	455	0	1052
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	38.2	0.0	0.0	41.5	0.0	37.6	8.6	0.0	20.4	19.1	0.0	11.7
Incr Delay (d2), s/veh	6.9	0.0	0.0	11.2	0.0	12.4	0.0	0.0	9.9	0.7	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	0.0	0.0	8.6	0.0	9.6	0.4	0.0	18.9	0.9	0.0	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.1	0.0	0.0	52.7	0.0	50.0	8.7	0.0	30.3	19.8	0.0	12.3
LnGrp LOS	D	A	A	D	A	D	A	A	C	B	A	B
Approach Vol, veh/h		167			641			929			345	
Approach Delay, s/veh		45.1			51.3			29.0			14.2	
Approach LOS		D			D			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	12.8	67.3		28.6	11.9	68.1		28.6				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 18	* 51		* 22	* 7	* 62		* 22				
Max Q Clear Time (g_c+I1), s	4.1	47.1		22.2	3.3	9.6		24.2				
Green Ext Time (p_c), s	0.1	1.9		0.0	0.0	1.4		0.0				

Intersection Summary

HCM 6th Ctrl Delay	34.7
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th Signalized Intersection Summary  
1: Hagadorn & Bennett

Future Conditions 2027 With Improvements

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	193	50	55	104	175	9	369	70	327	518	16
Future Volume (veh/h)	16	193	50	55	104	175	9	369	70	327	518	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	21	251	65	66	125	211	11	434	82	385	609	19
Peak Hour Factor	0.77	0.77	0.77	0.83	0.83	0.83	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	60	301	75	136	229	612	333	572	108	480	922	29
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.02	0.37	0.37	0.16	0.51	0.51
Sat Flow, veh/h	51	1304	324	324	992	1585	1781	1529	289	1781	1804	56
Grp Volume(v), veh/h	337	0	0	191	0	211	11	0	516	385	0	628
Grp Sat Flow(s),veh/h/ln	1679	0	0	1315	0	1585	1781	0	1818	1781	0	1860
Q Serve(g_s), s	5.7	0.0	0.0	0.0	0.0	7.5	0.3	0.0	19.7	9.7	0.0	19.8
Cycle Q Clear(g_c), s	15.4	0.0	0.0	9.7	0.0	7.5	0.3	0.0	19.7	9.7	0.0	19.8
Prop In Lane	0.06		0.19	0.35		1.00	1.00		0.16	1.00		0.03
Lane Grp Cap(c), veh/h	436	0	0	364	0	612	333	0	680	480	0	950
V/C Ratio(X)	0.77	0.00	0.00	0.52	0.00	0.34	0.03	0.00	0.76	0.80	0.00	0.66
Avail Cap(c_a), veh/h	550	0	0	463	0	718	457	0	680	600	0	950
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.2	0.0	0.0	26.6	0.0	17.2	15.2	0.0	21.7	14.9	0.0	14.3
Incr Delay (d2), s/veh	5.3	0.0	0.0	1.2	0.0	0.3	0.0	0.0	7.7	6.3	0.0	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	0.0	0.0	3.0	0.0	2.5	0.1	0.0	8.7	3.8	0.0	7.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.5	0.0	0.0	27.8	0.0	17.6	15.3	0.0	29.4	21.2	0.0	17.9
LnGrp LOS	C	A	A	C	A	B	B	A	C	C	A	B
Approach Vol, veh/h		337			402			527			1013	
Approach Delay, s/veh		34.5			22.4			29.2			19.2	
Approach LOS		C			C			C			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	18.7	36.0		24.7	7.8	46.8		24.7				
Change Period (Y+Rc), s	* 6.3	* 6.3		* 6.4	* 6.3	* 6.3		* 6.4				
Max Green Setting (Gmax), s	* 18	* 30		* 24	* 7	* 40		* 24				
Max Q Clear Time (g_c+I1), s	11.7	21.7		17.4	2.3	21.8		11.7				
Green Ext Time (p_c), s	0.6	1.8		0.9	0.0	3.5		1.4				

Intersection Summary

HCM 6th Ctrl Delay	24.3
HCM 6th LOS	C

Notes

\* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

**Intersection: 1: Hagadorn & Bennett**

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	209	385	260	171	537	101	148
Average Queue (ft)	103	163	111	33	239	34	51
95th Queue (ft)	179	297	212	116	452	71	114
Link Distance (ft)	200	1267			599		894
Upstream Blk Time (%)	2				1		
Queuing Penalty (veh)	0				0		
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		15	1		25	0	1
Queuing Penalty (veh)		40	2		12	1	1

Intersection: 1: Hagadorn & Bennett

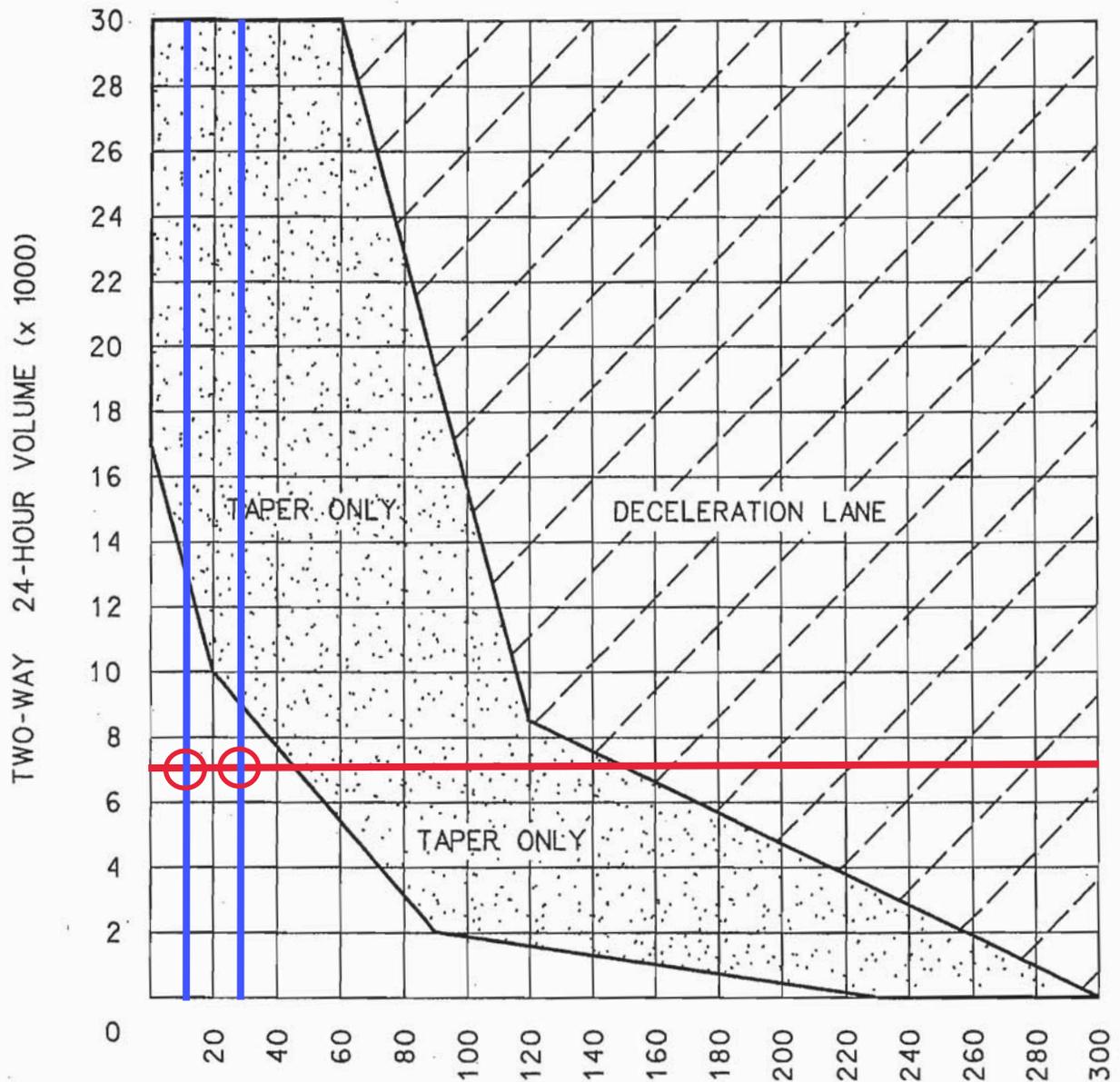
Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	L	TR	L	TR
Maximum Queue (ft)	220	303	172	98	362	199	410
Average Queue (ft)	127	100	59	9	174	110	137
95th Queue (ft)	213	247	141	51	305	195	311
Link Distance (ft)	200	1267			599		894
Upstream Blk Time (%)	6						
Queuing Penalty (veh)	0						
Storage Bay Dist (ft)			160	100		100	
Storage Blk Time (%)		6			26	10	9
Queuing Penalty (veh)		11			2	60	31

## **Appendix E**

# **WARRANT SUMMARIES**

E. Site Drive & Bennett Road

Warrants for Right Turn  
Deceleration Lane or Taper



24-Hour Volumes  
Bennett Road  
5,450 vpd (2018)  
5,920 vpd (2027)  
1,510 vpd (Site Gen)  
7,430 vpd Total (2027)

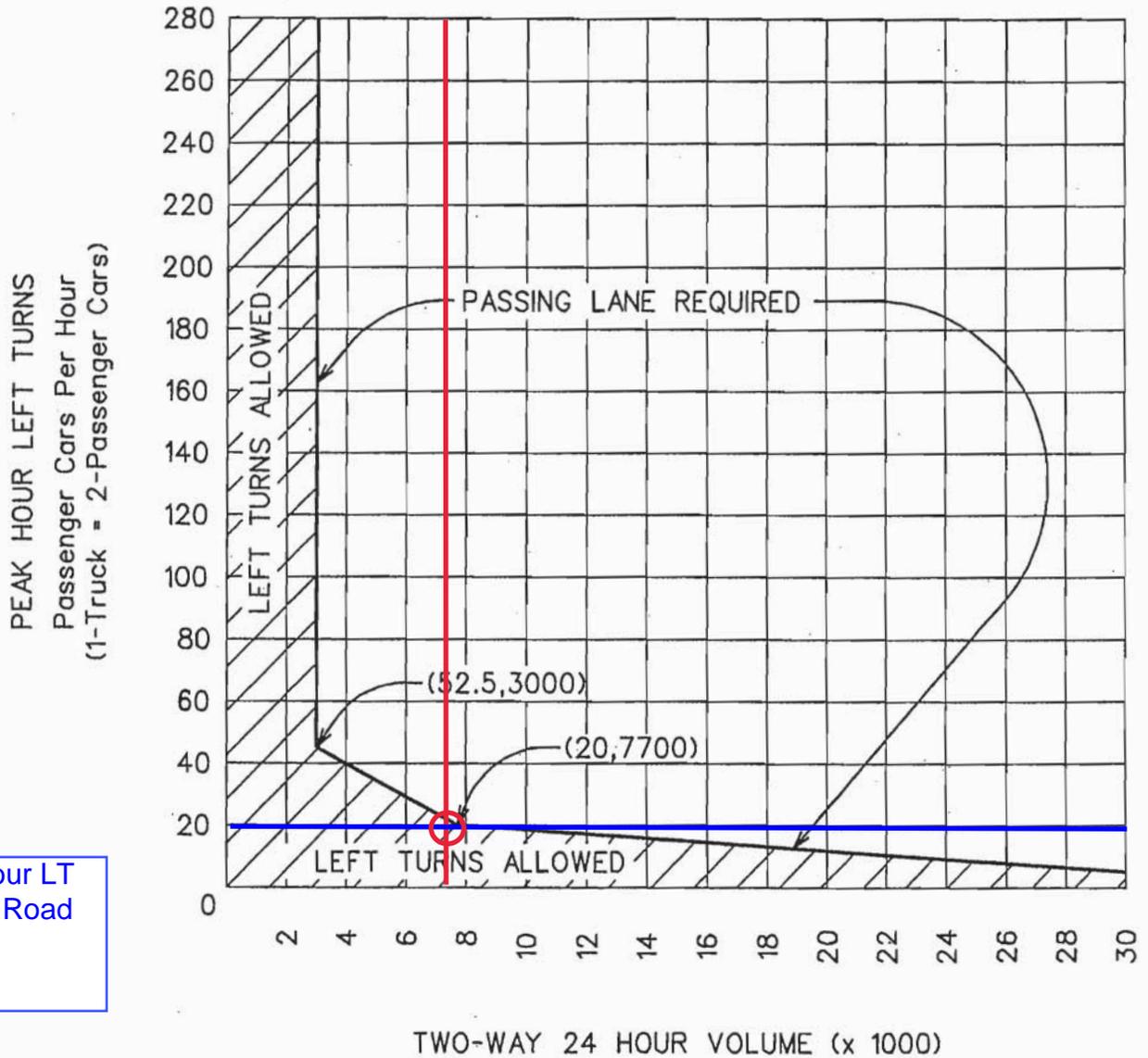
PEAK HOUR RIGHT TURNS

Peak Hour RT  
Bennett Road  
29 (AM)  
16 (PM)

**RADIUS ONLY REQUIRED**

E. Site Drive & Bennett Road

Warrants for Left Turn  
Passing Lane

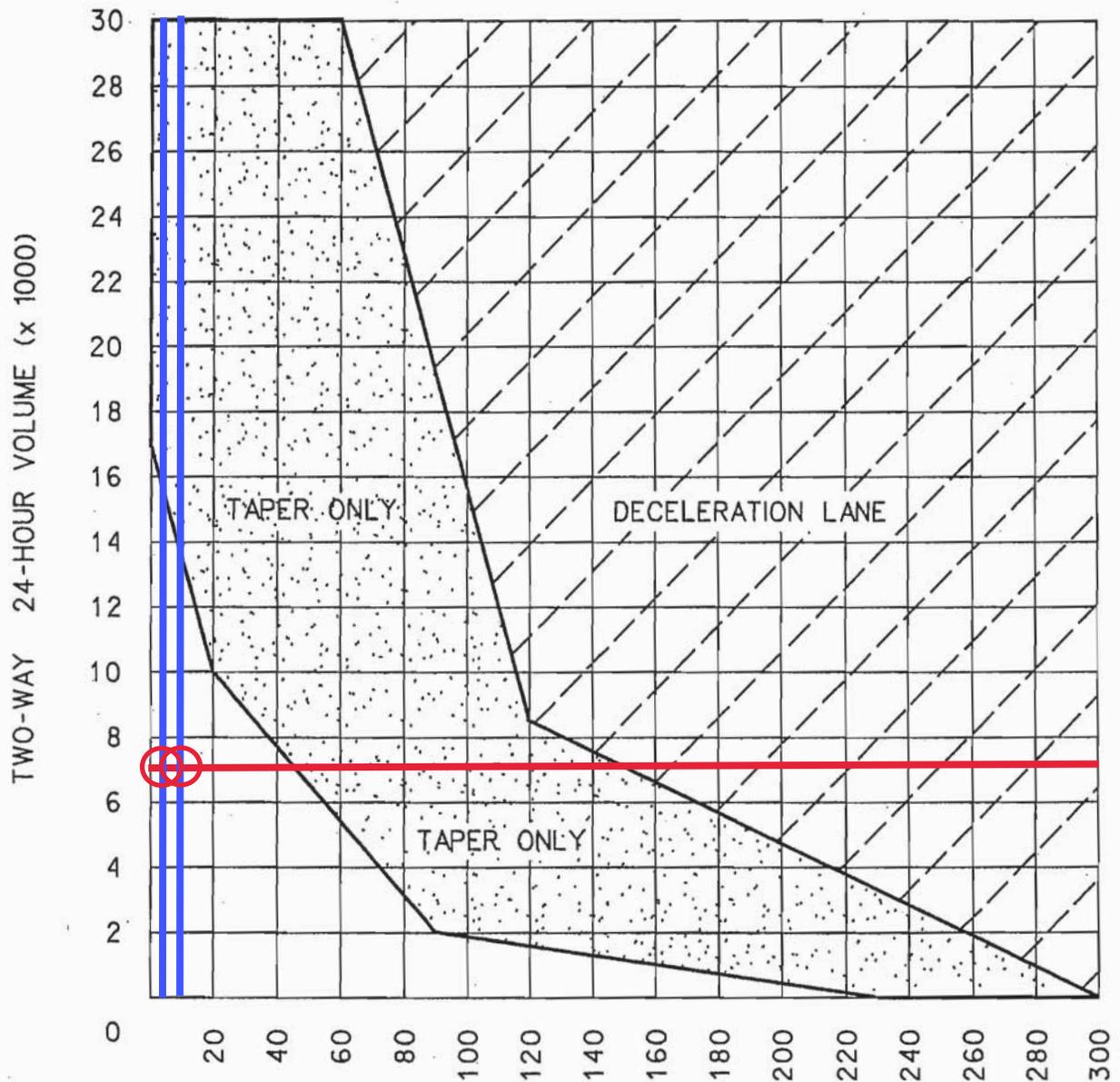


Peak Hour LT  
Bennett Road  
19 (AM)  
19 (PM)

**NO LEFT-TURN TREATMENT REQUIRED**

24-Hour Volumes  
Bennett Road  
5,450 vpd (2018)  
5,920 vpd (2027)  
1,510 vpd (Site Gen)  
7,430 vpd Total (2027)

Warrants for Right Turn  
Deceleration Lane or Taper



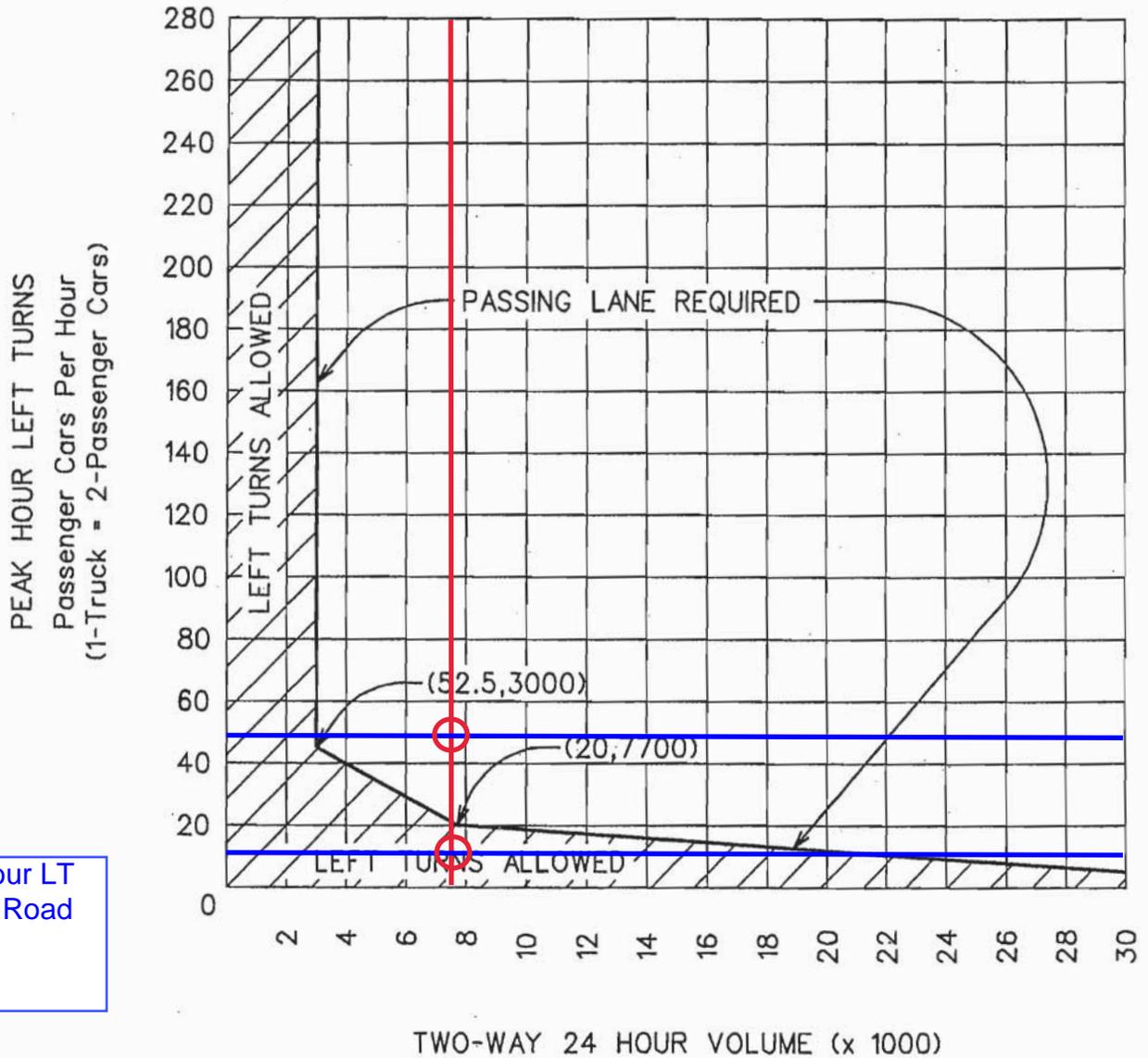
24-Hour Volumes  
Bennett Road  
5,450 vpd (2018)  
5,920 vpd (2027)  
1,510 vpd (Site Gen)  
7,430 vpd Total (2027)

PEAK HOUR RIGHT TURNS

Peak Hour RT  
Bennett Road  
6 (AM)  
16 (PM)

**RADIUS ONLY REQUIRED**

Warrants for Left Turn  
Passing Lane



Peak Hour LT  
Bennett Road  
13 (AM)  
48 (PM)

**LEFT-TURN TREATMENT REQUIRED**

24-Hour Volumes  
Bennett Road  
5,450 vpd (2018)  
5,920 vpd (2027)  
1,510 vpd (Site Gen)  
7,430 vpd Total (2027)

**NATURAL FEATURES INVENTORY AND IMPACT ASSESSMENT**

*for the*

**Silverleaf Condominiums PUD  
Section 29, Meridian Township, Michigan**

*Prepared for:*

**Mr. David Straub  
Mayberry Homes  
1650 Kendale Blvd., Suite 200  
East Lansing, Michigan 48823**



MARX  
WETLANDS  
LLC

*Prepared by:*

**Marx Wetlands, LLC**

**4/27/2020**

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## **1.0 INTRODUCTION**

Marx Wetlands, LLC (MW) was contracted by Mayberry Homes (Applicant/Developer) to perform a natural features inventory and impact assessment for the project Site, which is comprised of seven (7) parcels (29-300-008, 29-300-023, 29-300-020, 29-300-021, 29-300-025, 29-300-026, and 29-251-009) totaling approximately 93.90 acres located north of Bennett Road and approximately 0.25 miles east of South Hagadorn Road within section 29 of Meridian Township (T4N, R1W), Ingham County, Michigan (hereafter referred to as “Site”).

The Developer (Mayberry Homes) is proposing a new planned unit development (Silverleaf Condominiums PUD), which will include the construction of approximately 150 proposed residential units and associated roadways, including one main access drive to Bennett Road, and secondary access roads to Bennett Road. The development will also include associated stormwater detention system, utilities, and open green space pursuant to Meridian Township’s building requirements.

As part of a Special Use Permit Application, the Charter Township of Meridian Department of Community Planning and Development requires a “Natural Features Assessment,” which is to include “a written description of the anticipated impacts on the natural features at each phase and at project completion that contains the following:

- a. An inventory of natural features proposed to be retained, removed, or modified. Natural features shall include, but are not limited to, wetlands, significant stands of trees or individual trees greater than 12 inches dbh, floodways, floodplains, water bodies, identified groundwater vulnerable areas, slopes greater than 20 percent, ravines, and vegetative cover types with potential to sustain significant or endangered wildlife.
- b. Description of the impacts on natural features.
- c. Description of any proposed efforts to mitigate any negative impacts.

After obtaining site location information, Marx Wetlands LLC (MW) conducted desktop information reviews, an on-site assessment and information analysis to help address the Township’s natural features assessment requirements. MW also conducted a wetland determination and delineation for an approximately 22-acre parcel (33-02-02-29-251-009) on April 14, 2020. The remaining six parcels of the Site were delineated by Fishbeck in November of 2017. Please note that MW’s wetland delineation has not yet been verified by Meridian Township’s wetland consultant before the completion of this natural features inventory and impact assessment. In addition, a tree survey was conducted by others (data provided by Benchmark Engineering/Craig Sturk). The wetland delineations and tree survey results are included in this report as well.

## **2.0 SITE LOCATION & CONDITIONS AND PROJECT DESCRIPTION**

The Site is located directly north of Bennett Road and approximately 0.25 east of South Hagadorn Road and approximately 0.5 west of Hulett Road within Section 29 of Meridian Township (T4N,

R1W) of Ingham County, Michigan. The Developer (Mayberry Homes) is proposing a planned unit development (Silverleaf Condominiums PUD) consisting of approximately 150 single-family residential units, associated access roadways, utility, and stormwater infrastructure. The project will be entirely contained within Meridian Township.

The majority of the project footprint will be situated within upland disturbed fields or upland scrub-shrub/forest in Meridian Township. Based on MW's review, the project footprint (i.e., lot lines, roads, etc.) does not appear to impact the existing wetlands or 40-foot wetland buffers. The green open spaces (totaling approximately 35 acres) will largely occupy upland land directly adjacent to areas of wetland and/or 100-year floodplain in attempts to minimize impacts to on-site features. It appears that project activities such as grading, clearing associated with the proposed development and the construction of one (1) stormwater basin will occur in upland. Prior to site clearing and grading, soil erosion and sediment control measures will be installed and will be inspected and maintained during the construction project. All soil erosion and sedimentation control measures will be removed upon completion of construction and stabilization. **This impact assessment assumes that grading will not extend outside the proposed lot lines.** Please refer to *Figures 1.1 Site Location Map & 1.2 Preliminary Site Plan (3 Sheets; Dated 4-22-2020)* in **Appendix I**.

On April 14, 2020, MW conducted a wetland determination and delineation for the 22-acre parcel (#29-251-009) and identified five (5) wetlands (Wetlands A, B, C, D, and E) and one (1) county drain, Hoskins Drain (H6200) within parcel limits. Four (4) wetlands (Wetlands A, B, C, and E) are likely regulated by Michigan's Department of Environment, Great Lakes, and Energy (EGLE) and Meridian Township. Wetland D is not anticipated to be regulated by EGLE or Meridian Township.

Fishbeck conducted a wetland delineation for the remaining southern parcels (approximately 76.5 acres) of the Site on November 28, 2017 and identified three wetland areas (Wetlands A, B, and C) and Herron Creek. However, only one wetland is anticipated to be regulated by EGLE and Meridian Township (Wetland A-adjointing Herron Creek). Wetland B may be considered regulated by Meridian Township. Refer to Fishbeck's *Wetland Delineation Report WDV 17-06* provided in **Appendix IV**.

A natural features assessment for the whole Site (approximately 93.90 acres) was also conducted by MW on April 14, 2020.

Based on review of aerial photographs, available on-line resources, and on-site visit, the Site largely contains undeveloped land, consisting of areas of upland, disturbed fields, upland scrub-shrub/forest and wetland. In addition, debris, concrete, asphalt piles and old equipment was identified within the overall Site. Existing single-family and vacant residences were identified along Bennett Road. Mowed paths and a two-track were also identified throughout the Site. One (1) house was observed within the southeast quadrant of the Site, north of Bennett Road.

The Site is bound by undeveloped property and a railroad to the north; residential properties connecting to Sophiea Parkway and Creekstone Trail, the Okemos Public Schools bus garage and

Schultz Veterinary Clinic to the east; Bennett Road, and the College Fields Golf Club to the south and west. The general topography of the Site is generally flat with some moderate slopes associated with previous land disturbances, which appear manmade, presumably associated with mining activities. Topography also generally drops in elevation to the on-site wetlands. Refer to the *Figure 2: Aerial Imagery Map* in **Appendix I**. The yellow polygon depicts the approximate overall Project Site within Meridian Township, Ingham County, Michigan.

### **3.0 METHODS**

MW conducted a desktop review for the Site using publicly available information and imagery, including the United States Geological Service (USGS) topographic map, aerial photographs, National Wetland Inventory (NWI) map, county soil survey map, county drain maps, Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), and Meridian Township's Natural Features Map, which primarily includes wetlands and floodplains.

On April 14, 2020, MW conducted a wetland determination and delineation for the approximately 22-acre parcel and a natural features assessment for the overall 93.90-acre Site. The on-site visit consisted of a site reconnaissance to evaluate the current and prior land use, conduct habitat type determination, habitat quality evaluation, wetland determination and delineation, wildlife observations, and floodplain or other special concern observations. The wetland determination and delineation was performed in accordance with the Michigan Department of Environmental Quality Wetland Identification Manual (2001), the Northcentral-Northeast Manual to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual. The findings from the desktop review, site visit and wetland delineation, and Fishbeck's wetland delineation, and limited tree survey conducted by others were combined to help interpret the Site's natural features and evaluate potential project impacts upon those natural features.

### **4.0 RESULTS, FINDINGS, AND DISCUSSION**

#### ***4.1 Existing Structures, Materials, and Adjacent Land use***

The overall Site largely contains undeveloped land, consisting of areas of upland, disturbed fields, upland scrub-shrub/forest, and wetland. The Site's upland areas appeared highly disturbed and contained several piles of fill, debris (i.e., wood, asphalt, concrete, etc.), and old machinery. The piles of fill material were vegetated, which suggests fill activities likely occurred in the past. According to Google Earth aerial photographs dating back to 1999 show extensive ground disturbance and placement of fill material throughout the west-central portions of the Site. U.S. topographic maps reveal the Site may have contained previous gravel pits corresponding to these disturbed areas. In addition, existing single-family and vacant residences were identified along Bennett Road. Mowed paths and a two-track were also identified throughout the Site. One (1) house was observed within the southeast quadrant of the Site, north of Bennett Road.

The Site is bound by undeveloped property and a railroad to the north; residential properties connecting to Sophiea Parkway and Creekstone Trail, the Okemos Public Schools bus garage and Schultz Veterinary Clinic to the east; Bennett Road, and the College Fields Golf Club to the south

and west. The general topography of the Site is generally flat with some moderate slopes associated with previous land disturbances that appear constructed, presumably associated with mining activities. Topography also generally drops in elevation to the on-site wetlands. Refer to *Figure 2: Aerial Imagery Map* in **Appendix I**.



**Photograph 1.** View of gravel paths and upland disturbed fields identified throughout the Site.



**Photograph 2.** View of vegetated stockpiles identified in the disturbed areas of the Site.



**Photograph 3.** View of debris piles identified in the southwestern portions of the Site.



**Photograph 4.** View of upland forested/scrub-shrub areas identified throughout the Site.

#### **4.2 Topography**

The Site varies in elevation from approximately 846 to 860 feet above sea level (asl) and can be characterized as relatively moderate sloping and local microtopographic relief was identified near the wetland areas and on-site drain (Hoskins Drain-H6200). Refer to *Figure 1: Site Location Map* in **Appendix I**.

#### **4.3 Vegetation**

A vegetation assessment was conducted during the on-site visit to describe the dominant cover or community types observed throughout the Site. Based on review of aerial photographs,

available on-line resources, and on-site visits, the Site largely contains undeveloped land, consisting of areas of upland disturbed fields, upland scrub-shrub/forest, and wetland.

MW found three (3) distinct community types present on the Site: 1) upland disturbed old fields; 2) upland scrub-shrub/forest; and 3) wetlands. The descriptions of the three (3) main cover types identified within the Site are described below:

### *Cover Type Descriptions*

#### **1) Upland Disturbed Old Field**

Upland herbaceous species found in the areas of upland, disturbed old field include bluegrasses (*Poa compressa* and *P. pratensis*), spotted knapweed (*Centaurea stoebe*), orchard grass (*Dactylis glomerata*), smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), common teasel (*Dipsacus fullonum*), and goldenrods (*Solidago altissima* and *S. canadensis*). Scattered trees and shrubs included cottonwood (*Populus deltoides*), red-cedar (*Juniperus virginiana*), black raspberry (*Rubus occidentalis*), autumn-olive (*Elaeagnus umbellata*), and common blackberry (*Rubus allegheniensis*). Refer to *Table 1* in **Appendix II** for a complete list of identified plant species within this land cover type.

#### **2) Upland Scrub-shrub/Forest**

The upland forested and scrub-shrub areas were observed throughout the Site. These areas generally contain oaks (*Quercus alba*, *Q. bicolor*, *Q. macrocarpa*, *Q. rubra*, and *Q. velutina*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), cottonwood, box-elder (*Acer negundo*), sugar maple (*Acer saccharum*), scattered with red maple (*Acer rubrum*), basswood (*Tilia americana*), beech (*Fagus grandifolia*), American elm (*Ulmus americana*), and white ash (*Fraxinus americana*.) trees. Upland herbaceous understory species include strawberry (*Fragaria virginiana*), wild geranium (*Geranium maculatum*), may-apple (*Podophyllum peltatum*), Dame's rocket (*Hesperis matronalis*), Pennsylvania sedge (*Carex pennsylvanica*), white avens (*Geum canadense*), garlic mustard (*Alliaria petiolata*), and yellow trout-lily (*Erythronium americanum*). Upland shrub and vine species include common blackberry, black raspberry, hop-hornbeam (*Ostrya virginiana*), musclewood (*Carpinus caroliniana*), gray dogwood (*Cornus racemosa*), prickly-ash (*Zanthoxylum americanum*), Eurasian honeysuckles (*Lonicera spp.*), common buckthorn (*Rhamnus cathartica*), autumn-olive, and Virginia creeper (*Parthenocissus quinquefolia*). Refer to *Table 2* in **Appendix II**, for a complete list of identified plant species within the upland scrub-shrub/forest land cover type.

#### **3) Wetlands- (Includes Fishbeck and MW identified wetlands)**

Majority of the on-site wetlands are emergent and forested wetlands; however, Wetland E (also identified as *Wetland A-Fishbeck 2017 delineation*) is largely emergent. Wetland D identified in MW's delineation is vernal pool type (forested) wetland.

#### **MW's Delineation (22-Acre Parcel):**

**Wetlands A, B, and C** are emergent and forested wetlands, containing emergent wetland interiors and forested wetland perimeters. Wetland A was identified in the southeast quadrant

of the Site, extending off-site in a southeast direction. Wetland A is also hydrologically connected to Wetland E. Wetland A drains southwest through Watercourse 1 (trib to Herron Creek/Hoskins Drain H6200) via an existing culvert (at the existing two-track drive) and discharges west into Wetland E. Wetland B is entirely contained within the north-central portion of the Site. Wetland C is largely on-site; however, appears to drain off-site at the base of the railroad embankment.

Herbaceous vegetation generally observed within Wetlands A, B, and C include sedges (*Carex intumescens*; FACW, *C. lacustris*, *C. stricta*, and *C. vulpinoidea*; OBL), reed canary grass (*Phalaris arundinacea*; FACW), sensitive fern (*Onoclea sensibilis*; FACW), cattails (*Typha angustifolia* & *T. latifolia*; OBL), and false nettle (*Boehmeria cylindrica*; OBL). Other less common herbaceous vegetation included skunk-cabbage (*Symplocarpus foetidus*; OBL), white avens (FAC), and stinging nettle (*Urtica dioica*; FAC). Common shrubs observed include common buckthorn (FAC), gray dogwood (FAC), silky dogwood (*C. amomum*; FACW), green ash (*Fraxinus pennsylvanica*; FACW), and common elderberry (*Sambucus canadensis*; FACW). Common vines include riverbank grape (*Vitis riparia*; FAC) and poison-ivy (*Toxicodendron radicans*; FAC). Tree species include cottonwood (FAC), silver maple (*Acer saccharinum*; FACW), American elm (FACW), box-elder (FAC), and swamp white oak (*Quercus bicolor*; FACW).

**Wetland D** is a vernal pool type forested wetland with standing water and sparse vegetation. This wetland is entirely contained within the northeast corner of the Site. It is unclear if this was man-made feature or not. Herbaceous vegetation observed include reed canary grass (FAC) and sedge (*Carex intumescens*; FACW). Dominant trees observed include common buckthorn (FAC) and American elm (FACW). Although Wetland D appears to contain largely open water with sparse vegetation, wetland-rated trees line the perimeter and was flagged due to the presence of hydric soil and hydrological indicators.

**Wetland E** is a largely emergent wetland that extends off-site to the west and south and is part of a larger wetland system adjoining Herron Creek. Herbaceous vegetation generally observed include sedges (*C. lacustris*, *C. stricta*, and *C. vulpinoidea*; OBL), reed canary grass (FACW), cattails (OBL), late goldenrod (*Solidago gigantea*; FACW), and stinging nettle (FAC). Common shrubs observed include gray dogwood (FAC), silky dogwood (FACW), red raspberry (*Rubus strigosus*; FAC), and common elderberry (FACW). Common vines include riverbank grape (FAC) and poison-ivy (FAC). Tree species include box-elder (FAC), American elm (FACW), and common buckthorn (FAC). Dense thickets of gray dogwood (FAC) and prickly-ash (FACU) were not flagged within the wetland's limits, unless obvious hydrological and soil indicators were strongly detected. Refer to *Wetland Delineation Report (Marx Wetlands LLC; Dated April 23, 2020)* provided in **Appendix IV**.

#### **Fishbeck's Wetland Delineation (76.5-Acre):**

**Wetland A** is a large extensive emergent wetland dominated with reed canary grass and corresponds with Wetland E (identified by MW). This wetland also corresponds to Township Wetland 29-1 and is contiguous with Herron Creek.

**Wetland B** is an emergent/forested/scrub-shrub wetland identified along the eastern property boundary, directly south of Sophiea Parkway. The western portion of this wetland is dominated

with box-elder trees and glossy buckthorn (*Frangula alnus*) trees and shrubs. Wetland sampling point SP-E was evaluated approximately 400 feet north-northeast of SP-B in forested wetland dominated by eastern cottonwood and glossy buckthorn trees. Sophiea Parkway, Laforet Circle, and associated residential properties are located on the north and east sides of Wetland B.

**Wetland C** was located in a depression within the disturbed areas (potentially previous mining/gravel pit area) of the overall portion of the site. The western half of this wetland contained standing water and cattails; the eastern half contained forested wetland dominated by eastern cottonwood trees. Refer to *Fishbeck's Wetland Report– WDV 17-06 (Fishbeck; Dated December 19, 2017)* provided in **Appendix IV**.

### **Vegetation Assessment**

Several species associated with disturbed lands in the Great Lakes region were observed throughout these parcels. These include non-native species, invasive species, native species that are tolerant of human land uses, and native pioneer species that normally colonize land after activities are abandoned. Examples of these species present on the Site include smooth brome (non-native grass), (non-native forb), Eurasian honeysuckles (invasive shrub), common & English plantain (non-native forb), common buckthorn (invasive tree), multiflora rose (invasive shrub), autumn-olive (invasive shrub), tall goldenrod (native forb, but weedy), and cottonwood/trembling aspen (pioneer/early successional species).

The Vegetation ca. 1800 map produced by the Michigan Natural Features Inventory (MNFI) shows the Site appears to be part of an extensive sugar-maple forest spanning for many miles southward from the Red Cedar River. Refer to *Figure 3: Pre-settlement Vegetation/MNFI ca. 1800 map* in **Appendix I**. In addition, hardwood swamps were once scattered throughout this area as well, particularly corresponding with the large wetland complex associated with Herron Creek (Wetland A- delineated by Fishbeck/Wetland E- delineated by MW). Prior to extensive land clearing these shady forests were common on the flatter till plains of mid-Michigan. They often contained a wide variety of tree species, such as sugar maple, red maple, red oak, white oak, American beech, white ash, basswood, tulip tree, walnut, and hop-hornbeam. These forests were commonly cleared for agricultural purposes. It is likely the southern portion of the Site was cleared many decades ago for this purpose or used as gravel pits; notice the lighter color indicating open land in the 1983 USGS Topographic map (refer to Figure 1 in **Appendix I**). As twentieth century commercial and residential development began to fill in lands between East Lansing and Okemos, the southern portions of the Site was likely left idle due to the presence of adjacent wetland areas and the infeasibility of continuing agriculture on such a small scale. As a result, the Site contains both native and non-native plants that are able to recolonize.

Refer to the 1983 USGS Topographic map that depict light (gray) color indicating some areas of open/developed land in the property particularly near the disturbed upland fields and associated with historic filling activities (refer to Figure 1 in **Appendix I**). The areas of upland disturbed fields have a relatively low native mean Coefficient of Conservatism of 1.69 (adventive species were assumed as 0) is an overall indicator that this Site has been subjected to past disturbances.

The forested/scrub-shrub areas of the Site would normally have been cleared for agriculture; however, it is likely that these areas were retained due to the nearby wetlands. The upland scrub-shrub/forest areas are largely dominated by native hardwood forest trees, including early successional trees with a relatively weedy shrubs and groundcover plants. This land cover assemblage includes both native and non-native species. Examples of the species present on the Site include cottonwood, naturally established trees (i.e., black cherry, oaks, maples, elms, hickories), non-native smooth brome, and scattered common buckthorn (invasive). The tree species are likely the remaining native species, which are possibly descendent and/or residual from the original sugar maple-beech forest that likely occurred within this location. There is evidence that as vegetation recolonization progressed, the Site became relatively brushy in areas, particularly along forest edges and along the network of paths and two-track road where autumn-olive, Scotch pine, multiflora rose, Eurasian honeysuckles, and common buckthorn were more often observed. Therefore, due to the possible previous disturbances of habitat fragmentation, partial prior tree clearing, surrounding residential development of this general region of Meridian Township, etc., the areas of forest/scrub-shrub appear to contain a mix of non-native and native species within the understory; however, contains several native hardwood trees. The scrub-shrub/forest habitat's relatively low native mean Coefficient of Conservatism of 3.3 is an overall indicator that this site was modified in the past; however, does retain native forest remnant species and has the highest rating compared with the upland disturbed old fields and wetland habitat within the Site. Refer to the *Vegetation Lists* in **Appendix II**.

The wetland areas were identified in low-lying lands or small depressions within the Site and contain both native and non-native species. Examples of the species present on the Site include naturally established cottonwood, swamp white oak, white willow (non-native tree), common buckthorn (invasive), and reed canary grass (weedy native). The dominant plant species identified within the on-site wetlands was reed canary grass (aggressive, weedy native). This is likely because these wetlands may have not been subject to recent site disturbance or significant modifications, other than periodic flooding, siltation associated with the Herron Creek, adjacent land-use changes and installation of the two-tracks. The overall wetland habitat still has a relatively low native mean Coefficient of Conservatism of 2.5. Therefore, this overall rating indicates that this Site was likely modified in the past; however, the wetlands appear to contain several native species.



Photograph 5. View of upland disturbed old fields.



Photograph 6. Another typical view of the upland disturbed old fields littered with debris piles.



Photograph 7. Upland forest/scrub-shrub.



Photograph 8. Typical emergent/forested wetland (MW delineated Wetland A). No direct wetland impacts anticipated.



Photograph 9. Example of emergent wetland system, (Fishbeck delineated Wetland A/MW delineated Wetland A).



Photograph 10. Example of existing residences along Bennett Road.

Although the Developer intends to preserve as many trees as possible particularly within the higher quality habitats (i.e., wetland and forest habitats), the proposed development of the Site will require clearing some existing vegetation. The Site contains upland scrub-shrub/forest, consisting of non-native shrubs and native trees and nearby wetlands with both native and non-native species. The upland disturbed fields and portions of the upland scrub-shrub/forest will be converted into the proposed residential lots for the planned unit development.

**No formal mitigation for vegetation removal has been planned. Traditional landscape grass, shrub, and tree plantings are expected for this development; however, no formal landscaping plans are designed at this time. It is likely that much of the existing vegetation, particularly some of the large or remnant trees may be incorporated into the traditional landscaping to meet open/green space requirements.**

#### **4.4 Tree Inventory**

Separate from MW's natural features assessment and wetland delineation conducted in April of 2020, a tree survey of the entire Site was conducted by others (i.e., provided by Benchmark Engineering and Craig Sturk). The tree data was provided to MW to accompany this inventory and impact assessment of natural features. The survey included trees considered "significant" or deserving special protection because of their size, relative rarity, or historical importance. During the tree survey, trees with a diameter at breast height (DBH) (the standard measure for tree size) of 12 inches or greater were located on the Site. Dead trees appear to have been excluded from this inventory. The trees were identified to species and their size recorded in a table (**Appendix III**).

The tree survey recorded roughly 1,095 protected trees (i.e., 12.0 inches DBH or larger) within or along site boundaries. The average tree size recorded for the on-site protected trees was approximately 18.0 inches DBH, with a maximum tree size documented at 54.0 inches DBH. Majority of the surveyed trees were hardwood species (approximately 87%) and primarily native species, including black cherry, cottonwood, oaks (*Quercus alba*, *Q. macrocarpa*, and *Q. rubra*), box-elder, maples (*Acer rubrum*, *A. saccharinum*, and *A. saccharum*), white ash (*Fraxinus americana*), American elm, hackberry (*Celtis occidentalis*), basswood, black walnut, American beech, ironwood, and musclewood. Some planted, non-native, and/or escaped species recorded include honey-locust (*Gleditsia triacanthos*), Norway maple (*Acer platanoides*), black locust (*Robinia pseudoacacia*), and apple species (*Malus spp.*). Approximately 13% of the surveyed trees were softwood species include red pine (*Pinus resinosa*), white pine (*Pinus strobus*), Scotch pine (*Pinus sylvestris*), Norway spruce (*Picea abies*), and white-cedar (*Thuja occidentalis*). Refer to the *Table 1. Tree Summary Table* (next page).

**Table 1. Tree Summary Table.**

<u>Common Name</u>	<u>Scientific Name</u>	<u>TOTALS</u>
Black Cherry	<i>Prunus serotina</i>	202
Box-elder	<i>Acer negundo</i>	194
Cottonwood	<i>Populus deltoides</i>	175
White Pine	<i>Pinus strobus</i>	113
Red Oak	<i>Quercus rubra</i>	77
Black Walnut	<i>Juglans nigra</i>	75
Sugar Maple	<i>Acer saccharum</i>	38
Fagus grandifolia	<i>American Beech</i>	36
Norway Maple	<i>Acer platanoides</i>	28
White Oak	<i>Quercus alba</i>	24
Norway Spruce	<i>Picea abies</i>	23
American Elm	<i>Ulmus americana</i>	20
Red Maple	<i>Acer rubrum</i>	18
Basswood	<i>Tilia americana</i>	13
Hackberry	<i>Celtis occidentalis</i>	11
White Ash	<i>Fraxinus americana</i>	11
Willow	<i>Salix species</i>	6
Silver Maple	<i>Acer saccharinum</i>	5
Scotch Pine	<i>Pinus sylvestris</i>	5
Bur Oak	<i>Quercus macrocarpa</i>	4
Apple	<i>Malus pumila</i>	3
Black Locust	<i>Robinia pseudoacacia</i>	2
Honey-Locust	<i>Gleditsia triacanthos</i>	2
Red Pine	<i>Pinus resinosa</i>	2
White-Cedar	<i>Thuja occidentalis</i>	2
Ironwood	<i>Ostrya virginiana</i>	1
Hornbeam/Musclewood	<i>Carpinus caroliniana</i>	1
Tree-of-Heaven	<i>Ailanthus altissima</i>	1
White Mulberry	<i>Morus alba</i>	1
Hickory	<i>Carya species</i>	1
		1094

**Impact Assessment**

The areas associated with the proposed lots and roadways indicate that approximately 465 protected (i.e., 12 inches DBH or larger) trees (approximately 400 hardwood trees and 65 softwood trees) will be removed. The tree clearing areas appear to contain non-protected (less than 12 inches DBH in size) trees, protected native hardwood tree species (i.e., oaks, black walnut, cottonwood, black cherry, white ash, maples, etc.), and non-native or weedy species, such as Norway maple, Norway spruce, Scotch pine, black locust, and box-elder. **Please note that this is a rough estimate and would be subject to change depending on grading extents.**

Tree clearing activities are primarily restricted to the southern (six parcels), which appear to contain more weedy or non-native tree species and contain a brushy shrub layer dominated by common buckthorn, Eurasian honeysuckles, and prickly-ash. The northeastern parcel (29-251-009) contains a relatively higher quality forest with remnant species of sugar maple-beech forests, which is not anticipated to be cleared or developed by the proposed PUD Site Plan. Refer to Sheet 3 of the *Preliminary Site Plan (Silverleaf Condominiums PUD)* provided in **Appendix III**.

In addition, the majority of the on-site protected trees will be retained post-construction and the higher quality areas (i.e., wetlands and forest habitats) does not appear to be directly impacted by proposed project activities. **Although some native species are proposed for removal, it is not anticipated that tree clearing activities will significantly impact the overall existing or available forest habitat within the Site or local region.**

#### **4.5 Wetlands**

Marx Wetlands LLC conducted a wetland determination and delineation for the approximately 22-acre parcel (29-251-009) on April 14, 2020. MW identified five (5) wetlands (Wetlands A, B, C, D, and E) and one (1) watercourse was identified, which appears to correspond with the Hoskins Drain (Ingham County Drain H6200-**Figure 4** in **Appendix I**). In addition, Fishbeck conducted a wetland delineation for the remaining parcels (approximately 76.5 acres) of the Site on November 28, 2017 and identified three wetland areas (Wetlands A, B, and C) and Herron Creek. Refer to the enclosed Wetland Delineation Reports (Marx Wetlands 2020 & Fishbeck 2017) (**Appendix IV**).

*Meridian Township Natural Features Map* (Figure 5 in **Appendix I**) depicts one (1) township mapped large wetland system that spans the entire Site in a roughly southwest-northeast orientation, which generally corresponds to the delineated wetlands as indicated by the Township's map. In addition, the National Wetland Inventory Map-NWI (Figure 6 in **Appendix I**) also indicates the Site contains wetland areas comprised of forested (PFO1C) and emergent (PEM1Ad) wetland types, which generally correspond to the delineated wetland areas and wetlands shown on the *Meridian Township's Natural Features Map*.

#### Regulations

##### **State Regulations**

Part 301, Inland Lakes and Streams, states that a feature is considered a regulated watercourse by the Michigan Department of Environment, Great Lakes, and Energy (EGLE), if it possesses a defined bed, bank, and evidence of continued flow or a continued occurrence of water. Two (2) watercourses (Herron Creek and Hoskins Drain) were identified within the Site or along site boundaries and also appear to be designated Ingham County drains (Ingham County Drain). **These watercourses are anticipated to be regulated by EGLE under Part 301.**

Part 303, Wetlands Protection, of the NREPA states that if a wetland is five acres in size or larger and/or connected to or located within 500 feet of a river, stream, lake, or pond, it is considered regulated by the EGLE.

Fishbeck’s wetland delineation (WDV 17-06; Dated December 19, 2017) determined one (1) regulated wetland (Wetland A, large emergent system associated with Herron Creek). Wetlands B and C were determined as not likely EGLE regulated because they are less than 5 acres in size and do not appear to be contiguous (i.e., within 500 feet or connected to a regulating feature).

Marx Wetlands, LLC has the professional opinion that two (2) on-site wetlands (Wetlands A and E) are likely regulated by the EGLE. Wetlands A & E extend off-site and are contiguous to a regulating watercourse. Wetlands B, C, and D are less than five acres in size and are further than 500 feet of any obvious regulating features (i.e., pond, stream, drain, lake, etc.). However, Wetlands B and C may be considered regulated if a historic connection is determined to off-site wetlands (north) separated by the existing railroad. In addition, Wetland C appears to continue off-site within a ditch feature at the base of the railroad and may have a connection to the Herron Creek. *See below for the synopsis of MW’s findings for parcel 29-251-009 in a table format:*

Feature Name	Type*	Size (on-site acreage)	Regulated by the State of Michigan?	Meridian Township (Twp.) Regulated?
Wetland A	PEM/PFO	2.78 AC	Yes, connected to Watercourse 1	Likely
Wetland B	PEM/PFO	1.39 AC	Possibly, if a historic connection to a large (>5 ac wetland) north of the railroad is determined.	Likely, >0.25 acres in size
Wetland C	PEM/PFO	0.38 AC	Possibly if it drains to Herron Creek within the south railroad ditch.	Likely, >0.25 acres in size
Wetland D	PFO/Open Water	0.06 AC	Not Likely	Not Likely, unless determined essential for Twp.’s preservation
Wetland E	PEM	1.02 AC	Yes, >5 acres and contiguous to Watercourse 1	Likely

\*PEM- Emergent; PSS- Scrub-shrub; PFO-Forested; Open water

## Local Regulations

In addition, Meridian Township’s *Chapter 22 Environment, Article IV Wetland Protection*, states that protected wetlands include all wetlands subject to the regulation by the EGLE as well as any wetlands two acres\* or more, in size, including the area of any contiguous inland lake, pond, river, or stream. Any wetlands less than two acres in size and not connected to a body of water may still be regulated, if it is determined that the protection of the area is important for the preservation of the state’s natural resources. In addition, any wetlands, equal to or greater than one-quarter acre and equal to or less than two acres in size, which are not contiguous to any inland lake, stream, river or pond and are determined to be essential to the preservation of the natural resources of the Township (Meridian Township- Code 1974, § 105-3; Ord. No. 2002-02, 3-19-2002; Ord. No. 2003-11, 7-6-2003; Ord. No. 2011-04, 3-15-2011).

**According to Fishbeck’s wetland delineation (WDV 17-06; Dated December 19, 2017), Wetland A also falls under the jurisdiction of Meridian Township. Wetlands B and C were considered not regulated by EGLE’s Part 303; however, Wetland B could also be considered possibly regulated by Meridian Township if the preservation of the wetland is deemed essential for the Township’s natural resources.**

**MW has the professional opinion that four (4) wetlands A, B, C, and E on parcel 29-251-009 are likely regulated by Meridian Township. Wetland D is less than 0.25 acres in size and not contiguous to any regulating features; therefore, is not anticipated to be considered regulated by Meridian Township. However, please note that the wetland delineation conducted by MW has not been reviewed as part of a wetland verification conducted by Meridian Township's consultant.**

### **Impact Assessment**

The current site plan appears to avoid the regulated wetland and wetland buffers and minimizes native vegetation clearing to the maximum extent practicable. Therefore, it is the professional opinion of Marx Wetlands LLC that the current site plan appears to be a viable option for the development of the Site.

A permit or approval is likely required by the EGLE and/or Meridian Township for any proposed work (e.g., filling, dredging, construction, and draining and/or other development) that takes place within the boundaries of a regulated wetland. Most construction activities that take place outside of these boundaries do not require a wetland permit from the EGLE or Meridian Township. **Please note that the EGLE and Township have the final authority on the extent of regulated wetlands, lakes, and streams in the State of Michigan and Meridian Township, respectively.**

### ***4.6 Special Flood Hazard Area***

Flood Hazard Areas are those which are most likely to be inundated during flood events. Flood Hazard Areas are regulated by local, state, and federal regulations designed to reduce the damage to structures during floods. The regulations apply to areas within 100-year floodplains, which are defined by a one percent (1%) annual probability of flood occurrence. These areas are mapped by the Federal Emergency Management Agency (FEMA) on Flood Insurance Rate Maps, or FIRMs. These maps were developed using flow modeling and the existing USGS topographic maps. The modeling produces an elevation associated with 100-year flood events, and areas below these elevations are designated as the 100-year floodplains.

FEMA FIRMs for Ingham County were reviewed to determine if portions of the Site are mapped as floodplains, floodways, or other flood prone areas. These maps record the following data: 100-year (1% chance of annual flooding) and 500-year (0.2% annual chance of flooding) floodplains, the height of the base flood elevation, and the risk to premium areas developed across a floodplain. A review of FEMA FIRM Panel No. 26065C0154D, (eff. 8/16/2011) revealed that the Site contains a 100-year floodplain mapped as Zone AE (with available Base Flood Elevation- BFE at approximately 847 feet above sea level) associated with the Herron Creek (off-site) and associated wetlands within the Site. The remaining areas within the Site are mapped as Zone X: an area that is determined to be outside the 100-year floodplain. Refer to *Figure 7: Flood Insurance Rate Map* in **Appendix I**.

FIRM maps can incorrectly show areas of 100-year floodplain. In such cases, a site's topography can be surveyed using modern techniques. When such studies show that the mapped floodplain

is above the determined flood elevation or that the FIRM is otherwise inaccurate, this information can be sent to the National Flood Insurance Program to obtain a Letter of Map Amendment (LOMA) which officially changes the area included within the floodplain.

Part 31, Water Resources Protection, of the NREPA regulates activities within the 100-year floodplain and floodway of a river, stream, or drain, and within the floodplain of any watercourse with an upstream drainage area of two square miles or larger. Most construction activities that take place above the designated 100-year floodplain elevation may not require EGLE permitting and/or approvals. The Herron Creek is anticipated to have an EGLE regulated 100-year floodplain that has an upstream drainage area larger than two square miles in size. **A floodplain elevation request or pre-application meeting through the EGLE can assist with the project development process and/or floodplain permitting, if applicable.**

#### Floodways

A *floodway* is the portion of the floodplain that is required to carry and discharge flood waters during a flood event. They have more rapidly moving water during flood events. They include river channels, upper banks, and adjacent areas that effectively become part of the water transit process during a flood. The FIRM for Meridian Township shows that there is a floodway area associated with Herron Creek identified in the northwest corner of the parcel 29-300-023. No activities at the Site are anticipated to have any impact upon these floodway areas, nor will these floodway areas have any impact on development at the Site. **Therefore, it is the professional opinion of Marx Wetlands that the development will not directly impact any EGLE regulated 100-year floodways. However, a floodplain elevation or pre-application meeting request could help determine permit approvals or requirements, if applicable.**

#### **4.7 Water Bodies**

Streams, rivers, lakes, and many ponds are afforded legal protection under a combination of Township, county, state, and federal regulations pertaining to wetlands, flood prone areas, and water bodies. Any filling or alteration of these areas would typically require one or more permits from state agencies, county agencies, federal agencies, or Meridian Township.

A ditch feature was identified along the southern boundary of MW's delineated Wetland A, draining into Wetland E via an existing culvert, which appears to correspond Hoskins Drain (H6200 Ingham County Drain). A defined channel was identified within segments of the Site; however, loses stream morphology within portions of MW's delineated Wetlands A and E. It appears that this drain drains west, presumably into Herron Creek (off-site).

Herron Creek was identified in the northwest corner of parcel 29-300-023. Wetland E delineated by Marx Wetlands/Wetland A delineated by Fishbeck adjoins the Herron Creek. Refer to Photographs 11 and 12 (below) for the water features identified during the wetland delineation and natural features site visit in April of 2020.



**Photograph 11. Herron Creek Drain at Bennett Road crossing (off-site).**



**Photograph 12. Hoskins Drain (H6200) identified within the Site**

### **County Drain Information**

According to the Ingham County Drain Map- Meridian Township SW (Figure 4 in **Appendix I**), the Site appears to contain the Hoskins Drain (H6200- Open) within the limits of on-site wetlands (Wetland E– delineated by MW and Wetland A– delineated by Fishbeck), presumably draining west into Herron Creek. Herron Creek Drain is also a designated Ingham County Drain (H2100). In addition, according to the Ingham County’s Meridian Township- SW map, another county drain, branch of Hoskins Drain is shown along the eastern boundary of the Site, which appears to lie within the limits of Wetland B- delineated by Fishbeck in 2017 (Refer to Figure 4 in **Appendix I**). Although a channel may not have been identified by Fishbeck, it is possible that a county drain easement still exists. Typically, county drains have an easement for construction and maintenance purposes and where development or structures are prohibited. **Therefore, be sure to contact the Ingham County Drain Commissioners office to see if the proposed site development requires any approvals or permits through Ingham County.**

### **Impact Assessment**

Based on the available information acquired from Ingham County, it appears that the project is not anticipated to directly impact any existing drains. If the construction of the proposed roads to service the development will involve the installation of any culverts within the drains and/or enter the designated drain easements, approvals or permits through Ingham County and/or EGLE may be required. **Marx Wetlands LLC recommends that the Developer should formally consult Ingham County Drain Commissioner to determine if site development requires any easement approvals or permits.**

### **4.8 Soils**

According to the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey, the soils contained within Meridian Township, Ingham County) have been mapped largely with several soil types. Houghton muck, 0 to 1 percent slopes (Hn; 100% hydric rating), Adrian muck (Ad; 100% hydric rating), Colwood-Brookston loams (Co; 80% hydric rating), and Sebewa loam, 0 to 2 percent slopes (Sb; 95% hydric rating) generally correspond to

the delineated wetland areas and contain high percentages of hydric soil indicators. These soils are classified as hydric or contain hydric inclusions. Hydric soils are conducive to the growth and regeneration of hydrophytic vegetation by their ability to hold water for extended periods of time (USDA-NRCS 2010). The remaining soils (i.e., AnA-8%, CvraaB-5%, MaB-2%, MaC-0%, MeD2-0%, OsB-1%, OsC-1%, OtC-0%, OwB-0%, OwC-0%, RdB-0%, RdD-0%, SpB-0%, SpC-0%, ThA-10%, and UeB-0%) have low hydric ratings (10% or less) and are not classified as hydric. Refer to *Figure 8: County Soils Survey with Hydric Soils Ratings Map* in **Appendix I**.

Site balancing, filling, and subsurface excavation activities will take place within the limits of disturbance which are contained primarily within the areas of the more well-drained soil types, previously developed, and/or upland areas. The most suitable soils (with hydric ratings less than 10%) will largely be utilized on the Site for the proposed PUD development and roadways. Limited grading may occur in the county mapped Colwood-Brookston loams, but is situated within the upland and outside of the wetlands and 40-foot buffer.

Soil erosion and sedimentation control (SESC) measures will be installed and maintained by the Developer throughout the construction period, as required by the State of Michigan, Meridian Township, the Ingham County Drain Commissioner and will be removed once the entire Site has been stabilized. These measures will significantly reduce the possibility of soil erosion and the water transport of these soil materials, which could cause the degradation of areas receiving the Site's stormwater runoff.

#### **4.9 Identified Areas of Groundwater Vulnerability**

Areas of groundwater vulnerability are those areas where the hydrologic and geologic surface and subsurface setting makes the groundwater more vulnerable to contamination than in other areas. The wetland areas can be considered groundwater vulnerable or sensitive areas; however, anticipated construction activities on the Site will be outside the bounds of the regulated wetlands and wetland buffers. Based on the preliminary site plan (Figure 1.2 in **Appendix I**) provided to MW, the proposed development does not appear to directly impact any wetlands or other aquatic features; however, it is important to note that the site plan appears to be preliminary and is not intended to be used as a final construction plan.

It is MW's professional opinion that the proposed development should be designed minimize impacts to the natural features to the maximum extent practicable and follow standard SESC measures in accordance with local and state regulations in order to protect water quality of nearby wetland areas. **The current site plan (preliminary) appears to avoid direct impacts to the regulated wetland areas in Meridian Township and associated 40-foot wetland buffers.**

#### **4.10 Slopes Greater than 20 Percent**

Slopes of greater than 20% are highly susceptible to soil erosion which can lead to sedimentation in other on and off-site areas such as ponds, streams and lakes. The Site does not appear to contain significant slopes steeper than 20%. Moderate sloping (<10% slope) and local microtopographic relief was observed within the Site, particularly gradually sloping near areas of wetland. In addition, several of the on-site hills do not appear to reflect the Site's natural

topography and may suggest historic site grading and stockpiling (possibly associated with historic gravel pit or mining activities).

The development project is anticipated to follow structure and grading setbacks and requirements provided in Meridian Township ordinances. During construction, any slopes (if applicable) created by the project that are over 20% will be intentionally designed and stabilized with appropriate landscaping materials. Soil erosion and sedimentation control (SESC) measures will be placed and maintained in the areas necessary to control any erosion that may occur during construction.

The project is anticipated to meet state and local water quality standards and utilize the best available technologies that are necessary when considering the receiving waters and associated aquatic resources. Any excavated material and structures will be placed in upland (non-wetland). The project is not anticipated to significantly impact on-site features or impact any sensitive areas identified for groundwater vulnerability because the current site plan appears to avoid direct impacts to the likely regulated wetlands and buffers.

#### **4.11 Wildlife**

Evidence of wildlife presence has been observed throughout the Site in the form of both direct and indirect observations, including sightings, tracks, and droppings, although the amount of animal usage is naturally limited by the size of the Site and the surrounding commercial/rural context. Evidence of common wildlife were observed within the Site, including white-tailed deer (*Odocoileus virginiana*), gray squirrels (*Sciurus carolinensis*), turkey (*Meleagris gallopavo*), and raccoon (*Procyon lotor*). Squirrel evidence was mainly near the forested areas. Deer usage appeared most concentrated within the Site's interior and along the western boundary. Fresh deer and raccoon droppings were also observed. Several bird species, including red-tailed hawk (*Buteo jamaicensis*), Canada goose (*Branta canadensis*), sandhill crane (*Grus canadensis*), red-bellied woodpecker (*Melanerpes carolinus*), black-capped chickadees (*Poecile atricapillus*), mallard (*Anas platyrhynchos*), cardinal (*Cardinalis cardinalis*), red-winged blackbird (*Agelaius phoeniceus*), robin (*Turdus migratorius*), and blue jay (*Cyanocitta cristata*) were seen and heard during the on-site assessment.

It is likely that the Site or adjacent undeveloped areas may contain foraging habitat or resting grounds for numerous other wildlife, such as Monarch butterflies (*Danaus plexippus*), honeybees (*Apis mellifera*), mourning doves (*Zenaida macroura*), and eastern cottontail (*Sylvilagus floridanus*). Overall, the Site appears to contain species that can be considered urban or suburban wildlife, which are common across the Midwest. Typically, urban wildlife are mainly generalists species that have wide tolerance in diet and behavioral flexibility. They are very unlike threatened and endangered species, which are almost all specialized or restricted to unique habitats and intolerant of human disturbances.

The proposed site plan (Figure 1.2 in **Appendix I**) has been designed to minimize impacts to natural features, specifically regulated wetlands and their buffers. In addition, approximately 35 acres of upland open space has been incorporated into the site plan, which would likely provide

some habitat for wildlife post-construction. Majority of the on-site development is restricted to the upland disturbed old fields and/or forested/scrub-shrub areas of the Site. It appears that the proposed development has avoided on-site regulated wetlands and buffers to the maximum extent practicable. Therefore, any declines in certain very abundant wildlife species are not anticipated by the proposed site development. Wildlife will be temporarily displaced by the proposed development; however, the undeveloped portions of the Site (specifically the higher quality habitats- wetlands, drains, forest, etc.) will remain relatively intact post-construction. It is anticipated that some of these common urban and suburban wildlife species will continue to use the Site after the completion of the development.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

The proposed Site was reviewed for remnant and existing natural resources and features. The approximately 93.90-acre Site spans seven (7) parcels (29-300-008, 29-300-023, 29-300-020, 29-300-021, 29-300-025, 29-300-026, and 29-251-009) and is located north of Bennett Road and approximately 0.25 miles east of South Hagadorn Road within section 29 of Meridian Township, Ingham County, Michigan. The Site is bound by undeveloped property and a railroad to the north; residential properties connecting to Sophiea Parkway and Creekstone Trail, the Okemos Public Schools bus garage and Schultz Veterinary Clinic to the east; Bennett Road, and the College Fields Golf Club to the south and west.

The Site largely contains undeveloped land, consisting of areas of upland, disturbed fields, upland scrub-shrub/forest and wetland. In addition, debris, concrete, asphalt piles and old machinery were also identified, particularly within the west-central portions of the Site. Existing single-family and vacant residences were identified along Bennett Road. Mowed paths and a two-track were also observed throughout the Site. One (1) house was observed within the southeast quadrant of the Site, north of Bennett Road. MW identified four (4) likely regulated wetlands (Wetlands A, B, C, and E) and one (1) county drain (Hoskins Drain; H6200) within parcel 29-251-009 on April 14, 2020. Fishbeck identified one (1) EGLE regulated wetland (Wetland A) and Herron Creek within the southern six parcels in November 2017. Also, Fishbeck anticipates that Wetland B is also likely regulated by Meridian Township as well. **All wetlands (regulated by both EGLE and Meridian Township) and the 40-foot buffers appear to be outside of the proposed project footprint.**

Most of the on-site soils are upland sandy loams or loamy sands that formed under what was once a sugar maple-beech forest, which appear to be largely original to the Site, particularly in the northeastern portions of the Site. Vegetated stockpiles identified in the west-central portions may contain both fill and natural material. The delineated wetland areas contain mainly mucky soils and sandy loams with some hydric inclusions.

It is likely that this Site was once a small portion of that expansive sugar-maple forest which covered many acres but was cleared for agriculture or development. The northeastern parcel appears to contain a few indicator species (e.g., sugar maple, beech, musclewood, basswood, red oak, and ironwood) that could be considered a remnant area of the larger forest system (pre-

settlement). Within the last few decades this Site has been surrounded by roads and growing commercial and residential development. Wildlife that appear to utilize the Site are common in urban and suburban landscapes. It is anticipated that their populations will not be significantly affected by the development of this Site. Vegetation on the Site includes common native trees with a brushy and weedy understory of invasive shrubs, and relatively common native and non-native groundcover species. The loss of vegetation due to development on the Site will occur, though the species lost are very unlikely to include any that are locally rare (i.e. rare county-wide) or state threatened and endangered. There are several trees on the Site which are in good condition, which includes largely native hardwood species, some softwood species, and a few planted/non-native species. The natural heritage on this Site appears to be the native vegetation and wetland habitats.

The proposed development is positioned to utilize the upland areas within the overall Site to the maximum extent practicable, while avoiding sensitive and regulated areas (i.e., wetlands/40-foot buffer, 100-year floodplains, and drains). The areas within the upland disturbed fields and scrub-shrub/forest are proposed for overall project footprint. Tree clearing and landscaping activities are anticipated largely within the proposed single-family residential lots and associated roadways.

The Developer's selection of the site plan included an analysis of alternative on-site layouts, while taking into consideration existing site conditions, specific project and site requirements, building requirements and setbacks, visibility and accessibility, safety, parking, traffic flow into and out of the Site, and existing natural features. The existing natural features (i.e., forest habitat, wetlands, drains, floodplains, etc.) have also limited site design options. The current design provides a convenient access to the proposed development while preserving the natural features, including woodlands and wetlands to the maximum extent practicable. The proposed site plan appears to preserve the natural resource values of the Site because of the avoidance of regulated wetlands and wetland buffers, and by incorporating some of the larger or native trees into the overall landscape design; and thereby, preserving them on the post-development landscape.

#### **Final Notes:**

- The delineated wetland areas and the 40-foot buffer in Meridian Township appear to be avoided by project activities and preserved to the maximum extent practicable. However, the conceptual site plan does not indicate if treated stormwater will remain on the property or discharge into the existing wetlands; therefore, engineered plans including the stormwater management, calculations, and design of the proposed stormwater basin should be reviewed to determine if regulated features will be impacted by project activities. **Therefore, if the treated stormwater runoff is proposed to directly discharge into the regulated wetlands, minor permits through Meridian Township and/or EGLE will likely be required.**
- **The Site contains a 100-year floodplain and floodway associated with the Herron Creek; however, the proposed site plan does not appear to impact below the designated 100-year floodplain elevation as depicted by FEMA Firm Maps. However, Marx Wetlands**

LLC recommends that a floodplain elevation request and/or pre-application meeting request through EGLE be considered to help determine permit requirements, if applicable.

- Although the site plan does not appear to directly impact any on-site drains, Marx Wetlands LLC recommends that the Developer formally consult the Drain Commissioners office of Ingham County to determine if site development requires any approvals or permits.

Therefore, through consideration of these factors and requirements, it appears that the preferred (preliminary) site plan is a viable option for the development of the proposed Site because it appears to avoid the regulated wetlands and buffers and minimizes native vegetation clearing to the maximum extent practicable. **However, the final notes listed above should be addressed and determined prior to the commencement of project activities.**

Thank you for the opportunity to provide this inventory and impact assessment of on-site natural features in regard to the proposed project. If you have any questions, please contact me at your convenience.

Sincerely,

**Marx Wetlands, LLC**



---

Bryana J. Guevara, CSWO (MI)  
Environmental Scientist  
*ISA Certified Arborist #MI-4202A*  
*Professional Wetland Scientist #2949*

**APPENDIX I**

**Figure 1.1: Site Location Map**

**Figure 1.2 Preliminary Site Plan (With Wetland Buffer Exhibit)**

**Figure 2: Aerial Imagery Map**

**Figure 3: Pre-settlement Vegetation/MNFI ca. 1800 map**

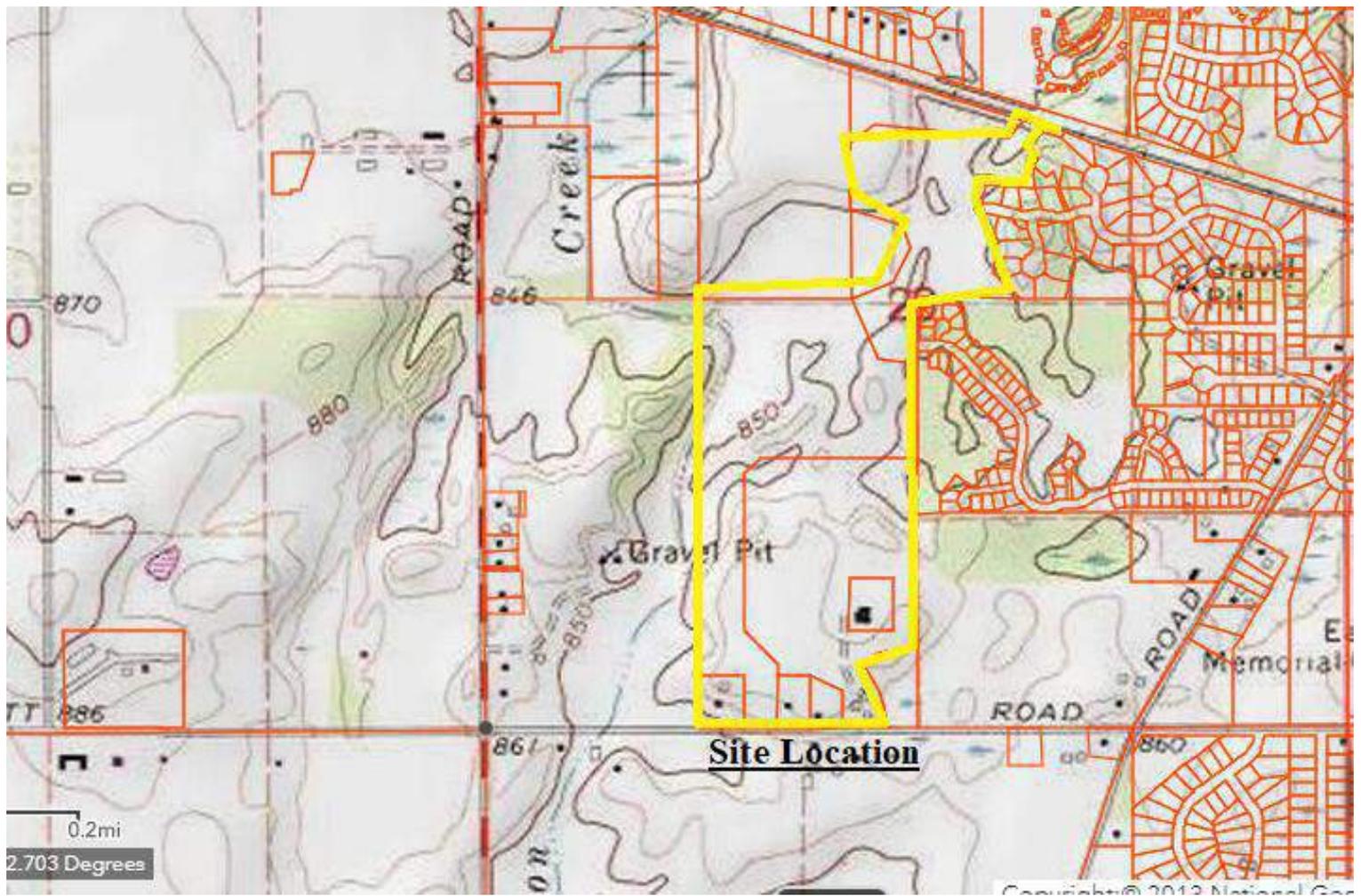
**Figure 4: Ingham County Drain Map**

**Figure 5: Township Natural Features Map**

**Figure 6: National Wetland Inventory Map**

**Figure 7: Flood Insurance Rate Map**

**Figures 8: County Soils Survey-Hydric Soils Map**



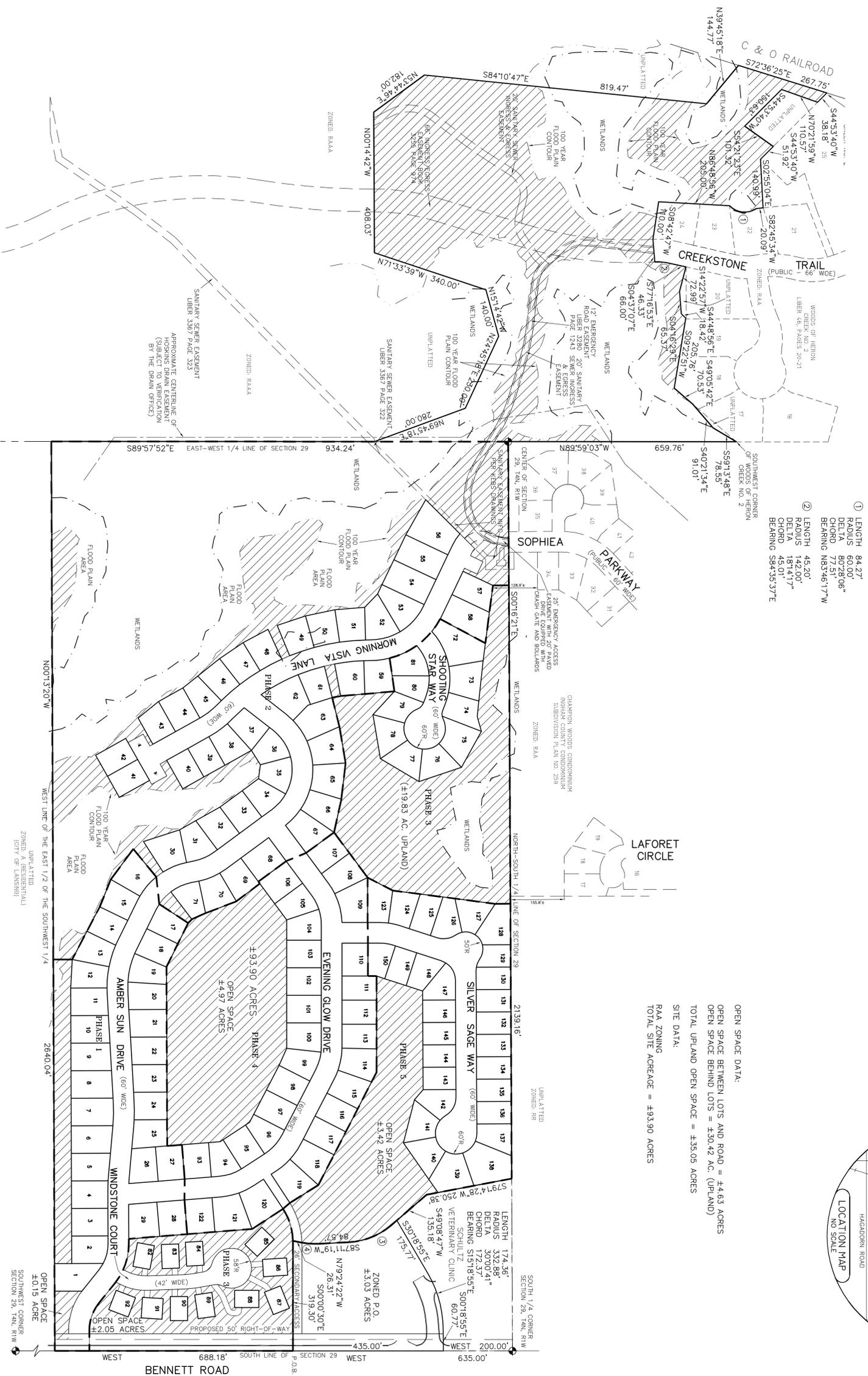


**OWNER/DEVELOPER:**  
 MAYBERRY HOKES  
 1650 KENDALE BOULEVARD  
 EAST LANSING, MI 48823  
 PH: (517) 371-5000  
 CONTACT: BOB SCHROEDER

**ENGINEER/SURVEYOR:**  
 KEBS, INC.  
 2116 HASLETT RD.  
 HASLETT, MI 48840  
 PH: (517) 339-1014  
 FAX: (517) 339-8047

# OPEN SPACE PLAN SILVERLEAF CONDOMINIUM

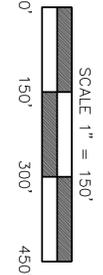
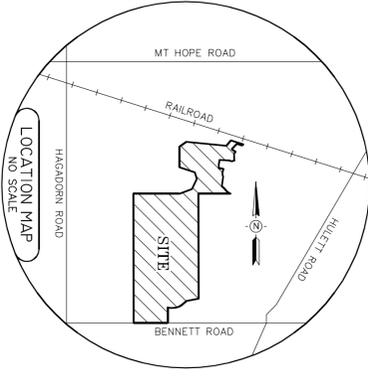
A SUBDIVISION OF PART OF THE NORTHEAST 1/4,  
 NORTHWEST 1/4 & SOUTHWEST 1/4 OF SECTION 29,  
 T4N, R1W, MERIDIAN TOWNSHIP, INGHAM COUNTY, MICHIGAN



- ① LENGTH 84.27'  
 RADIUS 60.00"  
 DELTA 89°28'06"  
 CHORD 77.51'  
 BEARING N83°49'17"W
- ② LENGTH 45.20'  
 RADIUS 142.00"  
 DELTA 181°4'17"  
 CHORD 45.01'  
 BEARING S84°35'37"E

OPEN SPACE DATA:  
 OPEN SPACE BETWEEN LOTS AND ROAD = ±4.63 ACRES  
 OPEN SPACE BEHIND LOTS = ±30.42 AC. (UPLAND)  
 TOTAL UPLAND OPEN SPACE = ±35.05 ACRES

SITE DATA:  
 PAA ZONING  
 TOTAL SITE AREA = ±93.90 ACRES



= UPLAND OPEN SPACE AREA

- ③ LENGTH 136.11'  
 RADIUS 205.00"  
 DELTA 133°02'32"  
 CHORD 133.63'  
 BEARING S68°10'03"W
- ④ LENGTH 50.30'  
 RADIUS 215.00"  
 DELTA 132°4'19"  
 CHORD 50.19'  
 BEARING N86°06'32"W

DATE  
 DANE B. PASCOE  
 PROFESSIONAL SURVEYOR NO. 54434

REVISIONS	COMMENTS
04/21/20	ORIGINAL

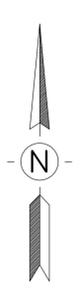
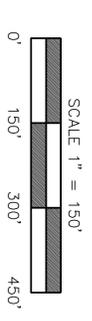
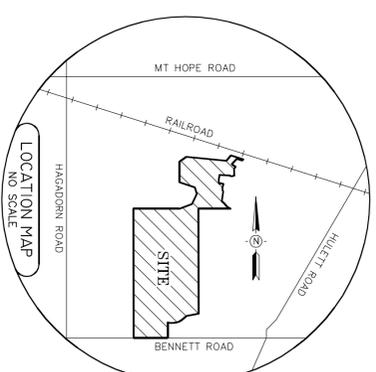
	<b>KEBS, INC.</b> ENGINEERING AND LAND SURVEYING
2116 HASLETT ROAD, HASLETT, MI 48840	
PH: 517-339-1014 WWW.KEBS.COM	
Meridian Office - Ph: 269-781-8800	
DRAWN BY KOB	SECTION 29, T4N, R1W
FIELD WORK BY ---	JOB NUMBER: 87297/SUB
SHEET 2 OF 3	

1: \B7\87297\44\87297-PLD-049

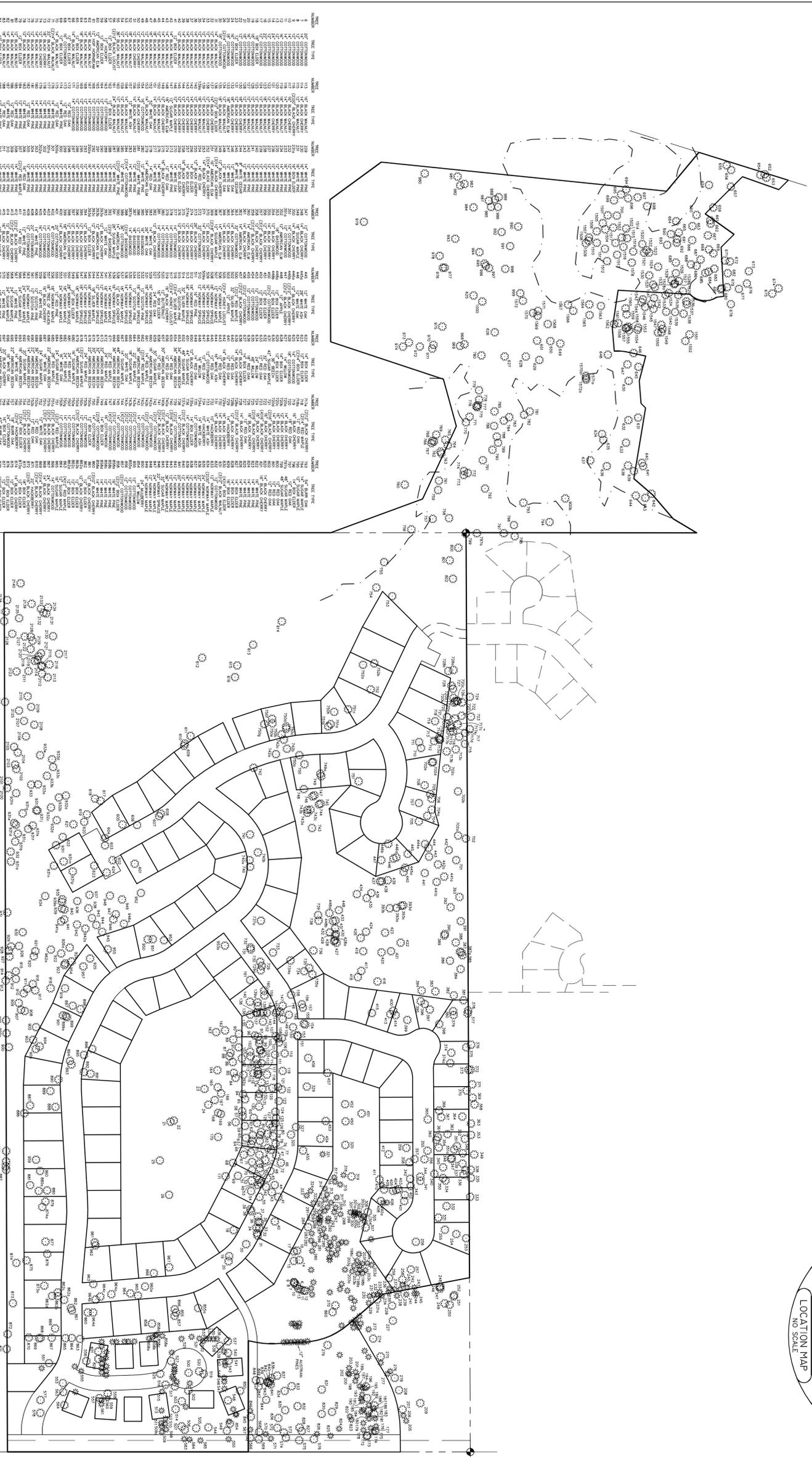
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 KEBS, INC.  
 2116 HASLETT RD.  
 HASLETT, MI 48840  
 PH: (517) 339-1014  
 FAX: (517) 339-8047

**TREE SURVEY PLAN**  
**SILVERLEAF CONDOMINIUM**  
 A SUBDIVISION OF PART OF THE NORTHEAST 1/4,  
 NORTHWEST 1/4 & SOUTHWEST 1/4 OF SECTION 29,  
 T4N, R1W, MERIDIAN TOWNSHIP, INGHAM COUNTY, MICHIGAN



- LEGEND**
- = BOUNDARY LINE
  - = PROPOSED LOT LINE
  - = DISTANCE NOT TO SCALE
  - = DECIDUOUS TREE
  - ⊛ = CONIFEROUS TREE
  - 205 = IDENTIFYING TREE NUMBER
- NOTE: TREES SHOWN THAT DO NOT HAVE AN IDENTIFYING NUMBER ARE LESS THAN 12" DIAMETER

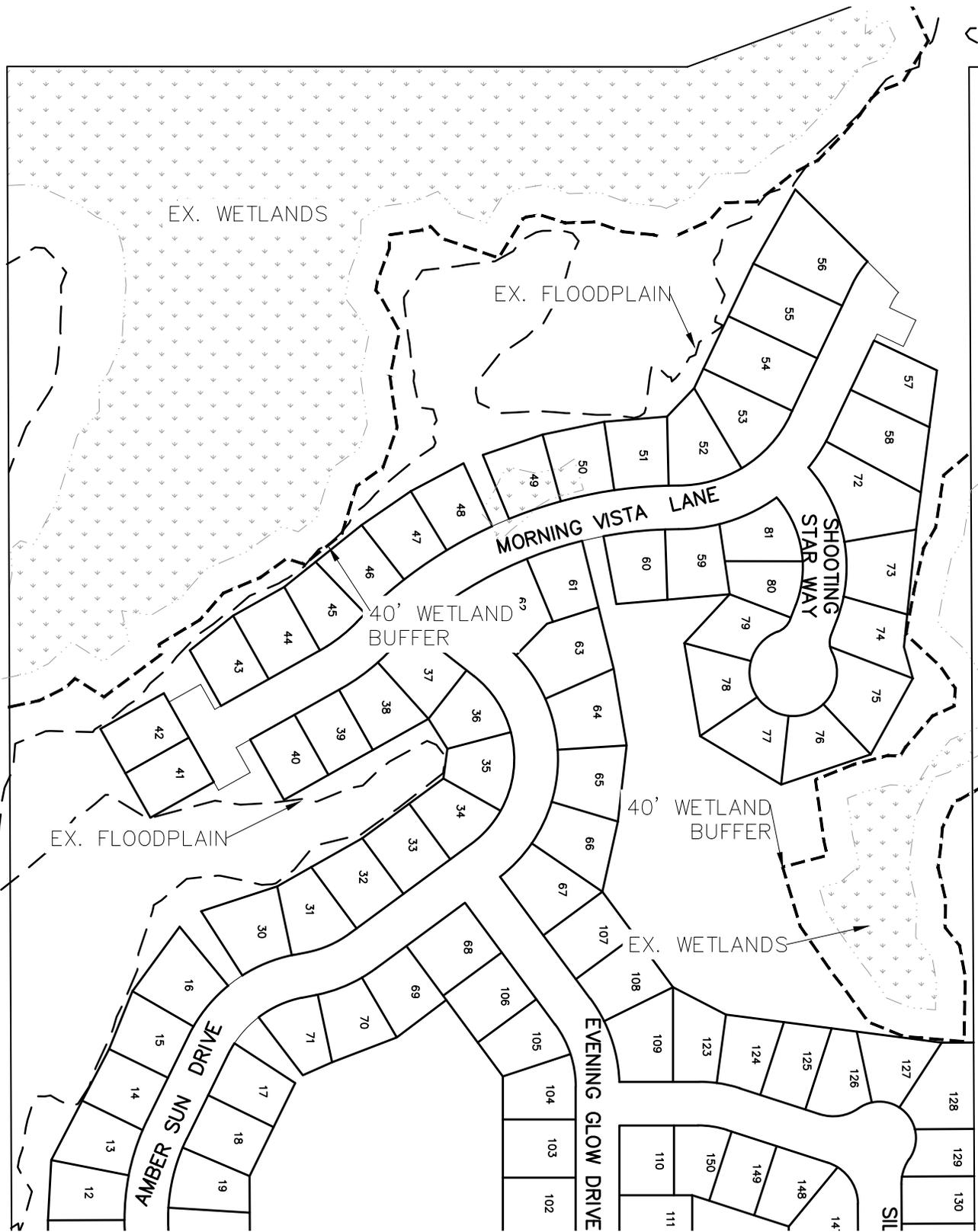
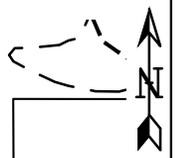


NUMBER	TREE TYPE	NUMBER	TREE TYPE
1	12' CONTINUED	201	12' CONTINUED
2	12' CONTINUED	202	12' CONTINUED
3	12' CONTINUED	203	12' CONTINUED
4	12' CONTINUED	204	12' CONTINUED
5	12' CONTINUED	205	12' CONTINUED
6	12' CONTINUED	206	12' CONTINUED
7	12' CONTINUED	207	12' CONTINUED
8	12' CONTINUED	208	12' CONTINUED
9	12' CONTINUED	209	12' CONTINUED
10	12' CONTINUED	210	12' CONTINUED
11	12' CONTINUED	211	12' CONTINUED
12	12' CONTINUED	212	12' CONTINUED
13	12' CONTINUED	213	12' CONTINUED
14	12' CONTINUED	214	12' CONTINUED
15	12' CONTINUED	215	12' CONTINUED
16	12' CONTINUED	216	12' CONTINUED
17	12' CONTINUED	217	12' CONTINUED
18	12' CONTINUED	218	12' CONTINUED
19	12' CONTINUED	219	12' CONTINUED
20	12' CONTINUED	220	12' CONTINUED
21	12' CONTINUED	221	12' CONTINUED
22	12' CONTINUED	222	12' CONTINUED
23	12' CONTINUED	223	12' CONTINUED
24	12' CONTINUED	224	12' CONTINUED
25	12' CONTINUED	225	12' CONTINUED
26	12' CONTINUED	226	12' CONTINUED
27	12' CONTINUED	227	12' CONTINUED
28	12' CONTINUED	228	12' CONTINUED
29	12' CONTINUED	229	12' CONTINUED
30	12' CONTINUED	230	12' CONTINUED
31	12' CONTINUED	231	12' CONTINUED
32	12' CONTINUED	232	12' CONTINUED
33	12' CONTINUED	233	12' CONTINUED
34	12' CONTINUED	234	12' CONTINUED
35	12' CONTINUED	235	12' CONTINUED
36	12' CONTINUED	236	12' CONTINUED
37	12' CONTINUED	237	12' CONTINUED
38	12' CONTINUED	238	12' CONTINUED
39	12' CONTINUED	239	12' CONTINUED
40	12' CONTINUED	240	12' CONTINUED
41	12' CONTINUED	241	12' CONTINUED
42	12' CONTINUED	242	12' CONTINUED
43	12' CONTINUED	243	12' CONTINUED
44	12' CONTINUED	244	12' CONTINUED
45	12' CONTINUED	245	12' CONTINUED
46	12' CONTINUED	246	12' CONTINUED
47	12' CONTINUED	247	12' CONTINUED
48	12' CONTINUED	248	12' CONTINUED
49	12' CONTINUED	249	12' CONTINUED
50	12' CONTINUED	250	12' CONTINUED
51	12' CONTINUED	251	12' CONTINUED
52	12' CONTINUED	252	12' CONTINUED
53	12' CONTINUED	253	12' CONTINUED
54	12' CONTINUED	254	12' CONTINUED
55	12' CONTINUED	255	12' CONTINUED
56	12' CONTINUED	256	12' CONTINUED
57	12' CONTINUED	257	12' CONTINUED
58	12' CONTINUED	258	12' CONTINUED
59	12' CONTINUED	259	12' CONTINUED
60	12' CONTINUED	260	12' CONTINUED
61	12' CONTINUED	261	12' CONTINUED
62	12' CONTINUED	262	12' CONTINUED
63	12' CONTINUED	263	12' CONTINUED
64	12' CONTINUED	264	12' CONTINUED
65	12' CONTINUED	265	12' CONTINUED
66	12' CONTINUED	266	12' CONTINUED
67	12' CONTINUED	267	12' CONTINUED
68	12' CONTINUED	268	12' CONTINUED
69	12' CONTINUED	269	12' CONTINUED
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71	12' CONTINUED	271	12' CONTINUED
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74	12' CONTINUED	274	12' CONTINUED
75	12' CONTINUED	275	12' CONTINUED
76	12' CONTINUED	276	12' CONTINUED
77	12' CONTINUED	277	12' CONTINUED
78	12' CONTINUED	278	12' CONTINUED
79	12' CONTINUED	279	12' CONTINUED
80	12' CONTINUED	280	12' CONTINUED
81	12' CONTINUED	281	12' CONTINUED
82	12' CONTINUED	282	12' CONTINUED
83	12' CONTINUED	283	12' CONTINUED
84	12' CONTINUED	284	12' CONTINUED
85	12' CONTINUED	285	12' CONTINUED
86	12' CONTINUED	286	12' CONTINUED
87	12' CONTINUED	287	12' CONTINUED
88	12' CONTINUED	288	12' CONTINUED
89	12' CONTINUED	289	12' CONTINUED
90	12' CONTINUED	290	12' CONTINUED
91	12' CONTINUED	291	12' CONTINUED
92	12' CONTINUED	292	12' CONTINUED
93	12' CONTINUED	293	12' CONTINUED
94	12' CONTINUED	294	12' CONTINUED
95	12' CONTINUED	295	12' CONTINUED
96	12' CONTINUED	296	12' CONTINUED
97	12' CONTINUED	297	12' CONTINUED
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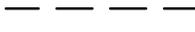
REVISIONS	COMMENTS	DATE
04/21/20	ORIGINAL	

<b>KEBS, INC.</b> ENGINEERING AND LAND SURVEYING 2116 HASLETT ROAD, HASLETT, MI 48840 PH: 517-339-1014 WWW.KEBS.COM Meridian Office - Ph: 269-781-8800	DRAWN BY: KOB FIELD WORK BY: --- SHEET 3 OF 3	JOB NUMBER: 87297/SUB
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DAVE B. PASCOE  
PROFESSIONAL SURVEYOR NO. 54434



### LEGEND

-  EXISTING WETLAND
-  EXISTING 40' WETLAND BUFFER
-  APPROX. ASSESSMENT AREA

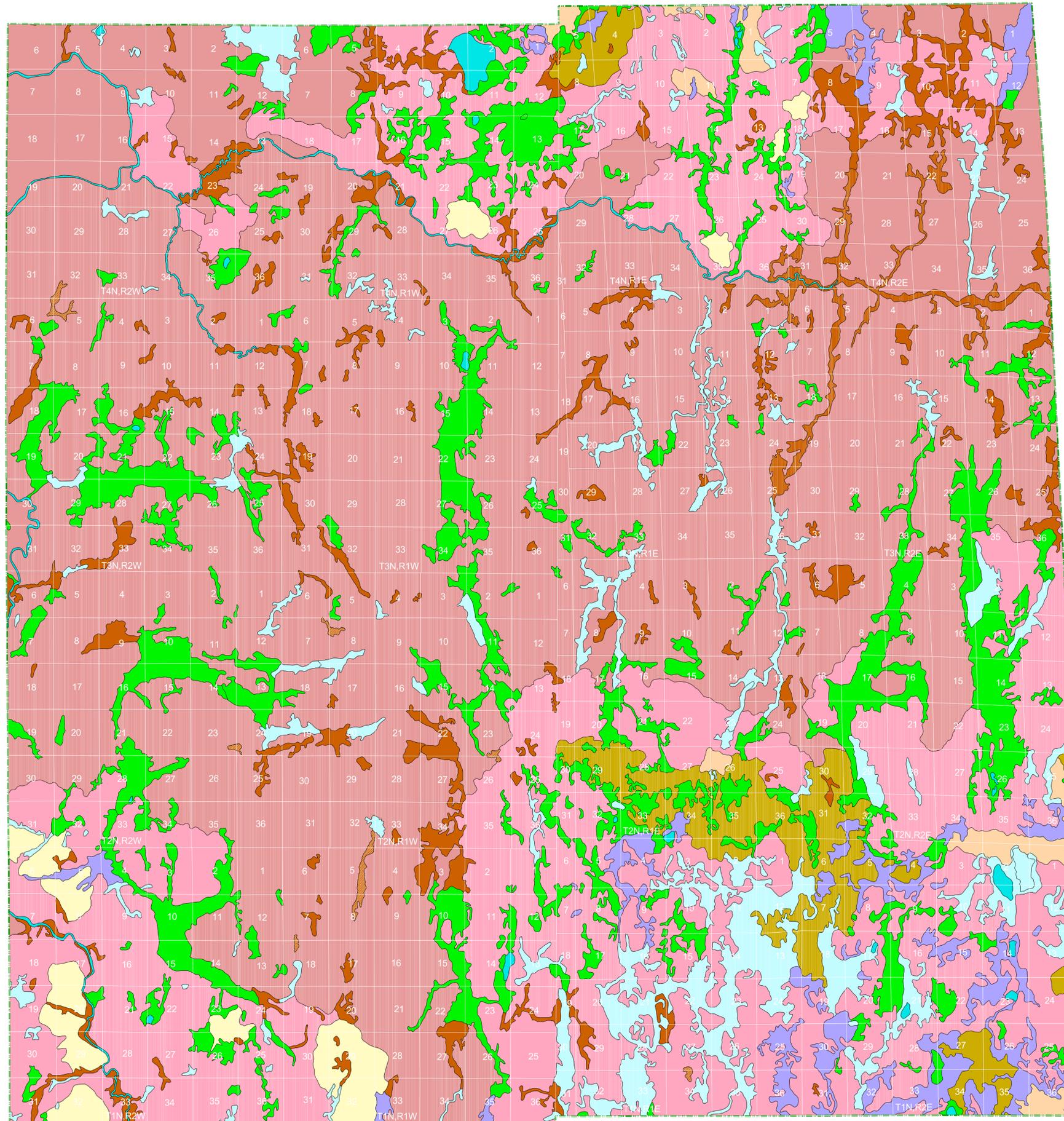
DATE: APR. 23, 2020		REVISIONS:		CLIENT: MAYBERRY HOMES		SECTION: 29			<b>MARX WETLANDS, LLC.</b> 3309 PLATT ROAD ANN ARBOR, MICHIGAN 48108 (734) 478-8277	
DB: BS	CB: BG			SILVERLEAF CONDOMINIUM		TOWN 04 NORTH, RANGE 01 WEST				
SHEET NO.				WETLAND BUFFER EXHIBIT		MERIDIAN TOWNSHIP				
<b>01</b>						INGHAM COUNTY, MICHIGAN				



# Vegetation circa 1800 of Ingham County, Michigan

An Interpretation of the General Land Office Surveys

By P. J. Comer and D. A. Albert  
Michigan Natural Features Inventory  
1997



## Legend

- ASPEN-BIRCH FOREST
  - BEECH-SUGAR MAPLE FOREST
  - BEECH-SUGAR MAPLE-HEMLOCK FOREST
  - BLACK ASH SWAMP
  - BLACK OAK BARREN
  - CEDAR SWAMP
  - GRASSLAND
  - HEMLOCK-WHITE PINE FOREST
  - HEMLOCK-YELLOW BIRCH FOREST
  - JACK PINE-RED PINE FOREST
  - LAKE/RIVER
  - MIXED CONIFER SWAMP
  - MIXED HARDWOOD SWAMP
  - MIXED OAK FOREST
  - MIXED OAK SAVANNA
  - MIXED PINE-OAK FOREST
  - MUSKEG/BOG
  - OAK-HICKORY FOREST
  - OAK-PINE BARREN
  - PINE BARREN
  - SAND DUNE
  - SHRUB SWAMP/EMERGENT MARSH
  - SPRUCE-FIR-CEDAR FOREST
  - WET PRAIRIE
  - WHITE PINE-MIXED HARDWOOD FOREST
  - WHITE PINE-RED PINE FOREST
  - WHITE PINE-WHITE OAK FOREST
- = LAND COVER TYPE PRESENT ON THIS MAP



Scale 1:80,000



Map Projection: Lambert Conformal Conic

SOURCE: Comer, P.J., D.A. Albert, H.A. Wells, B.L. Hart, J.B. Raab, D.L. Price, D.M. Kashian, R.A. Comer, D.W. Schuen (Map Interpretation), M.B. Austin, T.R. Leibfried, K.M. Koroch, L. Prange-Gregory, J.G. Spitzley, C.J. Delain, L.J. Springer, (Digital Map Production). 1995. Michigan's Presettlement Vegetation, as Interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. Digital Map.



# MERIDIAN TOWNSHIP SW, T.4N. - R.1W. , INGHAM COUNTY, MICHIGAN



PATRICK E. LINDEMANN  
INGHAM COUNTY DRAIN COMMISSIONER

**PRELIMINARY**

MERIDIAN TOWNSHIP SW DRAIN MAP  
T.4N. - R.1W.  
INGHAM COUNTY, MICHIGAN



**LEGEND**

- MUNICIPAL BOUNDARIES
- SECTIONS
- COUNTY
- DRAINAGE DISTRICT BOUNDARIES
- OPEN DRAIN
- CLOSED DRAIN
- ROADS
- RAILROADS
- NATURAL WATERCOURSE

RED = FORMERLY KNOWN AS

**DISCLAIMER:**

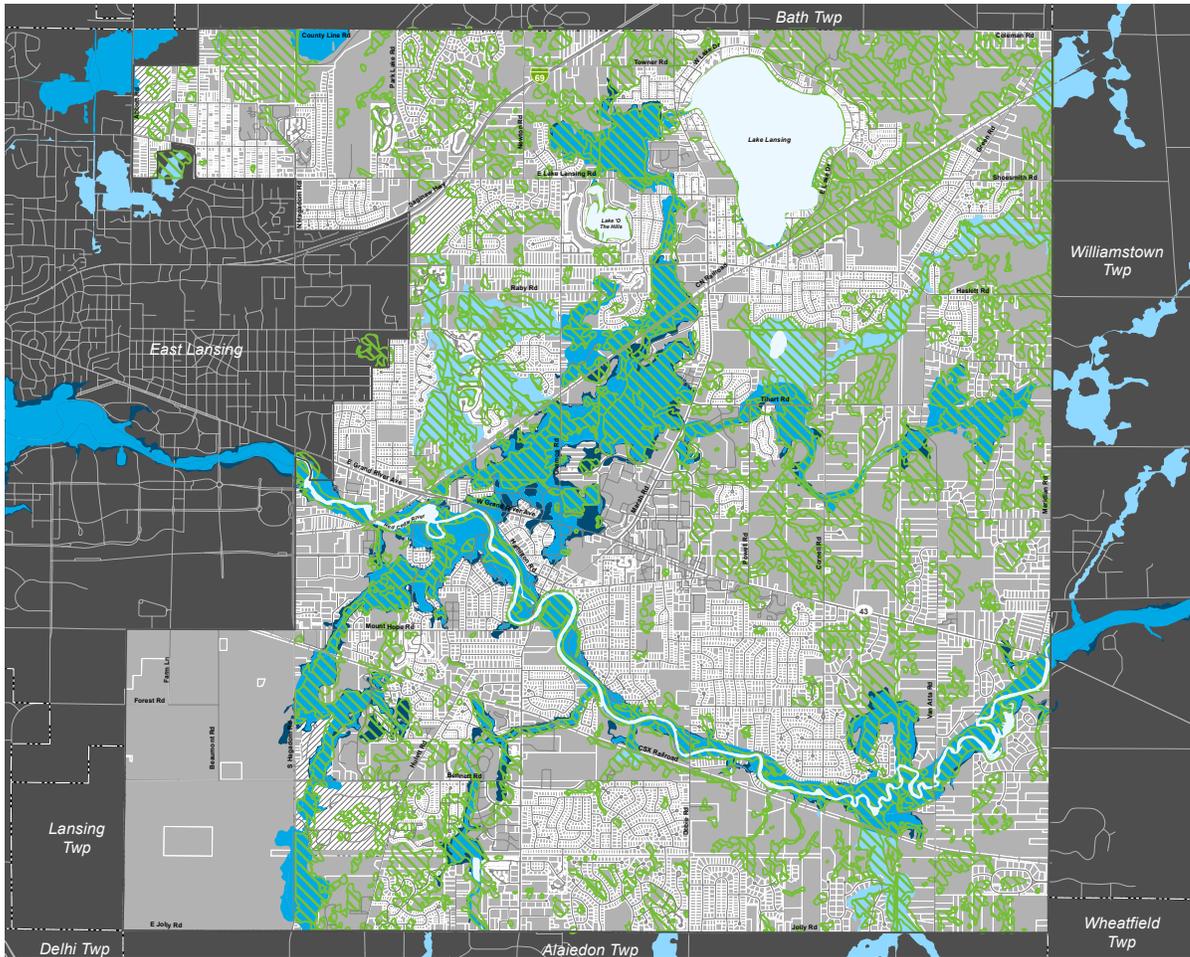
This map is a generalized representation of established drain routes and courses and/or drainage district boundaries. It is provided by the Ingham County Drain Commissioner for reference and display purposes only and does not confirm, create, refute, remove, expand, alter or otherwise affect any rights or obligations recognized or imposed by federal, state or local law, ordinance, regulation or rule.

0 0.13 0.25 0.5 Miles

1 INCH = 500 FEET

**DRAIN INDEX**

DRAIN NO	DRAIN NAME	DRAIN NO	DRAIN NAME	DRAIN NO	DRAIN NAME
A0900	ARMORE DRAIN	G2101	GRETENBURGER RELIEF DRAIN	N1300	NORTHWIND DRAIN
A2100	ADDISON DRAIN	H0300	HANNAH FARM DRAIN	O0200	OKEMOS PRESERVE DRAIN
B2804	BUTTON SPRING LAKES BRANCH DRAIN	H2100	HERRON CREEK DRAIN	O0400	OKEMOS DRAIN
B3600	BRIARWOOD DRAIN	H6200	HOSKINS DRAIN	O0900	OKEMOS TILE DRAIN
B4013	BANTA CONSOLIDATED DRAIN	I0200	INDIAN HILLS DRAIN	P1500	PROCTOR DRAIN
B5100	BIEBESHIEMER DRAIN	I0600	INDIAN LAKES DRAIN	R0100	RABY DRAIN
B5200	BENNETT DRAIN	I0602	INDIAN LAKES NO. 2 DRAIN	R1500	RIVERWOOD DRAIN AND BRANCHES DRAIN
C1000	CHIPPEWA HILLS DRAIN	I0602	INDIAN LAKES MAUMEE BRANCH DRAIN	S0200	SANCTUARY DRAIN
C8100	CIBA GEIGY DRAIN	K0400	KENT DRAIN	S2600	SPROSS DRAIN
D0202	DANIELS EXTENSION DRAIN	K1100	KINAWA VIEW DRAIN	S4520	SMITH CONSOLIDATED DRAIN
E0300	EBERLY DRAIN	M1700	MEADOWS DRAIN	S6000	SHAKER HEIGHTS DRAIN
E1600	EAST GATE DRAIN	M1800	MUD LAKE OUTLET DRAIN	T1800	SANDERS-TACOMA HILLS DRAIN
F0900	FOREST HILLS DRAIN	M2900	MELIERS DRAIN	T2100	TWYCKINGHAM DRAIN
G2100	GRETENBURGER DRAIN	N1200	NILSON DRAIN	U0200	UNRUH DRAIN



MAP 11

## Natural Features

Meridian Charter Township  
Ingham County, Michigan

January 17, 2017

### Wetlands

 Wetlands

### Flood Hazard Areas

 No Base Flood Elevations Determined

 Base Flood Elevations Determined

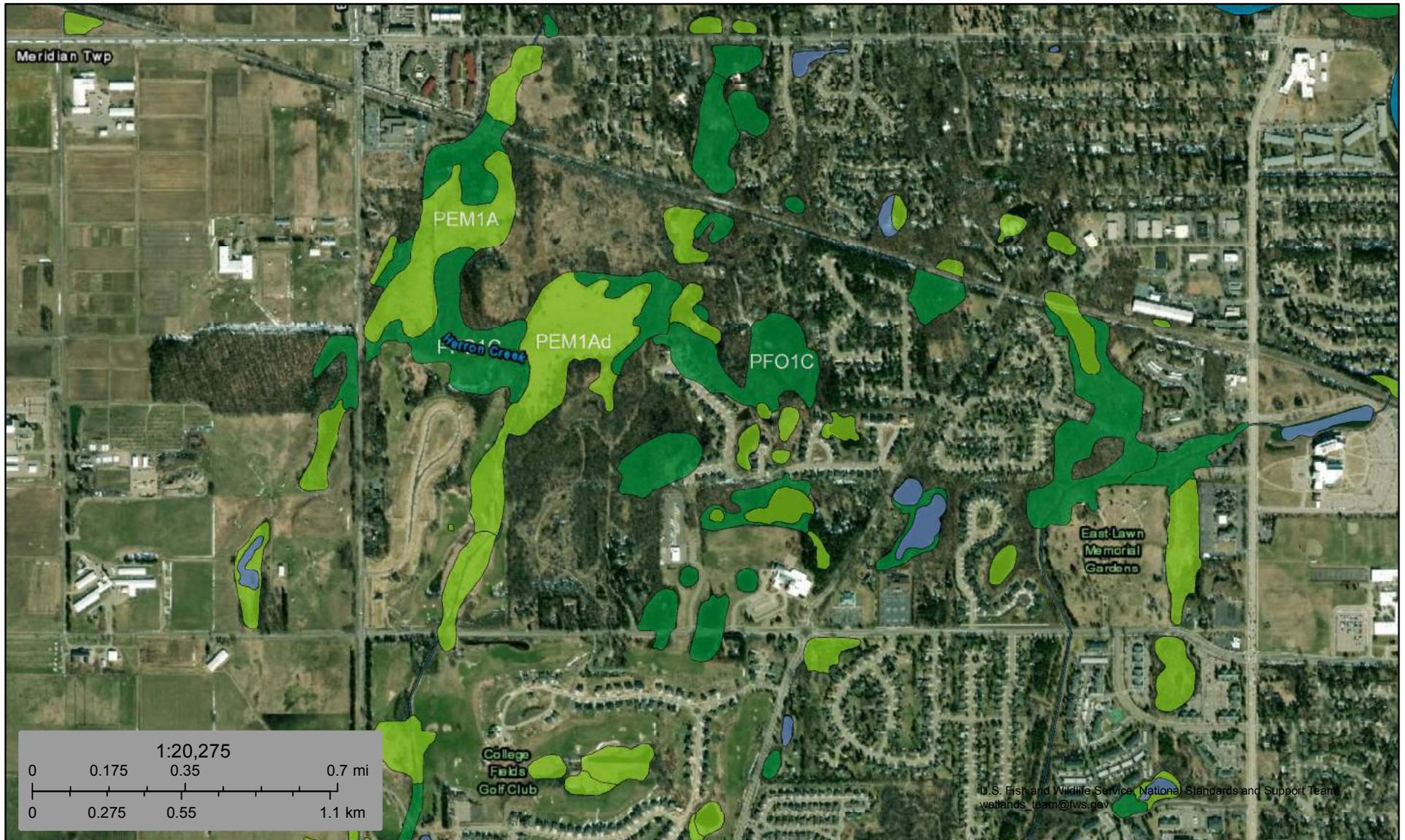
 500-year Flood Plain

 Cooperative Agreement

0 2,000 4,000 FEET

**MCKenna**  
ASSOCIATES

Map Feature Source: Meridian Charter Township, 2016



April 10, 2020

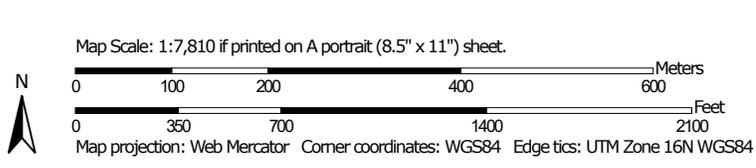
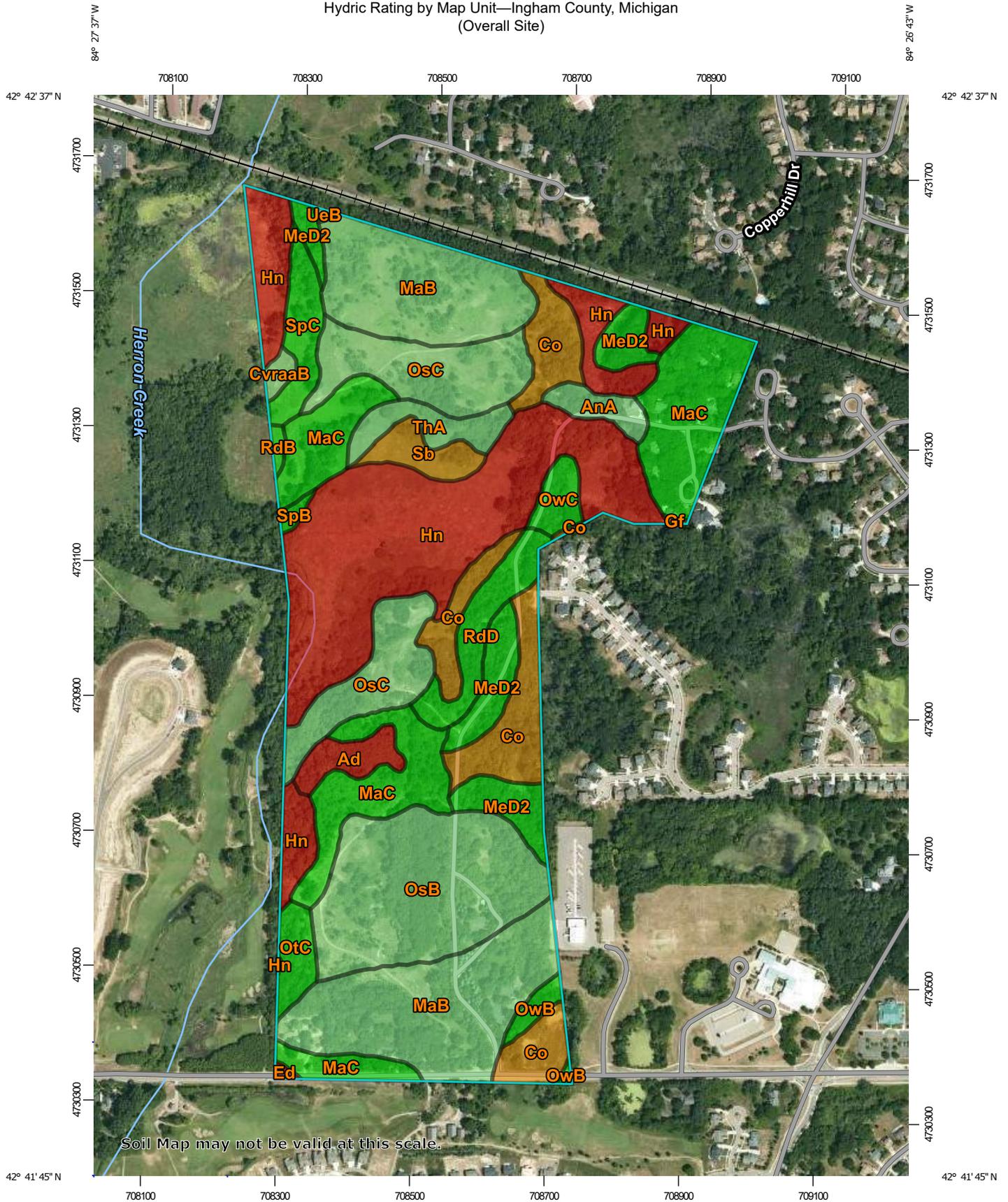
**Wetlands**

- |   |                                |   |                                   |   |          |
|---|--------------------------------|---|-----------------------------------|---|----------|
|  | Estuarine and Marine Deepwater |  | Freshwater Emergent Wetland       |  | Lake     |
|  | Estuarine and Marine Wetland   |  | Freshwater Forested/Shrub Wetland |  | Other    |
|   |                                |  | Freshwater Pond                   |  | Riverine |

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.



Hydric Rating by Map Unit—Ingham County, Michigan  
(Overall Site)



Hydric Rating by Map Unit—Ingham County, Michigan  
(Overall Site)

### MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

-  Hydric (100%)
-  Hydric (66 to 99%)
-  Hydric (33 to 65%)
-  Hydric (1 to 32%)
-  Not Hydric (0%)
-  Not rated or not available

**Soil Rating Lines**

-  Hydric (100%)
-  Hydric (66 to 99%)
-  Hydric (33 to 65%)
-  Hydric (1 to 32%)
-  Not Hydric (0%)
-  Not rated or not available

**Soil Rating Points**

-  Hydric (100%)
-  Hydric (66 to 99%)
-  Hydric (33 to 65%)
-  Hydric (1 to 32%)
-  Not Hydric (0%)
-  Not rated or not available

**Water Features**

 Streams and Canals

**Transportation**

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

**Background**

 Aerial Photography

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ingham County, Michigan  
Survey Area Data: Version 17, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 4, 2018—Jul 18, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydric Rating by Map Unit

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Ad	Adrian muck, 0 to 1 percent slopes	100	2.1	1.4%
AnA	Aubbeenaubbee-Capac sandy loams, 0 to 3 percent slopes	8	1.7	1.1%
Co	Colwood-Brookston loams	80	11.9	8.1%
CvraaB	Conover loam, 0 to 4 percent slopes	5	0.6	0.4%
Ed	Edwards muck, 0 to 1 percent slopes	100	0.1	0.1%
Gf	Gilford sandy loam, 0 to 2 percent slopes, gravelly subsoil	95	0.1	0.0%
Hn	Houghton muck, 0 to 1 percent slopes	100	32.9	22.3%
MaB	Marlette fine sandy loam, 2 to 6 percent slopes	2	25.2	17.1%
MaC	Filer fine sandy loam, Saginaw Lobe, 6 to 12 percent slopes	0	19.7	13.4%
MeD2	Marlette loam, 12 to 18 percent slopes, eroded	0	7.0	4.8%
OsB	Oshtemo sandy loam, 0 to 6 percent slopes	1	16.2	11.0%
OsC	Oshtemo sandy loam, 6 to 12 percent slopes	1	12.9	8.8%
OtC	Oshtemo-Spinks loamy sands, 6 to 12 percent slopes	0	1.9	1.3%
OwB	Owosso-Marlette sandy loams, 2 to 6 percent slopes	0	0.9	0.6%
OwC	Owosso-Marlette sandy loams, 6 to 12 percent slopes	0	1.6	1.1%
RdB	Riddles-Hillsdale sandy loams, 2 to 6 percent slopes	0	0.3	0.2%
RdD	Riddles-Hillsdale sandy loams, 12 to 18 percent slopes	0	3.9	2.6%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Sb	Sebewa loam, 0 to 2 percent slopes	95	2.2	1.5%
SpB	Spinks loamy sand, 0 to 6 percent slopes	0	0.4	0.2%
SpC	Spinks loamy sand, 6 to 12 percent slopes	0	3.1	2.1%
ThA	Thetford loamy sand, 0 to 3 percent slopes	10	2.7	1.8%
UeB	Urban land-Boyer-Spinks complex, 0 to 10 percent slopes	4	0.1	0.1%
<b>Totals for Area of Interest</b>			<b>147.4</b>	<b>100.0%</b>

## Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

### References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

## Rating Options

*Aggregation Method: Percent Present*

*Component Percent Cutoff: None Specified*

*Tie-break Rule: Lower*

**APPENDIX II- VEGETATION LISTS**

**Table 1. Species list including scientific and common name, wetness indicator code (WET), wetness co-efficient (W), conservation co-efficient (C), nativity, habit, and occurrence of species identified at the Silverleaf Condominiums (Meridian Twp.) project site - Disturbed Upland Old Field**

<i>Scientific Name</i>	Common Name	WET	W	C	Native	Habit	Occurrence
<i>Achillea millefolium</i>	Yarrow	FACU	3	1	Yes	Forb	Infrequent
<i>Agrostis gigantea</i>	REDTOP	FACW	-3	*	No	Forb	Occasional
<i>Asclepias syriaca</i>	Common Milkweed	UPL	5	1	Yes	Forb	Infrequent
<i>Bromus inermis</i>	SMOOTH BROME	UPL	5	*	No	Grass	Common
<i>Catalpa speciosa</i>	NORTHERN CATALPA	FACU	3	*	No	Tree	Infrequent
<i>Centaurea stoebe</i>	SPOTTED KNAPWEED	UPL	5	*	No	Forb	Common
<i>Cichorium intybus</i>	CHICORY	FACU	3	*	No	Forb	Occasional
<i>Cirsium arvense</i>	FIELD THISTLE	FACU	3	*	No	Forb	Infrequent
<i>Crataegus spp.</i>	Hawthorn species	FACU	3	Varies	Yes	Tree	Infrequent
<i>Dactylis glomerata</i>	ORCHARD GRASS	FACU	3	*	No	Grass	Common
<i>Daucus carota</i>	QUEEN ANNE'S LACE	UPL	5	*	No	Forb	Common
<i>Dipsacus fullonum</i>	TEASEL	FACU	3	*	No	Forb	Common
<i>Elaeagnus umbellata</i>	AUTUMN-OLIVE	UPL	5	*	No	Shrub	Occasional
<i>Juniperus virginiana</i>	Red-cedar	FACU	3	3	Yes	Tree	Occasional
<i>Phragmites australis subsp. australis</i>	COMMON REED	FACW	-3	*	No	Grass	Infrequent
<i>Pinus sylvestris</i>	SCOTCH PINE	UPL	5	*	No	Tree	Occasional
<i>Plantago lanceolata</i>	ENGLISH PLANTAIN	FACU	3	*	No	Forb	Common
<i>Plantago major</i>	COMMON PLANTAIN	FACU	3	*	No	Forb	Occasional
<i>Phleum pratense</i>	TIMOTHY	FACU	3	*	No	Grass	Occasional
<i>Poa compressa</i>	CANADA BLUEGRASS	FACU	3	*	No	Grass	Common
<i>Poa pratensis</i>	KENTUCKY BLUEGRASS	FACU	3	*	No	Grass	Common
<i>Populus deltoides</i>	Cottonwood	FAC	0	1	Yes	Tree	Occasional
<i>Prunus serotina</i>	Black Cherry	FACU	3	2	Yes	Tree	Infrequent
<i>Rubus allegheniensis</i>	Blackberry	FACU	3	1	Yes	Shrub	Occasional
<i>Rubus occidentalis</i>	Black Raspberry	UPL	5	1	Yes	Shrub	Occasional
<i>Rosa multiflora</i>	MULTIFLORA ROSE	FACU	3	*	No	Shrub	Occasional
<i>Salix eriocephala</i>	Willow	FACW	-3	2	Yes	Shrub	Infrequent
<i>Salix exigua</i>	Sandbar Willow	FACW	-3	1	Yes	Shrub	Infrequent
<i>Schizachyrium scoparium</i>	Little Bluestem	FACU	3	5	Yes	Grass	Infrequent
<i>Solidago altissima</i>	Tall Goldenrod	FACU	3	1	Yes	Forb	Common
<i>Solidago canadensis</i>	Canada Goldenrod	FACU	3	1	Yes	Forb	Occasional
<i>Toxicodendron radicans</i>	Poison-Ivy	FAC	0	2	Yes	Vine	Infrequent
<i>Verbascum blattaria</i>	MOTH MULLEIN	FACU	3	*	No	Forb	Infrequent
<i>Verbascum thapsis</i>	COMMON MULLEIN	UPL	5	*	N	Forb	Occasional
<b>Count = 34</b>	<b>Average Wetness Co-efficient =</b>		<b>2.59</b>				
	<b>Average Conservation Co-efficient =</b>			<b>1.69</b>			

**Table 2. Species list including scientific and common name, wetness indicator code (WET), wetness co-efficient (W), conservation co-efficient (C), nativity, habit, and occurrence of species identified at the Silverleaf Condominiums (Meridian Twp.) project site - Upland Forest/Scrub-shrub**

Scientific Name	Common Name	WET	W	C	Native	Habit	Occurrence
<i>Acer negundo</i>	Box-elder	FAC	0	0	Yes	Tree	Common
<i>Acer platanoides</i>	NORWAY MAPLE	UPL	5	*	No	Tree	Infrequent
<i>Acer rubrum</i>	Red Maple	FAC	0	1	Yes	Tree	Infrequent
<i>Acer saccharinum</i>	Silver Maple	FACW	-3	2	Yes	Tree	Infrequent
<i>Acer saccharum</i>	Sugar Maple	FACU	3	5	Yes	Tree	Occasional
<i>Alliaria petiolata</i>	GARLIC MUSTARD	FACU	3	*	No	Forb	Occasional
<i>Apocynum cannabinum</i>	Indian-hemp	FAC	0	3	Yes	Forb	Occasional
<i>Carex pensylvanica</i>	Penn Sedge	UPL	5	4	Yes	Sedge	Common
<i>Carpinus caroliniana</i>	Musclewood	FAC	0	6	Yes	Tree	Infrequent
<i>Cornus foemina</i>	Gray Dogwood	FAC	0	1	Yes	Shrub	Occasional
<i>Crataegus punctata</i>	Hawthorn	FACU	3	1	Yes	Tree	Infrequent
<i>Elaeagnus umbellata</i>	AUTUMN-OLIVE	FACU	3	*	No	Shrub	Infrequent
<i>Erythronium americanum</i>	Yellow Trout Lily	UPL	5	5	Yes	Forb	Occasional
<i>Fagus grandifolia</i>	American Beech	FACU	3	6	Yes	Tree	Occasional
<i>Fragaria virginiana</i>	Wild Strawberry	FACU	3	2	Yes	Forb	Common
<i>Fraxinus americana</i>	White Ash	FACU	3	5	Yes	Tree	Occasional
<i>Fraxinus pennsylvanica</i>	Green Ash	FACW	-3	2	Yes	Tree	Infrequent
<i>Geranium maculatum</i>	Wild Geranium	FACU	3	4	Yes	Forb	Infrequent
<i>Geum canadense</i>	White Avens	FAC	0	1	Yes	Forb	Occasional
<i>Hesperis matronalis</i>	DAME'S ROCKET	FACU	3	*	No	Forb	Common
<i>Juglans nigra</i>	Black Walnut	FACU	3	5	Yes	Tree	Occasional
<i>Lonicera maackii</i>	AMUR HONEYSUCKLE	UPL	5	*	No	Shrub	Common
<i>Lonicera morrowii</i>	MORROW HONEYSUCKLE	FACU	3	*	No	Shrub	Common
<i>Lonicera tatarica</i>	TARTARIAN HONEYSUCKLE	FACU	3	*	No	Shrub	Common
<i>Morus alba</i>	WHITE MULBERRY	FACU	3	*	No	Tree	Infrequent
<i>Ostrya virginiana</i>	Hophornbeam	FACU	3	5	Yes	Tree	Occasional
<i>Parthenocissus quinquefolia</i>	Virginia creeper	FACU	3	5	Yes	Vine	Common
<i>Picea abies</i>	NORWAY SPRUCE	UPL	5	*	No	Tree	Occasional
<i>Picea glauca</i>	White Spruce	FACU	3	3	Yes	Tree	Occasional
<i>Pinus resinosa</i>	Red Pine	FACU	3	6	Yes	Tree	Occasional
<i>Pinus strobus</i>	White Pine	FACU	3	3	Yes	Tree	Occasional
<i>Pinus sylvestris</i>	SCOTCH PINE	FACU	3	*	No	Tree	Occasional
<i>Podophyllum peltatum</i>	May-apple	FACU	3	3	Yes	Forb	Common
<i>Populus deltoides</i>	Cottonwood	FAC	0	1	Yes	Tree	Occasional
<i>Populus grandidentata</i>	Bigtooth Aspen	FACU	3	4	Yes	Tree	Infrequent
<i>Populus tremuloides</i>	Trembling Aspen	FAC	0	1	Yes	Tree	Occasional
<i>Prunus serotina</i>	Black Cherry	FACU	3	2	Yes	Tree	Common
<i>Quercus alba</i>	White Oak	FACU	3	5	Yes	Tree	Occasional
<i>Quercus macrocarpa</i>	Bur Oak	FACU	3	5	Yes	Tree	Infrequent
<i>Quercus rubra</i>	Red Oak	FACU	3	5	Yes	Tree	Occasional
<i>Quercus velutina</i>	Black Oak	UPL	5	6	Yes	Tree	Infrequent
<i>Rhamnus cathartica</i>	COMMON BUCKTHORN	FAC	0	*	No	Shrub	Common
<i>Rhus typhina</i>	Staghorn sumac	FACU	3	2	Yes	Shrub	Infrequent
<i>Robinia pseudoacacia</i>	BLACK LOCUST	FACU	3	*	No	Shrub	Occasional
<i>Rosa multiflora</i>	MULTIFLORA ROSE	FACU	3	*	No	Shrub	Occasional
<i>Rubus allegheniensis</i>	Blackberry	FACU	3	1	Yes	Shrub	Common
<i>Rubus occidentalis</i>	Black Raspberry	UPL	5	1	Yes	Shrub	Occasional
<i>Thuja occidentalis</i>	White-cedar	FACW	-3	4	Yes	Tree	Infrequent
<i>Tilia americana</i>	American Basswood	FACU	-3	5	Yes	Tree	Occasional
<i>Toxicodendron radicans</i>	Poison-Ivy	FAC	0	2	Yes	Vine	Common
<i>Ulmus pumila</i>	SIBERIAN ELM	FACU	3	*	No	Tree	Infrequent
<i>Verbena urticifolia</i>	White Vervain	FAC	0	4	Yes	Forb	Infrequent
<i>Vitis riparia</i>	Riverbank Grape	FAC	0	3	Yes	Vine	Occasional
<i>Zanthoxylum americanum</i>	Prickly-ash	FACU	3	3	Yes	Shrub	Common
<b>Count = 54</b>	<b>Average Wetness Co-efficient =</b>		<b>2.15</b>				
	<b>Average Conservation Co-efficient =</b>			<b>3.3</b>			

**Table 3. Species list including scientific and common name, wetness indicator code (WET), wetness co-efficient (W), conservation co-efficient (C), nativity, habit, and occurrence of species identified at the Silverleaf Condominiums (Meridian Twp.) project site -Wetlands**

<i>Scientific Name</i>	<b>Common Name</b>	<b>WET</b>	<b>W</b>	<b>C</b>	<b>Native</b>	<b>Habit</b>	<b>Occurrence</b>
<i>Acer negundo</i>	Box-elder	FAC	0	0	Yes	Tree	Common
<i>Acer saccharinum</i>	Silver Maple	FACW	-3	2	Yes	Tree	Occasional
<i>Acer rubrum</i>	Red Maple	FAC	0	1	Yes	Tree	Infrequent
<i>Agrostis gigantea</i>	Redtop	FACW	-3	*	No	Grass	Occasional
<i>Boehmeria cylindrica</i>	False Nettle	OBL	-5	5	Yes	Forb	Occasional
<i>Carex intumescens</i>	Sedge	FACW	-3	3	Yes	Sedge	Infrequent
<i>Carex lacustris</i>	Lake Sedge	OBL	-5	6	Yes	Sedge	Occasional
<i>Carex stricta</i>	Strict Sedge	OBL	-5	4	Yes	Sedge	Infrequent
<i>Carex vulpinoidea</i>	Fox Sedge	OBL	-5	1	Yes	Sedge	Occasional
<i>Cornus amomum</i>	Silky Dogwood	FACW	-3	2	Yes	Shrub	Common
<i>Cornus foemina/racemosa</i>	Gray Dogwood	FAC	0	1	Yes	Shrub	Common
<i>Fraxinus nigra</i>	Black Ash	FACW	-3	6	Yes	Tree	Occasional
<i>Fraxinus pennsylvanica</i>	Green Ash	FACW	-3	2	Yes	Tree	Common
<i>Geum canadense</i>	White Avens	FAC	0	1	Yes	Forb	Occasional
<i>Glyceria striata</i>	Fowl Manna Grass	OBL	-5	4	Yes	Grass	Infrequent
<i>Juncus dudleyi</i>	Dudley's Rush	FACW	-3	5	Yes	Forb	Infrequent
<i>Juncus tenuis</i>	Path Rush	FAC	0	1	Yes	Forb	Infrequent
<i>Lonicera tatarica</i>	Tartarian honeysuckle	FACU	3	*	No	Shrub	Infrequent
<i>Onoclea sensibilis</i>	Sensitive Fern	FACW	-3	2	Yes	Fern	Occasional
<i>Phalaris arundinacea</i>	Reed canary grass	FACW	-3	0	Yes	Grass	Common
<i>Phragmites australis var. australis</i>	Common Reed	FACW	-3	*	No	Grass	Infrequent
<i>Populus deltoides</i>	Cottonwood	FAC	0	1	Yes	Tree	Common
<i>Populus tremuloides</i>	Trembling Aspen	FAC	0	1	Yes	Tree	Infrequent
<i>Quercus bicolor</i>	Swamp White Oak	FACW	-3	8	Yes	Tree	Occasional
<i>Rhamnus cathartica</i>	Common Buckthorn	FAC	0	*	No	Shrub	Common
<i>Rosa multiflora</i>	Multiflora Rose	FACU	3	*	No	Shrub	Infrequent
<i>Rubus strigosus</i>	Red Raspberry	FAC	0	2	Yes	Shrub	Common
<i>Salix alba</i>	WHITE WILLOW	FACW	-3	*	No	Tree	Infrequent
<i>Sambucus canadensis</i>	Elderberry	FACW	-3	3	Yes	Shrub	Occasional
<i>Solidago gigantea</i>	Late Goldenrod	FACW	-3	3	Yes	Forb	Occasional
<i>Symphotrichum lateriflorum</i>	Calico American-aster	FAC	0	2	Yes	Forb	Infrequent
<i>Toxicodendron radicans</i>	Poison-Ivy	FAC	0	2	Yes	Vine	Common
<i>Typha angustifolia</i>	Narrowleaf Cattail	OBL	-5	*	No	Forb	Occasional
<i>Typha latifolia</i>	Broadleaf Cattail	OBL	-5	1	Yes	Forb	Occasional
<i>Ulmus americana</i>	American Elm	FACW	-3	1	Yes	Tree	Common
<i>Urtica dioica</i>	Stinging nettle	FAC	0	1	Yes	Forb	Occasional
<i>Verbena urticifolia</i>	White Vervain	FAC	0	4	Yes	Forb	Occasional
<i>Vitis riparia</i>	Riverbank Grape	FAC	0	3	Yes	Vine	Common
<i>Zanthoxylum americanum</i>	Prickly-ash	FACU	3	3	Yes	Shrub	Common
<b>Count = 40</b>	<b>Average Wetness Co-efficient =</b>		<b>-1.8</b>				
	<b>Average Conservation Co-efficient =</b>			<b>2.5</b>			

**APPENDIX III**

**Tree Survey Results Table (Prepared by others)**

**Tree Inventory Results- Silverleaf Condominiums PUD (Meridian Township, Ingham Co, MI**

TREE NUMBER	DBH (in) & TREE TYPE	Scientific Name	Common Name	Scientific Name	TOTALS
6	20" COTTONWOOD	<i>Populus deltoides</i>	Black Cherry	<i>Prunus serotina</i>	202
7	14" COTTONWOOD	<i>Populus deltoides</i>	Box-elder	<i>Acer negundo</i>	194
8	12" COTTONWOOD	<i>Populus deltoides</i>	Cottonwood	<i>Populus deltoides</i>	175
9	12" COTTONWOOD	<i>Populus deltoides</i>	White Pine	<i>Pinus strobus</i>	113
10	14" COTTONWOOD	<i>Populus deltoides</i>	Red Oak	<i>Quercus rubra</i>	77
11	14" COTTONWOOD	<i>Populus deltoides</i>	Black Walnut	<i>Juglans nigra</i>	75
12	16" COTTONWOOD	<i>Populus deltoides</i>	Sugar Maple	<i>Acer saccharum</i>	38
13	12" COTTONWOOD	<i>Populus deltoides</i>	Fagus grandifolia	<i>American Beech</i>	36
14	24" COTTONWOOD	<i>Populus deltoides</i>	Norway Maple	<i>Acer platanoides</i>	28
15	12" COTTONWOOD	<i>Populus deltoides</i>	White Oak	<i>Quercus alba</i>	24
16	22" COTTONWOOD	<i>Populus deltoides</i>	Norway Spruce	<i>Picea abies</i>	23
17	12" COTTONWOOD	<i>Populus deltoides</i>	American Elm	<i>Ulmus americana</i>	20
18	18" BOX ELDER	<i>Acer negundo</i>	Red Maple	<i>Acer rubrum</i>	18
19	18" COTTONWOOD	<i>Populus deltoides</i>	Basswood	<i>Tilia americana</i>	13
20	16" COTTONWOOD	<i>Populus deltoides</i>	Hackberry	<i>Celtis occidentalis</i>	11
21	18" COTTONWOOD	<i>Populus deltoides</i>	White Ash	<i>Fraxinus americana</i>	11
22	12" COTTONWOOD	<i>Populus deltoides</i>	Willow	<i>Salix species</i>	6
23	12" BOX ELDER	<i>Acer negundo</i>	Silver Maple	<i>Acer saccharinum</i>	5
24	16" COTTONWOOD	<i>Populus deltoides</i>	Scotch Pine	<i>Pinus sylvestris</i>	5
25	18" COTTONWOOD	<i>Populus deltoides</i>	Bur Oak	<i>Quercus macrocarpa</i>	4
26	(2)14" COTTONWOOD	<i>Populus deltoides</i>	Apple	<i>Malus pumila</i>	3
30	18" COTTONWOOD	<i>Populus deltoides</i>	Black Locust	<i>Robinia pseudoacacia</i>	2
31	14" BLACK WALNUT	<i>Juglans nigra</i>	Honey-Locust	<i>Gleditsia triacanthos</i>	2
32	12" BLACK WALNUT	<i>Juglans nigra</i>	Red Pine	<i>Pinus resinosa</i>	2
33	12" BLACK WALNUT	<i>Juglans nigra</i>	White-Cedar	<i>Thuja occidentalis</i>	2
34	12" BLACK WALNUT	<i>Juglans nigra</i>	Ironwood	<i>Ostrya virginiana</i>	1
35	12" BLACK WALNUT	<i>Juglans nigra</i>	Hornbeam/Musclewood	<i>Carpinus caroliniana</i>	1
36	14" BLACK WALNUT	<i>Juglans nigra</i>	Tree-of-Heaven	<i>Ailanthus altissima</i>	1
37	12" BLACK WALNUT	<i>Juglans nigra</i>	White Mulberry	<i>Morus alba</i>	1
38	14" BLACK WALNUT	<i>Juglans nigra</i>	Hickory	<i>Carya species</i>	1
39	14" BLACK WALNUT	<i>Juglans nigra</i>	Horse-chestnut	<i>Aesculus hippocastanum</i>	1
40	12" BLACK WALNUT	<i>Juglans nigra</i>			
41	12" BOX ELDER	<i>Acer negundo</i>			
42	14" BLACK WALNUT	<i>Juglans nigra</i>			
43	14" BLACK WALNUT	<i>Juglans nigra</i>			
44	14" BLACK WALNUT	<i>Juglans nigra</i>			
45	12" BLACK WALNUT	<i>Juglans nigra</i>			
46	18" BLACK WALNUT	<i>Juglans nigra</i>			
47	16" BLACK WALNUT	<i>Juglans nigra</i>			
48	12" BLACK WALNUT	<i>Juglans nigra</i>			
49	12" BLACK WALNUT	<i>Juglans nigra</i>			
50	12" BLACK CHERRY	<i>Prunus serotina</i>			
51	12" BLACK CHERRY	<i>Prunus serotina</i>			
52	18" BLACK WALNUT	<i>Juglans nigra</i>			
53	12" BLACK WALNUT	<i>Juglans nigra</i>			
54	12" BLACK WALNUT	<i>Juglans nigra</i>			
55	36" BLACK WALNUT	<i>Juglans nigra</i>			
56	(2)12" BLACK LOCUST	<i>Robinia pseudoacacia</i>			
57	12" BOX ELDER	<i>Acer negundo</i>			
58	12" HICKORY	<i>Carya species</i>			
59	12" BOX ELDER	<i>Acer negundo</i>			
60	12" AMERICAN ELM	<i>Ulmus americana</i>			
61	12" HOP HORNBEAM	<i>Carpinus caroliniana</i>			
62	16" BLACK WALNUT	<i>Juglans nigra</i>			
63	14" BLACK WALNUT	<i>Juglans nigra</i>			
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64		18" BLACK WALNUT	<i>Juglans nigra</i>
65		12" BOX ELDER	<i>Acer negundo</i>
66		14" BLACK WALNUT	<i>Juglans nigra</i>
67		12" BOX ELDER	<i>Acer negundo</i>
68		16" COTTONWOOD	<i>Populus deltoides</i>
69		12" BOX ELDER	<i>Acer negundo</i>
70		14" BLACK WALNUT	<i>Juglans nigra</i>
71		(2)14" BLACK WALNUT	<i>Juglans nigra</i>
72		22" BLACK WALNUT	<i>Juglans nigra</i>
73		18" BLACK CHERRY	<i>Prunus serotina</i>
74		12" BLACK CHERRY	<i>Prunus serotina</i>
75		14" BLACK WALNUT	<i>Juglans nigra</i>
76		12" BLACK WALNUT	<i>Juglans nigra</i>
77		12" BLACK WALNUT	<i>Juglans nigra</i>
78		12" BLACK WALNUT	<i>Juglans nigra</i>
79		12" BOX ELDER	<i>Acer negundo</i>
80		12" BLACK WALNUT	<i>Juglans nigra</i>
81		14" BLACK WALNUT	<i>Juglans nigra</i>
82		14" BLACK WALNUT	<i>Juglans nigra</i>
83		18" BLACK WALNUT	<i>Juglans nigra</i>
84		12" BOX ELDER	<i>Acer negundo</i>
85		12" BOX ELDER	<i>Acer negundo</i>
86		12" BOX ELDER	<i>Acer negundo</i>
87		12" BOX ELDER	<i>Acer negundo</i>
88		12" BOX ELDER	<i>Acer negundo</i>
89		12" BOX ELDER	<i>Acer negundo</i>
90		12" BOX ELDER	<i>Acer negundo</i>
91		12" WILLOW	<i>Salix species</i>
92		14" BOX ELDER	<i>Acer negundo</i>
92a		14" BOX ELDER	<i>Acer negundo</i>
94		24" BOX ELDER	<i>Acer negundo</i>
95		12" BOX ELDER	<i>Acer negundo</i>
96		12" AMERICAN ELM	<i>Ulmus americana</i>
97		16" BLACK CHERRY	<i>Prunus serotina</i>
98		16" BLACK CHERRY	<i>Prunus serotina</i>
99		14" HACKBERRY	<i>Celtis occidentalis</i>
100		24" HACKBERRY	<i>Celtis occidentalis</i>
101		22" BLACK WALNUT	<i>Juglans nigra</i>
102		18" BLACK WALNUT	<i>Juglans nigra</i>
103		16" BOX ELDER	<i>Acer negundo</i>
104		12" BLACK CHERRY	<i>Prunus serotina</i>
105		12" BLACK WALNUT	<i>Juglans nigra</i>
106		14" BLACK WALNUT	<i>Juglans nigra</i>
107		(2)16" BASSWOOD	<i>Tilia americana</i>
108		12" BLACK WALNUT	<i>Juglans nigra</i>
109		14" BLACK WALNUT	<i>Juglans nigra</i>
110		14" BLACK WALNUT	<i>Juglans nigra</i>
111		14" BLACK CHERRY	<i>Prunus serotina</i>
112		16" BLACK WALNUT	<i>Juglans nigra</i>
113		16" BLACK WALNUT	<i>Juglans nigra</i>
114		14" BLACK CHERRY	<i>Prunus serotina</i>
115		12" BLACK WALNUT	<i>Juglans nigra</i>
116		(2)20" BLACK CHERRY	<i>Prunus serotina</i>
117		16" BLACK CHERRY	<i>Prunus serotina</i>
118		14" BLACK WALNUT	<i>Juglans nigra</i>
119		18" BLACK WALNUT	<i>Juglans nigra</i>
120		16" BLACK WALNUT	<i>Juglans nigra</i>

121		12" BLACK CHERRY	<i>Prunus serotina</i>
122		12" BLACK WALNUT	<i>Juglans nigra</i>
123		18" BLACK WALNUT	<i>Juglans nigra</i>
124		12" BLACK WALNUT	<i>Juglans nigra</i>
125		12" BLACK WALNUT	<i>Juglans nigra</i>
126		12" BLACK WALNUT	<i>Juglans nigra</i>
127		12" BLACK WALNUT	<i>Juglans nigra</i>
128		12" BLACK WALNUT	<i>Juglans nigra</i>
130		18" BLACK CHERRY	<i>Prunus serotina</i>
131		12" BLACK CHERRY	<i>Prunus serotina</i>
132		18" BLACK CHERRY	<i>Prunus serotina</i>
133		18" AMERICAN ELM	<i>Ulmus americana</i>
134		12" BLACK WALNUT	<i>Juglans nigra</i>
135		18" BLACK WALNUT	<i>Juglans nigra</i>
136		(2)12" BOX ELDER	<i>Acer negundo</i>
137		14" BLACK CHERRY	<i>Prunus serotina</i>
138		12" BLACK CHERRY	<i>Prunus serotina</i>
139		12" BLACK WALNUT	<i>Juglans nigra</i>
139a		18" BLACK WALNUT	<i>Juglans nigra</i>
140		12" BLACK CHERRY	<i>Prunus serotina</i>
142		14" BLACK CHERRY	<i>Prunus serotina</i>
143		12" BLACK CHERRY	<i>Prunus serotina</i>
144		12" BLACK CHERRY	<i>Prunus serotina</i>
145		12" BLACK CHERRY	<i>Prunus serotina</i>
146		12" BLACK CHERRY	<i>Prunus serotina</i>
147		12" SUGAR MAPLE	<i>Acer saccharum</i>
148		18" AMERICAN ELM	<i>Ulmus americana</i>
149		12" BLACK CHERRY	<i>Prunus serotina</i>
150		12" BLACK WALNUT	<i>Juglans nigra</i>
151		14" BLACK WALNUT	<i>Juglans nigra</i>
152		52" WHITE OAK	<i>Quercus alba</i>
153		14" BLACK WALNUT	<i>Juglans nigra</i>
154		16" COTTONWOOD	<i>Populus deltoides</i>
155		14" BLACK CHERRY	<i>Prunus serotina</i>
156		14" BLACK WALNUT	<i>Juglans nigra</i>
157		12" WHITE ASH	<i>Fraxinus americana</i>
158		14" BLACK WALNUT	<i>Juglans nigra</i>
159		12" BLACK WALNUT	<i>Juglans nigra</i>
160		12" BLACK WALNUT	<i>Juglans nigra</i>
161		24" BLACK WALNUT	<i>Juglans nigra</i>
162		12" BOX ELDER	<i>Acer negundo</i>
163		12" COTTONWOOD	<i>Populus deltoides</i>
164		12" COTTONWOOD	<i>Populus deltoides</i>
165		12" COTTONWOOD	<i>Populus deltoides</i>
166		12" COTTONWOOD	<i>Populus deltoides</i>
167		14" COTTONWOOD	<i>Populus deltoides</i>
168		12" COTTONWOOD	<i>Populus deltoides</i>
169		12" COTTONWOOD	<i>Populus deltoides</i>
170		12" COTTONWOOD	<i>Populus deltoides</i>
171		14" COTTONWOOD	<i>Populus deltoides</i>
172		12" RED OAK	<i>Quercus rubra</i>
173		12" RED OAK	<i>Quercus rubra</i>
174		14" WHITE PINE	<i>Pinus strobus</i>
175		12" RED OAK	<i>Quercus rubra</i>
176		14" WHITE PINE	<i>Pinus strobus</i>
177		12" WHITE PINE	<i>Pinus strobus</i>
178		12" WHITE PINE	<i>Pinus strobus</i>

179		14" WHITE PINE	<i>Pinus strobus</i>
180		14" WHITE PINE	<i>Pinus strobus</i>
181		14" WHITE PINE	<i>Pinus strobus</i>
182		12" RED OAK	<i>Quercus rubra</i>
183		12" WHITE PINE	<i>Pinus strobus</i>
184		12" WHITE PINE	<i>Pinus strobus</i>
185		12" WHITE PINE	<i>Pinus strobus</i>
186		12" RED OAK	<i>Quercus rubra</i>
187		12" WHITE PINE	<i>Pinus strobus</i>
188		12" RED OAK	<i>Quercus rubra</i>
189		12" WHITE PINE	<i>Pinus strobus</i>
190		14" WHITE PINE	<i>Pinus strobus</i>
191		12" WHITE PINE	<i>Pinus strobus</i>
192		12" RED OAK	<i>Quercus rubra</i>
193		14" WHITE PINE	<i>Pinus strobus</i>
194		14" WHITE PINE	<i>Pinus strobus</i>
195		14" WHITE PINE	<i>Pinus strobus</i>
196		12" RED OAK	<i>Quercus rubra</i>
197		14" WHITE PINE	<i>Pinus strobus</i>
198		14" WHITE PINE	<i>Pinus strobus</i>
198a		14" WHITE PINE	<i>Pinus strobus</i>
198b		14" WHITE PINE	<i>Pinus strobus</i>
198c		14" WHITE PINE	<i>Pinus strobus</i>
199		14" WHITE PINE	<i>Pinus strobus</i>
200		12" WHITE PINE	<i>Pinus strobus</i>
201		14" WHITE PINE	<i>Pinus strobus</i>
202		12" WHITE PINE	<i>Pinus strobus</i>
203		16" WHITE PINE	<i>Pinus strobus</i>
203a		16" WHITE PINE	<i>Pinus strobus</i>
203b		16" WHITE PINE	<i>Pinus strobus</i>
203c		16" WHITE PINE	<i>Pinus strobus</i>
203d		16" WHITE PINE	<i>Pinus strobus</i>
203e		16" WHITE PINE	<i>Pinus strobus</i>
203f		16" WHITE PINE	<i>Pinus strobus</i>
203g		16" WHITE PINE	<i>Pinus strobus</i>
205		16" WHITE PINE	<i>Pinus strobus</i>
206		14" WHITE PINE	<i>Pinus strobus</i>
207		16" RED OAK	<i>Quercus rubra</i>
208		14" NORWAY MAPLE	<i>Acer platanoides</i>
209		14" NORWAY MAPLE	<i>Acer platanoides</i>
227		14" WHITE OAK	<i>Quercus alba</i>
228		12" BLACK CHERRY	<i>Prunus serotina</i>
229		14" WHITE PINE	<i>Pinus strobus</i>
230		16" WHITE PINE	<i>Pinus strobus</i>
231		16" WHITE PINE	<i>Pinus strobus</i>
231a		16" BOX ELDER	<i>Acer negundo</i>
232		12" WHITE PINE	<i>Pinus strobus</i>
233		16" WHITE PINE	<i>Pinus strobus</i>
234		14" WHITE PINE	<i>Pinus strobus</i>
235		12" WHITE PINE	<i>Pinus strobus</i>
236		12" WHITE PINE	<i>Pinus strobus</i>
237		12" WHITE PINE	<i>Pinus strobus</i>
238		12" WHITE PINE	<i>Pinus strobus</i>
239		12" WHITE PINE	<i>Pinus strobus</i>
240		12" WHITE PINE	<i>Pinus strobus</i>
241		12" WHITE PINE	<i>Pinus strobus</i>
242		12" WHITE PINE	<i>Pinus strobus</i>

243		12" WHITE PINE	<i>Pinus strobus</i>
244		8" WHITE CEDAR	<i>Thuja occidentalis</i>
245		8" WHITE CEDAR	<i>Thuja occidentalis</i>
246		12" WHITE OAK	<i>Quercus alba</i>
247		12" WHITE OAK	<i>Quercus alba</i>
248		12" WHITE OAK	<i>Quercus alba</i>
249		12" BLACK CHERRY	<i>Prunus serotina</i>
250		(3)14" BLACK CHERRY	<i>Prunus serotina</i>
251		16" AMERICAN ELM	<i>Ulmus americana</i>
252		(3)14" BLACK CHERRY	<i>Prunus serotina</i>
253		14" BLACK CHERRY	<i>Prunus serotina</i>
254		14" RED OAK	<i>Quercus rubra</i>
255		12" BLACK CHERRY	<i>Prunus serotina</i>
256		14" BOX ELDER	<i>Acer negundo</i>
257		14" BOX ELDER	<i>Acer negundo</i>
258		16" BLACK CHERRY	<i>Prunus serotina</i>
259		12" BOX ELDER	<i>Acer negundo</i>
270		14" WHITE OAK	<i>Quercus alba</i>
273		14" WHITE PINE	<i>Pinus strobus</i>
274		12" RED OAK	<i>Quercus rubra</i>
275		16" BLACK CHERRY	<i>Prunus serotina</i>
276		14" WHITE PINE	<i>Pinus strobus</i>
277		14" WHITE PINE	<i>Pinus strobus</i>
278		14" RED OAK	<i>Quercus rubra</i>
279		14" AMERICAN ELM	<i>Ulmus americana</i>
280		12" WHITE PINE	<i>Pinus strobus</i>
281		(2)12" WHITE PINE	<i>Pinus strobus</i>
282		12" WHITE PINE	<i>Pinus strobus</i>
283		14" WHITE PINE	<i>Pinus strobus</i>
284		(3)14" COTTONWOOD	<i>Populus deltoides</i>
285		12" WHITE PINE	<i>Pinus strobus</i>
286		(2)10" WHITE PINE	<i>Pinus strobus</i>
287		12" WHITE PINE	<i>Pinus strobus</i>
288		12" WHITE PINE	<i>Pinus strobus</i>
289		12" WHITE PINE	<i>Pinus strobus</i>
290		10" WHITE PINE	<i>Pinus strobus</i>
291		14" WHITE PINE	<i>Pinus strobus</i>
292		16" WHITE PINE	<i>Pinus strobus</i>
292a		16" WHITE PINE	<i>Pinus strobus</i>
293		12" WHITE PINE	<i>Pinus strobus</i>
295		10" WHITE PINE	<i>Pinus strobus</i>
296		10" WHITE PINE	<i>Pinus strobus</i>
297		18" WHITE PINE	<i>Pinus strobus</i>
298		14" WHITE PINE	<i>Pinus strobus</i>
299		10" WHITE PINE	<i>Pinus strobus</i>
300		12" WHITE PINE	<i>Pinus strobus</i>
300a		12" WHITE PINE	<i>Pinus strobus</i>
301		12" WHITE PINE	<i>Pinus strobus</i>
301a		14" WHITE PINE	<i>Pinus strobus</i>
302		12" WHITE PINE	<i>Pinus strobus</i>
302a		12" WHITE PINE	<i>Pinus strobus</i>
303		12" WHITE PINE	<i>Pinus strobus</i>
304		12" WHITE PINE	<i>Pinus strobus</i>
305		12" WHITE PINE	<i>Pinus strobus</i>
306		16" RED OAK	<i>Quercus rubra</i>
307		(2)12" RED MAPLE	<i>Acer rubrum</i>
308		14" WHITE PINE	<i>Pinus strobus</i>

309		10" WHITE PINE	<i>Pinus strobus</i>
310		12" WHITE PINE	<i>Pinus strobus</i>
311		12" WHITE PINE	<i>Pinus strobus</i>
312		12" WHITE PINE	<i>Pinus strobus</i>
313		14" WHITE PINE	<i>Pinus strobus</i>
314		14" WHITE PINE	<i>Pinus strobus</i>
315		12" WHITE PINE	<i>Pinus strobus</i>
316		14" WHITE PINE	<i>Pinus strobus</i>
317		16" WHITE PINE	<i>Pinus strobus</i>
318		12" WHITE PINE	<i>Pinus strobus</i>
319		32" COTTONWOOD	<i>Populus deltoides</i>
320		(3)18" BOX ELDER	<i>Acer negundo</i>
321		12" WHITE PINE	<i>Pinus strobus</i>
322		12" WHITE PINE	<i>Pinus strobus</i>
323		14" WHITE PINE	<i>Pinus strobus</i>
324		12" WHITE PINE	<i>Pinus strobus</i>
325		12" BLACK WALNUT	<i>Juglans nigra</i>
327		16" BOX ELDER	<i>Acer negundo</i>
329		32" COTTONWOOD	<i>Populus deltoides</i>
331		(3)12" BLACK CHERRY	<i>Prunus serotina</i>
332		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
333		(3)12" BLACK CHERRY	<i>Prunus serotina</i>
334		12" BLACK CHERRY	<i>Prunus serotina</i>
335		12" BLACK CHERRY	<i>Prunus serotina</i>
336		12" BLACK CHERRY	<i>Prunus serotina</i>
337		12" AMERICAN ELM	<i>Ulmus americana</i>
338		12" BLACK CHERRY	<i>Prunus serotina</i>
339		12" BLACK CHERRY	<i>Prunus serotina</i>
340		14" COTTONWOOD	<i>Populus deltoides</i>
341		16" COTTONWOOD	<i>Populus deltoides</i>
342		16" COTTONWOOD	<i>Populus deltoides</i>
343		30" COTTONWOOD	<i>Populus deltoides</i>
344		18" COTTONWOOD	<i>Populus deltoides</i>
345		14" COTTONWOOD	<i>Populus deltoides</i>
346		12" COTTONWOOD	<i>Populus deltoides</i>
347		12" COTTONWOOD	<i>Populus deltoides</i>
348		14" BLACK CHERRY	<i>Prunus serotina</i>
349		18" SUGAR MAPLE	<i>Acer saccharum</i>
350		14" BLACK CHERRY	<i>Prunus serotina</i>
351		14" COTTONWOOD	<i>Populus deltoides</i>
351a		12" COTTONWOOD	<i>Populus deltoides</i>
352		12" AMERICAN ELM	<i>Ulmus americana</i>
353		18" BASSWOOD	<i>Tilia americana</i>
354		12" BLACK CHERRY	<i>Prunus serotina</i>
355		14" BLACK CHERRY	<i>Prunus serotina</i>
356		12" BLACK CHERRY	<i>Prunus serotina</i>
357		(3)12" BLACK CHERRY	<i>Prunus serotina</i>
358		12" BLACK CHERRY	<i>Prunus serotina</i>
359		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
360		14" AMERICAN ELM	<i>Ulmus americana</i>
361		14" BLACK CHERRY	<i>Prunus serotina</i>
362		14" AMERICAN ELM	<i>Ulmus americana</i>
363		32" COTTONWOOD	<i>Populus deltoides</i>
364		14" BLACK CHERRY	<i>Prunus serotina</i>
365		12" BLACK CHERRY	<i>Prunus serotina</i>
366		14" BLACK CHERRY	<i>Prunus serotina</i>
367		14" AMERICAN ELM	<i>Ulmus americana</i>

368		12" SUGAR MAPLE	<i>Acer saccharum</i>
369		(2)18" BLACK CHERRY	<i>Prunus serotina</i>
370		12" BLACK CHERRY	<i>Prunus serotina</i>
371		14" BLACK CHERRY	<i>Prunus serotina</i>
372		32" COTTONWOOD	<i>Populus deltoides</i>
373		26" BLACK CHERRY	<i>Prunus serotina</i>
374		12" BLACK CHERRY	<i>Prunus serotina</i>
374a		12" BLACK CHERRY	<i>Prunus serotina</i>
375		12" BLACK CHERRY	<i>Prunus serotina</i>
376		12" BLACK CHERRY	<i>Prunus serotina</i>
377		14" COTTONWOOD	<i>Populus deltoides</i>
378		14" COTTONWOOD	<i>Populus deltoides</i>
379		14" COTTONWOOD	<i>Populus deltoides</i>
380		14" COTTONWOOD	<i>Populus deltoides</i>
381		14" COTTONWOOD	<i>Populus deltoides</i>
382		12" BLACK CHERRY	<i>Prunus serotina</i>
383		14" WHITE OAK	<i>Quercus alba</i>
384		26" WHITE OAK	<i>Quercus alba</i>
385		16" BASSWOOD	<i>Tilia americana</i>
386		12" BASSWOOD	<i>Tilia americana</i>
387		18" BASSWOOD	<i>Tilia americana</i>
387a		14" BASSWOOD	<i>Tilia americana</i>
388		(2)16" BASSWOOD	<i>Tilia americana</i>
389		36" COTTONWOOD	<i>Populus deltoides</i>
390		14" AMERICAN ELM	<i>Ulmus americana</i>
391		26" SUGAR MAPLE	<i>Acer saccharum</i>
392		(2)16" BASSWOOD	<i>Tilia americana</i>
393		12" WHITE OAK	<i>Quercus alba</i>
393a		12" BLACK CHERRY	<i>Prunus serotina</i>
393b		12" AMERICAN ELM	<i>Ulmus americana</i>
393c		12" BLACK CHERRY	<i>Prunus serotina</i>
393d		12" BOX ELDER	<i>Acer negundo</i>
394		12" BLACK CHERRY	<i>Prunus serotina</i>
395		12" BLACK CHERRY	<i>Prunus serotina</i>
396		14" BLACK CHERRY	<i>Prunus serotina</i>
397		12" BLACK CHERRY	<i>Prunus serotina</i>
398		12" BLACK CHERRY	<i>Prunus serotina</i>
399		18" AMERICAN ELM	<i>Ulmus americana</i>
400		14" BLACK CHERRY	<i>Prunus serotina</i>
401		20" COTTONWOOD	<i>Populus deltoides</i>
402		8" COTTONWOOD	<i>Populus deltoides</i>
403		14" COTTONWOOD	<i>Populus deltoides</i>
404		12" COTTONWOOD	<i>Populus deltoides</i>
405		16" COTTONWOOD	<i>Populus deltoides</i>
406		14" WHITE PINE	<i>Pinus strobus</i>
408		22" COTTONWOOD	<i>Populus deltoides</i>
409		12" COTTONWOOD	<i>Populus deltoides</i>
410		12" WHITE PINE	<i>Pinus strobus</i>
411		14" RED OAK	<i>Quercus rubra</i>
412		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
413		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
414		12" BLACK CHERRY	<i>Prunus serotina</i>
415		16" BLACK CHERRY	<i>Prunus serotina</i>
416		12" RED MAPLE	<i>Acer rubrum</i>
417		12" WHITE OAK	<i>Quercus alba</i>
418		12" WHITE OAK	<i>Quercus alba</i>
419		10" BLACK CHERRY	<i>Prunus serotina</i>

420		10" BLACK CHERRY	<i>Prunus serotina</i>
421		16" BLACK CHERRY	<i>Prunus serotina</i>
422		12" BOX ELDER	<i>Acer negundo</i>
423		16" BLACK CHERRY	<i>Prunus serotina</i>
424		(2)14" BLACK CHERRY	<i>Prunus serotina</i>
426		(2)12" COTTONWOOD	<i>Populus deltoides</i>
427		(3)14" COTTONWOOD	<i>Populus deltoides</i>
428		14" COTTONWOOD	<i>Populus deltoides</i>
428a		14" COTTONWOOD	<i>Populus deltoides</i>
429		14" COTTONWOOD	<i>Populus deltoides</i>
430		14" COTTONWOOD	<i>Populus deltoides</i>
431		12" COTTONWOOD	<i>Populus deltoides</i>
432		14" COTTONWOOD	<i>Populus deltoides</i>
433		16" BOX ELDER	<i>Acer negundo</i>
434		14" BASSWOOD	<i>Tilia americana</i>
435		(3)12" BOX ELDER	<i>Acer negundo</i>
436		(4)10" BOX ELDER	<i>Acer negundo</i>
437		18" COTTONWOOD	<i>Populus deltoides</i>
438		(2)16" COTTONWOOD	<i>Populus deltoides</i>
439		14" COTTONWOOD	<i>Populus deltoides</i>
440		12" BASSWOOD	<i>Tilia americana</i>
441		16" WHITE ASH	<i>Fraxinus americana</i>
441a		12" BOX ELDER	<i>Acer negundo</i>
441b		12" WHITE ASH	<i>Fraxinus americana</i>
442		26" SUGAR MAPLE	<i>Acer saccharum</i>
442a		12" BASSWOOD	<i>Tilia americana</i>
443		18" COTTONWOOD	<i>Populus deltoides</i>
444		12" HACKBERRY	<i>Celtis occidentalis</i>
444a		12" BLACK CHERRY	<i>Prunus serotina</i>
445		12" WHITE OAK	<i>Quercus alba</i>
445a		28" WHITE ASH	<i>Fraxinus americana</i>
446		12" WHITE OAK	<i>Quercus alba</i>
446a		12" BLACK CHERRY	<i>Prunus serotina</i>
446b		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
447		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
448		12" APPLE	<i>Malus pumila</i>
448a		12" BOX ELDER	<i>Acer negundo</i>
448b		12" BOX ELDER	<i>Acer negundo</i>
450		(2)12" COTTONWOOD	<i>Populus deltoides</i>
451		12" BOX ELDER	<i>Acer negundo</i>
452		12" BOX ELDER	<i>Acer negundo</i>
453		12" COTTONWOOD	<i>Populus deltoides</i>
454		12" COTTONWOOD	<i>Populus deltoides</i>
455		12" COTTONWOOD	<i>Populus deltoides</i>
456		(2)12" COTTONWOOD	<i>Populus deltoides</i>
457		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
500		(2)12" RED MAPLE	<i>Acer rubrum</i>
502		32" SILVER MAPLE	<i>Acer saccharinum</i>
503		12" APPLE	<i>Malus pumila</i>
505		(2)14" HONEY LOCUST	<i>Gleditsia triacanthos</i>
506		12" NORWAY MAPLE	<i>Acer platanoides</i>
507		12" NORWAY MAPLE	<i>Acer platanoides</i>
508		18" NORWAY SPRUCE	<i>Picea abies</i>
509		16" NORWAY SPRUCE	<i>Picea abies</i>
509a		16" NORWAY SPRUCE	<i>Picea abies</i>
510		12" NORWAY SPRUCE	<i>Picea abies</i>
511		16" RED PINE	<i>Pinus resinosa</i>

512		18" NORWAY SPRUCE	<i>Picea abies</i>
513		18" NORWAY SPRUCE	<i>Picea abies</i>
514		32" SILVER MAPLE	<i>Acer saccharinum</i>
515		12" SCOTCH PINE	<i>Pinus sylvestris</i>
516		(3)14" SILVER MAPLE	<i>Acer saccharinum</i>
517		(2)14" HONEY LOCUST	<i>Gleditsia triacanthos</i>
519		16" BLACK CHERRY	<i>Prunus serotina</i>
520		12" BUTTERNUT	<i>Juglans cinerea</i>
525		16" BOX ELDER	<i>Acer negundo</i>
527		24" RED OAK	<i>Quercus rubra</i>
529		16" NORWAY SPRUCE	<i>Picea abies</i>
531		18" NORWAY SPRUCE	<i>Picea abies</i>
532		12" SCOTCH PINE	<i>Pinus sylvestris</i>
533		18" NORWAY SPRUCE	<i>Picea abies</i>
534		12" SCOTCH PINE	<i>Pinus sylvestris</i>
535		14" NORWAY SPRUCE	<i>Picea abies</i>
536		14" NORWAY SPRUCE	<i>Picea abies</i>
537		18" NORWAY MAPLE	<i>Picea abies</i>
538		12" BLACK CHERRY	<i>Prunus serotina</i>
539		16" NORWAY SPRUCE	<i>Picea abies</i>
540		14" NORWAY MAPLE	<i>Acer platanoides</i>
541		18" NORWAY MAPLE	<i>Acer platanoides</i>
542		12" NORWAY SPRUCE	<i>Picea abies</i>
543		12" NORWAY SPRUCE	<i>Picea abies</i>
544		18" SILVER MAPLE	<i>Acer saccharinum</i>
545		18" NORWAY SPRUCE	<i>Picea abies</i>
546		12" NORWAY SPRUCE	<i>Picea abies</i>
547		18" NORWAY SPRUCE	<i>Picea abies</i>
548		18" NORWAY MAPLE	<i>Acer platanoides</i>
549		20" BOX ELDER	<i>Acer negundo</i>
550		28" NORWAY SPRUCE	<i>Picea abies</i>
551		18" NORWAY MAPLE	<i>Acer platanoides</i>
553		24" NORWAY MAPLE	<i>Acer platanoides</i>
555		12" RED PINE	<i>Pinus resinosa</i>
556		18" NORWAY MAPLE	<i>Acer platanoides</i>
557		18" TREE-OF-HEAVEN	<i>Ailanthus altissima</i>
558		16" BLACK CHERRY	<i>Prunus serotina</i>
559		12" WHITE PINE	<i>Pinus strobus</i>
560		12" SCOTCH PINE	<i>Pinus sylvestris</i>
561		12" SCOTCH PINE	<i>Pinus sylvestris</i>
563		24" NORWAY MAPLE	<i>Acer platanoides</i>
564		24" NORWAY MAPLE	<i>Acer platanoides</i>
566		24" SUGAR MAPLE	<i>Acer saccharum</i>
567		12" WHITE PINE	<i>Pinus strobus</i>
568		24" SUGAR MAPLE	<i>Acer saccharum</i>
569		24" SUGAR MAPLE	<i>Acer saccharum</i>
570		12" WHITE PINE	<i>Pinus strobus</i>
571		12" WHITE PINE	<i>Pinus strobus</i>
572		32" HORSE-CHESTNUT	<i>Aesculus hippocastanum</i>
573		12" BLACK WALNUT	<i>Juglans nigra</i>
574		12" BLACK WALNUT	<i>Juglans nigra</i>
575		12" BLACK WALNUT	<i>Juglans nigra</i>
576		12" BLACK WALNUT	<i>Juglans nigra</i>
577		34" SUGAR MAPLE	<i>Acer saccharum</i>
578		22" SUGAR MAPLE	<i>Acer saccharum</i>
583		12" NORWAY SPRUCE	<i>Picea abies</i>
584		12" NORWAY SPRUCE	<i>Picea abies</i>

585		14" NORWAY SPRUCE	<i>Picea abies</i>
601		(3)12" BOX ELDER	<i>Acer negundo</i>
602		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
603		14" BOX ELDER	<i>Acer negundo</i>
604		12" BOX ELDER	<i>Acer negundo</i>
605		18" BLACK CHERRY	<i>Prunus serotina</i>
606		14" BOX ELDER	<i>Acer negundo</i>
607		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
608		14" BLACK CHERRY	<i>Prunus serotina</i>
609		12" COTTONWOOD	<i>Populus deltoides</i>
610		14" COTTONWOOD	<i>Populus deltoides</i>
611		12" COTTONWOOD	<i>Populus deltoides</i>
612		24" BLACK CHERRY	<i>Prunus serotina</i>
613		12" BLACK CHERRY	<i>Prunus serotina</i>
614		12" BLACK CHERRY	<i>Prunus serotina</i>
615		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
616		14" BLACK CHERRY	<i>Prunus serotina</i>
617		16" BLACK CHERRY	<i>Prunus serotina</i>
618		14" BOX ELDER	<i>Acer negundo</i>
619		14" BLACK CHERRY	<i>Prunus serotina</i>
620		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
621		(2)18" BLACK CHERRY	<i>Prunus serotina</i>
622		14" BOX ELDER	<i>Acer negundo</i>
623		12" BOX ELDER	<i>Acer negundo</i>
624		(2)14" BOX ELDER	<i>Acer negundo</i>
625		14" COTTONWOOD	<i>Populus deltoides</i>
626		18" COTTONWOOD	<i>Populus deltoides</i>
627		14" WILLOW	<i>Salix species</i>
628		14" BOX ELDER	<i>Acer negundo</i>
629		12" BOX ELDER	<i>Acer negundo</i>
630		36" BEECH	<i>Fagus grandifolia</i>
631		42" SUGAR MAPLE	<i>Acer saccharum</i>
632		32" RED OAK	<i>Quercus rubra</i>
633		12" RED OAK	<i>Quercus rubra</i>
634		24" WILLOW	<i>Salix species</i>
635		48" WILLOW	<i>Salix species</i>
636		18" RED OAK	<i>Quercus rubra</i>
637		14" BOX ELDER	<i>Acer negundo</i>
638		12" BLACK CHERRY	<i>Prunus serotina</i>
639		14" BLACK CHERRY	<i>Prunus serotina</i>
640		12" RED OAK	<i>Quercus rubra</i>
641		12" RED OAK	<i>Quercus rubra</i>
642		14" BLACK CHERRY	<i>Prunus serotina</i>
643		12" RED OAK	<i>Quercus rubra</i>
644		16" WHITE ASH	<i>Fraxinus americana</i>
645		12" RED OAK	<i>Quercus rubra</i>
646		12" COTTONWOOD	<i>Populus deltoides</i>
647		12" RED OAK	<i>Quercus rubra</i>
648		16" WILLOW	<i>Salix species</i>
649		14" RED OAK	<i>Quercus rubra</i>
650		12" BLACK CHERRY	<i>Prunus serotina</i>
651		44" SUGAR MAPLE	<i>Acer saccharum</i>
652		48" SUGAR MAPLE	<i>Acer saccharum</i>
653		34" AMERICAN BEECH	<i>Fagus grandifolia</i>
654		36" AMERICAN BEECH	<i>Fagus grandifolia</i>
655		14" RED OAK	<i>Quercus rubra</i>
656		12" RED OAK	<i>Quercus rubra</i>

657		30" AMERICAN BEECH	<i>Fagus grandifolia</i>
658		12" RED OAK	<i>Quercus rubra</i>
659		30" SUGAR MAPLE	<i>Acer saccharum</i>
660		16" AMERICAN BEECH	<i>Fagus grandifolia</i>
661		14" RED MAPLE	<i>Acer rubrum</i>
662		(2)18" RED MAPLE	<i>Acer rubrum</i>
663		36" AMERICAN BEECH	<i>Fagus grandifolia</i>
664		22" RED MAPLE	<i>Acer rubrum</i>
665		18" SUGAR MAPLE	<i>Acer saccharum</i>
666		20" WHITE OAK	<i>Quercus alba</i>
667		14" SUGAR MAPLE	<i>Acer saccharum</i>
668		48" AMERICAN BEECH	<i>Fagus grandifolia</i>
669		36" AMERICAN BEECH	<i>Fagus grandifolia</i>
671		22" RED MAPLE	<i>Acer rubrum</i>
672		24" RED MAPLE	<i>Acer rubrum</i>
673		32" AMERICAN BEECH	<i>Fagus grandifolia</i>
674		32" AMERICAN BEECH	<i>Fagus grandifolia</i>
675		30" AMERICAN BEECH	<i>Fagus grandifolia</i>
676		22" AMERICAN BEECH	<i>Fagus grandifolia</i>
677		24" RED MAPLE	<i>Acer rubrum</i>
678		(3)12" SUGAR MAPLE	<i>Acer saccharum</i>
679		16" AMERICAN BEECH	<i>Fagus grandifolia</i>
680		16" SUGAR MAPLE	<i>Acer saccharum</i>
681		24" RED MAPLE	<i>Acer rubrum</i>
682		24" RED MAPLE	<i>Acer rubrum</i>
683		16" WHITE OAK	<i>Quercus alba</i>
684		24" SUGAR MAPLE	<i>Acer saccharum</i>
685		28" RED MAPLE	<i>Acer rubrum</i>
686		22" AMERICAN BEECH	<i>Fagus grandifolia</i>
687		16" WHITE OAK	<i>Quercus alba</i>
688		24" SUGAR MAPLE	<i>Acer saccharum</i>
689		36" AMERICAN BEECH	<i>Fagus grandifolia</i>
690		22" AMERICAN BEECH	<i>Fagus grandifolia</i>
691		14" AMERICAN BEECH	<i>Fagus grandifolia</i>
692		20" SUGAR MAPLE	<i>Acer saccharum</i>
693		18" AMERICAN BEECH	<i>Fagus grandifolia</i>
694		14" WHITE OAK	<i>Quercus alba</i>
695		22" AMERICAN BEECH	<i>Fagus grandifolia</i>
696		18" WHITE OAK	<i>Quercus alba</i>
697		20" BLACK CHERRY	<i>Prunus serotina</i>
698		16" AMERICAN BEECH	<i>Fagus grandifolia</i>
699		18" BLACK CHERRY	<i>Prunus serotina</i>
700		36" AMERICAN BEECH	<i>Fagus grandifolia</i>
701		22" RED MAPLE	<i>Acer rubrum</i>
702		12" WHITE ASH	<i>Fraxinus americana</i>
702a		16" AMERICAN ELM	<i>Ulmus americana</i>
702b		30" RED MAPLE	<i>Acer rubrum</i>
702c		16" BLACK CHERRY	<i>Prunus serotina</i>
702d		12" BLACK CHERRY	<i>Prunus serotina</i>
702e		12" BLACK CHERRY	<i>Prunus serotina</i>
704		22" RED OAK	<i>Quercus rubra</i>
704a		12" AMERICAN ELM	<i>Ulmus americana</i>
705		(2)14" RED OAK	<i>Quercus rubra</i>
706		16" WHITE ASH	<i>Fraxinus americana</i>
707		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
708		14" AMERICAN ELM	<i>Ulmus americana</i>
709		12" RED MAPLE	<i>Acer rubrum</i>

710		16" COTTONWOOD	<i>Populus deltoides</i>
711		16" COTTONWOOD	<i>Populus deltoides</i>
712		14" BLACK CHERRY	<i>Prunus serotina</i>
713		16" BLACK CHERRY	<i>Prunus serotina</i>
713a		14" BLACK CHERRY	<i>Prunus serotina</i>
713b		16" BLACK CHERRY	<i>Prunus serotina</i>
713c		12" BLACK CHERRY	<i>Prunus serotina</i>
714		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
715		16" BLACK CHERRY	<i>Prunus serotina</i>
716		14" BLACK CHERRY	<i>Prunus serotina</i>
717		16" BLACK CHERRY	<i>Prunus serotina</i>
717a		16" BLACK CHERRY	<i>Prunus serotina</i>
717b		14" BLACK CHERRY	<i>Prunus serotina</i>
717c		12" BLACK CHERRY	<i>Prunus serotina</i>
717d		12" BLACK CHERRY	<i>Prunus serotina</i>
717e		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
718		(2)14" RED MAPLE	<i>Acer rubrum</i>
718a		12" RED OAK	<i>Quercus rubra</i>
719		16" BLACK CHERRY	<i>Prunus serotina</i>
720		18" RED OAK	<i>Quercus rubra</i>
720a		14" BLACK CHERRY	<i>Prunus serotina</i>
720b		12" BLACK CHERRY	<i>Prunus serotina</i>
720c		16" BLACK CHERRY	<i>Prunus serotina</i>
720d		14" BLACK CHERRY	<i>Prunus serotina</i>
721		(2)16" BLACK CHERRY	<i>Prunus serotina</i>
722		16" BLACK CHERRY	<i>Prunus serotina</i>
723		(4)16" BLACK CHERRY	<i>Prunus serotina</i>
724		16" BLACK CHERRY	<i>Prunus serotina</i>
725		(2)16" BLACK CHERRY	<i>Prunus serotina</i>
726		18" BLACK CHERRY	<i>Prunus serotina</i>
727		12" RED OAK	<i>Quercus rubra</i>
728		14" BLACK CHERRY	<i>Quercus rubra</i>
728a		(2)12" BLACK CHERRY	<i>Quercus rubra</i>
728b		12" BLACK CHERRY	<i>Quercus rubra</i>
729		14" HACKBERRY	<i>Celtis occidentalis</i>
729a		16" BLACK CHERRY	<i>Quercus rubra</i>
730		14" BLACK CHERRY	<i>Quercus rubra</i>
731		16" BLACK CHERRY	<i>Quercus rubra</i>
732		10" HACKBERRY	<i>Celtis occidentalis</i>
733		14" WHITE ASH	<i>Fraxinus americana</i>
734		10" HACKBERRY	<i>Celtis occidentalis</i>
734a		14" WHITE ASH	<i>Fraxinus americana</i>
735		12" COTTONWOOD	<i>Populus deltoides</i>
735a		14" BOX ELDER	<i>Acer negundo</i>
736		14" COTTONWOOD	<i>Populus deltoides</i>
737a		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
738		14" COTTONWOOD	<i>Populus deltoides</i>
739		(2)12" COTTONWOOD	<i>Populus deltoides</i>
740		(3)16" BLACK CHERRY	<i>Prunus serotina</i>
740a		12" BLACK CHERRY	<i>Prunus serotina</i>
740b		(3)12" BLACK CHERRY	<i>Prunus serotina</i>
741		(2)14" BLACK CHERRY	<i>Prunus serotina</i>
742		(2)12" COTTONWOOD	<i>Populus deltoides</i>
742a		12" COTTONWOOD	<i>Populus deltoides</i>
742b		(2)12" COTTONWOOD	<i>Populus deltoides</i>
742c		12" COTTONWOOD	<i>Populus deltoides</i>
743		14" COTTONWOOD	<i>Populus deltoides</i>

743a		(2)12" COTTONWOOD	<i>Populus deltoides</i>
743b		(2)12" COTTONWOOD	<i>Populus deltoides</i>
743c		(2)12" COTTONWOOD	<i>Populus deltoides</i>
744		(4)12" COTTONWOOD	<i>Populus deltoides</i>
745		14" COTTONWOOD	<i>Populus deltoides</i>
746		(3)12" COTTONWOOD	<i>Populus deltoides</i>
747		(4)12" COTTONWOOD	<i>Populus deltoides</i>
748		16" COTTONWOOD	<i>Populus deltoides</i>
749		14" BOX ELDER	<i>Acer negundo</i>
749a		(2)18" COTTONWOOD	<i>Populus deltoides</i>
750		14" COTTONWOOD	<i>Populus deltoides</i>
750a		12" BOX ELDER	<i>Acer negundo</i>
750b		12" COTTONWOOD	<i>Populus deltoides</i>
750c		12" COTTONWOOD	<i>Populus deltoides</i>
750d		(3)10" BLACK CHERRY	<i>Prunus serotina</i>
750e		12" COTTONWOOD	<i>Populus deltoides</i>
750f		12" COTTONWOOD	<i>Populus deltoides</i>
750g		14" COTTONWOOD	<i>Populus deltoides</i>
750h		12" COTTONWOOD	<i>Populus deltoides</i>
751		(2)12" RED MAPLE	<i>Acer rubrum</i>
751a		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
751b		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
751c		(3)12" BLACK CHERRY	<i>Prunus serotina</i>
752		12" WHITE OAK	<i>Quercus alba</i>
752a		12" RED OAK	<i>Quercus rubra</i>
752b		12" RED OAK	<i>Quercus rubra</i>
753		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
754		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
755		(3)14" BOX ELDER	<i>Acer negundo</i>
756		(2)14" HACKBERRY	<i>Celtis occidentalis</i>
757		18" BURR OAK	<i>Quercus macrocarpa</i>
758		24" COTTONWOOD	<i>Populus deltoides</i>
759		16" BOX ELDER	<i>Acer negundo</i>
760		42" BURR OAK	<i>Quercus macrocarpa</i>
761		12" COTTONWOOD	<i>Populus deltoides</i>
762		24" COTTONWOOD	<i>Populus deltoides</i>
763		14" COTTONWOOD	<i>Populus deltoides</i>
764		14" COTTONWOOD	<i>Populus deltoides</i>
765		(2)14" COTTONWOOD	<i>Populus deltoides</i>
766		18" COTTONWOOD	<i>Populus deltoides</i>
767		22" COTTONWOOD	<i>Populus deltoides</i>
768		14" COTTONWOOD	<i>Populus deltoides</i>
769		14" COTTONWOOD	<i>Populus deltoides</i>
770		16" COTTONWOOD	<i>Populus deltoides</i>
771		12" COTTONWOOD	<i>Populus deltoides</i>
772		12" COTTONWOOD	<i>Populus deltoides</i>
773		14" BLACK CHERRY	<i>Prunus serotina</i>
774		14" BLACK CHERRY	<i>Prunus serotina</i>
775		12" COTTONWOOD	<i>Populus deltoides</i>
776		12" COTTONWOOD	<i>Populus deltoides</i>
777		12" COTTONWOOD	<i>Populus deltoides</i>
778		12" COTTONWOOD	<i>Populus deltoides</i>
779		12" BOX ELDER	<i>Acer negundo</i>
780		24" BOX ELDER	<i>Acer negundo</i>
781		12" BOX ELDER	<i>Acer negundo</i>
782		14" BOX ELDER	<i>Acer negundo</i>
783		(2)16" BOX ELDER	<i>Acer negundo</i>

784		12" BLACK CHERRY	<i>Prunus serotina</i>
785		18" COTTONWOOD	<i>Populus deltoides</i>
786		18" COTTONWOOD	<i>Populus deltoides</i>
788		14" BLACK CHERRY	<i>Prunus serotina</i>
789		12" BLACK CHERRY	<i>Prunus serotina</i>
790		14" BLACK CHERRY	<i>Prunus serotina</i>
791		18" COTTONWOOD	<i>Populus deltoides</i>
792		12" BLACK CHERRY	<i>Prunus serotina</i>
793		54" BURR OAK	<i>Quercus macrocarpa</i>
794		14" SUGAR MAPLE	<i>Acer saccharum</i>
795		12" SUGAR MAPLE	<i>Acer saccharum</i>
796		14" BOX ELDER	<i>Acer negundo</i>
797		12" RED OAK	<i>Quercus rubra</i>
797a		48" SUGAR MAPLE	<i>Acer saccharum</i>
799		48" SUGAR MAPLE	<i>Acer saccharum</i>
800		12" RED OAK	<i>Quercus rubra</i>
801		12" RED OAK	<i>Quercus rubra</i>
802		12" RED OAK	<i>Quercus rubra</i>
820		14" BLACK CHERRY	<i>Prunus serotina</i>
821		16" BLACK CHERRY	<i>Prunus serotina</i>
822		16" WHITE PINE	<i>Pinus strobus</i>
823		14" WHITE PINE	<i>Pinus strobus</i>
824		14" WHITE PINE	<i>Pinus strobus</i>
825		14" WHITE PINE	<i>Pinus strobus</i>
826		14" WHITE PINE	<i>Pinus strobus</i>
827		14" BOX ELDER	<i>Acer negundo</i>
828		14" BOX ELDER	<i>Acer negundo</i>
829		16" BOX ELDER	<i>Acer negundo</i>
830		(4)14" BOX ELDER	<i>Acer negundo</i>
831		(3)12" BLACK WALNUT	<i>Juglans nigra</i>
832		12" COTTONWOOD	<i>Populus deltoides</i>
833		12" NORWAY MAPLE	<i>Acer platanoides</i>
834		(2)30" NORWAY MAPLE	<i>Acer platanoides</i>
835		24" NORWAY MAPLE	<i>Acer platanoides</i>
836		22" NORWAY MAPLE	<i>Acer platanoides</i>
837		16" NORWAY MAPLE	<i>Acer platanoides</i>
838		12" NORWAY MAPLE	<i>Acer platanoides</i>
839		16" NORWAY MAPLE	<i>Acer platanoides</i>
840		12" NORWAY MAPLE	<i>Acer platanoides</i>
841		20" NORWAY MAPLE	<i>Acer platanoides</i>
842		12" NORWAY MAPLE	<i>Acer platanoides</i>
843		12" NORWAY MAPLE	<i>Acer platanoides</i>
844		36" NORWAY MAPLE	<i>Acer platanoides</i>
845		32" SUGAR MAPLE	<i>Acer saccharum</i>
846		22" NORWAY SPRUCE	<i>Picea abies</i>
847		24" NORWAY MAPLE	<i>Acer platanoides</i>
848		12" NORWAY MAPLE	<i>Acer platanoides</i>
849		16" NORWAY MAPLE	<i>Acer platanoides</i>
850		24" WHITE MULBERRY	<i>Morus alba</i>
854		18" WILLOW	<i>Salix species</i>
855		12" COTTONWOOD	<i>Populus deltoides</i>
855a		12" COTTONWOOD	<i>Populus deltoides</i>
856		12" COTTONWOOD	<i>Populus deltoides</i>
857		(2)12" COTTONWOOD	<i>Populus deltoides</i>
858		(2)12" BOX ELDER	<i>Acer negundo</i>
858a		16" WHITE PINE	<i>Pinus strobus</i>
858b		12" WHITE PINE	<i>Pinus strobus</i>

858c		12" WHITE PINE	<i>Pinus strobus</i>
858d		14" WHITE PINE	<i>Pinus strobus</i>
858e		14" WHITE PINE	<i>Pinus strobus</i>
860		(3)10" BLACK CHERRY	<i>Prunus serotina</i>
861		12" BLACK CHERRY	<i>Prunus serotina</i>
862		12" BOX ELDER	<i>Acer negundo</i>
862a		12" BLACK CHERRY	<i>Prunus serotina</i>
862b		12" BOX ELDER	<i>Acer negundo</i>
862c		12" BOX ELDER	<i>Acer negundo</i>
862d		12" BOX ELDER	<i>Acer negundo</i>
863		(4)12" RED MAPLE	<i>Acer rubrum</i>
864		12" SUGAR MAPLE	<i>Acer saccharum</i>
865		16" SUGAR MAPLE	<i>Acer saccharum</i>
866		14" COTTONWOOD	<i>Populus deltoides</i>
867		24" BLACK CHERRY	<i>Prunus serotina</i>
868		14" BLACK CHERRY	<i>Prunus serotina</i>
869		(2)14" BLACK CHERRY	<i>Prunus serotina</i>
870		(2)14" BLACK CHERRY	<i>Prunus serotina</i>
871		22" HACKBERRY	<i>Celtis occidentalis</i>
872		(2)16" BLACK CHERRY	<i>Prunus serotina</i>
873		18" BOX ELDER	<i>Acer negundo</i>
873a		12" BOX ELDER	<i>Acer negundo</i>
874		14" BLACK CHERRY	<i>Prunus serotina</i>
875		12" BOX ELDER	<i>Acer negundo</i>
876		(3)12" BOX ELDER	<i>Acer negundo</i>
877		12" BOX ELDER	<i>Acer negundo</i>
879		(2)12" BOX ELDER	<i>Acer negundo</i>
880		12" BOX ELDER	<i>Acer negundo</i>
880a		12" BOX ELDER	<i>Acer negundo</i>
881		12" BOX ELDER	<i>Acer negundo</i>
882		14" BLACK CHERRY	<i>Prunus serotina</i>
883		16" BLACK CHERRY	<i>Prunus serotina</i>
884		(2)16" BLACK CHERRY	<i>Prunus serotina</i>
885		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
886		(2)12" BOX ELDER	<i>Acer negundo</i>
887		(3)12" BOX ELDER	<i>Acer negundo</i>
888		(2)12" BOX ELDER	<i>Acer negundo</i>
889		14" BOX ELDER	<i>Acer negundo</i>
890		12" BOX ELDER	<i>Acer negundo</i>
891		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
892		14" BLACK CHERRY	<i>Prunus serotina</i>
893		36" COTTONWOOD	<i>Populus deltoides</i>
894		12" BLACK CHERRY	<i>Prunus serotina</i>
895		16" BLACK CHERRY	<i>Prunus serotina</i>
896		(3)12" BOX ELDER	<i>Acer negundo</i>
897		12" BOX ELDER	<i>Acer negundo</i>
898		(2)12" BOX ELDER	<i>Acer negundo</i>
899		18" BOX ELDER	<i>Acer negundo</i>
899a		16" BOX ELDER	<i>Acer negundo</i>
900		30" COTTONWOOD	<i>Populus deltoides</i>
900a		18" BOX ELDER	<i>Acer negundo</i>
900b		30" COTTONWOOD	<i>Populus deltoides</i>
901		(2)18" BOX ELDER	<i>Acer negundo</i>
902		14" BOX ELDER	<i>Acer negundo</i>
903		16" BOX ELDER	<i>Acer negundo</i>
904		18" COTTONWOOD	<i>Populus deltoides</i>
905		14" BOX ELDER	<i>Acer negundo</i>

906		14" BOX ELDER	<i>Acer negundo</i>
907		12" BOX ELDER	<i>Acer negundo</i>
908		14" BOX ELDER	<i>Acer negundo</i>
909		16" BOX ELDER	<i>Acer negundo</i>
910		14" BOX ELDER	<i>Acer negundo</i>
911		16" BOX ELDER	<i>Acer negundo</i>
912		14" BOX ELDER	<i>Acer negundo</i>
913		22" BOX ELDER	<i>Acer negundo</i>
914		14" BOX ELDER	<i>Acer negundo</i>
915		14" BOX ELDER	<i>Acer negundo</i>
916		12" BOX ELDER	<i>Acer negundo</i>
917		16" BOX ELDER	<i>Acer negundo</i>
918		14" BOX ELDER	<i>Acer negundo</i>
919		14" BLACK CHERRY	<i>Prunus serotina</i>
920		16" BOX ELDER	<i>Acer negundo</i>
921		16" BOX ELDER	<i>Acer negundo</i>
922		14" BLACK CHERRY	<i>Prunus serotina</i>
923		(2)18" BOX ELDER	<i>Acer negundo</i>
924		14" BOX ELDER	<i>Acer negundo</i>
925		(4)14" BOX ELDER	<i>Acer negundo</i>
926		22" BOX ELDER	<i>Acer negundo</i>
926a		(3)12" BOX ELDER	<i>Acer negundo</i>
927		(2)12" BOX ELDER	<i>Acer negundo</i>
928		16" BOX ELDER	<i>Acer negundo</i>
929		(2)14" BOX ELDER	<i>Acer negundo</i>
930		12" BOX ELDER	<i>Acer negundo</i>
931		42" SUGAR MAPLE	<i>Acer saccharum</i>
931a		(2)12" BOX ELDER	<i>Acer negundo</i>
931b		12" AMERICAN ELM	<i>Ulmus americana</i>
931c		14" BOX ELDER	<i>Acer negundo</i>
931d		16" BOX ELDER	<i>Acer negundo</i>
931e		14" BOX ELDER	<i>Acer negundo</i>
931f		14" BOX ELDER	<i>Acer negundo</i>
931g		16" BOX ELDER	<i>Acer negundo</i>
931h		(2)22" BOX ELDER	<i>Acer negundo</i>
931i		12" BOX ELDER	<i>Acer negundo</i>
931j		12" BOX ELDER	<i>Acer negundo</i>
931k		12" BOX ELDER	<i>Acer negundo</i>
931l		14" BOX ELDER	<i>Acer negundo</i>
931m		12" BOX ELDER	<i>Acer negundo</i>
931n		12" BLACK CHERRY	<i>Prunus serotina</i>
931p		16" BOX ELDER	<i>Acer negundo</i>
932		12" BOX ELDER	<i>Acer negundo</i>
932a		16" BOX ELDER	<i>Acer negundo</i>
932b		16" BOX ELDER	<i>Acer negundo</i>
932c		12" WHITE ASH	<i>Acer negundo</i>
932d		16" BOX ELDER	<i>Acer negundo</i>
933		12" BOX ELDER	<i>Acer negundo</i>
933a		(3)16" SILVER MAPLE	<i>Acer saccharinum</i>
933b		12" BOX ELDER	<i>Acer negundo</i>
933c		16" BOX ELDER	<i>Acer negundo</i>
933d		16" BOX ELDER	<i>Acer negundo</i>
933e		16" BOX ELDER	<i>Acer negundo</i>
934		16" BOX ELDER	<i>Acer negundo</i>
935		(2)12" BLACK CHERRY	<i>Prunus serotina</i>
936		(2)14" BOX ELDER	<i>Acer negundo</i>
937		18" BOX ELDER	<i>Acer negundo</i>

938		18" BOX ELDER	<i>Acer negundo</i>
939		18" BOX ELDER	<i>Acer negundo</i>
939a		(2)14" BLACK CHERRY	<i>Prunus serotina</i>
940		(2)14" BOX ELDER	<i>Acer negundo</i>
941		18" BLACK CHERRY	<i>Prunus serotina</i>
941a		18" BOX ELDER	<i>Acer negundo</i>
942		(3)12" BOX ELDER	<i>Acer negundo</i>
942a		12" BLACK CHERRY	<i>Prunus serotina</i>
943		(3)14" BOX ELDER	<i>Acer negundo</i>
944		(2)18" BOX ELDER	<i>Acer negundo</i>
945		(4)14" BOX ELDER	<i>Acer negundo</i>
946		12" BOX ELDER	<i>Acer negundo</i>
946a		12" BOX ELDER	<i>Acer negundo</i>
947		(3)12" BOX ELDER	<i>Acer negundo</i>
948		(3)16" BOX ELDER	<i>Acer negundo</i>
949		14" BOX ELDER	<i>Acer negundo</i>
950		16" COTTONWOOD	<i>Populus deltoides</i>
951		12" COTTONWOOD	<i>Populus deltoides</i>
952		12" BOX ELDER	<i>Acer negundo</i>
953		(2)14" BOX ELDER	<i>Acer negundo</i>
953a		14" COTTONWOOD	<i>Populus deltoides</i>
954		(2)18" BOX ELDER	<i>Acer negundo</i>
955		(2)12" BOX ELDER	<i>Acer negundo</i>
957		12" BOX ELDER	<i>Acer negundo</i>
959		14" COTTONWOOD	<i>Populus deltoides</i>
960		12" BLACK CHERRY	<i>Prunus serotina</i>
961		12" COTTONWOOD	<i>Populus deltoides</i>
962		12" COTTONWOOD	<i>Populus deltoides</i>
962a		(2)12" BOX ELDER	<i>Acer negundo</i>
963		12" COTTONWOOD	<i>Populus deltoides</i>
964		12" COTTONWOOD	<i>Populus deltoides</i>
964a		12" COTTONWOOD	<i>Populus deltoides</i>
964b		12" COTTONWOOD	<i>Populus deltoides</i>
964c		12" COTTONWOOD	<i>Populus deltoides</i>
964d		(2)12" BOX ELDER	<i>Acer negundo</i>
965		14" COTTONWOOD	<i>Populus deltoides</i>
966		(2)14" COTTONWOOD	<i>Populus deltoides</i>
966a		14" COTTONWOOD	<i>Populus deltoides</i>
967		(4)10" COTTONWOOD	<i>Populus deltoides</i>
968		12" WHITE ASH	<i>Fraxinus americana</i>
969		12" BOX ELDER	<i>Acer negundo</i>
970		18" BLACK CHERRY	<i>Prunus serotina</i>
971		(2)16" HACKBERRY	<i>Celtis occidentalis</i>
972		(2)12" COTTONWOOD	<i>Populus deltoides</i>
973		14" COTTONWOOD	<i>Populus deltoides</i>
974		(4)14" COTTONWOOD	<i>Populus deltoides</i>
975		16" BLACK CHERRY	<i>Prunus serotina</i>
976		18" COTTONWOOD	<i>Populus deltoides</i>
977		14" COTTONWOOD	<i>Populus deltoides</i>
978		14" COTTONWOOD	<i>Populus deltoides</i>
979		18" COTTONWOOD	<i>Populus deltoides</i>
980		12" COTTONWOOD	<i>Populus deltoides</i>
981		18" BLACK CHERRY	<i>Prunus serotina</i>
982		(3)12" COTTONWOOD	<i>Populus deltoides</i>
983		(2)12" COTTONWOOD	<i>Populus deltoides</i>
984		(2)12" BLACK LOCUST	<i>Robinia pseudoacacia</i>
985		12" WHITE ASH	<i>Fraxinus americana</i>

986		12" BLACK CHERRY	<i>Prunus serotina</i>
987		(2)12" COTTONWOOD	<i>Populus deltoides</i>
988		12" BLACK CHERRY	<i>Prunus serotina</i>
989		12" BLACK CHERRY	<i>Prunus serotina</i>
990		12" BLACK CHERRY	<i>Prunus serotina</i>
991		(2)16" COTTONWOOD	<i>Populus deltoides</i>
992		(2)14" COTTONWOOD	<i>Populus deltoides</i>
993		(3)12" COTTONWOOD	<i>Populus deltoides</i>
994		12" COTTONWOOD	<i>Populus deltoides</i>
995		(2)12" COTTONWOOD	<i>Populus deltoides</i>
996		(2)12" COTTONWOOD	<i>Populus deltoides</i>
997		(2)12" COTTONWOOD	<i>Populus deltoides</i>
998		12" BOX ELDER	<i>Acer negundo</i>
999		12" BLACK CHERRY	<i>Prunus serotina</i>
1000		14" BOX ELDER	<i>Acer negundo</i>
1501		12" RED OAK	<i>Quercus rubra</i>
1502		12" AMERICAN ELM	<i>Ulmus americana</i>
1503		12" RED OAK	<i>Quercus rubra</i>
1504		12" RED OAK	<i>Quercus rubra</i>
1505		12" RED OAK	<i>Quercus rubra</i>
1506		12" RED OAK	<i>Quercus rubra</i>
1507		12" RED OAK	<i>Quercus rubra</i>
1508		12" RED OAK	<i>Quercus rubra</i>
1509		12" BLACK CHERRY	<i>Prunus serotina</i>
1510		30" BASSWOOD	<i>Tilia americana</i>
1511		14" RED OAK	<i>Quercus rubra</i>
1512		24" BASSWOOD	<i>Tilia americana</i>
1513		24" SUGAR MAPLE	<i>Acer saccharum</i>
1514		12" RED OAK	<i>Quercus rubra</i>
1515		14" RED OAK	<i>Quercus rubra</i>
1516		14" RED OAK	<i>Quercus rubra</i>
1517		12" RED OAK	<i>Quercus rubra</i>
1518		48" BURR OAK	<i>Quercus macrocarpa</i>
1519		12" IRONWOOD	<i>Ostrya virginiana</i>
1520		22" AMERICAN BEECH	<i>Fagus grandifolia</i>
1521		24" AMERICAN BEECH	<i>Fagus grandifolia</i>
1522		26" AMERICAN BEECH	<i>Fagus grandifolia</i>
1523		32" AMERICAN BEECH	<i>Fagus grandifolia</i>
1524		12" RED OAK	<i>Quercus rubra</i>
1526		12" WHITE OAK	<i>Quercus alba</i>
1527		22" AMERICAN BEECH	<i>Fagus grandifolia</i>
1528		22" WHITE OAK	<i>Quercus alba</i>
1528a		14" AMERICAN BEECH	<i>Fagus grandifolia</i>
1528b		18" WHITE OAK	<i>Quercus alba</i>
1529		16" AMERICAN BEECH	<i>Fagus grandifolia</i>
1530		14" RED OAK	<i>Quercus rubra</i>
1531		12" RED OAK	<i>Quercus rubra</i>
1532		12" RED OAK	<i>Quercus rubra</i>
1533		18" SUGAR MAPLE	<i>Acer saccharum</i>
1534		28" AMERICAN BEECH	<i>Fagus grandifolia</i>
1535		32" AMERICAN BEECH	<i>Fagus grandifolia</i>
1536		14" AMERICAN BEECH	<i>Fagus grandifolia</i>
1537		24" SUGAR MAPLE	<i>Acer saccharum</i>
1538		24" RED OAK	<i>Quercus rubra</i>
1539		12" RED OAK	<i>Quercus rubra</i>
1540		12" RED OAK	<i>Quercus rubra</i>
1541		12" RED OAK	<i>Quercus rubra</i>

1543		12" PIN CHERRY	<i>Prunus serotina</i>
1544		20" AMERICAN BEECH	<i>Fagus grandifolia</i>
1545		24" AMERICAN BEECH	<i>Fagus grandifolia</i>
1546		24" SUGAR MAPLE	<i>Acer saccharum</i>
1547		12" RED OAK	<i>Quercus rubra</i>
1548		16" RED OAK	<i>Quercus rubra</i>
1549		16" RED OAK	<i>Quercus rubra</i>
1550		12" RED OAK	<i>Quercus rubra</i>
1551		36" AMERICAN BEECH	<i>Fagus grandifolia</i>
1552		20" AMERICAN BEECH	<i>Fagus grandifolia</i>
1553		14" RED OAK	<i>Quercus rubra</i>
1554		14" RED OAK	<i>Quercus rubra</i>
1555		(2)12" COTTONWOOD	<i>Populus deltoides</i>
1556		14" RED OAK	<i>Quercus rubra</i>
1557		(2)12" COTTONWOOD	<i>Populus deltoides</i>
1558		12" RED OAK	<i>Quercus rubra</i>
1559		12" RED OAK	<i>Quercus rubra</i>
1560		12" RED OAK	<i>Quercus rubra</i>
1561		14" RED OAK	<i>Quercus rubra</i>
1562		14" RED OAK	<i>Quercus rubra</i>
1563		12" SUGAR MAPLE	<i>Acer saccharum</i>
1564		14" NORWAY MAPLE	<i>Acer platanoides</i>
1565		14" SUGAR MAPLE	<i>Acer saccharum</i>
1566		14" BLACK CHERRY	<i>Prunus serotina</i>
1567		14" COTTONWOOD	<i>Populus deltoides</i>
1568		28" AMERICAN BEECH	<i>Fagus grandifolia</i>
1569		12" RED OAK	<i>Quercus rubra</i>
1570		16" BOX ELDER	<i>Acer negundo</i>
1570a		16" BOX ELDER	<i>Acer negundo</i>
1571		(2)12" BOX ELDER	<i>Acer negundo</i>
1571a		(2)12" BOX ELDER	<i>Acer negundo</i>
1572		12" BLACK CHERRY	<i>Prunus serotina</i>
1572a		12" BLACK CHERRY	<i>Prunus serotina</i>
2100		12" BOX ELDER	<i>Acer negundo</i>
2101		16" BOX ELDER	<i>Acer negundo</i>
2102		12" BOX ELDER	<i>Acer negundo</i>
2103		14" BOX ELDER	<i>Acer negundo</i>
2104		16" BOX ELDER	<i>Acer negundo</i>
2105		14" BLACK CHERRY	<i>Prunus serotina</i>
2106		14" BOX ELDER	<i>Acer negundo</i>
2107		12" BOX ELDER	<i>Acer negundo</i>
2108		14" BOX ELDER	<i>Acer negundo</i>
2109		20" BLACK CHERRY	<i>Prunus serotina</i>
2110		12" WHITE OAK	<i>Quercus alba</i>
2111		18" BLACK CHERRY	<i>Prunus serotina</i>
2112		12" BOX ELDER	<i>Acer negundo</i>
2113		14" BOX ELDER	<i>Acer negundo</i>
2114		12" BOX ELDER	<i>Acer negundo</i>
2115		12" BOX ELDER	<i>Acer negundo</i>
2116		16" BOX ELDER	<i>Acer negundo</i>
2117		12" HACKBERRY	<i>Celtis occidentalis</i>
2118		12" BLACK CHERRY	<i>Prunus serotina</i>
2119		14" BOX ELDER	<i>Acer negundo</i>
2120		12" HACKBERRY	<i>Celtis occidentalis</i>
2121		14" BLACK CHERRY	<i>Prunus serotina</i>
2122		36" SUGAR MAPLE	<i>Acer saccharum</i>
2123		12" BLACK CHERRY	<i>Prunus serotina</i>

2124		16" BLACK CHERRY	<i>Prunus serotina</i>
2125		14" AMERICAN ELM	<i>Ulmus americana</i>
2126		14" SUGAR MAPLE	<i>Acer saccharum</i>
2127		12" BOX ELDER	<i>Acer negundo</i>
2130		16" BLACK CHERRY	<i>Prunus serotina</i>
2131		14" BOX ELDER	<i>Acer negundo</i>
2132		14" APPLE	<i>Malus pumila</i>
2133		12" BOX ELDER	<i>Acer negundo</i>
2134		12" BOX ELDER	<i>Acer negundo</i>
2135		12" BLACK CHERRY	<i>Prunus serotina</i>
2136		32" SUGAR MAPLE	<i>Acer saccharum</i>
2137		12" BOX ELDER	<i>Acer negundo</i>
2138		14" BOX ELDER	<i>Acer negundo</i>
2139		18" WHITE OAK	<i>Quercus alba</i>
2140		14" BOX ELDER	<i>Acer negundo</i>



December 19, 2017  
Project No. G171994

Mr. Mark Kieselbach  
Charter Township of Meridian  
5151 Marsh Road  
Okemos, MI 48864-1198

Re: Wetland Investigation – WDV 17-06  
Sturk Property  
Bennett Road, Okemos, Ingham County, Michigan

Dear Mr. Kieselbach:

On November 20 and 28, 2017, Fishbeck, Thompson, Carr & Huber, Inc. (FTCH) staff conducted a field investigation to determine whether wetlands are present on the approximately 76.5-acre Sturk Property (the Site). The Site is located directly north of Bennett Road and 0.25 mile east of South Hagadorn Road (see Figure 1). The results of the investigation are included in this report.

The area of investigation is located in the southwest  $\frac{1}{4}$  of Section 29, Town 4 North, Range 1 West, and consists of multiple parcels. The Site contains historically disturbed undeveloped property. Its southern end contains three residential parcels fronting Bennett Road. An additional residence is located in the southeast quadrant of the Site. The Site is bound by undeveloped property to the north; residential property, the Okemos Public Schools bus garage and Schultz Veterinary Clinic to the east; Bennett Road, and the College Fields Golf Club to the south and west. Herron Creek flows north-northeast through the golf course and onto the northwest edge of the Site, as indicated in Figure 1.

The investigation was conducted in a manner consistent with the 1987 *Corps of Engineers Wetlands Delineation Manual* and 2012 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region* (Version 2). The wetlands identification and delineation procedures outlined in these manuals require evaluation of site vegetation, soils, and hydrologic characteristics. Hydrophytic vegetation decisions are based on the wetland indicator status of species that are dominant in the plant community. Species with indicator statuses of obligate wetland (OBL), facultative wetland (FACW), and facultative (FAC) are considered wetland species, while species with indicator statuses of facultative upland (FACU) and upland (UPL) are considered upland species. FAC species are also commonly present in upland plant communities.

## Literature Review

The Charter Township of Meridian (Township) wetland map for Section 29 indicates two wetlands on the Site:

- Wetland 29-1, a 131.30-acre emergent and scrub shrub wetland associated with Herron Creek. The wetland wraps around the north and northeast ends of the Site
- Wetland 29-2, a 0.46-acre emergent wetland in the Site's southeast quadrant.

According to the U.S. Department of Agriculture Natural Resources Conservation Service *Web Soil Survey*, the area mapped as Wetland 29-1 contains Houghton muck (100% hydric rating) and Colwood-Brookston loams (80% hydric rating). The remainder of the Site contains several different soil series ranked as not hydric or 1 to 32% hydric (Appendix 1).

The National Wetlands Inventory map indicates forested and emergent wetlands are present in generally the same areas as those with mapped hydric soil (Appendix 2).

## Site Investigation

The area of investigation and wetland sampling locations are noted in Figure 1. Photographs of wetland sampling points and associated plant communities are included in Appendix 3. The investigation was conducted after a killing frost which resulted in significant die-back of herbaceous vegetation. The Site sloped down to the north and to the east, to wetland areas. Overall, the Site's upland areas appeared highly disturbed, with many piles of fill soil and a network of dirt two-track trails and gravel access roads. Many of the fill piles were well-vegetated with large woody plants, indicating fill operations occurred historically. Google Earth aerial photographs dating back to 1999 confirmed extensive ground disturbance, fill placement, and ditches. Additionally, piles of wood and metal were observed onsite.

The northern portion of the Site contained an extensive emergent wetland dominated with reed canarygrass (*Phalaris arundinacea*, FACW). This wetland is designated as Wetland A on the Wetland Sketch Plan in Appendix 4. It corresponds to Township Wetland 29-1 and is contiguous with Herron Creek. Shrub thickets adjacent to the emergent wetland were dominated by northern prickly-ash (*Zanthoxylum americanum*, FACU), an upland species. The wetland boundary was generally located at the interface of the shrub thicket and the reed canarygrass-dominated plant community. Wetland A encompassed 9.06 acres on the Site.

No indication of Township Wetland 29-2 was observed during the site investigation. The area mapped on the Township wetland map was semi-developed and located just north of a house. It contained upland vegetation, including invasive honeysuckle shrubs (*Lonicera* sp.).

Wetland B was observed near the eastern property boundary, approximately midway between the north and south property boundaries. It consisted of an emergent/forested/scrub-shrub wetland complex. Sampling Point SP-B was located at the western edge of this wetland complex in forest dominated with box-elder trees (*Acer negundo*, FAC) and glossy buckthorn trees and shrubs (*Frangula alnus*, FAC). The adjacent emergent wetland contained shallow standing water.

Wetland sampling point SP-E was evaluated approximately 400 feet north-northeast of SP-B in forested wetland dominated by eastern cottonwood (*Populus deltoides*, FAC) and glossy buckthorn trees. Emergent wetland with shallow standing water was present further to the east. Wetland delineation determined that this wetland extended offsite to the east and connected to Wetland B to the south. Therefore, wetland associated with SP-E is part of Wetland B. The approximate total size of this wetland on the Site is 0.83 acre. The Township wetland map indicates that Wetland B is part of Township Wetland 29-1. This connection to Wetland 29-1 was not observed during the wetland delineation. Sophiea Parkway, Laforet Circle, and associated residential property are located on the north and east sides of Wetland B and contain upland which separate the two wetland systems.

Wetland C was located in a depression at the north end of the disturbed portion of the site. The western half of this wetland contained standing water and cattail marsh; the eastern half contained forested wetland dominated by eastern cottonwood trees. Wetland sampling point SP-C was located on the eastern edge of the emergent wetland. Wetland C is 0.16 acre in size.

Area D was located in a bowl-shaped depression east of the Site's main access road within a highly disturbed area, as noted on Figure 1. Area D contains a small area of shallow standing water. The adjacent plant community was not well developed and primarily consisted of herbaceous species which had died back due to frost. A U.S. Army Corps of Engineers Wetland Determination Data Form was not completed in this area because the area of standing water and associated low topography was much less than 0.25 acre in size, and therefore would not be regulated as wetland, if a wetland status was confirmed.

A U.S. Army Corps of Engineers Wetland Determination Data Form was completed to describe site vegetation, soil, and hydrology at each sampling location (Points SP-A, SP-B, SP-C, and SP-E) (Appendix 5). FTCH flagged the wetland boundaries with pink ribbon labelled A1 through A66, B1 through B22, C1 through C15, and E1 through



E10. The points were surveyed by Kebs, Inc. Wetland boundaries and associated wetland acreages are noted on the Wetland Sketch Plan in Appendix 4. Wetlands A and B/E extend onto adjacent parcels and are larger than is indicated.

## Conclusions

According to Michigan's Natural Resources and Environmental Protection Act, Act 451, Section 30301(d), wetlands "contiguous to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream" or "more than 5 acres in size" are regulated by the State of Michigan. In addition, the Township regulates wetlands greater than two acres in size which are not contiguous to a water body and wetlands between 0.25 acre and two acres in size that are determined to be essential to the preservation of the natural resources of the Township.

Table 1 summarizes information pertaining to the delineated wetlands.

**Table 1 – Summary of Wetlands**

Wetland Investigation

Meridian Township/Sturk Property

Wetland	Wetland Type	Size (on Subject Property) (acres)	Corresponding Meridian Wetland	Regulated by the State of Michigan?	Regulated by Meridian?
A	Emergent	9.06	29-1	Yes	Yes
B	Emergent/Forested/Scrub-Shrub	0.83	29-1	No	Possibly
C	Forested/Emergent	0.16		No	No

Wetland A is contiguous to Herron Creek is therefore regulated by both the State of Michigan and the Township. Wetland C is not regulated by the State of Michigan or the Township, due to its small size and not being contiguous to a body of water.

Wetland B is not regulated by the State of Michigan due to its size and not being contiguous with a body of water. Because this wetland is greater than 0.25 acre in size, a determination of essentiality is needed to determine whether it is regulated by the Township's wetland ordinance. A permit would be required from the Township for the following activities within wetlands regulated by the Township:

- Placing fill or permitting the placement of fill in the wetland.
- Dredging, removing, or permitting the removal of soil or minerals from the wetland.
- Constructing, operating, or maintaining any use or development in the wetland.
- Draining surface water from the wetland.
- Discharging water into the wetland.

In addition, the Township requires that all structures and grading activities during site development shall be set back 40 feet from the delineated wetland boundary and a natural vegetation strip shall be maintained within 20 feet of the wetland boundary.

Mr. Mark Kieselbach  
Page 4  
December 19, 2017



If you have any questions regarding this letter, the wetland permitting process, or any other wetland-related issues, please contact me at 616-464-3738 or [ehtripp@ftch.com](mailto:ehtripp@ftch.com).

Sincerely,

FISHBECK, THOMPSON, CARR & HUBER, INC.

A handwritten signature in black ink, reading "Elise Hansen Tripp". The signature is written in a cursive style.

Elise Hansen Tripp, PWS

pmb

Attachments

By email

cc/att: Mr. Peter Menser – Township of Meridian

# Figures



**SITE PLAN**  
 NORTH 0 150 300 FEET

**LEGEND**

- Wetland Sampling Point
- ▭ Area of Investigation

DATA SOURCES:  
 GOOGLE EARTH PRO  
 4/9/2015 IMAGE

**fish&h**  
 engineers  
 scientists  
 architects  
 constructors

fishbeck, thompson,  
 carr & huber, inc.

Hard copy is  
 intended to be  
 11"x17" when  
 plotted. Scale(s)  
 indicated and  
 graphic quality may  
 not be accurate for  
 any other size.

**Charter Township of Meridian**  
 Sturk Property, Ingham County, Michigan

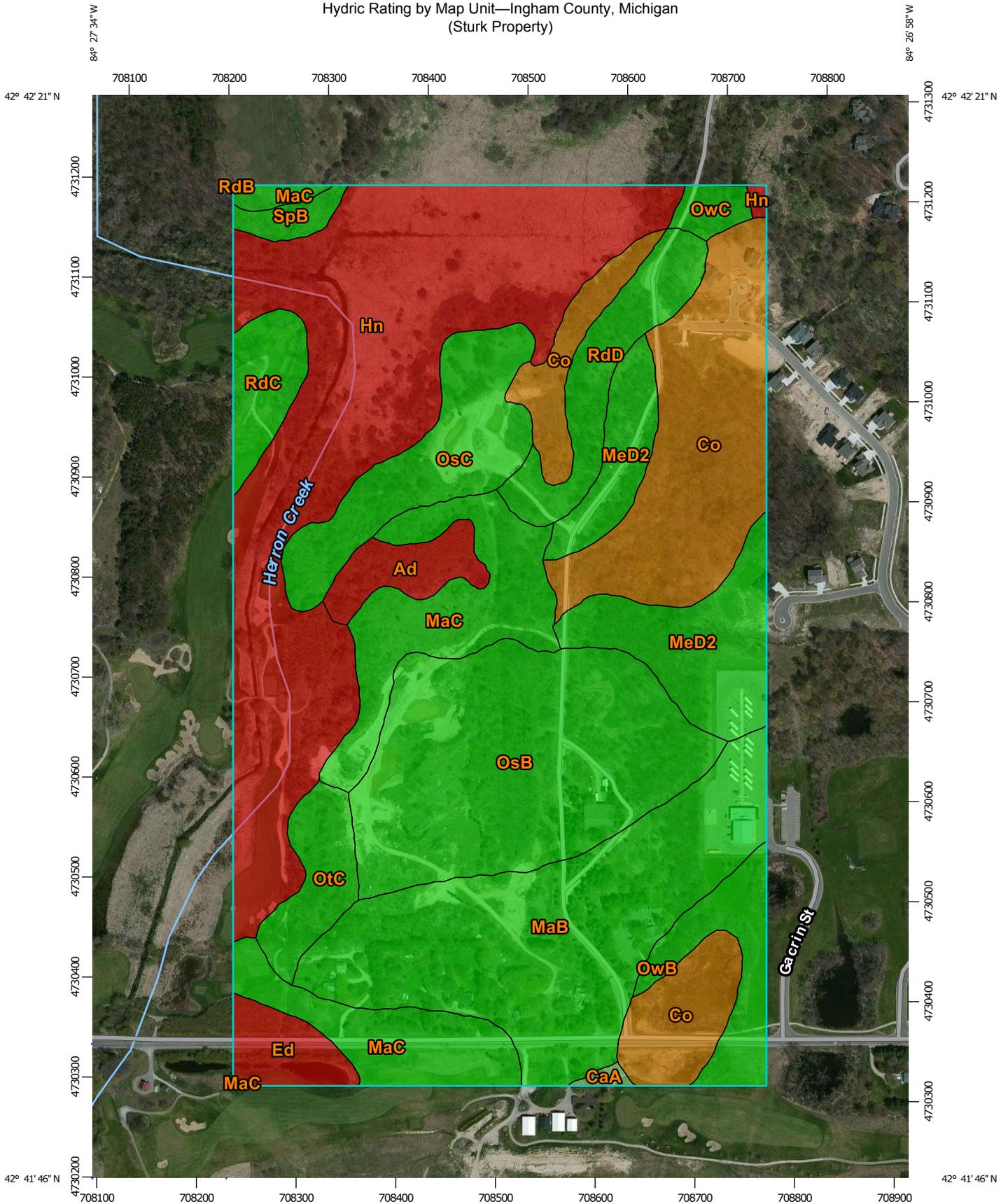
**Wetland Investigation**

PROJECT NO.  
 171994

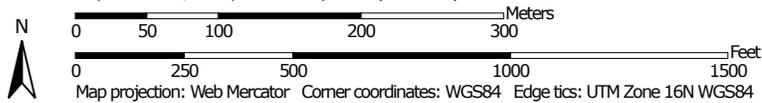
FIGURE NO.  
**1**

# Appendix 1

Hydric Rating by Map Unit—Ingham County, Michigan  
(Sturk Property)



Map Scale: 1:5,270 if printed on A portrait (8.5" x 11") sheet.



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons

-  Hydric (100%)
-  Predominantly Hydric (66 to 99%)
-  Partially hydric (33 to 65%)
-  Predominantly nonhydric (1 to 32%)
-  Nonhydric (0%)
-  Not rated or not available

#### Soil Rating Lines

-  Hydric (100%)
-  Predominantly Hydric (66 to 99%)
-  Partially hydric (33 to 65%)
-  Predominantly nonhydric (1 to 32%)
-  Nonhydric (0%)
-  Not rated or not available

#### Soil Rating Points

-  Hydric (100%)

-  Predominantly Hydric (66 to 99%)
-  Partially hydric (33 to 65%)
-  Predominantly nonhydric (1 to 32%)
-  Nonhydric (0%)
-  Not rated or not available

### Water Features

 Streams and Canals

### Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ingham County, Michigan  
Survey Area Data: Version 10, Dec 14, 2009

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 27, 2010—May 5, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydric Rating by Map Unit

Hydric Rating by Map Unit— Summary by Map Unit — Ingham County, Michigan (MI065)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Ad	Adrian muck	100	2.0	1.7%
CaA	Capac loam, 0 to 3 percent slopes	5	0.2	0.2%
Co	Colwood-Brookston loams	80	16.2	13.5%
Ed	Edwards muck	100	2.0	1.6%
Hn	Houghton muck	100	27.2	22.8%
MaB	Marlette fine sandy loam, 2 to 6 percent slopes	0	16.8	14.1%
MaC	Marlette fine sandy loam, 6 to 12 percent slopes	0	11.1	9.3%
MeD2	Marlette loam, 12 to 18 percent slopes, eroded	0	7.8	6.5%
OsB	Oshtemo sandy loam, 0 to 6 percent slopes	0	16.3	13.7%
OsC	Oshtemo sandy loam, 6 to 12 percent slopes	0	6.1	5.1%
OtC	Oshtemo-Spinks loamy sands, 6 to 12 percent slopes	0	2.7	2.2%
OwB	Owosso-Marlette sandy loams, 2 to 6 percent slopes	0	3.2	2.6%
OwC	Owosso-Marlette sandy loams, 6 to 12 percent slopes	0	0.8	0.7%
RdB	Riddles-Hillsdale sandy loams, 2 to 6 percent slopes	0	0.0	0.0%
RdC	Riddles-Hillsdale sandy loams, 6 to 12 percent slopes	0	2.3	1.9%
RdD	Riddles-Hillsdale sandy loams, 12 to 18 percent slopes	0	4.1	3.4%
SpB	Spinks loamy sand, 0 to 6 percent slopes	0	0.8	0.7%
<b>Totals for Area of Interest</b>			<b>119.5</b>	<b>100.0%</b>

## Description

This rating indicates the proportion of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is designated as "hydric," "predominantly hydric," "partially hydric," "predominantly nonhydric," or "nonhydric" depending on the rating of its respective components and the percentage of each component within the map unit.

"Hydric" means that all components listed for a given map unit are rated as being hydric. "Predominantly hydric" means components that comprise 66 to 99 percent of the map unit are rated as hydric. "Partially hydric" means components that comprise 33 to 66 percent of the map unit are rated as hydric. "Predominantly nonhydric" means components that comprise up to 33 percent of the map unit are rated as hydric. "Nonhydric" means that none of the components are rated as hydric. The assumption here is that all components of the map unit are rated as hydric or nonhydric in the underlying database. A "Not rated or not available" map unit rating is displayed when none of the components within a map unit have been rated.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as being hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

#### References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

### Rating Options

*Aggregation Method:* Percent Present

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Lower

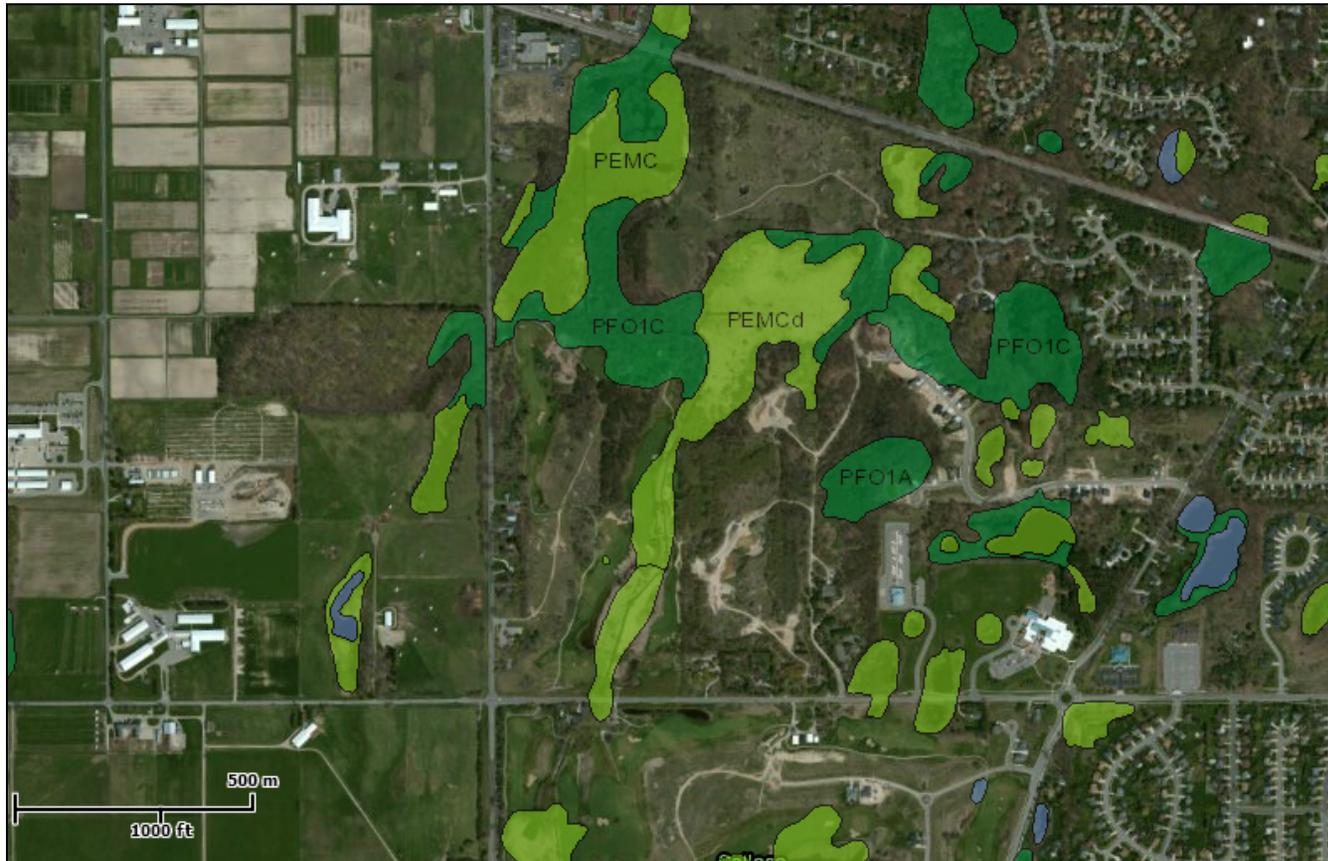
# Appendix 2



# U.S. Fish and Wildlife Service National Wetlands Inventory

Sturk Property

Oct 23, 2013



## Wetlands

- Freshwater Emergent
- Freshwater Forested/Shrub
- Estuarine and Marine Deepwater
- Estuarine and Marine
- Freshwater Pond
- Lake
- Riverine
- Other

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

User Remarks:

# Appendix 3

# Site Photographs

Sturk Property  
Bennett Road, Okemos, MI



Wetland Adjacent to SP-A



Sampling Point SP-A



Wetland A, West of Herron Creek



Herron Creek at Northwest End of the Site



Wetland Adjacent to SP-B



Sampling Point SP-B



Sampling Point SP-C



West End of Wetland C



East End of Wetland C



Area D



Wetland Adjacent to SP-E



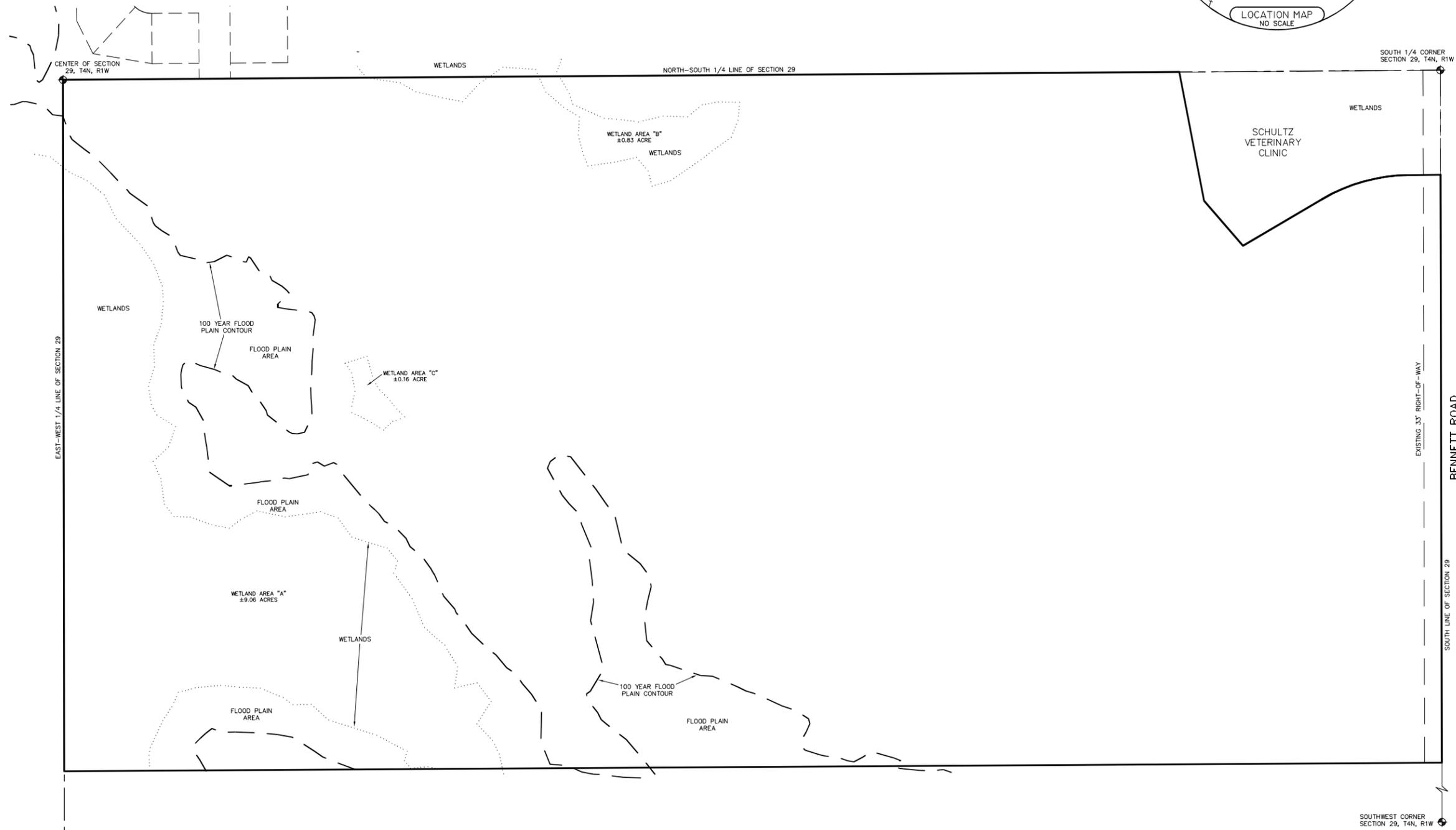
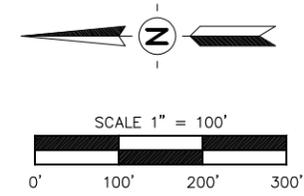
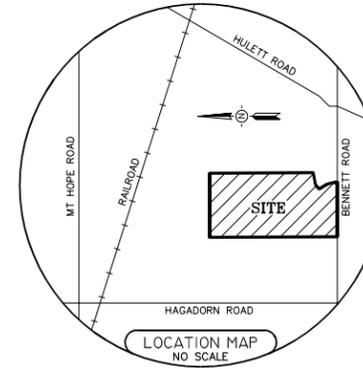
Sampling Point SP-E

# **Appendix 4**

FOR: MAYBERRY HOMES

# WETLAND SKETCH PLAN

## "STURK PROPERTY"



REVISIONS	COMMENTS	KEBS, INC. ENGINEERING AND LAND SURVEYING	
12/5/17	ORIGINAL	2116 HASLETT ROAD, HASLETT, MI 48840 PH. 517-339-1014 FAX 517-339-8047 WWW.KEBS.COM	
		Marshall Office - Ph. 269-781-9800	
		DRAWN BY KDB	SECTION 29, T4N, R1W
		FIELD WORK BY CM/SW	JOB NUMBER:
		SHEET 1 OF 1	87297.SUB-WETLANDS

# **Appendix 5**

**WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region**

**Project/Site:** Meridian Twp/WDV 17-06      **City/County:** Meridian Township/Ingham      **Sampling Date:** 28-Nov-17

**Applicant/Owner:** Bennett Road Holdings LLC      **State:** Michigan      **Sampling Point:** SP-A

**Investigator(s):** Elise Tripp      **Section, Township, Range:** S. 29      T. 4N      R. 1W

**Landform (hillslope, terrace, etc.):** Floodplain      **Local relief (concave, convex, none):** flat      **Slope:** 0.0 % / 0.0 °

**Subregion (LRR or MLRA):** LRR L      **Lat.:** 42.704133125      **Long.:** 84.453911592      **Datum:** WGS84

**Soil Map Unit Name:** Houghton muck      **NWI classification:** PEM1Ad

**Are climatic/hydrologic conditions on the site typical for this time of year?**      Yes  No       (If no, explain in Remarks.)

**Are Vegetation**  , **Soil**  , **or Hydrology**  **significantly disturbed?**      **Are "Normal Circumstances" present?**      Yes  No

**Are Vegetation**  , **Soil**  , **or Hydrology**  **naturally problematic?**      (If needed, explain any answers in Remarks.)

**Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.**

<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Hydric Soil Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>
<b>Remarks: (Explain alternative procedures here or in a separate report.)</b>     	

**Hydrology**

<b>Wetland Hydrology Indicators:</b>	
<b>Primary Indicators (minimum of one required; check all that apply)</b> <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Drift deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<b>Secondary Indicators (minimum of 2 required)</b> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input checked="" type="checkbox"/> Dry Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-neutral Test (D5)
<b>Field Observations:</b> Surface Water Present?      Yes <input type="radio"/> No <input checked="" type="radio"/> Depth (inches): <u>0</u> Water Table Present?      Yes <input checked="" type="radio"/> No <input type="radio"/> Depth (inches): <u>16</u> Saturation Present?      Yes <input checked="" type="radio"/> No <input type="radio"/> Depth (inches): <u>14</u> (includes capillary fringe)	
<b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>	
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:  	
Remarks:    	

**VEGETATION - Use scientific names of plants**

Sampling Point: SP-A

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That are OBL, FACW, or FAC: <u>3</u> (A)  Total Number of Dominant Species Across All Strata: <u>3</u> (B)  Percent of dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
1. <i>Frangula alnus</i>	5	<input checked="" type="checkbox"/>	FAC	
2.	0	<input type="checkbox"/>		
3.	0	<input type="checkbox"/>		
4.	0	<input type="checkbox"/>		
5.	0	<input type="checkbox"/>		
6.	0	<input type="checkbox"/>		
7.	0	<input type="checkbox"/>		
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15</u> )				<b>Prevalence Index worksheet:</b> Total % Cover of:      Multiply by: <b>OBL species</b> <u>0</u> x 1 = <u>0</u> <b>FACW species</b> <u>100</u> x 2 = <u>200</u> <b>FAC species</b> <u>10</u> x 3 = <u>30</u> <b>FACU species</b> <u>0</u> x 4 = <u>0</u> <b>UPL species</b> <u>0</u> x 5 = <u>0</u> <b>Column Totals:</b> <u>110</u> (A) <u>230</u> (B)  Prevalence Index = B/A = <u>2.091</u>
5 = Total Cover				
1. <i>Cornus racemosa</i>	5	<input checked="" type="checkbox"/>	FAC	
2.	0	<input type="checkbox"/>		
3.	0	<input type="checkbox"/>		
4.	0	<input type="checkbox"/>		
5.	0	<input type="checkbox"/>		
6.	0	<input type="checkbox"/>		
7.	0	<input type="checkbox"/>		
<b>Herb Stratum</b> (Plot size: <u>5</u> )				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> <b>Rapid Test for Hydrophytic Vegetation</b> <input checked="" type="checkbox"/> <b>Dominance Test is &gt; 50%</b> <input checked="" type="checkbox"/> <b>Prevalence Index is ≤3.0<sup>1</sup></b> <input type="checkbox"/> <b>Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)</b> <input type="checkbox"/> <b>Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)</b>  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
5 = Total Cover				
1. <i>Phalaris arundinacea</i>	95	<input checked="" type="checkbox"/>	FACW	
2. <i>Solidago gigantea</i>	5	<input type="checkbox"/>	FACW	
3.	0	<input type="checkbox"/>		
4.	0	<input type="checkbox"/>		
5.	0	<input type="checkbox"/>		
6.	0	<input type="checkbox"/>		
7.	0	<input type="checkbox"/>		
8.	0	<input type="checkbox"/>		
9.	0	<input type="checkbox"/>		
10.	0	<input type="checkbox"/>		
11.	0	<input type="checkbox"/>		
12.	0	<input type="checkbox"/>		
<b>Woody Vine Stratum</b> (Plot size: <u>30</u> )				<b>Definitions of Vegetation Strata:</b>  Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..  Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  Woody vine - All woody vines greater than 3.28 ft in height.
100 = Total Cover				
1.	0	<input type="checkbox"/>		
2.	0	<input type="checkbox"/>		
3.	0	<input type="checkbox"/>		
4.	0	<input type="checkbox"/>		
0 = Total Cover				<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>

Remarks: (Include photo numbers here or on a separate sheet.)

\*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.



**WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region**

**Project/Site:** Meridian Twp/WDV 17-06      **City/County:** Meridian Township/Ingham      **Sampling Date:** 20-Nov-17

**Applicant/Owner:** Bennett Road Holdings LLC      **State:** Michigan      **Sampling Point:** SP-B

**Investigator(s):** Elise Tripp      **Section, Township, Range:** S. 29      T. 4N      R. 1W

**Landform (hillslope, terrace, etc.):** Kettle      **Local relief (concave, convex, none):** flat      **Slope:** 0.0 % / 0.0 °

**Subregion (LRR or MLRA):** LRR L      **Lat.:** 42.701471867      **Long.:** 84.452827936      **Datum:** WGS84

**Soil Map Unit Name:** Colwood-Brookston loams      **NWI classification:** PFO1A

**Are climatic/hydrologic conditions on the site typical for this time of year?**      Yes  No       (If no, explain in Remarks.)

**Are Vegetation**  , **Soil**  , **or Hydrology**  **significantly disturbed?**      **Are "Normal Circumstances" present?**      Yes  No

**Are Vegetation**  , **Soil**  , **or Hydrology**  **naturally problematic?**      (If needed, explain any answers in Remarks.)

**Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.**

<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Hydric Soil Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>
<b>Remarks: (Explain alternative procedures here or in a separate report.)</b>     	

**Hydrology**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one required; check all that apply)</u>		<u>Secondary Indicators (minimum of 2 required)</u>	
<input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Drift deposits (B3) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input checked="" type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input checked="" type="checkbox"/> Dry Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-neutral Test (D5)	
<b>Field Observations:</b> Surface Water Present?      Yes <input type="radio"/> No <input checked="" type="radio"/> Depth (inches): <u>0</u> Water Table Present?      Yes <input checked="" type="radio"/> No <input type="radio"/> Depth (inches): <u>13</u> Saturation Present? (includes capillary fringe)      Yes <input checked="" type="radio"/> No <input type="radio"/> Depth (inches): <u>11</u> <b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>			
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:  			
Remarks: Standing water is nearby.			

**VEGETATION - Use scientific names of plants**

Sampling Point: SP-B

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That are OBL, FACW, or FAC: <u>3</u> (A)  Total Number of Dominant Species Across All Strata: <u>3</u> (B)  Percent of dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
1. <u><i>Acer negundo</i></u>	65	<input checked="" type="checkbox"/>	FAC	
2. <u><i>Acer saccharinum</i></u>	15	<input type="checkbox"/>	FACW	
3. <u><i>Frangula alnus</i></u>	20	<input checked="" type="checkbox"/>	FAC	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
<b>100 = Total Cover</b>				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ <b>OBL species</b> <u>0</u> x 1 = <u>0</u> <b>FACW species</b> <u>15</u> x 2 = <u>30</u> <b>FAC species</b> <u>110</u> x 3 = <u>330</u> <b>FACU species</b> <u>0</u> x 4 = <u>0</u> <b>UPL species</b> <u>0</u> x 5 = <u>0</u> <b>Column Totals:</b> <u>125</u> (A) <u>360</u> (B)  Prevalence Index = B/A = <u>2.880</u>
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15</u> )				
1. <u><i>Frangula alnus</i></u>	25	<input checked="" type="checkbox"/>	FAC	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
<b>25 = Total Cover</b>				
<b>Herb Stratum</b> (Plot size: _____ )				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> <b>Rapid Test for Hydrophytic Vegetation</b> <input checked="" type="checkbox"/> <b>Dominance Test is &gt; 50%</b> <input checked="" type="checkbox"/> <b>Prevalence Index is ≤3.0<sup>1</sup></b> <input type="checkbox"/> <b>Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)</b> <input type="checkbox"/> <b>Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)</b>  <sup>1</sup> <b>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.</b>
1. _____	0	<input type="checkbox"/>	_____	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
8. _____	0	<input type="checkbox"/>	_____	
9. _____	0	<input type="checkbox"/>	_____	
10. _____	0	<input type="checkbox"/>	_____	
11. _____	0	<input type="checkbox"/>	_____	
12. _____	0	<input type="checkbox"/>	_____	
<b>0 = Total Cover</b>				
<b>Woody Vine Stratum</b> (Plot size: <u>30</u> )				<b>Definitions of Vegetation Strata:</b>  Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..  Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  Woody vine - All woody vines greater than 3.28 ft in height.
1. _____	0	<input type="checkbox"/>	_____	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
<b>0 = Total Cover</b>				
<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>				

Remarks: (Include photo numbers here or on a separate sheet.)

\*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.



**WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region**

**Project/Site:** Meridian Twp/WDV 17-06      **City/County:** Meridian Township/Ingham      **Sampling Date:** 28-Nov-17

**Applicant/Owner:** Bennett Road Holdings LLC      **State:** Michigan      **Sampling Point:** SP-C

**Investigator(s):** Elise Tripp      **Section, Township, Range:** S. 29      T. 4N      R. 1W

**Landform (hillslope, terrace, etc.):** Lowland      **Local relief (concave, convex, none):** flat      **Slope:** 0.0 % / 0.0 °

**Subregion (LRR or MLRA):** LRR L      **Lat.:** 42.702967174      **Long.:** 84.454475001      **Datum:** WGS84

**Soil Map Unit Name:** Oshtemo sandy loam, 6-12% slopes      **NWI classification:** None

**Are climatic/hydrologic conditions on the site typical for this time of year?**      Yes  No       (If no, explain in Remarks.)

**Are Vegetation**  , **Soil**  , **or Hydrology**  **significantly disturbed?**      **Are "Normal Circumstances" present?**      Yes  No

**Are Vegetation**  , **Soil**  , **or Hydrology**  **naturally problematic?**      (If needed, explain any answers in Remarks.)

**Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.**

<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Hydric Soil Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>
<b>Remarks: (Explain alternative procedures here or in a separate report.)</b> Area has been historically disturbed.	

**Hydrology**

<b>Wetland Hydrology Indicators:</b> Primary Indicators (minimum of one required; check all that apply)	Secondary Indicators (minimum of 2 required)
<input checked="" type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Water-Stained Leaves (B9) <input checked="" type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Drift deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-neutral Test (D5)
<b>Field Observations:</b> Surface Water Present?      Yes <input checked="" type="radio"/> No <input type="radio"/> Depth (inches): <u>2</u> Water Table Present?      Yes <input checked="" type="radio"/> No <input type="radio"/> Depth (inches): <u>1</u> Saturation Present?      Yes <input checked="" type="radio"/> No <input type="radio"/> Depth (inches): <u>0</u> (includes capillary fringe)	
<b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>	
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	

**VEGETATION - Use scientific names of plants**

Sampling Point: SP-C

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That are OBL, FACW, or FAC: <u>3</u> (A)  Total Number of Dominant Species Across All Strata: <u>3</u> (B)  Percent of dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
1. <u>Populus deltoides</u>	15	<input checked="" type="checkbox"/>	FAC	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
15 = Total Cover				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ <b>OBL species</b> <u>85</u> x 1 = <u>85</u> <b>FACW species</b> <u>20</u> x 2 = <u>40</u> <b>FAC species</b> <u>15</u> x 3 = <u>45</u> <b>FACU species</b> <u>0</u> x 4 = <u>0</u> <b>UPL species</b> <u>0</u> x 5 = <u>0</u> <b>Column Totals:</b> <u>120</u> (A) <u>170</u> (B)  Prevalence Index = B/A = <u>1.417</u>
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15</u> )				
1. <u>Salix interior</u>	10	<input checked="" type="checkbox"/>	FACW	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
10 = Total Cover				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> <b>Rapid Test for Hydrophytic Vegetation</b> <input checked="" type="checkbox"/> <b>Dominance Test is &gt; 50%</b> <input checked="" type="checkbox"/> <b>Prevalence Index is ≤3.0</b> <sup>1</sup> <input type="checkbox"/> <b>Morphological Adaptations</b> <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> <b>Problematic Hydrophytic Vegetation</b> <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
<b>Herb Stratum</b> (Plot size: <u>5</u> )				
1. <u>Juncus effusus</u>	70	<input checked="" type="checkbox"/>	OBL	
2. <u>Carex vulpinoidea</u>	10	<input type="checkbox"/>	OBL	
3. <u>Typha angustifolia</u>	5	<input type="checkbox"/>	OBL	
4. <u>Phalaris arundinacea</u>	5	<input type="checkbox"/>	FACW	
5. <u>Cornus alba</u>	5	<input type="checkbox"/>	FACW	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
8. _____	0	<input type="checkbox"/>	_____	
9. _____	0	<input type="checkbox"/>	_____	
10. _____	0	<input type="checkbox"/>	_____	
11. _____	0	<input type="checkbox"/>	_____	
12. _____	0	<input type="checkbox"/>	_____	
95 = Total Cover				<b>Definitions of Vegetation Strata:</b>  Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..  Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  Woody vine - All woody vines greater than 3.28 ft in height.
<b>Woody Vine Stratum</b> (Plot size: <u>30</u> )				
1. _____	0	<input type="checkbox"/>	_____	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
0 = Total Cover				<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>
<b>Remarks: (Include photo numbers here or on a separate sheet.)</b>     				

\*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.



**WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region**

**Project/Site:** Meridian Twp/WDV 17-06      **City/County:** Meridian Township/Ingham      **Sampling Date:** 28-Nov-17

**Applicant/Owner:** Bennett Road Holdings LLC      **State:** Michigan      **Sampling Point:** SP-E

**Investigator(s):** Elise Tripp      **Section, Township, Range:** S. 29      T. 4N      R. 1W

**Landform (hillslope, terrace, etc.):** Kettle      **Local relief (concave, convex, none):** flat      **Slope:** 0.0 % / 0.0 °

**Subregion (LRR or MLRA):** LRR L      **Lat.:** 42.702496875      **Long.:** 84.452309715      **Datum:** WGS84

**Soil Map Unit Name:** Colwood-Brookston loams      **NWI classification:** None

**Are climatic/hydrologic conditions on the site typical for this time of year?**      Yes  No       (If no, explain in Remarks.)

**Are Vegetation**  , **Soil**  , **or Hydrology**  **significantly disturbed?**      **Are "Normal Circumstances" present?**      Yes  No

**Are Vegetation**  , **Soil**  , **or Hydrology**  **naturally problematic?**      (If needed, explain any answers in Remarks.)

**Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc.**

<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Hydric Soil Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/> <b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>
<b>Remarks: (Explain alternative procedures here or in a separate report.)</b>     	

**Hydrology**

<b>Wetland Hydrology Indicators:</b>		<u>Secondary Indicators (minimum of 2 required)</u>	
<u>Primary Indicators (minimum of one required; check all that apply)</u>			
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Surface Soil Cracks (B6)	
<input checked="" type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Aquatic Fauna (B13)	<input type="checkbox"/> Drainage Patterns (B10)	
<input checked="" type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Marl Deposits (B15)	<input type="checkbox"/> Moss Trim Lines (B16)	
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)	<input type="checkbox"/> Dry Season Water Table (C2)	
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3)	<input type="checkbox"/> Crayfish Burrows (C8)	
<input type="checkbox"/> Drift deposits (B3)	<input type="checkbox"/> Presence of Reduced Iron (C4)	<input type="checkbox"/> Saturation Visible on Aerial Imagery (C9)	
<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)	<input type="checkbox"/> Stunted or Stressed Plants (D1)	
<input type="checkbox"/> Iron Deposits (B5)	<input type="checkbox"/> Thin Muck Surface (C7)	<input type="checkbox"/> Geomorphic Position (D2)	
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Shallow Aquitard (D3)	
<input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)		<input type="checkbox"/> Microtopographic Relief (D4)	
		<input type="checkbox"/> FAC-neutral Test (D5)	
<b>Field Observations:</b>			
Surface Water Present?      Yes <input checked="" type="radio"/> No <input type="radio"/>	Depth (inches):      8		
Water Table Present?      Yes <input checked="" type="radio"/> No <input type="radio"/>	Depth (inches):      8		
Saturation Present? (includes capillary fringe)      Yes <input checked="" type="radio"/> No <input type="radio"/>	Depth (inches):      6	<b>Wetland Hydrology Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>	
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:			
Remarks: Standing water nearby			

**VEGETATION - Use scientific names of plants**

Sampling Point: SP-E

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That are OBL, FACW, or FAC: <u>2</u> (A)  Total Number of Dominant Species Across All Strata: <u>2</u> (B)  Percent of dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)
1. <u>Frangula alnus</u>	75	<input checked="" type="checkbox"/>	FAC	
2. <u>Populus deltoides</u>	25	<input checked="" type="checkbox"/>	FAC	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
<b>100 = Total Cover</b>				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ <b>OBL species</b> <u>0</u> x 1 = <u>0</u> <b>FACW species</b> <u>0</u> x 2 = <u>0</u> <b>FAC species</b> <u>100</u> x 3 = <u>300</u> <b>FACU species</b> <u>0</u> x 4 = <u>0</u> <b>UPL species</b> <u>0</u> x 5 = <u>0</u> <b>Column Totals:</b> <u>100</u> (A) <u>300</u> (B)  Prevalence Index = B/A = <u>3.000</u>
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15</u> )				
1. _____	0	<input type="checkbox"/>	_____	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
<b>0 = Total Cover</b>				
<b>Herb Stratum</b> (Plot size: <u>5</u> )				<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> <b>Rapid Test for Hydrophytic Vegetation</b> <input checked="" type="checkbox"/> <b>Dominance Test is &gt; 50%</b> <input checked="" type="checkbox"/> <b>Prevalence Index is ≤3.0<sup>1</sup></b> <input type="checkbox"/> <b>Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)</b> <input type="checkbox"/> <b>Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)</b>  <sup>1</sup> <b>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.</b>
1. _____	0	<input type="checkbox"/>	_____	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
5. _____	0	<input type="checkbox"/>	_____	
6. _____	0	<input type="checkbox"/>	_____	
7. _____	0	<input type="checkbox"/>	_____	
8. _____	0	<input type="checkbox"/>	_____	
9. _____	0	<input type="checkbox"/>	_____	
10. _____	0	<input type="checkbox"/>	_____	
11. _____	0	<input type="checkbox"/>	_____	
12. _____	0	<input type="checkbox"/>	_____	
<b>0 = Total Cover</b>				
<b>Woody Vine Stratum</b> (Plot size: <u>30</u> )				<b>Definitions of Vegetation Strata:</b>  Tree - Woody plants, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  Sapling/shrub - Woody plants less than 3 in. DBH and greater than 3.28 ft (1m) tall..  Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  Woody vine - All woody vines greater than 3.28 ft in height.
1. _____	0	<input type="checkbox"/>	_____	
2. _____	0	<input type="checkbox"/>	_____	
3. _____	0	<input type="checkbox"/>	_____	
4. _____	0	<input type="checkbox"/>	_____	
<b>0 = Total Cover</b>				
<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="radio"/> No <input type="radio"/>				
<b>Remarks: (Include photo numbers here or on a separate sheet.)</b>   				

\*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.





MARX  
WETLANDS  
LLC

April 23, 2020

Mr. David Straub  
**Mayberry Homes**  
248-303-0455  
[dstraub@mayberryhomes.com](mailto:dstraub@mayberryhomes.com)

Re: **Wetland Delineation Report: Creekstone Trail and Shadow Ridge  
Parcel #33-02-02-29-251-009 – Sturk Property  
Section 29, Meridian Township, Ingham County, Michigan**

Dear Mr. Straub:

Pursuant to your request, Marx Wetlands LLC (MW) conducted a wetland delineation and determination for the above-referenced (“Site”), an approximately 22.32-acre vacant property (parcel 29-251-009) located directly northwest of the intersection of Creekstone Trail and Shadow Ridge. The Site is also approximately 0.50 miles west of Hulett Road and approximately 0.50 north of Bennett Road situated within section 29 of Meridian Township (T4N, R1W), Ingham County, Michigan.

The intent of this wetland delineation and determination is to provide a report of the character of any wetland areas within the Site and a professional opinion as to the possible jurisdiction of the Michigan Department of Energy, Great Lakes, and Environment (EGLE) and/or local governances over wetland areas identified on-site. The wetland determination was performed in accordance with the Michigan Department of Environmental Quality Wetland Identification Manual (2001), the Northcentral-Northeast and Midwest Interim Regional Supplements to the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual. The delineation of any wetland depends on three basic parameters. These parameters are: 1) the presence of hydrophytic vegetation (plants adapted to living in saturated soils), 2) hydric soils (distinctive soil types that develop under saturated conditions), and 3) wetland hydrology (the presence of water at or near the surface for a specific period of time). The above parameters are virtually always inter-related and present in wetland systems.

The wetland determination and delineation consisted of desktop review of available background documentation and mapping followed by an on-site visit conducted on April 14, 2020. A review of the findings is provided below.

#### **Site Characteristics**

Based on review of aerial photographs, available on-line resources, and on-site visits, the Site contains largely undeveloped land, consisting of upland, disturbed old field, upland scrub-shrub/forest and wetland. A two-track drive and mowed paths transect the site’s interior. An existing drainage feature (i.e., Hoskins Drain) was also identified in the southern portion of the Site.

3309 Platt Road  
Ann Arbor, Michigan  
Mobile: 734-478-8277  
e-mail:  
[bg.marxwetlands@gmail.com](mailto:bg.marxwetlands@gmail.com)

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The upland disturbed old fields were identified particularly in the northwest quadrant of the Site. These areas generally contain bluegrasses (*Poa compressa* and *P. pratensis*), spotted knapweed (*Centaurea stoebe*), orchard grass (*Dactylis glomerata*), smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), common teasel (*Dipsacus fullonum*), and goldenrods (*Solidago altissima* and *S. canadensis*). Scattered trees and shrubs included cottonwood (*Populus deltoides*), red-cedar (*Juniperus virginiana*), black raspberry (*Rubus occidentalis*), autumn-olive (*Elaeagnus umbellata*), and common blackberry (*Rubus allegheniensis*).

The upland forested and scrub-shrub areas were observed throughout the Site. These areas generally contain oaks (*Quercus alba*, *Q. bicolor*, *Q. macrocarpa*, *Q. rubra*, and *Q. velutina*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), cottonwood, box-elder (*Acer negundo*), sugar maple (*Acer saccharum*), scattered with red maple (*Acer rubrum*), basswood (*Tilia americana*), beech (*Fagus grandifolia*), American elm (*Ulmus americana*), and white ash (*Fraxinus americana*.) trees. Upland herbaceous understory species include strawberry (*Fragaria virginiana*), wild geranium (*Geranium maculatum*), may-apple (*Podophyllum peltatum*), Dame's rocket (*Hesperis matronalis*), Pennsylvania sedge (*Carex pennsylvanica*), white avens (*Geum canadense*), and yellow trout-lily (*Erythronium americanum*). Upland shrub and vine species include common blackberry, black raspberry, hophornbeam (*Ostrya virginiana*), musclewood (*Carpinus caroliniana*), gray dogwood (*Cornus racemosa*), prickly-ash (*Zanthoxylum americanum*), Eurasian honeysuckles (*Lonicera spp.*), common buckthorn (*Rhamnus cathartica*), autumn-olive, and Virginia creeper (*Parthenocissus quinquefolia*). Refer to the *Site Photographs Log (Enclosure 1)*.

#### **Wetland Determination & Delineation**

Five (5) wetlands (Wetlands A, B, C, D, and E) were identified within or along the Site. One (1) watercourse (Branch No. 2 of Herron Creek/Hoskins Drain; H6200) was identified within the Site as well. Refer to the *Wetland Location Map* for the locations of the on-site wetland and *USACE Wetland Determination Data Forms (Enclosure 2)*. See Table 1, Natural Features Table (next page), for feature name, type, onsite acreage, regulatory statuses for State of Michigan and Meridian Township.

**Table 1. Natural Features Table**

Feature Name	Type*	Size (on-site acreage)	Regulated by the State of Michigan?	Meridian Township (Twp.) Regulated?
Wetland A	PEM/PFO	2.78 AC	Yes, connected to Watercourse 1	Likely
Wetland B	PEM/PFO	1.39 AC	Possibly, if a historic connection to a large (>5 ac wetland) north of the railroad is determined.	Likely, >0.25 acres in size
Wetland C	PEM/PFO	0.38 AC	Possibly if it drains to Herron Creek within the south railroad ditch.	Likely, >0.25 acres in size
Wetland D	PFO/Open Water	0.06 AC	Not Likely	Not Likely, unless determined essential for Twp.'s preservation
Wetland E	PEM	1.02 AC	Yes, >5 acres and contiguous to Watercourse 1	Likely
Watercourse 1/Hoskins Dr (H6200)	Perennial	-	Yes, presence of defined bed and banks.	-

\*PEM- Emergent; PSS- Scrub-shrub; PFO-Forested; Open water

**Vegetation**

**Wetlands A, B, and C** are emergent and forested wetlands, containing emergent wetland interiors and forested wetland perimeters. Wetland A was identified in the southeast quadrant of the Site, extending off-site in a southeast direction. Wetland A is also hydrologically connected to Wetland E. Wetland A drains southwest through Watercourse 1 (trib to Herron Creek/Hoskins Drain H6200) via an existing culvert (at the existing two-track drive) and discharges west into Wetland E. Wetland B is entirely contained within the north-central portion of the Site. Wetland C is largely on-site; however, appears to drain off-site at the base of the railroad embankment.

Herbaceous vegetation generally observed within Wetlands A, B, and C include sedges (*Carex intumescens*; FACW, *C. lacustris*, *C. stricta*, and *C. vulpinoidea*; OBL), reed canary grass (*Phalaris arundinacea*; FACW), sensitive fern (*Onoclea sensibilis*; FACW), cattails (*Typha angustifolia* & *T. latifolia*; OBL), and false nettle (*Boehmeria cylindrica*; OBL). Other less common herbaceous vegetation included skunk-cabbage (*Symplocarpus foetidus*; OBL), white avens (FAC), and stinging nettle (*Urtica dioica*; FAC). Common shrubs observed include common buckthorn (FAC), gray dogwood (FAC), silky dogwood (*C. amomum*; FACW), green ash (*Fraxinus pennsylvanica*; FACW), and common elderberry (*Sambucus canadensis*; FACW). Common vines include riverbank grape (*Vitis riparia*; FAC) and poison-ivy (*Toxicodendron radicans*; FAC). Tree species include cottonwood (FAC), silver maple (*Acer saccharinum*; FACW), American elm (FACW), box-elder (FAC), and swamp white oak (*Quercus bicolor*; FACW).

**Wetland D** is a vernal pool type forested wetland with standing water and sparse vegetation. This wetland is entirely contained within the northeast corner of the Site. It is unclear if this was man-made feature or not. Herbaceous vegetation observed include reed canary grass (FAC) and sedge (*Carex intumescens*; FACW).

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Dominant trees observed include common buckthorn (FAC) and American elm (FACW). Although Wetland D appears to contain largely open water with sparse vegetation, wetland-rated trees line the perimeter and was flagged due to the presence of hydric soil and hydrological indicators.

**Wetland E** is a largely emergent wetland that extends off-site to the west and south and is part of a larger wetland system adjoining Herron Creek. A minor scrub-shrub component along the wetland's eastern boundary was included at select locations. Herbaceous vegetation generally observed include sedges (*C. lacustris*, *C. stricta*, and *C. vulpinoidea*; OBL), reed canary grass (FACW), cattails (OBL), late goldenrod (*Solidago gigantea*; FACW), and stinging nettle (FAC). Common shrubs observed include gray dogwood (FAC), silky dogwood (FACW), red raspberry (*Rubus strigosus*; FAC), and common elderberry (FACW). Common vines include riverbank grape (FAC) and poison-ivy (FAC). Tree species include box-elder (FAC), American elm (FACW), and common buckthorn (FAC). Dense thickets of gray dogwood (FAC) and prickly-ash (*Zanthoxylum americanum*; FACU) were not flagged within the wetland's limits, unless obvious hydrological and soil indicators were strongly detected.

The majority of species within these wetlands range in wetland indicator status from obligate (OBL) to facultative (FAC), indicating species that typically occur in wetlands.

#### **Hydrology**

Typical hydrology indicators observed include standing water, saturation, hummocks, water-stained leaves, water marks, geomorphic position, and FAC Neutral Test. These wetlands appear to receive hydrology from precipitation, runoff from adjacent developed areas, and roadways, and/or overflow adjacent wetlands, resulting in seasonally saturated to seasonally inundated water regimes.

#### **Soils**

Hydric soil indicators were observed in soil sample pits within each of the wetlands. MW also collected adjacent upland sampling plots and data. Please refer to the USACE Wetland Determination Data Forms (**Enclosure 2**). The delineated wetland areas generally correspond to areas containing hydric (wetland) soils mapped by USGS's county soil survey maps.

#### **Watercourse & Floodplain**

One (1) watercourse was observed within the Site and/or along the site perimeters. Watercourse 1/Hoskins Drain(H-6200) is a branch of Herron Creek. This watercourse was identified at the southwest end of Wetland A, draining southwest/west via an existing culvert across the existing two-track drive, and into Wetland E. This watercourse was identified as a designated county drain (H-6200) on the *Meridian Township (SW) Drain Map* (**Enclosure 3**) and appears to drain west into Herron Creek (off-site) within the large wetland system. This feature appears to have a perennial water regime with flowing water or evidence of the

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continuance of water and defined bed and banks. This watercourse contains a substrate with silt, sand, fine-grained gravel, and plant material debris.

Review of the Federal Emergency Management Agency (FEMA) FIRM Panel No. 26065C0154D, (eff. 8/16/2011) revealed that the Site contains a 100-year floodplain mapped as Zone AE (with available Base Flood Elevation- BFE at approximately 847 feet above sea level) associated with the Herron Creek (off-site) and associated wetlands within the Site (**Enclosure 4**). The remaining areas within the Site are mapped as Zone X: an area that is determined to be outside the 100-year floodplain.

#### Regulations & Recommendations

##### *Watercourse, Drain, and Floodplain Regulations*

Part 301, Inland Lakes and Streams, states that a feature is considered a regulated watercourse by the EGLE if it possesses a defined bed, bank, and evidence of continued flow or a continued occurrence of water. One (1) watercourse was identified within the Site and is likely EGLE regulated under Part 301 of the NREPA.

In addition, the on-site drain appears to be a designated Ingham County drain (Hoskins Drain; H6200). Typically, county drains have an easement for construction and maintenance purposes and where development or structures are prohibited. **Therefore, be sure to contact the Ingham County Drain Commissioners office to see if the proposed site development requires any approvals or permits through Ingham County.** Refer to **Enclosure 3- Ingham County – Meridian Township (SW) Drain Map**.

Part 31, Water Resources Protection, of the NREPA regulates activities within the 100-year floodplain and floodway of a river, stream, or drain, and within the floodplain of any watercourse with an upstream drainage area of two square miles or larger. A Part 31 permit is required for construction within a regulated floodplain or floodway. MW's preliminary review of FEMA FIRM Panel No. 26065C0154D, (eff. 8/16/2011) revealed that the Site contains a 100-year floodplain mapped as Zone AE (with available Base Flood Elevation- BFE at approximately 847 feet above sea level) associated with the Herron Creek (off-site) and associated wetlands within the Site. The remaining areas within the Site are mapped as Zone X: an area that is determined to be outside the 100-year floodplain. Therefore, the Herron Creek is anticipated to have an EGLE regulated 100-year floodplain that has an upstream drainage area larger than two square miles in size. **A floodplain elevation request or pre-application meeting through the EGLE can assist with the project development process and/or floodplain permitting, if applicable. Refer to the Firm Map (Enclosure 4).**

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#### *State and Local Wetland Regulations*

Part 303, Wetlands Protection, of the NREPA states that if a wetland is five acres in size or larger and/or connected to or located within 500 feet of a river, stream, lake, or pond, it is considered regulated by the EGLE.

Marx Wetlands, LLC has the professional opinion that two (2) on-site wetlands (Wetlands A and E) are likely regulated by the EGLE. Wetlands A & E extend off-site and are contiguous to a regulating watercourse. Wetlands B, C, and D are less than five acres in size and are further than 500 feet of any obvious regulating features (i.e., pond, stream, drain, lake, etc.). However, Wetlands B and C may be considered regulated if a historic connection is determined to off-site wetlands (north) separated by the existing railroad. In addition, Wetland C appears to continue off-site within a ditch feature at the base of the railroad and may have a connection to the Herron Creek.

Therefore, Wetlands A and E appear to meet the requirements of Part 303, Wetlands Protection, of the NREPA, and therefore likely fall under the jurisdiction of the EGLE. Wetlands B and C may be considered regulated; however, Wetland D appears to be a non-regulated wetland under Part 303 of the NREPA. **Marx Wetlands LLC recommends confirmation of these regulatory statuses by the EGLE if impacts to on-site wetlands are anticipated by project activities. EGLE has pre-application services to determine if a permit is needed for on-site development and/or a Wetland Identification Program (WIP) to determine whether there are regulated wetlands on a given property.**

A permit is required by the EGLE for any proposed work that takes place within the boundaries of a regulated wetland. Most construction activities that take place outside of these boundaries do not require a wetland permit from the EGLE. **The EGLE has the final authority on the extent, size, shape, and regulatory status of wetlands, lakes, and streams in the State of Michigan.**

#### Local Regulations

In addition, Meridian Township (Township) has its own wetland protection ordinance. The township's Wetland Protection ordinance (Chapter 22, Article IV) states that wetlands are protected if they are:

- contiguous to any inland lake stream, river, or pond.
- Partially or entirely within 500 feet of the ordinary high-water mark of any inland lake, stream, river or pond.
- Two or more areas of wetland separated only by barriers, such as dikes, roads, berms or other similar features, if any of those wetlands are contiguous to an inland lake, stream, river or pond.

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- larger than two acres, even if not contiguous to an inland lake, stream, river or pond.
- not contiguous to any inland lake, stream, river or pond, if the state department of environmental quality determines the protection of the wetland is essential to the preservation of the natural resources of the state from pollution, impairment or destruction.
- wetlands, equal to or greater than one-quarter acre and equal to or less than two acres in size, which are not contiguous to any inland lake, stream, river or pond and are determined to be essential to the preservation of the natural resources of the Township as provided in township code § 22-156. Code § 22-156 provides that a wetland is essential to the preservation of the township's natural resources if it fulfills any of ten criteria.

It is the professional opinion of Marx Wetlands LLC that Wetlands A, B, C, and E are likely regulated by Meridian Township. Wetlands B and C are larger than 0.25 acres in size; therefore, would be considered regulated by Meridian Township's Code § 22-156.

Wetland D is less than 0.25 acres in size and does not appear to be within 500 feet of any regulating water body. Wetland D is not anticipated to be regulated by Meridian Township. **Meridian Township's wetland consultant will make the final decision regarding the regulatory statuses, shape, and extent of the on-site wetlands during a wetland verification visit.**

It is important to note that a wetland verification application is required following a wetland delineation conducted within Meridian Township, Ingham County, Michigan. The Meridian Township's wetland consultant will make the final decisions during an on-site wetland verification visit. Applications should include the following information:

- A completed application form.
- The required administrative fee and escrow amount addressed to Meridian Charter Township.
- Written permission from the property owner, if the property owner is not the applicant.
- For verifications only: written confirmation that the wetland flags are located on the site and remain observable.
- For verifications only: three (3) copies of an existing wetland delineation report and accompanying maps and materials prepared by a wetland or environmental consultant.
- Copies of any correspondence received from the Michigan Department of Environment, Great Lakes, and Energy (EGLE).
- Copies of any permits issued by the Ingham County Drain Commissioner's office for the subject site.

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The Meridian Township Wetland Verification & Escrow form can be found here:  
<http://www.meridian.mi.us/Home/ShowDocument?id=12235>.

Please note that the Meridian Township Board has a policy of no net loss of wetlands and impacts to wetlands may require wetland mitigation. A mitigation plan, if required, shall be approved as part of the wetland use permit decision.

A permit or approval is likely required by the Meridian Township for any proposed work (e.g., filling, dredging, construction, and draining and/or other development) that takes place within the boundaries of a regulated wetland. Most construction activities that take place outside of these boundaries do not require a wetland permit from the EGLE or Meridian Township. Please note that the EGLE and Township have the final authority on the extent of regulated wetlands, lakes, and streams in the State of Michigan and Meridian Township, respectively.

Please be advised that the information provided in this report is a professional opinion. The ultimate decision on wetland boundary locations and jurisdiction thereof rests with the EGLE and/or local government, and, in some cases, the federal government. Therefore, there may be adjustments to boundaries based upon review by a regulatory agency. An agency determination can vary depending on various factors including, but not limited to, experience of the agency representative making the determination and the season of the year. In addition, the physical characteristics of the site can change over time, depending on the weather, vegetation patterns, drainage, activities on adjacent parcels, or other events. Any of these factors can change the nature and/or extent of wetlands on the site.

Thank you for the opportunity to provide this wetland delineation and determination. If you have any questions, please contact me at your convenience.

Sincerely,



**Marx Wetlands LLC**  
Bryana J. Guevara, PWS 2949  
ISA Certified Arborist #MI-4240A

**Enclosures:**

1. Site Photographs Log
2. Wetland Location Map & Wetland Determination Data Forms
3. Meridian Township Southwest Drain Map
4. FIRM Map and other publicly available background information

**ENCLOSURE I**

## Site Photographs



1) View of typical two-track drive and mowed paths identified within the Site.



2) A north-facing view of typical upland forest/scrub-shrub.



3) A northwest-facing view of the existing railroad, which lines the northern boundary of the Site.



4) View of typical upland disturbed old field identified particularly along the existing two-track and in the northwest quadrant of the Site.

## Site Photographs



5) A north-facing view of Wetland A, extending southeast off-site.



6) View of sampling plot for Wetland A.



7) A south-facing view of Watercourse 1, which drains southeast/east from Wetland A.



8) View of the existing pipes found where the drain goes underneath the existing two-track drive.

## Site Photographs



9) View of Wetland B, which extends slightly off-site.



10) View of sampling plot for Wetland B.



11) An east-facing view of Wetland C.



12) View of where Wetland C extends off-site along the base of the existing railroad grade.

## Site Photographs



13) A south-facing view of Wetland D, a small vernal pool.



14) A northwest facing view of Wetland E, which extends off-site into a larger wetland system adjoining Herron Creek.

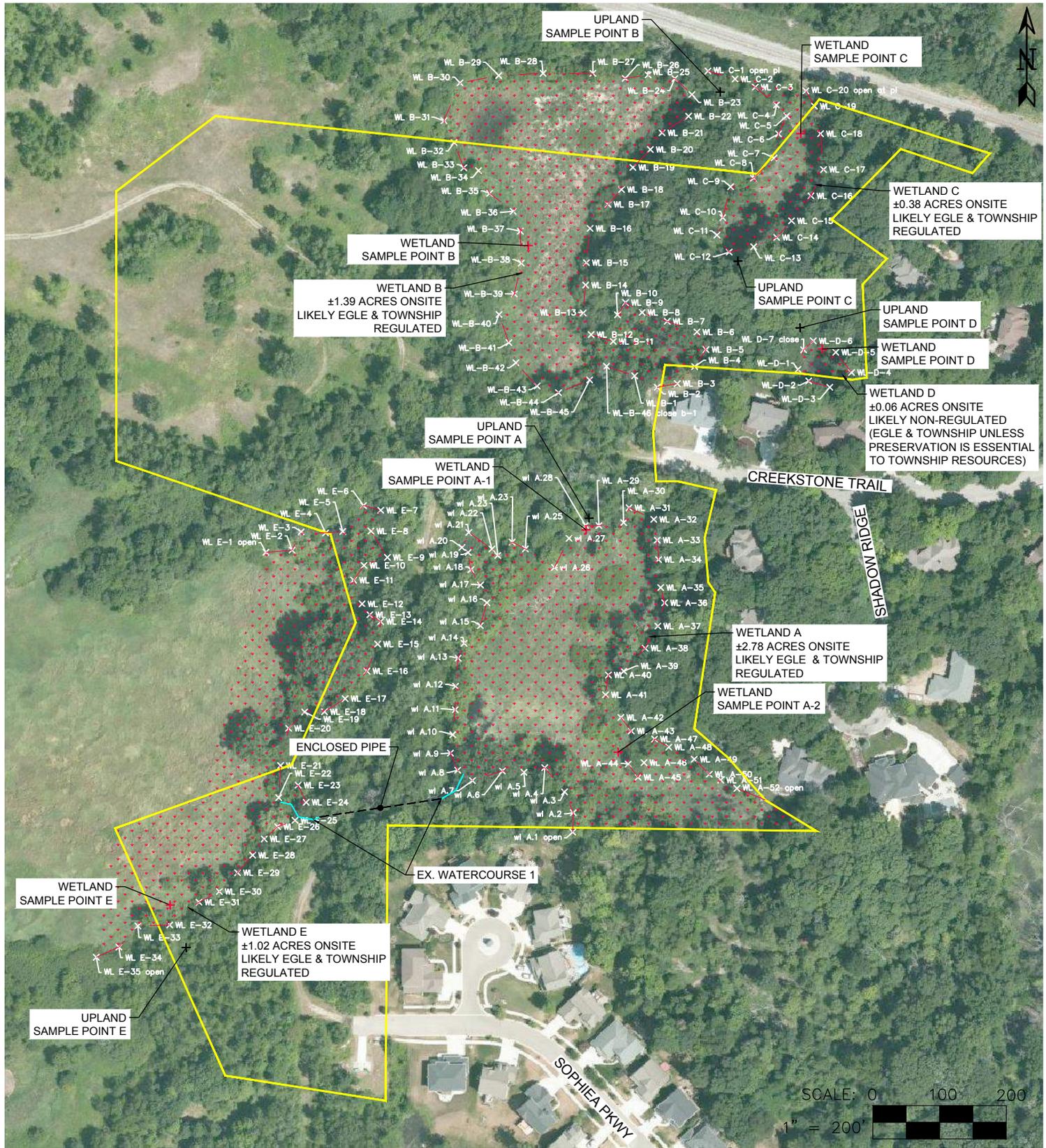


15) A view of Wetland E's forested component that appeared to have a small excavated area.



16) View of the existing pipe that connects Wetlands A and E via watercourse 1/Hoskins Drain, conveying water westward into Herron Creek.

**ENCLOSURE II**



**LEGEND**

-  APPROX. ASSESSMENT AREA
-  EXISTING WETLAND
-  EXISTING WATERCOURSE
-  UPLAND SAMPLE POINT
-  WETLAND SAMPLE POINT

NOTE: THIS MAP ILLUSTRATES AN APPROXIMATE DEPICTION OF THE WETLANDS LOCATED ON THE SUBJECT PROPERTY AS DELINEATED BY MARX WETLANDS, LLC. ON APRIL 14, 2020. PLEASE NOTE THAT THE EGLE HAS THE FINAL AUTHORITY ON THE EXTENT OF REGULATED WETLANDS, LAKES, AND STREAMS IN THE STATE OF MICHIGAN.

DATE: APR. 17, 2020	REVISIONS:
DB: BS    CB: BG	
SHEET NO.	
<b>01</b>	

CLIENT: MAYBERRY HOMES	SECTION: 29
PARCEL 29-251-009	TOWN 04 NORTH, RANGE 01 WEST
<b>WETLAND LOCATION MAP</b>	MERIDIAN TOWNSHIP
	INGHAM COUNTY, MICHIGAN



**MARX WETLANDS, LLC.**

3309 PLATT ROAD  
ANN ARBOR, MICHIGAN 48108  
(734) 478-8277

## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Parcel #33-02-02-29-251-009 – Sturk Property City/County: Meridian Twp./Ingham Co. Sampling Date: 4/14/2020  
 Applicant/Owner: Mayberry Homes State: MI Sampling Point: A-1  
 Investigator(s): B.Guevara & G.Marx; Marx Wetlands LLC Section, Township, Range: Section 29; T4N, R1W  
 Landform (hillside, terrace, etc.): lowland/depression Local relief (concave, convex, none): concave Slope (%): 0-2  
 Subregion (LRR or MLRA): LRR L Lat: 42.7058341362, Long: -84.45100194 Datum: WSG84  
 Soil Map Unit Name: Houghton muck NWI classification: PEM/PFO

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No      (If no, explain in Remarks.)  
 Are Vegetation     , Soil     , or Hydrology      significantly disturbed? Are "Normal Circumstances" present? Yes X No       
 Are Vegetation     , Soil     , or Hydrology      naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>  x  </u> No <u>    </u> Hydric Soil Present? Yes <u>  x  </u> No <u>    </u> Wetland Hydrology Present? Yes <u>  x  </u> No <u>    </u>	<b>Is the Sampled Area within a Wetland?</b> Yes <u>  x  </u> No <u>    </u> If yes, optional Wetland Site ID: <u>Wetland A</u>
Remarks: (Explain alternative procedures here or in a separate report.) Wetland A is an emergent and forested wetlands, containing an emergent wetland interiors and forested wetland perimeter. Wetland A was identified in the southeast quadrant of the Site, extending off-site in a southeast direction. Wetland A is also hydrologically connected to Wetland E. Wetland A drains southwest through Watercourse 1 (trib to Herron Creek/Hoskins Drain H6200) via an existing culvert (at the existing two-track drive) and discharges west into Wetland E.	

### HYDROLOGY

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) <input checked="" type="checkbox"/> Water-Stained Leaves (B9) <input checked="" type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input checked="" type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input checked="" type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input checked="" type="checkbox"/> Crayfish Burrows (C8) <input checked="" type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input checked="" type="checkbox"/> Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes <u>  XX  </u> No <u>    </u> Depth (inches): <u>  10  </u> Water Table Present? Yes <u>  XX  </u> No <u>    </u> Depth (inches): <u>    0  </u> Saturation Present? Yes <u>  XX  </u> No <u>    </u> Depth (inches): <u>    0  </u> (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <u>  X  </u> No <u>    </u>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: This wetland appears to receive hydrology from precipitation, groundwater, runoff from adjacent developed areas, and roadways, and overflow adjacent wetlands, resulting in seasonally saturated to seasonally inundated water regime.	

**VEGETATION** – Use scientific names of plants.

Sampling Point:     A-1    

	Absolute % Cover	Dominant Species?	Indicator Status																	
<b>Tree Stratum</b> (Plot size: <u>30-ft radius</u> )				<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: <u>    9    </u> (A)  Total Number of Dominant Species Across All Strata: <u>    10    </u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>    90.0%    </u> (A/B)  <b>Prevalence Index worksheet:</b> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align: center;">Total % Cover of:</td> <td style="width:50%; text-align: center;">Multiply by:</td> </tr> <tr> <td>OBL species <u>    40    </u></td> <td>x 1 = <u>    40    </u></td> </tr> <tr> <td>FACW species <u>   190   </u></td> <td>x 2 = <u>   380   </u></td> </tr> <tr> <td>FAC species <u>    50    </u></td> <td>x 3 = <u>   150   </u></td> </tr> <tr> <td>FACU species <u>    0    </u></td> <td>x 4 = <u>    0    </u></td> </tr> <tr> <td>UPL species <u>    0    </u></td> <td>x 5 = <u>    0    </u></td> </tr> <tr> <td>Column Totals: <u>   280   </u></td> <td>(A) <u>   570   </u> (B)</td> </tr> <tr> <td colspan="2" style="text-align: center;">Prevalence Index = B/A = <u>    2.04    </u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>    40    </u>	x 1 = <u>    40    </u>	FACW species <u>   190   </u>	x 2 = <u>   380   </u>	FAC species <u>    50    </u>	x 3 = <u>   150   </u>	FACU species <u>    0    </u>	x 4 = <u>    0    </u>	UPL species <u>    0    </u>	x 5 = <u>    0    </u>	Column Totals: <u>   280   </u>	(A) <u>   570   </u> (B)	Prevalence Index = B/A = <u>    2.04    </u>	
Total % Cover of:	Multiply by:																			
OBL species <u>    40    </u>	x 1 = <u>    40    </u>																			
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FACU species <u>    0    </u>	x 4 = <u>    0    </u>																			
UPL species <u>    0    </u>	x 5 = <u>    0    </u>																			
Column Totals: <u>   280   </u>	(A) <u>   570   </u> (B)																			
Prevalence Index = B/A = <u>    2.04    </u>																				
1. <u><i>Acer saccharinum</i></u>	<u>20</u>	<u>Yes</u>	<u>FACW</u>																	
2. <u><i>Quercus bicolor</i></u>	<u>10</u>	<u>No</u>	<u>FACW</u>																	
3. <u><i>Ulmus americana</i></u>	<u>10</u>	<u>No</u>	<u>FACW</u>																	
4. <u><i>Populus deltoides</i></u>	<u>15</u>	<u>Yes</u>	<u>FAC</u>																	
5. <u><i>Acer negundo</i></u>	<u>10</u>	<u>No</u>	<u>FACW</u>																	
6. _____																				
7. _____																				
	<u>65</u>	=Total Cover																		
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15-ft radius</u> )																				
1. <u><i>Fraxinus pennsylvanica</i></u>	<u>15</u>	<u>Yes</u>	<u>FACW</u>																	
2. <u><i>Cornus sericea</i></u>	<u>10</u>	<u>No</u>	<u>FACW</u>																	
3. <u><i>Cornus racemosa</i></u>	<u>10</u>	<u>No</u>	<u>FAC</u>																	
4. <u><i>Sambucus canadensis</i></u>	<u>20</u>	<u>Yes</u>	<u>FACW</u>																	
5. <u><i>Cornus amomum</i></u>	<u>15</u>	<u>Yes</u>	<u>FACW</u>																	
6. <u><i>Rhamnus cathartica</i></u>	<u>20</u>	<u>Yes</u>																		
7. _____																				
	<u>90</u>	=Total Cover																		
<b>Herb Stratum</b> (Plot size: <u>5-ft radius</u> )																				
1. <u><i>Phalaris arundinacea</i></u>	<u>35</u>	<u>Yes</u>	<u>FACW</u>																	
2. <u><i>Carex stricta</i></u>	<u>10</u>	<u>No</u>	<u>OBL</u>																	
3. <u><i>Typha angustifolia</i></u>	<u>10</u>	<u>No</u>	<u>OBL</u>																	
4. <u><i>Onoclea sensibilis</i></u>	<u>10</u>	<u>No</u>	<u>FACW</u>																	
5. <u><i>Carex lacustris</i></u>	<u>15</u>	<u>Yes</u>	<u>OBL</u>																	
6. <u><i>Carex intumescens</i></u>	<u>5</u>	<u>No</u>	<u>FACW</u>																	
7. <u><i>Carex vulpinoidea</i></u>	<u>5</u>	<u>No</u>	<u>OBL</u>																	
8. _____																				
9. _____																				
10. _____																				
11. _____																				
12. _____																				
	<u>90</u>	=Total Cover																		
<b>Woody Vine Stratum</b> (Plot size: <u>30-ft radius</u> )																				
1. <u><i>Toxicodendron radicans</i></u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>																	
2. <u><i>Vitis riparia</i></u>	<u>30</u>	<u>Yes</u>	<u>FACW</u>																	
3. _____																				
4. _____																				
	<u>55</u>	=Total Cover																		

**Hydrophytic Vegetation Indicators:**

Rapid Test for Hydrophytic Vegetation

Dominance Test is >50%

Prevalence Index is ≤3.0<sup>1</sup>

Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)

<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

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**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

---

**Hydrophytic Vegetation Present?**      Yes       No

Remarks: (Include photo numbers here or on a separate sheet.)



## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Parcel #33-02-02-29-251-009 – Sturk Property City/County: Meridian Twp./Ingham Co. Sampling Date: 4/14/2020  
 Applicant/Owner: Mayberry Homes State: MI Sampling Point: B-1  
 Investigator(s): B.Guevara & G.Marx; Marx Wetlands LLC Section, Township, Range: Section 29; T4N, R1W  
 Landform (hillside, terrace, etc.): lowland/depression Local relief (concave, convex, none): concave Slope (%): 0-2  
 Subregion (LRR or MLRA): LRR L Lat: 42.7070039445, Long: -84.4513266 Datum: WSG84  
 Soil Map Unit Name: Houghton muck, 0 to 1 percent slopes NWI classification: PEM1A/PFO1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No      (If no, explain in Remarks.)  
 Are Vegetation     , Soil     , or Hydrology      significantly disturbed? Are "Normal Circumstances" present? Yes X No       
 Are Vegetation     , Soil     , or Hydrology      naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes <u>x</u> No <u>    </u> Hydric Soil Present? Yes <u>x</u> No <u>    </u> Wetland Hydrology Present? Yes <u>x</u> No <u>    </u>	<b>Is the Sampled Area within a Wetland?</b> Yes <u>x</u> No <u>    </u> If yes, optional Wetland Site ID: <u>Wetland B</u>
Remarks: (Explain alternative procedures here or in a separate report.) Wetland B is an emergent and forested wetland, containing an emergent wetland interior and forested wetland perimeter. Wetland B is entirely contained within the north-central portion of the Site.	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) <input checked="" type="checkbox"/> Water-Stained Leaves (B9) <input checked="" type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input checked="" type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input checked="" type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input checked="" type="checkbox"/> Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
---	--

<b>Field Observations:</b> Surface Water Present? Yes <u>XX</u> No <u>    </u> Depth (inches): <u>8</u> Water Table Present? Yes <u>XX</u> No <u>    </u> Depth (inches): <u>0</u> Saturation Present? Yes <u>XX</u> No <u>    </u> Depth (inches): <u>0</u> (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <u>X</u> No <u>    </u>
--	---

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:  
 This wetland appears to receive hydrology from precipitation, groundwater, runoff from adjacent developed areas, and roadways, and overflow adjacent wetlands, resulting in seasonally saturated to seasonally inundated water regime.

**VEGETATION** – Use scientific names of plants.

Sampling Point:     B-1    

	Absolute % Cover	Dominant Species?	Indicator Status
<b>Tree Stratum</b> (Plot size: <u>30-ft radius</u> )			
1. <u><i>Acer saccharinum</i></u>	<u>5</u>	<u>Yes</u>	<u>FACW</u>
2. <u><i>Quercus bicolor</i></u>	<u>5</u>	<u>Yes</u>	<u>FACW</u>
3. <u><i>Ulmus americana</i></u>	<u>5</u>	<u>Yes</u>	<u>FACW</u>
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
	<u>15</u>	=Total Cover	
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15-ft radius</u> )			
1. <u><i>Cornus racemosa</i></u>	<u>15</u>	<u>Yes</u>	<u>FACW</u>
2. <u><i>Sambucus canadensis</i></u>	<u>10</u>	<u>Yes</u>	<u>FACW</u>
3. <u><i>Rhamnus cathartica</i></u>	<u>10</u>	<u>Yes</u>	<u>FAC</u>
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
	<u>35</u>	=Total Cover	
<b>Herb Stratum</b> (Plot size: <u>5-ft radius</u> )			
1. <u><i>Phalaris arundinacea</i></u>	<u>30</u>	<u>Yes</u>	<u>FACW</u>
2. <u><i>Typha latifolia</i></u>	<u>30</u>	<u>Yes</u>	<u>OBL</u>
3. <u><i>Typha angustifolia</i></u>	<u>30</u>	<u>Yes</u>	<u>OBL</u>
4. <u><i>Boehmeria cylindrica</i></u>	<u>10</u>	<u>No</u>	<u>OBL</u>
5. <u><i>Carex lacustris</i></u>	<u>10</u>	<u>No</u>	<u>OBL</u>
6. <u><i>Carex stricta</i></u>	<u>5</u>	<u>No</u>	<u>OBL</u>
7. <u><i>Solidago gigantea</i></u>	<u>10</u>	<u>No</u>	<u>FACW</u>
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
	<u>125</u>	=Total Cover	
<b>Woody Vine Stratum</b> (Plot size: <u>30-ft radius</u> )			
1. <u><i>Toxicodendron radicans</i></u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>
2. <u><i>Vitis riparia</i></u>	<u>30</u>	<u>Yes</u>	<u>FACW</u>
3. _____	_____	_____	_____
4. _____	_____	_____	_____
	<u>55</u>	=Total Cover	

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 11 (A)

Total Number of Dominant Species Across All Strata: 11 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

Total % Cover of:	Multiply by:
OBL species <u>85</u>	x 1 = <u>85</u>
FACW species <u>110</u>	x 2 = <u>220</u>
FAC species <u>35</u>	x 3 = <u>105</u>
FACU species <u>0</u>	x 4 = <u>0</u>
UPL species <u>0</u>	x 5 = <u>0</u>
Column Totals: <u>230</u> (A)	<u>410</u> (B)
Prevalence Index = B/A = <u>1.78</u>	

**Hydrophytic Vegetation Indicators:**

Rapid Test for Hydrophytic Vegetation

Dominance Test is >50%

Prevalence Index is ≤3.0<sup>1</sup>

Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)

<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?**      Yes X      No \_\_\_\_\_

Remarks: (Include photo numbers here or on a separate sheet.)



## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Parcel #33-02-02-29-251-009 – Sturk Property City/County: Meridian Twp./Ingham Co. Sampling Date: 4/14/2020  
 Applicant/Owner: Mayberry Homes State: MI Sampling Point: C-1  
 Investigator(s): B.Guevara & G.Marx; Marx Wetlands LLC Section, Township, Range: Section 29; T4N, R1W  
 Landform (hillside, terrace, etc.): lowland/depression Local relief (concave, convex, none): concave Slope (%): 0-2  
 Subregion (LRR or MLRA): LRR L Lat: 42.70755261 Long: -84.44986264 Datum: WSG84  
 Soil Map Unit Name: Houghton muck, 0 to 1 percent slopes NWI classification: PEM1A/PFO1C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No      (If no, explain in Remarks.)  
 Are Vegetation     , Soil     , or Hydrology      significantly disturbed? Are "Normal Circumstances" present? Yes X No       
 Are Vegetation     , Soil     , or Hydrology      naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <u>x</u> No <u>    </u> Hydric Soil Present? Yes <u>x</u> No <u>    </u> Wetland Hydrology Present? Yes <u>x</u> No <u>    </u>	<b>Is the Sampled Area within a Wetland?</b> Yes <u>x</u> No <u>    </u> If yes, optional Wetland Site ID: <u>Wetland C</u>
Remarks: (Explain alternative procedures here or in a separate report.) Wetland C is an emergent and forested wetlands, containing an emergent wetland interior and forested wetland perimeter. Wetland C is largely on-site; however, appears to drain off-site at the base of the railroad embankment.	

### HYDROLOGY

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) <input checked="" type="checkbox"/> Water-Stained Leaves (B9) <input checked="" type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input checked="" type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input checked="" type="checkbox"/> Crayfish Burrows (C8) <input checked="" type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input checked="" type="checkbox"/> Microtopographic Relief (D4) <input checked="" type="checkbox"/> FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes <u>XX</u> No <u>    </u> Depth (inches): <u>15</u> Water Table Present? Yes <u>XX</u> No <u>    </u> Depth (inches): <u>2</u> Saturation Present? Yes <u>XX</u> No <u>    </u> Depth (inches): <u>0</u> (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <u>X</u> No <u>    </u>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: This wetland appears to receive hydrology from precipitation, groundwater, runoff from adjacent developed areas, and roadways, and overflow adjacent wetlands, resulting in seasonally saturated to seasonally inundated water regime.	

**VEGETATION** – Use scientific names of plants.

Sampling Point: C-1

	Absolute % Cover	Dominant Species?	Indicator Status																	
<b>Tree Stratum</b> (Plot size: <u>30-ft radius</u> )																				
1. <u><i>Acer saccharinum</i></u>	<u>20</u>	<u>Yes</u>	<u>FACW</u>	<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: <u>9</u> (A)  Total Number of Dominant Species Across All Strata: <u>9</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100.0%</u> (A/B)																
2. <u><i>Quercus bicolor</i></u>	<u>5</u>	<u>No</u>	<u>FACW</u>																	
3. <u><i>Ulmus americana</i></u>	<u>5</u>	<u>No</u>	<u>FACW</u>																	
4. _____																				
5. _____																				
6. _____																				
7. _____																				
	<u>30</u>	=Total Cover																		
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15-ft radius</u> )																				
1. <u><i>Cornus racemosa</i></u>	<u>10</u>	<u>Yes</u>	<u>FACW</u>	<b>Prevalence Index worksheet:</b> <table style="width:100%; border:none;"> <tr> <td style="text-align:center;">Total % Cover of:</td> <td style="text-align:center;">Multiply by:</td> </tr> <tr> <td>OBL species <u>55</u></td> <td>x 1 = <u>55</u></td> </tr> <tr> <td>FACW species <u>140</u></td> <td>x 2 = <u>280</u></td> </tr> <tr> <td>FAC species <u>60</u></td> <td>x 3 = <u>180</u></td> </tr> <tr> <td>FACU species <u>0</u></td> <td>x 4 = <u>0</u></td> </tr> <tr> <td>UPL species <u>0</u></td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>255</u> (A)</td> <td><u>515</u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:center;">Prevalence Index = B/A = <u>2.02</u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>55</u>	x 1 = <u>55</u>	FACW species <u>140</u>	x 2 = <u>280</u>	FAC species <u>60</u>	x 3 = <u>180</u>	FACU species <u>0</u>	x 4 = <u>0</u>	UPL species <u>0</u>	x 5 = <u>0</u>	Column Totals: <u>255</u> (A)	<u>515</u> (B)	Prevalence Index = B/A = <u>2.02</u>	
Total % Cover of:	Multiply by:																			
OBL species <u>55</u>	x 1 = <u>55</u>																			
FACW species <u>140</u>	x 2 = <u>280</u>																			
FAC species <u>60</u>	x 3 = <u>180</u>																			
FACU species <u>0</u>	x 4 = <u>0</u>																			
UPL species <u>0</u>	x 5 = <u>0</u>																			
Column Totals: <u>255</u> (A)	<u>515</u> (B)																			
Prevalence Index = B/A = <u>2.02</u>																				
2. <u><i>Sambucus canadensis</i></u>	<u>15</u>	<u>Yes</u>	<u>FACW</u>																	
3. <u><i>Rhamnus cathartica</i></u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>																	
4. _____																				
5. _____																				
6. _____																				
7. _____																				
	<u>50</u>	=Total Cover																		
<b>Herb Stratum</b> (Plot size: <u>5-ft radius</u> )																				
1. <u><i>Phalaris arundinacea</i></u>	<u>30</u>	<u>Yes</u>	<u>FACW</u>	<b>Hydrophytic Vegetation Indicators:</b> <input type="checkbox"/> Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.																
2. <u><i>Carex lacustris</i></u>	<u>25</u>	<u>Yes</u>	<u>OBL</u>																	
3. <u><i>Onoclea sensibilis</i></u>	<u>20</u>	<u>Yes</u>	<u>FACW</u>																	
4. <u><i>Boehmeria cylindrica</i></u>	<u>15</u>	<u>No</u>	<u>OBL</u>																	
5. <u><i>Urtica dioica</i></u>	<u>10</u>	<u>No</u>	<u>FAC</u>																	
6. <u><i>Carex stricta</i></u>	<u>10</u>	<u>No</u>	<u>OBL</u>																	
7. <u><i>Solidago gigantea</i></u>	<u>5</u>	<u>No</u>	<u>FACW</u>																	
8. <u><i>Symplocarpus foetidus</i></u>	<u>5</u>	<u>No</u>	<u>OBL</u>																	
9. _____																				
10. _____																				
11. _____																				
12. _____																				
	<u>120</u>	=Total Cover																		
<b>Woody Vine Stratum</b> (Plot size: <u>30-ft radius</u> )																				
1. <u><i>Toxicodendron radicans</i></u>	<u>25</u>	<u>Yes</u>	<u>FAC</u>	<b>Definitions of Vegetation Strata:</b>  <b>Tree</b> – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/shrub</b> – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vines</b> – All woody vines greater than 3.28 ft in height.																
2. <u><i>Vitis riparia</i></u>	<u>30</u>	<u>Yes</u>	<u>FACW</u>																	
3. _____																				
4. _____																				
	<u>55</u>	=Total Cover																		
<table style="width:100%; border:none;"> <tr> <td style="width:60%;"><b>Hydrophytic Vegetation Present?</b></td> <td style="width:20%; text-align:center;"><b>Yes</b> <u>X</u></td> <td style="width:20%; text-align:center;"><b>No</b> _____</td> </tr> </table>					<b>Hydrophytic Vegetation Present?</b>	<b>Yes</b> <u>X</u>	<b>No</b> _____													
<b>Hydrophytic Vegetation Present?</b>	<b>Yes</b> <u>X</u>	<b>No</b> _____																		

Remarks: (Include photo numbers here or on a separate sheet.)





**VEGETATION** – Use scientific names of plants.

Sampling Point:  D-1

	Absolute % Cover	Dominant Species?	Indicator Status
<b>Tree Stratum</b> (Plot size: <u> 30-ft radius </u> )			
1. <u> <i>Ulmus americana</i> </u>	<u> 10 </u>	<u> Yes </u>	<u> FACW </u>
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
	<u> 10 </u>	<u> =Total Cover</u>	
<b>Sapling/Shrub Stratum</b> (Plot size: <u> 15-ft radius </u> )			
1. <u> <i>Rhamnus cathartica</i> </u>	<u> 10 </u>	<u> Yes </u>	<u> FACW </u>
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
	<u> 10 </u>	<u> =Total Cover</u>	
<b>Herb Stratum</b> (Plot size: <u> 5-ft radius </u> )			
1. <u> <i>Phalaris arundinacea</i> </u>	<u> 15 </u>	<u> Yes </u>	<u> FACW </u>
2. <u> <i>Carex intumescens</i> </u>	<u> 15 </u>	<u> Yes </u>	<u> FACW </u>
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
	<u> 30 </u>	<u> =Total Cover</u>	
<b>Woody Vine Stratum</b> (Plot size: <u> 30-ft radius </u> )			
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
	_____	<u> =Total Cover</u>	

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC:  4  (A)

Total Number of Dominant Species Across All Strata:  4  (B)

Percent of Dominant Species That Are OBL, FACW, or FAC:  100.0%  (A/B)

**Prevalence Index worksheet:**

Total % Cover of:	Multiply by:
OBL species <u> 0 </u>	x 1 = <u> 0 </u>
FACW species <u> 50 </u>	x 2 = <u> 100 </u>
FAC species <u> 0 </u>	x 3 = <u> 0 </u>
FACU species <u> 0 </u>	x 4 = <u> 0 </u>
UPL species <u> 0 </u>	x 5 = <u> 0 </u>
Column Totals: <u> 50 </u> (A)	<u> 100 </u> (B)
Prevalence Index = B/A = <u> 2.00 </u>	

**Hydrophytic Vegetation Indicators:**

Rapid Test for Hydrophytic Vegetation

Dominance Test is >50%

Prevalence Index is ≤3.0<sup>1</sup>

Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)

<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?**      Yes  X       No

Remarks: (Include photo numbers here or on a separate sheet.)





**VEGETATION** – Use scientific names of plants.

Sampling Point: E-1

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Plot size: <u>30-ft radius</u> )				
1.				
2.				
3.				
4.				
5.				
6.				
7.				
		=Total Cover		
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15-ft radius</u> )				
1.	<u>Rhamnus cathartica</u>	25	Yes	FACW
2.	<u>Sambucus canadensis</u>	10	No	FACW
3.	<u>Cornus amomum</u>	15	Yes	FACW
4.	<u>Cornus racemosa</u>	15	Yes	FAC
5.	<u>Zanthoxylum americanum</u>	10	No	FACU
6.				
7.				
		75	=Total Cover	
<b>Herb Stratum</b> (Plot size: <u>5-ft radius</u> )				
1.	<u>Phalaris arundinacea</u>	55	Yes	FACW
2.	<u>Carex lacustris</u>	25	Yes	OBL
3.	<u>Solidago gigantea</u>	20	Yes	FACW
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
		100	=Total Cover	
<b>Woody Vine Stratum</b> (Plot size: <u>30-ft radius</u> )				
1.				
2.				
3.				
4.				
			=Total Cover	

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

**Prevalence Index worksheet:**

Total % Cover of:	Multiply by:
OBL species <u>25</u>	x 1 = <u>25</u>
FACW species <u>125</u>	x 2 = <u>250</u>
FAC species <u>15</u>	x 3 = <u>45</u>
FACU species <u>10</u>	x 4 = <u>40</u>
UPL species <u>0</u>	x 5 = <u>0</u>
Column Totals: <u>175</u> (A)	<u>360</u> (B)
Prevalence Index = B/A = <u>2.06</u>	

**Hydrophytic Vegetation Indicators:**

Rapid Test for Hydrophytic Vegetation

Dominance Test is >50%

Prevalence Index is ≤3.0<sup>1</sup>

Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)

Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)

<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Definitions of Vegetation Strata:**

**Tree** – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

**Sapling/shrub** – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

**Herb** – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

**Woody vines** – All woody vines greater than 3.28 ft in height.

**Hydrophytic Vegetation Present?**      Yes       No

Remarks: (Include photo numbers here or on a separate sheet.)



**WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region**

Project/Site: Parcel #33-02-02-29-251-009 – Sturk Property City/County: Meridian Township/Ingham Co. Sampling Date: 4/14/2020  
 Applicant/Owner: Mayberry Homes State: MI Sampling Point: UPL-A  
 Investigator(s): B.Guevara; Marx Wetlands LLC Section, Township, Range: Section 29; T4N, R1W  
 Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): none Slope (%): 0-5  
 Subregion (LRR or MLRA): LRR L Lat: 42.7058822648, Long: -84.45098541 Datum: WSG84  
 Soil Map Unit Name: Houghton muck/Aubbeenaubbee-Capac sandy loams, 0 to 3 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation , Soil , or Hydrology  significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation , Soil , or Hydrology  naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.)   	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
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<b>Field Observations:</b> Surface Water Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:





## WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region

Project/Site: Parcel #33-02-02-29-251-009 – Sturk Property City/County: Meridian Township/Ingham Co. Sampling Date: 4/14/2020  
 Applicant/Owner: Mayberry Homes State: MI Sampling Point: UPL-B  
 Investigator(s): B.Guevara; Marx Wetlands LLC Section, Township, Range: Section 29; T4N, R1W  
 Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): none Slope (%): 0-5  
 Subregion (LRR or MLRA): LRR L Lat: 42.70763731 Long: -84.45025636 Datum: WSG84  
 Soil Map Unit Name: Marlette loam, 12 to 18 percent slopes, eroded NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation , Soil , or Hydrology  significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation , Soil , or Hydrology  naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, optional Wetland Site ID: _____
Hydric Soil Present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Wetland Hydrology Present?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Remarks: (Explain alternative procedures here or in a separate report.)			

### HYDROLOGY

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<b>Secondary Indicators (minimum of two required)</b> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
<b>Field Observations:</b> Surface Water Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks:	

**VEGETATION** – Use scientific names of plants.

Sampling Point: UPL-B

	Absolute % Cover	Dominant Species?	Indicator Status																	
<b>Tree Stratum</b> (Plot size: <u>30-ft radius</u> )				<p><b>Dominance Test worksheet:</b></p> <p>Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A)</p> <p>Total Number of Dominant Species Across All Strata: <u>9</u> (B)</p> <p>Percent of Dominant Species That Are OBL, FACW, or FAC: <u>11.1%</u> (A/B)</p> <p><b>Prevalence Index worksheet:</b></p> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align: center;">Total % Cover of:</td> <td style="width:50%; text-align: center;">Multiply by:</td> </tr> <tr> <td>OBL species <u>0</u></td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species <u>0</u></td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>20</u></td> <td>x 3 = <u>60</u></td> </tr> <tr> <td>FACU species <u>145</u></td> <td>x 4 = <u>580</u></td> </tr> <tr> <td>UPL species <u>0</u></td> <td>x 5 = <u>0</u></td> </tr> <tr> <td>Column Totals: <u>165</u> (A)</td> <td><u>640</u> (B)</td> </tr> <tr> <td colspan="2" style="text-align: center;">Prevalence Index = B/A = <u>3.88</u></td> </tr> </table> <p><b>Hydrophytic Vegetation Indicators:</b></p> <p><input type="checkbox"/> Rapid Test for Hydrophytic Vegetation</p> <p><input type="checkbox"/> Dominance Test is &gt;50%</p> <p><input type="checkbox"/> Prevalence Index is ≤3.0<sup>1</sup></p> <p><input type="checkbox"/> Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)</p> <p><input type="checkbox"/> Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)</p> <p><small><sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.</small></p> <p><b>Definitions of Vegetation Strata:</b></p> <p><b>Tree</b> – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.</p> <p><b>Sapling/shrub</b> – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.</p> <p><b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.</p> <p><b>Woody vines</b> – All woody vines greater than 3.28 ft in height.</p> <p><b>Hydrophytic Vegetation Present?</b>      Yes <u>    </u>      No <u>  x  </u></p>	Total % Cover of:	Multiply by:	OBL species <u>0</u>	x 1 = <u>0</u>	FACW species <u>0</u>	x 2 = <u>0</u>	FAC species <u>20</u>	x 3 = <u>60</u>	FACU species <u>145</u>	x 4 = <u>580</u>	UPL species <u>0</u>	x 5 = <u>0</u>	Column Totals: <u>165</u> (A)	<u>640</u> (B)	Prevalence Index = B/A = <u>3.88</u>	
Total % Cover of:	Multiply by:																			
OBL species <u>0</u>	x 1 = <u>0</u>																			
FACW species <u>0</u>	x 2 = <u>0</u>																			
FAC species <u>20</u>	x 3 = <u>60</u>																			
FACU species <u>145</u>	x 4 = <u>580</u>																			
UPL species <u>0</u>	x 5 = <u>0</u>																			
Column Totals: <u>165</u> (A)	<u>640</u> (B)																			
Prevalence Index = B/A = <u>3.88</u>																				
1. <u>Acer saccharum</u>	20	Yes	FACU																	
2. <u>Prunus serotina</u>	15	Yes	FACU																	
3. <u>Rhamnus cathartica</u>	5	No	FAC																	
4. <u>Tilia americana</u>	10	Yes	FACU																	
5. <u>Quercus alba</u>	10	Yes	FACU																	
6. <u>Quercus rubra</u>	10	Yes	FACU																	
7. _____																				
	70	=Total Cover																		
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15-ft radius</u> )																				
1. <u>Lonicera tatarica</u>	15	Yes	FAC																	
2. <u>Crataegus</u>	15	Yes	FACU																	
3. _____																				
4. _____																				
5. _____																				
6. _____																				
7. _____																				
	30	=Total Cover																		
<b>Herb Stratum</b> (Plot size: <u>5-ft radius</u> )																				
1. <u>Carex pennsylvanica</u>	10	No	FACU																	
2. <u>Alliaria petiolata</u>	10	No	FACU																	
3. <u>Erythronium americanum</u>	10	No	FACU																	
4. <u>Podophyllum peltatum</u>	25	Yes	FACU																	
5. <u>Fragaria virginiana</u>	10	No	FACU																	
6. <u>Hesperis matronalis</u>	20	Yes																		
7. _____																				
8. _____																				
9. _____																				
10. _____																				
11. _____																				
12. _____																				
	85	=Total Cover																		
<b>Woody Vine Stratum</b> (Plot size: <u>30-ft radius</u> )																				
1. _____																				
2. _____																				
3. _____																				
4. _____																				
			=Total Cover																	

Remarks: (Include photo numbers here or on a separate sheet.)



**WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region**

Project/Site: Parcel #33-02-02-29-251-009 – Sturk Property City/County: Meridian Township/Ingham Co. Sampling Date: 4/14/2020  
 Applicant/Owner: Mayberry Homes State: MI Sampling Point: UPL-C  
 Investigator(s): B.Guevara; Marx Wetlands LLC Section, Township, Range: Section 29; T4N, R1W  
 Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): none Slope (%): 0-5  
 Subregion (LRR or MLRA): LRR L Lat: 42.7069412295, Long: -84.45015685 Datum: WSG84  
 Soil Map Unit Name: Marlette loam, 12 to 18 percent slopes, eroded NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation , Soil , or Hydrology  significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation , Soil , or Hydrology  naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.)   	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
--	--

<b>Field Observations:</b> Surface Water Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

**VEGETATION** – Use scientific names of plants.

Sampling Point: UPL-C

	Absolute % Cover	Dominant Species?	Indicator Status																	
<b>Tree Stratum</b> (Plot size: <u>30-ft radius</u> )																				
1. <u>Acer saccharum</u>	15	Yes	FACU	<b>Dominance Test worksheet:</b>  Number of Dominant Species That Are OBL, FACW, or FAC: <u>2</u> (A)  Total Number of Dominant Species Across All Strata: <u>12</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>16.7%</u> (A/B)																
2. <u>Fraxinus americana</u>	15	Yes	FACU																	
3. <u>Rhamnus cathartica</u>	5	No	FAC																	
4. <u>Prunus serotina</u>	10	Yes	FACU																	
5. <u>Fagus grandifolia</u>	10	Yes	FACU																	
6. <u>Quercus rubra</u>	10	Yes	FACU																	
7. _____																				
	65	=Total Cover		<b>Prevalence Index worksheet:</b>  <table style="width:100%; border:none;"> <tr> <td style="width:50%; text-align:center;">Total % Cover of:</td> <td style="width:50%; text-align:center;">Multiply by:</td> </tr> <tr> <td>OBL species <u>0</u></td> <td>x 1 = <u>0</u></td> </tr> <tr> <td>FACW species <u>0</u></td> <td>x 2 = <u>0</u></td> </tr> <tr> <td>FAC species <u>30</u></td> <td>x 3 = <u>90</u></td> </tr> <tr> <td>FACU species <u>155</u></td> <td>x 4 = <u>620</u></td> </tr> <tr> <td>UPL species <u>5</u></td> <td>x 5 = <u>25</u></td> </tr> <tr> <td>Column Totals: <u>190</u> (A)</td> <td><u>735</u> (B)</td> </tr> <tr> <td colspan="2" style="text-align:center;">Prevalence Index = B/A = <u>3.87</u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>0</u>	x 1 = <u>0</u>	FACW species <u>0</u>	x 2 = <u>0</u>	FAC species <u>30</u>	x 3 = <u>90</u>	FACU species <u>155</u>	x 4 = <u>620</u>	UPL species <u>5</u>	x 5 = <u>25</u>	Column Totals: <u>190</u> (A)	<u>735</u> (B)	Prevalence Index = B/A = <u>3.87</u>	
Total % Cover of:	Multiply by:																			
OBL species <u>0</u>	x 1 = <u>0</u>																			
FACW species <u>0</u>	x 2 = <u>0</u>																			
FAC species <u>30</u>	x 3 = <u>90</u>																			
FACU species <u>155</u>	x 4 = <u>620</u>																			
UPL species <u>5</u>	x 5 = <u>25</u>																			
Column Totals: <u>190</u> (A)	<u>735</u> (B)																			
Prevalence Index = B/A = <u>3.87</u>																				
<b>Sapling/Shrub Stratum</b> (Plot size: <u>15-ft radius</u> )																				
1. <u>Lonicera tatarica</u>	15	Yes	FACU	<b>Hydrophytic Vegetation Indicators:</b>  <input type="checkbox"/> Rapid Test for Hydrophytic Vegetation <input type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is ≤3.0 <sup>1</sup> <input type="checkbox"/> Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)																
2. <u>Ostrya virginiana</u>	15	Yes	FACU																	
3. <u>Carpinus caroliniana</u>	10	Yes	FAC																	
4. <u>Rubus occidentalis</u>	5	No	FACU																	
5. <u>Rubus allegheniensis</u>	5	No	UPL																	
6. _____																				
7. _____																				
	50	=Total Cover																		
<b>Herb Stratum</b> (Plot size: <u>5-ft radius</u> )																				
1. <u>Carex pennsylvanica</u>	15	Yes	FACU	<sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.  <b>Definitions of Vegetation Strata:</b>  <b>Tree</b> – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.  <b>Sapling/shrub</b> – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.  <b>Herb</b> – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.  <b>Woody vines</b> – All woody vines greater than 3.28 ft in height.																
2. <u>Erythronium americanum</u>	15	Yes	FACU																	
3. <u>Geum canadense</u>	15	Yes	FAC																	
4. <u>Podophyllum peltatum</u>	20	Yes	FACU																	
5. <u>Fragaria virginiana</u>	10	No	FACU																	
6. _____																				
7. _____																				
8. _____																				
9. _____																				
10. _____																				
11. _____																				
12. _____																				
	75	=Total Cover																		
<b>Woody Vine Stratum</b> (Plot size: <u>30-ft radius</u> )																				
1. _____				<b>Hydrophytic Vegetation Present?</b> Yes <u>    </u> No <u>  x  </u>																
2. _____																				
3. _____																				
4. _____																				
		=Total Cover																		

Remarks: (Include photo numbers here or on a separate sheet.)



**WETLAND DETERMINATION DATA FORM - Northcentral and Northeast Region**

Project/Site: Parcel #33-02-02-29-251-009 – Sturk Property City/County: Meridian Township/Ingham Co. Sampling Date: 4/14/2020  
 Applicant/Owner: Mayberry Homes State: MI Sampling Point: UPL-D  
 Investigator(s): B.Guevara; Marx Wetlands LLC Section, Township, Range: Section 29; T4N, R1W  
 Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): none Slope (%): 0-5  
 Subregion (LRR or MLRA): LRR L Lat: 42.7066666752, Long: -84.44980977 Datum: WSG84  
 Soil Map Unit Name: Filer fine sandy loam, Saginaw Lobe, 6 to 12 percent slopes NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation , Soil , or Hydrology  significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation , Soil , or Hydrology  naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes, optional Wetland Site ID: _____
Remarks: (Explain alternative procedures here or in a separate report.)    	

**HYDROLOGY**

<b>Wetland Hydrology Indicators:</b> <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Marl Deposits (B15) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
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<b>Field Observations:</b> Surface Water Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Water Table Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Depth (inches): _____ (includes capillary fringe)	<b>Wetland Hydrology Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
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Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:



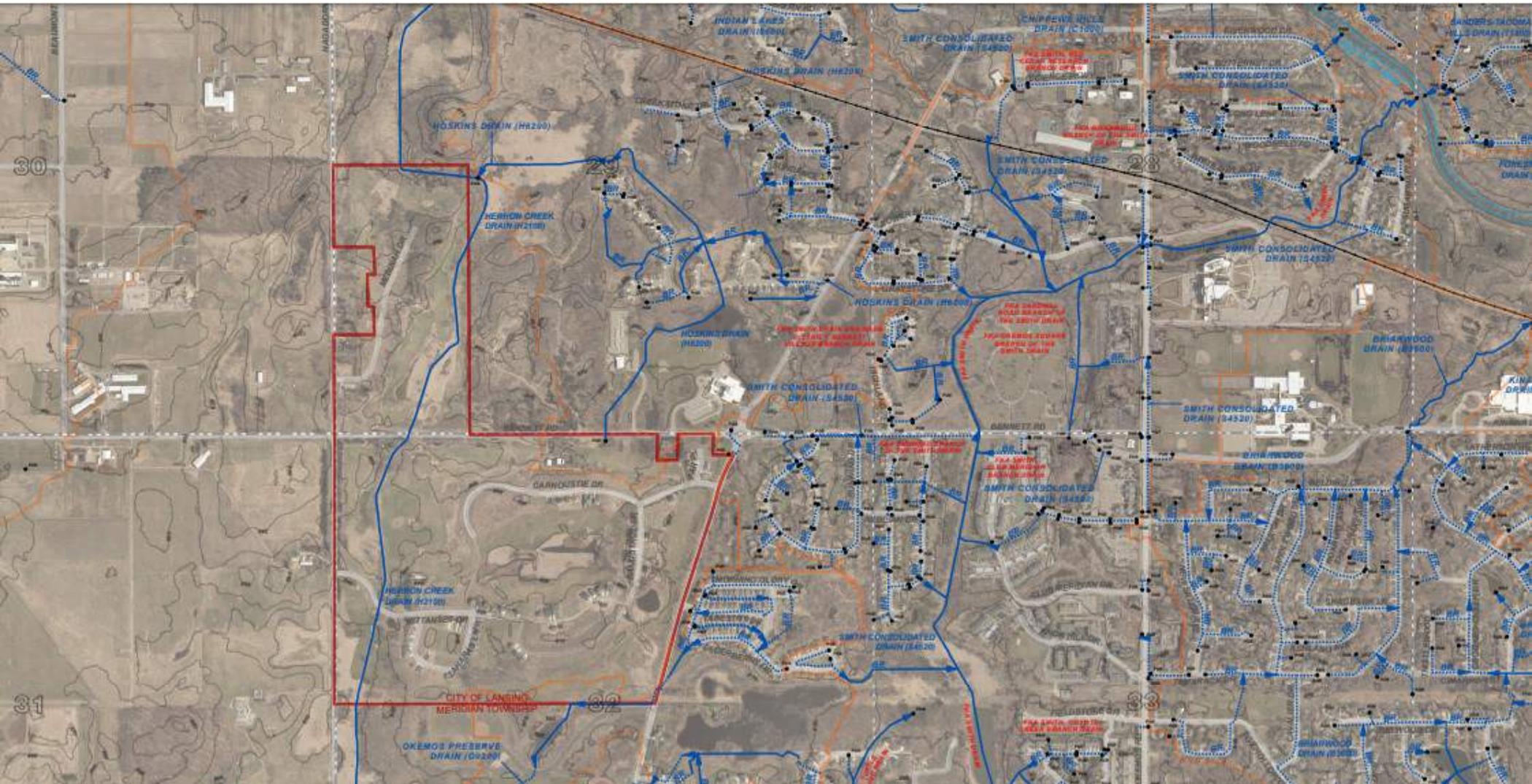








**ENCLOSURE III**



**ENCLOSURE IV**

# National Flood Hazard Layer FIRMette



## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/15/2020 at 1:46:29 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

42°42'36.14"N



USGS The National Map: Orthoimagery. Data refreshed April, 2019.

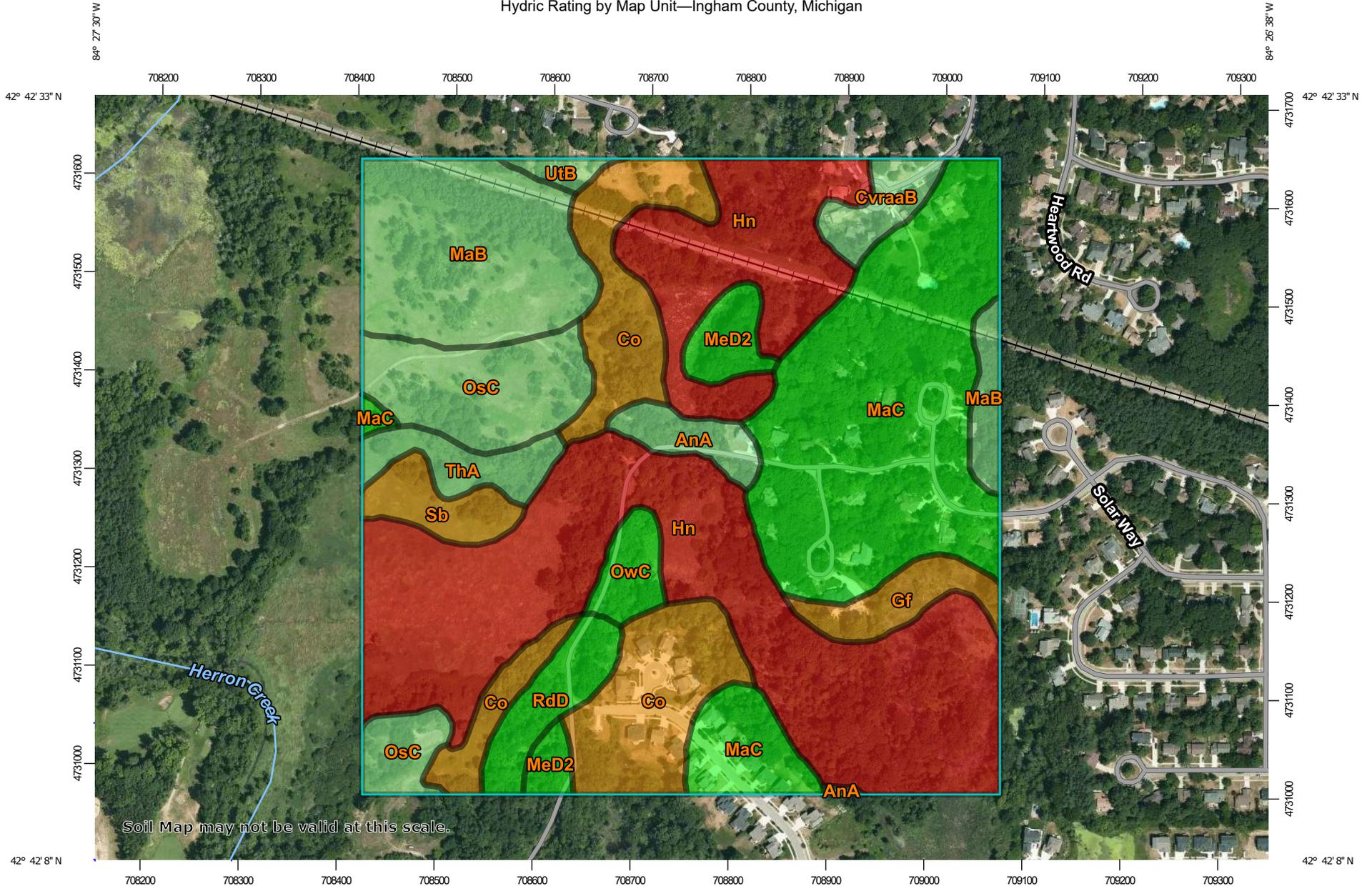


42°42'9.70"N

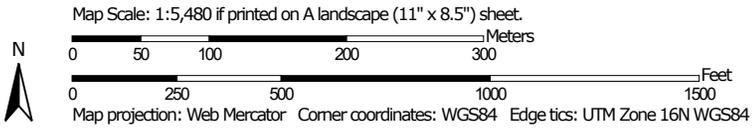
84°26'47.71"W



Hydric Rating by Map Unit—Ingham County, Michigan



Soil Map may not be valid at this scale.



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons

 Hydric (100%)  
 Hydric (66 to 99%)  
 Hydric (33 to 65%)  
 Hydric (1 to 32%)  
 Not Hydric (0%)  
 Not rated or not available

#### Soil Rating Lines

 Hydric (100%)  
 Hydric (66 to 99%)  
 Hydric (33 to 65%)  
 Hydric (1 to 32%)  
 Not Hydric (0%)  
 Not rated or not available

#### Soil Rating Points

 Hydric (100%)  
 Hydric (66 to 99%)  
 Hydric (33 to 65%)  
 Hydric (1 to 32%)  
 Not Hydric (0%)  
 Not rated or not available

### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ingham County, Michigan  
 Survey Area Data: Version 17, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 4, 2018—Jul 18, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydric Rating by Map Unit

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AnA	Aubbeenaubbee-Capac sandy loams, 0 to 3 percent slopes	8	1.7	1.7%
Co	Colwood-Brookston loams	80	12.5	12.0%
CvraaB	Conover loam, 0 to 4 percent slopes	5	1.8	1.7%
Gf	Gilford sandy loam, 0 to 2 percent slopes, gravelly subsoil	95	2.2	2.1%
Hn	Houghton muck, 0 to 1 percent slopes	100	34.5	33.0%
MaB	Marlette fine sandy loam, 2 to 6 percent slopes	2	11.1	10.7%
MaC	Filer fine sandy loam, Saginaw Lobe, 6 to 12 percent slopes	0	22.2	21.3%
MeD2	Marlette loam, 12 to 18 percent slopes, eroded	0	2.3	2.2%
OsC	Oshtemo sandy loam, 6 to 12 percent slopes	1	7.0	6.7%
OwC	Owosso-Marlette sandy loams, 6 to 12 percent slopes	0	1.6	1.5%
RdD	Riddles-Hillsdale sandy loams, 12 to 18 percent slopes	0	2.6	2.5%
Sb	Sebewa loam, 0 to 2 percent slopes	95	2.1	2.0%
ThA	Thetford loamy sand, 0 to 3 percent slopes	10	2.2	2.1%
UtB	Urban land-Marlette complex, 2 to 12 percent slopes	5	0.6	0.5%
<b>Totals for Area of Interest</b>			<b>104.4</b>	<b>100.0%</b>

## Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

### References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

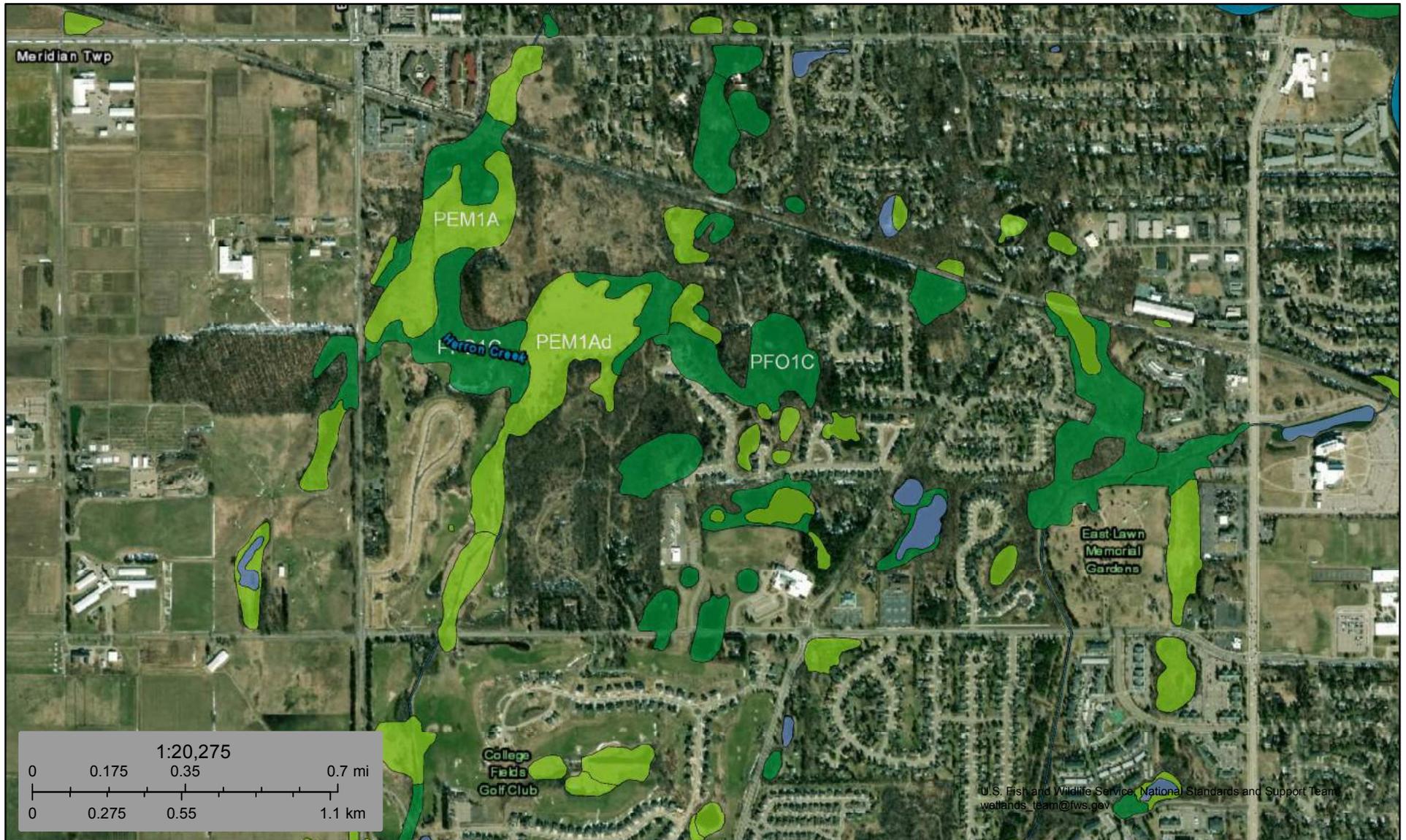
Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

## **Rating Options**

*Aggregation Method: Percent Present*

*Component Percent Cutoff: None Specified*

*Tie-break Rule: Lower*



April 10, 2020

**Wetlands**

- |  |   |  |
|--|---|--|
|  Estuarine and Marine Deepwater |  Freshwater Emergent Wetland       |  Lake     |
|  Estuarine and Marine Wetland   |  Freshwater Forested/Shrub Wetland |  Other    |
|  |  Freshwater Pond                   |  Riverine |

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

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May 27, 2020  
Project No. 200699

Peter Menser  
Charter Township of Meridian  
5151 Marsh Road  
Okemos, MI 48864 1198

**Wetland Boundary Verification – WDV 20-02**  
**22.32-acre site northwest of the Creekstone Trail/Shadow Ridge Intersection**  
**Meridian Township, Ingham County, Michigan**

Dear Peter:

On May 13, 2020, Fishbeck staff conducted a field investigation and verified wetland boundaries on an approximately 22.32-acre site located northwest of the intersection of Creekstone Trail and Shadow Ridge, and approximately 0.5 mile north of Bennett Road and 0.5 mile west of Hulett Road (the Site). The Site encompasses parcel number 33-02-02-29-251-009 located in Section 29 of Meridian Township (Town 4 North, Range 1 West). The Township wetland map identifies Wetland 29-1 on and west of the Site, a 131.30-acre emergent and scrub shrub wetland associated with Herron Creek.

Site wetlands were recently delineated by Marx Wetlands (Marx), as described in its April 23, 2020, report entitled *Wetland Delineation Report: Creekstone Trail and Shadow Ridge, Parcel #33-02-02-29-251-009 – Sturk Property, Section 29, Meridian Township, Ingham County, Michigan* (Report).

## Site Investigation

Fishbeck staff met Bryana Guevara of Marx at the Site on May 13th to inspect the wetland boundaries. Site conditions were consistent as described in the Report. Marx delineated five wetlands: Wetland A through E. Fishbeck made minor adjustments to wetland boundaries, as described below. Marx then surveyed all moved and new wetland flags.

- Wetland A: located in the Site's southeast quadrant. This wetland extends offsite to the southeast and is part of Township Wetland 29-1. The Meridian Township wetland map does not note an upland ridge that exists between Wetlands A and E, as delineated by Marx. The following adjustments were made to the delineated wetland boundary:
  - Wetland Flag A-21 was moved and Flags A-21a, A-21b and A-21c were added to expand the wetland area. Flag A-21c connects to Flag A-22.
  - Wetland Flags A-23 and A-29 were deleted. The wetland boundary extended from Flag A-22 to Flag A-24 and Flag A-28 to Flag A-30.
  - The following flags were moved: A-26, A-27, A-28, A-32, and A-43.
  - The rest of the wetland flags in Wetland A were accurately placed.
- Wetland B: located at the north end of the Site. This wetland is part of Township Wetland 29-10. The southeast end of the wetland extends offsite onto residential property.
  - Wetland B's entire boundary was delineated by Marx. Unfortunately, Wetland Flags B-1 through B-13 had been removed, probably by adjacent property owners. The adjoining wetland flags (Flags B-45 and B-14)

were accurately placed. Fishbeck walked the unflagged wetland boundary with Marx, with Marx indicating where flags had been placed. This boundary was consistent with Marx’s Wetland Location Map. Fishbeck concurs with the wetland boundary as depicted in Marx’s report between Flags B-45 and B-14, based upon our field observations.

- Wetland Flag B-17 was moved.
- Wetland Flag B-34 was deleted. The wetland boundary extended from Flag B-33 to Flag B-35.
- All other wetland flags observed in Wetland B were accurately placed.
- Wetland C: located directly east of Wetland B. This wetland extends north toward a railroad embankment and curves west along the toe of the embankment. The Township wetland map notes this area as Wetland 29-10 and does not indicate the ridge between Wetlands B and C. Wetland Flags C-1 through C-20 were accurately placed.
- Wetland D: located at the east end of the Site in a depression. This wetland is noted as Wetland 29-9 on the Township wetland map. Wetland Flags D-1 through D-7 were accurately placed.
- Wetland E: located in the southwest quadrant of the Site. This wetland extends offsite to the west and is part of Township Wetland 29-1.
  - Wetland Flag E-11 was deleted. The wetland boundary extended from Flag E-10 to Flag E-12.
  - The remaining wetland flags (Flags E-1 through E-35) were accurately placed.

## Regulatory Review

According to Michigan’s Natural Resources and Environmental Protection Act (NREPA), Act 451, Section 30301(d), wetlands "contiguous to the Great Lakes or Lake St. Clair, an inland lake or pond, or a river or stream" or "more than 5 acres in size" are regulated by the State of Michigan. In addition, the Township regulates wetlands greater than two acres in size which are not contiguous to a water body and wetlands between 0.25 acre and two acres in size that are determined to be essential to the preservation of the natural resources of the Township.

Table 1 summarizes information pertaining to the delineated wetlands.

**Table 1 – Summary of Wetlands**  
 Wetland Verification WDV 20-02

Wetland	Wetland Type	Size (on Subject Property) (acres)	Corresponding Meridian Wetland	Regulated by the State of Michigan?	Regulated by Meridian?
A	Emergent/forested	2.78	29-1	Yes	Yes
B	Emergent/forested	1.39	29-10	Possibly	Likely
C	Emergent/forested	0.38	29-10	Possibly	Likely
D	Forested	0.06	29-9	No	No
E	Emergent/scrub-shrub	1.02	29-1	Yes	Yes

Wetland E is part of Township Wetland 29-1, which is greater than five acres in size and is contiguous to Herron Creek. This wetland is regulated by both the State of Michigan and the Township. Likewise, Wetland A is contiguous to the Hoskins Drain, a tributary to Herron Creek, and is regulated by both the State of Michigan and the Township.

Wetlands B and C are greater than 0.25 acre in size but less than 2.0 acres in size. Therefore, a Determination of Essentiality is required by the Township to verify the regulatory status of these wetlands under the Township’s wetland ordinance. A large wetland is present north of the railroad embankment on the north edge of Wetlands B and C. If Wetlands B and C were historically part of this wetland complex, they may also be regulated by the State of Michigan under NREPA.

Wetland D is not regulated by the Township because it is less than 0.25 acre in size and is not contiguous to a regulating body of water.

The noted adjustments to Wetlands A, B and E's boundary need to be made to Marx's Wetland Location Map. The adjustments will result in a minor increase in wetland size and are not expected to change the regulatory status of these wetlands. However, the updated wetland boundaries will impact the location of the Township's corresponding wetland buffer, if site development is proposed in these areas.

A Wetland Use Permit (WUP) is required from the Township for any of the following activities within wetlands regulated by the Township:

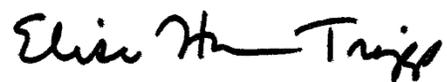
- Placing fill or permitting the placement of fill in regulated wetland.
- Dredging, removing, or permitting the removal of soil or minerals from regulated wetland.
- Constructing, operating, or maintaining any use or development in regulated wetland.
- Draining surface water from regulated wetland.

In addition, the Township requires that all structures and grading activities during site development shall be set back 40 feet from the delineated wetland boundary and a natural vegetation strip shall be maintained within 20 feet of the wetland boundary.

Fishbeck recommends the Wetland Location Map be updated as described in this letter and the location of Township mandated buffers be determined in areas where site development is proposed.

If you have any questions regarding this letter or any other wetland-related issues, please contact me at 616.464.3738 or [ehtripp@fishbeck.com](mailto:ehtripp@fishbeck.com).

Sincerely,



**Elise Hansen Tripp, PWS**

Senior Wetland Scientist

By email

copy: Mark Kieselbach – Charter Township of Meridian

# Patrick E. Lindemann

## Ingham County Drain Commissioner

PO Box 220  
707 Buhl Avenue  
Mason, MI 48854-0220

Phone: (517) 676-8395

Fax: (517) 676-8364

<http://dr.ingham.org>



Carla Florence Clos  
*Deputy Drain Commissioner*

Paul C. Pratt  
*Deputy Drain Commissioner*

Angie Cosman  
*Chief of Engineering and Inspection*

Sheldon Lewis  
*Administrative Assistant*

June 26, 2020

To: Meridian Charter Township Planning Commission

From: Angie Cosman, Drain Engineer

RE: Silverleaf Condo P.U.D  
Meridian Charter Township – NW¼ of Section 29  
Herron Creek Drain and Hoskins Drain

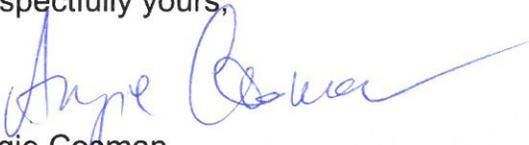
On May 20, 2020, the Drain Commissioner's Office received a request from Mr. Dane Pascoe of KEBS, Inc. of Haslett, Michigan for a conceptual review of a proposed development of 150 condominium units across multiple parcels located north of Bennett Road and East of Hagadorn Road in Meridian Charter Township. The project is proposed by Bob Schroeder of Mayberry Homes. The request was accompanied by one set of plans by KEBS. This conceptual review is offered as a courtesy to Meridian Charter Township only. It should not be construed by the project owner or others as formal submission to the Ingham County Drain Commissioner for site plan or drainage review. A detailed review will be conducted when the plans are submitted for an official Site Plan and Drainage Review. Our conceptual review comments include the following:

- Drainage Plans must meet the Rules of the Ingham County Drain Commissioner, as amended, for low impact development (LID), including storage and treatment requirements for:
  - First 1.0 inch of rainfall from the entire site
  - 2-year, 24-hour storm
  - 100-year, 24-hour storm
- The site is in a Phase II area and the stormwater discharge must be held to adequate pretreatment standards to protect the receiving waters of the Drain.
- The property is in two drainage districts and ultimate drainage configuration from the site may require revisions to the Hoskins Drain Drainage District.
- The storm drainage system on the site will remain private; therefore, a Maintenance Agreement with the Drainage District will be required.

- Approval from the Drain Commissioner's Office requires that the plans be submitted and the appropriate fees be paid for Site Plan and Drainage Review.

If you have any questions, please do not hesitate to contact me. It is an honor and a privilege to serve you and the other businesses, citizens and municipalities of Ingham County.

Respectfully yours,



Angie Cosman  
Ingham County Drain Engineer

cc: Dane Pascoe, KEBS, Inc.

# CHARTER TOWNSHIP OF MERIDIAN

Ronald J. Styka  
Brett Dreyfus  
Phil Deschaine  
Frank L. Walsh

Supervisor  
Clerk  
Treasurer  
Manager



Courtney Wisinski  
Patricia Herring Jackson  
Dan Opsommer  
Kathy Ann Sundland

Trustee  
Trustee  
Trustee  
Trustee

June 10, 2020

Mr. Dane Bascoe, PS  
KEBS, Inc.  
2116 Haslett Road  
Haslett, MI 4840

## **RE: Silverleaf Condominiums PUD**

Dear Mr. Pascoe:

The following comments are based on the latest plans received for the subject development, dated 5/11/2020:

### **Water System**

To ensure reliable fire protection and resiliency of the system during emergencies the proposed water main shall be fully looped with connections to Bennett Road, Sopiaea Parkway, and Creekstone Trail. Complete plans including plan/ profile views will be required for review and approval of the proposed water system. The plans shall be provided in accordance with Meridian Township standards & specifications.

A permit from EGLE will be required before any installation can begin.

### **Sanitary Sewer**

Complete plans including plan/ profile views will be required for review and approval of the proposed sanitary system. The plans shall be provided in accordance with Meridian Township standards & specifications.

A permit from EGLE will be required before any installation can begin.

### **Site Layout/ Connectivity:**

The site layout, and phasing scheme should be reconsidered to improve connectivity, emergency vehicle access, and road maintenance. At minimum, all dead ends must have large permanent signs with very clear language to ensure unobstructed access at Sopiaea/ Morning Vista Lane junction, and at Creekstone/emergency road. sewer access junction.

### **Floodplain:**

Impacts on existing floodplain shall be detailed to ensure appropriate mitigation measures, and to preclude potential flooding to proposed units and adjacent existing properties. To that end, the plans shall have all the floodplain elevations (based on NAVD 88) clearly shown on the plan, and not just show the limit of the floodplain contours.

Mr. Dane Pascoe, PS  
June 10, 2020  
Page 2

The above was only a cursory review of the limited plans provided. A complete and detailed review will be forthcoming from this office upon submittal of full plans as required for this type of project. If you have any questions or concerns, please feel free to contact me at our office (517) 853-4460.

Sincerely,



**Younes Ishraidi, PE**

Chief Engineer

[ishraidi@meridian.mi.us](mailto:ishraidi@meridian.mi.us)

**A Prime Community** W 517.853.4460 | F 517.853.4095

5151 Marsh Road | Okemos, MI 48864

[meridian.mi.us](http://meridian.mi.us)



**Meridian Township**  
5151 Marsh Road  
Okemos, MI 48864

P 517.853.4000  
F 517.853.4096

**Township Board:**

**Ronald J. Styka**  
*Township Supervisor*

**Brett Dreyfus**  
*Township Clerk*

**Phil Deschaine**  
*Township Treasurer*

**Patricia Herring  
Jackson**  
*Township Trustee*

**Dan Opsommer**  
*Township Trustee*

**Kathy Ann Sundland**  
*Township Trustee*

**Courtney Wisinski**  
*Township Trustee*

**Frank L. Walsh**  
*Township Manager*

May 20, 2020

Mr. Dane Pascoe  
KEBS, Inc.  
2116 Haslett Road  
Haslett, MI 48840

Dear Mr. Pascoe:

RE: Silverleaf Condominium Planned Unit Development

This letter is in response to your request for comments dated May 11, 2020.

1. It appears that there is a sufficient and ample buffer between the proposed housing development and the land preserve.
2. Our primary concern is relative to the existing access easement between the Woods of Herron Creek and Champion Woods. This access easement provides the only public access to the land preserve and it is imperative that this remains open, accessible, and obvious for visitors and maintenance of the land preserve.

Thank you for the opportunity to provide comments on the proposed Silverleaf Condominium Planned Unit Development, which lies adjacent to a Meridian Township Land Preserve known as the South West Meridian Uplands.

Sincerely,

LuAnn Maisner, CPRP  
Director of Parks and Recreation



# KEBS, INC

Engineering • Surveying

May 11, 2020

LuAnn Maisner  
Parks and Recreation Director  
Meridian Township Park Commission  
5151 Marsh Road  
Okemos, MI 48864

RE: Silverleaf Condominium Planned Unit Development (P.U.D.) Plan

Ms. Maisner:

Enclosed you will a copy of the P.U.D. Plan of Silverleaf Condominium, being part of the Northeast 1/4, Northwest 1/4 and Southwest 1/4 of Section 29, Meridian Township, Ingham County, Michigan for your review.

Per Meridian Township regulations we are required to get a written response from your office stating that you have received a copy of the plan along with your comments and/or concerns of the layout of the P.U.D. If you have no comments or concerns regarding the layout a simple letter stating that fact will suffice.

Please either email a signed .pdf on your letterhead to Dane Pascoe ([dpascoe@kebs.com](mailto:dpascoe@kebs.com)) or Keith Baker ([kbaker@kebs.com](mailto:kbaker@kebs.com)) or you can send a hard copy of the letter directly to our office.

If you have any questions or need further information, please feel free to contact us.

Sincerely,

Dane B. Pascoe, PS  
KEBS, Inc.  
2116 Haslett Road  
Haslett, MI 48840  
517-339-1014

# Office of the Superintendent

John J. Hood, Okemos Public Schools

---

4406 North Okemos Road, Okemos, Michigan 48864  
Phone: 517-706-5009 · Fax: 517-349-6235  
John.hood@okemosk12.net

Peter Menser  
Principal Planner  
Department of Community Planning and Development  
Meridian Township  
5151 Marsh Rd  
Okemos MI 48864

May 13, 2020

Dear Mr. Menser:

David Straub from Mayberry Homes recently emailed requesting that the Okemos schools weigh in on the Silverleaf PUD under consideration by Meridian Township. It is my understanding that Meridian Township will now regularly request input from local school districts in regards to all Planned Unit Developments and the impact of such on our school systems.

In May 2019, Okemos voters approved a bond that included an addition of four classrooms to Bennett Woods Elementary to meet immediate elementary capacity needs. During that process, the Board charged administration with oversight of student enrollment and impacts on building capacities, including investigation of options for the district should numbers continue to grow over time. Administration continues to monitor enrollments as the Bennett Woods expansion is expected to come on line during the 20-21 school year.

Last August, the Okemos Board of Education had the opportunity to discuss and respond to a zoning and development inquiry from a concerned community member, the response of which was also shared with Supervisor Styka and the Township Board by President Dean Bolton.

That letter clarified the board's role as one "to establish policies that improve public education," and furthermore described zoning and development as, "not within the scope of the powers and responsibilities of the board."

*"Together...educating with excellence, inspiring each learner for life."*

# Office of the Superintendent

John J. Hood, Okemos Public Schools

---

4406 North Okemos Road, Okemos, Michigan 48864  
Phone: 517-706-5009 · Fax: 517-349-6235  
John.hood@okemosk12.net

As superintendent, I do not speak for our Board of Education, however, I can articulate that our school board has made it clear in the very recent past that they are committed to actions to accommodate enrollment growth in general, no matter the source, and would not state a position on any specific development proposal or development in general.

If you should have any questions regarding this, or would like correspondence directly from our Board of Education, please let me know. Our district remains committed to equity and inclusion, and welcomes any and all students who enroll in our district.

Regards,

John J. Hood  
Superintendent



**To:** Planning Commission

**From:** Peter Menser, Principal Planner  
Keith Chapman, Assistant Planner

**Date:** August 7, 2020

**Re:** Special Use Permit #20051 (1732 Hamilton Road LLC), establish an auto repair shop in an existing building at 1732 Hamilton Road.

---

The public hearing for Special Use Permit #20051 was held at the July 27, 2020 Planning Commission meeting. A straw poll taken at the meeting indicated the Planning Commission was willing to consider a resolution to approve the request at its next meeting on August 10, 2020 with the conditions proposed by staff as detailed in the memorandum dated July 24, 2020 and additional conditions from the Planning Commission discussion at the July 27, 2020 meeting.

### **Planning Commission Options**

The Planning Commission may approve, approve with conditions, or deny the special use permit. A resolution to approve the request with conditions is provided.

- **Move to adopt the resolution approving Special Use Permit #20051 to establish an auto repair shop in an existing building at 1732 Hamilton Road with conditions.**

### **Attachment**

1. Resolution to approve.

G:\Community Planning & Development\Planning\SPECIAL USE PERMITS (SUP)\2020\SUP 20051 (1732 Hamilton Road LLC)\SUP 20051 (1732 Hamilton Road LLC)\SUP 20051.pc2.docx

**RESOLUTION TO APPROVE**

**Special Use Permit #20051  
(1732 Hamilton Road LLC)**

**RESOLUTION**

At a regular meeting of the Planning Commission of the Charter Township of Meridian, Ingham County, Michigan, held virtually using the Zoom web conferencing application on the 10th day of August, 2020, at 7:00 p.m., Local Time.

PRESENT: \_\_\_\_\_  
\_\_\_\_\_

ABSENT: \_\_\_\_\_

The following resolution was offered by \_\_\_\_\_ and supported by \_\_\_\_\_.

WHEREAS, 1732 Hamilton Road LLC has requested a special use permit to establish an auto repair shop in an existing building at 1732 Hamilton Road; and

WHEREAS, the Planning Commission held a public hearing at its regular meeting on July 27, 2020 and has reviewed staff material forwarded under cover memorandum July 24, 2020; and

WHEREAS, the subject site is appropriately zoned C-2 (Commercial), which allows an auto repair shop by special use permit; and

WHEREAS, the proposed project is consistent with the general standards for granting a special use permit found in Section 86-126 of the Code of Ordinances; and

WHEREAS, the subject site is adequately served by municipal water and sanitary sewer.

NOW THEREFORE, BE IT RESOLVED THE PLANNING COMMISSION OF THE CHARTER TOWNSHIP OF MERIDIAN hereby approves Special Use Permit #20051 to establish an auto repair shop in an existing building at 1732 Hamilton Road, subject to the following conditions:

1. Approval is in accordance with the Site plan prepared by Shellenbarger Engineering & Surveying, PC. dated March 19, 2020 and received by the Township on June 17, 2020.
2. All activities shall take place only inside the building to mitigate noise and any noxious odors on site.
3. Any exterior doors must remain closed while vehicles are being worked on to limit noise impacts to adjacent properties.
4. No outdoor storage of wrecked or partially dismantled vehicles shall be permitted unless such vehicles are required to be temporarily stored for a period of time by police or court order. All such storage facilities shall be screened or shielded, in accordance with the special use permit.
5. There shall be no outdoor displays of items for sale, such as tires, tractors, lawnmowers, or other materials.



## Chapter 86. Zoning

### ARTICLE IV. District Regulations

#### DIVISION 4. Other Districts

#### § 86-440. Mixed use planned unit development (MUPUD).

[Ord. No. 2004-08, 10-31-2004; Ord. No. 2005-11, 11-27-2005; Ord. No. 2006-08, 12-31-2006; Ord. No. 2007-12, 10-28-2007; Ord. No. 2008-04, 4-13-2008; Ord. No. 2010-02, 2-28-2010; Ord. No. 2011-08, 7-5-2011]

- (a) Purpose and intent. The purpose of the mixed use planned unit development (mixed use PUD) section is to create more walkable pedestrian oriented developments by promoting and accommodating developments in rational mixed patterns that respect Meridian Township's transitional land use concept to protect, enhance and preserve natural resources. The second purpose is to encourage rehabilitation of existing structures to include those originally built or partially built before zoning ordinances were adopted, and in such a manner that will maintain traditional urban design to preserve and enhance community resources.

The intent of this section is two-fold.

- (1) Meet Township goals through well planned, integrated, high quality mixed use in redevelopment projects:
  - a. Enhance health and safety goals by requirements for walkability, pedestrian orientation and high quality, durable, building materials.
  - b. Increase Township prosperity goals and citizen welfare by appreciated property values which will support necessary public services.
  - c. Actualize our cultural heritage through citizen pride in creative, new places to walk to, shop at and work in that retain a flavor of Meridian Township's rich history.
  - d. Enhance diversity goals with new types of residential uses in close-knit community design.
  - e. Improve our natural environment goal by mixed use redevelopment with incentives for more intensely landscaped buffers and open spaces designed to complement Township parks and green space plans.
- (2) Improve the potential for financially attractive and high quality mixed use projects in the Township while meeting Township goals of a safe, healthy and sustainable community.
  - a. Enhance incentives for investment by the ability to mix residential with commercial and office uses within the same development.
  - b. Allow flexibility in setback and parking requirements.

- c. Encourage redevelopment by allowing increases in density in exchange for providing specified community amenities.
  - d. Achieve attractive and commercially successful core areas through cooperative development projects with one or more land owners.
  - e. Encourage mitigation to lessen potential hazards associated with the location of a mixed use PUD such as when adjacent to a railroad.
- (b) Definitions.

**AMENITY**

Aesthetic, practical or other characteristics of a development that increase its desirability to a community or its marketability to the public. Amenities may differ from development to development.

**AWNING**

A roof-like cover, often fabric, metal, or glass designed and intended for protection from weather or as a decorative embellishment, and which projects from a wall or roof of a structure over a window, walk, door, or the like.

**BALCONY**

A platform that projects from the wall of a building and is surrounded by a railing or balustrade, for the private use of tenants.

**CLOSE-KNIT COMMUNITY**

A style of land development advocating smaller, narrower lots, shallower yards and setbacks, smaller and more intensely used spaces, etc. that is less land consumptive than traditional suburban development.

**HORTICULTURAL MAINTENANCE PLAN**

A written statement documenting the methods to be used to maintain landscaping materials in a healthy condition, free of refuse and debris.

**IMPROVEMENT**

Alterations to any structure that do not change the intensity of its use, do not increase the gross floor area, height, or bulk of the structure by more than 10%, and/or do not block or impede public access.

**MONUMENT SIGN**

A freestanding sign, in which the entire bottom (base) is in contact with the ground and is independent of any other structure.

**ORNAMENTAL**

Something that is either decorative or something that provides aesthetic quality to an object required for other purpose.

**PEDESTRIAN ORIENTED DEVELOPMENT**

Development designed with an emphasis primarily on the street sidewalk and on pedestrian access to the site and building, rather than on auto access and parking areas with design bearing a definite relationship to the human dimension. The building is generally placed close to the street and the main entrance is oriented to the street sidewalk. There are generally windows or display cases along building facades which face the street. A pedestrian oriented neighborhood offers variety in housing clustered around well-defined neighborhood centers which support jobs, commercial activity, and a range of amenities to sustain lively streets and gathering places. It offers a gradient density from open space to high-intensity commercial cores. The layout of pathways, streets and transportation corridors minimizes conflict between walking, biking, and driving.

## **REDEVELOPMENT**

The process by which an existing developed area is rehabilitated, restored, renovated, expanded and/or adaptively reused. Redevelopment may also mean a site that contains an existing building(s) to be removed with the approval of the mixed use PUD.

## **SIGN PROGRAM**

A plan of all signs proposed to be installed in a mixed use PUD project submitted for approval to create a coordinated project theme of uniform design elements such as color, lettering style, size, and placement consistent with the context of the project and its surroundings and the purpose and intent of this section.

## **SUBSTANTIAL IMPROVEMENT**

Alterations to any structure that does change the intensity of its use, does increase the gross floor area, height, or bulk of the structure by more than 10%, and/or does block or impede public access.

## **WAIVER**

Permission to depart from the requirements or standards of the underlying zoning district.

### (c) Permitted locations and uses.

#### (1) Locations.

- a. Mixed use PUD shall be permitted in the C-2, C-3, CS, and CR zoning districts, where public water and sewer are available.
- b. Mixed use PUD shall be permitted in the PO and C-1 districts where public water and sewer are available, provided that when adjacent to land zoned and developed in a single-family residential district, the height of buildings in the mixed use PUD shall be no taller than the abutting residential district would allow.

#### (2) Uses.

- a. All uses permitted by right and by special use permit in the underlying zoning district or districts where a project includes more than one zoning district, provided that the purpose and intent of this section is incorporated within the total development plan.
- b. Limited commercial uses in an underlying PO zoning district.
  1. In addition to the uses permitted in the underlying PO zoning district, only the following neighborhood-oriented commercial uses are allowed:
    - i. Personal service establishments which perform services on the premises such as, but not limited to, barber or beauty shops, repair shops (jewelry, electronic, shoe, small appliances, etc.), pharmacies, tailor shops, laundries and dry cleaners, with the exception of dry cleaning plants.
    - ii. Restaurants and cafes which serve food or beverages. This use shall not include bars and taverns.
    - iii. Grocery stores.
    - iv. Financial institutions.
    - v. Retail merchandise establishments.
    - vi. Outdoor seating areas for cafes and restaurants.

2. Commercial development shall not be located in any PO zoned mixed use PUD without approval by the Township Board of the location and general amount of commercial uses shown in the form of a site plan at the time of approval of the mixed use PUD. The request will be evaluated for consistency with the intent of the mixed use PUD ordinance and whether it is harmonious with adjacent sites. The Township Board may approve, approve with conditions, or deny a request in regards to the location and amount of any allowed commercial development in a PO zoned mixed use PUD.
3. If the Township Board approves the location and/or amount of commercial uses in a PO zoned mixed use PUD, it may place conditions on the development in order to guarantee consistency with the purpose and intent of the mixed use PUD ordinance, which includes, but is not limited to, providing walkable, pedestrian-friendly communities and ensuring compatibility with surrounding residential neighborhoods on adjacent sites. Conditions may include, but are not limited to, the following subjects:
  - i. Hours of operation.
  - ii. Total square footage allotted for the commercial uses.
  - iii. Location, design, and orientation of specific commercial uses which may locate within the development and their placement in relationship to neighboring uses.
  - iv. Proportion of the development which may be occupied by individual commercial uses or by all commercial uses.
  - v. Maximum noise levels emitted.
  - vi. Lighting levels, direction, and timing.
  - vii. Sufficiency of parking.
  - viii. Enhancement of walkability within the development and connectivity to surrounding uses.
  - ix. Landscaping and screening.
- c. Single- and multiple-family residential uses up to a density of 14 dwelling units per acre when developed in conjunction with the redevelopment of an existing building(s) for a use permitted by right or by special use permit in the underlying zoning district and on the same parcel of land. The density may be increased to 18 dwelling units per acre by offering four or more additional unique and extraordinary amenities acceptable to the Township.  
[Amended 5-15-2018 by Ord. No. 2018-06]
- d. Single- and multiple-family residential uses up to a density of 10 dwelling units per acre when developed in conjunction with the development of an undeveloped site for a use permitted by right or by special use permit in the underlying district and on the same parcel of land.  
[Amended 5-15-2018 by Ord. No. 2018-06]
- e. For mixed-use PUDs within the Okemos Downtown shown on Map 1 and the Haslett Downtown shown on Map 2<sup>[1]</sup> the Township Board may in its sole discretion approve a higher density per acre of residential dwelling units and an increase in the height of a building based upon the proposed mixed-use PUD complying with the following performance criteria:  
[Amended 5-15-2018 by Ord. No. 2018-06]

1. Architectural design and placement of building(s) on the parcel(s) will be consistent with the architectural standards set forth in the Master Plan, of current adoption, and are to include sustainability and environmental considerations, including, but not limited to, energy usage from renewable energy resources. Achieving Energy Star or LEED Silver standards or better is highly valued.
2. The building height is no more than four stories above the finished grade. A fifth story may be allowed where there is a minimum of a ten-foot setback for such fifth story from the predominant first-floor facade elevation. Overall height from the finished grade to the top of the wall does not exceed 60 feet. Floor-to-ceiling height is at a minimum of 14 feet for first floor commercial or office uses, and a minimum of nine feet for all residential and any upper floors, regardless of use.
3. A parking plan that provides a unified design for any parking structures with the main building through the use of similar building materials, color, and architectural style.
4. An innovative design including a number of different dwelling unit types, sizes, and floor plans are available within the mixed-use PUD.
5. The mixed-use PUD provides common areas and/or amenities for residents and the general public, including, but not limited to, gathering spaces, gardens, courtyards, pavilions, pocket parks, swimming pools, exercise rooms, storage rooms, lockers, and covered parking.
6. The mixed-use PUD promotes nonmotorized and shared (public) transportation by providing convenient access to the public pedestrian/bicycle pathway system and public transportation systems as outlined in the Master Plan.
7. The mixed-use PUD provides opportunities for shared parking, accessways, and driveways with adjoining properties or provides additional parking spaces that may be used by the public.
8. The mixed-use PUD generally provides commercial and other nonresidential uses on the ground floor(s), and the development demonstrates a financially viable plan for sustainable commercial and/or office space usage.
9. The mixed-use PUD demonstrates how proposed higher density will not negatively impact the character, aesthetics, safety, or welfare of surrounding businesses and neighborhoods.
10. The mixed-use PUD considers any potential for increased traffic and provides solutions to address the traffic increases.
11. The mixed-use PUD makes efforts to preserve and use existing structures or provides explanations to justify why such preservation and use is not possible.

[1] *Editor's Note: Said maps are included as an attachment to this chapter.*

- f. Uses may be mixed vertically and/or horizontally.  
[Added 5-15-2018 by Ord. No. 2018-06]
- (d) Phasing. Mixed use planned unit developments may be phased provided each phase incorporates a use permitted in the underlying zoning district. Phasing plans shall be evaluated for the proportionality of permitted use(s) to residential use(s). Phasing plans shall be submitted with the original mixed use PUD.
- (e) Amenities.

- (1) Requirements and guidelines.
  - a. Every mixed use PUD shall incorporate one or more amenities.
  - b. Every request for a density bonus shall incorporate one or more amenities in addition to those required by subsection (e)(1)a.
  - c. Waivers from zoning ordinance standards may be granted by the Township Board in exchange for amenities.
  - d. Amenities shall not be combined or counted more than once or counted toward any other requirement of the ordinance.
  - e. When multiple amenities are proposed, multiple criteria categories should be represented.
  - f. Amenities shall be visible and/or accessible to the public from a fully improved street, and/or a benefit to the general public.
- (2) Criteria. Amenities acceptable for consideration by the Township shall meet one or more of the following criteria:
  - a. Type, value and number of amenities shall be proportionate to the size and/or cost of the project.
  - b. Variety of amenity categories represented.
  - c. Support of goals expressed in this section, the Township Board policy manual, the master plan or other applicable adopted plans.
  - d. Consistency and compatibility with the intended use of the site.
  - e. Continuity of design elements.
  - f. Appropriate and harmonious with the surrounding area.
  - g. Potential to act as a catalyst for improvements to surrounding sites.
- (3) Categories listing examples of possible amenities.
  - a. Conservation:
    1. Any alternative energy system.
    2. Grey water recycling.
    3. Green roofs.
    4. Electric car charging stations.
    5. Activities or technologies listed for Leadership in Energy and Environmental Design (LEED) certification by the U.S. Green Building Council or certification criteria of organizations with similar goals; for example, American Society of Landscape Architects' (ASLA) Sustainable Sites Initiative (SITES) or Society of Environmentally Responsible Facilities (SERF).
  - b. Environment:
    1. Significantly increased pervious surfaces.

2. Rehabilitation of degraded sites.
  3. Green space exceeding the underlying permeable surface regulation.
  4. Rehabilitation of green space designated as links on the greenspace plan.
  5. Street trees installed at a 20% higher density or one inch caliper larger than required by the Code of Ordinances.
- c. Accessibility:
1. Transit stops. The addition or relocation of one or more transit stops when supported by a local transit provider.
  2. Foot and bicycle pathways and sidewalks that connect with the Township's pedestrian/bicycle pathway system and routes identified in the Township's green space plan via a public right-of-way or public access easement.
  3. Covered bicycle storage on site.
- d. Parks, recreation and culture for active and passive activities:
1. Public recreation resources.
  2. Public cultural venues.
  3. Public art at 1% of the project cost designed to withstand natural elements and reasonable public contact for at least 10 years.
- e. Social interaction:
1. Outdoor gathering spaces or outdoor eating spaces of 300 square feet or more.
  2. Public outdoor seating plazas adjacent to or visible and accessible from the street including, but not limited to, benches or other outdoor seating not associated with an outdoor cafe.
  3. Privately maintained courtyards, plazas, pocket parks, and rooftop gardens and similar features with seating for the public.
- f. Site and building design:
1. Underground utilities.
  2. Combination of first floor awnings and upper floor balconies adjacent to a public street.
  3. Porches on any structure.
  4. Multilevel or underground parking.
  5. Ornamental paving treatments for sidewalks and/or parking areas such as, but not limited to, concrete masonry unit pavers, brick, stone or pervious concrete or asphalt.
  6. Innovative lighting.
  7. Sidewalk planters located in the vicinity of sidewalks and/or outdoor seating areas.

8. Public access to new technology including wireless access points, electronic information displays, excluding unsolicited electronic broadcast information.
9. Consolidation of multiple land parcels into one to facilitate an integrated design.
10. Fountain.

(f) Design standards.

(1) General restrictions.

- a. Except as noted elsewhere in this section, the yard, setback, lot size, type and size of dwelling unit, frontage requirements, and impervious surface regulations and restrictions are generally waived for the mixed use PUD, provided that the spirit and intent of this section, as defined in Subsection **86-440(a)** above, are incorporated with the total development plan. The Planning Commission may recommend and the Township Board shall establish all requirements by means of the approval of the planned unit development.
- b. Maximum height in a mixed use PUD shall be no higher than 45 feet. Exceptions provided in § **86-591** shall apply.
- c. Except as stated above, all requirements regarding floodways, floodplains and wetlands in the conservancy district shall apply to the mixed use PUD.
- d. Metal and portable buildings shall be prohibited.
- e. Residential uses shall be located as far as possible from railroad tracks.

(2) Structure.

- a. Building materials generally. Materials should include, but are not limited to, wood, brick, clapboards, beadboard, glass, and stone. Other materials, such as vinyl, aluminum, and other metal sidings should be avoided. All buildings shall be completed on all sides with acceptable finishing materials. Any element not specifically mentioned in this section shall otherwise conform to other provisions of the Code of Ordinances.
- b. Architectural design. Diversity and variety in architecture is encouraged.
  1. Architectural design shall be consistent with pedestrian-oriented development.
  2. Property owners shall be encouraged to design and construct their building facades so that these improvements relate to and are sensitive to nearby historical features, blend with the facades of adjacent buildings and complement streetscape improvements in the area. Buildings greater than 50 feet in width shall be divided into increments of no more than 50 feet through articulation of the facade.
  3. Windows shall cover no less than 50% of nonresidential street level facades.
  4. All mechanical, heating, ventilation, and air conditioning (HVAC) and like systems shall be screened from street level view on all sides by an opaque structure or landscape material selected to complement the building.
  5. Railings, benches, trash receptacles and/or bicycle racks, if provided, shall be of commercial quality, and complement the building design and style, subject to the approval of the Director of Community Planning and Development.

(3) Parking.

- a. Setbacks for parking areas from the public street, adjoining properties, and when adjacent to residentially zoned properties shall be established during the review process. Consideration should be given to preservation of existing residential neighborhoods and heritage trees.
  - b. The number of required off-street parking spaces shall comply with § **86-755** of the Code of Ordinances, which outlines the schedule of requirements for parking spaces. The Township Board may reduce the number of off-street parking spaces required for a development. The Township Board shall establish a reasonable number of required off-street parking spaces based on the characteristics associated with the property and availability of other sources of parking or the provision of amenities in lieu of parking.
  - c. Parking lots are encouraged to be on the side or in the rear of a building.
  - d. Bicycle parking shall be separated from automobile parking in visible locations.
- (4) Landscaping shall generally comply with the provisions of the Code of Ordinances. Landscaping should be designed to preserve existing significant natural features and to buffer service areas, parking, or dumpsters; a mix of evergreen and deciduous plants and trees are preferred with seasonal accent plantings to add to the visual appeal of the area. Native plant species are encouraged and a horticultural maintenance plan shall be required. Landscaping shall also comply with other applicable provisions of this section. Maintenance of landscaped areas shall be subject to Subsection **86-758(3)** of the Code of Ordinances. Additional landscaping may be required in order to preserve and/or protect adjacent properties.
- (5) Lighting. All outdoor lighting associated with nonresidential and multiple family residential projects in a mixed use overlay area shall conform to Article **VII** in Chapter **38** of the Code of Ordinances and is subject to the approval of the Director of Community Planning and Development. Street lighting intended to provide illumination for pedestrians on the sidewalk shall not exceed 15 feet in height.
- (6) Signs. Each applicant shall submit a sign program illustrating each proposed sign type, its size and location as part of the project's application materials. The size, number and location of signs shall be submitted at the same time as the mixed use PUD project. The Director of Community Planning and Development may be authorized to approve the entire sign program, or any part of the sign program, as part of the site plan review process.
- a. General guidelines.
    1. Signs designed to enhance the pedestrian experience, reflect and complement the character of the building, and respect the overall character of the area in an attractive and functional manner are preferred.
    2. Signs shall not cover or obscure architectural features of buildings but should be located in logical signable areas which relate to the pattern of the facade.
    3. Signs shall be properly maintained.
    4. Signs or sign faces shall not be changed or installed without a new building permit and in accordance with an approved sign program.
  - b. The following sign types are permitted in the mixed use PUD district. Except as indicated below, the number and size of signs shall be approved as part of the project's application for the mixed use PUD approval.
    1. Wall signs, defined as a sign mounted flat against, or painted on the wall of a building (not a window sign) with the exposed face of the sign in the plane parallel to the face of the wall.

- i. Only one primary wall sign for each business with direct access to a public street shall be permitted.
    - ii. Identification signs are a type of wall sign that fit within an imaginary two square foot rectangle. One identification sign shall be permitted for the business name and/or logo and shall be located on the wall surface adjacent to a tenant's main entry. Restaurants may add an additional two square feet to the rectangle for a menu.
    - iii. Tenant directory signs are a type of wall sign used to identify businesses without direct frontage on a public street. The sign shall be located adjacent to the main entrance to the nonfrontage suites and shall not exceed six feet in height.
  2. Canopy or awning signs, defined as a sign incorporated into a canopy or awning. The sign and/or logo on a canopy or awning shall not exceed 30% of the canopy nor shall it be internally lit.
  3. Projecting signs, defined as a sign attached to and projecting perpendicularly from a building wall, excluding canopy or awning signs. One projecting sign per business with direct access to a public street shall be permitted. Projecting signs shall fit within an imaginary six square foot rectangle except projecting signs located under a canopy or first floor eaves or overhang shall fit within an imaginary rectangle with a maximum area of four square feet. The lowest edge of a projecting sign shall be no lower than eight feet above the sidewalk elevation.
  4. Window signs, defined as a sign affixed to the interior or exterior of a window or placed behind a window pane so as to attract attention of persons outside the building. Window signs shall not exceed 40% of the window area, except opaque signs shall be limited to 10% of the window area. Etched glass and similar artistic designs shall not be considered opaque.
  5. Freestanding signs, defined as any sign supported wholly or in part by some structure other than the building housing the business to which the sign pertains, are generally not permitted in the mixed use PUD district. Exceptions for freestanding signs of the monument type may be permitted when a building is set back a minimum of 15 feet from the right-of-way line with the resulting yard set aside for permanent public open space. In such case, the size, location and design of the sign shall be reviewed and approved as part of the overall sign program.
- (7) Sidewalks. Sidewalks shall be a minimum of five feet in width, except in two specific scenarios:
- a. When the sidewalk(s) is immediately adjacent to an outdoor seating cafe, the sidewalk shall be a minimum of seven feet in width to provide additional maneuverability, and
  - b. When the sidewalk(s) is immediately adjacent to an off-street parking area, where vehicles may overhang on the sidewalk, the sidewalk shall be a minimum of seven feet in width to provide additional maneuverability.
- (8) Pedestrian/bicycle pathways. Where a site submitted for mixed use PUD approval is located on a route of the Township's pedestrian/bicycle pathway master plan, construction or reconstruction of the route shall conform to Township standards for pedestrian/bicycle pathways.
- (9) Noise levels. No noise exceeding 70 dB(A) shall be emitted, as measured from a property line.
- (g) Procedure.

- (1) Each applicant shall confer with the Department of Community Planning and Development regarding the preparation of the mixed use PUD application. The general proposal in the form of a conceptualized site plan shall be reviewed by the Director of Community Planning and Development in a preapplication conference prior to submission of the mixed use PUD application. The Director of Community Planning and Development shall furnish the applicant with requirements to the components of the mixed use PUD application. It is not required that any person requesting a preapplication conference be an owner of or holder of an equitable interest in the subject property.
- (2) An applicant is urged to meet with owners and occupants of surrounding properties to apprise them of a proposed development, share the physical design, receive comments, and revise the proposal accordingly prior to submitting an official application. The Township will assist by providing property owner and occupant contact information.
- (3) Concept plan (optional). A property owner, prospective applicant or their representative may submit a concept plan for review and comment by the Planning Commission and Township Board.
  - a. Purpose.
    1. To acquaint the Planning Commission and Township Board with the proposed project.
    2. To provide guidance regarding the proposed design's compatibility with the purpose, intent and standards of the mixed use PUD ordinance.
    3. To reduce the applicant's time and cost.
  - b. Submittal requirements.
    1. A written request to initiate a concept plan review submitted to the Director of Community Planning and Development.
    2. A written summary of the project (amount and type of uses, basis for the design concept).
    3. A concept plan drawn to scale containing the following information:
      - i. Boundaries and acreage of the site.
      - ii. Zoning.
      - iii. Adjacent road network.
      - iv. General layout of buildings, interior access roads and unique design elements.
      - v. General location of known features affecting the site layout such as, but not limited to, floodplain, wetlands, woodlands, railroads, drains, rivers or rivers and streams, parkland, etc.
  - c. Review procedure.
    1. Upon receipt of a written request and other required data and information, the Director of Community Planning and Development shall review the concept plan.
    2. Within 30 days of the date of receiving a complete request the director shall forward to the Planning Commission and Township Board the concept plan and accompanying data along with any written comments from the director. The Planning Commission and Township Board shall concurrently review the concept plan and

may offer comments or suggestions on the design. Comments or suggestions made during the review of the concept plan shall not be binding on the Township or the applicant.

- (4) Required data and information for a mixed use PUD.
  - a. A complete application accompanied by the appropriate fee.
  - b. A map drawn to an engineer's scale of the total property involved, showing its location in the Township and its relation to adjacent property.
  - c. A site analysis indicating principal factors which influenced the design, including building elevations and/or architectural documents and plans.
  - d. A schematic layout of the proposed storm sewer system.
  - e. A document generally describing the proposed phasing program for the mixed use PUD of all dwelling units, nondwelling units, recreation and other facilities, and open space improvements.
  - f. A reproducible two-foot contour topographic map (i.e., sepia, mylar, etc.) drawn at the same scale as the site plan and showing the existing relief features on the site.
  - g. A sign program.
  - h. Natural features study for previously undeveloped properties.
  - i. Traffic study where the project will exceed 100 vehicle trips during the peak hour of the adjacent roadway.
  - j. Building elevations drawn to scale (in color).
  - k. The developer shall provide the Township with copies of comments from other reviewing agencies, such as:
    1. The Ingham County Road Commission.
    2. The Ingham County Drain Commissioner.
    3. Michigan Department of Transportation (if applicable).
    4. Michigan Department of Environmental Quality (if applicable).
    5. Township Environmental Commission (if applicable).
    6. Township Engineering Department.
    7. Township Fire Department.
    8. The appropriate School Board (if applicable).
  - l. The developer shall provide proof of property ownership, or a letter from the owner authorizing the request and proof of property ownership from the author of the letter.
- (5) Hearing. Upon submittal of a complete application, the Planning Commission shall hold a public hearing.
  - a. Notice of public hearing. Notices shall comply with the provisions outlined in Subsection **86-65(b)** of the Code of Ordinances.

- (6) Planning Commission decision. Following the public hearing, the Planning Commission will make a decision on whether to recommend approval of the request, recommend approval with conditions of the request, or recommend denial of the request, to the Township Board. The Planning Commission shall recommend approval, modification, or denial, to the Township Board, within 60 days of the date the planned unit development was placed on the commission's agenda and shall within said 60 days, report its action to the Township Board. The sixty-day period may be extended if the applicant consents.
  - (7) Township Board decision. After receiving a recommendation from the Planning Commission, the Township Board shall conduct a public hearing which shall be preceded by notice as specified in the preceding subsection (e)(3). Following the public hearing, the Township Board shall make a determination to approve, modify, or deny the request. The Township Board shall approve, modify or deny the planned unit development within 30 days of the date the planned unit development was placed on the board's agenda. The thirty-day period may be extended if the applicant consents.
  - (8) Site plan review. Upon approval by the Township Board of the mixed use PUD, the developer shall submit a complete application to the Department of Community Planning and Development for site plan review, as outlined in the Code of Ordinances. The site plan review process shall be subject to the standards outlined in Chapter **86** of the Code of Ordinances.
  - (9) Any condition imposed upon a mixed use PUD shall be part of the record and remain unchanged, unaltered, and not expanded upon, except with the mutual consent of the Township and the landowner. The Township shall maintain a record of conditions which are changed.
- (h) Effect of issuance.
- (1) Effective date. The effective date of an approved mixed use PUD shall be the date of the Township Board decision.
  - (2) When a mixed use PUD becomes void. If construction related to the mixed use PUD has not commenced within four years after the effective date, approval shall be void, except one two-year extension may be considered if a written request is submitted to the Department of Community Planning and Development prior to the expiration date.
  - (3) Extension of a phased mixed use PUD. Once the first phase of a multiphased mixed use PUD is under construction, the Township Board may grant a two-year extension for future phases if a written request is submitted to the Department of Community Planning and Development prior to the current expiration date. Provided construction progresses on subsequent phases, the Township Board may grant additional two-year extensions if a written request is submitted to the Department of Community Planning and Development prior to the most recent expiration date.
- (i) Amendments.
- (1) Generally. The property owner may apply for an amendment in writing to the Director of Community Planning and Development. The director shall make a determination as to whether a proposed amendment constitutes a major or minor amendment to the original planned unit development.
  - (2) Major amendments. A major amendment shall have a significant impact on the mixed use PUD and the conditions of its approval, which shall include, but not be limited to:
    - a. Building additions located outside a building envelope as shown on the approved mixed use PUD site plan.
    - b. Building additions that reduce any setback shown on the approved mixed use PUD site plan.

- c. Building additions in excess of 2,000 square feet for buildings under 20,000 square feet in gross floor area or 10% of an existing building over 20,000 square feet in gross floor area.
  - d. Expansion of a use that results in an additional 100 or more vehicle trip ends during the peak hours.
  - e. Addition of land to the mixed use PUD equal to or more than 20,000 square feet for existing sites less than 40,000 square feet in area or two times the original site size for sites over 40,000 square feet.
  - f. Expansion of a use that anticipates a 10% or greater increase in required off-street parking.
  - g. Any addition to a legal nonconforming site.
- (3) Minor amendments. All amendments not deemed to be major amendments by the Director of Community Planning and Development shall be considered a minor amendment.
- (4) Process to amend a mixed use PUD.
- a. Major amendments shall follow the same procedure set forth in this section for new applications, including, but not limited to, submitting an application and fee.
  - b. Minor amendments. The Director of Community Planning and Development shall initiate the following review process:
    - 1. Application. An application for an amendment to a mixed use PUD shall be submitted to the Director of Community Planning and Development.
    - 2. Fee. A fee shall be paid at the time of filing the application in the amount established in the schedule of fees adopted by the Township Board.
    - 3. Hearing. Upon submittal of a complete application, the Director of Community Planning and Development shall hold a public hearing.
      - i. Notice of the public hearing. Notices shall comply with the provisions outlined in Subsection **86-65(b)** of the Code of Ordinances.
      - ii. Director of Community Planning and Development decision. Following the public hearing and after adequate review and study of the application, the Director of Community Planning and Development shall make a decision to approve, approve with conditions or deny the minor amendment request within 60 days of the public hearing date. The sixty-day period may be extended if the applicant consents.
    - 4. Site plan review. Upon approval of a minor amendment by the Director of Community Planning and Development, the applicant shall submit a complete site plan review application to the Department of Community Planning and Development, as outlined in Chapter **86** of the Code of Ordinances.
    - 5. Any condition imposed upon a minor amendment to a mixed use PUD by the Director of Community Planning and Development shall remain unchanged, unaltered, and not expanded upon, unless the change is reviewed and authorized by the Director of Community Planning and Development.
  - c. Appeal. An aggrieved person may appeal the decision of the Director of Community Planning and Development to the Township Board in accordance with § **86-188**.

- (j) Enforcement. The provisions of this article shall be enforced in the manner provided elsewhere in this Code of Ordinances. Any development that is not otherwise in conformance with these regulations shall not be approved.