

**CHARTER TOWNSHIP OF MERIDIAN
ENVIRONMENTAL COMMISSION
AGENDA
Wednesday, October 5, 2016**

**Town Hall Room
Meridian Municipal Building
5151 Marsh Road, Okemos, MI 48864**

Work Session

1. Call to Order at 6:30 p.m.
2. Approval of the work session agenda
3. Work Items
 - a. 2004 Greenspace Plan Update
 - b. Meridian Climate Action Plan Discussion
 - c. Upcoming Township Leadership Presentation
4. Public remarks
5. Adjournment

Regular Meeting

1. Call to Order at 7:00 p.m.
2. Approval of Agenda
3. Approval of Minutes of the September 7, 2016 work session
4. Public Remarks
5. Chair's Report
6. Staff Report
7. Commission Liaison/Workgroup Reports (Land Preservation, Energy, Parks)
 - a. Special Signage Project Update by Commissioner Holland
8. ACTION ITEM: Wetland Use Permit #16-04 (Nemoka Drain Improvements)
9. REVIEW ITEM: Draft Resolution Regarding Public Outreach Efforts Related to Safe Drinking Water in the Township
10. Public Remarks
11. Adjournment

**CHARTER TOWNSHIP OF MERIDIAN
ENVIRONMENTAL COMMISSION MINUTES
Meridian Municipal Building – Town Hall Room
September 7, 2016 - Draft**

WORK SESSION

PRESENT: Chair McConnell, Vice-Chair Schools, Commissioners Dickmann, Jackson, Sarver, Holland, Kielbaso and Masten

ABSENT: None

STAFF: Harmony Gmazel, AICP, Associate Planner; Township Environmental Consultant Elise Tripp

OTHERS: Judy Linn, Planning Commission Chair John Scott-Craig

1. CALL WORK SESSION TO ORDER

Chair McConnell called the meeting to order at 6:30 p.m.

2. APPROVAL OF THE WORK SESSION AGENDA

Approved by consent without objection.

3. A. GREENSPACE PLAN UPDATE

Copies of draft maps were shared and reviewed by the Commission. Maps included inventories of various types of open spaces throughout the Township.

B. WETLAND USE PERMIT/MITIGATION DATA

The Commission heard from the Township Environmental Consultant regarding her work in verifying and delineating wetlands, developing wetland use permit review letters and also in inspecting ongoing mitigation projects throughout the Township. The process for each type of review was briefly presented and Ms. Tripp took questions about success of past and current mitigation projects.

C. 2016 TOWNSHIP MASTER PLAN UPDATE

Chair McConnell presented the Commission with key elements of 2016 Draft Master Plan as they pertain to the Environmental Commission. A discussion was had about needed changes to the 2004 Greenspace Plan section of the Draft. A resolution listing changes to the text in the Plan was drafted and approved. It will be forwarded to the Planning Commission. Planning Commission Chair John Scott Craig commended the Commission on its work.

D. OTHER

The Commission expressed interest in creating a resolution to support increased public outreach regarding Safe Drinking Water. A draft resolution will be shared with the Commission for their comments at a future meeting.

4. PUBLIC REMARKS

None

5. ADJOURNMENT

Approved by consent without objection at approximately 8:50 p.m.

Sustainability & Climate Action Plan *(draft: 9-28-16)*

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Introduction

Energy is deeply connected to our community's quality of life and sustainability. According to the U.S. Department of Energy, Meridian residents spend over \$100,000,000 each year on energy.¹ Almost all of the energy used is imported, non-renewable, fossil fuels including coal, oil, and natural gas. This represents a huge impact on our economy, our health, and our environment. While we may disagree on the urgency of reducing climate change, we can all agree that using energy wisely, economically, and efficiently makes sense.

In 2007, Meridian joined what is now over 1060 communities in signing the U.S. Mayors Climate Protection Agreement. This is a commitment to exceed carbon emission reduction goals described in the Kyoto Protocol Agreement. This law is an attempt to address climate disruption and has been ratified in 141 countries.

During the past few years, many major Michigan communities, including Grand Rapids, Ann Arbor, Traverse City, East Lansing, and others) have developed Climate Action Plans. Many of these are integrated in to Comprehensive Plans. The Michigan Municipal League, MI Townships Association, State of Michigan, and others have launched a Green Communities Network to assist local governments in addressing environmental challenges including climate change.

The following Sustainability and Climate Action Plan is a list of priorities for the next five years in an effort to use energy wisely and achieve the resulting economic, environmental, and other benefits. It is also intended to stimulate conversation, generate ideas, and evolve as new information becomes available, supplementing the Township Master Plan, Annual Plan, and related documents.

¹ <http://energy.gov/articles/how-much-do-you-spend> downloaded 9-12-16

Plan Purpose, Scope, and Process

Meridian Township has a long history of implementing environmentally conscious policies and programs and the adoption of a Sustainability and Climate Action Plan will provide a framework and blueprint for continuing and expanding those efforts. One of the purposes of the Plan is to help create a culture of energy conservation and environmental stewardship that will influence all Township policies and actions. Sustainability is a concept that should be included in all township planning and actions. However, in order to make this Plan a useful and workable document, the focus has been on five areas: Energy Efficiency, Renewable Energy, Waste Management, Transportation, and Water Management. The Plan has been initiated and drafted by the Meridian Township Energy Team but the process to develop and implement the plan should and must include township staff, township officials and all members of our community.

Sustainability Plan, Programs, Policies, and Progress to Date

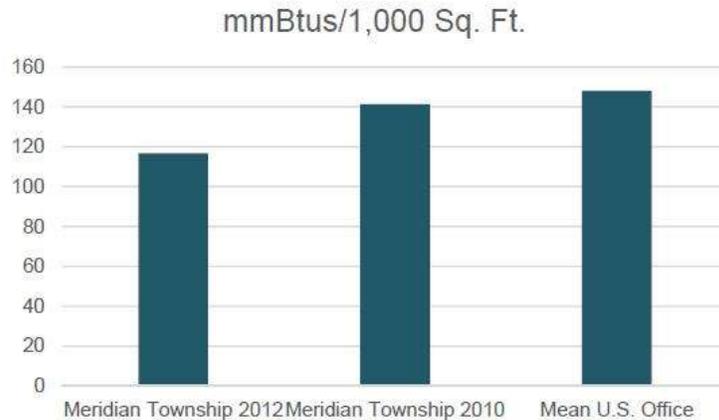
a. Energy Efficiency

Energy efficiency remains the quickest, safest, and most economical way toward sustainability and resilience. Meridian has made great strides reducing energy consumption saving over \$100,000 during the past 5 years. These energy improvements have more than paid for themselves and a portion of this savings has been allocated to a Revolving Energy Fund to support new investments in efficiency.

A Mid-Michigan Energy Study (2014, Michigan Energy Options), illustrates this effort:

Meridian Township Main Office Building

Since 2009, Meridian Municipal Township has taken incremental steps toward sustainability. Their main office building is one of many along the corridor and is an example of how a municipal building can save tens of thousands of dollars through consistent efficiency improvements. The township office was very close to the average office building's energy use intensity, but was able to reduce energy consumption by 18%. Meridian Township is committed to driving efficiency of all its buildings and this means less tax dollars spent on operating costs.



A “Phase II” Energy Study was completed in 2015 (<http://bit.ly/phase-II>). In addition to seeking bids on the items recommended in this report (<http://bit.ly/p2summary>), a major engineering study is underway to explore some major HVAC system replacements and/or retrofits.

Objective a.1: Complete Phase II Energy Recommendations and HVAC Engineering Study

Strategies:

- Review list of Energy Conservation Measures (ECMs) in summary above
- Review Recent Engineering Study/Capital Improvement Plans
- Include major HVAC upgrades in Capital Improvement Plans
- Seek bids on ECMs
- Hire contractor(s) to do work not performed in-house
- Monitor savings and return 80% of savings to Revolving Energy Fund

Objective a.2: Energy & Greenhouse Gas Monitoring

Strategies

- Explore cost-effective energy monitoring systems, software, assistance, and equipment including WeGoWise and Consumers Municipal Energy Efficiency Pilot
- Prioritize top energy-using sites/buildings/equipment for more frequent monitoring

- Discuss better ways to provide energy consumption data feedback to building managers, occupants/Township staff, and accounting/budgeting staff and financial managers. Information should also be provided to township residents so they are aware of township efforts.
- Stay abreast of changes in Consumers E-Billing Program, smart metering opportunities, street lighting options, and other pilot programs.

Other:

- Explore State, Federal, utility and Grant-Funding, Pilot Programs, Utility Programs, etc.
- Other outreach, pilot, experimenting, research, partnerships, etc. such as Green Community Network, Clean Cities, Sustainability Forums, and Greater Lansing area Local Government collaboration (East Lansing, Delhi, Williamstown Twp, Delta Twp, Ingham County, Clinton Co., Eaton Co, City of Lansing, etc.)
- Remaining challenges – motivating employees; Assisting residences and businesses

b. Renewable Energy

Renewable energy systems are becoming more cost effective as technology advances increase efficiency, system costs decrease, and the price of traditional power sources increase. Meridian Township will explore and examine opportunities to install solar, wind, geothermal, and other renewable energy systems at Township facilities and to foster installations at private developments. The focus will be on solar energy in the near term because many opportunities exist. Meridian Township will look at policies and procedures that can hinder or encourage a greater use of renewable energy. An aspirational goal of 100% renewable energy by 2050 should be adopted as part of this Plan.

Past and Current Renewable Energy Efforts:

Meridian Township adopted a wind energy ordinance in May 2011. The purpose of the **wind** energy ordinance is to: a. Provide standards and regulations pertaining to the location, construction, design, maintenance, and abandonment of **wind** energy systems and anemometer towers; b. Enhance and expand the alternative energy options available to residents and businesses located in the Township; and c. Limit potential impacts to adjacent and nearby properties from **wind** energy systems and anemometer towers through proper design, engineering, and siting.

Meridian Township worked with Peninsula Solar, Michigan Energy Options, U.S. Dept. of Energy, and Consumers Energy to create a solar demonstration and educational project at Harris Nature Center. The demonstration includes a solar-powered webcam system, grid-connected photovoltaic (PV) system, and an indoor educational exhibit. The main panels are mounted on a racking system on the roof and a micro-inverter rests behind each panel. The two 250 watt roof-mounted solar panels are made in Michigan by Global Watt. These provide an average of 1.76 kWh on a sunny day. A separate 135 watt PV panel powers two webcams pointed at the bird-feeding area and hawk cage. The cameras are independent of the electric grid and send images to the web for remote viewing.



The Meridian Township Energy Team has been discussing various opportunities and approaches that could be used to encourage more solar energy in the Township. Community Solar has been a frequent topic of conversation and Consumers Energy was invited to select a Township site for their Solar Gardens pilot. Consumers Energy did actively look into a number of possible sites but was not able to find a site big enough (5-6 acres) and suitable for one of their Solar Gardens PV arrays. The Lansing Board of Water & Light (LBW&L) is developing a 300 kW Community Solar project in Burcham Park on the border of Meridian Township. Since the Township does have LBW&L streetlighting accounts, the Township Board authorized leasing ten 300 watt solar panels at the Burcham Park PV array. The Township will get utility bill credits for 25 years based on the electric production from the leased solar panels.

Objective b.1: Develop Township policies and procedures that encourage the use of renewable energy.

Strategies

- Review Township ordinances and procedures to ensure that they are renewable energy-friendly and do not provide any unnecessary barriers to the use of renewable energy.
- Incorporate provisions in the Master Plan that will encourage a greater use of renewable energy.

Objective b.2: Increase the use of renewable energy at Township facilities.

Strategies

- Since the Township receives almost all of its electricity from Consumers Energy, indirectly the Township gets 10% of its electricity from renewable energy resources because of the state Renewable Portfolio Standard (RPS) requiring the 10%. The Township can do better and set a goal of obtaining 20% of Township electric usage from renewable energy sources by 2022.
- Pursue the installation of solar electric systems at Township facilities by Dec. 2017.
- Participate in Community Solar or other green purchasing programs where possible.
- Pursue grant funding where possible to obtain funding for demonstrations of new renewable energy technologies.
- Explore non-grid connected applications like solar streetlighting and solar lighting for signs.

- Explore using a special millage to fund solar energy installations on township facilities.

Objective b.3: Educate the community about renewable energy options and encourage the installation of renewable energy at private and public facilities throughout the Township.

Strategies

- Set a goal of obtaining 15% of total community electric use from renewable energy resources by 2022. This includes the 10% due to the RPS.
- Inform Township residents, businesses, and institutions about current and proposed policies, programs and incentives that could help them utilize renewable energy.
- Explore the types of incentives that could be provided by the Township to encourage a greater use of renewable energy.
- Explore collaborations with schools and other institutions on joint purchasing of renewable energy systems.

Objective b.4: Monitor both energy and cost savings and determine benefits to the community and contributions to the Climate Sustainability Plan.

Strategies

- Continue current monitoring efforts.
- Invest in monitoring equipment as needed.
- Calculate energy and cost savings and reductions in greenhouse gases.

c. Recycling and Waste Reduction

Meridian Township has partnered with citizen groups and waste haulers/recycling providers to provide recycling options to residents for over a decade. During this time, Meridian has offered drop-off of yard waste, paper, metal, glass, and #1-#2 plastic at its Recycling Center and Transfer Station at 5976 E. Lake Drive in Haslett. This has been expanded to include electronics, Styrofoam/expanded polystyrene, green glass, and batteries. In addition, useable household furniture and knick-knacks are often reclaimed and refinished for resale. In 2005, Granger, who serves the majority of single-family residential customers in the Township, began providing curbside recycling at no charge to their customers in 1-5 unit single-family dwelling units. Also, in 2006, the Meridian Township Citizen's Recycling Advisory Committee formed and offered the first bi-annual community-wide recycling day. In 2007 Meridian hired a Recycling Coordinator to assist with recycling efforts in the township.

The following graph, from Granger Recycling, illustrates increases in curbside recycling rates during the past decade:



In 2015, larger residential recycling carts were offered, which helped increase recycling rates in the residential sector. In addition, more materials were collected at our drop off center.



Objective c.1: Increase recycling in single-family and 1-4 unit homes

Strategies

- Work with Granger and others to expand the use of 96 gallon carts
- Launch a collaborative marketing and outreach program to promote existing recycling services and options
- Explore and conduct regional education and promotion opportunities in collaboration with the Regional Recycling Coordinating Committee (R2C2), Capital Area Local First (CALF) and other neighborhoods/organizations/partners.

Objective c.2: Expand recycling in multi-family housing and apartments

Strategies

- Promote current recycling efforts in multi-family housing
- Explore ordinances and policies that encourage recycling
- Provide technical assistance to managers and occupants of multi-family housing/apartments

Objective c.3: Offer community- and region-wide recycling events and other partnerships

Strategies

- Partner with local business, schools, neighborhoods, governments, churches, and others to promote and offer recycling events
- Promote Ingham County household hazardous waste collections
- Explore collaborative processing and/or transfer of recyclables locally and/or in the regions (regional “material recovery facility”)
- Explore food, grease, composting, and related organic material recycling options

d. Transportation

Transportation contributes 31% of greenhouse gases. Alternative fuels can reduce these impacts and the most accessible alternative to petroleum is often overlooked, non-motorized transportation options like walking and biking. Transportation fuel use reduction measures decrease emissions, save the Township and its residents money, enhance environmental quality, and promote public health. The Township will focus on measures in its own fleet, walking and biking, and land use decisions that can reduce petroleum use.

Past and Current Efforts:

A Complete Streets Ordinance was passed by Meridian Township on Sept. 18, 2012. The ordinance is “intended to provide safe, convenient, and comfortable routes for multiple modes of transportation including but not limited to walking, bicycling, personal vehicles and public transportation while encouraging healthy, active living, reduced traffic congestion and dependence on fossil fuels, and improved safety and quality of life for residents of Meridian Charter Township.”

The Township has 20 miles of trails (both natural and paved) and 80 miles of pedestrian/bicycle pathway. These trails and pathways are funded through the Park Millage and Pedestrian/Bicycle Pathway Millage and are maintained by the Township's Parks and Grounds Maintenance Staff. The purpose of the pedestrian/bicycle pathway system is to provide a network of interconnected pathways throughout Meridian Township. The completed system is intended to connect all destination points in the Township, including: schools in Okemos, Haslett, and East Lansing; libraries; parks; public buildings; commercial areas; and related connecting routes outside the Township.

Smart Commute competitions encourage trips involving anything other than one driver, one motorized vehicles. Meridian has participated in the competitions for a number of years and in 2015 placed first among 23 teams participating. The 34-member Primed Meridian team won with 1,083 smart commutes. The previous year the team had 927 trips.

Objective d.1: Encourage employee and citizen participation in Smart Commute competitions and encourage employees and citizens to be smart commuters year round.

Strategies

- Continue to expand the bike and pedestrian pathways network throughout the Township.
- Encourage employee participation in Smart Commute competitions and encourage employees to be smart commuters year round.

Objective d.2: Decrease the use of petroleum in the Township vehicle fleet.

Strategies

- Choose the cleanest and most fuel-efficient vehicle that meets the department’s needs.
- Use electric or hybrid vehicles whenever possible.

- Reduce engine idling.
- Encourage efficient trip-planning to reduce the use of fuel.

Objective d.3: Use land-use planning to reduce vehicle miles traveled and petroleum use.

Strategies

- Continue a complete streets policy to ensure that the entire roadway is designed and operated with all users in mind - including bicyclists, public transportation vehicles and riders, and pedestrians of all ages and abilities.
- Use the Urban Service Boundary to reduce vehicle miles traveled and encourage infill and redevelopment.

Objective d.4: Educate the community about transportation alternatives that can reduce petroleum use.

Strategies

- Use the Township web site to promote transportation alternatives.
- Use public forums and HOM-TV to inform the public.
- Educate the community about how to bike and walk safely, as well as drive safely around bikers and walkers.
- Continue membership in Greater Lansing Area Clean Cities (<http://michigancleancities.org>)

Objective d.5: Monitor both energy and cost savings and determine benefits to the community and contributions to the Climate Sustainability Plan.

Strategies

- Continue current monitoring efforts.
- Calculate energy and cost savings and reductions in greenhouse gases.

Possible Additions:

- Conduct an inventory and efficiency audit of the government vehicle fleet.
- Adopt a fuel efficiency target for the government fleet, including an implementation plan for reaching this target. The plan should incorporate vehicle efficiency and life cycle cost analysis as well as highlight opportunities for purchasing or converting vehicles to be more efficient.
- Review and update the idling policy for the government fleet and/or a community-wide policy.
- Explore grants and support for alternative fuel and vehicle charging infrastructure.

e. Water Management

Water and how it is managed impacts almost all aspects of society, in particular health, food production, water supply and sanitation, and the functioning of ecosystems. Higher temperatures and changes in extreme weather conditions due to climate change are projected to affect rainfall, river flows and groundwater, and water quality. Water management is an important Township responsibility and pollution prevention and wetland preservation are priorities.

Past and Current Water Management Efforts:

Meridian Township Public Works and Engineering maintains, repairs and operates the water distribution system; which includes 158 miles of water mains, over 12,000 water services, 15,000+ water meters, 15,000+ remote readers, 2,000+ water distribution valves, 1,900+ fire hydrants, 1,900+ fire hydrant valves, and two 500,000 gallon elevated storage tanks. The Township is responsible for maintenance of the water mains in the streets and in easements, and for the service lines from the water main to the curb stop (water shut-off valve), which is usually located at the street right-of-way line, and for the water meter. The property owner is responsible for maintenance of the water service line from the curb stop to the building.

The Township's web site has information on stormwater management and pollution prevention including the following topics:

- Pollution Isn't Pretty
- What Can You Do? Public Responsibility and Stewardship
- Sanitary Sewers vs. Storm Sewers
- Prevent or Report Illicit Discharges
- How to Properly Wash Pavement and Your Car
- Pesticides and Fertilizers
- Disposing of Grass, Leaves, and Animal Waste
- Where to Dispose of Household Hazardous Waste, Travel Trailer Waste, Motor Oil, and More
- Septic System Maintenance
- Green Infrastructure and Low Impact Development
- Managing Riparian Lands

The Township is a member of the East Lansing Meridian Water & Sewer Authority and purchases treated water from the Authority for areas of the Township north of Bennett Road and Kinawa Drive. The Township purchases treated water from the Lansing Board of Water & Light for areas south of Bennett Road and Kinawa Drive.

The Township adopted a wetland protection ordinance that is more protective of wetlands than regulations provided by the State. The Township ordinance of "no net loss" of wetlands means that wetlands drained or filled must be replaced by a wetland of equal size. This includes wetlands as small

as .25 acres. The Township maintains a wetland inventory and incorporates wetlands into the site plan review process, including setbacks from natural features such as wetlands.

Objective e.1: Decrease water usage at Township facilities.

Strategies

- Use building energy audits to determine which water fixtures to upgrade.
- Amend purchasing policy to require that when purchasing or replacing new toilets, showers, and faucets only low flow fixtures will be purchased.
- Install waterless urinals where appropriate.
- Explore and implement, as funds allow, a system to capture and use rainwater and gray water for turf and landscape irrigation at municipal facilities.

Objective e.2: Reduce the amount of stormwater runoff.

Strategies

- Increase the number of street trees.
- Use porous pavement, rain gardens, bioswales, riparian buffers, and retention ponds.
- Encourage projects that reuse storm water for irrigation purposes.

Objective e.3: Educate the community about water conservation and management.

Strategies

- Educate staff and building patrons on the importance of water conservation by creating signs or other outreach materials describing why we conserve water and what the Township is doing to conserve water.
- Maintain and update the Township web site as needed.
- Use public forums and HOM-TV to inform the public.
- Educate about fertilizer use and alternatives as it affects run-off to streams etc.
- Educate and provide information about rain barrels.

Objective e.4: Monitor both water and cost savings and determine benefits to the community and contributions to the Climate Sustainability Plan.

Strategies

- Continue current monitoring efforts.
- Invest in monitoring equipment as needed.
- Calculate water and cost savings and reductions in greenhouse gases.

Conclusion

Management

Staff

Committees/Commissions

Integration with other Plans

Acknowledgements



September 20, 2016
Project No. G160096W08

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

Re: Wetland Use Permit (WUP) #16-02 Application Review
Ingham County Drain Commissioner
Nemoka Drain

Dear Mr. Kieselbach:

The Ingham County Drain Commissioner (ICDC) is requesting to daylight the enclosed tile Nemoka Drain (Drain), with associated open channel construction and culvert installation. The primary purpose of the project is to alleviate flooding in backyards, basements, and streets of the older, single-family residential area in the upstream portion of the Nemoka Drain drainage district (east of Marsh Road and north of Haslett Road).

At the request of the Charter Township of Meridian (Township), FTCH reviewed the WUP request, including the following:

- Water and Woods Ecology, LLC (W&W) transmittal letter, dated March 18, 2016;
- A Joint Permit Application, dated March 18, 2016, prepared by the ICDC and W&W;
- W&W Wetland Delineation Report, dated April 2014.

This report provides a brief description of the resources that would be impacted by the proposed work, evaluates WUP Application #16-02 according to review standards in the Township Wetland Protection Ordinance (Article IV of Chapter 22 of the Code of Ordinances of the Charter Township of Meridian), and makes recommendations to the Township regarding issuance or denial of the WUP application. This evaluation is limited to a review of wetland impacts and does not assess broader hydrologic and hydraulic issues pertaining to the Nemoka Drain and proposed improvements.

Overview of Proposed Wetland Impacts

The proposed activities are located in Section 10 of Town 4 North, Range 1 West, Ingham County, Michigan. Proposed impacts are located on:

- Parcel Number 33-02-02-10-130-007, owned by Meridian Charter Township. This parcel contains Hillbrook Park, the Pine Lake Outlet Drain, and Township Wetland No. 10-5. This wetland is contiguous with the Pine Lake Outlet Drain and is therefore regulated by both the State of Michigan and the Township.
- Parcel Number 33-02-02-10-251-003, owned by Benson Hills Haslett LLC. This parcel contains an easement for a Benson Hills subdivision stormwater detention area and an approximately 0.06 acre emergent wetland within this easement, as determined by W&W's wetland assessment. The wetland serves as a stormwater detention basin; buried stormwater pipe associated with the Benson Hills branch of the Nemoka Drain discharges into it. It is not apparent from available aerial photographs (dated 1993 through 2015) if this

wetland was present prior to subdivision development or was constructed. The wetland corresponds to Township Wetland No. 10-10, which the Township wetland map notes is 0.46 acre in size.

FTCH did not verify the delineated wetland boundaries as it is likely that wetland flags are no longer present, since the delineation was conducted in April 2014. Review of aerial photography indicates that the stormwater detention wetland may be slightly larger than was delineated, but is less than one-quarter acre. This wetland is located within 500 feet of the Pine Lake Outlet Drain. Therefore, this wetland is regulated by the Township.

The enclosed Nemoka Drain crosses the above parcels and outlets to the Pine Lake Outlet Drain in Hillbrook Park. The ICDC has submitted a WUP application to the Township proposing the following:

- Replace an enclosed portion of the Nemoka Drain with a 200 foot long, 52-foot wide meandering, two-stage channel.
- Impact 931 square feet of wetland by excavating 46.7 cubic yards of material and placing 31 cubic yards of riprap where the new open channel joins the Pine Lake Outlet Drain.
- Construct a 6-foot wide by 76-foot long foot bridge on piles at the historic trail location spanning the open channel. The foot bridge will cross a regulated wetland and its construction will result in excavating 3.6 cubic yards of wetland soil and replacing it with 3.6 cubic yards of fill at an abutment. These activities will impact 96 square feet of regulated wetland.
- Temporarily impact the northern edge of the stormwater detention wetland to install a 24-inch drainage tile. This area will be restored and reseeded with wetland species.
- Seed the new channel and disturbed areas with native seed mixes, including wetland seed mixes in wetland areas.

Review of WUP Application

The review standards used to evaluate WUP applications are found in Section 22-157 of Article IV (Wetland Protection) of Chapter 22 of the Township's Code of Ordinances. WUPs are not to be issued unless the proposed activity is found to be in the public interest, the permit is necessary to realize the benefits from the activity, and the proposed activity is otherwise lawful in all respects. Section 22-157(2) lists eleven general criteria to be considered when evaluating whether or not a proposed activity is in the public interest. An evaluation of the proposed activity, according to each of the eleven criteria, is as follows:

Section 22-157(2)(a) *The relative extent of the public and private need for the proposed activity.*

- There is a high public and private need for the proposed activities. The primary goal of the project is to alleviate flooding in backyards, basements, and streets in an older residential and commercial area. The Board of Determination has deemed that drain improvements are necessary to protect the health and welfare of the public. Additionally, construction of the foot bridge to cross the new, open channel maintains the function of an existing trail within Hillbrook Park.

Section 22-157(2)(b) *The availability of feasible and prudent alternative locations and methods to accomplish the expected benefits from the activity.*

- The No Action alternative is not feasible and prudent, because it will result in future flooding and adverse impacts to the health and welfare of the public.

- Installation of a large diameter pipe network in the Nemoka Drain Drainage District would need to accommodate a 100-year storm event, either for direct discharge to the Pine Lake Outlet Drain or for inline detention. Hydraulic analysis determined that a minimum 72-inch diameter pipe would be required to accommodate a 100-year storm event. The ICDC determined that installation of such a pipe would be impractical and burdensome in terms of direct and indirect costs, and could exacerbate flood conditions downstream of the Nemoka Drain Drainage District.
- The proposed alternative provides needed stormwater detention, is less expensive than the large diameter pipe alternative, and should result in a reduced downstream impact. In addition, improvements to water quality and wildlife and aquatic habitats will also be achieved. Therefore, this alternative is the most feasible and prudent alternative.

Section 22-157(2)(c) *The extent and permanence of the beneficial or detrimental effects which the proposed activity may have on the public and private uses to which the area is suited, including the benefits the wetlands provide.*

- The proposed project is a suitable use for the subject site, since channel construction will occur in a public park.
- The project will result in a net increase in the total wetland area at the project site, since new wetlands will develop on the channel's flood bench. These wetlands should be of higher quality than those impacted by project activities, due to improved plant diversity introduced through seeding the wetland with a native seed mixture. The created wetland will provide the following functions and values: water storage, water quality improvement, wildlife habitat, and aesthetic value.
- The existing wetlands provide the following functions and values: water storage, water quality improvement, wildlife habitat, and limited aesthetic value. The project will result in very limited impact to these wetlands.

Section 22-157(2)(d) *The probable impact of each proposal in relation to the cumulative effect created by other existing and anticipated activities in the watershed.*

- The proposed drain improvements are important elements in a larger effort addressing stormwater management in the Drain's watershed. By providing additional stormwater detention, the proposed improvements will contribute to alleviation of flooding in the drainage district, both upstream and downstream of the proposed channel.

Section 22-157(2)(e) *The probable impact on recognized historic, cultural, scenic, ecological, or recreational values and on the public health or safety, or fish or wildlife.*

- The project will alleviate flooding within a historic area of the Township. Portions of the Nemoka Drain Drainage District were platted in the 1880s.
- FTCH has no other direct information pertaining to historic and cultural values pertaining to the project's impact area.
- The proposed activities will support recreational use in Hillbrook Park, through maintaining an existing trail and constructing a foot bridge over the new channel.
- Construction of the proposed channel is likely to result in a larger and more scenic wetland than is currently present on the site.

- Daylighting the Drain will result in improved and more varied wildlife, fish and aquatic habitat within the park, and greater ecological value.
- Daylighting the Drain will enable wetland plants to filter and trap nutrients and pollutants, resulting in improved water quality in the Pine Lake Outlet Drain. Water quality improvements in the wetland and downstream areas will aid in creating diverse and high-quality fish and aquatic habitat, which presently does not exist in the enclosed pipe.
- The reduction of flooding resulting from this project will provide public health and safety benefits.

Section 22-157(2)(f) *Economic value, both public and private, of the proposed land change to the general township area.*

- The proposed activities protect against upstream flooding, which provides positive economic value, both public and private, to the Nemoka Drain Drainage District.

Section 22-157(2)(g) *The size and quality of the wetland being considered.*

- Excavation and installation of riprap at the channel outlet will impact an area of approximately 0.24 acre in size. This area includes portions of the Pine Lake Outlet Drain, associated forested/scrub shrub wetland and upland bank. The WUP application does not specify what portion of the impact area is wetland. Sheet 3 of 9 indicates that the wetland edge is 3 to 6 feet wide along the Drain. Photographs submitted with the WUP indicate this edge is eroded and not well vegetated. Therefore, the wetland impact area is limited and of poor quality.
- Channel excavation and foot bridge construction will also impact the southern edge of a 0.04 acre, regulated, forested and scrub shrub wetland. This impact is limited to an area of 96 square feet.

Section 22-157(2)(h) *The findings of necessity for the proposed activity which have been made by other agencies.*

- The proposed work was found necessary by a statutory Board of Determination, pursuant to the Michigan Drain Code, Public Act 40 of 1956.

Section 22-157(2)(i) *Amount of wetland remaining in the general area and proximity to a waterway.*

- The Township wetland map indicates that a relatively narrow band of forested and scrub shrub wetland is present along the edges of the Pine Lake Outlet Drain between Haslett and Lake Lansing Road (i.e. in Hillbrook Park). The map indicates this wetland is approximately 7 acres in size. Extensive wetland complexes are located contiguous to the Drain both north of Lake Lansing Road and South of Haslett Road.
- The project will likely result in a net increase in overall wetland area, since wetland is expected to develop on the flood bench within the new channel.

Section 22-157(2)(j) *Proximity to any waterbody.*

- The proposed impacts to regulated wetlands are located within 90 feet of the Pine Lake Outlet Drain.

Section 22-157(2)(k) *Extent to which upland soil erosion adjacent to the protected wetland is controlled.*

- The WUP application indicated that a soil erosion and sedimentation control (SESC) plan will be approved by the ICDC, whose office is an Authorized Public Agency. Protective measures will include installation of orange snow fencing to define the limits of construction; silt fence around proposed work areas, as



appropriate; temporary best management practices (BMPs) (such as “silt stop”) for non-active disturbed soil areas; and permanent BMPs (such as seed and mulch) when construction is complete in a given area.

Recommendations

Based upon our review of the submitted materials, it is our opinion that the proposed project meets the Township’s requirements for permit issuance. FTCH recommends the WUP permit be issued with the following conditions:

- Conduct all site activities in accordance with MDEQ Permit No. WRP002505.
- Implement appropriate SESC measures during construction to ensure there are no impacts to wetlands outside of project activities as a result of soil erosion.
- Submit a wetland mitigation and monitoring plan for Township approval. The wetland mitigation area shall consist of the flood bench within the constructed two stage channel. In addition, wetland disturbed along the northern edge of the stormwater detention wetland shall be restored at the existing grade and seeded with an appropriate native wetland mix. The mitigation plan shall include:
 - Specifications for the recommended native seed mixtures, including species name (both botanical and common), ounces per acre (on a pure, live seed basis), the total seeding rate, and the seed mix supplier.
 - A figure noting the locations where native seed mixtures will be planted, including wetland and upland locations.
 - A figure noting vegetative monitoring sampling plots within the mitigation area and photo points. Establish a minimum of 5 sample plots. Monitor the wetland restoration area along the northern edge of the stormwater detection wetland through a meander survey.
- Conduct wetland monitoring for five years.
- The performance standards for the wetland mitigation and restoration areas are:
 - Sixty percent cover of native wetland plant species.
 - Ten percent cover or less of invasive species.

We appreciate the opportunity to assist in the review of this file. If you have any questions or require additional information, please contact me at 616.464.3738 or ehtripp@ftch.com.

Sincerely,

FISHBECK, THOMPSON, CARR & HUBER, INC.

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

Elise Hansen Tripp, PWS

pmb

By email

cc: Ms. Harmony Gmazel, AICP – Meridian Township

TAB 1

Cover/Transmittal Letter



WATER AND WOODS ECOLOGY, LLC
P.O. Box 141, Haslett, MI 48840

March 18, 2016

MDEQ – WRD
Lansing District Office
Constitution Hall 1st Floor South Tower
525 W. Allegan Street
P. O. Box 30242
Lansing, MI 48909

RE: Nemoka Drain Drainage District
MDEQ – Joint Permit Application

Dear MDEQ Staff:

Please consider this letter the transmittal for the Joint Permit Application package for the Nemoka Drain Drainage District project. This project includes tile daylighting, open channel construction and culvert installation under Parts 301 and 303 of NREPA.

The project is located in Meridian Township, Ingham County.

Included with this submittal is an application binder containing the application package; and, one compact disc containing a PDF copy of the entire application and HEC-RAS files. The application will also be submitted through the MDEQ MiWaters web application and payment of the application fee transacted at that time.

The application package is divided into 8 tabs containing a cover letter and the various portions of the permit application and support documents. The Table of Contents identifies the information contained in each tab.

This application is being submitted on behalf of the Nemoka Drain Drainage District and Patrick E. Lindemann, Ingham County Drain Commissioner by Blair Webster of Water and Woods Ecology, LLC and Alan Boyer of LSG Engineers & Surveyors.

Questions may be directed to Blair Webster at 517-230-9409 (beeraywebster@cs.com),
or Alan Boyer at 517-393-2902 x225 (boyer@lsg-es.com).

Sincerely

A handwritten signature in black ink that reads "Blair Webster". The signature is written in a cursive style with a large initial 'B'.

Blair Webster, CPE, CWS
Water and Woods Ecology, LLC

cc: Patrick E. Lindemann, Ingham County Drain Commissioner

Attachments: Joint Permit Application binder
CD containing PDF of the binder and HEC-RAS files

TAB 2

**Project Narrative and
Joint Permit Application Form**

PROJECT NARRATIVE

1.0 Location

Established in 1906 (see the Final Order of Determination in **Tab 4**), the Nemoka Drain Drainage District is located in Section 10 of Meridian Charter Township (T4N-R1W), in the north-central part of Ingham County.

The district lies immediately southwest of Lake Lansing, bounded by Lake Lansing Road to the north, Lake Drive/Shaw Street to the east, Haslett Road and the Canadian National Railway railroad to the south, and Hillbrook Park to the west. The district is located and delineated on the attached Location Map, District Boundary Map and USGS Topographic Map (see **Figures 1, 2 and 3**).

2.0 Description of Existing Drainage Course

The Nemoka Drain is an enclosed tile drain approximately 3,200 feet long. At the upstream end of the drainage district (east of Marsh Road), it receives runoff from an older residential and commercial area originally platted in the 1880's. The drain then crosses Marsh Road and wends its way through the Benson Hills Apartments complex and Meridian Township's Hillbrook Park before discharging into the Pine Lake Outlet Drain. (Note that a negligible amount of flow discharges to Lake Lansing.)

Photos of existing conditions in the proposed work area pertaining to this permit application are included in **Tab 3**.

3.0 Necessity of Improvements to the Nemoka Drain Drainage District

As shown in the First Order of Determination for the current petition project (see **Tab 4**), the Board of Determination deemed drain improvements necessary to protect the health and welfare of the public. The primary concern is flooding in the backyards, basements and streets of the older, single-family residential area in the upstream portion of the district (east of Marsh Road and north of Haslett Road).

Therefore, the Ingham County Drain Commissioner, in order to fulfill his duties and obligations under the Michigan Drain Code, surveyed and verified the district boundaries and obtained the services of an engineering firm to design improvements for stormwater control within the Nemoka Drain Drainage District.



Site Location



Site Location

Site Location

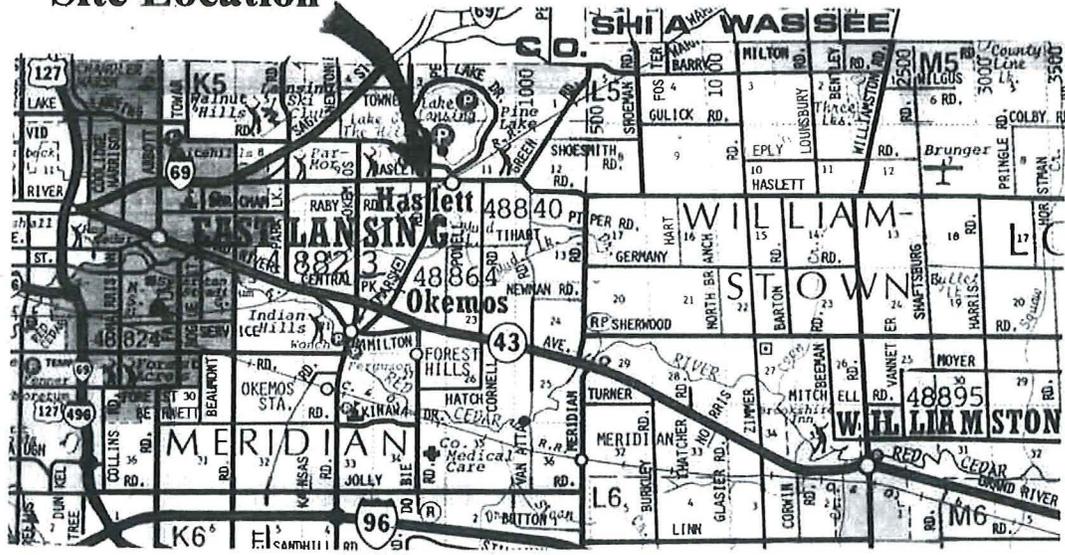
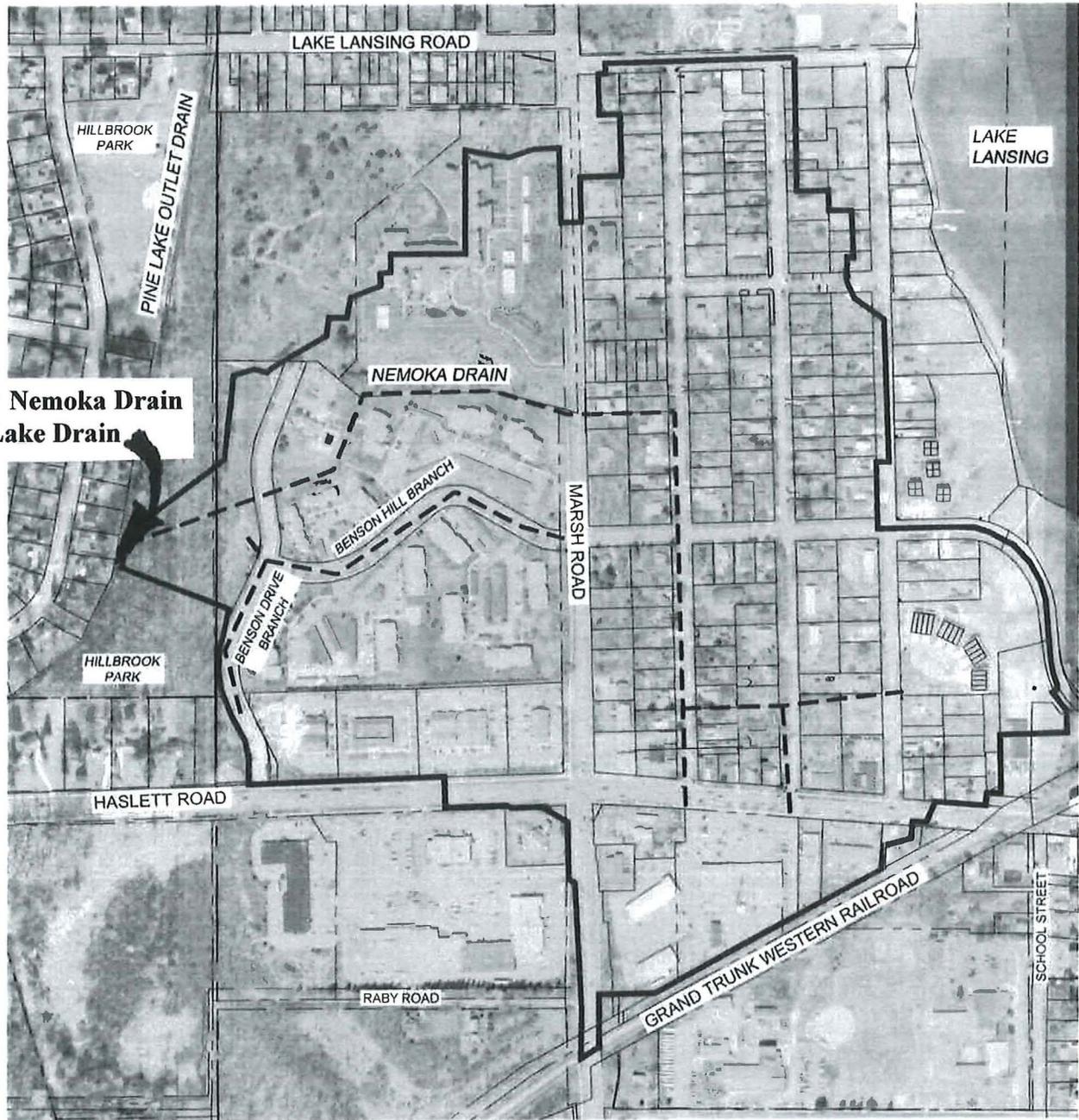


Figure 1

Location Map



Outlet of Nemoka Drain
to Pine Lake Drain

1 inch = 500 feet



Figure 2

**Nemoka Drain District
Boundary Map**

4.0 Proposed Project and Work Covered Under The Joint Permit Application

Proposed drainage system improvements within the Drainage District include additional as well as larger diameter piping, installation of vegetated infiltration swales within existing rights-of-way, and construction of regional detention basins. Negotiations are ongoing with property owners for temporary grading or construction easements, and purchase agreements for the proposed detention basins.

The joint permit application only pertains to work that impacts regulated resources under Parts 303 (wetland protection) and 31 (floodplains) of the NREPA. This work is confined to Hillbrook Park and includes the following (see **Tab 6**):

- Adding a junction chamber to accommodate the existing 21-inch pipe and a new 24-inch parallel relief pipe approaching the east edge of Hillbrook Park;
- Removal of 160 feet of 21-inch pipe;
- Abandonment in place of the remaining 200 feet of existing 21-inch pipe (by filling with grout and capping the ends) between the open channel and Pine Lake Outlet Drain;
- Placement of 110 feet of new 36-inch pipe from a new junction chamber to a new open channel;
- Placement of a new 60-inch diameter manhole just before the point of discharge of the 36-inch pipe into the open channel;
- Construction of a two-stage open channel, six feet to eight feet deep, with 2 to 1 (vertical to horizontal) side slopes and a low-flow channel meandering down the center;
- Obtaining additional easement area to traverse the open channel around wetland in order to minimize impacts to the extent feasible;
- Placing 31 cubic yards of 6- to 12-inch field stone over woven geotextile fabric along the banks and bottom of the Pine Lake Outlet Drain at the point of discharge of the Nemoka Drain in order to protect it from erosion and scour during high flow events;
- Placement of a footbridge constructed in place over the open drain channel, aligned with the existing trail;
- Planting of maple and oak trees, 2- to 3-inch in diameter adjacent to the open drain channel where space is available and other select locations within Hillbrook Park to offset those trees removed for the proposed work; and,

- Seeding with native seed mixes adapted for the bottom, sides and top of bank of the drain channel and disturbed areas.

The proposed work in Hillbrook Park will add a new natural feature in the park and point of interest for wildlife viewing, as well as provide additional wetland habitat. It will also diversify habitat types in the upland area of the park, while providing necessary capacity improvements in the Nemoka Drain Drainage District.

5.0 Soil Erosion and Sedimentation Control

A Soil Erosion and Sedimentation Control Plan will be approved for the project through the applicant (Ingham County Drain Commissioner), whose office is an Authorized Public Agency.

All work will be in accordance with this plan and State, County and local government laws, requirements and ordinances that are associated with soil erosion and sedimentation control, in order to protect regulatory aquatic resources.

Protective measures will include:

- Orange snow fencing at the perimeter of temporary construction easements, property boundaries and wetland/surface water in order to define the limits of construction;
- Silt fencing as appropriate around proposed work areas;
- Installing temporary BMPs (such as “silt stop”) for non-active disturbed soil areas;
- Installing permanent BMPs (such as seeding and mulching) when construction is complete in a given area.

6.0 Wetland Assessment and Proposed Impacts

A Wetland Assessment was conducted of the entire 116-acre Nemoka Drain Drainage District (see **Tab 7**). The basis for the assessment was the multi-parameter approach found in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1987) and the Michigan Department of Natural Resources Wetland Manual.

Only one *regulated* wetland area will be impacted by the work within or near Hillbrook Park (Area “G” as shown in **Figures 3a and 3b** of the assessment). The impact is limited in area and the construction of the two-stage open channel will compensate by adding new wetland habitat within the low-flow overbank area.

One *non-regulated* area will be impacted during construction of the proposed relief pipe within the Benson Hills detention area. The impact will be limited in scope and the area will be re-seeded with wetland seed mix during restoration of the area.

As noted above, silt fencing and/or orange construction fencing will be used to keep construction equipment and materials out of wetland habitat beyond what is necessary to conduct the work.

7.0 100-Year Floodplain and Floodway

The 100-year floodplain elevation (FEMA Zone A) for the Pine Lake Outlet Drain is approximately 848.0 (NAVD 88) at the Nemoka Drain outlet. Less than one acre of the proposed area of disturbance is within the floodplain. The work in this area will create a net gain in the volume of the available flood storage by excavation of 2,632 cubic yards for the creation of an open channel, where there is currently a buried 21-inch diameter pipe.

8.0 Endangered, Threatened and Special Concern Species

Based on a search of the Michigan Natural Features Inventory, there are no known Endangered, Threatened or Special Concern species and/or potential habitat of such in the vicinity of proposed construction or other disturbance of the natural environment. This is likely due to ongoing trail usage and past drain construction and maintenance.

9.0 Feasible and Prudent Alternatives Analysis

There were three primary alternatives considered for making improvements to the Nemoka Drain Drainage District (taking into account construction techniques, the route and course of the existing and proposed drain, impacts to regulatory aquatic resources, and the long-term need to alleviate flooding in the District):

Alternative 1 - Do Nothing

The Board of Determination, acting in accordance with the Michigan Drain Code, determined that improvements to the Nemoka Drain Drainage District were necessary and the Ingham County Drain Commissioner has a duty to provide a means of relief. Flooding within the Drainage District will not diminish with time. The alternative to “Do Nothing” is neither feasible nor prudent, as it does not address harmful impacts to the health and welfare of the public.

Alternative 2 - Install Large Diameter Pipe Network in the Nemoka Drain Drainage District

The design guidance from the Ingham County Drain Commissioner stipulated that any solution must provide protection for the 100-year storm event. The second Alternative evaluated the feasibility of increasing the pipe size and the overall extent of the pipe network to either simply discharge a 100-year storm event, or provide inline detention in the pipe network and release stormwater at a rate less than the 100-year storm discharge rate. Both scenarios would have required large diameter pipe (minimum 72-inch diameter) and would have been particularly burdensome and impractical in terms of direct and indirect costs. Direct discharge of the 100-year event would also likely exacerbate flood conditions in the Red Cedar River watershed downstream of the Nemoka Drain Drainage District. Therefore, this Alternative was rejected.

Alternative 3 - Install Detention Basins, Roadside Infiltration Swales and Enhance the Pipe Network (Low-Impact Design)

Evaluation of the second Alternative indicated that detention would be an important and necessary element in any developed solution. Therefore, the design concept for the third Alternative started with the premise of limiting the pipe sizes within the network (no more than 24-inch diameter, though there would be discrete instances of larger pipe dictated by hydraulics) and then providing regional detention basins and vegetated infiltration swales to store and filter stormwater and reduce the peak discharge rate. This Low-Impact Design Alternative was selected as the least expensive while also yielding a reduced downstream impact outside of the District.

Additional scenarios within the overarching selected design alternative were considered relative to the outlet through Hillbrook Park:

A) Install a Relief Drain By Means of Open-Cut Construction

One crucial enhancement to the Nemoka Drain Drainage District pipe network will be the installation of a 24-inch diameter relief tile drain parallel to the existing 21-inch tile drain from Marsh Road to the point of outlet at the Pine Lake Outlet Drain. Without this component, it will not be possible to reduce the 100-year water surface elevation to an acceptable level east of Marsh Road even with detention in place. Open-cut construction was considered first. However, an evaluation of the impact on the natural features in the park indicated that there would be significant disturbance to existing regulated wetlands. There was also evidence of severe bank erosion on both banks at the outlet suggesting the need to provide energy dissipation, thus leading in the direction of a section of open channel at the point of discharge.

B) Install a Junction Chamber, 36-inch pipe outlet and Open Channel Section

The proposed design as shown in the attached drawings envisions open-cut installation of the relief tile drain to a point just outside of Hillbrook Park. Flows from both the existing 21-inch and the proposed 24-inch diameter pipes will join at a proposed junction chamber. The combined flow then discharges from a single 36-inch pipe into an open channel connecting to the Pine Lake Outlet Drain. This will be a two-stage channel for both high and low flows (with a meandering low-flow channel). The benefits of this plan include limiting the impact to the existing regulated wetlands, minimizing tree removal, and lowering discharge velocities during storm events.

In sum, the Low-Impact Design Alternative with its two-stage outlet channel through Hillbrook Park has the least degree of impact to the natural environment and surface water resources, alleviates flooding in accordance with the drain petition for relief, and has the greatest benefit relative to the cost.



AGENCY USE	Previous USACE File Number	Date Received	DEQ File Number
	USACE File Number		Fee received \$

Validate that all parts of this checklist are submitted with the application package. Fill out application and additional pages as needed.

- All items in Sections 1 through 9 are completed.
- Project-specific Sections 10 through 20 are completed.
- Dimensions, volumes, and calculations are provided for all impact areas.
- All information contained in the headings for the appropriate Sections (1-20) are addressed, and identified attachments (➔) are included.
- Map, site plan(s), cross sections; one set must be black and white on 8 1/2 by 11 inch paper; photographs.
- Application fee is attached.

1 Project Location Information For Latitude, Longitude, and TRS info anywhere in Michigan see www.mcgi.state.mi.us/wetlands/

Project Address (road, if no street address) <i>Bet. Montebello Dr. & Benson Drive, 1200' S. of L. Lansing Rd. & 1300' N. of Haslett Rd.</i>	Zip Code <i>48840 Haslett</i>	Municipality (Township/Village/City) <i>Meridian</i>	County <i>Ingham</i>
Property Tax Identification Number(s) <i>(See Tab 5 for adjoining property owners)</i>	Latitude <i>42 deg 45'.02" N</i>	Township/Range/Section (TRS) T <i>4</i> N or S; R <i>1W</i> E or W;	
Subdivision/Plat and Lot Number <i>NA</i>	Longitude <i>- 84 deg 24' 48" W</i>	Sec <i>10</i> OR Private Claim # <i>NA</i>	

2 Applicant and Agent Information

Owner/Applicant (individual or corporate name) <i>Ingham County Drain Commissioner - Paul Pratt, Deputy Drain Commissioner</i>	Agent/Contractor (firm name and contact person) <i>Water and Woods Ecology, LLC - Blair Webster</i>
Mailing Address <i>707 Buhl Drive</i>	Mailing Address <i>808 Lake Lansing Road, Suite 207</i>
City <i>Mason</i> State <i>MI</i> Zip Code <i>48854</i>	City <i>East Lansing</i> State <i>MI</i> Zip Code <i>48823</i>
Contact Phone Number Fax <i>517-676-8391 517) 676-8364</i>	Contact Phone Number Fax <i>517-230-9409 517-316-2358</i>
Email <i>ppratt@ingham.org</i>	E-mail <i>beeraywebster@cs.com</i>
<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes Is the applicant the sole owner of all property on which this project is to be constructed and all property involved or impacted by this project? ➔ If no, attach letter(s) of authorization from all property owners including the owner of the disposal site.	
Property Owner's Name (If different from applicant) <i>See attached list of adjoining owners</i>	Mailing Address <i>See attached</i>
Contact Phone Number <i>N/A</i>	City <i>N/A</i> State <i>N/A</i> Zip Code <i>N/A</i>

3 Project Description

Project Name <i>Nemoka Drain Outlet</i>	Preapplication File Number <i>N/A</i>
Name of Water body <i>Nemoka Drain</i>	Date project staked/flagged <i>4/1/2014</i>
The proposed project is on, within, or involves (check all that apply)	
<input type="checkbox"/> an inland lake (5 acres or more) <input type="checkbox"/> a pond (less than 5 acres) <input checked="" type="checkbox"/> a stream, river, ditch or drain <input checked="" type="checkbox"/> a legally established County Drain Date Drain was established <i>Aug. 16, 1906</i> <input type="checkbox"/> a channel/canal <input type="checkbox"/> 500 feet of an existing water body	<input type="checkbox"/> a Great Lake or Section 10 Waters <input checked="" type="checkbox"/> a wetland <input checked="" type="checkbox"/> a 100-year floodplain <input type="checkbox"/> a dam <input type="checkbox"/> a designated high risk erosion area <input type="checkbox"/> a designated critical dune area <input type="checkbox"/> a designated environmental area
Project Use	
<input type="checkbox"/> private <input type="checkbox"/> commercial <input checked="" type="checkbox"/> public/government <input type="checkbox"/> project is receiving federal/state transportation funds <input type="checkbox"/> Wetland Restoration <input type="checkbox"/> other	

Indicate the type of permit being applied for: General Permit Minor Project Individual (All other projects.) ➔ See Appendix C.

Written Summary of All Proposed Activities *Removing or abandoning (by grouting and capping ends of pipe) the existing 21-inch tile drain in Hillbrook Park; installing new 36-inch tile drain; excavating a two-stage open channel along new route and course to the south of the existing enclosed tile drain; placing 6-inch to 12-inch riprap and/or field stone along and within the Pine Lake Outlet Drain where the Nemoka Drain discharges into the latter in order to protect against erosion; installing a pedestrian bridge over the proposed open channel to maintain the existing walking trail connections; tree planting; and, stabilizing disturbed areas with native seed mixes.*

Construction Sequence and Methods *Same sequence as above using excavator, backhoe and skid loader.*

4 Project Purpose, Use and Alternatives *Attach additional sheets as necessary.*

Describe the purpose of the project and its intended use; include any new development or expansion of an existing land use.

The purpose of the project is to alleviate flooding due to increased runoff and insufficient storm system capacity in the eastern half of the Nemoka Drain Drainage District.

Describe the alternatives considered to avoid or minimize resource impacts. Include factors such as, but not limited to, alternative locations, project layout and design, and construction technologies. For utility crossings include alternative routes and construction methods.

See discussion under Project Narrative (Tab 2).

5 Locating Your Project Site *Attach a legible black and white map with a North arrow.*

Names of roads of closest intersection *Haslett Road and Benson Drive.*

Directions from main intersection to the project site, with distances from the best and nearest visible landmark and water body *1200 feet north of Benson Drive and Haslett Road at intersection of Lake Drive extended to the west, across Benson Hills Apartments detention basin and into Hillbrook Park (Meridian Twp. owned), to discharge of the Nemoka Drain into the Pine Lake Drain.*

Description of buildings on the site (color; 1 or 2 story, other)
N/A

Description of adjacent landmarks or buildings (address; color; etc)
N/A

How can your site be identified if there is no visible address? *The existing drain alignment will be marked with lath and surveyors tape from the edge of the detention area serving the Benson Hills Apartments to the outlet at the Pine Lake Outlet Drain. Follow existing drainage course as shown on attached location map, USGS topographic map and engineering design plans in Tabs 2 and 6.*

6 Easements and Other Permits

No Yes Is there a conservation easement or other easement, deed restriction, lease, or other encumbrance upon the property?

➔ If yes, attach a copy. Provide copies of court orders and legal lake levels if applicable.

List all other federal, interstate, state, or local agency authorizations including required assurances for Critical Dune Area projects.

Agency	Type of Approval	Number	Date Applied	Date approved /denied	Reason for denial
<i>Ingham County Drain Commission (APA)</i>	<i>Part 91, Soil Erosion and Sedimentation Control, permit</i>	<i>TBD</i>	<i>TBD – Application to be made upon issuance of MDEQ permit</i>	<i>TBD</i>	<i>N/A</i>
<i>Meridian Township</i>	<i>Wetland Use Permit</i>	<i>TBD</i>	<i>TBD – Application to be made concurrent with this application</i>	<i>TBD</i>	<i>N/A</i>

7 Compliance

If a permit is issued, when will the activity begin? (M/D/Y) *Fall 2016*

Proposed completion date (M/D/Y) *Summer 2017*

No Yes Has any construction activity commenced or been completed in a regulated area?

➔ If Yes, identify the portion(s) underway or completed on drawings or attach project specifications and give completion date(s).

No Yes Were the regulated activities conducted under a DEQ and/or USACE permit?

➔ If Yes, list the permit numbers

No Yes Are you aware of any unresolved violations of environmental law or litigation involving the property?

➔ If Yes, attach explanation.

8 Adjoining Property Owners *Provide current mailing addresses. Attach additional sheets/labels for long lists.*

<input type="checkbox"/> Established Lake Board	Contact Person	Mailing Address	City	State and Zip Code
<input type="checkbox"/> Lake Association	<i>N/A</i>			

List all adjoining property owners.

If you own the adjoining lot, provide the requested information for the first adjoining parcel that is not owned by you.

Property Owner's Name	Mailing Address	City	State and Zip Code
<i>See list in Tab 5</i>			

9 Applicant's Certification

Read carefully before signing.

I am applying for a permit(s) to authorize the activities described herein. I certify that I am familiar with the information contained in this application; that it is true and accurate; and, to the best of my knowledge, that it is in compliance with the State Coastal Zone Management Program. I understand that there are penalties for submitting false information and that any permit issued pursuant to this application may be revoked if information on this application is untrue. I certify that I have the authority to undertake the activities proposed in this application. By signing this application, I agree to allow representatives of the DEQ, USACE, and/or their agents or contractors to enter upon said property in order to inspect the proposed activity site before and during construction and after the completion of the project. I understand that I must obtain all other necessary local, county, state, or federal permits and that the granting of other permits by local, county, state, or federal agencies does not release me from the requirements of obtaining the permit requested herein before commencing the activity. I understand that the payment of the application fee does not guarantee the issuance of a permit.

<input type="checkbox"/> Property Owner <input type="checkbox"/> Agent/Contractor <input checked="" type="checkbox"/> Corp. or Public Agency / Title	Printed Name	Signature	Date
	Paul Pratt, Deputy Drain Commissioner	<i>Paul C. Pratt</i>	3/18/16

10 Projects Impacting Inland Lakes, Streams, Great Lakes, Wetlands or Floodplains

- Complete only those sections A through M applicable to your project.
- If your project impacts wetlands also complete Section 12. If your project impacts regulated floodplains also complete Section 13.
- To calculate volume in cubic yards (cu yd), multiply the average length in feet (ft) times the average width (ft) times the average depth (ft) and divide by 27. Example: (25 ft long x 10 ft wide x 2 feet deep) / 27 = 18.5 cubic yards
- Some projects on the Great Lakes require an application for conveyance prior to Joint Permit Application completeness.
 - ➔ Provide a black and white overall site plan, with cross-section and profile drawings. Show existing lakes, streams, wetlands, and other water features; existing structures; and the location of all proposed structures, land change activities and soil erosion and sedimentation control measures. Review Appendix B and EZ Guides for aid in providing complete site-specific drawings.
 - ➔ Provide tables for multiple impact areas or multiple activities such as multiple fill areas or multiple culverts. Include your calculations.

Water Level Elevation

On inland waters NGVD 29 NAVD 88 other Observed water elevation (ft) date of observation (M/D/Y)
 On a Great Lake IGLD 85 surveyed converted from observed still water elevation.

A. PROJECTS REQUIRING FILL (See All Sample Drawings)

- ➔ Attach a site plan and cross-section views to scale showing maximum and average fill dimensions with calculations.
- ➔ For multiple impact areas on a site provide a table with location, dimensions and volumes for each fill area.

Purpose	<input type="checkbox"/> bioengineered shore protection <input checked="" type="checkbox"/> riprap	<input type="checkbox"/> boat ramp <input type="checkbox"/> seawall	<input type="checkbox"/> boat well <input type="checkbox"/> swim area	<input type="checkbox"/> bridge or culvert <input checked="" type="checkbox"/> other stabilization of drain banks	<input type="checkbox"/> crib dock
Dimensions of fill (ft) Length 35 Width 24 Maximum Depth 1.0	Total volume (cubic yards) 31.0 (top @ bankfull = 838.3)	Volume below OHWM (cubic yards) 25.0 (OHWM @ 836.0 +/-, bot. @ 835.5)	Maximum water depth in fill area (ft) 5.3 to bank overflow		
Area filled (sq ft) 840		Will filter fabric be used under proposed fill? <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes (if Yes, type) woven			

Fill will extend **16' (from bank to bank in drain)** feet into the water from the shoreline and upland **2.3' (upslope to top/bank)** feet out of the water.

Type of clean fill peastone % sand % gravel % other **6-12" field stone (see sheet 5 of 9 on plans)**

Source of clean fill commercial on-site other
 ➔ If on-site, show location on site plan.
 ➔ If other, attach description of location.

B. PROJECTS REQUIRING DREDGING OR EXCAVATION (See Sample Drawings)

- Refer to www.mi.gov/jointpermit for spoils disposal and authorization requirements.
- ➔ Attach a site plan and cross-section views to scale showing maximum and average dredge or excavation dimensions with calculations.
- ➔ For multiple impact areas on a site provide a table with location, dimensions and volumes for each dredge/excavation area.

Purpose	<input type="checkbox"/> boat ramp <input type="checkbox"/> navigation	<input type="checkbox"/> boat well <input type="checkbox"/> pond/basin	<input type="checkbox"/> bridge or culvert <input checked="" type="checkbox"/> other daylight existing tile drain	<input type="checkbox"/> maintenance dredge
Dimensions (ft) Length 200 Width 52 avg (top of bank) Maximum Depth 7 (6' avg)	Total volume (cu yds) 2,632	Volume below OHWM (cu yds) 39	Has this same area been previously dredged? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	
If Yes, provide date and permit number:		Will the previously dredged area be enlarged? <input type="checkbox"/> No <input type="checkbox"/> Yes		
If Yes, when and how much?		Is long-term maintenance dredging planned? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		
If Yes, how often? The proposed use of natural channel design for the (daylighted) open channel should reduce and potentially eliminate the need for any maintenance dredging				

Dredge or Excavation Method Hydraulic Mechanical other

Dredge or Excavation Method <input type="checkbox"/> Hydraulic <input checked="" type="checkbox"/> Mechanical <input type="checkbox"/> other				
Spoils Disposal	Dredged or excavated spoils will be placed <input checked="" type="checkbox"/> on-site <input type="checkbox"/> landfill <input type="checkbox"/> USACE confined disposal facility <input type="checkbox"/> other upland off-site For disposal, provide a <input checked="" type="checkbox"/> Detailed spoils disposal area location map and site plan with property lines. <input checked="" type="checkbox"/> Letter of authorization from property owner of spoils disposal site, if disposed off-site.			
	For volumes less than 5,000 cu yards, has proposed dredge material been tested for contaminants within the past 10 years? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes <input checked="" type="checkbox"/> If Yes, provide test results with a map of sampling locations.			
<input checked="" type="checkbox"/> C. PROJECTS REQUIRING RIPRAP (See Sample Drawings 2, 3, 8, 12, 14, 22, and 23)				
Riprap water ward of the ordinary high water mark: dimensions (ft) length 35 width 24 depth 1.0				Volume(cu yd) 31.0 (in County Drain Easement)
Riprap landward of the ordinary high water mark: dimensions (ft) length 35 width 5.6 depth 1.0				Volume(cu yd) 8.3
Type and size of riprap (inches) <input checked="" type="checkbox"/> field stone 6-12" <input type="checkbox"/> angular rock <input type="checkbox"/> other			Will filter fabric or pea stone be used under proposed riprap? <input type="checkbox"/> No <input checked="" type="checkbox"/> Yes, Type woven fabric	
<input checked="" type="checkbox"/> I. BOARDWALKS and DECKS in WETLANDS or FLOODPLAINS (See Sample Drawings 5 and 6. Complete Sections 12 and/or 13) <input checked="" type="checkbox"/> Provide a table for multiple boardwalks and decks proposed in one project; include locations and dimensions.				
Wetlands			Floodplains	
Boardwalk <input checked="" type="checkbox"/> on pilings <input type="checkbox"/> on fill	Deck <input type="checkbox"/> on pilings <input type="checkbox"/> on fill	Boardwalk <input checked="" type="checkbox"/> on pilings <input type="checkbox"/> on fill	Deck <input type="checkbox"/> on pilings <input type="checkbox"/> on fill	
Dimensions (ft) length 12 width 8 (N. end of boardwalk)	Dimensions (ft) length width	Dimensions (ft) length 62 width 6 (boardwalk)	Dimensions (ft) length width	
12 Activities That May Impact Wetlands (See Sample Drawings 8 & 9). Complete other Sections as applicable.				
<ul style="list-style-type: none"> • Locate your site and wetland information with the DEQ Wetlands Map Viewer at www.mcgi.state.mi.us/wetlands/ • For information on the DEQ's Wetland Identification Program (WIP) visit www.mi.gov/wetlands. <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Provide a detailed site plan with labeled property lines, upland and wetland areas, and dimensions and volumes of wetland impacts. <input checked="" type="checkbox"/> Complete the wetland dredge and wetland fill dimension information below for each impacted wetland area. <input checked="" type="checkbox"/> Attach tables for multiple impact areas or activities. <input checked="" type="checkbox"/> Attach at least one cross-section for each wetland dredge and/or fill area; show wetland and upland boundaries on the cross-section. 				
Has the DEQ conducted a wetland assessment for this parcel?		<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	<input checked="" type="checkbox"/> If Yes, provide a copy or WIP number:	
Has a professional wetland delineation been conducted for this parcel?		<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> If Yes, provide a copy with data sheets	
Is there a recorded DEQ easement on the property?		<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	<input checked="" type="checkbox"/> If Yes, provide the easement number	
Did the applicant purchase the property before October 1, 1980?		<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	<input checked="" type="checkbox"/> If Yes, provide documentation.	
Is any grading or mechanized land clearing proposed?		<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> If Yes, label the locations on the site plan.	
Has any of the proposed grading or mechanized land clearing been completed?		<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes	<input checked="" type="checkbox"/> If Yes, label the locations on the site plan	
Proposed Activity <input checked="" type="checkbox"/> boardwalk or deck (Section 10I) <input type="checkbox"/> bridges and culverts (Section 14) <input type="checkbox"/> designated environmental area				
<input type="checkbox"/> dewatering <input type="checkbox"/> draining surface water <input type="checkbox"/> driveway / road				
<input type="checkbox"/> fences (Section 10L) <input checked="" type="checkbox"/> fill or dredge <input type="checkbox"/> restoration				
<input type="checkbox"/> septic system <input checked="" type="checkbox"/> stormwater discharge (Section 10J) <input checked="" type="checkbox"/> other boardwalk in 100-year floodplain				
FILL	Dimensions maximum length (ft) 12 maximum width (ft) 8		Area <input type="checkbox"/> acres <input checked="" type="checkbox"/> sq ft 96	Average depth (ft) 1.0 Volume (cu yd) 3.6
	DREDGE	Dimensions maximum length (ft) 12 maximum width (ft) 8		Area <input type="checkbox"/> acres <input checked="" type="checkbox"/> sq ft 96
Spoils Disposal		Dredged or excavated spoils will be placed <input type="checkbox"/> on-site <input type="checkbox"/> landfill <input type="checkbox"/> USACE confined disposal facility <input checked="" type="checkbox"/> other upland off-site For disposal, provide a <input checked="" type="checkbox"/> Detailed spoils disposal area location map and site plan with property lines. <input checked="" type="checkbox"/> Letter of authorization from property owner of spoils disposal site, if disposed off-site.		

➔ For activities on legally established county drains, provide original design and proposed dimensions and elevations.

Stream Information	Water elevation (ft) datum <input type="checkbox"/> NGVD 29 <input checked="" type="checkbox"/> NAVD 88 <input type="checkbox"/> IGLD 85 (Great Lakes coastal areas) <input checked="" type="checkbox"/> other <i>surveyed</i> ➔ Show elevation on plans with description.	
	Dimensions (ft) of existing stream/drain channel <i>Existing Nemoka Drain is an enclosed channel</i> (ft) length width depth	
	Existing channel average water depth in a normal year (ft)	
Proposed Activity <input type="checkbox"/> enclosure <input checked="" type="checkbox"/> improvement <input type="checkbox"/> maintenance <input type="checkbox"/> new drain <input type="checkbox"/> relocation <input checked="" type="checkbox"/> wetlands <input checked="" type="checkbox"/> other <i>100-yr. floodplain</i>		
If an enclosed structure is proposed, check material type <input type="checkbox"/> concrete <input type="checkbox"/> corrugated metal <input type="checkbox"/> plastic <input type="checkbox"/> other		
Dimensions (ft) of the structure: diameter length		Volume of fill (cu yds)
Will old/enclosed stream channel be backfilled to top of bank grade? <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		
Length of channel to be abandoned (ft) <i>190 of underground pipe</i>		Volume of fill (cu yds) <i>None</i>
Dimensions (ft) of improved, maintained, new, relocated or wetland stream/drain channel. length <i>200' of new two-stage open channel drain</i> width <i>52' top width, 28-30' bot. width with 6' low flow channel</i> depth <i>6' avg</i>		Volume of dredge/excavation (cu yds) <i>2,632 cubic yards of excavation for new open channel section</i>
How will slopes and bottom be stabilized? <i>native plant seed mix</i>		Proposed side slopes (vertical / horizontal) <i>2/1</i>
Spoils Disposal	Dredged or excavated spoils will be placed <input type="checkbox"/> on-site <input type="checkbox"/> landfill <input type="checkbox"/> USACE confined disposal facility <input checked="" type="checkbox"/> other upland off-site For disposal, provide a ➔ Detailed spoils disposal area location map and site plan with property lines. ➔ Letter of authorization from property owner of spoils disposal site, if disposed off-site. <i>TBD</i>	

TAB 3

Photos of Existing Conditions



Photo 1 – Spring 2015: Trailhead at south end of Hillbrook Park at Haslett Road, looking north. Pine Lake Outlet Drain crosses Haslett Road approximately 750 feet to the west (left in this picture).



Photo 2 – Spring 2015: Pine Lake Outlet Drain at upstream side of Haslett Road crossing, looking north.



Photo 3 – Fall 2015: Pine Lake Outlet Drain at upstream side of Haslett Road crossing, looking north.

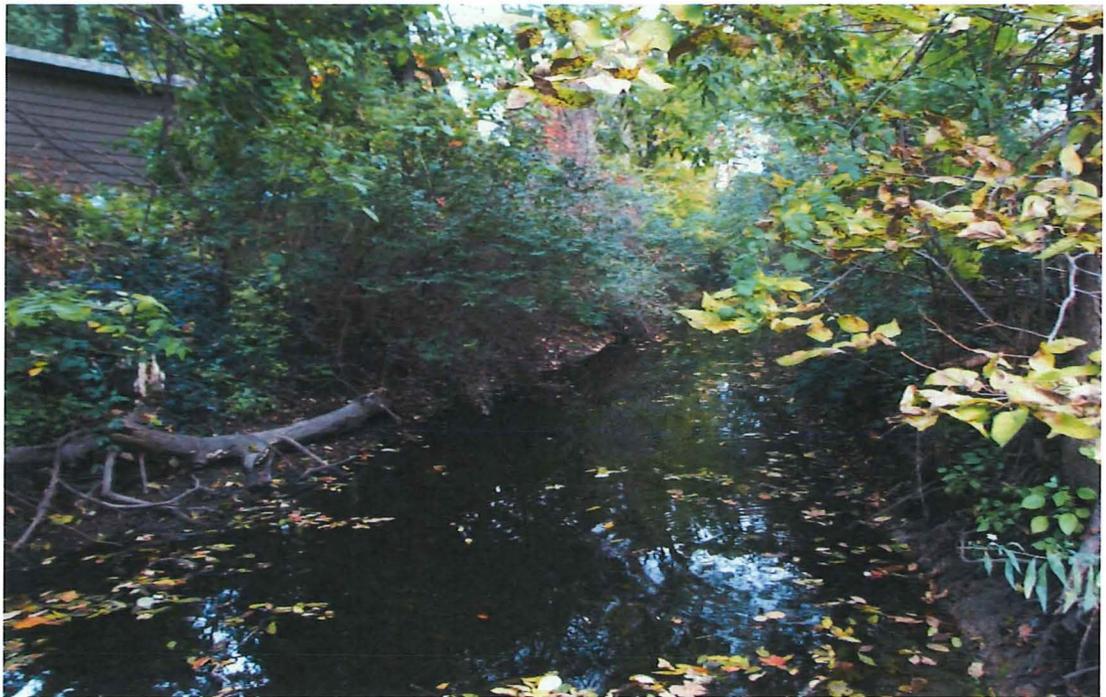


Photo 4 - Fall 2015: Pine Lake Outlet Drain at upstream side of Haslett Road crossing, looking north (taken just upstream of Photo 3).



Photo 5 – Spring 2015: Entrance at north end of Hillbrook Park at Lake Lansing Road, with Pine Lake Outlet Drain in the background (looking east).



Photo 6 – Spring 2015: Pine Lake Outlet Drain at downstream side of Lake Lansing Road crossing, looking south. Hillbrook Park is to the right.



Photo 7 – Fall 2015: Pine Lake Outlet Drain at downstream side of Lake Lansing Road crossing, looking north. The smaller diameter culverts are for road drainage.



Photo 8 – Spring 2015: Benson Hills detention basin, looking north. Hillbrook Park is to the left (west) and the Benson Hills Apartments are to the right (east).



Photo 9 – Fall 2015: Benson Hills detention basin, looking north. Note evidence of continual mowing in this area.



Photo 10 – Fall 2015: Benson Hills detention basin, looking north. Note wetland vegetation in the middle foreground.



Photo 11 – Spring 2015: Proceeding north on Benson Drive from Haslett Road. Note detention basin to the left (west) with the wetland area directly behind sign.



Photo 12 – Fall 2015: Continuing north on Benson Drive. Note the character of grounds maintenance within the detention basin to the left (west).



Photo 13 – Spring 2015: Part of trail system through Hillbrook Park, looking south at approximate location where the (enclosed) Nemoka Drain passes through the park.

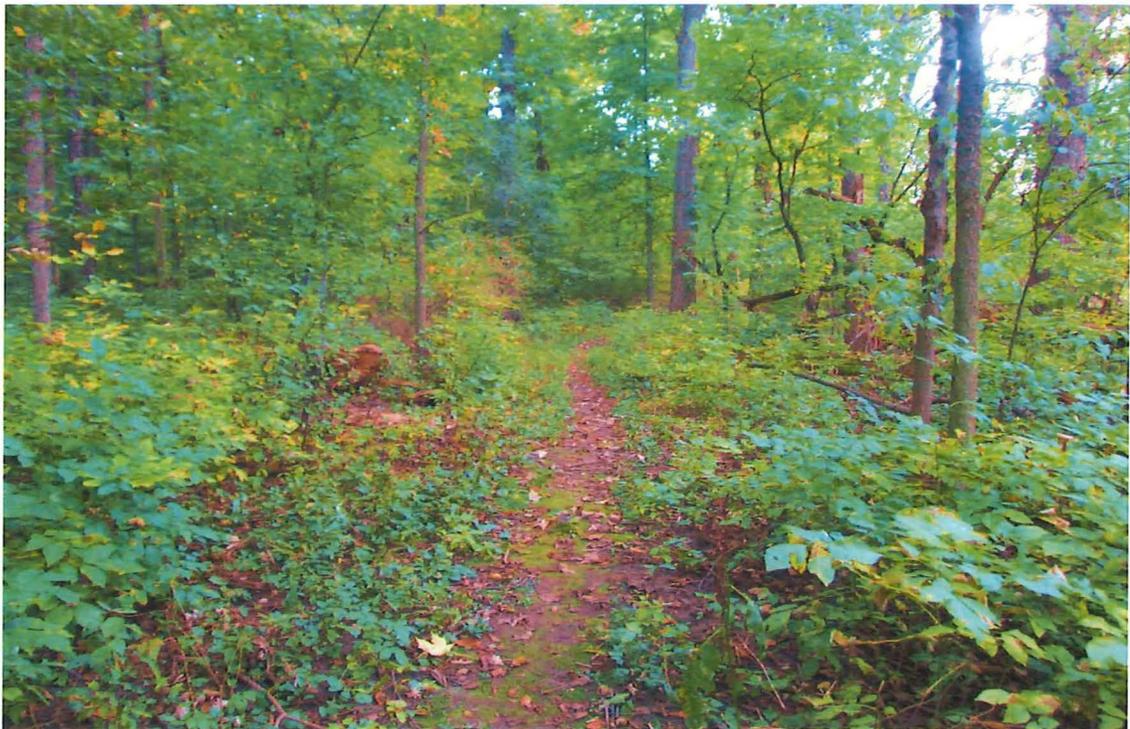


Photo 14 – Fall 2015: Part of trail system through Hillbrook Park, looking south at approximate location where the (enclosed) Nemoka Drain passes through the park.



Photo 15 – Spring 2015: Hillbrook Park, looking west along the existing Nemoka Drain alignment (photo taken from the Benson Hills detention basin—just below foreground).

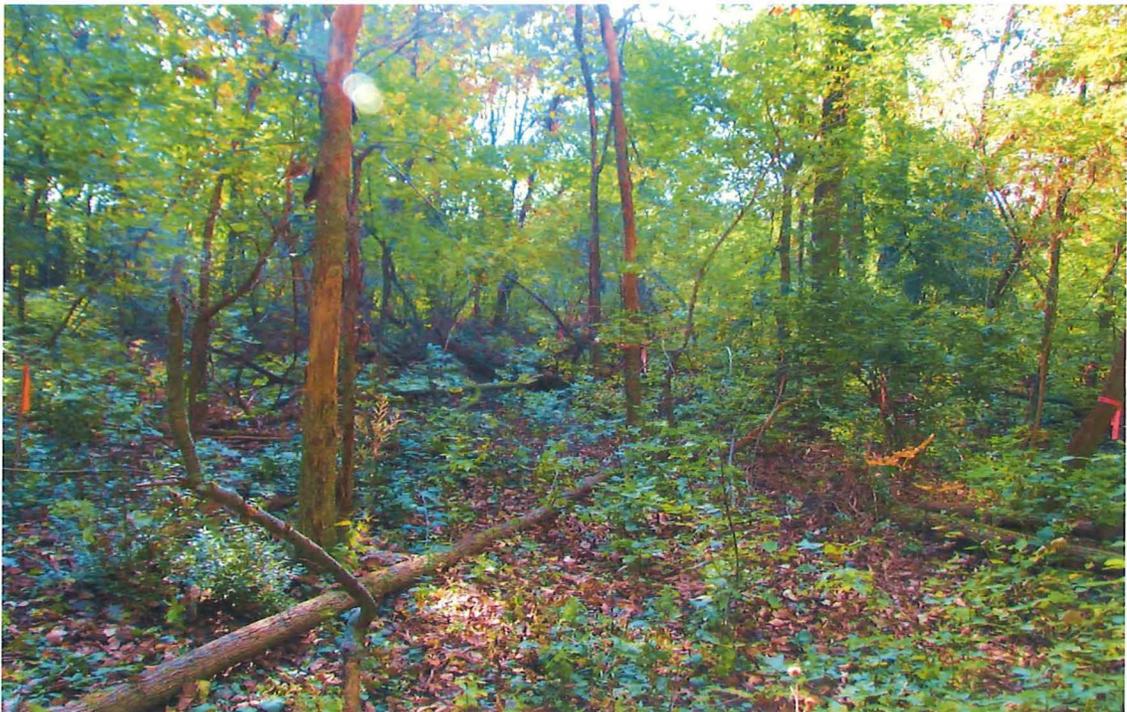


Photo 16 – Fall 2015: Hillbrook Park, looking west along the existing Nemoka Drain alignment (photo taken from the Benson Hills detention basin—just below foreground).



Photo 17 – Spring 2015: Benson Hills Apartments, looking east along the Nemoka Drain alignment (the Benson Hills detention basin is in the foreground).



Photo 18 – Fall 2015: Benson Hills detention basin, looking west along Nemoka Drain alignment. Storm manhole in foreground is part of the Nemoka Drain enclosed tile system.



Photo 19 – Spring 2015: Pine Lake Outlet Drain, looking south from the existing outlet of the Nemoka Drain.

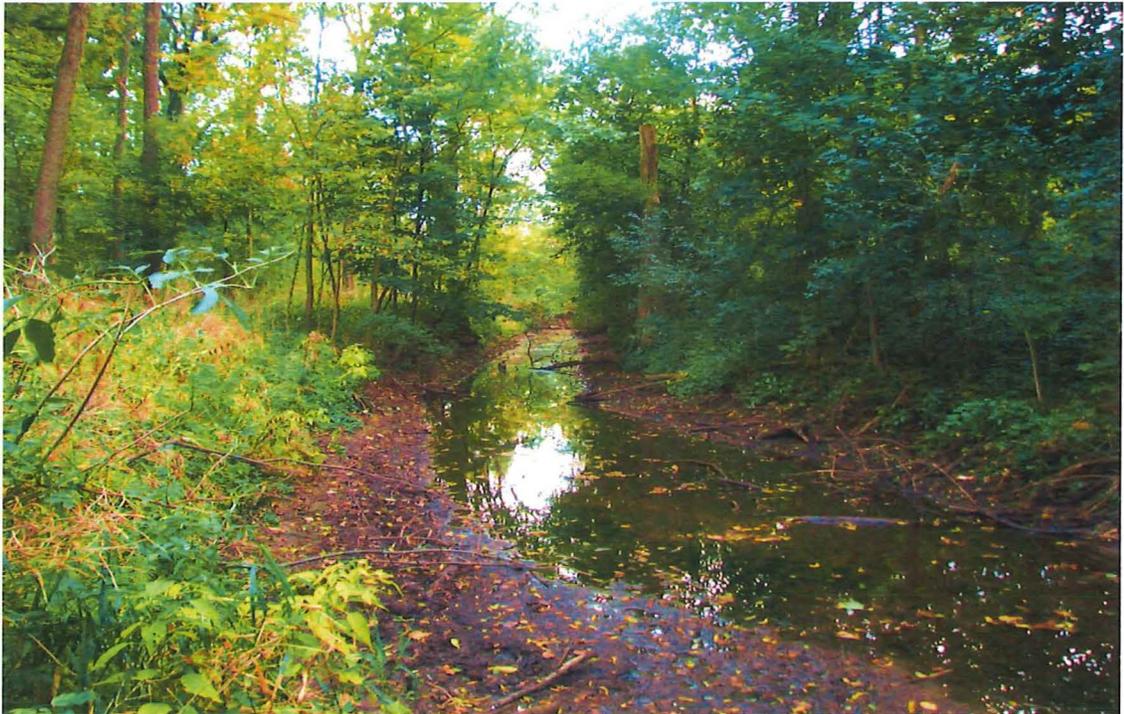


Photo 20 – Fall 2015: Pine Lake Outlet Drain, looking south from the existing outlet of the Nemoka Drain.



Photo 21 – Spring 2015: Pine Lake Outlet Drain, across from the Nemoka Drain outlet (looking west). Note sediment buildup and erosion on the opposite bank.

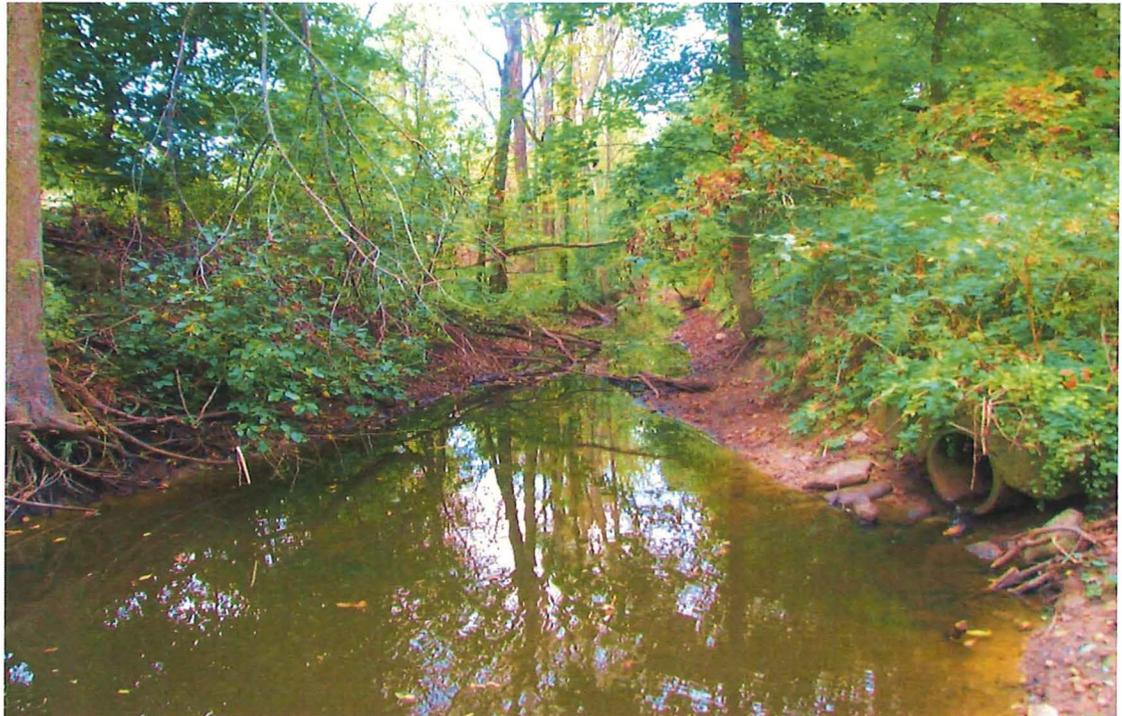


Photo 22 – Spring 2015: Pine Lake Outlet Drain, looking north (upstream). The Nemoka Drain outlet pipe is at right (east). Note the scoured pool and bank erosion on the near bank of the drain outlet.

TAB 4

Drainage District Documents

Final Order of Determination.

(See Section 1, of Chapter IV—§ 4310, C. L.)

Whereas, I, W. H. Clark County Drain Commissioner of the County of Ingham, State of Michigan, did, on the 27th day of July A. D. 1906 make and issue an order determining that it was necessary and conducive to the public health, convenience and welfare that a certain drain should be Located and Established

in the Township of Meridian County and State aforesaid, as follows, to-wit:

SURVEY

OF NEMOKA DRAIN MERIDIAN.

Survey of the Nemoka Drain located upon Blocks 5, 11 and 10 of the "Village of Nemoka" as platted and upon Edson Street crossing Okemos, Rich, Bundy, Potter and Shaw Streets, highways of the said Village of Nemoka, and upon section 10 (all of said lands being upon section 10) in the township of Meridian (town 4 north, range 1 west, meridian of Michigan) County of Ingham, State of Michigan and described as follows, to-wit:

Commencing at the outlet of said drain in the Pine Lake Outlet Drain at a point upon the E 1/4 of the N W 1/4 of said section 10 490.38 feet north and 291.34 feet west of the center of said section 10, thence upon the E 1/4 of the N W 1/4 of said Section 10, James A. Greenman and Theda M. Greenman, owners, N 68° 31' E 181 ft, thence N 74° 8' E 181 ft. to the east line of said land at a point 601 feet north of the S E cor. thereof. Total length of drain upon said land is 312 feet.

Thence upon that part of the N 3/4 of the E 1/2 of said section 10 lying west of the Ingham Center road or Okemos street of the Village of Nemoka, except the North 20 acres thereof, Charles Benson, owner, N 74° 8' E 288 ft. to point of curve, thence curve to left (radius 112.8 ft.) 60.1 ft. to point of tangent, thence N 43° 23' E 289.9 ft. to point of curve, thence curve to right (radius 112.8 ft.) 109.6 ft. to point of tangent, thence S 82° 33' E 476.9 ft., thence N 89° 50' E 59.5 ft. to the east line of said land and the center line of Ingham Center road at a point 929 ft. north of the E and W quarter line of said section 10. Total length of drain upon said land is 1284 feet.

Thence upon the Ingham Center road or Okemos street of the Village of Nemoka, a public street, N 89° 10' E 33 ft. to the west line of block 5 of the Village of Nemoka at a corner in the west line of said block 5 common to lots 10 and 11 of said block.

Thence upon block 5 of the Village of Nemoka upon the line between lots 10 and 11 and lots 9 and 12, Sarah A. Haslett, owner, N 89° 50' E 264 ft. to the West line of Edson street at a corner in said line common to lots 9 and 12.

Thence upon Edson street, a public street of the Village of Nemoka N 89° 50' E 52 ft. to angle 2, thence South 395 ft. to the north line of Rich street, thence south across Rich street 66 ft. to the South line of Rich street 14 ft West of the N W Cor. of Block 11, thence South in Edson street 765 ft. to the North line of Bundy street, thence south in Edson street directly across Bundy street 54 ft. to the end of the main line of said drain in the intersection of Edson and Bundy streets 12 ft. north of the south line of Bundy street and 14 ft. west of the east line of Edson street.

The total length of said main drain is 3225 feet.

A branch of the said drain commences at stake 29 of the main drain being at a point on the main drain in Edson street 14 ft. west from the east line thereof and 271 feet north of the north line of Bundy street, thence in Edson street N 89° 50' E 14 ft. to the West line of Block 11 of the Village of Nemoka at the corner in said line common to lots 14 and 15 of said Block 11.

Thence upon Block 11 of the Village of Nemoka N 89° 50' E upon the line between lots 14 and 15 and lots 13 and 16, Susan A. Burgess,

Thence upon Shaw street a public street of the Village of Nemoka N 89 50'E 51.5 ft. to the upper end of the said branch in Shaw street at a point 351.5 ft. north and 14 ft. west of the S W corner of Block 9 of the Village of Nemoka.

Total length of said branch is 659 feet.

Total length of said drain is 3884 feet.

The line above described is the center line of said drain. The excavations for the drain shall be made in equal widths along each side of said center line. Said center line is marked by stakes at the beginnings and ends thereof, and at each angle and point of curve and tangent throughout the course thereof. Regular survey stations consisting of a stake in the center line together with a grade and witness stake set at one side of the said center line are set at the beginning of said drain, at each 100 feet therefrom except stake 38 which is only 25 feet from stake 32 and stake 40 which is only 59 feet from stake 39. Said stations are numbered consecutively from the lower end of the main drain on and to the upper end thereof, running from station 0 to 33, then beginning at stake 29 of the main line and running on the branch stations 34 to 40 consecutively.

Said drain shall be constructed as a tile drain. Beginning at station 0 of the main drain the said drain shall be constructed with tile 12 inches in diameter up to angle 3, then with a rise in the established grade of 6 inches the drain shall be constructed of 10 inch tile to the end of the main drain or station 33. The branch shall be constructed of 8 inch tile throughout the entire course thereof. The grade of the said drain is as follows, beginning at station 0 with a depth of 3.15 ft., then a grade of .18 ft per 100 ft to angle three, depth at stake 19 8.22 ft., then a rise in grade at angle three of 6 inches, depth at station 20 7.73 ft., thence a grade of .15 ft per 100 ft to stake 29, depth 6.38 ft., then a rise in grade of 8 inches, then a grade of .15 ft per 100 ft to station 33, depth 5.43 ft. The branch shall begin at stake 29 with a rise of .80 ft. in grade, thence a grade of .20 ft. per 100 ft. throughout the entire course thereof to station 40, depth 4.21 ft.

For the constructing and maintaining of said drain a strip of land thirty (30) feet in width along each side of and next adjoining said center line for its entire length shall be required for the right of way. The right of way shall be used for the placing thereon the dirt excavated from said drain or for any other purpose necessary in constructing and maintaining said drain as herein described.

Surveyed July 13 and 14, 1906.

E. A. Calkins
)))))))))
Surveyor.

By order of C. W. Clark, County Drain Commissioner
of Ingham County, Michigan

said order being based upon application, and examination and survey:

And Whereas, Since the date of the said order, the right of way for said drain and all damages by reason of the construction thereof, has been released by all of the owners of lands traversed by said drain.

And Whereas, For such of the owners of such lands as did not release as aforesaid, an application was made by me, the said County Drain Commissioner, to the Probate Court for the County of Ingham, State of Michigan, for the appointment of three special commissioners, to determine the necessity for

..... said drain, and for the taking of private property for the use and benefit of the public for the purpose thereof, and the just compensation to be made therefor, which said special commissioners, having been so appointed, did, on the day of 190..... make and file with me, the County Drain Commissioner, as aforesaid, a return in writing of their hearing and determination and of their several awards; and it appearing from said return that said special commissioners have determined that the said drain will be conducive to the public health, convenience and welfare, and that it is necessary to take private property for the use and benefit of the public for the purpose of said drain; and it further appearing from said return that they have awarded and determined the just compensation to be paid to each and every person over and across whose lands said drain is to be constructed, for the right of way over and upon the same, and their damages by reason of the construction thereof upon such lands;

Now, Therefore, I, C. H. Clark County Drain Commissioner as aforesaid, do order and determine that said drain shall be and the same is hereby ordered

Located and Established in accordance with the hereinabove described survey, and that the commencement, route, terminus, length, depth and width of surface excavations of the said drain shall in every respect be in accordance therewith, and that the name of said drain shall be Nemaha Drain, by which name it shall hereafter be known and recorded. The several tracts or parcels of land to be assessed for benefits in the construction of said drain are as follows:

	Section	Town	Range		Section	Town	Range
Township of Meridian at large		N	W	The following Lots and parts of Lots, Village of Nemaha	N	W	
	4	1		East of Lot 1 and 1/2 Blk 2	10	4	1
That part of E 1/4 of NW 1/4 East of Pine Lake Outlet Drain	10	"	"	W 1/2 of Lots 1 and 4 and Lot 2 and 5 Blk 2	"	"	"
That part of NE 1/4 of Sec 10 west of State Road except 7.20 acres thereof	10	"	"	Lot 6, Blk 2	"	"	"
East part of NW 1/4 of SE 1/4 of Section 10 lying west of State Road	10	"	"	Lot 8, Blk 2	"	"	"
Corner at NE cor. of Lot 1, Blk 10				Lots 7 and 10, Blk 2	"	"	"
Village of Nemaha E. in S line of Broadway Street to N line of Grand Trunk Western R.R. right of way, SW by in R.R. line to a point S. by in N to begin	10	"	"	Lot 11, Blk 2	"	"	"
				Lots 14, 15 and 18, Blk 2	"	"	"
				Lots 12, 13, 16, 17, 19 and 20, Blk 2	"	"	"
				W 1/2 of E 1/2 of Lot 1 and 4, Blk 2	"	"	"
				W 1/2 of Lot 3, Blk 2	"	"	"
				W 1/2 of Lot 1, Blk 3	"	"	"
				W 1/2 of E 1/2 of Lot 1, Blk 3	"	"	"
				E 1/2 of Lot 1, Blk 3	"	"	"
				Lots 2 and 3, Blk 3	"	"	"
				Lots 6, 7 and 10, Blk 3	"	"	"
				W 1/2 of Lot 4, Blk 3	"	"	"
				E 1/2 of Lot 4, Blk 3	"	"	"
				W 1/2 of Lot 5, Blk 3	"	"	"
				E 1/2 of Lot 5, Blk 3	"	"	"
				W 1/2 of Lot 8, Blk 3	"	"	"
				E 1/2 of Lot 8, Blk 3	"	"	"

	Section	Town	Range		Section	Town	Range
The following lots and parts of Lts. Village of Nemoka	10	N	W	The following Lots and parts of Lts. Village of Nemoka	N	N	
W/2 Lot 9, Blk 3.	"	"	"	Lots 1, 2, 3 and 4, Blk 9	10	4	1
W/2 Lot 9, Blk 3.	"	"	"	Lots 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16	"	"	"
Lot 12, Blk 3.	"	"	"	and 18, Blk 9	"	"	"
Lots 11 and 14, Blk 3.	"	"	"	Lots 17, 20, 21 and 24, Blk 9	"	"	"
Lots 15, 16, 18 and 19 and 50 ft of Lot 13, Blk 3	"	"	"	W/2 of Lots 22 and 23, Blk 9	19	"	"
W/2 of Lot 17, Blk 3	"	"	"	Lot 19 and E/2 of Lots 22 and 23, Blk 9	"	"	"
Lot 20, Blk 3	"	"	"				
				Lot 2, Blk 10	"	"	"
Lots 1, 4, 5 and 8, Blk 4	"	"	"	Lot 20, Blk 10	"	"	"
Lot 9, Blk 4	"	"	"	Lot 21, Blk 10	"	"	"
Lots 2, 3, 6, 7, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 and 20, Blk 4	"	"	"	Lots 22 and 23, Blk 10	"	"	"
				Lot 24, Blk 10	"	"	"
Lots 1, 4, 5 and 8, Blk 5	"	"	"	Lots 1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19, Blk 10	"	"	"
Lots 2, 3, 6 and 7, Blk 5	"	"	"				
Lots 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22, Blk 5	"	"	"	Lot 1, Blk 11	"	"	"
				Lots 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22, Blk 11	"	"	"
Lot 5, Blk 6	"	"	"				
Lots 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22, Blk 6	"	"	"	Lots 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 and 22, Blk 12	"	"	"
Lots 1 and 2, Blk 7	"	"	"	Lot 12, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 and 17 and Lots 18 and 19, et. R. R. Right of way Blk 13	"	"	"
Lot 3, Blk 7	"	"	"				
Lot 4, Blk 7	"	"	"	Lots 1, 2, 3, 4, 5, 6, 7, 10, 11 and 12, Blk 14	"	"	"
Lot 5, Blk 7	"	"	"				
Lot 6, Blk 7	"	"	"	Lot 1, Blk 15	"	"	"
Lots 7 and 10, Blk 7	"	"	"	Lot 2, Blk 15	"	"	"
Lots 8 and 9, Blk 7	"	"	"	Lots 3 and 4, Blk 15	"	"	"
Lots 11 and 14, Blk 7	"	"	"				
Lots 12 and 13, Blk 7	"	"	"				
Lot 15, Blk 7	"	"	"				
Lots 16, 17, 18, 19, 20, 21, 22, Blk 7	"	"	"				
Lots 1, 2, 3, 4 and 5, Blk 8	"	"	"				
S. 80 ft of Lot 8 and Lots 6, 7, 9, 10 and 11, Blk 8	"	"	"				

street, thence in Edson street N 89 50' E 14 ft. to the West line of Block 11 of the Village of Nemoka at the corner in said line common to lots 14 and 15 of said Block 11.

Thence upon Block 11 of the Village of Nemoka N 89 50' E upon the line between lots 14 and 15 and lots 13 and 16, Susan A. Burgess,

All of which said tracts or parcels of land shall, and they are hereby declared to constitute the special assessment district for the purpose of Locating or Establishing

..... said drain, said district to be known and designated as Nemaska

Drain Special Assessment District.

Given under my hand this 16th day of August A. D. 1906

W. B. Clark
County Drain Commissioner of the County of Ingham.

STATE OF MICHIGAN, }
County of Ingham, } ss.

I, _____ County Drain Commissioner of the County of Ingham, State of Michigan, HEREBY CERTIFY, that I have compared the foregoing copy of Final Order of Determination with the original Final Order of Determination in the matter of _____

the _____ Drain and find the same to be a true copy of said original Final Order of Determination.

Given under my hand this _____ day of _____ A. D. 190_____

County Drain Commissioner.

Final Order of Determination

In the Matter of the

Locating or Establishing
Nemaska

Drain.

Received and filed this _____ day

of _____ A. D. 190_____

County Clerk.

FILED

OCT 15 1907

Alfred Allen
CLERK

OFFICE OF THE INGHAM COUNTY DRAIN COMMISSIONER

In the Matter of: Nemoka Drain

FIRST ORDER OF DETERMINATION

WHEREAS, a petition, dated June 30, 2009, has been made and filed with me, Patrick E. Lindemann, the County Drain Commissioner of the County of Ingham, State of Michigan, praying for the cleaning out, relocating, widening, deepening, straightening, tiling, extending, improving, providing structures, and adding branches and a relief drain to the drain known and designated as the Nemoka Drain and for the addition of lands to the Nemoka Drain Drainage District; and

WHEREAS, the Petition was signed by Tara Cox, Donald Haid, Lisa VanOrder, Heekyong Bae, Suntae Kim, and Karen Bowles; six (6) freeholders whose lands shall be liable to an assessment for benefits of such work; and

WHEREAS, the Board of Determination, consisting of Cheryl Risner, Larry Sullivan, and Penelope Tsernoglou, in a meeting of the Board held on October 19, 2009, according to the statute, by a majority vote of the Board, determined that the proposed maintenance and improvements to the drain as petitioned are necessary and conducive to the public health, convenience or welfare and necessary for the protection of the public health of Meridian Charter Township; and,

WHEREAS, said Board of Determination, by a majority vote of the Board, determined that the proposed addition of lands to the Nemoka Drain Drainage District as petitioned is necessary, as evidenced by the attached Exhibit A, which was also attached to the Order of Necessity; and,

WHEREAS, as a means of determining the necessity of the maintenance and improvements to the drain, I did cause surveys and measurements to be made by a competent engineer or surveyor: Ledy Design Group.

NOW, THEREFORE, I do order and determine that the petition for the proposed maintenance and improvements, having been determined to be necessary and conducive to the public health, convenience or welfare and necessary for the protection of the public health of Meridian Charter Township should be granted, as hereby determined from the surveys filed in my office as is hereinafter more particularly specified.

I do further order and determine that the drain shall be called "Nemoka Drain," by which name it shall be known and recorded.

I do further order and determine that the Nemoka Drain Drainage District, incorporating lands added by the Board of Determination shall hereafter be described as follows:

The Nemoka Drain Drainage District, located upon Section 10, T4N, R1W, Meridian Township, Ingham County, Michigan being described as: Commencing at a point in the Pine Lake Drain, said point being S89°53'W, 290.0 feet and N00°07'W, 532.0 feet from the center of Section 10, T4N, R1W, thence N51° 32'E, 373.2 feet; thence N00°05'E, 1107.1 feet; thence N89°41'E, 1097.8 feet; thence S01°24'E, 359.4 feet; thence N88°36'E, 67.6 feet; thence N01°36'W, 476.9 feet; thence N88°58'E, 792.0 feet; thence S01°36'E, 792.0 feet; thence N88°58'E, 132.0 feet; thence S01°36'E, 66.0 feet; thence S88°58'W, 132.0 feet; thence S01°36'E, 396.0 feet; thence N88°58'E, 330.0 feet; thence S01°36'E, 198.0 feet; thence N88°58'E, 132.0 feet; thence S01°11'E, 892.9 feet; thence S33°22'W, 152.9 feet; thence S61°13'W, 1044.5 feet; thence S88°46'W, 268.6 feet; thence N70°34'W, 67.6 feet; thence N89°54'W, 572.2 feet; thence N01°07'W, 673.2 feet; thence S87°56'W, 557.2 feet; thence N00°04'W, 816.9 feet; thence N89°56'W, 292.3 feet to the point of beginning, containing 134.5 acres of land, more or less.

It is thereupon further ordered and determined that the commencement, route and terminus of the open and enclosed drain, with the width, length and depth thereof, shall be in accordance with the engineer's survey and is as follows:

Survey of the Nemoka Drain, located on Section 10, T4N, R1W, Meridian of Michigan, Meridian Township, Ingham County, Michigan, the centerline thereof being described as follows:

Main

Commencing at the lower terminus thereof at a point in the Pine Lake Outlet Drain, said point being 490 feet North and 291 feet West of the center of said Section 10; thence N68°40'E, 149 feet; thence N77°50'E, 151 feet; thence N72°55'E, 337 feet; thence N32°25'E, 317 feet; thence East, 394 feet; thence S68°15'E, 282 feet; thence East, 348 feet, thence South, 1228 feet. The total length of said Main is 3206 feet.

Branch

A branch to the main is located as follows: Commencing at a point being 48 feet West of the NW corner of Lot 18, Block 11 of the Village of Nemoka; thence East, 690 feet. The total length of said Branch is 690 feet.

Potter Street Lateral A lateral to the branch is located as follows: Commencing at a point being 8 feet East of the Northeast corner of lot 17, Block 11 of the Village of Nemoka, said lateral being wholly in Potter Street under control of the Ingham County Road Commission; thence South, 244 feet. The total length of said Potter Street Lateral is 244 feet.

The total length of said Nemoka Drain is 4140 feet.

Dated:

Nov. 16, 2009



Patrick E. Lindemann
Ingham County Drain Commissioner

In the Matter of:
Nemoka Drain Drainage District (N 03-00)

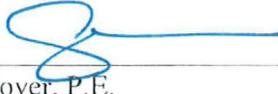
**PROPOSED REVISION
OF DRAINAGE DISTRICT BOUNDARIES FOR
NEMOKA DRAIN DRAINAGE DISTRICT**

Sections 10 & 11, T.4 N.- R.1 W.,
Meridian Township, Ingham County, Michigan

Beginning at a point on the West line of Section 11, T.4 N.-R.1 W., Meridian Township, Ingham County, Michigan; which is 351.40 feet, N.00°-21'-34"W., of the Southwest corner of the Northwest quarter of said Section 11; thence S. 17°-15'-18" E., 42.58 feet; thence S. 04°-56'-17" E., 129.37 feet; thence S. 04°-49'-29" E., 72.68 feet; thence S. 12°-24'-07" E., 41.05 feet; thence S. 19°-55'-54" E., 36.48 feet; thence S. 07°-27'-44" W., 17.42 feet; thence S. 65°-09'-27" W., 15.50 feet; thence S. 37°-50'-22" E., 73.86 feet; thence S. 02°-18'-27" E., 71.15 feet; thence S. 88°-28'-05" W., 216.90 feet; thence S. 00°-49'-50" E., 188.20 feet; thence N. 88°-02'-44" W., 45.80 feet; thence S. 06°-11'-55" W., 40.90 feet; thence N. 85°-17'-20" W., 162.91 feet; thence S. 22°-46'-57" W., 73.48 feet; thence N. 84°-38'-39" W., 44.64 feet; thence S. 07°-07'-30" W., 55.99 feet; thence S. 75°-16'-36" W., 89.65 feet; thence S. 02°-15'-38" W., 74.17 feet; thence S. 61°-38'-26" W., 460.03 feet; thence S. 61°-07'-31" W., 366.89 feet; thence S. 88°-57'-53" W., 180.15 feet; thence S. 00°-11'-41" E., 168.85 feet; thence S. 58°-36'-16" W., 69.15 feet; thence N. 01°-03'-52" E., 153.04 feet; thence N. 03°-00'-00" W., 410.30 feet; thence N. 61°-04'-25" W., 22.61 feet; thence N. 01°-27'-08" W., 184.96 feet; thence N. 59°-48'-03" W., 97.05 feet; thence S. 88°-14'-15" W., 99.17 feet; thence N. 61°-27'-43" W., 18.97 feet; thence S. 88°-01'-20" W., 193.61 feet; thence N. 01°-50'-38" W., 98.89 feet; thence S. 87°-54'-59" W., 630.28 feet; thence N. 00°-29'-54" W., 79.86 feet; thence N. 11°-10'-54" W., 60.88 feet; thence N. 27°-53'-50" W., 93.51 feet; thence N. 21°-22'-14" W., 85.76 feet; thence N. 08°-52'-50" W., 67.48 feet; thence N. 04°-07'-39" E., 67.54 feet; thence N. 12°-36'-58" E., 132.75 feet; thence N. 68°-43'-42" W., 366.09 feet; thence N. 10°-41'-47" E., 119.26 feet; thence N. 53°-05'-27" E., 379.43 feet; thence N. 06°-25'-34" E., 274.09 feet; thence N. 73°-18'-03" E., 67.97 feet; thence S. 73°-48'-39" E., 42.03 feet; thence N. 42°-30'-38" E., 21.20 feet; thence N. 60°-14'-28" E., 206.57 feet; thence N. 07°-45'-28" E., 58.26 feet; thence S. 88°-38'-10" E., 58.92 feet; thence N. 11°-00'-13" E., 67.14 feet; thence N. 69°-13'-26" E., 101.37 feet; thence N. 02°-30'-41" W., 39.62 feet; thence N. 84°-10'-25" E., 34.20 feet; thence N. 00°-20'-30" E., 58.21 feet; thence E., 237.15 feet; thence N. 00°-03'-35" E., 334.16 feet; thence S. 78°-54'-34" E., 38.12 feet; thence S. 80°-58'-41" E., 103.80 feet; thence N. 72°-20'-37" E., 83.72 feet; thence N. 87°-07'-24" E., 82.87 feet; thence S. 01°-29'-01" E., 241.15 feet; thence N. 88°-35'-35" E., 65.19 feet; thence N. 01°-18'-52" W., 144.47 feet; thence N. 88°-30'-38" E., 131.04 feet; thence N. 01°-26'-50" W., 198.00 feet; thence S. 88°-30'-29" W., 66.02 feet; thence N. 01°-18'-09" W., 131.97 feet; thence N. 88°-28'-52" E., 23.15 feet; thence N. 00°-02'-58" W., 32.94 feet; thence N. 88°-28'-00" E., 604.76 feet; thence S. 00°-58'-06" E., 429.29 feet; thence N. 88°-29'-33" E., 102.12 feet; thence S. 01°-05'-19" E., 65.02 feet; thence S. 89°-27'-16" E., 72.92 feet; thence S. 02°-36'-52" E., 152.24 feet; thence N. 84°-17'-22" W., 20.94 feet; thence S. 01°-33'-44" W., 76.42 feet; thence S. 24°-49'-14" E., 61.21 feet; thence S. 53°-59'-41" E., 116.48 feet; thence S. 01°-58'-28" E., 457.42 feet; thence S. 89°-14'-19" W., 40.82 feet; thence S. 01°-22'-29" E., 214.18 feet; thence N. 88°-39'-04" E., 241.24 feet; thence S. 87°-51'-09" E., 69.49 feet; thence S. 73°-00'-33" E., 49.01 feet; thence S. 61°-57'-35" E., 90.48 feet; thence S. 43°-21'-00" E., 74.61 feet; thence S. 30°-07'-54" E., 71.76 feet; thence S. 17°-15'-18" E., 17.41 feet to the point of beginning, containing 115.68 acres, more or less. Subject to easements, covenants, conditions, restrictions and/or reservations of record, if any.

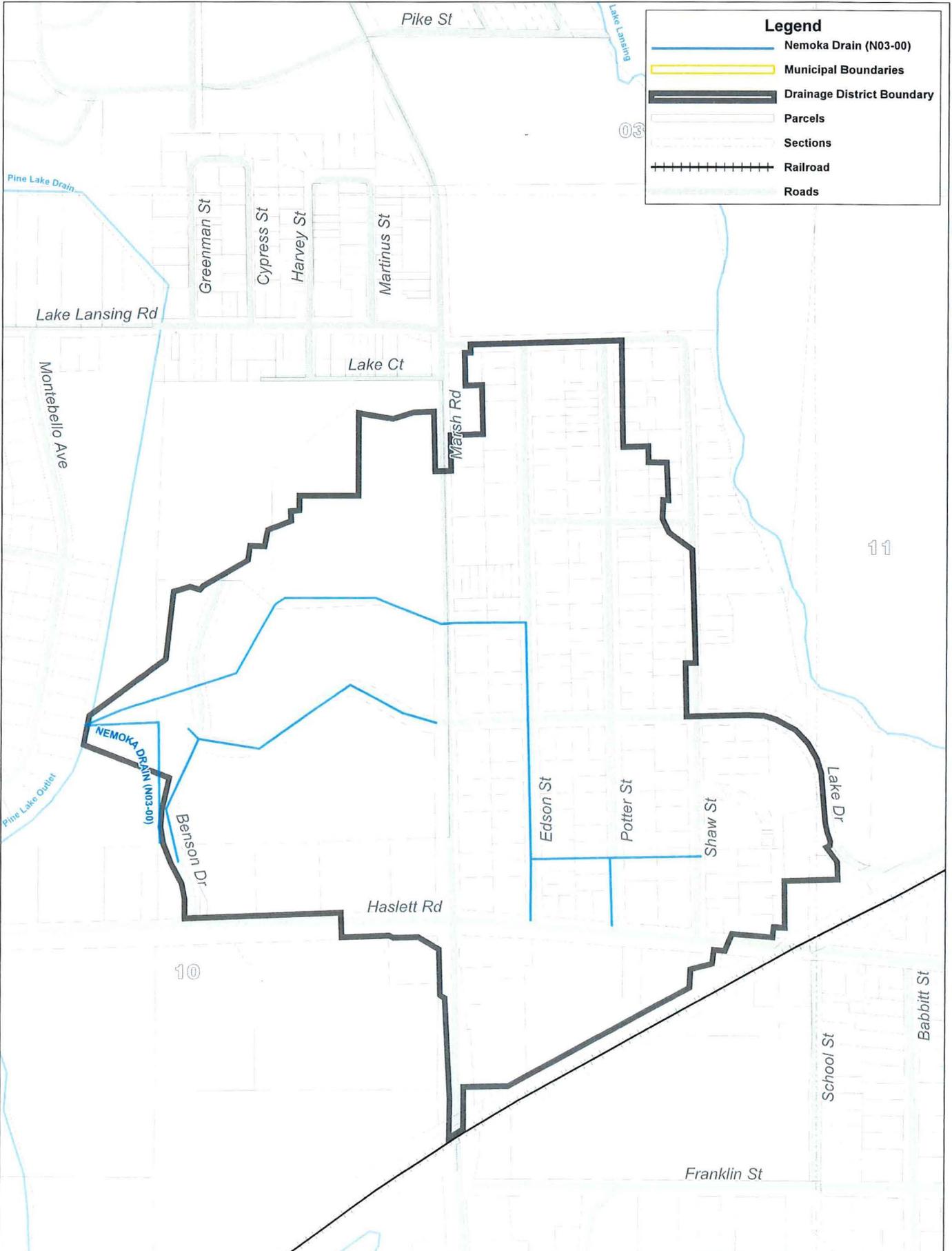
I hereby certify that I have been retained by the Drain Commissioner to review the drainage district boundaries for the drain referenced above, and it is my recommendation that the above described revisions be approved, with lands to be added and/or deleted as depicted in the attached Exhibit A, so that the drainage district boundaries will include all lands now benefited by the drain.

Dated: Nov 13, 2014



Alan Boyer, P.E.
(State of Michigan License #6201032017)

EXHIBIT B



Legend

- Nemoka Drain (N03-00)
- Municipal Boundaries
- Drainage District Boundary
- Parcels
- Sections
- Railroad
- Roads

SHEET 1 OF 1

N03-00

NEMOKA DRAIN DRAINAGE DISTRICT
 DRAINAGE DISTRICT BOUNDARY
 MERIDIAN TOWNSHIP
 INGHAM COUNTY, MICHIGAN



707 BUHL AVENUE
 P.O. BOX 220
 MASON, MI 48854
 PHONE: (517) 676-8395
 FAX: (517) 676-8364

TAB 5

**List of Adjoining Property Owners and
Landowner Authorization**

List of Adjoining Property Owners

<u>Tax Parcel ID</u>	<u>Owner and Owner Address</u>
33-02-02-10-178-001	White, Kathleen E 5846 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-002	Green, John J and Judy A 5846 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-003	Prescher, Kenny J 5832 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-004	Wilson, Thomas and Linda 5822 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-005	Hershberger, Brian 5816 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-006	Durkee, Willard C and Marjorie 5808 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-007	Bates, Anna M and Jeremy M 5802 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-008	McDonald, Scott H 5794 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-009	Harney, Edward V 5788 Montebello Ave, Haslett, MI 48840
33-02-02-10-178-010	Bird Family Trust 5778 Montebello Ave, Haslett, MI 48840
33-02-02-10-179-006	Jacobson, Charles and Sarah 1819 Lyndhurst Ave, Haslett, MI 48840
33-02-02-10-179-007	Dale, Angela D and Allen D 1809 Lyndhurst Ave, Haslett, MI 48840

Tax Parcel ID

Owner and Owner Address

33-02-02-10-179-008

Ellis, Mark M and Donna L

1797 Lyndhurst Ave, Haslett, MI 48840

33-02-02-10-251-003

Benson Hills Haslett, LLC

5800 Benson Dr, Haslett, MI 48840

33-02-02-10-130-007

Meridian Charter Township

5151 Marsh Rd, Okemos, MI 48864

CHARTER TOWNSHIP OF MERIDIAN

Elizabeth Ann LeGoff Supervisor
Brett Dreyfus Clerk
Julie Brixie Treasurer
Frank L. Walsh Manager



Milton L. Scales Trustee
Ronald J. Styka Trustee
John Veenstra Trustee
Angela Wilson Trustee

December 21, 2015

MDEQ – WRD
Lansing District Office
Constitution Hall 1st Floor South Tower 525 W. Allegan Street
P. O. Box 30242 Lansing, MI 48909

**RE: Nemoka Drain, Ingham County, MI. Parcel No. 33-02-02-10-130-007
 Authorization Letter for DEQ Permit Submittal in Hillbrook Park**

Dear MDEQ Staff:

Please consider this letter as our authorization for Paul Pratt, Ingham County Deputy Drain Commissioner, to submit a Joint Permit Application for improvements to the Nemoka Drain located in Hillbrook Park, Meridian Township, Ingham County, Michigan. The improvements involve: the removal and abandonment of existing tile drain; installation of new tile drain; excavation of open drain channel; installation of a wood pedestrian bridge; and, riprap stabilization and restoration.

Please contact me with any questions at 517-853-4604.

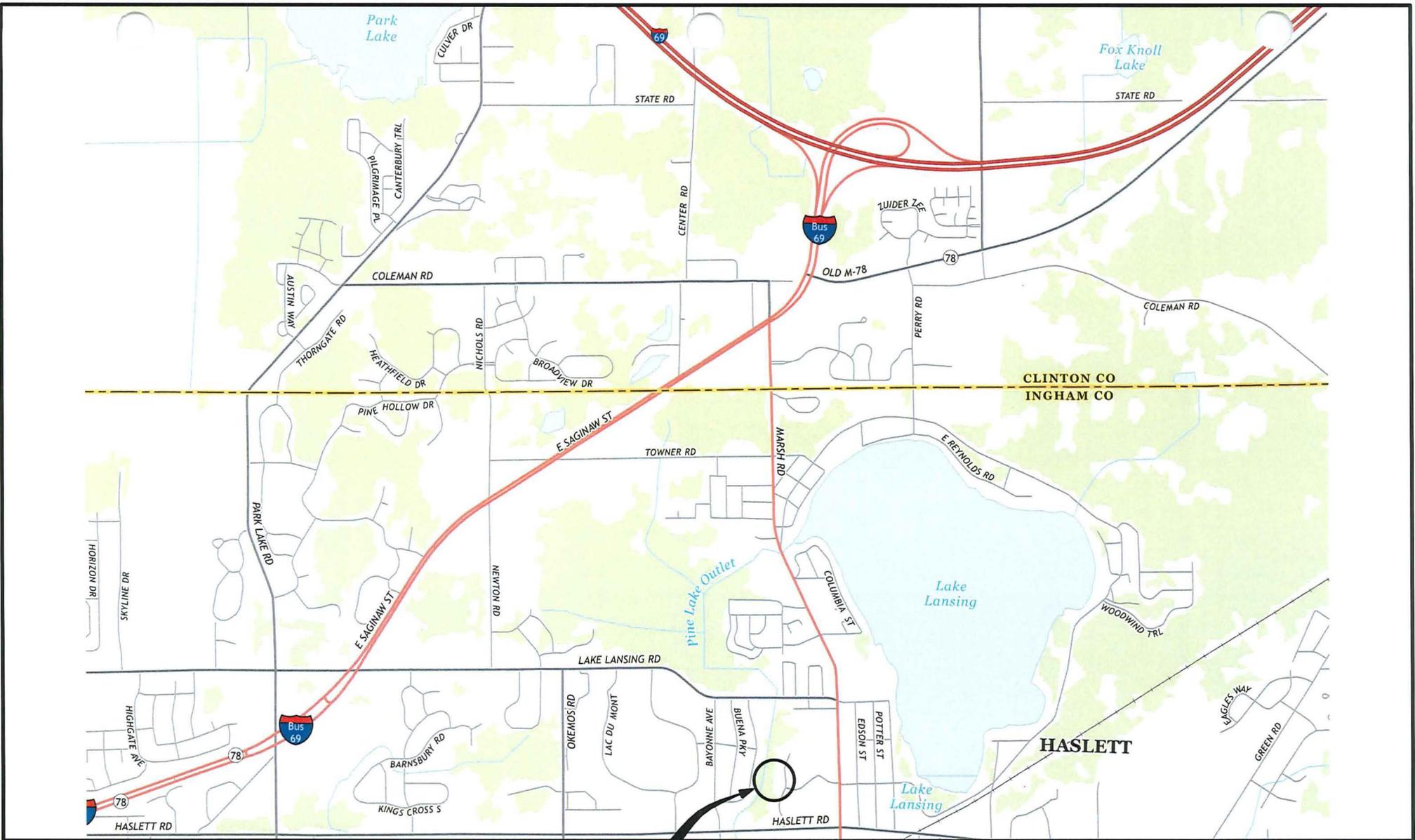
Sincerely,

A handwritten signature in black ink, appearing to read "LuAnn Maisner".

LuAnn Maisner
Director of Parks and Recreation

TAB 6

Exhibit Drawings



WORK AREA

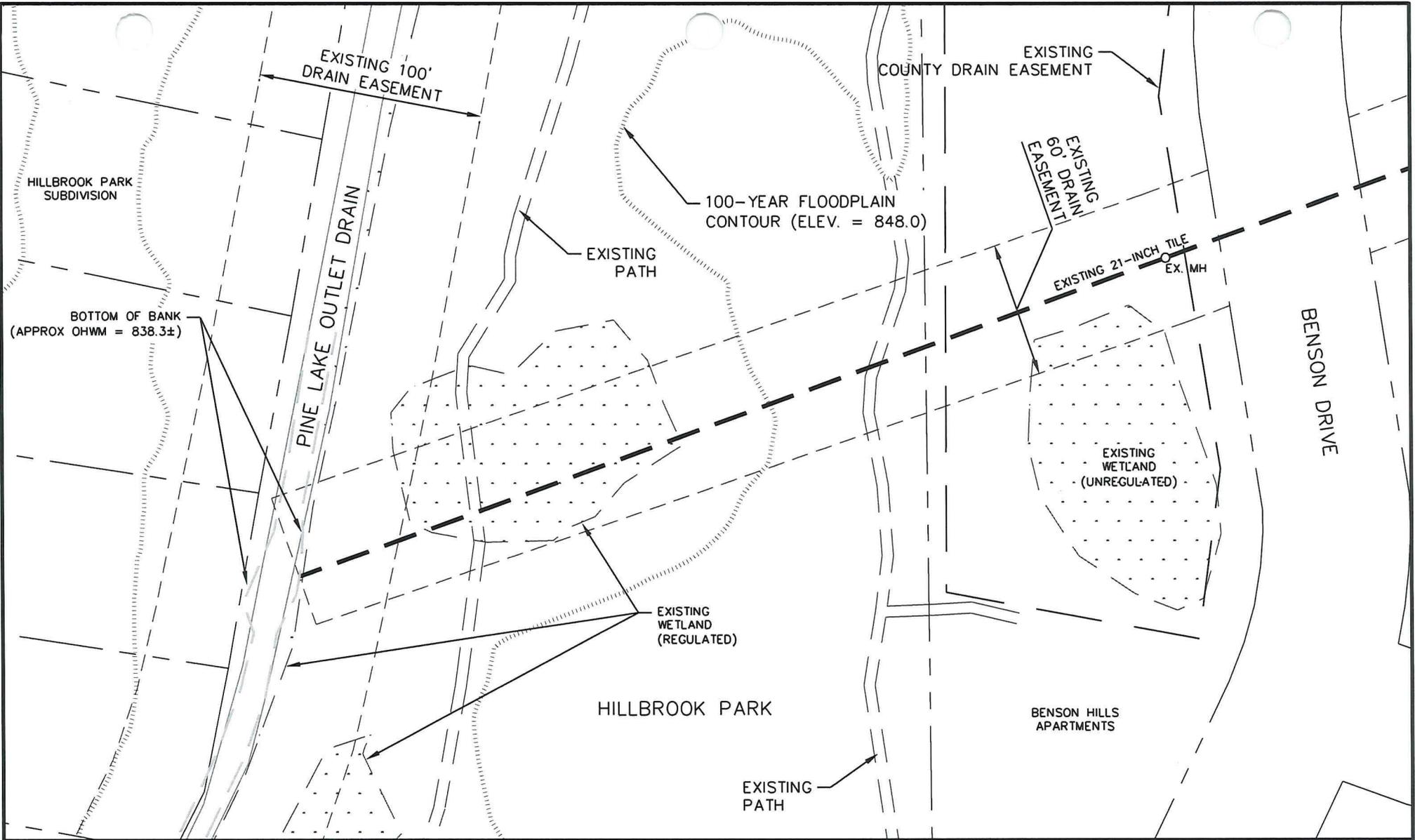
**NEMOKA DRAIN
LOCATION MAP**

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	1 OF 9
DATE:	NOVEMBER 9, 2015



SCALE: 1" = 2500'

DATUM: NAVD 88

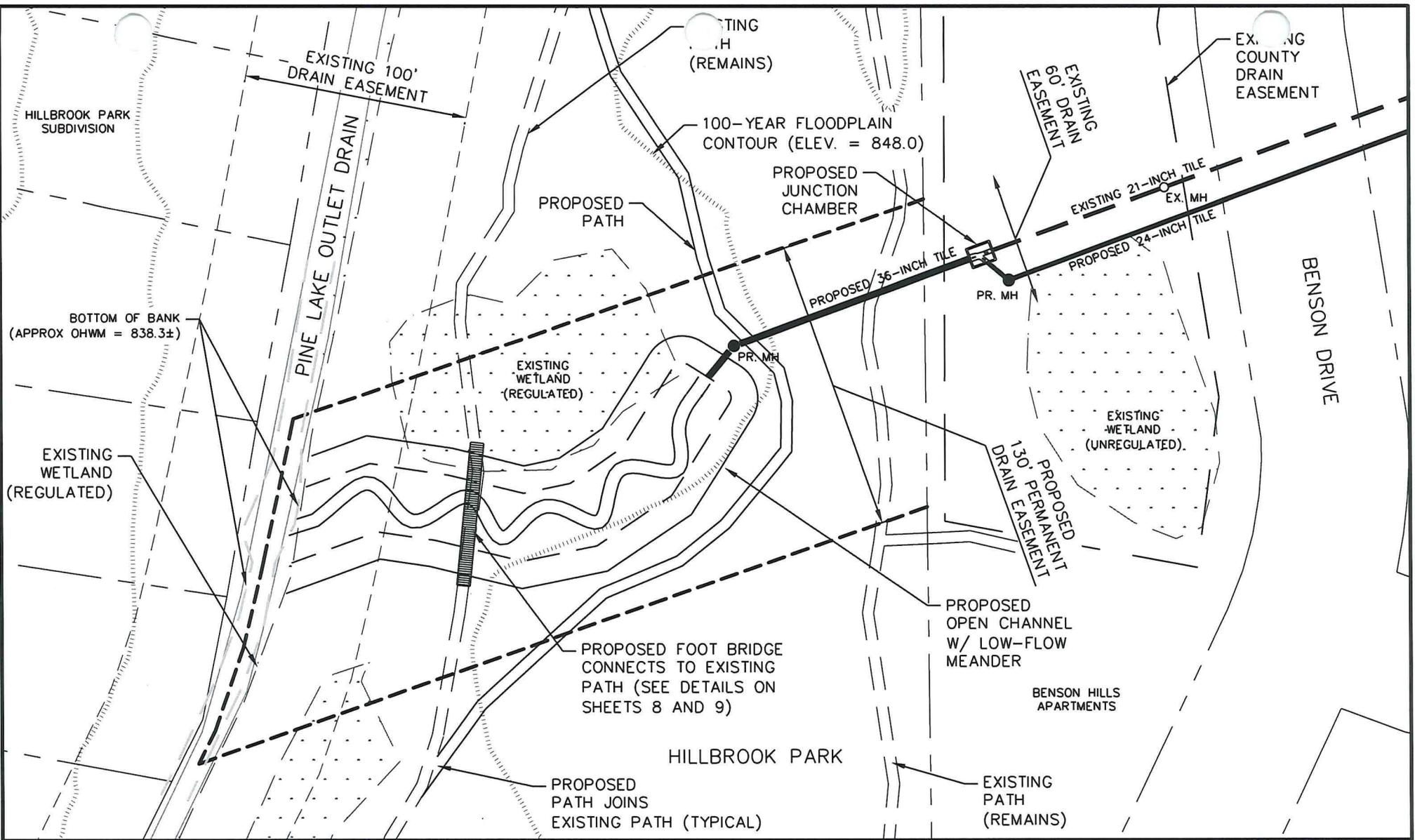


SCALE: 1" = 60'

DATUM: NAVD 88

NEMOKA DRAIN
EXISTING CONDITIONS

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	2 OF 9
DATE:	NOVEMBER 9, 2015

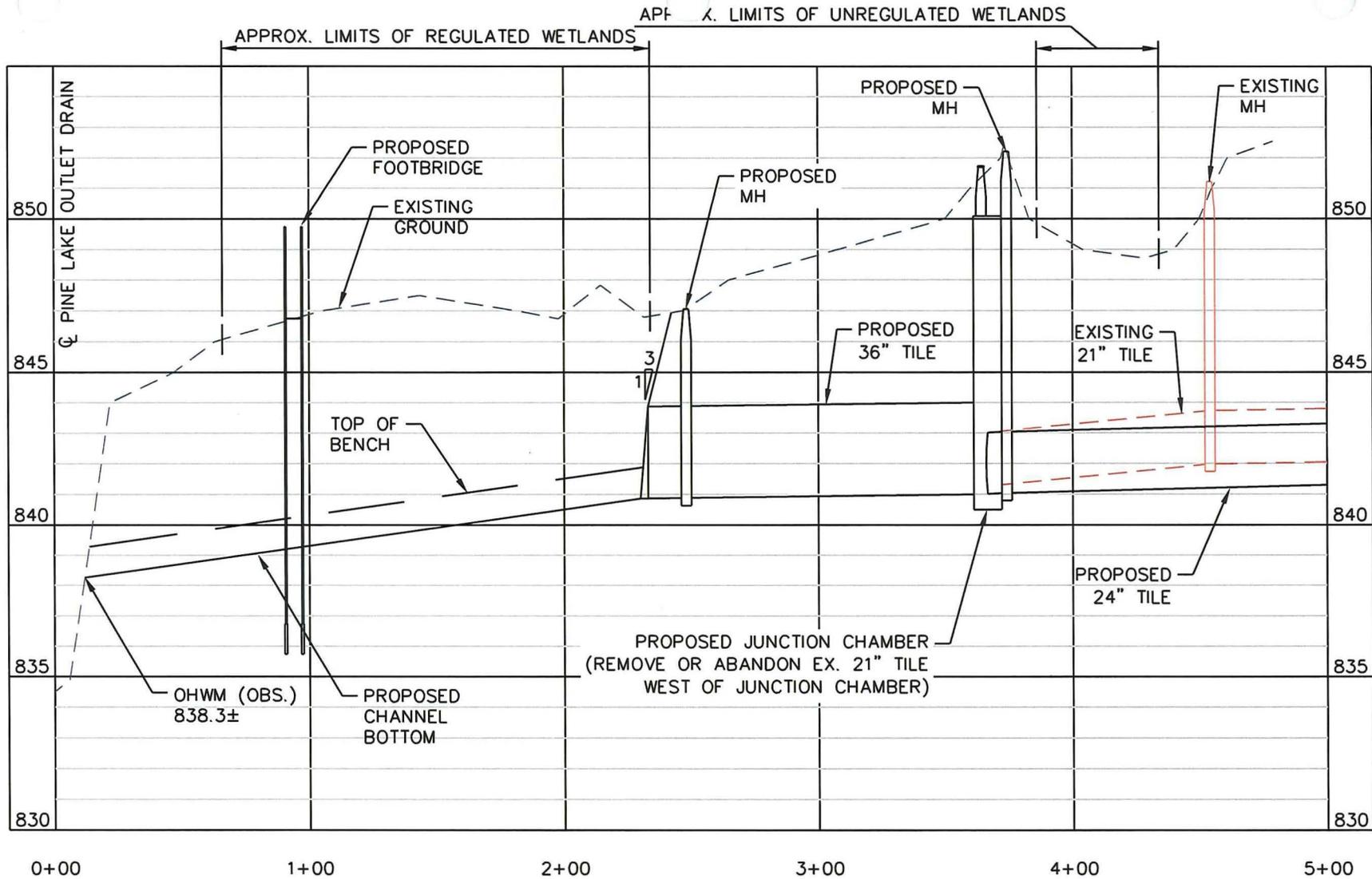


SCALE: 1" = 60'

DATUM: NAVD 88

**NEMOKA DRAIN
PROPOSED IMPROVEMENTS**

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	3 OF 9
DATE:	NOVEMBER 9, 2015

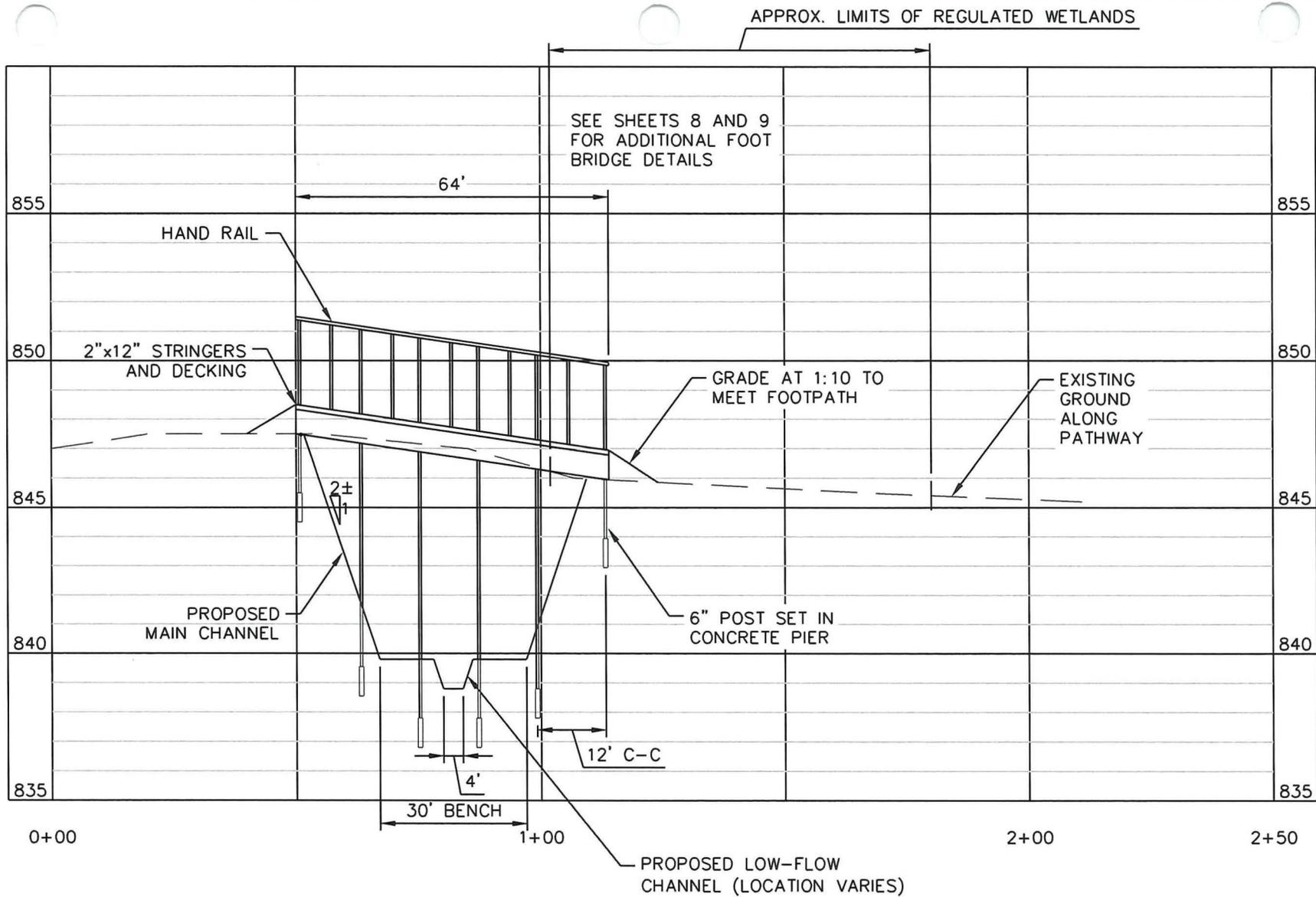


SCALE: 1" = 60' HORIZONTAL
 1" = 5' VERTICAL

DATUM: NAVD 88

NEMOKA DRAIN
 DRAIN PROFILE

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	4 OF 9
DATE:	NOVEMBER 9, 2015

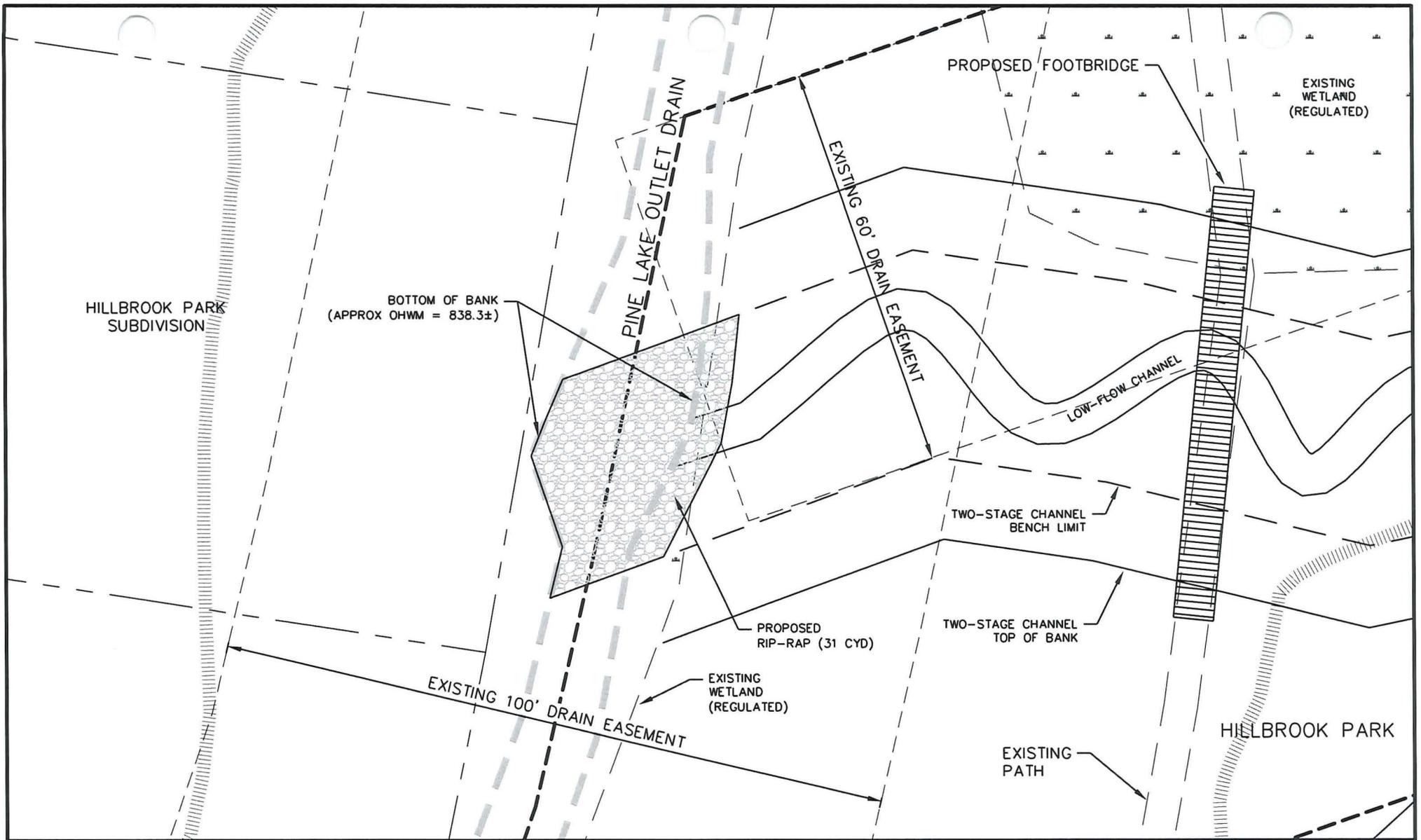


SCALE: 1" = 30' HORIZONTAL
1" = 5' VERTICAL

DATUM: NAVD 88

NEMOKA DRAIN
PROPOSED FOOTBRIDGE PROFILE & DRAIN X-SEC

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	5 OF 9
DATE:	NOVEMBER 9, 2015

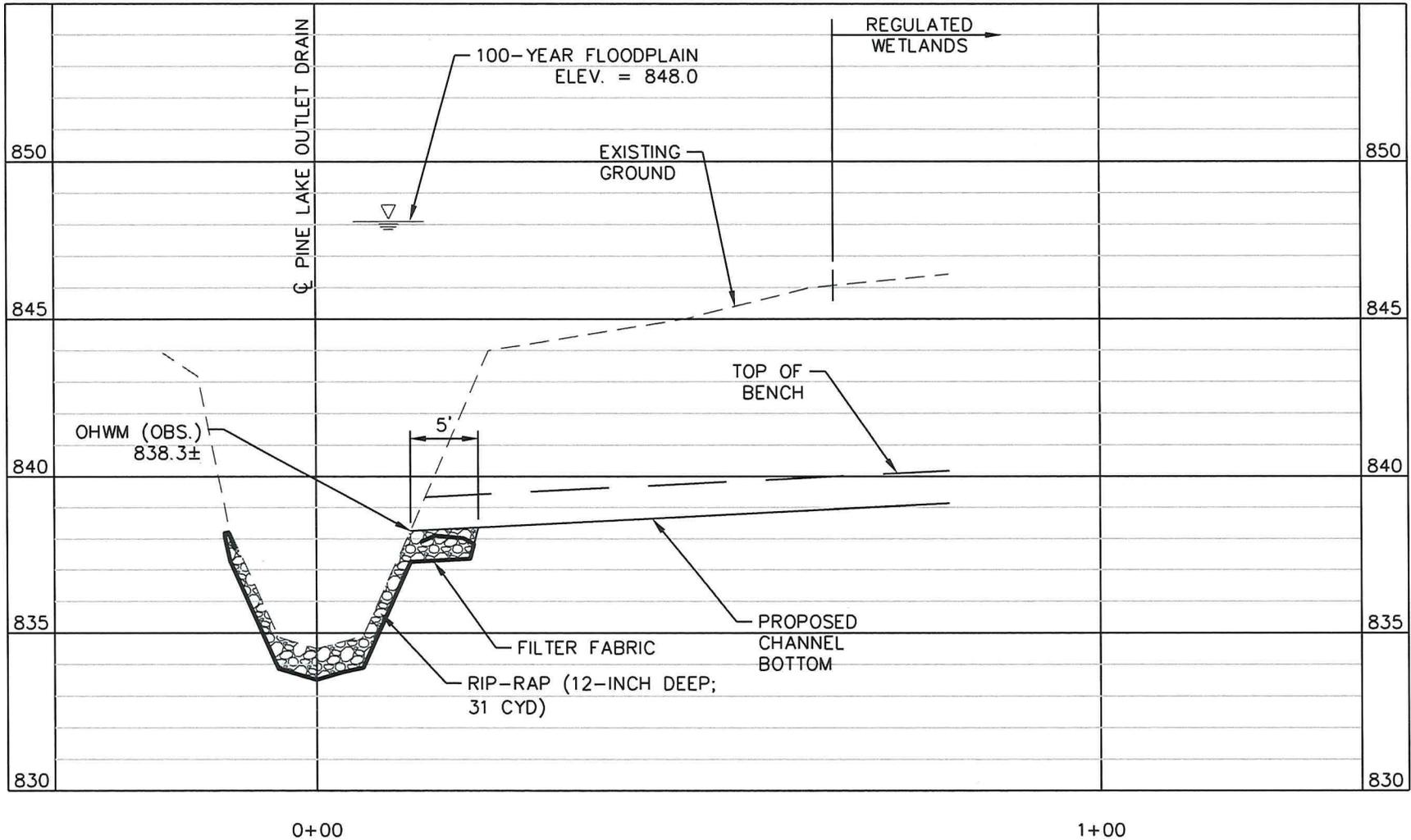


SCALE: 1" = 20'

DATUM: NAVD 88

NEMOKA DRAIN
PROPOSED OUTLET TO PINE LAKE OUTLET DRAIN

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	6 OF 9
DATE:	NOVEMBER 9, 2015

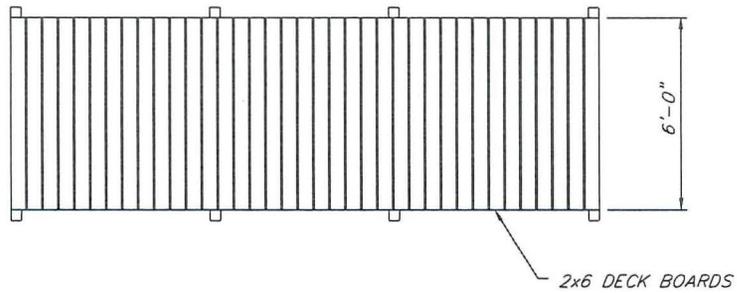


SCALE: 1" = 20' HORIZONTAL
 1" = 5' VERTICAL

DATUM: NAVD 88

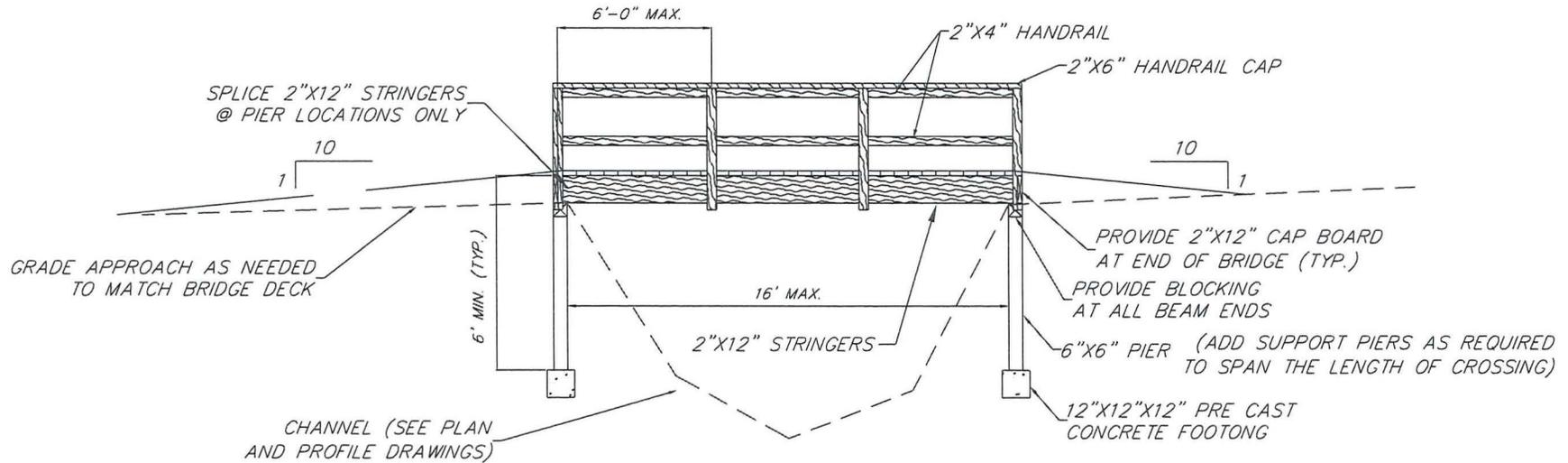
NEMOKA DRAIN
 DRAIN PROFILE AT PINE LAKE OUTLET DRAIN

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	7 OF 9
DATE:	NOVEMBER 9, 2015



TYPICAL WOODEN FOOT BRIDGE DECK PLAN

NTS

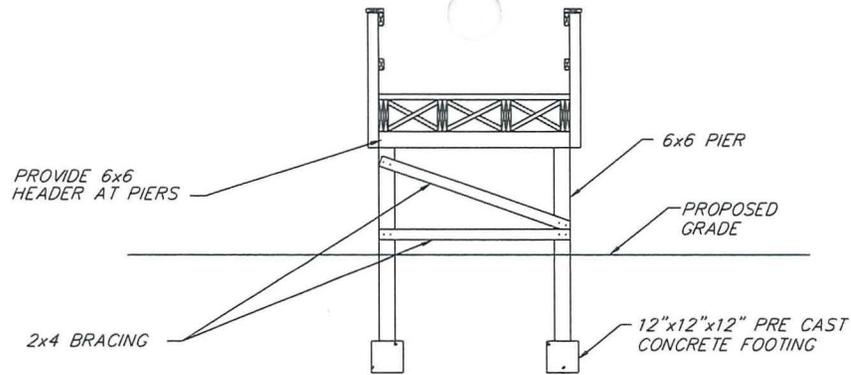


TYPICAL WOODEN FOOT BRIDGE ELEVATION

NTS

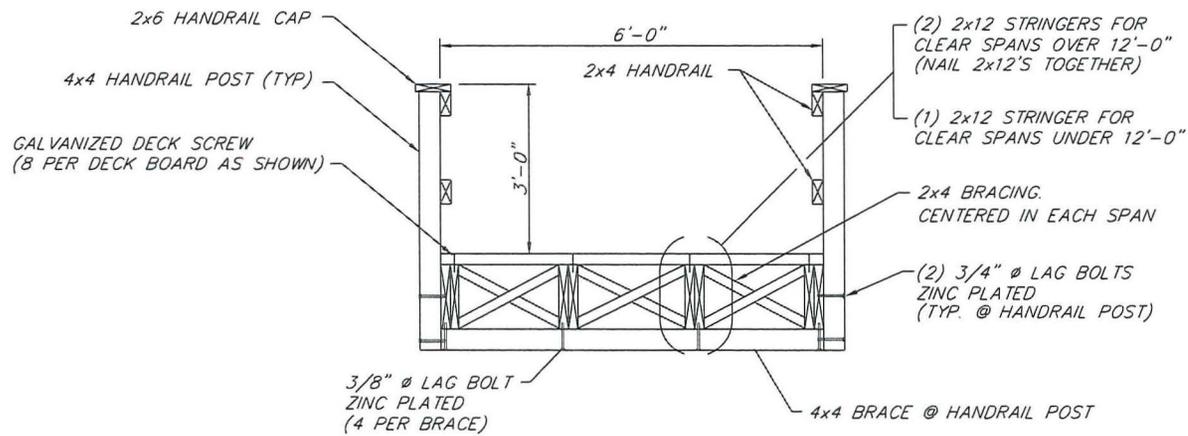
NEMOKA DRAIN
PROPOSED FOOTBRIDGE – TYPICAL DETAILS

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	8 OF 9
DATE:	NOVEMBER 9, 2015



TYPICAL WOODEN FOOT BRIDGE SECTION

NTS



FOOT BRIDGE DETAIL

NTS

NEMOKA DRAIN
PROPOSED FOOT BRIDGE – TYPICAL DETAILS

APPLICANT:	INGHAM CO. DR. COMM.
WATERWAY:	NEMOKA DRAIN
CITY:	HASLETT, MICHIGAN
COUNTY:	INGHAM
NUMBER OF SHEETS:	9 OF 9
DATE:	NOVEMBER 9, 2015

TAB 7

Wetland Assessment

WETLAND ASSESSMENT

**For the Nemoka Drain District in
Section 10 of Meridian Charter Township,
Ingham County, Michigan**

PREPARED FOR:

**Patrick E. Lindemann
Ingham County Drain Commissioner
P.O. Box 220
Mason, Michigan 48854**

PREPARED BY:



WATER AND WOODS ECOLOGY, LLC
P. O. Box 141 • Haslett, Michigan 48840
Phone and Fax (517) 316-2358 • cell 517-230-9409

April 2014

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1.0 INTRODUCTION	1
2.0 WETLAND DETERMINATION METHODS	1
3.0 REGULATION OF WETLANDS	2

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FIGURE 3 - WETLAND DELINEATION MAPS	5-8
FIGURE 4 - INGHAM COUNTY SOILS MAP	9

LIST OF TABLES

TABLE 1 - REGULATORY STATUS OF WETLAND AREAS
--

LIST OF APPENDICES

APPENDIX 1 - ROUTINE LEVEL WETLAND DETERMINATION DATA FORMS

1.0 INTRODUCTION

On April 1 and 4 and May 1, 2014 a Wetland Assessment was conducted for the Ingham County Drain Commissioner within the Nemoka Drain District, in section 10 of Meridian Charter Township (T4N-R1W), Ingham County, Michigan. This 135 acre drainage district is a documented Ingham County Drain under the Michigan Drain Code. It is located in the north-central portion of Ingham County, immediately southwest of Lake Lansing. The overall district is generally bounded by Lake Lansing Road on the north, Lake Drive/Shaw Street on the east, Haslett Road/Raby Road/Grand Trunk Western railroad grade on the south and Hillbrook Park on the west. This district is more specifically defined on the attached Location Map and USGS Topography Map, Wetland Delineation Map and Ingham County Soil Survey Map of this report (**Figures 1 - 4**). This assessment included flagging the wetland boundary in the field with consecutively numbered flags, locating soil/vegetation identification points and their respective dominant plants, soils and hydrology (**Appendix 1**). The flagged boundary was surveyed by LSG Engineers and Surveyors and is shown on four pages (**Figures 3a-3d**) within this report.

The existing Nemoka Drain District consists of a mix of single family residential, multi-use residential (apartments) and mixed use commercial. Topography is slightly rolling, with numerous major and minor road arteries bisecting the overall district. The purpose of the project is to: relieve isolated flooding of yards and parking lots; upgrading of pipe size and material; adding additional pipe where needed; providing additional retention and detention facilities; create more drain capacity; capture more sediment and associated pollutants; and slowing the volume of discharge downstream to the Pine Lake Outlet County Drain.

Delineated and determined wetland is shown on **Figures 3a-3d**, the Wetland Delineation Maps. The on-site wetland generally follows the margins of the hydric soil mapping unit of Houghton Muck, Napoleon Muck and Colwood Loam, as shown on **Figure 4**, the Ingham County Soils Map of the District. The dominant wetland vegetation within the areas of wetland field delineated and mapped on-site includes, but is not limited to: cattails (*Typha latifolia*), reed-canary grass (*Phalaris arundinacea*), red-osier dogwood (*Cornus stolonifera*), cottonwood (*Populus deltoides*), spicebush (*Lindera benzoin*), silver maple (*Acer saccharinum*), slippery elm (*Ulmus rubra*) and sedges (*Carex spp.*), as shown on Standard Wetland Determination Data Forms in **Appendix 1**.

2.0 WETLAND DETERMINATION METHODS

Under both Federal and Michigan law, for a given area to be qualified as wetland there must be three criteria present. Those three criteria, called Diagnostic Environmental Characteristics, include hydrophytic (water loving) vegetation, hydric (wetland) soils and appropriate hydrology. These criteria have specific indicators which verify their presence and thus give a basis for the presence of each. The following sections, along with standard data forms found in **Appendix 1**, define the type of indicators which were present at specific locations on the site. These specific locations, or soil/vegetation sampling sites are shown on **Figure 3b-3c** and were located such that questionable areas can be confirmed or denied as wetlands. When the sites are located, the dominant vegetation is identified within a 50-foot radius, a soil pit is dug and existing soil indicators and hydrology are recorded.

Pursuant to Section 404 of the Clean Water Act and Part 303 of the State of Michigan's Natural Resource and Environmental Protection Act (Act 451 of 1994), wetland delineation/determination was conducted using a multi-parameter approach, which included delineating wetlands in the field. The format for identification is based on the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (1987) and the Michigan Department of Natural Resources Wetland Manual.

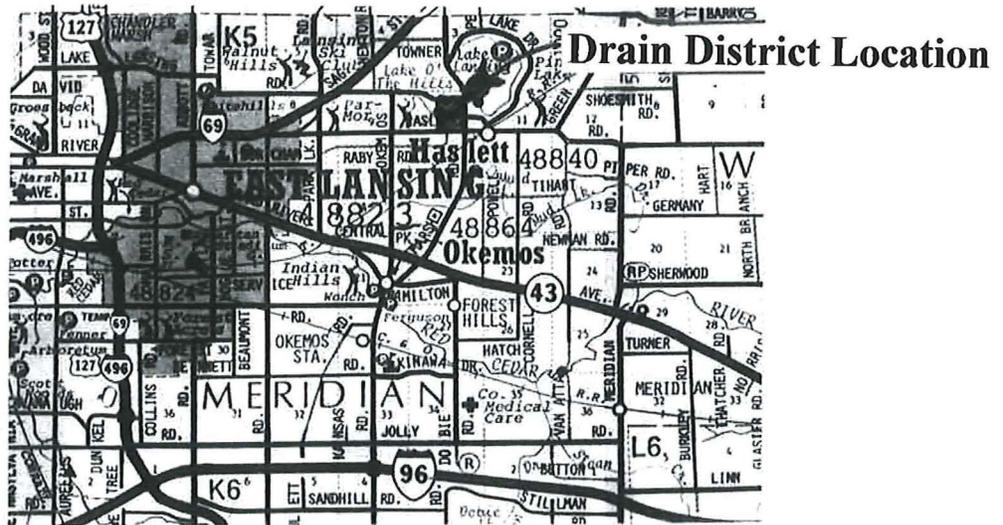
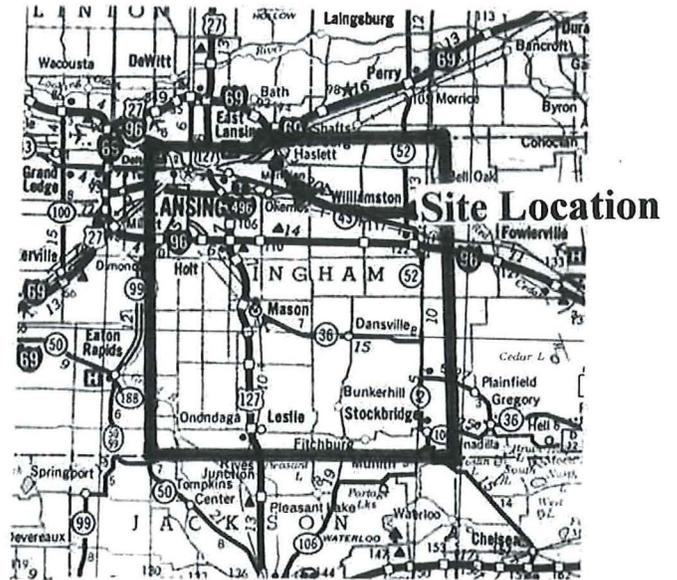
3.0 REGULATION OF WETLAND

After it has been determined that a given area is a wetland based on vegetation, soils and hydrology under Part 303 of the Natural Resources and Environmental Protection Act (P.A. 451 of 1994) wetlands must meet at least one of the following criteria to be regulated: 1) Contiguous* to a lake, pond, river or stream; 2) If not contiguous, it must be five acres or more in size; 3) If not contiguous or five acres or more in size the land must be essential to the preservation of natural resources and the State and the MDNR/MDEQ must have so notified the property owner. However, Meridian Township has a local wetland protection ordinance which regulates wetland that is not State or Federally regulated, down to 1/4 acre in size. Any wetland that is less than 1/4 acre in overall size and does not meet the criteria for protection under any other agency, or is within existing dedicated retention/detention easements under the jurisdiction of the County Drain Commissioner, is not protected. The only exception to this is a controlled set back area of all regulated wetland under the Township ordinance, which essentially controls land clearing activities in a 20 to 40 foot perimeter.

Based on the above criteria, the basis for regulation of the field delineated wetland within the subject Nemoka Drain District is defined in the Table below.

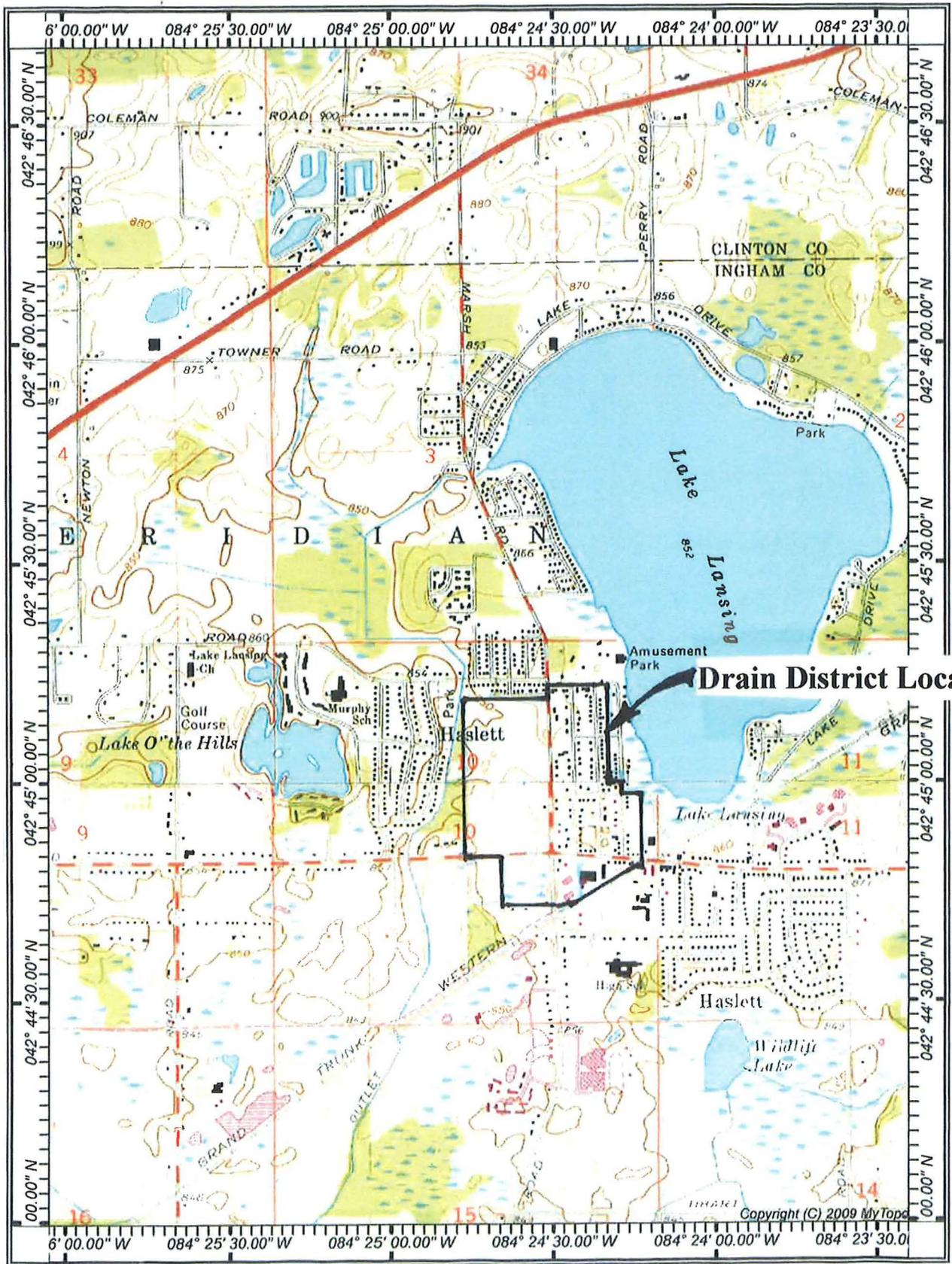
Table 1 -Nemoka Drain District Regulatory Status of Field Delineated Wetland				
Wetland Area	Size (Ac.)	State Regulated?	Township Regulated?	Basis for Regulatory Status
"A"	>5	Yes	(set back)	Greater than 5 acres and with 500 feet of Lake Lansing
"B"	>5	Yes	(set back)	Greater than 5 acres and contiguous with Lake Lansing
"C"	1.4	Yes	(set back)	Contiguous and within 500 feet of Lake Lansing
"D"	0.05	No	No	Less than 1/4 ac. & not within 500' of surface water
"E"	>5	Yes	(set back)	Greater than 5 ac. & contiguous with Pine Lake Drain
"F"	0.40	Yes	(set back)	Within 500 feet of the Pine Lake Drain
"G"	0.04	Yes	(set back)	Within 500 feet of the Pine Lake Drain
"H"	0.06	No	No	Less than 1/4 ac. and within a County Drain Basin
"I"	0.06	No	No	Less than 1/4 ac. and within a County Drain Basin

*Under the Wetland Protection Act a wetland is considered contiguous if it is within 500 feet of the ordinary high water mark of an inland lake, pond, river or stream or is within 1,000 feet of the ordinary high water mark of a "Great Lake."



LOCATION MAP

FIGURE 1



Drain District Location

USGS QUADRANGLE MAP

FIGURE 2

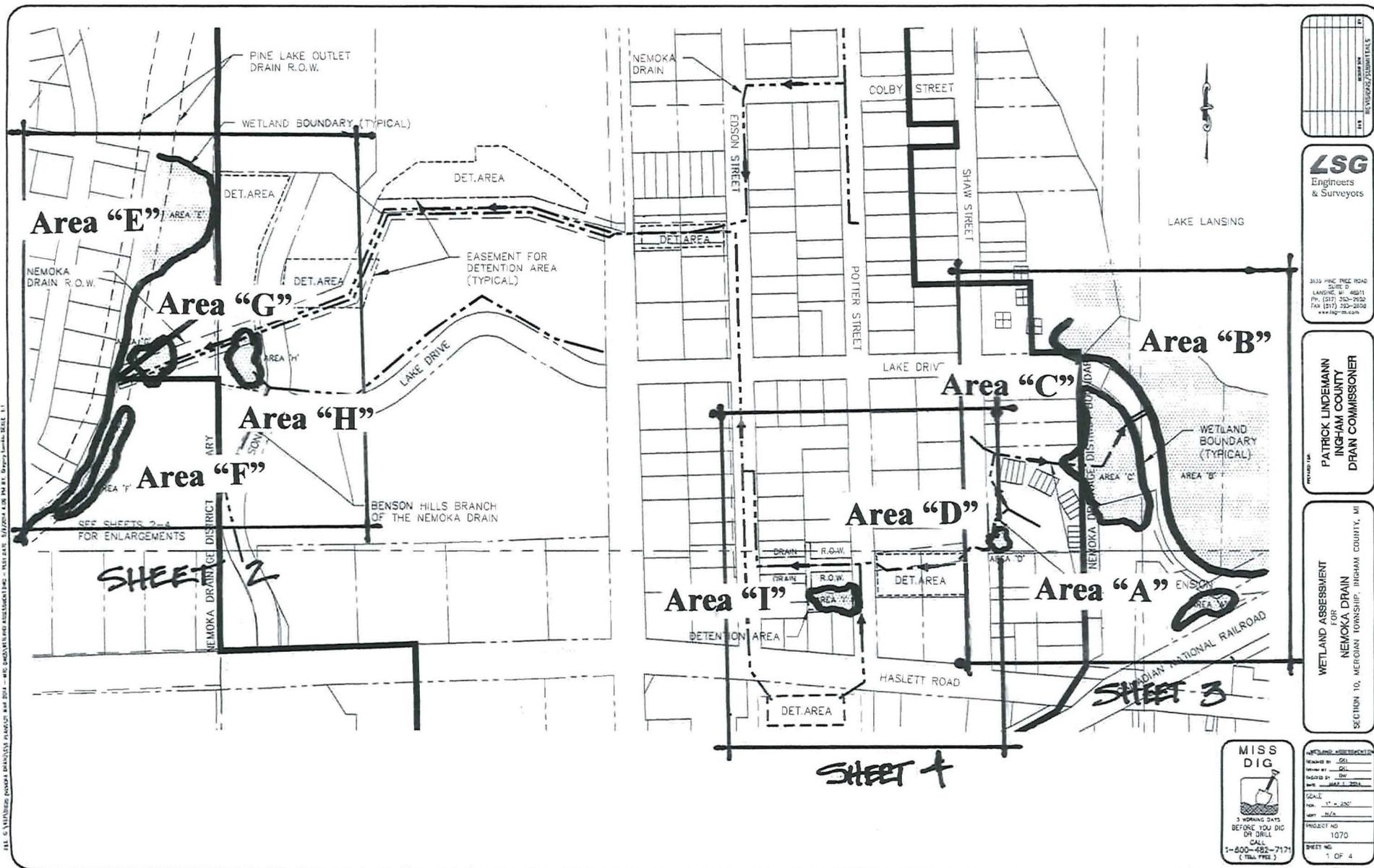
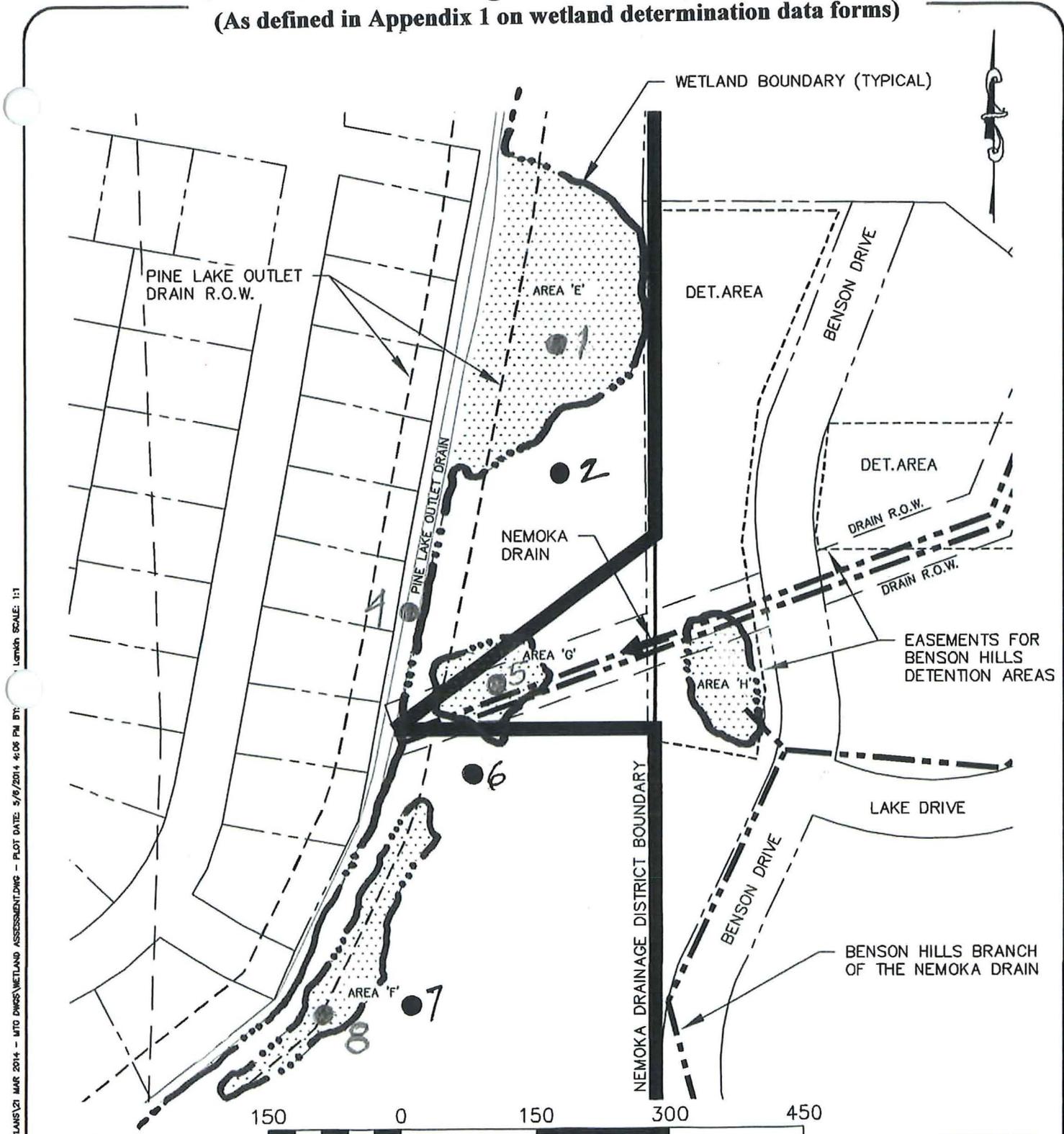


Figure 3a

Overall Locations of Wetland Delineation Within the Nemoka Drain District

● 1 - 13 Soil/Vegetation Analysis Locations
 (As defined in Appendix 1 on wetland determination data forms)



FILE: G:\1020 (NEMOKA DRAIN)\C16 PLANS\21 MAR 2014 - WTD PHOS\WETLAND ASSESSMENT.DWG - PLOT DATE: 5/09/2014 4:06 PM BY: Lcmh SCALE: 1:1

ZSG
 Engineers & Surveyors
 3135 PINE TREE ROAD
 SUITE D
 LANSING, MI 48911
 PH. (517) 593-2902
 FAX (517) 393-2808

PREPARED FOR:
PATRICK LINDEMANN
 INGHAM COUNTY DRAIN COMMISSIONER

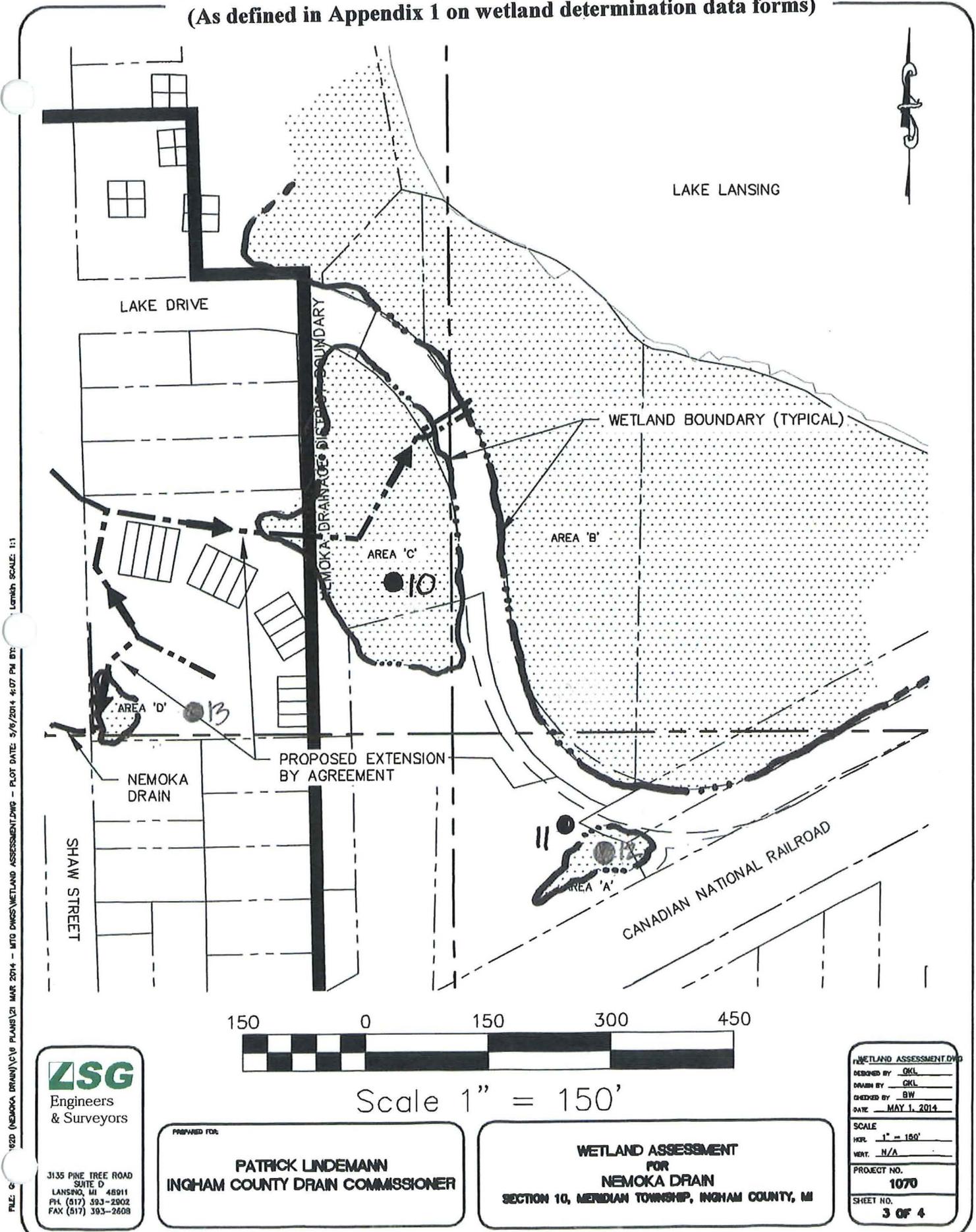
WETLAND ASSESSMENT
 FOR
NEMOKA DRAIN
 SECTION 10, MERIDIAN TOWNSHIP, INGHAM COUNTY, MI

WETLAND ASSESSMENT.DWG	
DESIGNED BY	OKL
DRAWN BY	OKL
CHECKED BY	BW
DATE	MAY 1, 2014
SCALE	
HOR.	1" = 150'
VERT.	N/A
PROJECT NO.	
1070	
SHEET NO.	
2 OF 4	

Figure 3b

Wetland Delineation Sheet 2 of 4

● 1 - 13 Soil/Vegetation Analysis Locations
 (As defined in Appendix 1 on wetland determination data forms)



FILE: G:\M2D (NEMOKA DRAIN)\CIV PLANS\21 MAR 2014 - MTO DWG\WETLAND ASSESSMENT.DWG - PLOT DATE: 5/5/2014 4:07 PM BY: Laminh SCALE: 1:1

ZSG
 Engineers & Surveyors

3135 PINE TREE ROAD
 SUITE D
 LANSING, MI 48911
 PH. (517) 593-2902
 FAX (517) 393-2608

PREPARED FOR:

PATRICK LINDEMANN
 INGHAM COUNTY DRAIN COMMISSIONER

WETLAND ASSESSMENT
 FOR
NEMOKA DRAIN
 SECTION 10, MERIDIAN TOWNSHIP, INGHAM COUNTY, MI

WETLAND ASSESSMENT.DWG

DESIGNED BY CKL

DRAWN BY CKL

CHECKED BY BW

DATE MAY 1, 2014

SCALE

HORIZ. 1" = 150'

VERT. N/A

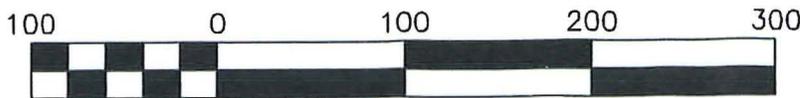
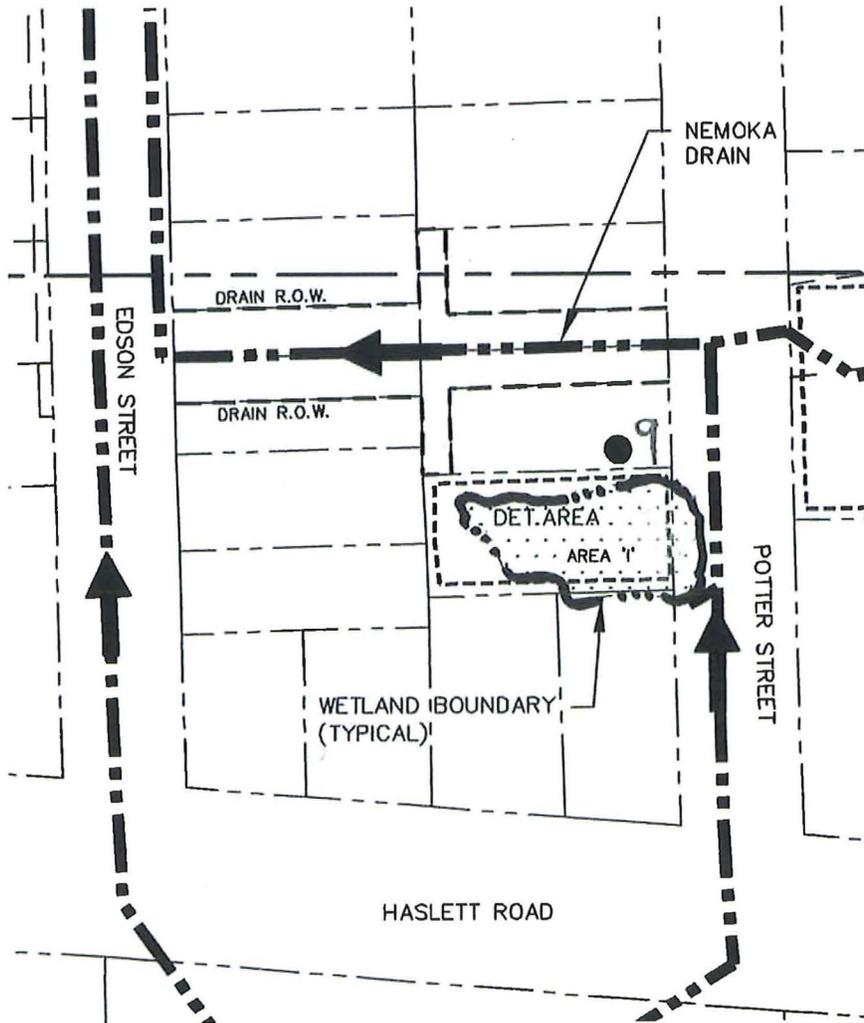
PROJECT NO. 1070

SHEET NO. 3 OF 4

Figure 3c

Wetland Delineation Sheet 3 of 4

● 1 - 13 Soil/Vegetation Analysis Locations
 (As defined in Appendix 1 on wetland determination data forms)



Scale 1" = 100'



3135 PINE TREE ROAD
 SUITE D
 LANSING, MI 48011
 PH. (517) 393-2902
 FAX (517) 393-2608

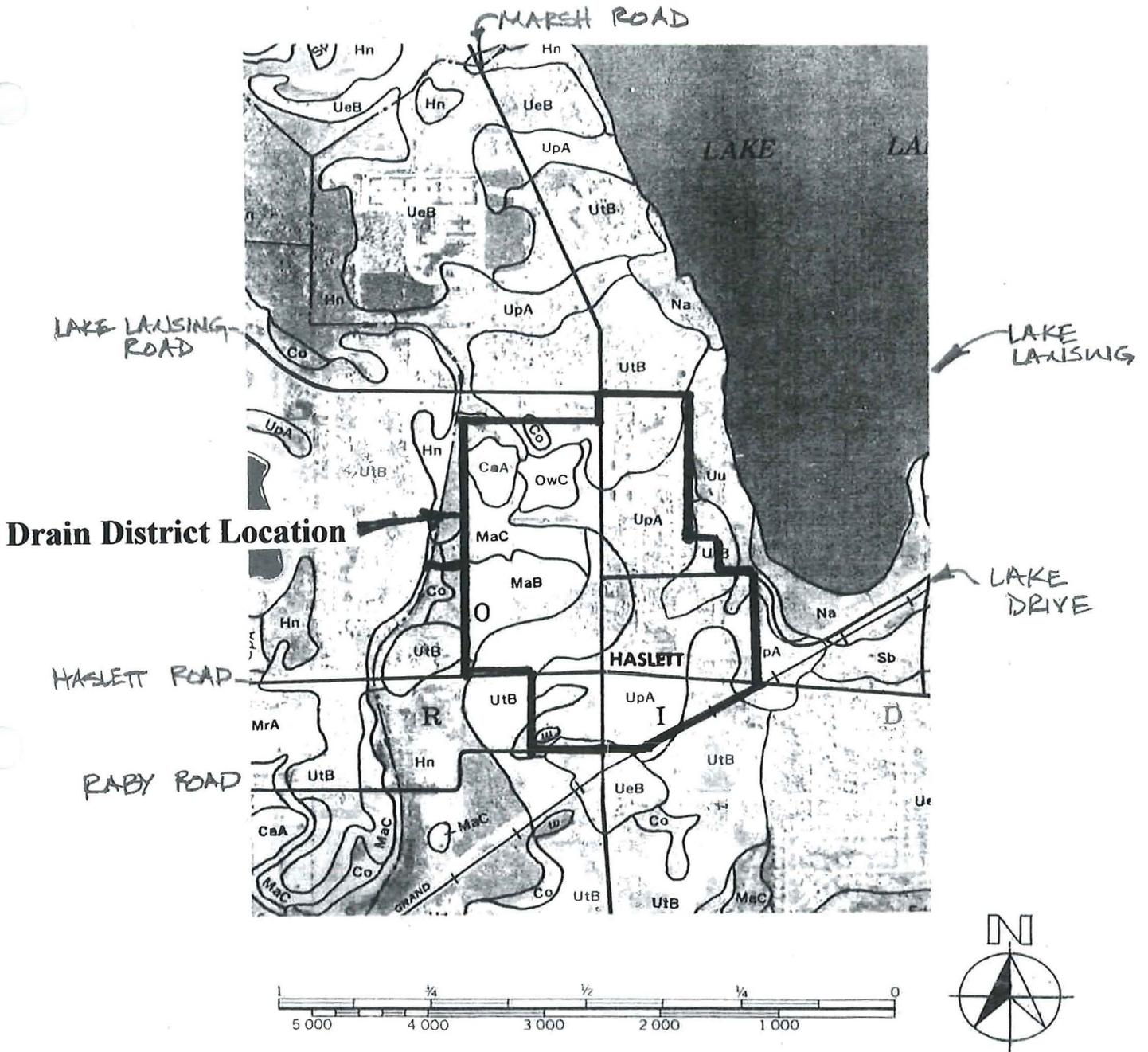
PREPARED FOR:
PATRICK LINDEMANN
 INGHAM COUNTY DRAIN COMMISSIONER

WETLAND ASSESSMENT
 FOR
 NEMOKA DRAIN
 SECTION 10, MERIDIAN TOWNSHIP, INGHAM COUNTY, MI

FILE NO.	WETLAND ASSESSMENT.DWG
DESIGNED BY	OKL
DRAWN BY	OKL
CHECKED BY	BW
DATE	MAY 1, 2014
SCALE	1" = 100'
HOR.	N/A
VERT.	N/A
PROJECT NO.	1070
SHEET NO.	4 OF 4

Figure 3d

FILE: G:\1070 (NEMOKA DRAIN)\V\PLANS\21 MAR 2014 - MTO DWG\WETLAND ASSESSMENT.DWG - PLOT DATE: 5/8/2014 4:08 PM BY: J Lemah SCALE: 1:1



Soils On-Site

Ca	Capac Loam	Na	Napoleon Muck*
Co	Colwood Loam *	Ow	Owosso Sandy Loam
Hn	Houghton Muck *	UpA	Urban Land-Capac/Colwood Loam
Ma	Marlette Fine Sandy Loam	UtB	Urban Land- Marlette Complex

***Hydric or Wetland Soil**

INGHAM COUNTY SOILS MAP

FIGURE 4

APPENDIX 1

**ROUTINE LEVEL WETLAND
DETERMINATION DATA FORMS**

(1)

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: HEMOKA DRAIN DISTRICT City/County: INGHAM Sampling Date: 9/22
Applicant/Owner: INGHAM CO. DRAIN COMMISSIONER State: MI Sampling Point:
Investigator(s): BLAIR R. WEBSTER Section, Township, Range: SEC 10 MERIDIAN TWP
Landform (hillslope, terrace, etc.): Residential-Flat Local relief (concave, convex, none): Slightly rolling
Slope (%): 3% Lat: 84° 24' 30" Long: 42° 00' 00" Datum: 1927
Soil Map Unit Name: Colwood Loam NWI classification: PEN/SS

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes No
Are Vegetation N, Soil N, or Hydrology N 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 checked="" type="checkbox"/> No <input type="checkbox"/>	Hydrlic Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks:			

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: <u>50' Rad</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Cottonwood</u>	<u>20</u>	<u>N</u>	<u>FAC</u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>1</u> (A)
2. <u>(Populus deltoides)</u>				Total Number of Dominant Species Across All Strata: <u>1</u> (B)
3.				Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
4.				
5.				
= Total Cover				
Sapling/Shrub Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Prevalence Index worksheet:
1. <u>Red-Osier Dogwood</u>	<u>10</u>	<u>N</u>	<u>FAC</u>	Total % Cover of: <u>1</u> x 1 = <u>1</u>
2. <u>(Cornus stolonifera)</u>				FACW species <u>0</u> x 2 = <u>0</u>
3.				FAC species <u>2</u> x 3 = <u>6</u>
4.				FACU species <u>-</u> x 4 = <u>-</u>
5.				UPL species <u>-</u> x 5 = <u>-</u>
= Total Cover				Column Totals: <u>3</u> (A) <u>7</u> (B)
				Prevalence Index = B/A = <u>2.1</u>
Herb Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Indicators: <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0' <input type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain) ¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
1. <u>Cattail (Typha latifolia)</u>	<u>60</u>	<u>Y</u>	<u>FACW</u>	
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
= Total Cover				
Woody Vine Stratum (Plot size: <u> </u>)	Absolute % Cover	Dominant Species?	Indicator Status	Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
1.				
2.				
<u>90</u> = Total Cover				

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

SOIL

Sampling Point: 17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
	Black to brown to 18"						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: <input checked="" type="checkbox"/> Histosol (A1) <input type="checkbox"/> Histic Epipedon (A2) <input type="checkbox"/> Black Histic (A3) <input type="checkbox"/> Hydrogen Sulfide (A4) <input type="checkbox"/> Stratified Layers (A5) <input type="checkbox"/> 2 cm Muck (A10) <input type="checkbox"/> Depleted Below Dark Surface (A11) <input checked="" type="checkbox"/> Thick Dark Surface (A12) <input type="checkbox"/> Sandy Mucky Mineral (S1) <input type="checkbox"/> 5 cm Mucky Peat or Peat (S3)	<input type="checkbox"/> Sandy Gleyed Matrix (S4) <input type="checkbox"/> Sandy Redox (S5) <input type="checkbox"/> Stripped Matrix (S6) <input type="checkbox"/> Loamy Mucky Mineral (F1) <input type="checkbox"/> Loamy Gleyed Matrix (F2) <input type="checkbox"/> Depleted Matrix (F3) <input type="checkbox"/> Redox Dark Surface (F6) <input type="checkbox"/> Depleted Dark Surface (F7) <input type="checkbox"/> Redox Depressions (F8)	Indicators for Problematic Hydric Soils³: <input type="checkbox"/> Coast Prairie Redox (A16) <input type="checkbox"/> Iron-Manganese Masses (F12) <input type="checkbox"/> Other (Explain in Remarks)
---	--	--

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
 Type: _____
 Depth (inches): _____

Hydric Soil Present? Yes No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)	Secondary Indicators (minimum of two required)
<input type="checkbox"/> Surface Water (A1) <input checked="" type="checkbox"/> High Water Table (A2) <input checked="" type="checkbox"/> Saturation (A3) <input checked="" type="checkbox"/> Water Marks (B1) <input checked="" 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 type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input checked="" type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> True Aquatic Plants (B14) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres on 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"/> Gauge or Well Data (D9) <input type="checkbox"/> Other (Explain in Remarks)

Field Observations:

Surface Water Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Depth (inches): <u>3"</u>	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Water Table Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Depth (inches): <u>18"</u>	
Saturation Present? (includes capillary fringe)	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Depth (inches): <u>Surface</u>	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: MEMORA DRAIN DISTRICT City/County: ENGLHAM Sampling Date: 9/22
Applicant/Owner: ENGLHAM CO. DRAIN COMMISSIONER State: NE. Sampling Point: _____
Investigator(s): BLAIR R. WEBSTER Section, Township, Range: SEC 10 MERIDIAN TWP.
Landform (hillslope, terrace, etc.): Residential-Flat Local relief (concave, convex, none): Slightly rolling
Slope (%): 3% Lat: 84° 24' 30" Long: 42° 00' 00" Datum: 1927
Soil Map Unit Name: "Made Land" - Fill clay loam/gravel NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)
Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No _____
Are Vegetation N, Soil N, or Hydrology N 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 _____ No <u>✓</u>	Is the Sampled Area within a Wetland? Yes _____ No <u>✓</u>
Hydric Soil Present? Yes _____ No <u>✓</u>	
Wetland Hydrology Present? Yes _____ No <u>✓</u>	
Remarks:	

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: <u>50' Rad.</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Quaking aspen</u>	<u>70</u>	<u>Y</u>	<u>FACU</u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A)
2. <u>(Populus tremuloides)</u>				Total Number of Dominant Species Across All Strata: <u>1</u> (B)
3.				Percent of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A/B)
4.				
5.				
<u>70</u> = Total Cover				Prevalence Index worksheet:
Sapling/Shrub Stratum (Plot size: _____)				Total % Cover of:
1. <u>Honeysuckle</u>	<u>20</u>	<u>N</u>	<u>FACU</u>	OBL species _____ x 1 = _____
2. <u>(Cornus spp.)</u>				FACW species _____ x 2 = _____
3.				FAC species _____ x 3 = _____
4.				FACU species <u>2</u> x 4 = <u>8</u>
5.				UPL species _____ x 5 = _____
<u>20</u> = Total Cover				Column Totals: _____ (A) _____ (B)
Herb Stratum (Plot size: _____)				Prevalence Index = B/A = <u>4</u>
1.				Hydrophytic Vegetation Indicators:
2.				___ Dominance Test is >50%
3.				___ Prevalence Index is ≤3.0 ¹
4.				___ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
5.				___ Problematic Hydrophytic Vegetation ¹ (Explain)
6.				¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
7.				
8.				
9.				
10.				
Woody Vine Stratum (Plot size: _____)				Hydrophytic Vegetation Present? Yes _____ No <u>✓</u>
1.				
2.				
<u>90</u> = Total Cover				

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

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
	Full material	70	18					

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: <input type="checkbox"/> Histosol (A1) <input type="checkbox"/> Histic Epipedon (A2) <input type="checkbox"/> Black Histic (A3) <input type="checkbox"/> Hydrogen Sulfide (A4) <input type="checkbox"/> Stratified Layers (A5) <input type="checkbox"/> 2 cm Muck (A10) <input type="checkbox"/> Depleted Below Dark Surface (A11) <input type="checkbox"/> Thick Dark Surface (A12) <input type="checkbox"/> Sandy Mucky Mineral (S1) <input type="checkbox"/> 5 cm Mucky Peat or Peat (S3)	<input type="checkbox"/> Sandy Gleyed Matrix (S4) <input type="checkbox"/> Sandy Redox (S5) <input type="checkbox"/> Stripped Matrix (S6) <input type="checkbox"/> Loamy Mucky Mineral (F1) <input type="checkbox"/> Loamy Gleyed Matrix (F2) <input type="checkbox"/> Depleted Matrix (F3) <input type="checkbox"/> Redox Dark Surface (F6) <input type="checkbox"/> Depleted Dark Surface (F7) <input type="checkbox"/> Redox Depressions (F8)	Indicators for Problematic Hydric Soils³: <input type="checkbox"/> Coast Prairie Redox (A16) <input type="checkbox"/> Iron-Manganese Masses (F12) <input type="checkbox"/> Other (Explain in Remarks)
---	--	--

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):
 Type: _____
 Depth (inches): _____

Hydric Soil Present? Yes _____ No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u>			<u>Secondary Indicators (minimum of two required)</u>					
<input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> High Water Table (A2) <input 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 type="checkbox"/> Sparsely Vegetated Concave Surface (B8)	<input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13) <input type="checkbox"/> True Aquatic Plants (B14) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Oxidized Rhizospheres on 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"/> Gauge or Well Data (D9) <input type="checkbox"/> Other (Explain in Remarks)	<input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Drainage Patterns (B10) <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"/> FAC-Neutral Test (D5)	Field Observations: Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>< 18"</u> Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>2 18"</u> Saturation Present? (includes capillary fringe) Yes _____ No <input checked="" type="checkbox"/> Depth (inches): <u>< 18"</u>			Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>		

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

(3)

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: NEMOKA DRAW DISTRICT City/County: ENGLHAM Sampling Date: 9/22
Applicant/Owner: ENGLHAM CO. DRAIN COMMISSIONER State: ME. Sampling Point:
Investigator(s): BLAIR R. WEBSTER Section, Township, Range: Sec 10 MERIDIAN TWP
Landform (hillslope, terrace, etc.): Residential-Flat Local relief (concave, convex, none): Slightly rolling
Slope (%): 3% Lat: 84° 24' 30" Long: 42° 00' 00" Datum: 1927
Soil Map Unit Name: Napoleon Muck NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes [checked] No
Are Vegetation, Soil, or Hydrology significantly disturbed? No Are "Normal Circumstances" present? Yes [checked] No
Are Vegetation, Soil, or Hydrology naturally problematic? No (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Table with 2 columns: Hydrophytic Vegetation Present?, Hydric Soil Present?, Wetland Hydrology Present? and Is the Sampled Area within a Wetland? All 'Yes' boxes are checked.

Remarks:

VEGETATION - Use scientific names of plants.

Vegetation data table with columns: Tree Stratum, Sapling/Shrub Stratum, Herb Stratum, Woody Vine Stratum, Absolute % Cover, Dominant Species?, Indicator Status, Dominance Test worksheet, Prevalence Index worksheet, Hydrophytic Vegetation Indicators.

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

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
	Black-dark brown w/ fibrous roots to 18"							

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 5 cm Mucky Peat or Peat (S3)

- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F8)
- Depleted Dark Surface (F7)
- Redox Depressions (FB)

Indicators for Problematic Hydric Soils³:

- Coast Prairie Redox (A16)
- Iron-Manganese Masses (F12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____
Depth (inches): _____

Hydric Soil Present? Yes No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- True Aquatic Plants (B14)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Gauge or Well Data (D9)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes No Depth (inches): 6"
 Water Table Present? Yes No Depth (inches): 6"
 Saturation Present? (includes capillary fringe) Yes No Depth (inches): Surface

Wetland Hydrology Present? Yes No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: NEMOKA DRAIN DISTRICT City/County: ENGLHAM Sampling Date: 9/22
 Applicant/Owner: ENGLHAM CO. DRAIN COMMISSIONER State: NE. Sampling Point:
 Investigator(s): BLAIR R. WEBSTER Section, Township, Range: Sec 10 MERIDIAN TWP
 Landform (hillslope, terrace, etc.): Residential-Flat Local relief (concave, convex, none): Slightly rolling
 Slope (%): 3% Lat: 94° 24' 30" Long: 42° 00' 00" Datum: 1927
 Soil Map Unit Name: Colwood Loam/Houghton Muck NWI classification: P EM/SS
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes No (If no, explain in Remarks.)
 Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes No
 Are Vegetation N, Soil N, or Hydrology N 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 checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Hydric Soil Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		
Wetland Hydrology Present?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>		
Remarks:			

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: <u>50' Rad</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:	
1. <u>Cottonwood</u>	<u>90</u>	<u>Y</u>	<u>FAC</u>	Number of Dominant Species That Are OBL, FACW, or FAC:	<u>3</u> (A)
2. <u>Populus deltoides</u>				Total Number of Dominant Species Across All Strata:	<u>3</u> (B)
3.				Percent of Dominant Species That Are OBL, FACW, or FAC:	<u>100</u> (A/B)
4.					
5.					
= Total Cover				Prevalence Index worksheet:	
Sapling/Shrub Stratum (Plot size: <u> </u>)				Total % Cover of:	
1. <u>Red-Osier Dogwood</u>	<u>10</u>		<u>FAC</u>	OBL species <u>2</u> x 1 = <u>2</u>	
2. <u>Cornus stolonifera</u>				FACW species <u>0</u> x 2 = <u>0</u>	
3.				FAC species <u>2</u> x 3 = <u>6</u>	
4.				FACU species <u>1</u> x 4 = <u>4</u>	
5.				UPL species <u>1</u> x 5 = <u>5</u>	
= Total Cover				Column Totals:	<u>7</u> (A) <u>8</u> (B)
Herb Stratum (Plot size: <u> </u>)				Prevalence Index = B/A = <u>2</u>	
1. <u>Cattails (Typha latifolia)</u>	<u>30</u>	<u>Y</u>	<u>OBL</u>	Hydrophytic Vegetation Indicators:	
2. <u>Sedge (Carex spp)</u>	<u>30</u>	<u>Y</u>	<u>OBL</u>	<input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is ≤3.0 ¹ <input checked="" type="checkbox"/> Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation ¹ (Explain)	
3.				¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.	
4.					
5.					
6.					
7.					
8.					
9.					
10.					
<u>90</u> = Total Cover				Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
Woody Vine Stratum (Plot size: <u> </u>)					
1.					
2.					
= Total Cover					

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

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
	Dark brown		black	40		1B"	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 5 cm Mucky Peat or Peat (S3)

- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- Coast Prairie Redox (A16)
- Iron-Manganese Masses (F12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____
Depth (inches): _____

Hydric Soil Present? Yes No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)

- Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- True Aquatic Plants (B14)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Gauge or Well Data (D9)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes No Depth (inches): 3"
 Water Table Present? Yes No Depth (inches): 10"
 Saturation Present? Yes No Depth (inches): Surface
 (includes capillary fringe)

Wetland Hydrology Present? Yes No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: WENOKA DRAIN DISTRICT City/County: INGHAM Sampling Date: 9/22
 Applicant/Owner: INGHAM CO. DRAIN COMMISSIONER State: ME. Sampling Point: _____
 Investigator(s): BLAIR R. WEBSTER Section, Township, Range: Sec 10 MERIDIAN TWP
 Landform (hillslope, terrace, etc.): Residential-Flat Local relief (concave, convex, none): Slightly rolling
 Slope (%): 3% Lat: 84° 24' 30" Long: 42° 00' 00" Datum: 1927
 Soil Map Unit Name: _____ NWI classification: _____

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 _____ No _____	Hydric Soil Present? Yes _____ No _____	Wetland Hydrology Present? Yes _____ No _____	Is the Sampled Area within a Wetland? Yes _____ No _____
Remarks:			

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: <u>50' rad</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Sleeping Elm (Ulmus rubra)</u>	<u>30</u>	<u>Y</u>	<u>FAC</u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A)
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: <u>3</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet: Total % Cover of: _____ Multiply by: OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species <u>3</u> x 3 = <u>9</u> FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: <u>3</u> (A) <u>9</u> (B) Prevalence Index = B/A = <u>3.0</u>
5. _____	_____	_____	_____	
<u>30</u> = Total Cover				
Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Spicebush (Lindera benzoin)</u>	<u>30</u>	<u>Y</u>	<u>FAC</u>	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
<u>30</u> = Total Cover				
Herb Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Sedge</u>	<u>30</u>	<u>Y</u>	<u>FAC</u>	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
<u>30</u> = Total Cover				
Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
<u>90</u> = Total Cover				

Hydrophytic Vegetation Indicators:
 Dominance Test is >50%
 Prevalence Index is ≤3.0'
 _____ Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
 _____ Problematic Hydrophytic Vegetation¹ (Explain)
¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No _____

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

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Coast Prairie Redox (A16)
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> Iron-Manganese Masses (F12)
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Other (Explain in Remarks)
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	
<input type="checkbox"/> 2 cm Muck (A10)	<input type="checkbox"/> Depleted Matrix (F3)	
<input type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Redox Dark Surface (F8)	
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Depleted Dark Surface (F7)	
<input type="checkbox"/> Sandy Mucky Mineral (S1)	<input type="checkbox"/> Redox Depressions (F8)	
<input type="checkbox"/> 5 cm Mucky Peat or Peat (S3)		

Indicators for Problematic Hydric Soils³:

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

<u>Primary Indicators (minimum of one is required; check all that apply)</u>	<u>Secondary Indicators (minimum of two required)</u>
<input type="checkbox"/> Surface Water (A1)	<input type="checkbox"/> Water-Stained Leaves (B9)
<input type="checkbox"/> High Water Table (A2)	<input type="checkbox"/> Surface Soil Cracks (B6)
<input type="checkbox"/> Saturation (A3)	<input type="checkbox"/> Aquatic Fauna (B13)
<input type="checkbox"/> Water Marks (B1)	<input type="checkbox"/> True Aquatic Plants (B14)
<input type="checkbox"/> Sediment Deposits (B2)	<input type="checkbox"/> Hydrogen Sulfide Odor (C1)
<input type="checkbox"/> Drift Deposits (B3)	<input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3)
<input type="checkbox"/> Algal Mat or Crust (B4)	<input type="checkbox"/> Presence of Reduced Iron (C4)
<input type="checkbox"/> Iron Deposits (B5)	<input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6)
<input type="checkbox"/> Inundation Visible on Aerial Imagery (B7)	<input type="checkbox"/> Thin Muck Surface (C7)
<input type="checkbox"/> Sparsely Vegetated Concave Surface (BB)	<input type="checkbox"/> Gauge or Well Data (D9)
	<input type="checkbox"/> Other (Explain in Remarks)
	<input type="checkbox"/> Surface Soil Cracks (B6)
	<input type="checkbox"/> Drainage Patterns (B10)
	<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"/> FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? Yes _____ No _____ Depth (inches): _____

(includes capillary fringe)

Wetland Hydrology Present? Yes _____ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

Project/Site: MEMORA DRAIN DISTRICT City/County: ENGLAND Sampling Date: 9/22
 Applicant/Owner: ENGLAND CO. DRAIN COMMISSIONER State: ME. Sampling Point: /
 Investigator(s): BLAIR R. WEBSTER Section, Township, Range: Sec 10 MERIDIAN TWP.
 Landform (hillslope, terrace, etc.): Residential-Flat Local relief (concave, convex, none): Slightly rolling
 Slope (%): 3% Lat: 24° 24' 30" Long: 42° 00' 00" Datum: 1927
 Soil Map Unit Name: "Mud land" - fill material NWI classification: /
 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"/>	Is the Sampled Area within a Wetland?	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"/>		
Remarks:			

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: <u>50' rad.</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Boxelder (Acer negundo)</u>	<u>30</u>	<u>Y</u>	<u>FAC</u>	
2. _____	_____	_____	_____	Total Number of Dominant Species Across All Strata: <u>3</u> (B)
3. _____	_____	_____	_____	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>30</u> (A/B)
4. _____	_____	_____	_____	Prevalence Index worksheet:
5. _____	_____	_____	_____	
= Total Cover				OBL species <u>0</u> x 1 = _____
Seedling/Shrub Stratum (Plot size: _____)				FACW species <u>0</u> x 2 = _____
1. <u>Honeysuckle (Lonicera sp.)</u>	<u>30</u>	<u>Y</u>	<u>FACU</u>	FAC species <u>1</u> x 3 = <u>3</u>
2. _____	_____	_____	_____	FACU species <u>2</u> x 4 = <u>8</u>
3. _____	_____	_____	_____	UPL species <u>0</u> x 5 = <u>0</u>
4. _____	_____	_____	_____	Column Totals: <u>3</u> (A) <u>11</u> (B)
5. _____	_____	_____	_____	Prevalence Index = B/A = <u>3.8</u>
= Total Cover				Hydrophytic Vegetation Indicators:
Herb Stratum (Plot size: _____)				
1. <u>Upland Goldenrod (Solidago sp.)</u>	<u>30</u>	<u>Y</u>	<u>FACU</u>	___ Prevalence Index is ≤3.0 ¹
2. _____	_____	_____	_____	___ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet)
3. _____	_____	_____	_____	___ Problematic Hydrophytic Vegetation ¹ (Explain)
4. _____	_____	_____	_____	¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	Remarks: (Include photo numbers here or on a separate sheet.)
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
= Total Cover				
Woody Vine Stratum (Plot size: _____)				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
= Total Cover				

SOIL

Sampling Point **6**

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
	clay loam w/ intermixed sand & gravel						

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 5 cm Mucky Peat or Peat (S3)

- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F8)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils³:

- Coast Prairie Redox (A16)
- Iron-Manganese Masses (F12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____
Depth (inches): _____

Hydric Soil Present? Yes _____ No

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)

- Water-Stained Leaves (B9)
- Aquatic Fauna (B13)
- True Aquatic Plants (B14)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tilled Soils (C6)
- Thin Muck Surface (C7)
- Gauge or Well Data (D9)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No Depth (inches): < 18"
 Water Table Present? Yes _____ No Depth (inches): < 18"
 Saturation Present? (includes capillary fringe) Yes _____ No Depth (inches): 16"

Wetland Hydrology Present? Yes _____ No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

WETLAND DETERMINATION DATA FORM - Midwest Region

7

Project/Site: MEMORA DRAW DISTRICT City/County: ENGLHAM Sampling Date: 9/22
 Applicant/Owner: ENGLHAM CO. DRAIN COMMISSIONER State: ME. Sampling Point: _____
 Investigator(s): BLAIR R. WEBSTER Section, Township, Range: Sec 10 MERIDIAN T14P
 Landform (hillslope, terrace, etc.): Residential-Flat Local relief (concave, convex, none): Slightly rolling
 Slope (%): 3% Lat: 84° 24' 30" Long: 42° 00' 00" Datum: 1927
 Soil Map Unit Name: Marlette loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes No _____ (If no, explain in Remarks.)
 Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes No _____
 Are Vegetation N, Soil N, or Hydrology N 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 _____ No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland?	Yes _____ No <input checked="" type="checkbox"/>
Hydric Soil Present?	Yes _____ No <input checked="" type="checkbox"/>		
Wetland Hydrology Present?	Yes _____ No <input checked="" type="checkbox"/>		

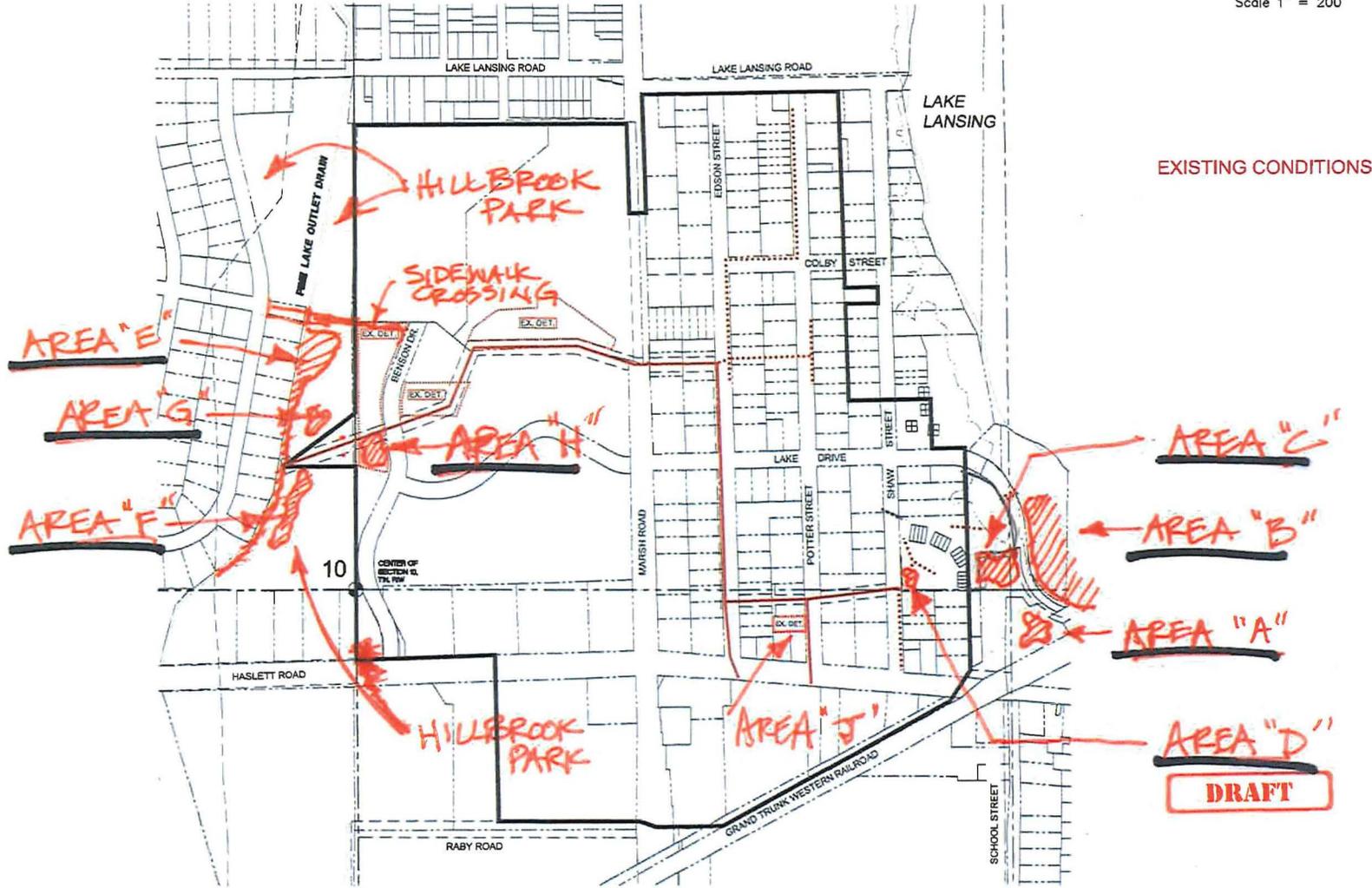
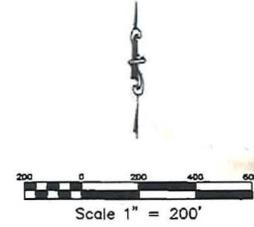
Remarks: _____

VEGETATION - Use scientific names of plants.

Tree Stratum (Plot size: <u>50' rad.</u>)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Black Cherry (Prunus serotina)</u>		<input checked="" type="checkbox"/>	<u>FACW</u>	Number of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A)
2. <u>Green oak (Fraxinus pensylvanica)</u>			<u>II</u>	Total Number of Dominant Species Across All Strata: <u>6</u> (B)
3. <u>Red oak (Quercus rubra)</u>			<u>II</u>	Percent of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A/B)
4. <u>Walnut (Carya ovata)</u>			<u>II</u>	
80 = Total Cover				Prevalence Index worksheet:
Sapling/Shrub Stratum (Plot size: _____)				Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species <u>7</u> x 4 = <u>16</u> UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)
Herb Stratum (Plot size: _____)				Prevalence Index = B/A = <u>4.0</u>
Woody Vine Stratum (Plot size: _____)				Hydrophytic Vegetation Indicators: ___ Dominance Test is >50% ___ Prevalence Index is ≤3.0 ¹ ___ Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation ¹ (Explain)
80 = Total Cover				Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/>

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

PATRICK E. LINDEMANN
INGHAM COUNTY DRAIN COMMISSIONER
NEMOKA DRAIN
 SECTION 10, MERIDIAN TOWNSHIP, INGHAM COUNTY



NO.	DATE	REVISIONS

L&S
Engineers
& Surveyors

3155 AVE. TREE ROAD
 SUITE 0
 LANSING, MI 48911
 PH: (313) 363-2502
 FAX: (313) 363-2508
 www.lsg-m.com

PATRICK E. LINDEMANN
INGHAM COUNTY DRAIN COMMISSIONER
NEMOKA DRAIN
 SECTION 10, MERIDIAN TWP., INGHAM COUNTY, MICHIGAN

DRAIN ID. NO.
N03-00

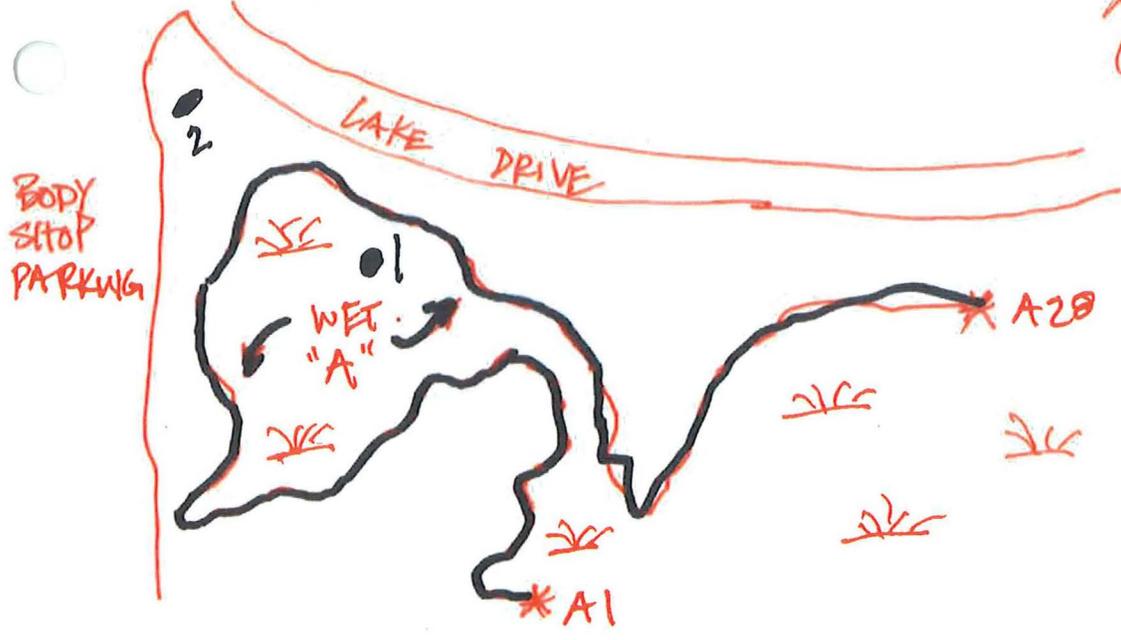
SHEET NO.
1 OF 27

WATER AND WOODS
 ECOLOGY, LLC

GENERAL LOCATION OF
 FIELD FLAGGED WETLANDS

FOR E:\Projects\Ingham County\Nemoka Drain\Section 10\Map 27.dwg - 10/15/2014 10:48:11 AM - 10/15/2014 10:48:11 AM - 10/15/2014 10:48:11 AM - 10/15/2014 10:48:11 AM

AREA "A"

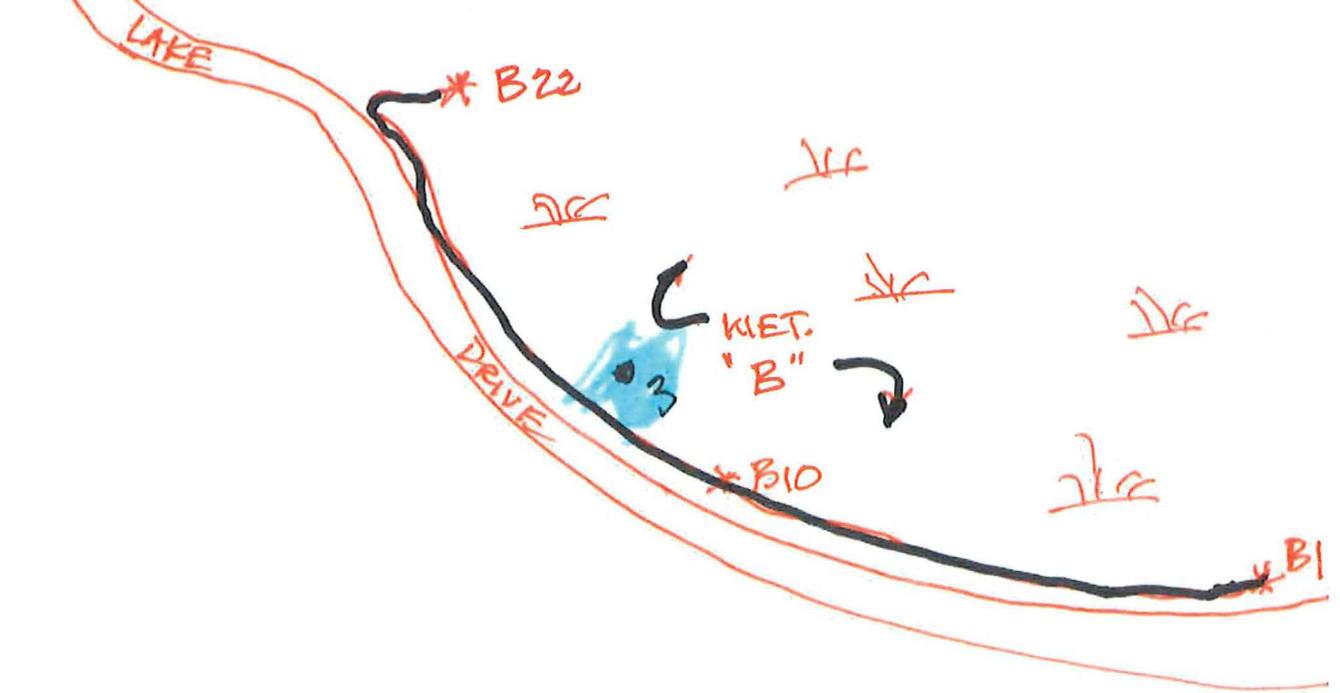


AREA "B"

SHAW ST.

← APTS. →

(LAKE LAUSING)



AREA "C"



SHARKY ST.

(LAKE LAUSING)

AREA "C"

(WET. "B")

STAW CONDO

WET. "C"

LAKE

DRIVE

FENCE

BODY SHOP PARKING

(WET. "A")

C25

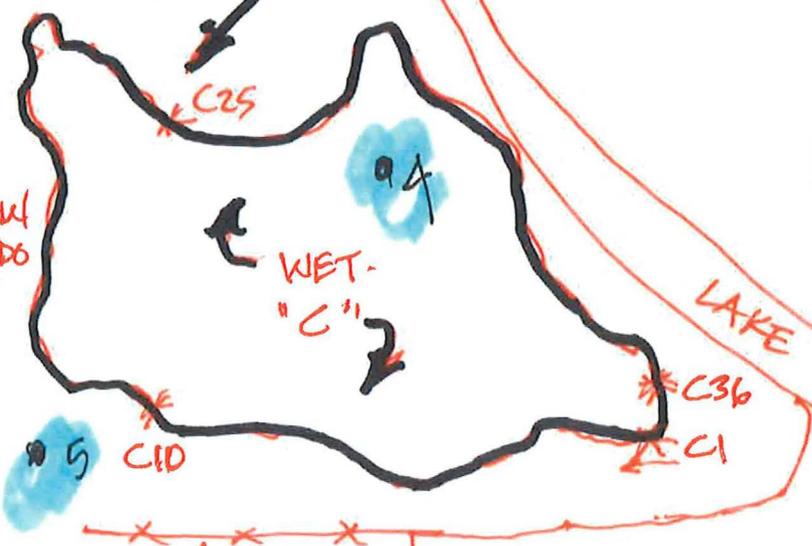
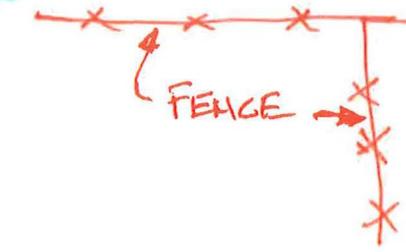
94

C10

C36

C1

5



AREA "D" (D1-D13)

LAKE DRIVE

SHAW ST.

SHAW CONDOS.

D13

WET "D"

D6

7

AREA "D"

MARSH ROAD

BEASON HILLS



~~TO HASLETT ROAD~~
(TO LAKE LAUSING RD)

AREA "E" (E1-E34)

SIDEWALK

HUBBROOK PARK LOT

PINE LAKE OUTLET

WET "E"

WET "E"

WET "E"

WET "E"

E10

E22

E22

G15

G19

WET "G"

G1

AREA "G" (G1-G19)

G10

G11

BEASON HILLS

E25

WET "F"

F10

AREA "F" (F1-F27)

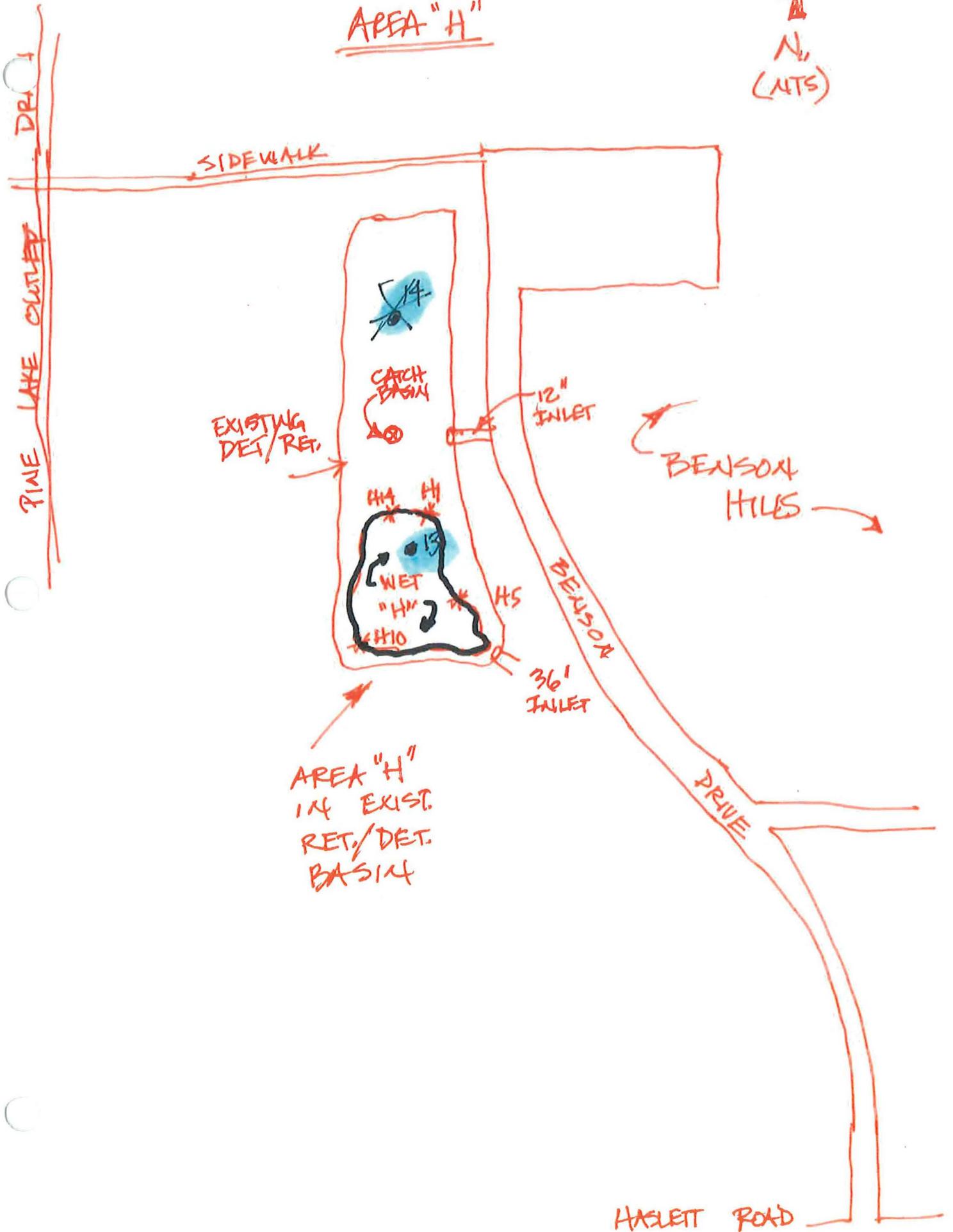
F27

F1

E34

(TO HASLETT ROAD)

AREA "H"



EXISTING
DET./RET.

14

CATCH
BASIN

12" INLET

BENSON
HILLS

H4

H5

WET
"H"

13

H5

36" INLET

BENSON
DRIVE

AREA "H"
IN EXIST.
RET./DET.
BASIN

DRIVE

HASLETT ROAD

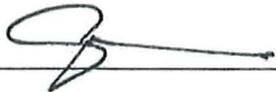
TAB 8

**Hydraulic Capacity Certification
Hydraulic Report
(including HEC-RAS model)**

Hydraulic Capacity Certification

Nemoka Drain – Confluence with the Pine Lake Outlet Drain
Pine Lake Outlet Drain
T04N, R01E, Section 10
Meridian Township
Ingham County

I, Alan D. Boyer, P.E. (Michigan Registration No. 32017), do hereby certify that I have inspected the adjoining properties and find that the proposed change in the hydraulic condition will not cause harmful interference or damage to adjacent structures or croplands, and that there are no structures that meet the definition of harmful interference in the floodplain where there are increases in existing versus proposed conditions. Harmful interference is defined as an increased stage or change in discharge or direction of flow that causes or is likely to cause any of the following: damage to property; a threat to life; a threat to personal injury; pollution, impairment, or destruction of water or other natural resources.



Alan D. Boyer, P.E.



Hydraulic Report

Nemoka Drain – Confluence with the Pine Lake Outlet Drain

Executive Summary

The Ingham County Drain Commissioner retained LSG Engineers & Surveyors to provide professional engineering services for improvements to the Nemoka Drain (Meridian Township) as part of a petition project under the Michigan Drain Code. The Nemoka Drain discharges into the Pine Lake Outlet Drain just upstream of Haslett Road by means of a 21-inch diameter tile. In order to alleviate flooding within the Nemoka Drain Drainage District, proposed improvements include installation of a 24-inch diameter relief tile parallel to the existing pipe as it makes its way to the outlet at the Pine Lake Outlet Drain. In addition to improvements at the outlet, regional detention facilities are proposed which will lower the hydraulic grade line and reduce the discharge velocity at the outlet.

Field observation of conditions at the outlet indicates erosion on both banks possibly due to turbulence as flows from the two drains commingle. Therefore, the proposed improvements feature combining the flows from the existing and relief tiles into a single 36-inch diameter pipe and then constructing a new two-stage, open channel outlet for ultimate discharge into the Pine Lake Outlet Drain.

This report examines the effect of the proposed improvements on the water surface elevations in the Pine Lake Outlet Drain. Cross-section and discharge data from the 1994 report by STS Consultants prepared for FEMA was correlated with 2011 FIS flood stage elevations to model before and after conditions. The Q_{100} values for the Nemoka Drain are 13 CFS existing and 22 CFS proposed based on EPA-SWMM modeling. The increase in flow of 9 CFS is approximately 3.5 percent greater than the existing Q_{100} in the Pine Lake Outlet Drain (see below).

Introduction

Watercourse:	Pine Lake Outlet Drain
City/Township:	Meridian Township
County:	Ingham
Section, Town & Range:	Section 10, T04N, R01W
Drainage Area:	5.5 sq. mi. (upstream)
Discharge Rate (1% Flood Event):	255 CFS (existing – from 1994 STS study) 264 CFS (proposed)

Method of Analysis

The US Army Corps of Engineers HEC-RAS program (Version 4.1.0) was used to develop a duplicate effective model in order to determine the water surface profile in the Pine Lake Outlet Drain for existing conditions and after proposed improvements to the Nemoka Drain.

Input data included cross-sections and discharge data from a 1994 study performed by STS Consultants, Inc. for the Red Cedar watershed, and flood stage elevations from the 2011 FIS for Ingham County.

Upstream and Downstream Modeling Limits (based on 1994 STS study)

Upstream Limit Station 15950 - Located just downstream of Lake Lansing Road

Downstream Limit Station 13500 - Located just upstream of Haslett Road

The modeling limits are within the area bracketed by stations 'C' and 'D' in the 2011 FIS for the Pine Lake Outlet Drain. Ground profile elevations and stations for each cross-section were copied from the HEC-2 printouts from the 1994 STS study (note: the right bank for river station 13550 was revised using 2003 LIDAR data to better reflect actual conditions—the HEC-2 data at this location indicated a deep depression offset from the main channel that does not exist). The datum for the original work was NGVD 29; elevations were converted to NAVD 88 (minus 0.44 feet).

Boundary Conditions

The initial boundary condition for the downstream water surface profile was for a known water surface elevation using the 2011 FIS for Ingham County. In this particular instance, the WSEL appears to be 847.9 just upstream of Haslett Road, at the mouth of the culvert.

Variables, Coefficients and Modeling Strategies

The 1994 STS study used Manning's $n = 0.045$ in the main channel and $n = 0.120$ for the left and right overbank areas. The HEC-RAS model substituted $n = 0.050$ for the main channel to better approximate the 2011 FIS profile, and $n = 0.160$ for the left and right overbank areas since field observation indicated substantial undergrowth or other landscape features that will inhibit flow.

The coefficients used for the expansion and contraction losses, etc. are the default values provided by the HEC-RAS software.

An obstructed area was used for the cross-section at Station 13500 (Haslett Road) since the ground data resulted in split flow with conveyance where none is actually possible in the initial trial run (i.e. all flow must pass through the culvert).

Summary Table

Water Surface Elevation Comparisons for the 100-year storm event (All in NAVD 88)

HEC-2 River Station	FIS Cross Section Station*	FIS Cross Section Letters	Approx. Location Description	Effective Aug. 16, 2011 FIS Water Surface	Existing Water Surface (HEC-RAS duplicate effective model) Q = 255 CFS	Proposed Water Surface (HEC-RAS duplicate effective model) Q = 264 CFS
13400	5700	C	D/S of Haslett Rd.			
13500				847.9	847.9	847.9
13550				848.0	848.0	848.0
14000				848.0	848.0	848.0
15950				848.1	848.1	848.1
16000	8300	D	D/S of Lake Lansing Rd.			

*Stream distance in feet above confluence with Mud Lake / Foster Drain

Conclusion

The tabular data above demonstrates that the minor increase in flow from the Nemoka Drain will not cause harmful interference in the Pine Lake Outlet Drain.

- Increase in discharge = 9 CFS (from 255 CFS to 264 CFS downstream of confluence)
- Decrease in velocity = -1.0 FPS (from 4.2 to 3.2 FPS at the outlet)

Appendix/Supporting Documents

EPA-SWMM Hydrographs Existing Q_{100} and V_{100}

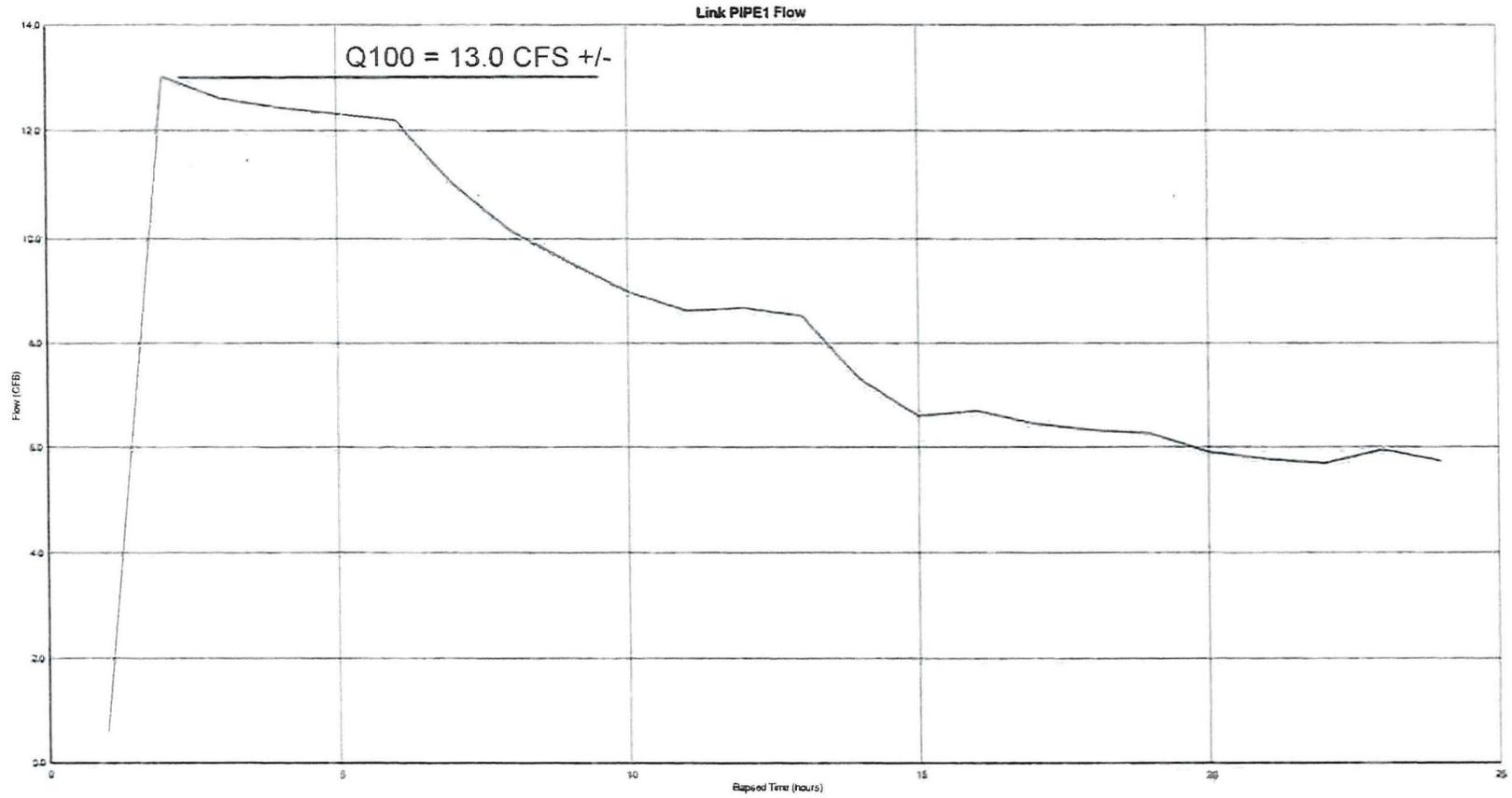
Proposed Q_{100} and V_{100}

HEC-2 Printouts from 1994 STS study (partial)

CD with HEC-RAS data for duplicate effective model

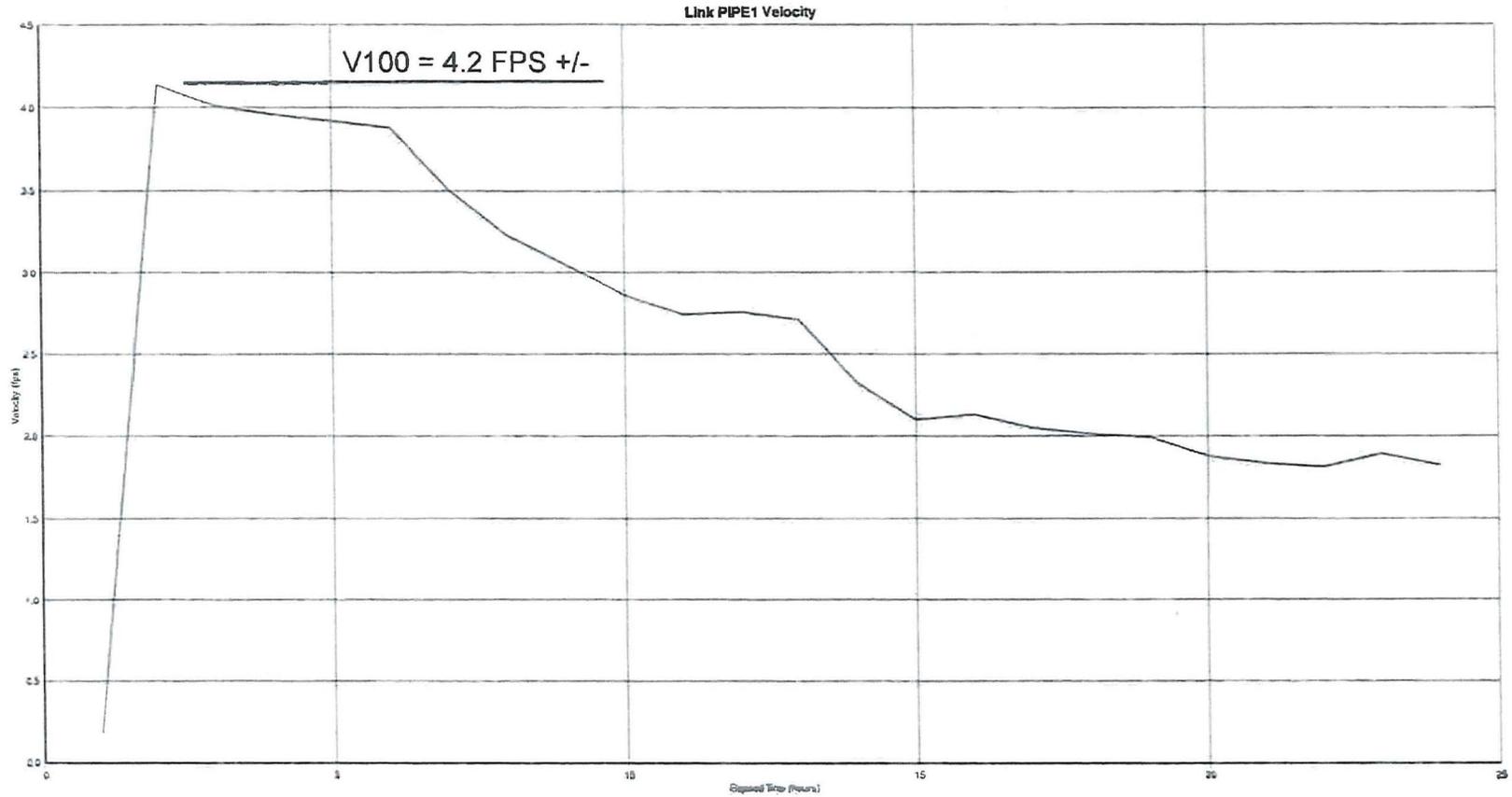
Nemoka Drain

Existing Conditions at Outlet (21-inch diameter pipe)



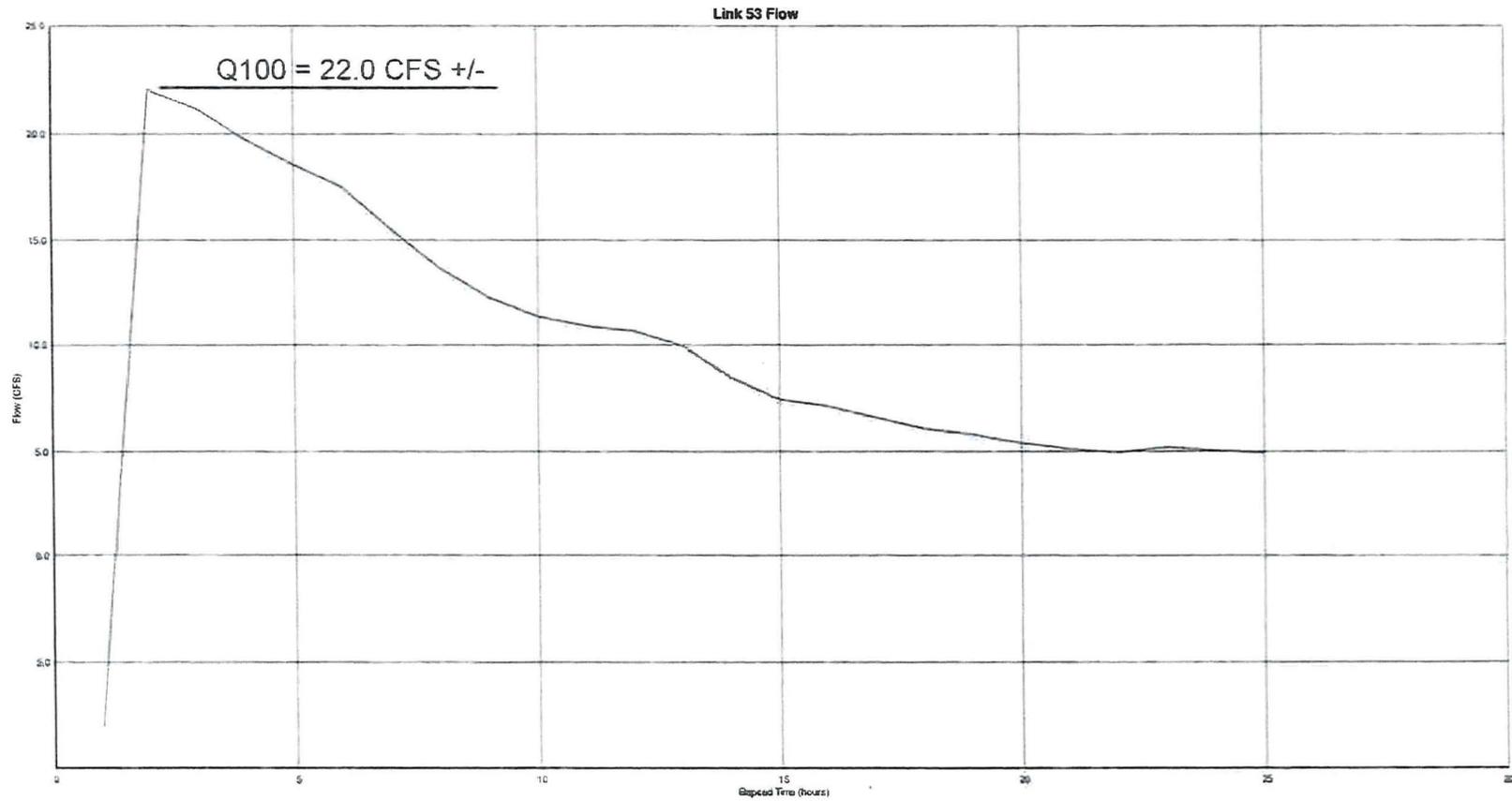
Nemoka Drain

Existing Conditions at Outlet (21-inch diameter pipe)



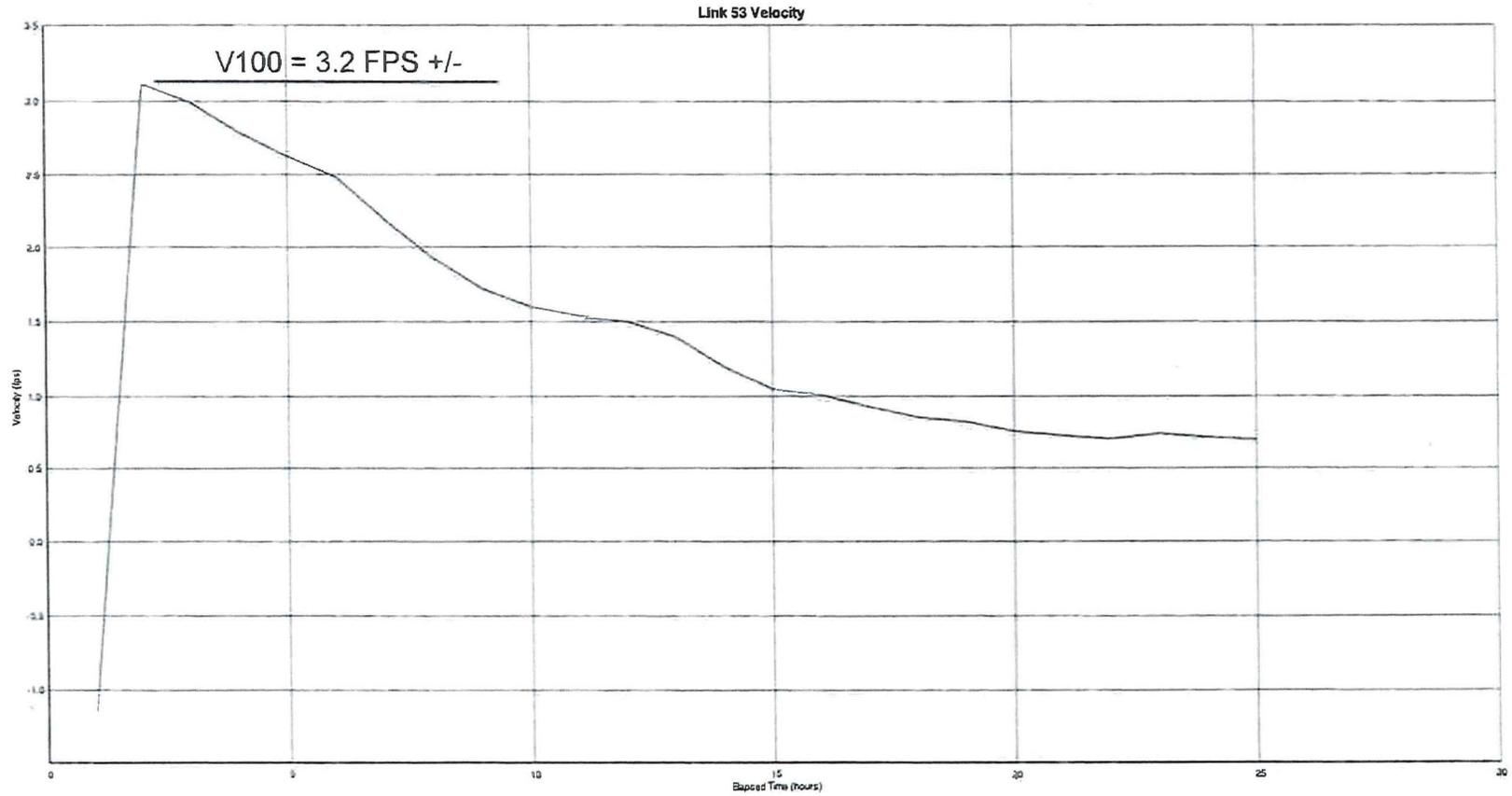
NEMOKA DRAIN

Proposed Conditions at Outlet (36-inch diameter pipe)



NEMOKA DRAIN

Proposed Conditions at Outlet (36-inch diameter pipe)



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1*****
* HEC-2 WATER SURFACE PROFILES *
* * *
* Version 4.6.2; May 1991 *
* * *
* RUN DATE 14APR94 TIME 11:35:40 *
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*****
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET, SUITE D
* DAVIS, CALIFORNIA 95616-4687
* (916) 756-1104
*****

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HEC-2 WATER SURFACE PROFILES
Version 4.6.2; May 1991
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T1Meridian Township FIS
T2Updated 10-Year Flood STS Consultants Ltd. 4/94 DMR
T3Pine Lake Outlet

Start cross-section data

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-0.0	2.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	835.3	-0.0
J2	NPROF	IPLLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	1.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

J3 VARIABLE CODES FOR SUMMARY PRINTOUT Just U/S of confluence with Red Cedar River

	1.0	10.0	11.0	12.0	3.0	4.0	26.0	-0.0	-0.0	-0.0
NC	.12	.12	.045	.30	.50	-0.0	-0.0	-0.0	-0.0	-0.0
OT	4.0	175.0	1290.0	1490.0	1920.0	-0.0	-0.0	-0.0	-0.0	-0.0
X1	0.0	22.0	312.0	356.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
GR	845.8	0.0	840.0	22.0	839.0	77.0	841.2	91.0	840.6	112.0
GR	840.3	119.0	830.2	212.0	833.1	247.0	832.3	312.0	826.8	326.0
GR	826.3	331.0	825.8	336.0	825.9	345.0	826.5	349.0	830.3	356.0
GR	831.9	380.0	830.2	385.0	830.3	399.0	839.9	424.0	842.5	512.0
GR	842.3	612.0	844.3	712.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
X1	100.0	11.0	185.0	215.0	100.0	100.0	100.0	-0.0	-0.0	-0.0
GR	844.1	0.0	842.6	100.0	841.9	154.0	842.8	185.0	827.8	187.0

X3	10.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	833.5	833.5	-0.0
GR	846.3	0.0	843.9	100.0	841.3	200.0	839.3	300.0	838.0	400.0
GR	836.9	500.0	832.6	600.0	832.2	700.0	832.1	800.0	832.1	900.0
GR	831.5	950.0	830.6	992.0	829.6	1000.0	829.7	1006.9	830.5	1007.0
GR	831.0	1050.0	831.1	1100.0	834.0	1200.0	839.1	1300.0	840.4	1400.0
GR	841.5	1500.0	842.8	1600.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

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SB	-0.0	1.5	2.6	-0.0	15.0	-0.0	70.0	-0.0	829.6	829.6
X1	5825.0	-0.0	-0.0	-0.0	25.0	25.0	25.0	-0.0	-0.0	-0.0
X2	-0.0	-0.0	1.0	833.5	835.2	-0.0	-0.0	-0.0	-0.0	-0.0
X3	10.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	835.2	835.2	-0.0
BT	23.0	0.0	846.3	820.0	100.0	843.9	820.0	200.0	841.3	820.0
BT	300.0	839.3	820.0	400.0	838.0	820.0	500.0	836.9	820.0	600.0
BT	836.1	820.0	700.0	835.6	820.0	800.0	835.2	820.0	900.0	835.4
BT	820.0	950.0	835.4	820.0	992.0	835.7	830.6	992.0	835.7	833.5
BT	1000.0	835.8	833.5	1006.9	835.8	833.5	1007.0	835.8	830.5	1050.0
BT	835.4	820.0	1100.0	835.3	820.0	1200.0	836.9	820.0	1300.0	839.1
BT	820.0	1400.0	840.4	820.0	1500.0	841.5	820.0	1600.0	842.8	820.0

Just U/S of confluence with Mud Lake / Foster Drain

X1	5860.0	21.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
GR	847.9	0.0	844.4	100.0	840.1	200.0	838.0	300.0	836.1	400.0
GR	834.8	500.0	833.5	600.0	833.1	700.0	833.0	800.0	832.6	900.0
GR	832.2	950.0	830.9	992.0	829.8	1000.0	830.3	1008.0	830.6	1050.0
GR	832.2	1100.0	833.5	1200.0	836.9	1300.0	838.8	1400.0	839.0	1500.0
GR	841.6	1500.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

QT	5.0	74.0	151.0	255.0	313.0	438.0	-0.0	-0.0	-0.0	-0.0
X1	7800.0	24.0	1000.0	1019.0	1840.0	1940.0	1940.0	-0.0	-0.0	-0.0
GR	842.3	0.0	843.3	200.0	841.0	300.0	838.2	400.0	835.9	500.0
GR	835.5	550.0	836.2	600.0	837.7	700.0	836.2	800.0	835.4	900.0
GR	835.0	1000.0	830.9	1013.0	830.7	1016.0	835.1	1019.0	834.6	1100.0
GR	835.5	1200.0	835.4	1300.0	835.4	1400.0	835.6	1500.0	836.1	1600.0
GR	835.1	1700.0	835.3	1800.0	1900.0	1900.0	835.8	2000.0	-0.0	-0.0

Q100

X1	9200.0	28.0	800.0	852.0	1400.0	1400.0	1400.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	600.0	-0.0	1100.0	-0.0	-0.0	-0.0	-0.0
GR	854.0	0.0	845.5	100.0	843.4	200.0	844.3	300.0	840.1	400.0
GR	838.5	500.0	838.7	600.0	838.2	700.0	837.4	783.0	840.1	800.0
GR	837.0	813.0	832.3	822.0	831.8	825.0	832.3	830.0	832.5	832.0
GR	837.1	842.0	840.0	852.0	837.4	861.0	837.0	900.0	838.4	1000.0
GR	838.7	1100.0	835.7	1200.0	835.1	1300.0	835.2	1400.0	835.0	1500.0
GR	835.1	1600.0	835.2	1700.0	835.1	1800.0	-0.0	-0.0	-0.0	-0.0

X1	10850.0	19.0	161.0	200.0	1650.0	1650.0	1650.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	100.0	-0.0	300.0	-0.0	-0.0	-0.0	-0.0
GR	849.5	0.0	845.7	100.0	844.9	161.0	838.5	175.0	836.4	182.0
GR	835.8	183.0	835.2	190.0	836.0	194.0	840.0	200.0	837.5	300.0
GR	837.5	400.0	838.0	500.0	836.9	600.0	838.3	700.0	838.8	800.0
GR	839.3	900.0	839.3	1000.0	840.7	1100.0	840.5	1200.0	-0.0	-0.0

X1	10900.0	16.0	1000.0	1005.0	50.0	50.0	50.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	1000.0	-0.0	1100.0	-0.0	-0.0	-0.0	-0.0
GR	848.0	0.0	848.2	700.0	848.2	800.0	845.7	900.0	845.7	1000.0
GR	836.5	1000.0	835.5	1001.0	835.0	1002.0	835.0	1003.0	835.5	1004.0
GR	836.5	1005.0	840.0	1005.0	837.5	1100.0	837.5	1200.0	838.0	1300.0
GR	840.5	2000.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

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X3	-0.0	-0.0	-0.0	900.0	-0.0	1200.0	-0.0	-0.0	-0.0	-0.0
BT	26.0	0.0	846.5	820.0	100.0	846.1	820.0	200.0	844.7	820.0
BT	300.0	844.8	820.0	400.0	844.1	820.0	500.0	844.2	820.0	600.0
BT	844.3	820.0	700.0	844.1	820.0	800.0	843.7	820.0	900.0	843.1
BT	820.0	989.0	842.2	820.0	989.0	843.0	839.4	998.0	842.9	839.4
BT	998.0	842.1	820.0	1100.0	841.1	820.0	1200.0	841.8	820.0	1300.0
BT	841.2	820.0	1400.0	840.9	820.0	1500.0	840.7	820.0	1600.0	841.2
BT	820.0	1700.0	841.2	820.0	1750.0	840.3	820.0	1800.0	841.1	820.0
BT	1830.0	842.4	820.0	1900.0	842.2	820.0	2000.0	840.1	820.0	-0.0

X1	11110.	20.0	250.0	293.0	50.0	50.0	50.0	-0.0	-2.2	-0.0
GR	853.9	0.0	851.2	75.0	851.5	150.0	850.3	200.0	843.9	250.0
GR	838.5	263.0	838.0	266.0	838.6	272.0	845.9	293.0	845.5	350.0
GR	844.9	450.0	844.9	550.0	839.4	604.0	839.4	650.0	839.5	750.0
GR	840.1	850.0	841.8	950.0	843.5	1050.0	851.0	1150.0	857.3	1250.0

X1	13350.	-0.0	-0.0	-0.0	2240.0	2240.0	2240.0	-0.0	2.2	-0.0
X3	-0.0	-0.0	-0.0	200.0	-0.0	400.0	-0.0	-0.0	-0.0	-0.0

X1	13400.	29.0	1000.0	1012.0	50.0	50.0	50.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	1000.0	-0.0	1012.0	-0.0	-0.0	-0.0	-0.0
GR	849.0	0.0	849.2	100.0	849.2	200.0	849.3	300.0	849.5	400.0
GR	850.2	500.0	850.9	600.0	851.4	700.0	851.3	800.0	850.5	900.0
GR	849.0	1000.0	837.3	1000.0	837.3	1002.0	837.3	1004.0	837.3	1005.0
GR	837.3	1006.0	837.3	1008.0	837.3	1010.0	837.3	1012.0	849.0	1012.0
GR	849.9	1100.0	847.2	1200.0	847.0	1300.0	846.9	1400.0	846.9	1500.0
GR	847.2	1600.0	848.4	1700.0	850.7	1800.0	854.1	1900.0	-0.0	-0.0

SB	-0.0	1.5	2.9	-0.0	12.5	-0.0	62.0	-0.0	838.6	838.4
X1	13500.	29.0	1000.0	1012.0	100.0	100.0	100.0	-0.0	-0.0	-0.0
X2	-0.0	-0.0	1.0	844.8	849.0	-0.0	-0.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	-0.0	-0.0	1100.0	-0.0	-0.0	-0.0	-0.0
BT	7.0	1000.0	849.0	838.3	1002.0	849.0	842.0	1004.0	849.0	843.8
BT	1006.0	849.0	844.8	1008.0	849.0	843.8	1010.0	849.0	842.0	1012.0
BT	849.0	838.3	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
GR	849.0	0.0	849.2	100.0	849.2	200.0	849.3	300.0	849.5	400.0
GR	850.2	500.0	850.9	600.0	851.4	700.0	851.3	800.0	850.5	900.0
GR	849.0	1000.0	837.3	1000.0	837.3	1002.0	837.3	1004.0	837.3	1005.0
GR	837.3	1006.0	837.3	1008.0	837.3	1010.0	837.3	1012.0	849.0	1012.0
GR	849.9	1100.0	847.2	1200.0	847.0	1300.0	846.9	1400.0	846.9	1500.0
GR	847.2	1600.0	848.4	1700.0	850.7	1800.0	854.1	1900.0	-0.0	-0.0

X1	13550.	20.0	250.0	293.0	50.0	50.0	50.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	200.0	-0.0	293.0	-0.0	-0.0	-0.0	-0.0
GR	853.9	0.0	851.2	75.0	851.5	150.0	850.3	200.0	843.9	250.0
GR	838.5	263.0	838.0	266.0	838.6	272.0	845.9	293.0	845.5	350.0
GR	844.9	450.0	844.9	550.0	839.4	604.0	839.4	650.0	839.5	750.0
GR	840.1	850.0	841.8	950.0	843.5	1050.0	851.0	1150.0	857.3	1250.0

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Ground data pulled from these stations and on next page

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X1	14000.	0.0	0.0	0.0	450.0	450.0	450.0	-0.0	.19	-0.0
X3	-0.0	-0.0	-0.0	200.0	-0.0	604.0	-0.0	-0.0	-0.0	-0.0

X1	15950.	18.0	564.0	600.0	1950.0	1950.0	1950.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	500.0	-0.0	600.0	-0.0	-0.0	-0.0	-0.0
GR	855.0	0.0	852.1	109.0	852.5	200.0	849.6	221.0	850.0	230.0
GR	847.0	310.0	845.9	400.0	845.0	500.0	845.0	564.0	840.8	572.0
GR	839.4	576.0	839.0	581.0	841.0	589.0	846.6	600.0	845.7	700.0
GR	847.4	800.0	852.4	900.0	858.2	1000.0	-0.0	-0.0	-0.0	-0.0

X1	16000.	18.0	600.0	610.0	50.0	50.0	50.0	-0.0	-0.0	-0.0
X3	-0.0	839.2	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
X4	1.0	839.3	600.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
GR	856.0	0.0	854.6	70.0	853.1	200.0	852.5	300.0	851.6	400.0
GR	850.8	500.0	850.6	599.9	838.3	600.0	838.3	602.0	838.1	604.0
GR	838.1	606.0	838.3	608.0	838.3	610.0	850.6	610.0	851.4	700.0
GR	853.2	800.0	855.8	900.0	858.1	1000.0	-0.0	-0.0	-0.0	-0.0
SB	-0.0	1.5	2.8	-0.0	10.0	-0.0	44.0	-0.0	839.0	839.2
X1	16100.	18.0	600.0	610.0	100.0	100.0	100.0	-0.0	-0.0	-0.0
X2	-0.0	-0.0	1.0	844.0	850.6	-0.0	-0.0	-0.0	-0.0	-0.0
X3	-0.0	839.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
X4	1.0	839.3	600.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
BT	18.0	0.0	856.0	830.0	70.0	854.6	830.0	200.0	853.1	830.0
BT	300.0	852.5	830.0	400.0	851.6	830.0	500.0	850.8	830.0	599.9
BT	850.6	830.0	600.0	850.6	839.3	602.0	850.6	842.5	604.0	850.6
BT	844.0	606.0	850.6	844.0	608.0	850.6	842.5	610.0	850.6	839.3
BT	610.0	850.6	830.0	700.0	851.4	830.0	800.0	853.2	830.0	900.0
BT	855.8	830.0	1000.0	858.1	830.0	-0.0	-0.0	-0.0	-0.0	-0.0
GR	856.0	0.0	854.6	70.0	853.1	200.0	852.5	300.0	851.6	400.0
GR	850.8	500.0	850.6	599.9	838.3	600.0	838.3	602.0	838.1	604.0
GR	838.1	606.0	838.3	608.0	838.3	610.0	850.6	610.0	851.4	700.0
GR	853.2	800.0	855.8	900.0	858.1	1000.0	-0.0	-0.0	-0.0	-0.0
X1	16150.	18.0	564.0	600.0	50.0	50.0	50.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	510.0	-0.0	620.0	-0.0	-0.0	-0.0	-0.0
GR	855.0	0.0	852.1	109.0	852.5	200.0	849.6	221.0	850.0	230.0
GR	847.0	310.0	845.9	400.0	845.0	500.0	845.0	564.0	840.8	572.0
GR	839.4	576.0	839.0	581.0	841.0	589.0	846.6	600.0	845.7	700.0
GR	847.4	800.0	852.4	900.0	858.2	1000.0	-0.0	-0.0	-0.0	-0.0
QT	5.0	11.0	25.0	48.0	62.0	100.0	-0.0	-0.0	-0.0	-0.0
X1	18700.	22.0	1240.0	1278.0	2600.0	2700.0	2650.0	-0.0	-0.0	-0.0
X3	-0.0	-0.0	-0.0	700.0	-0.0	1700.0	-0.0	-0.0	-0.0	-0.0
GR	845.3	0.0	844.2	100.0	843.0	200.0	843.2	300.0	842.7	400.0
GR	844.4	500.0	843.9	600.0	844.5	700.0	844.8	800.0	843.2	900.0
GR	843.0	1000.0	845.6	1100.0	843.5	1200.0	843.5	1240.0	840.6	1252.0
GR	844.4	1278.0	843.3	1300.0	843.3	1400.0	844.0	1500.0	844.0	1600.0
GR	849.9	1715.0	864.7	1800.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

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X1	20550.	10.0	280.0	315.0	1850.0	1850.0	1850.0	-0.0	-0.0	-0.0
GR	859.5	0.0	857.2	100.0	853.5	200.0	848.0	280.0	845.5	296.0
GR	845.5	300.0	848.0	315.0	854.8	400.0	857.2	500.0	865.6	600.0

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XLN	XLNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

0

CCHV= .300 CERV= .500

*SECNO .000

.000 9.50 835.30 .00 835.30 835.33 .03 .00 .00 832.30

.001320 100. 100. 100. 2 0 0 .00 10.05 610.00

*SECNO 16150.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.88

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SECNO	DEPTH	CWSEL	CRWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3470 ENCROACHMENT STATIONS=	510.0	620.0	TYPE=	1	TARGET=	110.000			
16150.000	5.61	844.61	.00	.00	844.64	.03	.03	.03	845.00
151.0	.0	151.0	.0	.0	108.5	.0	659.0	187.6	846.60
19.48	.00	1.39	.00	.000	.045	.000	.000	839.00	564.75
.000373	50.	50.	50.	2	0	0	.00	31.33	596.08

*SECNO 18700.000

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.07

3470 ENCROACHMENT STATIONS=	700.0	1700.0	TYPE=	1	TARGET=	1000.000			
18700.000	4.19	844.79	.00	.00	844.79	.00	.14	.01	843.50
25.0	8.8	8.4	7.8	413.8	92.3	368.0	688.9	214.1	844.40
35.90	.02	.09	.02	.120	.045	.120	.000	840.60	700.00
.000002	2600.	2650.	2700.	4	0	0	.00	840.55	1615.35

*SECNO 20550.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

3693 PROBABLE MINIMUM SPECIFIC ENERGY

3720 CRITICAL DEPTH ASSUMED

20550.000	.74	846.24	846.24	.00	846.48	.24	.02	.12	848.00
25.0	.0	25.0	.0	.0	6.3	.0	707.6	232.2	848.00
36.03	.00	3.97	.00	.000	.045	.000	.000	845.50	291.29
.038937	1850.	1850.	1850.	20	25	0	.00	13.12	304.41

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T1Meridian Township FIS
T2Updated 100-Year Flood STS Consultants Ltd. 4/94 DMR
T3Pine Lake Outlet

Start Q100 results and n-values

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	4.0	0	0	0	0	0	0	835.3	0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

n-values for left bank, channel and right bank, respectively

3470 ENCROACHMENT STATIONS=	.0	1100.0	TYPE=	1	TARGET=	1099.999			
13500.000	8.66	845.96	.00	.00	846.23	.26	.22	.08	849.00
255.0	.0	255.0	.0	.0	61.8	.0	867.0	209.2	849.00
15.84	.00	4.13	.00	.000	.045	.000	.000	837.30	1000.00
.006563	100.	100.	100.	2	0	0	-42.18	12.00	1012.00

*SECNO 13550.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 6.86

zero-values ignored, data at other stations indicates that where n is non-zero, 0.12 was used exclusively for left and right banks

3470 ENCROACHMENT STATIONS=	200.0	293.0	TYPE=	1	TARGET=	93			
13550.000	8.30	846.30	.00	.00	846.32	.02	.02	.07	843.90
255.0	3.7	251.3	.0	22.6	223.7	.0	867.2	209.2	100000.00
15.85	.16	1.12	.00	.120	.045	.000	.000	838.00	231.22
.000140	50.	50.	50.	2	0	0	.00	61.78	293.00

*SECNO 14000.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.40

3470 ENCROACHMENT STATIONS=	200.0	604.0	TYPE=	1	TARGET=	404.000			
14000.000	8.17	846.36	.00	.00	846.37	.01	.04	.00	844.09
255.0	2.3	172.7	80.0	20.1	218.0	468.2	872.1	211.5	846.09
16.06	.11	.79	.17	.120	.045	.120	.000	838.19	232.26
.000071	450.	450.	450.	2	0	0	.00	371.74	604.00

*SECNO 15950.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .58

3470 ENCROACHMENT STATIONS=	500.0	600.0	TYPE=	1	TARGET=	100.000			
15950.000	7.58	846.58	.00	.00	846.60	.02	.22	.01	845.00
255.0	24.2	230.8	.0	100.5	175.1	.0	894.1	222.0	100000.00
16.51	.24	1.32	.00	.120	.045	.000	.000	839.00	500.00
.000214	1950.	1950.	1950.	0	0	0	.00	99.94	599.94

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA

SLOPE XLOBL XLCH XLOBR ITRIAL IDC ICONT CORAR TOPWID ENDST

*SECNO 16000.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .36

16000.000	7.32	846.52	.00	.00	846.71	.19	.02	.08	839.30
255.0	.0	255.0	.0	.3	73.2	.0	894.3	222.1	850.60
16.51	.04	3.48	.00	.120	.045	.000	.000	839.20	599.93
.001632	50.	50.	50.	2	0	0	.00	10.07	610.00

SPECIAL BRIDGE

SB	XK	XKOR	COFQ	RDLEN	BWC	BWP	BAREA	SS	ELCHU	ELCHD
	.00	1.50	2.80	.00	10.00	.00	44.00	.00	839.00	839.20

*SECNO 16100.000

PRESSURE FLOW

EGPRS	EGLWC	H3	QWEIR	QPR	BAREA	TRAPEZOID AREA	ELLC	ELTRD	WEIRLN
847.30	846.71	.00	0.	255.	44.	50.	844.00	850.60	0.
16100.000	8.15	847.15	.00	.00	847.30	.15	.59	.00	839.30
255.0	.0	255.0	.0	.3	81.4	.0	894.5	222.1	850.60
16.52	.04	3.13	.00	.120	.045	.000	.000	839.00	599.93
.001223	100.	100.	100.	2	0	0	.00	10.07	610.00

*SECNO 16150.000

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 3.15

3470 ENCROACHMENT STATIONS=	510.0	620.0	TYPE=	1	TARGET=	110.000			
16150.000	8.34	847.34	.00	.00	847.36	.02	.01	.04	845.00
255.0	29.7	223.3	2.0	126.4	202.8	16.6	894.7	222.2	846.60
16.53	.24	1.10	.12	.120	.045	.120	.000	839.00	510.00
.000123	50.	50.	50.	2	0	0	.00	110.00	620.00

*SECNO 18700.000

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SECNO	DEPTH	CWSEL	CRISW	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 4.58

3470 ENCROACHMENT STATIONS=	700.0	1700.0	TYPE=	1	TARGET=	1000.000			
18700.000	6.78	847.38	.00	.00	847.38	.00	.01	.00	843.50