ST. LOUIS COUNTY BOARD OF ADJUSTMENT STAFF REPORT

INSPECTION DATE: 2/22/2024 **REPORT DATE: 2/26/2024** **MEETING DATE: 3/14/2024**

APPLICANT INFORMATION

APPLICANT NAME: Northern Environmental Solutions

APPLICANT ADDRESS: 3867 Sandberg Road, Duluth, MN 55810

OWNER NAME: Brett & Iris Hiemenz

SITE ADDRESS: 1484 Melrude Road, Cotton, MN 55724

LEGAL DESCRIPTION: PART OF LOT 3 LYING S OF NLY 723 85/100 FT AND EX RY RT OF WAY, S29, T55N, R16W (Ellsburg)

PARCEL IDENTIFICATION NUMBER (PIN): 320-0010-04705

VARIANCE REQUEST: The applicant is requesting relief from St. Louis County SSTS Ordinance 61 adopted Technical Standards 7080.2150, Subpart 2 (F), to allow a subsurface sewage treatment system installation at a reduced shoreline setback, a reduced property line setback, and a reduced structure setback.

PROPOSAL DETAILS: The applicant is requesting to replace a subsurface sewage treatment system at a reduced shoreline setback of 48 feet where 75 feet is required, to replace a subsurface sewage treatment system at a reduced property line setback of 9 feet where 10 feet is required, and to replace a subsurface sewage treatment system at a reduced structure setback of 2 feet where 10 feet is required. This system is a replacement to abandon an existing failing system.

PARCEL AND SITE INFORMATION

ROAD ACCESS NAME/NUMBER: Melrude Rd./ CSAH 59

ROAD FUNCTIONAL CLASS: Local Public Road

LAKE NAME: Dinham Lake

LAKE CLASSIFICATION: RD

RIVER NAME: N/A

RIVER CLASSIFICATION: N/A

DESCRIPTION OF DEVELOPMENT ON PARCEL: The parcel currently contains a dwelling, garage, and several small storage buildings.

ZONE DISTRICT: SMU 7

PARCEL ACREAGE: 0.60 ACRES

LOT WIDTH: APPROX. 88 FEET

FEET OF ROAD FRONTAGE: 0 FEET

FEET OF SHORELINE FRONTAGE: 550 FEET

PARCEL AND SITE INFORMATION

VEGETATIVE COVER/SCREENING: There is adequate vegetation screening from the shoreline and neighboring properties.

TOPOGRAPHY: There is an approximate elevation change of 14 feet, steeply sloping from the West side to the East side of the property, towards the shoreline.

FLOODPLAIN ISSUES: N/A

WETLAND ISSUES: N/A

ADDITIONAL COMMENTS ON PARCEL: There is a well located on the property, requiring a tank setback of 50 feet.

FACTS AND FINDINGS

A. Official Controls:

1. Ordinance 61 states that all SSTS components must be setback in accordance with Table VII of the SSTS Technical standards.
2. The required shoreline setback on a Recreational Development Lake is 75 feet. The applicant is requesting a reduced shoreline setback of 48 feet.
3. The required property line setback is 10 feet. The applicant is requesting a reduced property line setback of 9 feet.
4. The required setback from an existing structure is 10 feet. The applicant is requesting a reduced structure setback of 2 feet.

5. **Practical Difficulty:**

1. The parcel is zoned Shoreland Multiple Use - 7. The lot is 0.60 acres and 88 feet wide where 1.0 acre and 150 feet lot width is required.
2. There is minimal conforming area for replacement, due to the parcel's narrow width and acreage.
3. The parcel contains a drilled well which requires a 50 foot setback, which limits replacement area for the system.

6. **Essential Character of the Locality:**

1. The area is zoned Shoreland Multiple Use - 7 consisting of conforming and nonconforming residences.
2. There have been no similar variance requests within the area.

7. **Other Factor(s):**

1. There is limited septic replacement area due to the lot width and acreage.

BOARD OF ADJUSTMENT CRITERIA FOR APPROVAL OF A VARIANCE

1. **Is the variance request in harmony with the general purpose and intent of official controls?**
2. **Has a practical difficulty been demonstrated in complying with the official controls?**

3. **Will the variance alter the essential character of the locality?**
4. **What, if any, other factors should be taken into consideration on this case?**

CONDITIONS

Conditions that may mitigate the variance for relief from St. Louis County SSTS Ordinance 61 adopted Technical Standards 7080.2150 Subpart 2 (F) to allow the replacement of a subsurface sewage treatment system at a reduced shoreline setback, at a reduced property line setback, and at a reduced structure setback, include, but are not limited to:

1. All other Onsite Wastewater SSTS standards shall be met.
2. Following system installation, an inspection shall be performed by a qualified inspector to ensure setbacks are met prior to issuing Certificate of Compliance.
3. All other local, county, state and federal regulations shall be met.

ST. LOUIS COUNTY, MN
PLANNING AND COMMUNITY DEVELOPMENT DEPARTMENT
(On-Site Wastewater Division)

Duluth
Government Services Center

320 West 2nd Street, Suite 301
Duluth, MN 55802
Phone (218) 725-5200
Toll Free (800) 450-9278

Virginia
Government Services Center
201 South 3rd Avenue West
Virginia, MN 55792
Phone (218) 749-0625
Toll Free (800) 450-9278

Permit Construction Application Subsurface Sewage Treatment System

General

- This permit application form is used to apply for a Permit to Construct. Additional information: www.stlouiscountymn.gov/septic

Enter the Primary PIN and Associated PIN (if applicable) of the property to be reviewed.
PIN is found on your Property Tax Statement. For example, 123-1234-12345. Primary PIN: Parcel where Structure/SSTS are located. Associated PIN: Additional and/or adjacent property that you own or that is related to the project.
County Land Explorer: https://www.stlouiscountymn.gov/explorer
Property Lookup: http://apps.stlouiscountymn.gov/auditor/parcelInfo2005Iframe

Primary PIN	**320-0010-04705**
Associated PINs	

Enter Applicant Information

I am a:	**Contractor**
Are you an LLC Business?	**Yes**
LLC Business Name	**Northern Environmental Solutions**
Applicant Name:	**Mike Parrott**
Address:	**3867 Sandberg RD** **--**
City:	**Duluth**
State:	**MN**
Zip:	**55810**
Primary Phone:	**218-600-8808**
Mobile Phone:	**--**
Email:	**mparrott.nes@gmail.com**
Preferred Contact Method:	**Any**
Contact Person Name:	**--**
Contact Person Phone:	**--**

Property Owner Name and Contact Information.

If the property owner information we have on file is not correct, please enter the current owner information.

Property Owner Name:	**HIEMENZ BRETT**
Site Address:	**1484 MELRUDE ROAD**
	--
City:	**COTTON**
State/Province:	**MN**
Zip:	**55724**
Primary Phone:	**(218)330-3736**
Mobile Phone:	**--**
Email:	**brett.hiemenz@gmail.com**
Preferred Contact Method:	**Any**
Contact Person Name	**--**
Contact Person Phone	**--**

Mailing Address Information

This address can default from the address you selected. If the values defaulted are not correct, please enter the correct information.

Same as Property address?	☐ **Yes**
Same as Applicant address?	☐ **Yes**
Name:	**HIEMENZ BRETT**
Address:	**1484 MELRUDE ROAD**
	--
City:	**COTTON**
State/Province:	**MN**
Zip:	**55724**
Primary Phone:	**(218)330-3736**
Mobile Phone:	**--**
Email:	**--**

Provide additional email recipients	☐ **Yes**

SITE INFORMATION

Enter Site information

Do you need to request a 911 address number and sign?	**No**
Is this a leased property?	**No**

Is this for Residential or Commercial?

Residential

Is the property used year round or used seasonally?

Year round

Is this project within 300 feet of a river/stream or 1,000 feet of a lake?

	Yes
River/Lake Name	**Dinham Lake**

Is this property connected to a Common Interest Community?

No

Is this serving multiple dwellings sharing a SSTS component?

No

Is this related to a Point of Sale Requirement?

No

Is the SSTS located in a floodplain?

No

APPLICATION REASON

What are you applying for?	**Replacing the existing SSTS**
Explain why:	**System is backing up into the home.**
Permit Number (being replaced, if known):	**--**

RESIDENTIAL WORKSHEET

Select the System Type

Type I System

"Type I System" means an ISTS that follows a standard trench, bed, at-grade, mound, or graywater system design in accordance with MPCA rules, Minnesota Rules, Chapter 7080.2200 through 7080.2240.

	Yes
System Type	**Seepage or Pressure Bed**

Type II System

"Type II System" means an ISTS with acceptable modifications or sewage containment system that may be permitted for use on a site not meeting the conditions acceptable for a standard Type I system. These include systems on lots with rapidly permeable soils or lots in floodplains and privies or holding tanks.

No

Type III System

"Type III System" means a custom designed ISTS having acceptable flow restriction devices to allow its use on a lot that cannot accommodate a standard Type I soil treatment and dispersal system.

No

Type IV System

"Type IV System" means an ISTS, having an MPCA registered pretreatment device and incorporating pressure distribution

and dosing, that is capable of providing suitable treatment for use where the separation distance to a shallow saturated zone is less than the minimum allowed.

No

Type V System

"Type V System" means an ISTS, which is a custom engineered design to accommodate the site taking into account pretreatment effluent quality, loading rates, loading methods, groundwater mounding, and other soil and other relevant soil, site, and wastewater characteristics such that groundwater contamination by viable fecal coliforms is prevented.

No

WELL INFORMATION

Enter information about the well.

Do you have a proposed water source?

No

Enter # of existing water sources on the property

1

After completing the following information for the 1st water source, please use the Add Another Water Source button to add the additional water source(s) information.

Water Source Type	**Well**
Well #	**428006**
Well Depth (Feet)	**84**
Case Depth (Feet)	**84**
Well Type	**Drilled**

DESIGNER & INSTALLER INFORMATION

Select the Designer

Licensed Business Name or Designer Name	**Northern Environmental Solutions LLC**
License #	**4072**
Certification #	**1789**
Designer's Comments (To On-Site Wastewater Staff)	**--**

Select the Installer (if known)

Licensed Business Name or Installer Name	**--**
License #	**--**
Certification #	**--**
Installer's Comments (To On-Site Wastewater Staff)	**--**

STRUCTURE - RESIDENTIAL

Enter Building Type and Water Uses
Home, mobile home, hunting shack, cabin, RV

Dwelling	**Yes**

Dwelling

# of Bedrooms	**3**
Plumbing	☑ **Yes**
Basement Plumbing	☑ **Yes**
Garbage Disposal	☐ **Yes**
Clothes Washer	☑ **Yes**
Dishwasher	☑ **Yes**
Water Conditioning Unit	☐ **Yes**
Furnace w/Humidifier	☐ **Yes**
Bathtub > 40 gal.	☐ **Yes**
Sewer Grinder Pump	☐ **Yes**
Multi-Family	**No**
Accessory Dwelling	**No**
Accessory Structure w/water	**--**
Other	**No**

Other information to be considered for this application

--

Will this project require a Septic Variance?

Yes

VARIANCE WORKSHEET

Enter Variance information. About SSTS Variances Pursuant to Ordinance 61, Article V, Section 3.0 A property owner may request a variance from the standards specified in the Ordinance pursuant to county policies and procedures. Variances shall only be permitted when they are in harmony with the general purposes and intent of this Ordinance where there are practical difficulties or particular hardship in meeting the strict letter of this Ordinance, excluding the technical standards. Certain deviations may require the approval of the MPCA or the MN Department of Health.

Describe the specific provision(s) in the ordinance from which the variance is requested.

Setbacks

Describe the practical difficulty that prevents compliance with the rule.

In order to put in a new septic a variance will be needed for the setback from the lake, house and property line.

Describe the alternative measures that will be taken to achieve a comparable degree of compliance with the purposes and intent of the applicable provisions.

Holding tank that would need a variance
for the lake setback....

Identify cost considerations preventing reasonable use of the property under the terms of this ordinance

Holding tank would have to be pumped every month and will be expensive.

OFFICE USE ONLY

ES Area	**JO**
Office	**Duluth**

Section	**29**
Township	**55**
Range	**16**
Variance Department Recommendation	**--**

Specify reasons for recommendation:
Hint: (Reference pertinent sections of the Ordinance and ISTS Construction Standards)

	--
Hearing Info. and Outcome	**--**
Board of Adjustment Hearing Date	**--**
Permit #	**--**
Variance Granted	**--**
Case #	**--**

VARIANCE AGREEMENT

By submitting this request for variance from the Ordinance and the Construction Standards, I certify and agree that no substantial health hazard is likely to occur therefrom and an unnecessary hardship might result in strict compliance with the Ordinance and Standards.
I further agree to install a sewage treatment system in accordance with the permit application, plans, and specification that are made as part of this variance request, in addition to paying the Variance Fee associated with this request.

Northern Environmental Solutions

SEPTIC DESIGNS | INSPECTIONS | INSTALLATIONS | LAND CLEARING | WATER TESTING

LICENSE #4072 PHONE 218-600-8808

Client: Brett Hiemenz

Address: 1448 Melrude Rd

Cotton MN 55724

PID# 320-0010-4705

System Type: I Pressure Bed

Construction Notes: Septic site and alternative site must be protected. Prior to installation the County Must verify the soils and proposed septic site for this design to be valid. Gopher one must be called to locate utilities, all required setbacks must be met and verified prior to installation. All manhole covers must be to grade. It is the responsibility of the installer to verify that all required setbacks will be met prior to installing the system in this design. It is up to property owner to protect septic drain field sites (primary site and alternate site) from damage. Rope off area to be protected. Do not drive on sites with a wheeled vehicle of any type. Only a track type vehicle can be used. **All**

sewer pipe that runs under or through a driveway must be insulated and protected from frost. A clean out must be installed by the building and one added every 100 ft of pipe installed.

Please review the stakes I have placed on your property. The stakes indicate the location of drain field and tank area. I request that the property lines be verified to be 10 feet or more from the stakes.

It is up to property owner to preform maintenance on tank system by pumping

This design must be submitted for permit. Once local regulatory authority has issued a permit our responsibility for design is done.

Stakes are in place for the primary drain field area and marked. Any changes to be made should be done before approval of design.
Call 218- 600-8808 for changes.

Any changes to design will be at a cost for new design.

Any tree removal is up to homeowner to have removed. If this design is for a mound trees need to be cut to grade. Do not remove roots or stumps.
Before digging get locates! Gopher state one call 1-800-252-1166
Any results and /or information in this report are strictly the interpretation of the licensed individual issuing the report. All field work and test results are done to the best of the individual's ability, and under no circumstances is any work to be performed or action taken as a result of this report prior to full review and approval by the proper governing authorities.

Northern Environmental Solutions LLC
3869 Sandberg RD
Duluth MN 55810
LIC # 4072
218-600-8808

Construction notes: prepared for Brett Hiemenz

This system is going to be a type I Pressure Bed.

Tank size: A new 1060Septic and a 540-pump tank with alarm and block. All electric wiring needs to be protected around the pump and septic tanks. An event counter must be installed when type III is used.

All manhole lids bring to grade and secure.

Install inspection pipes all inspection must be 4" in diameter. Where needed, also install a clean out where needed in the supply line and end of laterals.

Pump: GPM 31 total head 16 feet:

All pumps piping, and controls must have access for servicing or replacement without entering the pump tank.

Piping: SCH 40 4'' or 3: house to septic tank 13' FT= field verify
SCH, 40 2'' pump tank to rock bed: 14' FT= field verify
From pump to tank place 2''SCH. 40 inside 4''SCH 40 help protect sagging of 2'' (5-10 FT)

Install insulated pipe across driveway, also place straw on all new construction to help prevent freezing.

MONITERING WILL NEED TO BE DONE:

SOILS MUST BE VERIFIED WITH THE COUNTY PRIOR TO THE INSTALLATION OF THIS SYSTEM!

It is up to the installer to receive and place clean material for mound and pressure bed construction accepting substandard material can cause the finished system to fail sooner!! Note: as built form, send to country. Fill out elevation form send to lug. Fill out abandonment form send to lug.

Make sure all water is diverted from mound and tanks,

All paperwork is included to send to LUG!!!!

Northern Environmental Solutions LLC
3869 Sandberg RD
Duluth MN 55810
LIC#4072
218-600-8808

Maintenance tips for new systems

The new system should be pumped after he first year.
(reason to see how your system is working and the pumping company can recommend how often your system should be pumped)

Alarms are put on systems for a reason to help the system owner avert back up into the home. Alarms should be checked each year when you change your smoke detectors battery. Ask your installer to show you how to check alarms (when an alarm goes off call for maintenance) \
Keep from driving on your system. (a riding lawn mower is excepted)
This is an option if you can put it somewhere else.
Do not put water softener water back wash into septic.
Do not put drain tile water into septic.
Do not put 90% furnace water into septic.

The last pages of design has information on management tasks of your new system.

St. Louis County, MN

PERMIT

Residential Construction Application

Subsurface Sewage Treatment System

Form **3000** Rev. 12-28-2021

This permit application form is used to apply for a Permit to Construct. Additional Information: www.stlouiscountymn.gov/septic.

PROPERTY IDENTIFICATION NUMBER (PIN) and SITE

Primary PIN: 3 2 0 - 0 0 1 0 - 4 7 0 5 | Associated PIN: - -

PIN is found on your Property Tax Statement (E.g. 123-1234-12345), searching the County Land Explorer at https://gis.stlouiscountymn.gov/landexplorer/, or searching the Property Lookup at http://apps.stlouiscountymn.gov/auditor/parcelInfo2005Iframe/.

Site Address **1484 Melrude Rd** | City **Cotton** | Zip **55724**

☐ Check to request a 911 address number and sign. Visit https://www.stlouiscountymn.gov/departments-a-z/sheriff/emergency/911-emergency#5143571-obtaining-a-911-address for addressing information.

APPLICANT (Property Owner)

Name **Brett Hiemenz** | Date **12/28/2023**

Address **1484 Melrude Rd** | City **Cotton** | State **MN** | Zip **55724**

Email | Phone **218-330-3736** | Phone

CONTACT (If Different than Applicant Above)

Name

Email | Phone | Phone

MAILING INFORMATION (If Different than Site Address)

☐ US Mail | Address | City | State | Zip

✓ Email | Email **brett.hiemenz@gmail.com**

REASON FOR APPLICATON

✓ New SSTS | ☐ Replacing the Existing SSTS **Why Failing** | ☐ Point of Sale Requirement

SYSTEM TYPE (refer to design summary) and PERMIT FEES

Type I		Type II		Type III		Type IV		Type V	
☐ Non-Shoreland	$310	☐ Holding Tank	$255	☐ System	$350	☐ System	$400	☐ System	$500
✓ Shoreland	$535	☐ Privy/Outhouse	$105	☐ Component Add/Replace	$205	☐ Component Add/Replace	$205	☐ Component Add/Replace	$205
☐ Component Add/Replace	$205	☐ Floodplain-Shoreland	$315						
		☐ Component Add/Replace	$205						

Please make checks payable to: St. Louis County Auditor

SITE INFORMATION *(Check all that apply)*

✓ Yes	☐ No	Is the SSTS within 1,000 feet of a lake or 300 feet of a river? **Lake/River Name Dinham Lake**
✓ Yes	☐ No	Is the property used year round?
☐ Yes	✓ No	Is the property part of a CIC (Common Interest Community)? If yes, include the Associated PIN on this Application.
☐ Yes	✓ No	Is this property serving multiple dwellings sharing a SSTS component?
☐ Yes	☐ No	Is this leased property? If yes, you must obtain & attach the Lessor's written authorization for this project.

Leased From: ☐ MN Power | ☐ St. Louis County | ☐ MN DNR | ☐ US Forest Service | ☐ Other

WELL INFORMATION *(Check all that apply)*

Water Source	☐ Proposed Well	✓ Existing Well	☐ Hand Carried	☐ Surface/Lake Water	☐ Municipal
Well Type	✓ Drilled	☐ Sandpoint	☐ Dug	Is there one or more wells? ☐ Yes ✓ No	
Well #	**428068**	Well Depth Feet **84**		Case Depth Feet **84**	

St. Louis County, MN

PERMIT

Residential Construction Application

Subsurface Sewage Treatment System

Form **3000**

Rev. 12-28-2021

DESIGNER

Licensed Business Name **Northern Environmental Solutions**

License # **4072**	Certification # **1789**

Designer's Comments *(To On-Site Wastewater Staff)*

STRUCTURE

Building Type and Water Uses Check all that apply		# of Bedrooms	Seasonal Use Only	Plumbing	Basement Plumbing	Garbage Disposal	Clothes Washer	Dishwasher	Water Conditioning Unit	Furnace w/Humidifier	Bathtub > 40 gal	Sewer Grinder Pump
✓ Dwelling	Home, mobile home, hunting shack, cabin, RV	3	☐	✓	✓	☐	✓	✓	☐	☐	☐	☐
☐ Multi-Family	Multiple units		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ Accessory Dwelling	Guest cottage, bunk house		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ Accessory Structure	Garage, pole building, shed, sauna, gazebo screen-house	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
☐ Other			☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Other information to be considered for this application

AGREEMENT

By submitting this application, the entire contents of which are considered to be public data, I certify and agree that I am the owner or the authorized agent of the owner of the above property, and that all uses will conform to the provisions of St. Louis County. I further certify and agree that I will comply with all conditions imposed in connection with the approval of the application. Applicants may be required to submit additional property descriptions, property surveys, site plans, building plans and other information before the application is accepted or approved. ***Intentional or unintentional falsification of this application or any attachments thereto will make the application, any approval of the application and any resulting permit invalid.*** I authorize St. Louis County staff to inspect the property to review the application and for compliance inspections. Furthermore, by submitting this application, I release St. Louis County and its employees from any and all liability and claims for damages to person or property in any manner or form that may arise from the approval of the application or any related plans, the issuance of any resulting permit or the subsequent location, construction, alteration, repair, extension, operation or maintenance of the subject matter of the application.

CONTACT Planning and Community Development (On-Site Wastewater Division)

Duluth Office		Virginia Office	
Government Services Center 320 W 2nd Street, Suite 301 Duluth, MN 55802	Phone (218) 725-5200 Toll Free (800) 450-9777 www.stlouiscountymn.gov/septic	Government Services Center 201 South 3rd Avenue West Virginia, MN 55792	Phone (218) 749-0625 Toll Free (800) 450-9777 www.stlouiscountymn.gov/septic

OFFICE USE ONLY

Amount Paid	Paid by	Cash	Check #	Permit #
Revenue Code	Received By	☐ Mail ☐ IP	Date RIO	

St. Louis County, MN

PERMIT

SSTS Dwelling Classification Worksheet

Subsurface Sewage Treatment System

Form **3011**

Rev. 12-28-2021

This form is used to complete a SSTS Design. Additional Information: www.stlouiscountymn.gov/septic

SITE INFORMATION

Site Address **1484 Melrude Rd**	City **Cotton**	Zip **55724**	Parcel ID **320-0010-04705**

DWELLING INFORMATION

Dwelling dimensions (ft) **26** x **49**	Finished Square Feet **2000**
Number of Bedrooms **3**	Finished Square Feet per Bedroom **667**
Information provided by **owner**	

WATER USING DEVICES (check all that apply)

✓ Clothes Washing Machine	☐ Bathtub > 40 gallons
✓ Dishwasher	☐ Garbage Disposal
☐ Water Conditioning Unit	☐ Self-cleaning Humidifier in Furnace

CLASSIFICATION

☐ I	More than 800 finished square feet per bedroom and/or more than 2 water using devices
✓ II	Between 500 and 800 finished square feet per bedroom and not more than 2 water using devices
☐ III	Less than 500 finished square feet per bedroom and not more than 2 water using devices
☐ IV	Dwellings with wastewater systems designed under part 7080.2240

Extracted from SLC Ordinance 61 Technical Standards

7080.1860 DESIGN FLOW (GALLONS PER DAY).

TABLE IV

Classification of dwelling

	I**	II	III	IV
Number of bedrooms	Gallons per day			
2 or less	300	225	180	*
3	450	300	218	*
4	600	375	256	*
5	750	450	294	*
6	900	525	332	*

* Flows for Classification IV dwellings are 75 percent of the values as determined for Classification I, II, or III systems.

** Design flows for Class I dwellings wastewater systems with design flows at a minimum 100 gallons per day per bedroom must meet the requirements of 7080.2300, Item I.

For more than six bedrooms, the design flow is determined by the following formulas:

Classification I: Classification I dwellings are those with more than 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, or where more than two of the following water-use appliances are installed or anticipated: clothes washing machine, dishwasher, water conditioning unit, bathtub greater than 40 gallons, garbage disposal, or self-cleaning humidifier in furnace. The design flow for Classification I dwellings is determined by multiplying 150 gallons by the number of bedrooms.

Classification II: Classification II dwellings are those with 500 to 800 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification II dwellings is determined by adding one to the number of bedrooms and multiplying this result by 75 gallons.

Classification III: Classification III dwellings are those with less than 500 square feet per bedroom, when the dwelling's total finished floor area is divided by the number of bedrooms, and where no more than two of the water-use appliances listed in Classification I are installed or anticipated. The design flow for Classification III dwellings is determined by adding one to the number of bedrooms, multiplying this result by 38 gallons, then adding 66 gallons.

Classification IV: Classification IV dwellings are dwellings with wastewater systems designed under part 7080.2240.

St. Louis County, MN

PERMIT

SSTS Design Summary

Subsurface Sewage Treatment System

Form **3002**

Rev. 07-27-2022

This form is used to complete a SSTS Design. Additional Information: www.stlouiscountymn.gov/septic

SITE INFORMATION

Site Address **1484 Melrude Rd** | City **Cotton** | Zip **55724** | Parcel ID **320-0010-04705**

DESIGNER

Name **Northern Environmental Solutions** | Date **12/28/2023**

Email **mparrott.nes@gmail.com** | Phone **218-600-8808** | Phone

SYSTEM INFORMATION

MPCA Type ✓ Type I ☐ Type II ☐ Type III ☐ Type IV ☐ Type V | Dwelling Classification ☐ I ✓ II ☐ III ☐ IV

☐ Residential ☐ Commercial ☐ Seasonal ☐ Other | Well Casing Depth **84**

# Bedrooms **3**	# Water using devices **2**	Total Finished Sq ft **2000**	Sq ft / Bedroom **667**
Design Flow **300**	Water Meter **No**	Pressure Test **yes**	Grinder or Disposal **No**
CLR **10** / SLR **.6**		Limiting Soil Type **47**	Limiting Layer Depth (in)

SSTS Flow Description

House to 1060 Septic tank to 540 Pump tank to pressure bed.

TANK INFORMATION

Type (Septic, Pump, Holding etc.)	Size (gallons)	Status (New, Existing)	Material (Precast, Plastic)	Alarm (Yes, No)	Insulated (Yes, No)	Bedded (Yes, No)	Building Sewer (Gravity, Pressure, Both)
Septic	**1060**	**New**	Plastic	**Yes**	**Yes**	**Yes**	**Gravity**
Pump	**540**	**New**	Plastic	**Yes**	**Yes**	**Yes**	**Gravity**

Gallons per inch of pump tank **12.27**

Tank Installation & Pumping comments

DISTRIBUTION INFORMATION

☐ Gravity | ☐ Drop Box ☐ Distribution Box

✓ Pressure | Gal/Min **31** | Ft Head **16** | Pump Model **Must meet pump curve**

✓ Event Counter ☐ ETM | Time Dose Panel **No** | Timer On | Timer Off

Max Dose **75** | Min. Dose **60.8** | Drainback **2.4** | Dose + Drainback **72.4** | Float Tether (in) **5.9**

Manifold		Laterals	
Location ✓ Center	☐ End	Number **6**	Length (ft) **24**
Size (in) **2**		Size (in) **1.5**	
Insulated **No**		Orifices	

St. Louis County, MN

PERMIT

SSTS Design Summary

Subsurface Sewage Treatment System

Form **3002**

Rev. 07-27-2022

Size (in)	**5/32**	# Per lateral	**9**
Spacing (in)	**36**	Shields	**NO**

DRAINFIELD INFORMATION

Trench

Number		Width (ft)		Length (ft)		Media Type	
Max Depth (in)		Rock (in)		Cover (in)		Sand Liner (in)	

Bed

Number	**1**	Width (ft)	**10**	Length (ft)	**50**	Media Type	**Rock**
Max Depth (in)	**11**	Rock (in)	**10**	Cover (in)	**12**	Sand Liner (in)	**12**

At-Grade

Width (ft)	Length (ft)	Number	Up Berm (ft)	Down Berm (ft)

Mound

Number	Bed Width (ft)	Bed Length (ft)	Media Type
Sand (in) to	Rock (in)	Cover (in)	Total Width (ft)
Up Berm (ft)	Down Berm (ft)	Sand (yd³)	Total Length (ft)

Registered Filter Product

Filter Class ☐ Intermittent/Single Pass ☐ Recirculating ☐ Subsurface Flow ☐ Other

Media Type ☐ Sand ☐ Peat ☐ Textile/Synthetic ☐ Constructed Wetlands

No. of Filters	Rock Bed Dimensions (ft) x	Bed Media Depth (in)

Manufacturer

Registered Aerobic Treatment System

Type ☐ Suspended Growth ☐ Fixed Film ☐ Sequencing Batch ☐ Other

Gallons/day	No. of Units	Disinfection (yes or no)	If yes, chermical or UV

Manufacturer

Designer Comments

CONTACT Planning and Community Development (On-Site Wastewater Division)

Pump Selection for a Pressurized System - Single Family Residence Project

Parameters

Discharge Assembly Size	2.00	inches
Transport Length	14	feet
Transport Pipe Class	40	
Transport Line Size	2.00	inches
Distributing Valve Model	None	
Max Elevation Lift	5	feet
Manifold Length	8	feet
Manifold Pipe Class	40	
Manifold Pipe Size	1.50	inches
Number of Laterals per Cell	6	
Lateral Length	24	feet
Lateral Pipe Class	40	
Lateral Pipe Size	1.50	inches
Orifice Size	5/32	inches
Orifice Spacing	3	feet
Residual Head	3.5	feet
Flow Meter	None	inches
'Add-on' Friction Losses	5	feet

Calculations

Minimum Flow Rate per Orifice	0.57	gpm
Number of Orifices per Zone	54	
Total Flow Rate per Zone	30.6	gpm
Number of Laterals per Zone	6	
% Flow Differential 1st/Last Orifice	0.2	%
Transport Velocity	2.9	fps

Frictional Head Losses

Loss through Discharge	1.9	feet
Loss in Transport	0.2	feet
Loss through Valve	0.0	feet
Loss in Manifold	0.1	feet
Loss in Laterals	0.0	feet
Loss through Flowmeter	0.0	feet
'Add-on' Friction Losses	5.0	feet

Pipe Volumes

Vol of Transport Line	2.4	gals
Vol of Manifold	0.8	gals
Vol of Laterals per Zone	15.2	gals
Total Volume	18.5	gals

Minimum Pump Requirements

Design Flow Rate	30.6	gpm
Total Dynamic Head	15.7	feet

300 ÷ 4 = 75 gal MAX Dose
use 70 gal Dose

MIN Dose 60.8 gal
Drain Back 2.4 gal
GPM 31
TDH 16

PumpData

Legend

System Curve:
Pump Curve:
Pump Optimal Range:
Operating Point:
Design Point:

Orenco
SYSTEMS
PROTECTING THE WORLD'S WATER

IN GROUND CALCULATIONS (Spreadsheet)

Name of Applicant: ______ Brett Hiemenz

1. SITE CONDITIONS

Evaluate the site and soils report for the following:
> Surface water movement
> Measure Elevations and distances on the site so that slope, contours and available areas can be determined.
> Description of several soil profiles where the system will be located.
> Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and setbacks.
(Note: shaded boxes to be filled in by designer)

Slope = 15 %

Occupancy: One or two family dwelling   # of bedrooms = 3

Public facility (I.e. non-residential). Daily wastewater flow ______ GPD
(provide particulars on separate sheet)

Wastewater: Typical residential BOD5   Y/N = Y
Or other: BOD5= ______ mg/L

Suitable area: Cross slope distance = 60 Feet
Width = 40 Feet

Soil limiting factor= Fine Sand   Depth to limiting factor = 47 Inches

60

In-situ soil application rate used ______ gal/sf/day

2. DESIGN WASTEWATER FLOW (DWF)

One or two-family dwelling:

DWF = gal/day/bedroom (generally 150) x # of bedrooms
DWF = 100 gal/day/bedroom x 3 # of bedrooms
DWF = 300 gal/day

Public Facilities

DWF = Sum of each wastewater flow per source per day x 1.5
DWF = ______ gal/day x 1.5
DWF = 0 gal/day

3. WIDTH AND LENGTH OF THE DISTRIBUTION CELL

1. Determine the design loading rate (DLR) for the site

Select the effluent application rate for the most restrictive soil horizon in contact with the distribution cell that matches the soil conditions. The effluent application rate selected is the design loading rate (DLR) for the site.

DLR = 0.6 gpd/sf

2. Determine the distribution cell area.

Calculate the distribution cell area by dividing the daily design wastewater flow (DWF) by the design loading rate (DLR).

Distribution cell area = DWF/DLR
Distribution cell area = 300 gpd divided by 0.6 gpd/sf
Distribution cell area = 500 sf

3. Select a width (A) for the distribution cell. (Usually 3 feet)

A = 10

4. Determine the distribution cell length.

Calculate the distribution cell length (B) by dividing the required distribution area by the distribution cell width (A).

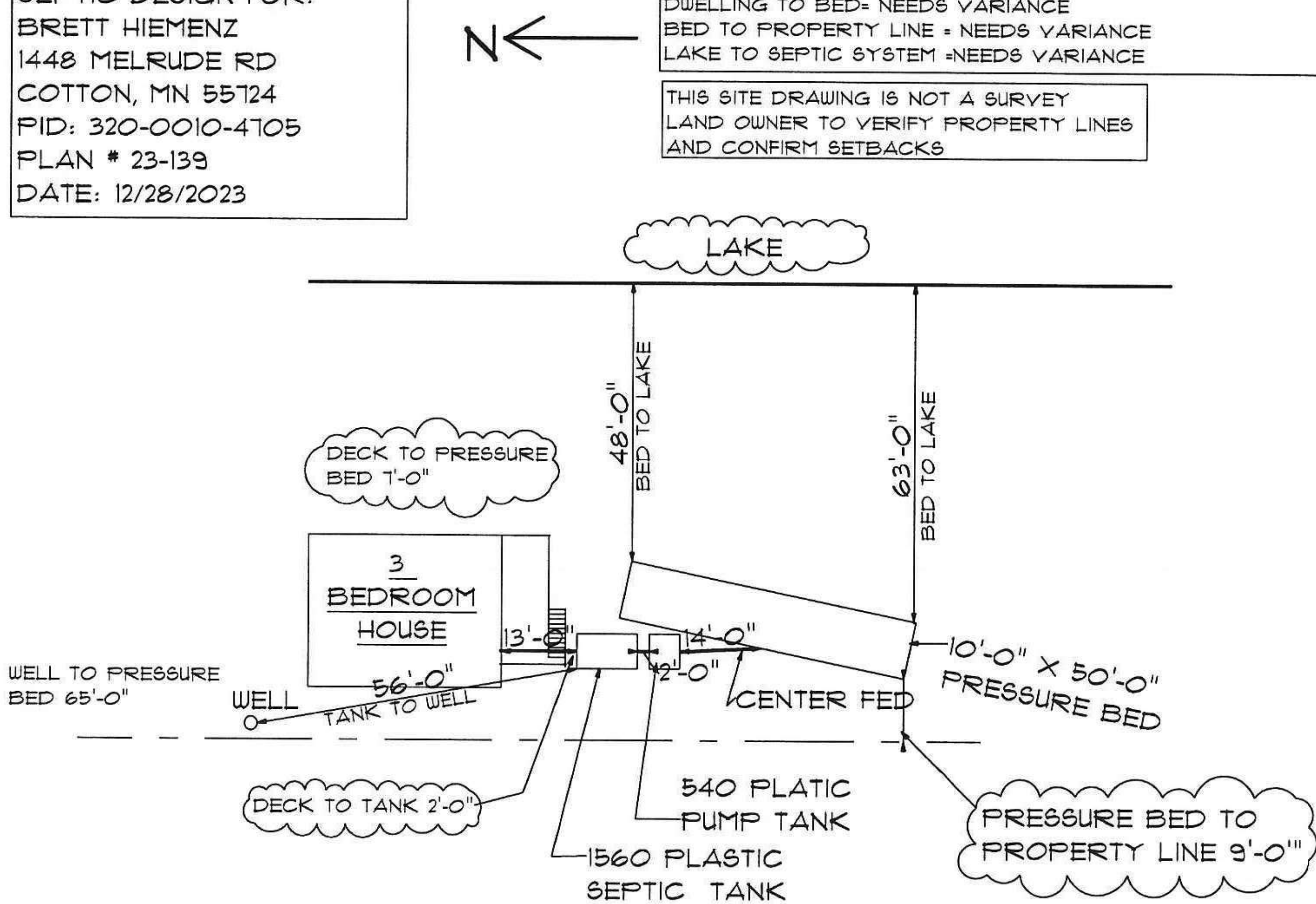
B = Distribution cell area divided by A
B = 500 sf divided by 10 ft
B = 50 ft

DESIGNED BY:
NORTHERN ENVIRONMENTAL SOLUTIONS
LICENCE # 4072
218-600-8808

SEPTIC DESIGN FOR:
BRETT HIEMENZ
1448 MELRUDE RD
COTTON, MN 55724
PID: 320-0010-4705
PLAN # 23-139
DATE: 12/28/2023

SET BACK:
TANK TO WELL= MINIMUM OF 50'-0"
BED TO WELL= MINIMUM OF 50'-0" FOR WELLS WITH MORE THAN 50'-0" OF CASING
BED TO WELL= MINIMUM OF 100'-0" FOR WELLS WITH LESS THAN 50'-0" OF CASING
DWELLING TO TANK= NEEDS VARIANCE
DWELLING TO BED= NEEDS VARIANCE
BED TO PROPERTY LINE = NEEDS VARIANCE
LAKE TO SEPTIC SYSTEM =NEEDS VARIANCE

THIS SITE DRAWING IS NOT A SURVEY
LAND OWNER TO VERIFY PROPERTY LINES
AND CONFIRM SETBACKS



SEPTIC DESIGN

SCALE: 1" = 30'-0"

MDH Minnesota Department of Health

Minnesota Well Index

General Information

Unique Well ID:	**428068**	*Well Name:*	**LUNDGREN, NORMAN**	*County:*	**St. Louis**	*Aquifer:*	**Quat. buried artes. aquifer**
Well Elevation (msl in feet):	**1362**	*Drilled Depth (ft):*	**84**	*Well Completed (ft):*	**84**	*Date Drilled:*	**12/17/1986**
Township:	**55**	*Range:*	**16**	*Dir:*	**W**	*Section:*	**30**
Subsection:	**AADADA**	*Use:*	**domestic**	*Well Status:*	**Active**	*Depth To Bedrock:*	
Driller:	**Petersen Well Co.**	*Entry Date:*	**02/22/1988**	*Update Date:*	**10/10/2019**		

Related Resources:

Go to MN Well Index Map   Well Log Report   Scanned Record(s)   Stratigraphy Report

More Details **Stratigraphy** **Address** **Chemical Data** **Construction** **Pump Test**

Static Water **Comments** **Location Changes** **Overview Map**

Casing

Diameter (in)	*From (ft)*	*To (ft)*	*Amount (lbs/ft)*
6	0	84	20

Screen

Diameter (in)	*Length (ft)*	*From (ft)*	*To (ft)*	*Slot*

No records found.

Grouting

Material	*From (ft)*	*To (ft)*	*Amount*	*Units*

No records found.

Open Hole

Diameter (in)	*To (ft)*
6	84

Pump

Pump manufacuturer	*Model*	*Type*	*Horsepower*	*Voltage*	*Capacity (gal)*	*Date Installed*
GOULD	10EKJ05	Submersible	0.5	115		12/19/1986

December 3, 2023

Mr. Mike Parrott, Project Manager
Northern Environmental Solutions
3869 Sandberg Road
Duluth, MN 55810

℅ mparrott.nes@gmail.com

Re: Onsite Wastewater Treatment and Dispersal Capability Evaluation
Hiemenz Residence, 1484 Melrude Road, Cotton, MN 55724
(PID 320-0010-04705)

Dear Mike,

You retained MATRIX Soils & Systems to evaluate suitability of soil conditions within the Hiemenz property on the western shore of Dinham Lake in Ellsburg Township east-northeast of Cotton for on-site wastewater treatment and dispersal. This letter presents results and conclusions regarding the evaluation.

The property is a 0.60-acre parcel described as part of Government Lot 3 in part of southwest ¼ of the northwest ¼ of northwest ¼ of Section 29, Township 55 North, Range 16 West, Ellsburg Township of St. Louis County, Minnesota. The triangular-shaped parcel, which is only approximately 93 feet at its widest point, is bounded on the east by Dinham Lake (Recreational Development classification) and on the west by railroad right-of-way, its location recently surveyed. Currently, the parcel is developed with a three-bedroom, year-round, reportedly Class II, single family dwelling built in 1962, and detached garage. Because the parcel is in a rural area, water supply and wastewater systems are on site. Potable water is supplied by an 84-foot deep well that's cased the complete depth; wastewater treatment and dispersal is provided by a septic tank – subsurface infiltration trench system installed south of the dwelling in 1970. A 2017 system compliance appraisal noted components do not meet the code-required 75-foot setback distance from the lake, and recently the system has been malfunctioning hydraulically, causing intermittent high liquid levels in the septic tank and building sewer. During review of the property, sole location for replacement of the system identified is area in which existing system components are installed. MATRIX Soils & Systems was retained to determine treatment and dispersal capability within this site.

Evaluation of site and soil conditions occurred November 22nd, 2023. Soil profiles within two excavator-dug test pits in the treatment and dispersal site were observed and described using United States Department of Agriculture (USDA) nomenclature (see attached Figure 1). Soils within this portion of the parcel have been mapped by the USDA Natural Resource Conservation Service (NRCS) as Duluth-Culver complex, soils formed in loamy material over loamy tills of glacial moraines (see attached copy of the Custom Soil Resource Report).

Because of well and detached garage locations north of the dwelling, area south of the dwelling remains the sole potential site for septic tank effluent (STE) treatment and dispersal, although area that would meet lake, dwelling deck, and property boundary setback distances: 75 feet, 20 feet, and 10 feet, respectively would be too small, perhaps even for an holding tank. As a result,

MATRIX Soils & Systems, Inc.
3990 Fairview Road, Duluth, MN 55803-2708
(218)390-2869, FAX (218)728-6171
e-mail: rwwhitmyer.matrixss@charter.net

variances to one of more of the setback distances will be needed. The site is back-slope of the ridge on which the existing property improvements have been constructed, and is covered with grass and a few trees. Fifty feet from the lake ground surface is approximately 6 feet higher than the ordinary high water level. Observed soil conditions are sandy, resembling the Grayling series (see official series description at end of the attached NRCS Custom Soil Resource Report), which is mapped in vicinity of the property, but approximately three miles to the east-southeast. Specifically, surface, subsoil, and substrate horizons are comprised of glacial outwash sands, some of which are loamy and contain fine sand; consistence varies from loose to very friable. Mottling (an indication of periodic saturation) was observed as shallow as 47 inches below existing grade in the substrate horizon of test pit TP1, but not in test pit TP2 to a depth of 60 inches, while faint staining of iron likely translocated from overlying horizons when moisture conditions were wetter was observed within the subsoils of both profiles and substrate of test pit TP2 (see attached detailed soil profile descriptions).

Site soils are suitable for subsurface treatment and dispersal of residential strength septic tank effluent. Subsurface treatment is feasible because there is greater than three feet of consistently unsaturated permeable (suitable treatment and dispersal zone) soil. As a result, water movement within site soils will be primarily vertical, and standard STE loading rate and area available will be the factors limiting treatment and dispersal capability, loading rate being dependent on the observed soil conditions and type of wastewater discharged to the soil. A loading rate of 0.6 gallon per day per square foot (gpd/ft^2) for residential strength STE is recommended to address observed variability of sand-size particles. On these bases, sufficient area would need to be provided via varying setback distances for a 500-square-foot subsurface infiltration bed with pressure distribution to treat and disperse code projected flows for the three-bedroom Class II dwelling (300 gpd design flow, 200 gpd operational average flow).

Please note the following regarding design and installation of the bed:

- Depth of the infiltrative surface should be no more than 11 inches below existing grade.
- Remove and properly dispose gravel of any existing trench that'll be within 3 feet of bed distribution media, and use clean (mound) sand to replace the material.

This letter should provide the information needed to continue planning a wastewater system for the site, then pursuing the necessary setback distance variance(s). If you or anyone else has further questions about site treatment and dispersal capability, please call me at (218)390-2869.

Sincerely,

MATRIX Soils & Systems, Inc.

Robert W. Whitmyer, CPSS, PSS, Advanced Designer/Inspector, Service Provider
President

Attachments

DRAWN	SITE PLAN	AS SHOWN	0	SOIL TEST PIT LOCATIONS	11/22/23
RWW		SCALE	REV.	DESCRIPTION	DATE
	MATRIX Soils & Systems	HIEMENZ RESIDENCE 1484 MELRUDE ROAD COTTON, MINNESOTA 55724			FIGURE 1

USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for St. Louis County, Minnesota, Meadowlands Part

December 3, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map (Hiemenz Residence)

Map Scale: 1:1,260 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 15, 30, 60, 90

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: St. Louis County, Minnesota, Meadowlands Part
Survey Area Data: Version 16, Sep 10, 2023

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

Date(s) aerial images were photographed: May 27, 2014—Oct 21, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Hiemenz Residence)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
B81A	Cathro muck, depressional, duluth catena, 0 to 1 percent slopes	0.2	16.4%
B126D	Duluth-Culver complex, 3 to 18 percent slopes	0.4	33.1%
W	Water	0.6	50.5%
Totals for Area of Interest		**1.3**	**100.0%**

Map Unit Descriptions (Hiemenz Residence)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

St. Louis County, Minnesota, Meadowlands Part

B81A—Cathro muck, depressional, duluth catena, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 1vlbt
Elevation: 1,150 to 1,800 feet
Mean annual precipitation: 20 to 27 inches
Mean annual air temperature: 37 to 41 degrees F
Frost-free period: 95 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Cathro, depressional, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cathro, Depressional

Setting

Landform: Swamps on till plains, swamps on moraines
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Parent material: Organic material over loamy till

Typical profile

Oa - 0 to 36 inches: muck
A - 36 to 40 inches: mucky silt loam
2Cg - 40 to 50 inches: stratified sandy loam to silty clay loam
2C,2BC - 50 to 80 inches: loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Very high (about 19.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: C/D
Ecological site: F088XY003MN - Open Peatland
Forage suitability group: Not Suited (G088XN024MN)
Other vegetative classification: Not Suited (G088XN024MN)
Hydric soil rating: Yes

Minor Components

Rifle, depressional

Percent of map unit: 10 percent

Landform: Swamps on moraines, swamps on till plains
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Other vegetative classification: Not Suited (G088XN024MN)
Hydric soil rating: Yes

Baden, depressional

Percent of map unit: 10 percent
Landform: Rims on swamps on moraines, rims on swamps on till plains
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Other vegetative classification: Not Suited (G088XN024MN)
Hydric soil rating: Yes

B126D—Duluth-Culver complex, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 1vlcb
Elevation: 1,150 to 1,800 feet
Mean annual precipitation: 20 to 27 inches
Mean annual air temperature: 37 to 41 degrees F
Frost-free period: 95 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Duluth and similar soils: 70 percent
Culver and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Duluth

Setting

Landform: Moraines
Landform position (two-dimensional): Shoulder, backslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy and or silty material over loamy till

Typical profile

A - 0 to 5 inches: fine sandy loam
E,E/B,B/E - 5 to 18 inches: silt loam
2Bt,2B/E - 18 to 38 inches: clay loam
2C,2BC - 38 to 80 inches: loam

Properties and qualities

Slope: 8 to 18 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: High (about 9.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F090AY015WI - Loamy Upland with Carbonates
Forage suitability group: Sloping; Fine Texture (G088XN023MN)
Other vegetative classification: Sloping; Fine Texture (G088XN023MN)
Hydric soil rating: No

Description of Culver

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, backslope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy and or silty material over loamy till

Typical profile

A - 0 to 4 inches: silt loam
E,E/B,Bw - 4 to 16 inches: silt loam
2Bt,2B/E - 16 to 52 inches: clay loam
2C - 52 to 80 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 13 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: F090AY016WI - Loamy Upland
Forage suitability group: Sloping Upland, Acid (G088XN006MN)
Other vegetative classification: Sloping Upland, Acid (G088XN006MN)
Hydric soil rating: No

Minor Components

Dusler

Percent of map unit: 10 percent
Landform: Moraines
Landform position (two-dimensional): Footslope, summit

Down-slope shape: Concave
Across-slope shape: Linear
Other vegetative classification: Level Swale, Acid (G088XN005MN)
Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Particle Size and Coarse Fragments (Hiemenz Residence)

This table shows estimates of particle size distribution and coarse fragment content of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Total fragments is the content of fragments of rock and other materials larger than 2 millimeters in diameter on volumetric basis of the whole soil.

Fragments 2-74 mm refers to the content of coarse fragments in the 2 to 74 millimeter size fraction.

Fragments 75-249 mm refers to the content of coarse fragments in teh 75 to 249 millimeter size fraction.

Fragments 250-599 mm refers to the content of coarse fragments in the 250 to 599 millimeter size fraction.

Fragments >=600 mm refers to the content of coarse fragments in the greater than or equal to 600 millimeter size fraction.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Particle Size and Coarse Fragments–St. Louis County, Minnesota, Meadowlands Part										
Map symbol and soil name	Horizon	Depth	Sand	Silt	Clay	Total fragments	Fragments 2-74 mm	Fragments 75-249 mm	Fragments 250-599 mm	Fragments >=600 mm
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
B81A—Cathro muck, depressional, duluth catena, 0 to 1 percent slopes										
Cathro, depressional	Oa	0-36	- 5-	-90-	0- 5- 15	—	—	—	—	—
	A	36-40	-20-	-55-	22-25- 27	0	—	—	—	—
	2Cg	40-50	-20-	40-55- 65	8-25- 30	6	5	1	—	0
	2C,2BC	50-80	-40-	30-35- 45	20-25- 30	7	5	1	—	1
B126D—Duluth-Culver complex, 3 to 18 percent slopes										
Duluth	A	0-5	-55-	30-35- 40	8-10- 15	7	5	1	—	1
	E,E/B,B/E	5-18	-37-	30-55- 60	5- 8- 15	7	5	1	—	1
	2Bt,2B/E	18-38	-35-	30-35- 45	25-30- 35	7	5	1	—	1
	2C,2BC	38-80	-40-	30-35- 45	20-25- 30	7	5	1	—	1
Culver	A	0-4	-35-	30-55- 60	8-10- 15	7	5	1	—	1
	E,E/B,Bw	4-16	-37-	30-55- 60	5- 8- 15	7	5	1	—	1
	2Bt,2B/E	16-52	-35-	30-35- 45	25-30- 35	7	5	1	—	1
	2C	52-80	-40-	30-35- 45	20-25- 30	6	5	1	—	0
W—Water										
Water	—	—	—	—	—	—	—	—	—	—

Physical Soil Properties (Hiemenz Residence)

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Physical Soil Properties–St. Louis County, Minnesota, Meadowlands Part														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
B81A—Cathro muck, depressional, duluth catena, 0 to 1 percent slopes														
Cathro, depressional	0-36	- 5-	-90-	0- 5- 15	0.15-0.25-0.35	4.23-23.28-42.34	0.35-0.40-0.45	0.0- 0.0- 0.0	20.0-65.0-85.0			1	8	0
	36-40	-20-	-55-	22-25- 27	1.30-1.37-1.45	1.41-2.82-4.23	0.22-0.23-0.24	1.0- 2.5- 3.0	10.0-14.5-19.0	.37	.37			
	40-50	-20-	40-55- 65	8-25- 30	1.20-1.45-1.60	0.42-0.50-1.41	0.17-0.22-0.24	1.0- 2.5- 4.2	2.0- 5.0-8.0	.37	.37			
	50-80	-40-	30-35- 45	20-25- 30	1.60-1.70-1.75	0.42-0.92-1.41	0.13-0.16-0.19	1.2- 2.6- 4.2	0.0- 0.0-0.0	.37	.37			

Physical Soil Properties–St. Louis County, Minnesota, Meadowlands Part														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
B126D—Duluth-Culver complex, 3 to 18 percent slopes														
Duluth	0-5	-55-	30-35- 40	8-10- 15	1.15-1.40-1.50	4.23-28.23-42.34	0.14-0.15-0.24	0.5- 0.6- 0.9	3.0- 5.0-7.0	.28	.28	5	3	86
	5-18	-37-	30-55- 60	5- 8- 15	1.40-1.50-1.75	4.23-9.17-42.34	0.14-0.19-0.22	0.3- 0.5- 0.9	0.5- 1.0-2.0	.55	.55			
	18-38	-35-	30-35- 45	25-30- 35	1.60-1.70-1.75	0.42-0.92-1.41	0.13-0.14-0.19	2.6- 4.2- 5.8	0.0- 0.1-0.5	.37	.37			
	38-80	-40-	30-35- 45	20-25- 30	1.60-1.70-1.75	0.42-0.92-1.41	0.13-0.16-0.19	1.2- 2.6- 4.2	0.0- 0.0-0.0	.37	.37			
Culver	0-4	-35-	30-55- 60	8-10- 15	1.15-1.40-1.50	4.23-9.17-42.34	0.14-0.21-0.24	0.5- 0.6- 0.9	3.0- 5.0-7.0	.37	.37	5	5	56
	4-16	-37-	30-55- 60	5- 8- 15	1.40-1.50-1.75	4.23-9.17-42.34	0.14-0.19-0.22	0.3- 0.5- 0.9	0.5- 1.0-2.0	.55	.55			
	16-52	-35-	30-35- 45	25-30- 35	1.60-1.70-1.75	0.42-0.92-1.41	0.13-0.14-0.19	2.6- 4.2- 5.8	0.0- 0.1-0.5	.37	.37			
	52-80	-40-	30-35- 45	20-25- 30	1.60-1.70-1.75	0.42-0.92-1.41	0.13-0.16-0.19	1.2- 2.6- 4.2	0.0- 0.0-0.0	.37	.37			
W—Water														
Water	—	—	—	—	—	—	—	—	—					

Water Features

This folder contains tabular reports that present soil hydrology information. The reports (tables) include all selected map units and components for each map unit. Water Features include ponding frequency, flooding frequency, and depth to water table.

Water Features (Hiemenz Residence)

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table. The kind of water table, apparent or perched, is given if a seasonal high water table exists in the soil. A water table is perched if free water is restricted from moving downward in the soil by a restrictive feature, in most cases a hardpan; there is a dry layer of soil underneath a wet layer. A water table is apparent if free water is present in all horizons from its upper boundary to below 2 meters or to the depth of observation. The water table kind listed is for the first major component in the map unit.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Map unit symbol and soil name	Hydrologic group	Surface runoff	Most likely months	Water table			Ponding			Flooding	
				Upper limit	Lower limit	Kind	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*		*Ft*				
B81A—Cathro muck, depressional, duluth catena, 0 to 1 percent slopes											
Cathro, depressional	C/D		Jan	0.5	6.0	Apparent	0.3-1.0	Long (7 to 30 days)	Occasional	—	None
			Feb	1.0	6.0	Apparent	0.3-1.0	Long (7 to 30 days)	Occasional	—	None
			Mar	0.5	6.0	Apparent	0.3-1.0	Long (7 to 30 days)	Occasional	—	None
			Apr-Nov	0.0	6.0	Apparent	0.3-1.0	Long (7 to 30 days)	Frequent	—	None
			Dec	0.5	6.0	Apparent	0.3-1.0	Long (7 to 30 days)	Occasional	—	None
B126D—Duluth-Culver complex, 3 to 18 percent slopes											
Duluth	C		Jan-Dec	—	—	—	—	—	None	—	None
Culver	C/D		Jan-Mar	—	—	—	—	—	None	—	None
			Apr	1.1	1.7	Perched	—	—	None	—	None
			May	1.5	1.7	Perched	—	—	None	—	None
			Jun-Oct	—	—	—	—	—	None	—	None
			Nov	1.3	1.7	Perched	—	—	None	—	None
			Dec	—	—	—	—	—	None	—	None
W—Water											
Water				—	—	—	—	—	—	—	

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LOCATION CATHRO MI+ME MN ND NY VT WI

Established Series
Rev. WEM-WEF-LMC-AGG
06/2006

CATHRO SERIES

The Cathro series consists of very deep, very poorly drained organic soils moderately deep to loamy materials. They formed in organic material 16 to 51 inches thick overlying loamy glacial deposits on ground moraines, end moraines, outwash plains, lake plains, stream terraces, and flood plains. Permeability is moderately slow to moderately rapid in the organic material and moderately slow or moderate in the loamy material. Slopes range from 0 to 2 percent. Mean annual precipitation is about 32 inches. Mean annual air temperature is about 43 degrees F.

TAXONOMIC CLASS: Loamy, mixed, euic, frigid Terric Haplosaprists

TYPICAL PEDON: Cathro muck - on a slope of 1 percent in a forested area (Colors are for moist conditions unless otherwise stated.)

Oa1--0 to 6 inches; black (5YR 2/1) rubbed and pressed muck (sapric material); about 40 percent fiber, about 15 percent rubbed; weak fine granular structure; nonsticky; primarily herbaceous fibers; neutral (pH 6.8 in water); clear wavy boundary.

Oa2--6 to 11 inches; black (5YR 2/1) broken face and rubbed muck (sapric material), dark reddish brown (5YR 2/2) pressed; about 35 percent fiber, about 10 percent rubbed; weak medium granular structure; nonsticky; primarily herbaceous fibers; neutral (pH 6.8 in water); clear smooth boundary.

Oa3--11 to 23 inches; black (5YR 2/1) on broken face and rubbed muck (sapric material); about 40 percent fibers, less than 10 percent rubbed; massive; nonsticky; primarily herbaceous fibers; neutral (pH 6.8 in water); abrupt smooth boundary. (Combined thickness of Oa horizons is 15 to 51 inches.)

Cg--23 to 60 inches; grayish brown (2.5Y 5/2) sandy loam; massive; slightly sticky; common coarse prominent reddish brown (5YR 5/3) and common coarse distinct brown (10YR 5/3) Fe concentrations; strongly effervescent; moderately alkaline.

TYPE LOCATION: Delta County, Michigan; about 4 miles south of Ensign; 1,620 feet north and 200 feet east of the southwest corner of sec. 23, T. 40 N., R. 21 W.

RANGE IN CHARACTERISTICS: The depth to the loamy C horizon ranges from 16 to 51 inches. Woody fragments over 2cm in size comprise less than 15 percent of the organic material. The organic portion of the control section has hue of 10YR, 7.5YR, or 5YR; value of 2 or 3; and chroma of 0 to 3 or are neutral. In some pedons the value or chroma or both increases 1 or 2 units when exposed to the air. The organic portion of the control section ranges from pH 4.5 to less than pH 7.8 in calcium chloride and does not have free carbonates.

The surface tier exclusive of loose surface litter or mosses, is comprised of mucky peat (hemic material) or muck (sapric material) material with an unrubbed fiber content that ranges from about 20 percent to 50 percent; rubbed is less than 20 percent. Up to 4 inches of peat is on the surface in some pedons. The surface tier is weak or moderate fine granular structure. Typically the structure grade becomes stronger as the amount of recognizable woody material increases.

The subsurface tier is muck (sapric material). The unrubbed fiber content ranges from 50 to less than 10 percent and is less than 16 percent after rubbing. Some pedons have thin layers of mucky peat (hemic material) in the control section. Ash content of the organic layer just above the loamy substratum is as much as 40 percent in some pedons.

A thin A horizon is present in some pedons. It has hue of 10YR, 2.5Y, 5Y or is neutral, value of 2 or 3 and chroma of 0 to 2. It is sandy loam, fine sandy loam, sandy clay loam, loam, silt loam or their mucky analogs. It ranges from moderately acid to slightly alkaline.

The C horizon has hue of 5YR, 7.5YR, 10YR, 2.5Y, 5GY, 5GB, or 5Y; value of 4 to 6; and chroma of 1 to 3. It is sandy loam, fine sandy loam, very fine sandy loam, sandy clay loam, loam, silt loam, clay loam or silty clay loam. Stratified substratums phases containing thin strata of fine sand or sand, less than 3 inches thick are recognized. It ranges from moderately acid to moderately alkaline. Coarse fragments range from 0 to 25 percent by volume. Some pedons do not contain free carbonates.

COMPETING SERIES: These are the Berner, Bullwinkle, Dingle, Nidaros, and Wonsqueak series. Berner soils have a sandy layer above the loamy sediment. Bullwinkle soils have greater than 15 percent woody fragments in the organic material. Dingle soils occur in areas with 14 to 16 inches of annual precipitation and in elevations from 5900 to 6000 feet. Nidaros soils have sandy underlying materials. Wonsqueak soils are substantially drier in the moisture control section during the 120 days following the summer solstice.

GEOGRAPHIC SETTING: Cathro soils commonly are in relatively small depressions mainly within ground moraines, end moraines, lake plains and outwash plains. A few areas are on narrow flood plains. Individual bodies range in size from about 10 to 100 acres. Slopes are 0 to 2 percent. The ground water carrying minerals from the surrounding upland, influences the composition of the organic deposit. Mean annual precipitation ranges from about 19 to 43 inches. Mean annual air temperature ranges from 36 to 45 degrees F. Frost-free days range from 70 to 145. Elevation above sea levl ranges from 600 to 2,000 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Carbondale and Rifle soils that occupy similar landscape positions and the Angelica and Ensley soils. Angelica and Ensley soils are poorly drained mineral soils commonly located adjacent to the edges of Cathro soils. The Carbondale soils have hemic soil materials within 51 inches. Rifle soils formed in hemic materials 51 inches or greater.

DRAINAGE AND PERMEABILITY: Very poorly drained. Depth to the seasonal high saturation ranges from 1 foot above the surface to 0.5 foot below the surface at some time from October to June in most years. Ponded phases have a seasonal high saturation from 4 foot above the surface to 0.5 foot below the surface throughout the year. Surface runoff is neglible to low. Permeability is moderately rapid to moderately slow in the organic portion and moderately slow or moderate in the mineral substratum. Stratified substratum phases have saturated hydraulic conductivity ranging up to moderately rapid or rapid in the individual sand strata.

USE AND VEGETATION: Most of these soils are in woodland, however some are in sedge and cattails. Vegetation includes white cedar, alder, and balsam fir. A few areas are cleared and are used for pasture.

DISTRIBUTION AND EXTENT: Northern Lower Peninsula and Upper Peninsula of Michigan, northern Minnesota, northern Wisconsin and upper New England.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota.

SERIES ESTABLISHED: Delta County, Michigan, 1969.

REMARKS: Diagnostic horizons and features recognized in this pedon are: sapric material from the surface to 23 inches (Oa1, Oa2, and Oa3 horizons); terric feature at 23 inches (Cg horizon); aquic moisture regime (low chroma in the soil moisture control section.)

National Cooperative Soil Survey
U.S.A.

Established Series
Rev. RTR-MPD-MBW
01/2009

CULVER SERIES

The Culver series consists of very deep, moderately well drained soils that formed in a mantle of loamy eolian or glaciofluvial deposits and in the underlying firm loamy till on moraines and till plains. Slope ranges from 2 to 10 percent. Mean annual air temperature is about 4 degrees C. Mean annual precipitation is about 711 millimeters.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, frigid Oxyaquic Glossudalfs

TYPICAL PEDON: Culver silt loam on a 4 percent linear slope on a moraine under a recently harvested mixed deciduous forest. Elevation of about 404 meters. (Colors are for moist soil unless otherwise stated.)

A--0 to 10 centimeters; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many very fine to medium roots; 5 percent gravel; strongly acid; abrupt smooth boundary. (3 to 15 centimeters thick; if an Ap, as thick as 20 centimeters)

E--10 to 15 centimeters; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; many very fine to medium roots; few fine prominent strong brown (7.5YR 4/6) Fe concentrations; 5 percent gravel; strongly acid; clear smooth boundary. (3 to 30 centimeters thick)

Bw--15 to 23 centimeters; brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; many very fine and fine and few medium roots; common medium prominent grayish brown (10YR 5/2) Fe depletions and few fine distinct strong brown (7.5YR 4/6) Fe concentrations; 5 percent gravel; strongly acid; clear smooth boundary. (0 to 10 centimeters thick)

E/B--23 to 41 centimeters; 70 percent brown (7.5YR 5/3) silt loam, pinkish gray (7.5YR 7/2) dry (E); 30 percent brown (7.5YR 4/3) loam (Bt); strong medium subangular blocky structure; friable; common very fine and fine roots; common fine faint brown (7.5YR 5/2) Fe depletions and common medium distinct strong brown (7.5YR 4/6) Fe concentrations; 5 percent gravel; strongly acid; gradual wavy boundary. (combined thickness of the E/B, B/E, 2E/B or 2B/E horizons is 5 to 48 centimeters)

2Bt1--41 to 69 centimeters; reddish brown (5YR 4/4) clay loam; strong medium subangular blocky structure; firm; common fine and very fine roots; common continuous reddish brown (5YR 4/3) clay films on faces of peds and in pores, common discontinuous light brown (7.5YR 6/3) dry silt coats on faces of peds; few medium prominent strong brown (7.5YR 5/6) Fe concentrations; 5 percent gravel; strongly acid; gradual wavy boundary.

2Bt2--69 to 99 centimeters; reddish brown (5YR 4/4) clay loam; strong medium prismatic structure parting to strong medium subangular blocky; firm; common very fine roots; common continuous reddish brown (5YR 4/3) clay films on faces of peds and in pores; few fine prominent strong brown (7.5YR 5/6) Fe concentrations; 5 percent gravel and 1 percent cobbles; slightly acid; diffuse wavy boundary.

2Bt3--99 to 132 centimeters; reddish brown (5YR 4/4) clay loam; moderate coarse subangular blocky structure parting to moderate medium platy; firm; few fine roots; few discontinuous reddish brown (5YR 4/3) clay films on faces of peds; few fine prominent red (2.5YR 5/8) Fe concentrations; 5 percent gravel; slightly acid; diffuse wavy boundary. (combined thickness of the 2Bt horizons is 38 to 127 centimeters)

2C--132 to 203 centimeters; reddish brown (5YR 4/4) clay loam; massive; firm; few fine prominent red (2.5YR 5/8) Fe concentrations; 5 percent gravel; neutral.

TYPE LOCATION: Major Land Resource Area (MLRA) 88-Northern Minnesota Glacial Lake Basins, St. Louis County (Meadowlands Part), Minnesota; about 2 miles northwest of the town of Brookston; located about 1,800 feet north and 150 feet west of the southeast corner of section 20, T.51 N., R. 18 W.; USGS Brookston NW topographic quadrangle; latitude 46 degrees 53 minutes 19 seconds N., and longitude 92 degrees 38 minutes 25 seconds W., NAD 27.

RANGE IN CHARACTERISTICS:
Thickness of the loamy mantle and depth to till ranges from 10 to 51 centimeters
Depth to free carbonates--152 to greater than 203 centimeters
Volume of rock fragments throughout the profile--total 1 to 10 percent; with 1 to 10 percent gravel, 0 to 2 percent cobbles and 0 to 1 percent stones. Rock fragments are mostly of mixed lithology
Clay content of the loamy mantle of eolian or glaciofluvial deposits averages less than 18 percent
Clay content of the till ranges from 20 to 35 percent
Sand content of the till is less than 45 percent

Some pedons have an O horizon (duff layer).

A or Ap horizon:
Hue--7.5YR or 10YR
Value--2 or 3 moist, 5 or 6 dry (if an Ap, value moist is 3 or 4)
Chroma--1 or 2 moist or dry (if an Ap, chroma moist is 1 to 3)

Texture--silt loam, very fine sandy loam, fine sandy loam or loam
Reaction--very strongly to moderately acid

E horizon:
Hue--5YR to 10YR
Value--4 or 5 moist, 6 or 7 dry
Chroma--1 to 3 moist or dry
Texture--silt loam, very fine sandy loam or fine sandy loam
Reaction--very strongly to moderately acid
The E horizon typically has distinct to prominent Fe concentrations

Bw horizon (when present):
Hue--5YR to 10YR
Value--4 or 5
Chroma--3 or 4
Texture--silt loam, very fine sandy loam, fine sandy loam or loam
Reaction--very strongly acid to moderately acid
The Bw horizon typically has distinct to prominent Fe concentrations and depletions

All pedons have a glossic horizon comprised of an E/B, B/E, 2E/B, 2B/E or any combination of these horizons.

E part of the E/B, B/E, 2E/B, or 2B/E horizon:
Hue--5YR to 10YR
Value--4 or 5
Chroma--1 to 3
Texture--silt loam, very fine sandy loam, or fine sandy loam

Bt part of the E/B or B/E horizon:
Hue--5YR to 10YR
Value--4 or 5
Chroma--3 or 4
Texture--loam or silt loam

Bt part of the 2E/B or 2B/E horizon:
Hue--2.5YR to 7.5YR
Value--4 or 5
Chroma--3 or 4
Texture--clay loam or loam
Reaction--very strongly acid to moderately acid.

The E/B or B/E typically has faint to distinct Fe concentrations and depletions.

2Bt horizon:
Hue--2.5YR to 7.5YR
Value--4 or 5
Chroma--3 or 4
Texture--clay loam or loam
Reaction--strongly acid to slightly acid

Some pedons have a 2BC horizon.

2C horizon:
Hue--2.5YR to 7.5YR
Value--4 or 5
Chroma--3 or 4
Texture--loam or clay loam
Reaction--slightly acid to slightly alkaline

3C horizon (when present):
Some phases recognized have 3C horizons below a depth of 152 centimeters
Hue--5YR to 10YR
Texture--sand and/or gravel
Reaction--slightly acid to neutral

COMPETING SERIES: These are the Branstad, Daybrook, Dinham, Flambeau, Flintsteel, Hiles, Loyal and Nashwauk soils.
Branstad--allow free carbonates as shallow as 100 centimeters and average between 45 and 65 percent sand in the particle-size control section
Daybrook--formed in a 60 to 100 centimeter thick mantle of outwash overlying Rainy lobe till with a densic contact at a depth ranging from 100 to 150 centimeters
Dinham--have a sand content of more than 70 percent in the upper part of the series control section
Flambeau--allow for greater than 45 percent sand throughout
Flintsteel--lack a significant mantle of loamy eolian or glaciofluvial deposits and have a densic contact at a depth ranging from 64 to 102 centimeters

Hiles--have a paralithic contact at a depth of 50 to 100 centimeters
Loyal--have a mantle of loess or silty alluvium 30 to 91 centimeters thick over loamy till
Nashwauk--have a densic contact within the depth of 100 to 150 centimeters and have greater than 45 percent sand content throughout

GEOGRAPHIC SETTING:
Parent material--mantle of loamy eolian or glaciofluvial deposits and the underlying firm loamy till of the St. Louis sublobe of the Des Moines lobe of the Late Wisconsinan glaciation
Landform--on summits and on linear and convex back slopes of moraines and till plains
Slope--2 to 10 percent
Mean annual air temperature--3 to 5 degrees C
Mean annual precipitation--500 to 762 millimeters
Frost-free period--90 to 145 days
Elevation above sea level--300 to 550 meters

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Baden, Blackhoof, Duluth, Dusler and Ellsburg soils, that form a hydrosequence with the Culver soils.
Baden--are in lower landscape positions in drainageways and depressions and are in the Typic Endoaquepts subgroup
Blackhoof--are in lower landscape positions in drainageways and depressions and are in the Histic Humaquepts subgroup
Duluth--are on similar or more sloping positions on the landscape and are in the Haplic Glossudalfs subgroup
Dusler--are on slightly concave to slightly convex lower lying or less sloping positions on the landscape and are in the Aquic Glossudalfs subgroup
Ellsburg--are on flats and in drainageways and are in the Typic Glossaqulfs subgroup

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--moderately well drained--a perched seasonal saturated zone occurs as shallow as 33 centimeters below the surface during the spring in normal years
Saturated hydraulic conductivity--1.00 to 100.00 micrometers per second (moderately high or high) in the loamy mantle and 0.10 to 1.00 micrometers per second (moderately low) in the underlying till

USE AND VEGETATION: Most areas are forested. Common trees are quaking aspen, paper birch, American basswood, sugar maple, northern red oak, eastern white pine, balsam fir and white spruce. Some is used for agricultural cropland. Hay, pasture and small grains are the most common crops.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains or Laurentian Upland
Physiographic Province--Central Lowland or Superior Upland
Physiographic sections--Western Lake section (if in the Central Lowland Province) or undefined (if in the Superior Upland Province)
MLRAs--Northern Minnesota Glacial Lake Basins (88) and Wisconsin and Minnesota Thin Loess and Till, Northern Part (90A) LRR K; northeastern Minnesota
Extent--moderate

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Mille Lacs County, Minnesota, 2005.

REMARKS:
Particle-size control section--the zone from a depth of 41 to 91 centimeters;
series control section--the zone from the surface to a depth of 150 centimeters.

Diagnostic horizons and features recognized in this pedon include:
ochric epipedon--the zone from the mineral soil surface to 15 centimeters (A and E horizons);
glossic horizon--the zone from 23 to 41 centimeters (E/B horizon);
argillic horizon--the zone from 41 to 132 centimeters (2Bt1, 2Bt2 and 2Bt3 horizons);
udic moisture regime.

This series also recognizes a coarse substratum phase.

Saturated horizons often do not show reduction due to the nature of the reddish parent material.

Taxonomy version--Keys to Soil Taxonomy, tenth edition, 2006.

ADDITIONAL DATA:
Laboratory data--Reference samples from lab pedon number 97P0224, samples 97P01545-1553 from St. Louis County, Minnesota, samples by National Soil Survey Laboratory, Lincoln, Nebraska (http://ssldata.nrcs.usda.gov/).

LOCATION DULUTH MN

Established Series
Rev. RTR-MPD-MBW
01/2011

DULUTH SERIES

The Duluth series consists of very deep, well drained soils that formed in a friable mantle of loamy eolian or glaciofluvial deposits and in the underlying firm loamy till on moraines and till plains. Slopes range from 6 to 45 percent. Mean annual air temperature is about 4.0 degrees C. and mean annual precipitation is about 711 millimeters.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, frigid Haplic Glossudalfs

TYPICAL PEDON: Duluth fine sandy loam on an 8 percent linear slope on a moraine under mixed deciduous forest. Elevation of about 420 meters (Colors are for moist soil unless otherwise stated.)

A--0 to 13 centimeters; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; friable; many very fine and fine and common medium and few coarse roots; 3 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary. (3 to 15 centimeters thick; if an Ap, as thick as 20 centimeters)

E--13 to 33 centimeters; brown (10YR 5/3) fine sandy loam, very pale brown (10YR 7/3) dry; weak thick platy parting to weak fine granular structure; very friable; common very fine and fine and common medium roots; 3 percent gravel; strongly acid; clear wavy boundary. (3 to 30 centimeters thick)

E/B--33 to 46 centimeters; 80 percent brown (10YR 5/3) fine sandy loam (E), 20 percent brown (7.5YR 4/4) loam (Bt); weak fine subangular blocky structure; friable; common very fine and fine and few medium roots; common discontinuous brown (7.5YR 4/3) clay films on ped faces; many pale brown (10YR 6/3) silt coats on ped faces; 5 percent gravel and 2 percent cobbles; strongly acid; clear wavy boundary. (combined thickness of the E/B, B/E, 2E/B or 2B/E is 5 to 46 centimeters)

2Bt1--46 to 74 centimeters; reddish brown (5YR 4/4) clay loam; moderate medium subangular blocky parting to moderate fine subangular blocky structure; firm; few fine roots; common discontinuous reddish brown (5YR 4/3) clay films on ped faces; 5 percent gravel and 1 percent cobbles; moderately acid; gradual wavy boundary.

2Bt2--74 to 97 centimeters; reddish brown (5YR 4/4) clay loam; moderate coarse subangular blocky structure; firm; few fine roots; common discontinuous reddish brown (5YR 4/3) clay films on ped faces; 5 percent gravel and 1 percent cobbles; slightly acid; gradual wavy boundary. (combined thickness of the 2Bt horizons is 38 to 127 centimeters)

2BC--97 to 127 centimeters; reddish brown (5YR 5/4) clay loam; weak coarse subangular blocky structure; firm; 8 percent gravel and 1 percent cobbles; slightly acid; gradual wavy boundary. (0 to 38 centimeters thick)

2C--127 to 203 centimeters; reddish brown (5YR 4/4) clay loam; massive; firm; 8 percent gravel and 1 percent cobbles; slightly acid.

TYPE LOCATION: Major Land Resource Area (MLRA) 88-Northern Minnesota Glacial Lake Basins; St. Louis County (Meadowlands Part), Minnesota; about 4 miles west of the town of Culver; located about 400 feet south and 600 feet west of the northeast corner of section 8, T.51 N., R.18 W.; USGS Brookston NW, Minnesota topographic quadrangle; latitude 46 degrees 55 minutes 32 seconds N. and longitude 92 degrees 38 minutes 28 seconds W., NAD 27.

RANGE IN CHARACTERISTICS:
Thickness of the loamy mantle and depth to till ranges from 10 to 51 centimeters
Depth to free carbonates--152 to more than 203 centimeters
Rock fragment content--total 1 to 10 percent; with 1 to 10 percent gravel, 0 to 2 percent cobbles and 0 to 1 percent stones. Rock fragments are mostly of mixed lithology.
The loamy mantle averages less than 18 percent clay. The till ranges from 20 to 35 percent clay and contains less than 45 percent sand.

Some pedons have an O horizon (duff layer).

A or Ap horizon:
Hue--7.5YR or 10YR
Value--2 or 3 moist, 5 or 6 dry (if an Ap, value moist is 3 or 4)
Chroma--1 or 2 moist or dry (if an Ap, chroma moist is 1 to 3)
Texture--silt loam, very fine sandy loam, fine sandy loam or loam
Reaction--very strongly to moderately acid

E horizon:

Hue--5YR to 10YR
Value--4 or 5 moist, 6 or 7 dry
Chroma--1 to 3 moist or dry
Texture--silt loam, loam, very fine sandy loam or fine sandy loam
Reaction--very strongly to moderately acid

Some pedons have a Bw horizon.

All pedons have a glossic horizon comprised of an E/B, B/E, 2E/B, 2B/E or any combination of these horizons.

E part of the E/B, B/E, 2E/B, or 2B/E horizon:
Hue--5YR to 10YR
Value--4 or 5
Chroma--1 to 3
Texture--silt loam, loam, very fine sandy loam or fine sandy loam

Bt part of the E/B or B/E horizon:
Hue--5YR to 10YR
Value--4 or 5
Chroma--3 or 4
Texture--loam, fine sandy loam, very fine sandy loam or silt loam

Bt part of the 2E/B or 2B/E horizon:
Hue--2.5YR to 7.5YR
Value--4 or 5
Chroma--3 or 4
Texture--clay loam or loam
Reaction--very strongly acid to moderately acid

2Bt horizon:
Hue--2.5YR to 7.5YR
Value--4 or 5
Chroma--3 or 4
Texture--clay loam or loam
Reaction--strongly to slightly acid

2BC horizon (when present):
Hue--2.5YR to 7.5YR
Value--4 or 5
Chroma--3 or 4
Texture--loam or clay loam
Reaction--moderately acid to neutral

2C horizon:
Hue--2.5YR to 7.5YR
Value--4 or 5
Chroma--3 or 4
Texture--loam or clay loam
Reaction--slightly acid to slightly alkaline

3C horizon (when present, it is below 152 centimeters and hence outside the series control section):
Hue--5YR to 10YR
Texture--sand and/or gravel
Reaction--slightly acid to neutral

COMPETING SERIES: These are the Cushing, Fenwood, Greatscott, Rozellville, Sol, Warba and Watton series in the same family.
Cushing soils allow for free carbonates above 152 centimeters and average more than 45 percent total sand content in the till
Fenwood soils have a lithic contact within a depth range of 102 to 152 centimeters
Greatscott soils have a densic contact within a depth range of 102 to 152 centimeters
Rozellville have greater than 20 percent rock fragment content in the substratum
Sol soils have less than 18 percent clay in the lower third of the series control section
Warba soils have hue of 10YR or yellower, and have friable till

GEOGRAPHIC SETTING:
Parent material--mantle of loamy eolian or glaciofluvial deposits and the underlying firm loamy till of the St. Louis sublobe of the Des Moines lobe of the Late Wisconsinan glaciation
Landform--on summits and on linear and convex back slopes of moraines and till plains
Slope--6 to 45 percent
Mean annual air temperature--3 to 5 degrees C
Mean annual precipitation--500 to 762 millimeters

Frost-free period--90 to 145 days
Elevation--300 to 550 meters

GEOGRAPHICALLY ASSOCIATED SOILS:
Near the type location, these are the Baden, Blackhoof, Culver, Dusler and Ellsburg soils. These soils form a hydrosequence with the Duluth soils.
Baden--are in drainageways and depressions and lack a glossic horizon and an argillic horizon
Blackhoof--are in drainageways and depressions and have a histic epipedon but lack a glossic horizon and an argillic horizon
Culver--are on similar or less sloping positions on the landscape and are in the Oxyaquic Glossudalfs subgroup
Dusler--are at slightly lower positions, on slightly concave to slightly convex, less sloping positions on the landscape, and are in the Aquic Glossudalfs subgroup
Ellsburg--are at lower landscape positions, on flats and in drainageways, and are in the Typic Glossaqualfs subgroup

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--well drained
Saturated hydraulic conductivity--1.00 to 100.00 micrometers per second (moderately high or high) in the loamy mantle and 0.10 to 1.00 micrometers per second (moderately low) in the underlying till
This soil has a very transitory perched zone of saturation above the till during spring in normal years.

USE AND VEGETATION: Most areas are forested. Common trees are quaking aspen, paper birch, American basswood, sugar maple, northern red oak, eastern white pine, balsam fir and white spruce. Some is used for agricultural cropland. Hay, pasture and small grains are the most common crops.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains or Laurentian Upland
Physiographic Province--Central Lowland or Superior Upland
Physiographic sections--Western Lake Section (if in the Central Lowland Province) or undefined (if in the Superior Upland Province)
MLRAs--Northern Minnesota Glacial Lake Basins (88), Wisconsin and Minnesota Thin Loess and Till, Northern Part (90A), Wisconsin and Minnesota Thin Loess and Till, Southern Part (90B), Superior Lake Plain (92), and Superior Stony and Rocky Loamy Plains and Hills, Western Part (93A)
LRR K; Northeastern Minnesota.
Extent--moderate

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Carlton County, Minnesota, 1973.

REMARKS:
Particle-size control section--the zone from a depth of 46 to 96 centimeters
Series control section--the zone from the surface to a depth of 150 centimeters

Diagnostic horizons and features recognized in this pedon include:
ochric epipedon--the zone from the mineral soil surface to 13 centimeters (A and E horizons);
glossic horizon--the zone from 33 to 46 centimeters (E/B horizon);
argillic horizon--the zone from 46 to 97 centimeters (2Bt1 and 2Bt2 horizons);
Udic moisture regime

This soil (along with its other hydrosequence members) was originally established on Superior lobe till of the late Wisconsinan glaciation, but now represents those soils formed in the St. Louis sub lobe of the Des Moines lobe of the late Wisconsinan glaciation. 1/18/2011-TYPE LOCATION error was corrected.

Taxonomy version--Keys to Soil Taxonomy, tenth edition, 2006

LOCATION GRAYLING MI+WI

Established Series
Rev. LWB-WEF-GDW
09/2014

GRAYLING SERIES

The Grayling series consists of very deep, excessively drained soils formed in sandy glaciofluvial deposits on outwash plains, deltas, kames, kame moraines, stream terraces, disintegration moraines and lake plains. Slope ranges from 0 to 45 percent. Mean annual precipitation is 762 mm (30 inches), and mean annual temperature is about 6.1 degrees C (43 degrees F).

TAXONOMIC CLASS: Isotic, frigid Typic Udipsamments

TYPICAL PEDON: Grayling sand, on a 1 percent slope in a forested area at an elevation of 352 meters (1,155 feet)above mean sea level. (Colors are moist soil unless otherwise stated.)

Oe--0 to 2 cm (0 to 1 inch); black (10YR 2/1) moderately decomposed plant material; extremely acid; abrupt smooth boundary. [0 to 5 cm (0 to 2 inches) thick]

A--2 to 10 cm (1 to 4 inches); black (10YR 2/1) sand, very dark grayish brown (10YR 3/2) dry; mixed with about 25 percent grayish brown (10YR 5/2) uncoated sand grains; weak fine granular structure; very friable; many very fine and fine and common medium and coarse roots; very strongly acid; abrupt wavy boundary. [2 to 13 cm (1 to 5 inches) thick]

Bw1--10 to 28 cm (4 to 11 inches); strong brown (7.5YR 4/6) sand; weak fine and medium subangular blocky structure parts to single grain; very friable; common very fine and fine and few medium and coarse roots; about 1 percent fine and medium gravel; moderately acid; gradual wavy boundary.

Bw2--28 to 48 cm (11 to 19 inches); dark yellowish brown (10YR 4/6) sand; weak fine and medium subangular blocky structure parts to single grain; very friable; common very fine and fine roots; about 2 percent fine and medium gravel; slightly acid; gradual wavy boundary. [Combined thickness of the Bw horizon is 30 to 64 cm (12 to 25 inches).]

BC--48 to 61 cm (19 to 24 inches); brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; about 2 percent fine and medium gravel; slightly acid; gradual wavy boundary. [0 to 38 cm (0 to 15 inches) thick]

C--61 to 203 cm (24 to 80 inches); light yellowish brown (10YR 6/4) sand; single grain; loose; about 3 percent fine and medium gravel; slightly acid.

TYPE LOCATION: Crawford County, Michigan; about 5 miles northwest of Grayling; 2,500 feet north and 1,200 feet east of the southwest corner of sec. 19, T. 27 N., R. 4 W., Frederic Township; USGS Frederic, Michigan topographic quadrangle; lat. 44 degrees 43 minutes 19 seconds N. and long. 84 degrees 50 minutes 42 seconds W., NAD 27.

RANGE IN CHARACTERISTICS:
Thickness of the solum: 38 to 89 cm (15 to 35 inches)
Content of rock fragments: 0 to 10 percent gravelly volume throughout the series control section
Particle-size control section: less than 20 percent coarse sand and very coarse sand

O horizon (where present)
Organic materials: oak leaves or jack pine needles, and some twigs and roots in various stage of decomposition

The A horizon and E horizon, where present, are normally intermixed in a single layer. Some pedons have a separate E horizon.

A horizon:
Hue: 5YR, 7.5YR, 10YR, or is neutral
Value: 2 to 4
Chroma: 0 to 3
Texture: sand
Reaction: extremely acid to strongly acid

Bw1 horizon:
Hue: 5YR, 7.5YR, or 10YR
Value: 4 or 5
Chroma: 4 to 6
Texture: sand

Bw2 horizon:
Hue: 7.5YR or 10YR

Value: 4 or 5
Chroma: 4 to 8
Texture: sand
Reaction: extremely acid to slightly acid

BC horizon:
Hue: 7.5YR or 10YR
Value: 5 or 6
Chroma: 4 to 6
Texture: sand
Reaction: strongly acid to slightly acid

C horizon:
Hue: 7.5YR or 10YR
Value: 6
Chroma: 3 or 4
Texture: sand or coarse sand
Reaction: ranges from moderately acid to neutral
Other features: dark minerals are more common in the northwestern part of the soils range; some pedons have color bands below 102 cm (40 inches) that do not qualify for lamella

Some pedons have a banded substratum below 203 centimeters (80 inches). Some pedons have a loamy substratum below depths of 152 centimeters (60 inches). Calcareous phases and deep water table phases are recognized.

COMPETING SERIES: This is the Lavell series. Lavell soils average more than 50 percent fine sand in the particle-size control.

GEOGRAPHIC SETTING: Grayling soils are on outwash plains, deltas, kames, kame moraines, stream terraces, disintegration moraines, and lake plains of Wisconsinan age. Slope gradients are dominantly less than 8 percent but range from 0 to 45 percent. Grayling soils formed in sandy glaciofluvial deposits. Mean annual precipitation ranges from 686 to 864 mm (27 to 34 inches). Mean annual temperature ranges from 4.4 to 8.3 degrees C (40 to 47 degrees F).

GEOGRAPHICALLY ASSOCIATED SOILS: These are the somewhat excessively drained Graycalm, excessively drained Rubicon, and moderately well drained Croswell soils on similar landscape positions. The Rubicon soils have a spodic horizon. The somewhat poorly drained Au Gres and poorly drained Deford soils are in lower landscape positions or depressions.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Excessively drained. Potential for surface runoff is negligible to low depending on the slope. Saturated hydraulic conductivity is high.

USE AND VEGETATION: Used for woodland. Jack pine is the principal tree species in the Upper Peninsula of Michigan, whereas jack pine and scrub oak are principal tree species in the northern part of the Lower Peninsula. Ground cover includes blueberries, lichens, mosses, sweet fern, and wintergreen.

DISTRIBUTION AND EXTENT: MLRAs 93A, 93B, 94A, 94B, 94C, 95A, and 98 in the northern Lower Peninsula, Upper Peninsula of Michigan, and northern Wisconsin. The type location is in MLRA 94A. The series is of large extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: AMHERST, MASSACHUSETTS

SERIES ESTABLISHED: Alger County, Michigan, 1929.

REMARKS: Diagnostic horizons and features recognized in this pedon include:
1. Ochric epipedon: from the surface to a depth of 8 cm (0-3 inches). (A horizon).
2. Cambic horizon; the zone from 10 to 48 cm (4 to 19 inches). (Bw1 and Bw2 horizons).

ADDITIONAL DATA: Soil Interpretation Record No. MI0097; LOAMY SUBSTRATUM PHASE (MI0652); BANDED SUBSTRATUM PHASE (MI0653).

National Cooperative Soil Survey
U.S.A.

SOIL PROFILE DESCRIPTION

PROJECT Hiemenz Residence
TEST PIT* TP1
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation **DATE** 11/22/23
LOCATION† 15% linear, linear ridge back-slope @ 151°
N47°13'28.44"/W92°24'31.38"

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
AB1	0 – 8	7.5YR 4/3	sandy loam to loamy sand; < 5% gravel (fill)	moderate, fine granular; very friable, moist		common very fine and fine, and few medium roots; abrupt irregular boundary	0.6/1.0
AB2	8 – 20	7.5YR 4/3	loamy sand; < 5% gravel (fill)	weak, fine subangular blocky; very friable, moist		common very fine and fine, and few medium and coarse roots; abrupt irregular boundary	0.8/1.6§
Bwb	20 – 47	10YR 4/6	sand to fine sand; < 5% gravel and cobbles	single grain; loose to very friable, moist		common, coarse, faint 7.5YR 5/6, Fe staining; few very fine and fine roots to 38 in.; clear wavy boundary	0.6/1.0§
C	47 – 51	10YR 4/3	sand to fine sand; < 5% gravel	single grain; loose to very friable, moist	common, fine, distinct 7.5YR 4/6, round Fe concentrations		NP‖
	51					END OF EXCAVATION	

* Excavator dug.

† Degree of slope for down- and cross-slope shapes at position, direction, and latitude/longitude indicated.

‡ Loading rate in gpd/ft² (gallons per day per square foot) for code projected (design) flows (≤ 150 gpd/bedroom) of residential strength septic tank (Level C)/additionally pretreated (Level B-2 or cleaner) effluents (STE). Pressure distribution required for additionally pretreated STE dispersal.

§ Provisional rate(s), i.e. rate(s) that is/are or would be acceptable with an underlying 3 feet or equivalent of consistently unsaturated, permeable (suitable treatment zone) soil.

‖ Discharge of STE to this horizon is not permitted.

PROFESSIONAL SOIL SCIENTIST
I hereby certify that this plan, document, or report was prepared by me or under my supervision and that I am a duly Licensed Professional Soil Scientist under the laws of the State of Minnesota.
Robert W. Whitmyer License No. 30355

MATRIX Soils & Systems, Inc.
3990 Fairview Road, Rice Lake, MN 55803-2708
(218)390-2869, FAX (218)728-6171, e-mail: rwwhitmyer.matrixss@charter.net

SOIL PROFILE DESCRIPTION

PROJECT Hiemenz Residence
TEST PIT* TP2
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 14% convex, convex ridge back-slope @ 159°
N47°13'28.26"/W92°24'32.22"

DATE 11/22/23

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 12	7.5YR 3/2	sand	weak, coarse granular; very friable to loose, moist		many very fine and fine, common medium, and few coarse roots; abrupt wavy boundary	0.8/1.6
Bw	12 – 50	10YR 4/6	sand	single grain; loose, moist		common, medium, faint 7.5YR 4/4, Fe staining; common very fine and fine, and few medium and coarse roots; clear wavy boundary	0.8/1.6§
C	50 – 60	10YR 4/3	sand	single grain; loose, moist		common, medium, faint 7.5YR 4/4, Fe staining; few very fine and fine roots	0.8/1.6§
	60					END OF EXCAVATION	

* Excavator dug.

† Degree of slope for down- and cross-slope shapes at position, direction, and latitude/longitude indicated.

‡ Loading rate in gpd/ft² (gallons per day per square foot) for code projected (design) flows (≤ 150 gpd/bedroom) of residential strength septic tank (Level C)/additionally pretreated (Level B-2 or cleaner) effluents (STE). Pressure distribution required for additionally pretreated STE dispersal.

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PROFESSIONAL SOIL SCIENTIST
I hereby certify that this plan, document, or report was prepared by me or under my supervision and that I am a duly Licensed Professional Soil Scientist under the laws of the State of Minnesota.
Robert W. Whitmyer License No. 30355

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Septic System Management Plan for Above Grade Systems

The goal of a septic system is to protect human health and the environment by properly treating wastewater before returning it to the environment. Your septic system is designed to kill harmful organisms and remove pollutants before the water is recycled back into our lakes, streams and groundwater.

This **management plan** will identify the operation and maintenance activities necessary to ensure long-term performance of your septic system. Some of these activities must be performed by you, the homeowner. Other tasks must be performed by a licensed septic maintainer or service provider. However, it is **YOUR** responsibility to make sure all tasks get accomplished in a timely manner.

The University of Minnesota's *Septic System Owner's Guide* contains additional tips and recommendations designed to extend the effective life of your system and save you money over time.

Proper septic system design, installation, operation and maintenance means safe and clean water!

Property Owner	Brett Hiemenz	Email	
Property Address	1484 Melrude Rd Cotton <MN 55724	Property ID	320-0010-4705
System Designer	Mike Parrott/ NES	Contact Info	218-600-8808
System Installer	TBD	Contact Info	
Service Provider/Maintainer		Contact Info	
Permitting Authority	St Louis County	Contact Info	218-725-5200
Permit #		Date Inspected	

Keep this Management Plan with your Septic System Owner's Guide. The Septic System Owner's Guide includes a folder to hold maintenance records including pumping, inspection and evaluation reports. Ask your septic professional to also:

- Attach permit information, designer drawings and as-built of your system, if they are available.
- Keep copies of all pumping records and other maintenance and repair invoices with this document.
- Review this document with your maintenance professional at each visit; discuss any changes in product use, activities, or water-use appliances.

For a copy of the *Septic System Owner's Guide*, visit www.bookstores.umn.edu and search for the word "septic" or call 800-322-8642.

For more information see http://septic.umn.edu

Version: August 2015

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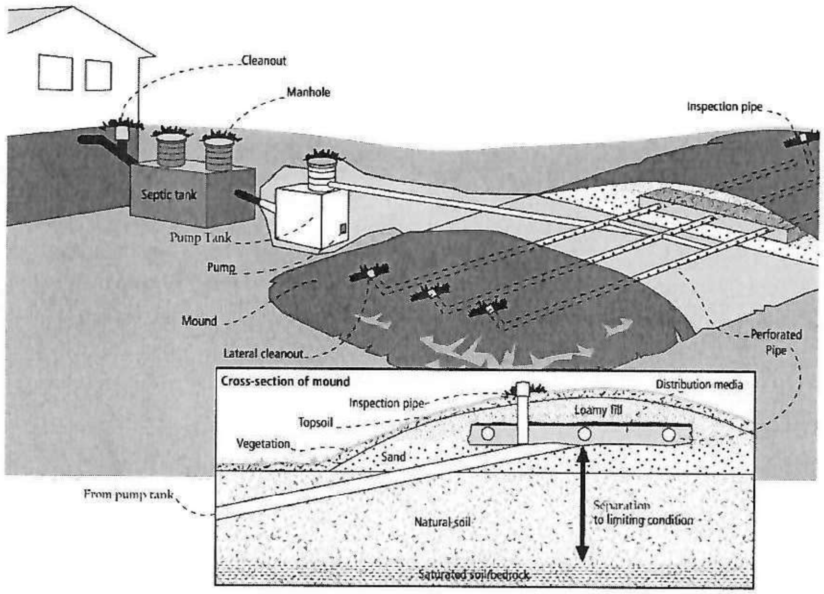
Septic System Management Plan
for Above Grade Systems

Your Septic System



Septic System Specifics

System Type: (●) I ( ) II ( ) III ( ) IV* ( ) V*
(Based on MN Rules Chapter 7080.2200 – 2400)
**Additional Management Plan required*

☐ System is subject to operating permit*
☐ System uses UV disinfection unit*
Type of advanced treatment unit ______

Dwelling Type

Number of bedrooms: 3
System capacity/ design flow (gpd): 300
Anticipated average daily flow (gpd): 210
Comments ______
Business? : (●) Y ( ) N What type? ______

Well Construction

Well depth (ft): 84
❑ Cased well Casing depth: 84
❑ Other (specify): ______
Distance from septic (ft): 59
Is the well on the design drawing? (●) Y ( ) N

Septic Tank

❑ First tank *Tank volume:* 1060 *gallons*
Does tank have two compartments? ( ) Y (●) N
❑ Second tank *Tank volume:* ______ *gallons*
❑ Tank is constructed of ______
❑ Effluent screen: (●) Y ( ) N Alarm (●) Y ( ) N

❑ Pump Tank 540 *gallons*
❑ Effluent Pump *make/model:* ______
Pump capacity 31 GPM
TDH 16 Feet of head
❑ Alarm location at pump

Soil Treatment Area (STA)

Mound/At-Grade area (width x length): 10 ft x 50 ft
Rock bed size (width x length): 10 ft x 50 ft
Location of additional STA: ______
Type of distribution media: rock

☑ Inspection ports ☑ Cleanouts
☐ Surface water diversions
☐ Additional STA not available

Homeowner Management Tasks

These op*eration and maintenance ac*tivities are your responsibility. *Chart on page 6 can help track your activities.*

Your toilet is not a garbage can. Do not flush anything besides human waste and toilet paper. No wet wipes, cigarette butts, disposal diapers, used medicine, feminine products or other trash!

The system and septic tanks needs to be checked every 36 months

Your service provider or pumper/maintainer should evaluate if your tank needs to be pumped more or less often.

Seasonally or several times per year

- *Leaks.* Check (listen, look) for leaks in toilets and dripping faucets. Repair leaks promptly.
- *Soil treatment area.* Regularly check for wet or spongy soil around your soil treatment area. If surfaced sewage or strong odors are not corrected by pumping the tank or fixing broken caps and leaks, call your service professional. *Untreated sewage may make humans and animals sick.* Keep bikes, snowmobiles and other traffic off and control borrowing animals.
- *Alarms.* Alarms signal when there is a problem; contact your service professional any time the alarm signals.
- *Lint filter.* If you have a lint filter, check for lint buildup and clean when necessary. If you do not have one, consider adding one after washing machine.
- *Effluent screen.* If you do not have one, consider having one installed the next time the tank is cleaned along with an alarm.

Annually

- *Water usage rate.* A water meter or another device can be used to monitor your average daily water use. Compare your water usage rate to the design flow of your system (listed on the next page). Contact your septic professional if your average daily flow over the course of a month exceeds 70% of the design flow for your system.
- *Caps.* Make sure that all caps and lids are intact and in place. Inspect for damaged caps at least every fall. Fix or replace damaged caps before winter to help prevent freezing issues.
- *Water conditioning devices.* See Page 5 for a list of devices. When possible, program the recharge frequency based on *water demand (gallons)* rather than *time (days)*. Recharging too frequently may negatively impact your septic system. Consider updating to demand operation if your system currently uses time,
- *Review your water usage rate.* Review the Water Use Appliance chart on Page 5. Discuss any major changes with your service provider or pumper/maintainer.

During each visit by a service provider or pumper/maintainer

- Make sure that your service professional services the tank through the manhole. (NOT though a 4" or 6" diameter inspection port.)
- Ask how full your tank was with sludge and scum to determine if your service interval is appropriate.
- Ask your pumper/maintainer to accomplish the tasks listed on the Professional Tasks on Page 4.

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Septic System Management Plan
for Above Grade Systems

Professional Management Tasks

These are the operation and maintenance activities that a pumper/maintainer performs to help ensure long-term performance of your system. At each visit a written report/record must be provided to homeowner.

Plumbing/Source of Wastewater

- Review the Water Use Appliance Chart on Page 5 with homeowner.
  Discuss any changes in water use and the impact those changes may have on the septic system.
- Review water usage rates (if available) with homeowner.

Septic Tank/Pump Tanks

- *Manhole lid.* A riser is recommended if the lid is not accessible from the ground surface. Insulate the riser cover for frost protection.
- *Liquid level.* Check to make sure the tank is not leaking. The liquid level should be level with the bottom of the outlet pipe. (If the water level is below the bottom of the outlet pipe, the tank may not be watertight. If the water level is higher than the bottom of the outlet pipe of the tank, the effluent screen may need cleaning, or there may be ponding in the soil treatment area.)
- *Inspection pipes.* Replace damaged or missing pipes and caps.
- *Baffles.* Check to make sure they are in place and attached, and that inlet/outlet baffles are clear of buildup or obstructions.
- *Effluent screen.* Check to make sure it is in place; clean per manufacturer recommendation. Recommend retrofitted installation if one is not present.
- *Alarm.* Verify that the alarm works.
- *Scum and sludge.* Measure scum and sludge in each compartment of each septic and pump tank, pump if needed.

Pump

- *Pump and controls.* Check to make sure the pump and controls are operating correctly.
- *Pump vault.* Check to make sure it is in place; clean per manufacturer recommendations.
- *Alarm.* Verify that the alarm works.
- *Drainback.* Check to make sure it is draining properly.
- *Event counter or elapsed time meter.* Check to see if there is an event counter or elapsed time meter for the pump. If there is one or both, calculate the water usage rate and compare to the anticipated use listed on Design and Page 2. Dose Volume: 72.4 gallons: Pump run time: 2.3 Minutes

Soil Treatment Area

- *Inspection pipes.* Check to make sure they are properly capped. Replace caps and pipes that are damaged.
- *Surfacing of effluent.* Check for surfacing effluent or other signs of problems.
- *Lateral flushing.* Check lateral distribution; if cleanouts exist, flush and clean at recommended frequency.
- *Vegetation* - Check to see that a good growth of vegetation is covering the system.

All other components – evaluate as listed here:

Water-Use Appliances and Equipment in the Home

Appliance	Impacts on System	Management Tips
Garbage disposal	• Uses additional water. • Adds solids to the tank. • Finely-ground solids may not settle. Unsettled solids can exit the tank and enter the soil treatment area.	• Use of a garbage disposal is not recommended. • Minimize garbage disposal use. Compost instead. • To prevent solids from exiting the tank, have your tank pumped more frequently. • Add an effluent screen to your tank.
Washing machine	• Washing several loads on one day uses a lot of water and may overload your system. • Overloading your system may prevent solids from settling out in the tank. Unsettled solids can exit the tank and enter the soil treatment area.	• Choose a front-loader or water-saving top-loader, these units use less water than older models. • Limit the addition of extra solids to your tank by using liquid or easily biodegradable detergents. Limit use of bleach-based detergents and fabric softeners. • Install a lint filter after the washer and an effluent screen to your tank • Wash only full loads and think even – spread your laundry loads throughout the week.
Dishwasher	• Powdered and/or high-phosphorus detergents can negatively impact the performance of your tank and soil treatment area. • New models promote "no scraping". They have a garbage disposal inside.	• Use gel detergents. Powdered detergents may add solids to the tank. • Use detergents that are low or no-phosphorus. • Wash only full loads. • Scrape your dishes anyways to keep undigested solids out of your septic system.
Grinder pump (in home)	• Finely-ground solids may not settle. Unsettled solids can exit the tank and enter the soil treatment area.	• Expand septic tank capacity by a factor of 1.5. • Include pump monitoring in your maintenance schedule to ensure that it is working properly. • Add an effluent screen.
Large bathtub (whirlpool)	• Large volume of water may overload your system. • Heavy use of bath oils and soaps can impact biological activity in your tank and soil treatment area.	• Avoid using other water-use appliances at the same time. For example, don't wash clothes and take a bath at the same time. • Use oils, soaps, and cleaners in the bath or shower sparingly.
Clean Water Uses	**Impacts on System**	**Management Tips**
High-efficiency furnace	• Drip may result in frozen pipes during cold weather.	• Re-route water directly out of the house. Do not route furnace discharge to your septic system.
Water softener Iron filter Reverse osmosis	• Salt in recharge water may affect system performance. • Recharge water may hydraulically overload the system.	• These sources produce water that is not sewage and should not go into your septic system. • Reroute water from these sources to another outlet, such as a dry well, draintile or old drainfield. • When replacing, consider using a demand-based recharge vs. a time-based recharge. • Check valves to ensure proper operation; have unit serviced per manufacturer directions
Surface drainage Footing drains	• Water from these sources will overload the system and is prohibited from entering septic system.	

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Septic System Management Plan for Above Grade Systems

Homeowner Maintenance Log

Track maintenance activities here for easy reference. See list of management tasks on pages 3 and 4.

Activity	Date accomplished									
Check frequently:										
Leaks: check for plumbing leaks*										
Soil treatment area check for surfacing**										
Lint filter: check, clean if needed*										
Effluent screen (if owner-maintained)***										
Alarm**										
Check annually:										
Water usage rate (maximum gpd _____)										
Caps: inspect, replace if needed										
Water use appliances – review use										
Other:										

*Monthly

**Quarterly

***Bi-Annually

Notes:

"As the owner of this SSTS, I understand it is my responsibility to properly operate and maintain the sewage treatment system on this property, utilizing the Management Plan. If requirements in this Management Plan are not met, I will promptly notify the permitting authority and take necessary corrective actions. If I have a new system, I agree to adequately protect the reserve area for future use as a soil treatment system."

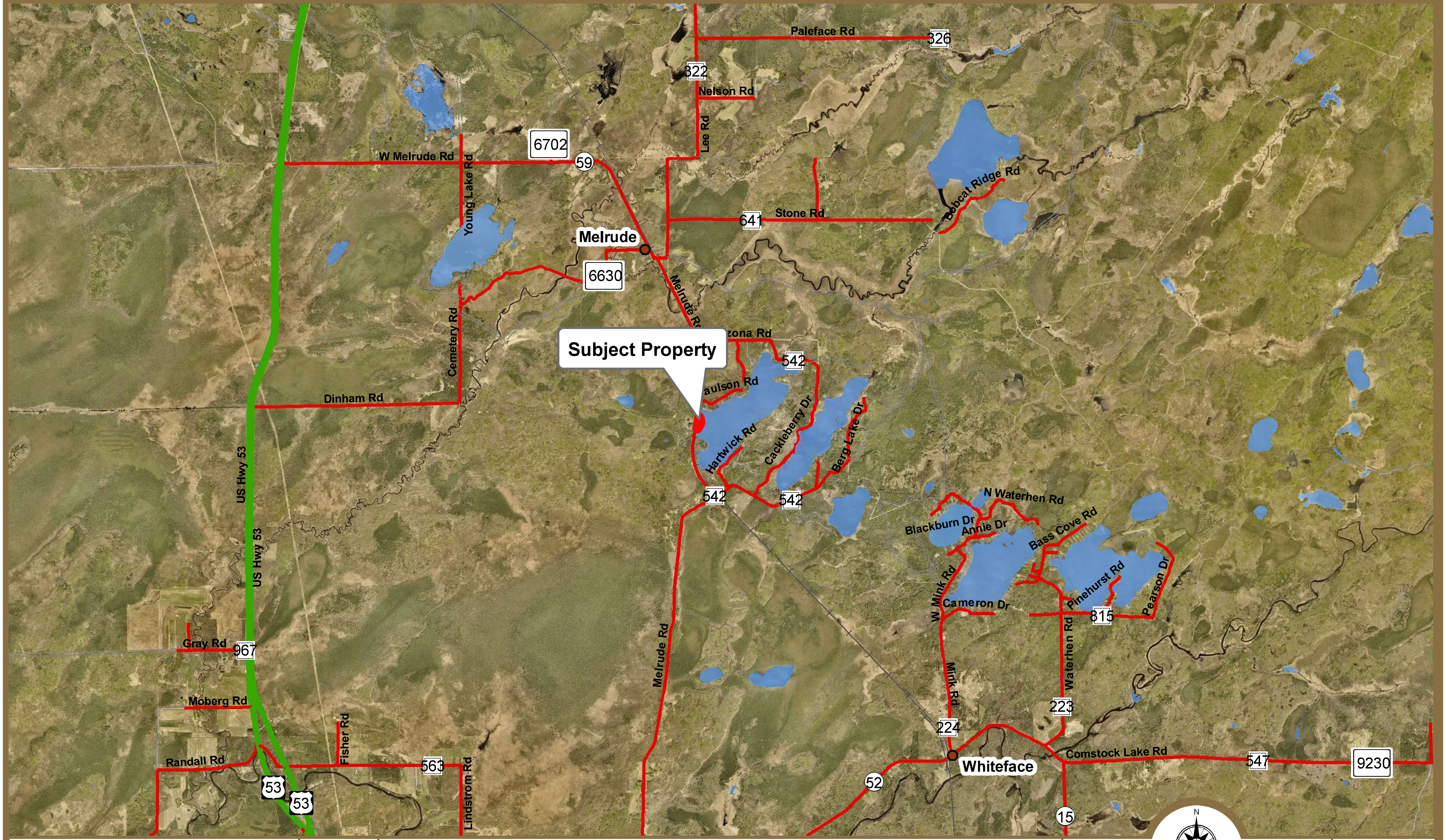
Property Owner Signature: ______________________ Date ______

Management Plan Prepared By: MIke Parrott/ NES   Certification # 1789

Permitting Authority: St Louis County

St. Louis County

March BOA Meeting



Prepared By: **Planning & Zoning Department**
(218) 725-5000
www.stlouiscountymn.gov

Source: St. Louis County

Map Created: 2/14/2024

Disclaimer: This is a compilation of records as they appear in the St. Louis County Offices affecting the area shown. This drawing is to be used only for reference purposes and the County is not responsible for any inaccuracies herein contained.

Northern Environmental Solutions

Location Map

320-0010-04705

0 0.75 1.5

Miles

St. Louis County MN

St. Louis County

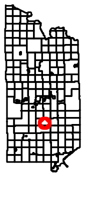
March BOA Meeting

Prepared By: **Planning & Zoning Department**
(218) 725-5000
www.stlouiscountymn.gov

Source: St. Louis County

Map Created: 2/14/2024

Disclaimer: This is a compilation of records as they appear in the St. Louis County Offices affecting the area shown. This drawing is to be used only for reference purposes and the County is not responsible for any inaccuracies herein contained.



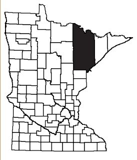
Northern Environmental Solutions

Location Map

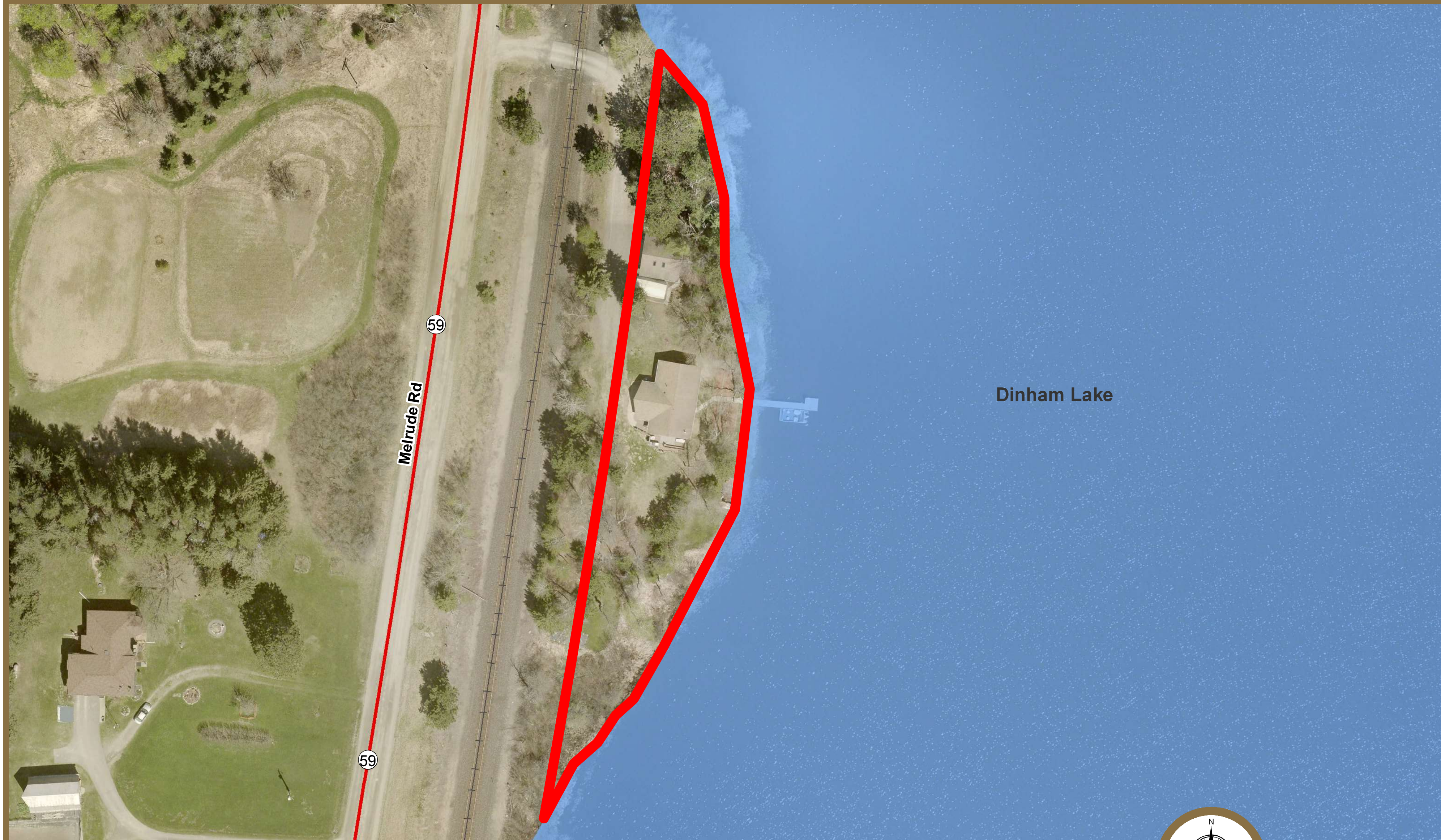
320-0010-04705

0 600 1,200

Feet



St. Louis County
March BOA Meeting



Prepared By: **Planning & Zoning Department**
(218) 725-5000
www.stlouiscountymn.gov

Source: St. Louis County
Map Created: 2/14/2024

Disclaimer: This is a compilation of records as they appear in the St. Louis County Offices affecting the area shown. This drawing is to be used only for reference purposes and the County is not responsible for any inaccuracies herein contained.

Northern Environmental Solutions
Site Map
320-0010-04705

St. Louis County

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Zoning Map

320-0010-04705

0 600 1,200
Feet

St. Louis County MN