Community Assessment Report

Birch Point Road Sanitary District
St. Louis County, Minnesota

Project No. 08812001

November 2011

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Community Assessment Report

Birch Point Road Sanitary District, St. Louis County, Minnesota

SUBMITTAL CERTIFICATION

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Print Name: Carl Scharfe, P.E.

Signature: _____

Date: 11/16/2011 License #: 46907

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.

Print Name: Robert Whitmyer, PSS, SSTS Advanced Designer

Signature: _____

Date: 11/16/2011 PSS/SSTS AD License #'s: 30355/L2028

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EXECUTIVE SUMMARY

Caribou Lake is located in St. Louis County approximately 10 miles northwest of Duluth, Minnesota. A group of 34 homeowners along Birch Point Road on the north shore of Caribou Lake have formed the Birch Point Road Sanitary District. The district is located within Grand Lake Township. Wastewater generated by residents in the district is currently treated via individual sewage treatment systems (ISTS). Past studies have indicated that many of the existing ISTS systems are not meeting regulatory codes. In order to address long term wastewater treatment, the District received a planning grant from the Minnesota Pollution Control Agency (MPCA) to evaluate options for treatment. Grand Lake Township is lending its support to the District, and potential land area (to be donated by the township) for a cluster type wastewater treatment system has been identified.

The District hired MSA to determine the most cost effective alternative for providing a new wastewater collection and treatment system. MSA evaluated a number of alternatives for the wastewater collection and treatment system.

The recommend alternative is to install a new pressurized sewer collection system and a fixed film below grade treatment system with treated water dispersed to a below grade trench system. All 34 homes would be connected to the system and wastewater generated by the homes collected and treated. A grinder station would be installed at each home and a sewer lateral from the house or cabin connected to the grinder station. A small pressure line from the grinder station would be connected to a collection main along Birch Point Road. The pressurized piping would be installed using directional drilling technology which does not require pipe trenching.

The permitting authority for the cluster wastewater treatment system is St. Louis County. However, the grant and loan funding agency for this project is to be provided by the Public Facilities Authority (PFA) which follows MPCA requirements. The MPCA has indicated that in order to get grant funding, the wastewater has to be treated to a greater degree than County requirements. The primary treatment requirement is to reach a total Nitrogen limit of 10 mg/L. To meet this limit, the centralized wastewater treatment system would consist of approximately seven below grade concrete tanks and six treated-water dispersal trenches. The total estimated capital cost for the recommended alternative is approximately $1.34 million dollars. If the total N treatment requirement is removed, the estimated capital cost is approximately $1.06 million dollars.

To provide an estimate of the project cost impact on the homeowners, a preliminary sewer user rate was calculated. The user rate was calculated based on a 30-year PFA (state) loan, a loan interest rate of 2.0%, a grant covering 50% of the project construction cost and 34 users to be served. For these conditions, the estimated future average user charge would be $138/month/user. If the Total Nitrogen treatment requirement is removed, the estimated user rate is $106/month/user. As these user charges are a significant burden, additional grant funding from the PFA is being considered.

I. INTRODUCTION

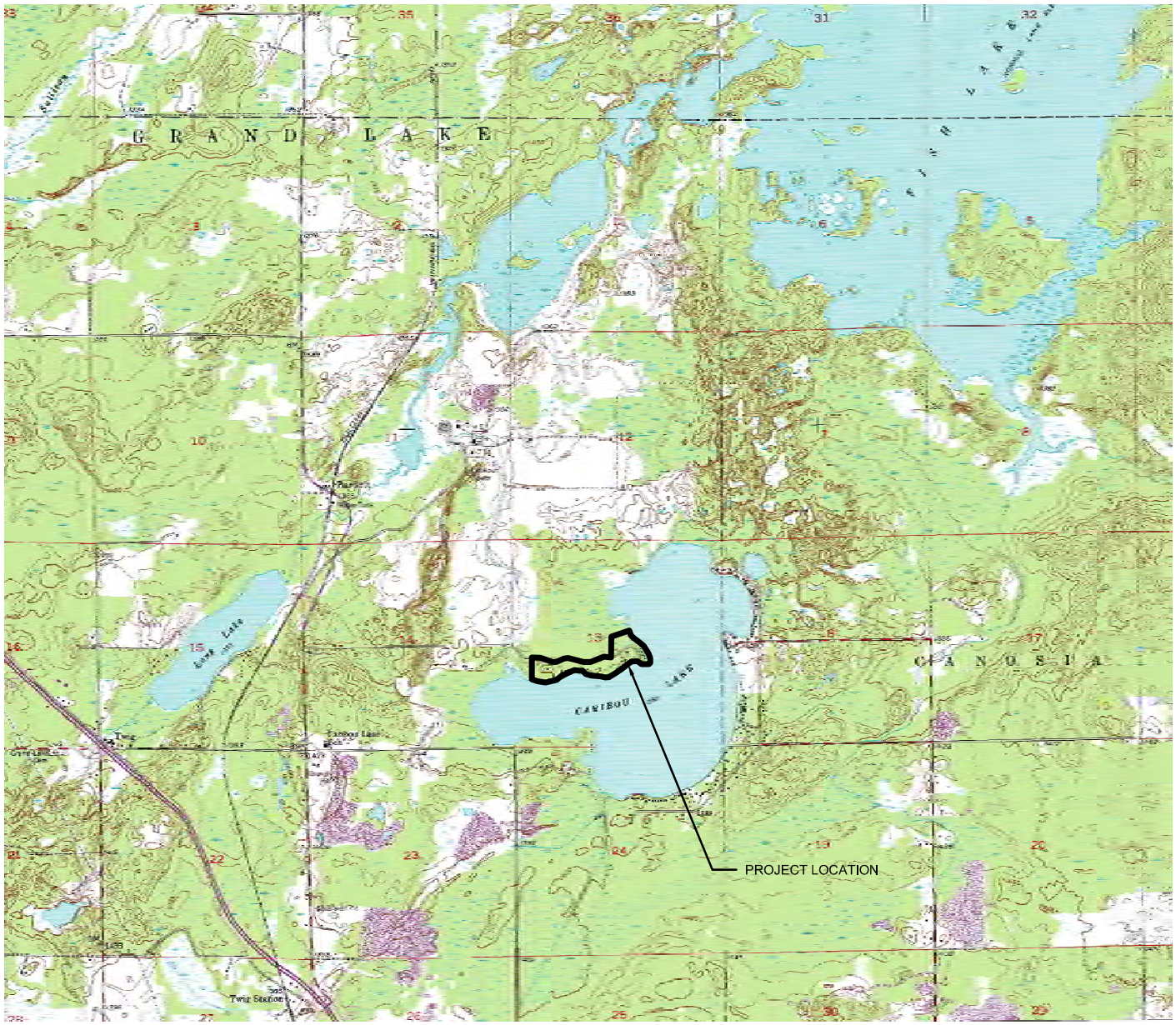
A. Background

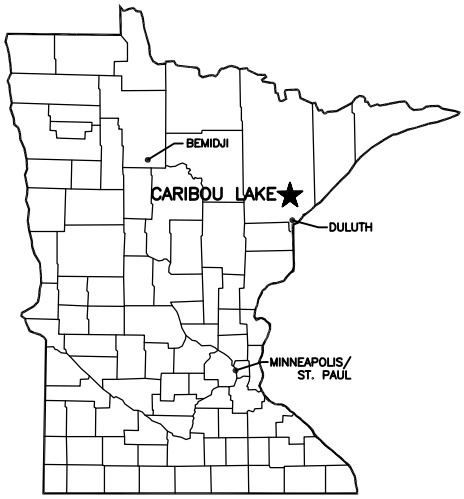
Caribou Lake is located in St. Louis County approximately 10 miles northwest of Duluth, Minnesota. **Figure 1-1** shows the location of the lake. The far eastern edge of the lake lies within Canosia Township while the remainder of the lake is in Grand Lake Township.

Wastewater generated by residents around the lake is currently treated via individual sewage treatment systems (ISTS). Many of the existing ISTS systems are failing or not meeting regulatory codes. From 2003 to 2006, multiple studies and a design for a centralized collection and treatment system around Caribou Lake were completed. However, a wastewater collection and treatment system serving the entire lake has not been implemented to date due to difficulties with project completion and implementation.

Although the larger project has not been implemented, a group of 34 homeowners along Birch Point Road on the north shore of Caribou Lake are dedicated to moving forward with a project to address their wastewater needs. This group is the Birch Point Road Sanitary District and is located within Grand Lake Township. **Figures 1-1, 1-2, and 1-3** show the project location for the 34 homeowners. Grand Lake Township is lending its support to this group, and potential land area (to be donated by the township) for a cluster type wastewater treatment system has been identified. In August 2010, a soils study was conducted to determine the suitability of the site. The potential treatment system area is depicted in **Figures 1-2** and **1-3**.

The Birch Point Road Sanitary District has hired MSA to prepare this CAR to evaluate wastewater collection and treatment options for the residents along Birch Point Road.





REGIONAL LOCATION MAP
MINNESOTA

0 1/16 1/8 1/4 mile

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218-722-3915 1-800-777-7380 Fax: 218-722-4548

SITE LOCATION MAP

BIRCH POINT COLLECTION & TREATMENT SYSTEM
TOWN OF GRAND LAKE
ST. LOUIS COUNTY, MINNESOTA

FILE NO.

SHEET
1-1

File Name: P:\8800s\8810s\88120\88120001\CADD\Location Maps.dwg

File Name: P:\8800s\8810s\8812\08812001\CADD\Location Maps.dwg

PROJECT NO.: 08812001	SCALE: AS SHOWN	NO.	DATE	REVISION	BY
PROJECT DATE: MAY_2011	DRAWN BY: LAJ				
CHECKED BY: CWS					
PLOT DATE:					

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CARIBOU LAKE AERIAL MAP

BIRCH POINT COLLECTION & TREATMENT SYSTEM
OWNER
TWIG, ST. LOUIS COUNTY, MINNESOTA

FILE NO.

SHEET
1-2

0 75' 125' 250'

File Name: P:\8800s\8810s\8812\08812001\CADD\Location Maps.dwg

PROJECT NO: 08812001	SCALE: AS SHOWN	NO.	DATE	REVISION	BY
PROJECT DATE: MAY_2011	DRAWN BY: LAJ				
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BIRCH POINT AERIAL MAP

BIRCH POINT COLLECTION & TREATMENT SYSTEM
TOWN OF GRAND LAKE
ST. LOUIS COUNTY, MINNESOTA

FILE NO.

SHEET
1-3

B. Purpose and Scope

The purpose of the CAR is to determine the most cost effective and environmentally beneficial wastewater treatment system for the Birch Point Road Sanitary District.

The scope of this CAR is as follows:

1. Collect and review background data and current condition of wastewater treatment.
2. Determine future design wastewater flows and loadings.
3. Describe the Birch Point Road area taking into consideration factors such as location, geology, soils, water resources, and economic background
4. Evaluate wastewater collection, treatment and dispersal options including an evaluation of the potential for on-lot upgrades.
5. Provide a preliminary funding and user cost analysis.
6. Present a recommendation of the most cost effective and environmentally sound plan for wastewater treatment and dispersed.
7. Recommend a timetable for implementation of the recommended plan

C. Planning Area

The 20-year planning area boundary is shown in **Figure 1-3** and includes the 34 homes along Birch Point Road. The project area is essentially fully developed and future additional development is not anticipated.

D. Project Funding and MPCA Scoring

This project is being assisted through the Minnesota Public Facilities Authority (PFA) and the Minnesota Pollution Control Agency (MPCA) Small Community Assistance Program. The program provides funding to help communities replace non-complying septic systems and straight pipes with new individual or cluster subsurface sewage treatment systems (SSTS) that will be publicly owned, operated and maintained. The PFA has provided a Technical Assistance (TA) grant to the Birch Point Road residents for this project. The Community Assessment Report (CAR) is being funded through this grant. Through the MPCA Community Assistance Program, future grant money for construction may be available for this project. As part of the program, an income survey for the Birch Point Road residents is required. Results of this survey are summarized in Section II

Funding also requires that the proposed project be ranked (scored) by the MPCA/PFA. The project received a score of 53 points by MPCA. The result of the project score is sufficient so that this project is eligible for grant assistance through the Community Assistance Program. A copy of the scoring is provided in **Appendix A**. It is important to note that the score is predicated on use of a subsurface treatment system with total Nitrogen removal. If this provision is removed, the project may no longer be eligible for the grant funding.

E. Definitions and Abbreviations

Definitions of some terms used in this evaluation report are as follows:

Biochemical Oxygen Demand	The biochemical oxygen demand (BOD) of domestic and industrial wastewater is the amount of molecular oxygen required to stabilize the decomposable matter present in water by aerobic biochemical action.
Suspended Solids	These are solids that either float to the surface of, or are suspended in water, sewage, or industrial waste which are removable by a laboratory filtration device.
Nitrification	The process of biologically oxidizing ammonia (NH_4^+/NH_3) to nitrate/nitrite (NO_3^-/NO_2^-).
Denitrification	The process of biologically converting nitrate/nitrite (NO_3^-/NO_2^-) to nitrogen gas.
Infiltration	The water entering a sewer system (including service connections) from the ground, through such means as, but not limited to, defective pipes, pipe joints, connections, or manhole walls. Infiltration does not include, and is distinguished from, inflow.
Infiltration/Inflow	The total quantity of water from both infiltration and inflow without distinguishing the source.
Inflow	The water discharged into a sewer system (including service connections) from such sources as, but not limited to, roof drains, cellar, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm sewers and combined sewers, catch basins, storm water, surface runoff, street wash waters, or drainage. It does not include, and is distinguished from, infiltration.

Excessive Infiltration/Inflow	The quantity of infiltration/inflow which can be economically eliminated from a sewer system by rehabilitation as determined by a cost-effective analysis that compares the costs for correcting the infiltration/inflow conditions with the total costs for transportation and treatment of the infiltration/inflow.
Present Worth	The total present worth method of evaluating sewage treatment systems involves bringing all costs of buildings, operating and maintaining the sewage treatment systems over a 20-year period to a total present worth in accordance with DNR guidelines.
Sanitary Sewer	A sewer intended to carry only sanitary or sanitary and industrial wastewater, from residences, commercial buildings, industrial plants, and institutions.

Abbreviations of some terms used in this report are as follows:

BOD_5	five-day biochemical oxygen demand
cfs	cubic feet per second
CTH	county trunk highway
EPA	Environmental Protection Agency (Federal)
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
HRT	hydraulic retention time
I/I	infiltration/inflow
lb/day	pounds per day
lb/cap/d	pounds per capita per day
mg	million gallons
mgd	million gallons per day
mg/l	milligrams per liter
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
MPCA	Minnesota Pollution Control Agency
MSA	MSA Professional Services, Inc.
NH_4-N	ammonia nitrogen
NO_3-N	nitrate nitrogen
Total N	total nitrogen
STH	state highway
SRT	solids retention time or sludge age
TKN	total Kjeldahl nitrogen
TP	total phosphorus
TSS	total suspended solids

II. EXISTING CONDITIONS

A. Environmental Setting

The Birch Point Road project area is a residential development on the north shore of Caribou Lake. Surface water drainage is generally towards the lake via overland flow and small ditches. Based on the US Fish and Wildlife wetland inventory maps for the area, there are some isolated wetlands in the project area and extensive wetlands north of Birch Point Road. **Figure 2-1** shows the wetland map for the area. In general, the majority of the land north of Birch Point Road is identified as wetland area.

Soils in the project area have been mapped by the USDA NPES to be comprised primarily of sandy loams and fine sandy loans in the upper 6 inches to 36 inches and gravelly coarse sand below 3 feet. They are classified in the USDA soil survey as Aldenlake-Pequaywan series (F122B) and Pequaywan (F125A) series. A detailed soil analysis conducted for a potential cluster type wastewater treatment system identified conditions different than those mapped. This information is presented later in Section II.

The USDA also has published information for depth to the groundwater table in the area. The majority of the project area has the Aldenlake-Pequaywan soils and the depth to groundwater is at or greater than 200 cm (6.5 feet). The Pequaywan (F125A) series has a depth to groundwater of 76 cm (2.5 feet). A map showing the depth to groundwater and the associated soil series is presented in **Appendix B**.

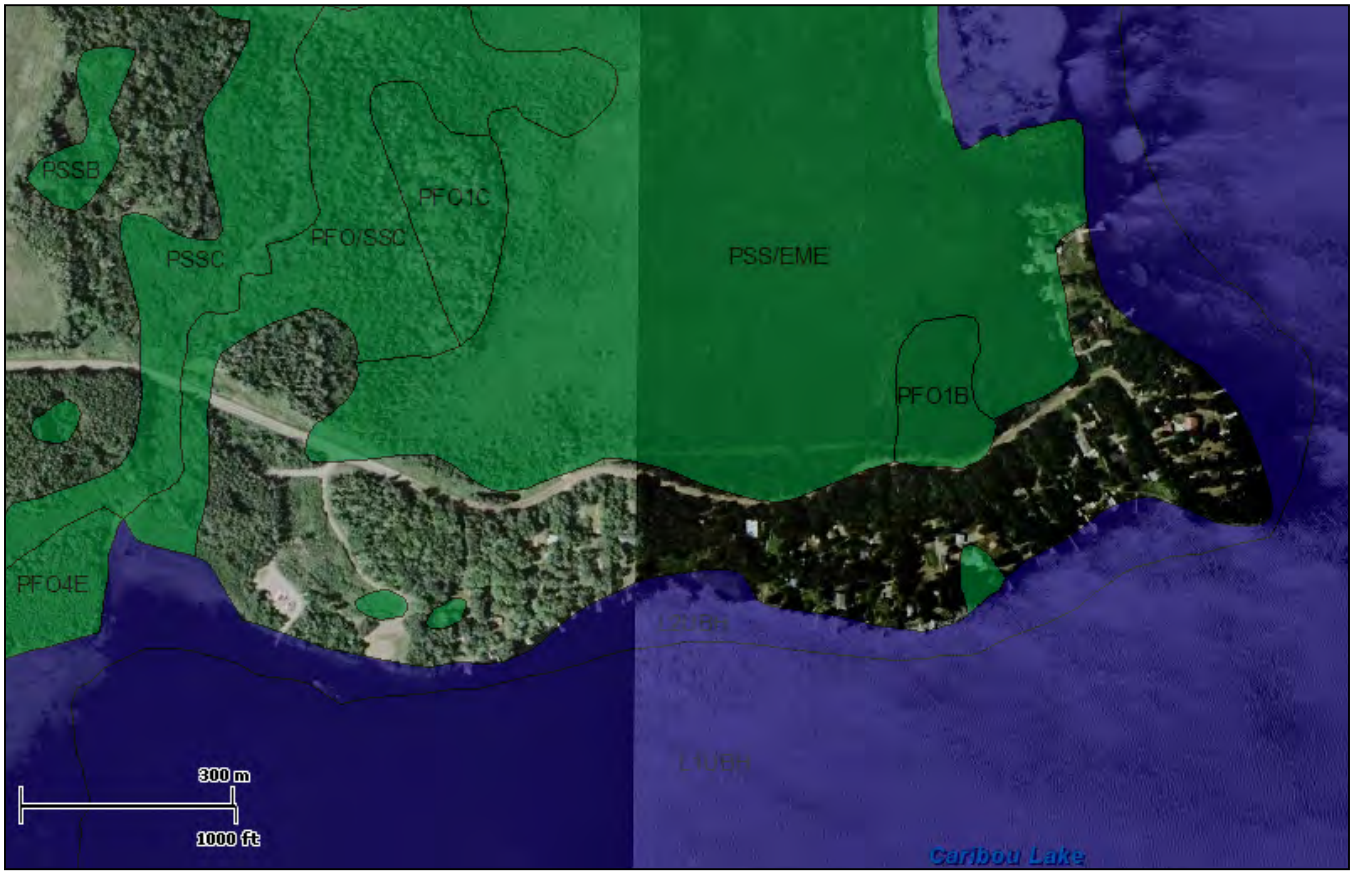
Based on drinking water well data, the depth to bedrock in the area is over 200 feet.

U.S. Fish and Wildlife Service

National Wetlands Inventory

Birch Point Road

Apr 15, 2011



Wetlands

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

User Remarks:

http://137.227.242.85/wetland/wetland.html

Figure 2-1

B. Income Survey

As part of the PFA Small Assistance Program, an income survey for the project was conducted. The survey was conducted by the Northspan Group, Inc. This survey was conducted in March 2011. A description of the methodology and results of the survey are presented in **Appendix C**. A survey letter was sent out to each household and follow-up resulted in obtaining information from 31 of the 34 households. Results of the survey indicate a median household income of $55,500 and a population of 62 people (for 31 homes). Thus, based on the survey there are currently two people per home. The median household income (MHI) value that the PFA will use for determining grant eligibility is not yet finalized. The income survey report indicates that the best available data now indicates a state MHI of $55,500 is applicable for this project. Based on current communications with the PFA, it appears that the MHI will not be determined until November 2011.

C. Description and Condition of Existing Individual On-Site Treatment Systems (ISTS')

A study of ISTS' around Caribou Lake was conducted in 2003 as part of the original design concept to provide wastewater collection for the entire lake. For the homes within the Birch Point Road project area, 25 of the 34 properties with dwellings (19 of which were seasonally-used at that time) were evaluated for compliance with MPCA codes. Eighteen of the 25 systems evaluated had subsurface infiltration systems (trench, seepage bed, sanitary privy or other), five had mound systems, and there was one holding tank system, and one subsurface constructed wetland system. Of the nine (9) which were not evaluated, St. Louis County documentation listed eight (8) that were subsurface infiltration systems of known or unknown types. Evaluation results showed 80 percent of the 25 ISTS' to be failing to protect groundwater (FPG), i.e. having less than three feet of suitable soil below infiltrative surfaces. Of the portion of systems that were subsurface infiltration systems, 94 percent failed to protect groundwater. One ISTS was observed to be an imminent health threat. Based on proximity to adjacent properties with FPG ISTS and the observed rate for this type of failure with subsurface systems evaluated, it is estimated that at least 7 of the 9 properties not evaluated are likely to have FPG ISTS'.

In the summer of 2011 a topographic survey and house survey for the project area were completed under the PFA Technical Assistance (TA) grant. The topographic survey included an area proposed for the future wastewater treatment system, Birch Point Road, and portions of the lots along the road. House surveys were conducted to locate cabins/homes, private wells, and existing septic tank

vent pipes. A number of residents also assisted by placing stakes near their water wells and septic tank vents. A total of 34 home surveys were conducted.

Appendix D contains a summary of the house survey results. The results of the survey are as follows:

- Thirty-four (34) future service locations were identified.
- Twenty-six (26) private wells were located.
- Twenty-eight (28) septic tanks were located.
    - One also has a peat treatment system
    - One also has a multi-mound system
    - One also has a sand filter
    - One also has an advance treatment system
- Five (5) outhouse were located
- One (1) holding tank was identified.

Construction of the future collection system would require installation of a grinder pump or septic tank effluent pump and a pressure lateral. Based on the house surveys, thirteen future hook-ups would need a variance from the Minnesota Department of Health criteria for the 50-foot separation distance from a private well to a septic tank, future grinder station or forcemain as the separation distance requirement would not be met.

D. Wastewater Treatment and Dispersal Site Evaluation

During scoping of this project, an approximate 5-1/2 acre property was identified as the treatment system area. The area is shown in **Figure 1-3.** A resolution by the St. Louis County Board of Commissioners was passed authorizing transfer of this land to Grand Lake Township for use as a treatment site area. A copy of this resolution is provided at the end of **Appendix E.**

In order to evaluate the use of the site for locating the wastewater treatment units and the treated effluent subsurface dispersal, an on-site evaluation was conducted in August 2010. The results of that site evaluation are presented in this section. **Appendix E** contains the full report of the evaluation.

The purpose of the evaluation was to determine the capability of soil within the site to treat and disperse wastewater from the area. A total of 23 soil test pits were dug and soil profiles observed and recorded. Nineteen (19) measurements of saturated hydraulic conductivity within four horizons were also completed. In general soils are structured and unstructured sandy loams and loamy sands. Depths of consistently unsaturated soils average between 69 inches in interior

portion of the site to 45 inches along the southwestern boundary to 38 inches in the eastern portion. Those portions of the site with 4 feet or greater of unsaturated soil would be suitable for subsurface treatment and dispersal of residential strength septic tank effluent (approximately 1-¼ acre total in vicinity of test pits TP5, TP6, TP8 to TP15, and TP19 to TP21).. To use the remainder of the site, additional pretreatment of septic tank would be required as there is less than 3 feet of unsaturated soils (test pits TP3 to TP4, TP7, TP16, TP17, TP22, and TP23). There is between 3 feet and 4 feet of unsaturated soil in vicinity of test pits TP1 and TP18.

Based on results of the evaluation, the site could accommodate a cluster system with a capability to treat and disperse up to at least 9,500 gpd. This is sufficient for the actual design flow of 8,700 gpd.

Flow of any treated effluent discharged subsurfacely to site soils would have vertical and horizontal components. Vertical flow would predominate within the upper three feet to four feet. Underlying the upper material is a much less permeable zone of platy-structured loam that appears to increase in density with depth. Because of the notably lower permeability of this zone, water movement in the permeable zone immediately above would be primarily horizontal, particularly during wet periods. Treated effluent discharged within western three-quarters of the site would likely flow horizontally in a generally west-northwesterly direction. In eastern portion of the site, horizontal flow is likely to be toward the north or the south of the knoll summit (TP 15) depending on location of subsurface infiltration cells. Some vertical leakage within the platy-structured loam substrate would occur, albeit at a rate likely to be in the range of less than or equal to 5×10^{-6} cm/sec.

III. DECENTRALIZED ON-SITE UPGRADE EVALUATION (ON-LOT)

A. General

The MPCA/PFA community assistance program requires that the ability of upgrading or replacing the existing ISTS' on the existing lots be evaluated. This evaluation should also include any specific St. Louis County on-site system requirements as well. The evaluation general includes looking at the following possibilities:

- Individual, Type I solutions, (trench, mound, at-grade)
- Shared Type I solutions, (trench, mound, at-grade)
- Individual, then shared Type III solutions
- Individual, then shared Type IV or V solutions

The evaluation for this project is presented below

B. Evaluation

A total of 34 homes are located in the project area. As indicated above, an ISTS study was conducted identifying the percentage of existing ISTS that are non-compliant or failing. As part of the funding application process with the MPCA/PFA, a lot by lot evaluation was previously conducted. The evaluation was included with the application for the project scoring.

Of the properties appraised 80 percent would not be capable of accommodating Type I replacement systems. Because of dwelling and water supply well density within the sanitary district, potential for using Type III (reduced-flow) and Type IV or V systems would be limited. For homes where these systems are possible to use, the cost would be above a reasonable level both for construction and operation due to the complexity of these systems. Thus, replacement of the existing ISTS with standard or non-standard individual or shared systems is not considered feasible and is eliminated as an alternative.

As a land area for a cluster system has been identified, evaluated, and found suitable for this project, a collection system with a cluster treatment system is feasible. Design flows and loads for a cluster system are presented in the next section.

IV. DESIGN FLOWS AND LOADINGS FOR CLUSTER SYSTEM

A. Permit Flows and Design Flows

Two types of flows were determined for evaluation of a cluster treatment system for this project: permitted flow and design flow. The permit flow was calculated in accordance with MPCA Statute 7081.0120 and 7080.1860. This flow is used to determine whether St. Louis County or the MPCA is the regulating authority. The design flow was calculated based on the actual flows expected and is used in sizing treatment units.

The permitted flow for this project is based on 1) thirty-four (34) dwellings classified as 3 bedroom, Type I dwellings with a flow of 450 gpd per dwelling and 2) utilizing the flow equation in MPCA Statue 7081.0120. This equation indicates that the design flow is equal to the full flow from the first ten dwellings added to forty-five percent of the remaining dwelling flows. For this project this equates to the following:

Permitted flow = 450 x 10 homes + 450 x 24 x 0.45 = 9,360 gpd.

Actual flow data is not available as the proposed project will serve a currently unsewered area. Design flows are based on per capita wastewater generation. Flows generated per person for small residential systems are typically in the range of 50 to 65 gpd as listed in the *3rd Edition of Metcalf & Eddy - Wastewater Engineering Treatment, Disposal, Reuse* (p. 1,019). Chapter 5 of the *University of Minnesota's Manual for Septic System Professionals in Minnesota* indicates a weighted average of 69 gpcd. Thus, a typical residential base flow of 70 gallons per capita per day (gpcd) is used. Infiltration and inflow is typically minimized in smaller cluster systems where either pressure sewers are used or smaller gravity lines are used. To allow for some infiltration a per capita design value of 85 gpcd is used for this project. This allowance is equivalent to a 1 gallon per minute in the system as constructed.

The income survey indicated approximately two persons per resident. However, approximately half of the homes are seasonal cabins and typically have four people per home on a regular basis on the weekends. Thus, the average number of users per home in the summer is closer to three persons per home. Based upon 34 dwellings, 3.0 person per household, and 85 gal/capita-day, the design flow is calculated as follows:

Design flow = 34 homes x 3.0 persons per home x 85 gal/capita/d = ~8,700 gpd

Based on information from the Birch Point Road Sanitary District, approximately 17 of the 34 will have year round residents. The winter occupancy rate is expected to be two persons per home. Thus, winter flow is expected to be approximately 2,900 gpd. This will need to be considered in the design of a cluster treatment system.

B. Organic Loadings

Organic loading generated in the system were calculated using per capital loading factors as presented in *3rd Edition of Metcalf & Eddy - Wastewater Engineering Treatment, Disposal, Reuse* (p. 166). These loading factors are BOD_5=0.20 lb/capita-day, TSS=0.20 lb/capita-day, and TKN=0.03 lb/capita-day. Based on these values, the design organic loadings are BOD_5=20 lb/day, TSS=20lb/day, and TKN=3 lb/day.

V. REGULATORY REQUIREMENTS FOR DISCHARGE

A. Subsurface Discharge Requirements

The permit flow calculated above is used to determine the governing regulatory body permitting the new system. Permitted flows below 10,000 gpd fall under the regulatory authority of St Louis County rather than MPCA jurisdiction. As the permit flow is below 10,000 gpd, the regulating and permitting body for this project will be St. Louis County. As the system permitted flow falls between 5,000 gpd and 10,000 gpd, the system is classified as a Midsized Subsurface Sewage Treatment System (MSTS).

Under MPCA Chapter 7081.00080 subpart 4.D., an MSTS system must employ nitrogen reduction processes such that 1) if the MSTS will impact groundwater, the effluent from the MSTS system in combination with the recharge must not exceed a total nitrogen concentration greater than 10 mg/L at the property boundary or at the nearest receptor the groundwater quality of the aquifer or 2) if the discharge does not impact groundwater, then best management practices must be employed to mitigate impacts.

In general, the requirement above usually results in designing the treatment system to produce an effluent of 10 mg/L or less total Nitrogen. Relying on recharge (as in Item 1) or demonstrating that the aquifer will not be affected by the discharge (Item 2) requires modeling, chemical soil analysis, and/or hydrologic studies. Although it may be possible to pursue this avenue, the likelihood of successfully demonstrating no impact is considered low.

The MPCA standards for total Nitrogen removal for MSTS systems are slated to be adopted by Minnesota Counties by state legislative mandate. However, St. Louis County and a number of other counties have yet to adopt the standards and recent Minnesota legislative action indicates that the deadline for adoption of MPCA standards have been extended an additional two years (2013). **Based on the current legislative rulemaking, the County is the regulating authority for the MSTS sized-system and the nitrogen limit would not currently apply to this project. However, grant funding for the project is to be provided through the Minnesota PFA and MPCA. Through discussions with Brett Ballavance, MPCA plan reviewer, the grant funding requires that total N be addressed in the treatment system.** Thus, as part of the treatment system evaluation for subsurface discharge, systems without nitrogen removal (just standard BOD removal) and with Total N removal will be sized and cost estimates prepared.

Typical subsurface discharge methods are to apply the treated effluent to a standard trench or a drip irrigation system. Based on the results of the treatment site study (**Appendix E**), effluent dispersal in trenches is suitable for the available site.

B. Surface Water Discharge

Surface water discharge options were evaluated in past Facility Plans and found to be impractical. For discharges to the Lake Superior watershed, MPCA will require that the effluent mercury concentration be 1.3 nanograms/L and phosphorus be 1.0 mg/L. The effluent mercury limit is currently only technically feasible with an expensive and complicated ultrafiltration system. This system would be cost prohibitive and too complicated to operate for such a small treatment system. In addition, discharge to surface water would reduce the MPCA project score and eliminate grant funding. Thus, surface water discharge **is eliminated** from consideration on this project.

C. Spray Irrigation Effluent Disposal

Wastewater treatment with final spray irrigation is another potential discharge option for this project. Spray irrigation would be permitted by MPCA under a State Disposal System (SDS) Permit For spray irrigation in northern Minnesota, the MPCA requires that wastewater be stored for 210 days over the winter period and that the wastewater sprayed meet a fecal coliform limit of 200 #/100 ml. The fecal coliform limit requires that disinfection be used prior to spray irrigation. There are no nitrogen limits for spray irrigation, but the effluent nitrogen level would need to be known in order to determine the acceptable wastewater application rate to the spray irrigation field.

A standard system for spray irrigation would include a 0.6 acre storage pond, spray irrigation pump and pump house and an irrigation field with irrigating equipment. Storage over the 210-day winter period would require a storage pond volume of approximately 0.7 million gallons. Approximately 2.0 million gallons per year would need to be spray irrigated. Based on typical application rates (0.75 in/wk) and nitrogen loading rates, the estimated spray irrigation area is 7 acres. A potential spray irrigation field is a parcel of land near the Northeast Regional Correctional Institute located northeast of the proposed project. This field was identified as part of the earlier Facility Plan for the entire Caribou Lake collection and treatment system. The costs for a standard spray irrigation are estimated to be $1.5 million dollars and exceed that of a subsurface disposal system. A standard spray irrigation system will not be cost effective versus subsurface disposal and **is eliminated** from further consideration.

A variant to a standard spray irrigation system has been implemented in Kabetogama, Minnesota. In this system, winter flows only are treated with a subsurface ISTS system. As the winter flows are below 5,000 gpd, the system is classified as an ISTS versus a MSTS. The County permits this system and a total nitrogen limit does not apply as the system is an ISTS. In the summer period the flows increase up to 18,000 gpd and the treated wastewater is spray irrigated. Because winter flows are treated there is no need for a storage pond. This system includes a septic tank, treatment tank, UV disinfection unit, a two-week storage tank and spray irrigation fields and equipment.

One of the primary purposes of this variant was also to secure additional grant funding (25% of the spray irrigation system costs) through the MPCA's Green Infrastructure Funding program. Thus, Kabetogama received both technical assistance grant funding and funding through the Green Infrastructure program. It is also important to note that at Kabetogama the subsurface discharge area available was not available for the required summer flowrates. Thus, for that system there was no choice other than to include off-site spray irrigation.

This type of variant was analyzed for the Birch Point Road project. However, a 25% grant from the Green Infrastructure Program would not offset the additional 75% cost for the irrigation equipment, pump station, land acquisition (5 acres), and force main for this variant. In essence, the extra cost for the irrigation system would be greater than the savings in using a smaller wastewater treatment system (3,000 gpd) versus the larger system (8,700 gpd) without the spray irrigation system. Thus, this variant is **eliminated** from further consideration.

D. Rapid Infiltration Basin Effluent Disposal

This option would involve discharging treated effluent to at-grade rapid infiltration basins (RIBs) in the identified treatment area for ultimate disposal to the groundwater. These systems are permitted as State Disposal System (SDS) through the MPCA. Typically, discharge to RIBs requires meeting groundwater quality standards, including a total nitrogen standard of 10 mg/L. MPCA requirements for RIBs are listed below:

a) No floodplain within 50 feet of RIBs.
b) No wetland within 50 feet of the RIBs
c) No wellhead protection areas are within a one mile radius of the RIB system.
d) No domestic or municipal wells within ½ mile of the RIBs
e) There must be a separation distance of 3 feet from the bottom of the cell to the highest anticipated groundwater level.

f) 10 feet separation to bedrock. Specific soil textures are also required.
g) A minimum distance of 100 feet must be provided between the RIB and the property line.
h) A storage pond equivalent to a minimum of 150 days of design flow is required.
i) In order to determine the RIB hydraulic loading rate, a site soil survey must be performed. The survey must be conducted by an expert in soil science and who has completed the MPCA Onsite Sewage Treatment Workshop Soils class.
j) For nitrogen, there are two options: 1) meet the 10 mg/L total nitrogen limit at the discharge to the RIB and do a limited hydrogeologic investigation with no groundwater monitoring or 2) perform a complete hydrogeologic investigation and a 10 mg/L total nitrogen limit will be assigned to groundwater monitoring wells downstream of the RIBs. In either case, a hydrogeologic study and an analysis of groundwater mounding must be completed.
k) A phosphorus evaluation is required if the RIB is located closer than the following distances to a receiving water:
   (1) 2,500 feet for sand soil texture
   (2) 1,500 feet for loam soil texture
   (3) 300 feet for clay loan soil texture.
l) Meet all the MPCA RIB engineering design requirements
m) Adjust the final RIB loading rate based on in-basin infiltration rates conducted after the RIBs are constructed.

For Birch Point Road project, the criteria for separation of RIBs from domestic wells (1/2 mile) would require that the site be north or northwest of treatment area identified in **Figure 1-3**. As the treatment area identified is also within 1,500 feet of the Caribou Lake, a phosphorus evaluation would be required. A 210-day storage period for the design flow of 8,500 gallons would require a holding pond size of 1.3 million gallons. The estimated annual amount of wastewater to apply would be approximately 1.0 million gallons per year based on winter flows approximately half the design flow.

The areal size of the RIBs is highly dependent on the field measured soil hydraulic conductivity. Based on information from the treatment site study, the acceptable loading rate to the soil is approximately 0.5 gal/sq ft. Using 0.5 gal/sq ft, an annual volume of 1.6 million gallons and an application period of 175 days results in total RIB area requirement of approximately 18,000 square feet. The

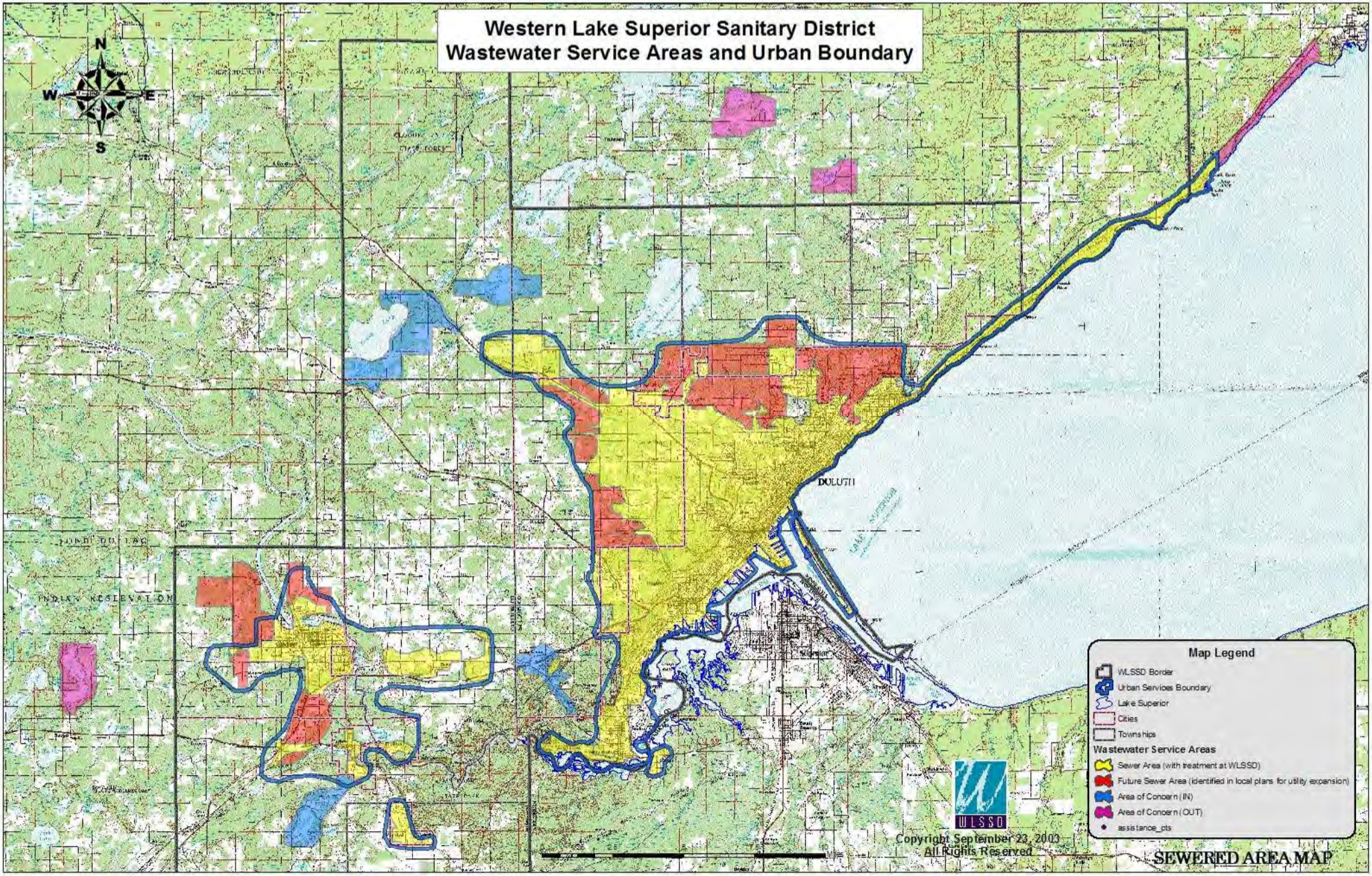
final size would depend on the measured hydraulic conductivity of the existing soils.

If the soil study and phosphorus modeling show that the subsurface soil does not have sufficient phosphorus holding capacity, then chemical addition is required prior to discharge to the RIBs. One method would be to add chemical directly to the storage pond prior to the start of the application season. This could be accomplished from a boat or with an agricultural type recirculation gun. As wastewater continues to flow into the storage pond as the application season progresses, it may be necessary to apply chemicals more than once so that phosphorus breakthrough does not occur.

This disposal alternative **is eliminated** from further consideration due to difficulty in meeting the regulatory requirements.

E. Regionalization

The Birch Point Road project area is located with the Western Lake Superior Sanitary Sewer District (WLSSD). The District boundaries extend as shown on Figure 4-1 (black line in the figure). Although the District encompasses the project area, WLSSD is only extending sewer service to the areas in urban services boundary (blue line on Figure 4-1). The Birch Point Road project area is not inside the urban services boundary. WLSSD policy is not to extend sewer service to areas outside the urban services boundary. WLSSD was contacted in past facility plan efforts and have indicated they are not prepared to extend sewer service to this area. There are no other community wastewater systems in the vicinity that can accept the wastewater from the project area. Thus, regional treatment is not a viable option and is **eliminated**.


Western Lake Superior Sanitary District
Wastewater Service Areas and Urban Boundary
N
W
E
S
DULUTH
Map Legend
WLSSD Border
Urban Services Boundary
Lake Superior
Cities
Townships
Wastewater Service Areas
Sewer Area (with treatment at WLSSD)
Future Sewer Area (identified in local plans for utility expansion)
Area of Concern (IN)
Area of Concern (OUT)
assistance_pts
WLSSD
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SEWERED AREA MAP

Figure 4-1

VI. DESCRIPTION AND EVALUATION OF WASTEWATER COLLECTION ALTERNATIVES

A. General

Previous evaluations indicate that a wastewater collection and cluster treatment system is appropriate for this project. The service area includes the 34 homes in the Birch Point Road project area. There would be 34 connections to the new wastewater collection system. Three collection system alternatives were evaluated.

B. Gravity Collection System

A gravity collection system would consist of approximately 1,500 feet of 8" and 10" PVC gravity sewer pipe, 8 manholes, 13,000 feet of lateral piping, two sewage pump stations, and 1,300 feet of forcemain. The gravity collection system would need to be constructed along the existing winding road as all areas to the north of the existing road are wetland. The gravity sewer requires installation by the open cut method in trenches that are 8 to 14 feet deep. There are two high points along the road that would require the construction of the two lift stations. The relatively long distance from the houses on the shore the road would result in relatively deep sewers (>12 feet deep). The open cut method could be difficult due to the amount of trench dewatering that would be needed in an area of high groundwater tables. In addition, gravity sewers contain manholes that are susceptible to leakage from high groundwater. Leakage can be controlled but will be a concern in the future where manhole joints and casting rings are present. A preliminary cost estimate for a gravity system indicates the cost to be approximately 1.5 million dollars. Because of the higher cost, lift stations, and concern for infiltration/inflow, gravity sewers are not considered a viable alternative for this project and are **eliminated**.

C. Pressure Sewer System and Grinder Pump Stations

A pressure sewer system with grinder pump stations would consist of approximately 19,000 feet of small diameter high density polyethelene (HDPE) pressure sewer with valves and flushing connections. Each home would be provided with a grinder pump station, which would pump effluent directly into the pressure sewer system. The water from the home plumbing would flow by gravity to the grinder station located in the yard. The sewage would get pumped out of the grinder station to a 2 or 3 inch forcemain depending on the home's location. The system would be sized to provide pumping capacity during the highest use periods, typically morning and evening.

In pressure systems the lines are typically directionally drilled at a minimal depth of 7 feet. Directional drilling will limit the amount of dewatering that will be required as compared with gravity systems. Directional drilling will also minimize impacts on any wetland areas.

Pressure sewers have a further advantage when considering potential leakage into the collection system from high groundwater. The pressure grinder stations are typically a HDPE or fiberglass unit that is sealed to prevent groundwater from infiltrating. In addition, the pressure system does not have manhole joints that could allow water to infiltrate into the system. As the collection system is under pressure the system is inherently not susceptible to inflow and infiltration. However, there is a potential for some infiltration and inflow in the gravity lateral lines to the grinder stations.

The advantages and disadvantages of a grinder pump system are as follows:

Grinder Pump System

Advantages
- Smaller diameter pipes (versus gravity system).
- Force main follows contours of the land.
- Force main can be installed by directional drilling techniques minimizing soil and road disturbance that is not possible with gravity collection systems.
- Minimized inflow/infiltration.
- Can share grinder station between residents, as necessary to reduce costs.

Disadvantages
- Grinder pump stations required (versus gravity system).
- Higher operating and maintenance cost (versus gravity system).
- Easement requirements if grinder stations are on private property.
- Larger septic tank volume required versus a STEP system per MPCA codes (does not apply if BOD treatment units used prior to effluent dispersal).
- The homeowner or the district will need to maintain the pump station.

D. Pressure Sewer System with Septic Tanks and Effluent Pumps (STEP)

A pressure sewer system with septic tanks and effluent pumps (STEP system) would be similar in configuration to the pressure system with grinder pumps. It would consist of approximately 8,000 feet of small diameter HDPE pressure pipe with valves and cleanouts. Each service connection would have a septic tank to settle solids from the effluent with a pump chamber and pump discharging directly to the pressure sewer system. The STEP systems typically have a filter in the pump chamber in order to prevent clogging of the pumps. This system would

require that the Birch Point Sanitary District mandate the periodic pumping of all septic tanks connected to the pressure system

One potential disadvantage of the STEP systems is the septic tanks are more susceptible to leakage versus a grinder station when placed below the ground water table. If the septic tanks leak substantially, the hydraulic loading to the wastewater treatment plant would increase. The primary locations where leakage is possible is at the connection point of the gravity lateral to the septic tank, the tank inspection manhole risers, and where the pump discharge line exists the tank.

One advantage of the STEP system is that if newer septic systems or other primary treatment systems have already been installed, then there may be some cost savings. Currently there are four homes that have had some form of advanced treatment system installed after their septic tanks. However, for the five homes/cabins with outhouses a new septic tank/STEP system would be required. Thus, the overall cost savings may not be that significant.

The STEP system also reduces the BOD and solids loading on the chosen wastewater system. A summary of advantages and disadvantages for a STEP system follows:

STEP System

Advantages
- Smaller diameter pipes (versus gravity system).
- Force main follows contours of the land and is suitable for flat terrain.
- Force main can be installed by directional drilling techniques minimizing soil and road disturbance that is not possible with gravity collection systems.
- Septic tank volume required less than a grinder-based system (unless a BOD treatment unit is used prior to effluent dispersal).
- Less potential for clogging of the force main lines.

Disadvantages
- Effluent pump stations required (versus gravity sewer).
- Higher operating and maintenance cost (versus gravity sewer), but lower than grinder stations.
- Need to evaluate existing individual septic tanks and decide which septic tanks need to be replaced and which can be retrofitted. In some cases, all the septic tanks require replacement.
- The individual STEP systems will require monitoring of the sludge level and periodic sludge pumpout. This will need to be arranged either by the sanitary district or the individual home owners.
- The STEP system is more susceptible to inflow and infiltration.

- The home owner or district will need to clean the filters in the pump chambers (~once every three months).
- Cannot effectively share STEP systems because septic tanks cannot typically be shared.

E. Summary and Recommendation of Collection System Alternatives

The main factor driving the selection of a collection system alternative in Birch Point Road area is minimization of wastewater flow and construction cost. The best way to minimize future inflow and infiltration concerns is to install a pressure sewer system. The use of either grinders system or STEP systems is dependent on the desires of the customers served and the condition of the existing septic tanks in the existing individual mound systems. The installed cost for a new grinder station and a new STEP system are very close. The maintenance requirements for a grinder station are typically slightly higher than for a STEP system. However, the STEP systems are likely to require more monitoring and will require periodic sludge pumpout of the tanks.

The house survey results indicate that seven of the thirty-four homes have outhouses and would require a new septic tank to be installed.

If a significant proportion of the existing septic tanks can meet code requirements, then the existing tanks could be retrofitted with the effluent pump/filter units and the STEP system may offer some significant savings. If minimization of inflow and infiltration and monitoring/maintenance by the customer is paramount, then the grinder systems are likely to be the better choice.

The estimated capital cost for a grinder or STEP system for each customer and a pressure collection piping system is approximately $800,000. This cost includes the grinder or STEP stations, valve and air release manholes, HDPE pipe, restoration of pavement and lawn areas, contingency and engineering costs. If a grinder system is installed and if approximately one-third of the grinder station can be eliminated by sharing amongst some residents, the estimated reduction in the collection system costs is approximately $180,000.

Appendix F contains the engineering cost estimate for a pressurized collection system.

VII. DESCRIPTION AND EVALUATION OF WASTEWATER TREATMENT ALTERNATIVES

A. General

The most feasible option for this project is to utilize subsurface discharge. Based on the dispersal site evaluation presented earlier in this CAR, a wastewater treatment system for pre-treatment will be required to utilize the site. The treatment system would be followed by pressure discharge to subsurface infiltration cells in the soil. As indicated earlier, the County has jurisdiction on permitting this system. Currently the County has not adopted MPCA state rules that the subsurface discharge of treated water meet total Nitrogen treatment requirements of 10 mg/L. However, for grant funding purposes, the MPCA is requiring treatment to meet a Total Nitrogen limit of 10 mg/L. Thus, costs are presented for a system with BOD removal and partial nitrogen removal (~ 20 mg/L) and for a system to reach a Total N limit of 10 mg/L.

B. Fixed Film Treatment System Description

There are a number of small fixed film wastewater treatment systems available on the marketplace that are typically used as pretreatment system prior to a subsurface disposal system. Each system utilizes plastic media ("fixed film") and a method of air addition to promote bacterial growth for treatment of the wastewater. These systems include the FAST® system, the BioClere® system, and the Advantex® System. All of these systems have standard package sizes up to 9,000 gpd. For treatment of total Nitrogen additional treatment units are used and addition of commercial chemicals to provide extra "food" is required. Description of these treatment systems are presented below.

1. Fixed Activated Sludge (FAST®) system

The Fixed Activated Sludge (FAST®) system includes septic tanks for solids removal followed by two or more FAST® tank. A 9,000 gpd FAST® tank contains polyethylene or rigid PVC fixed film media that is typically 5 feet in depth, 13 feet long and 7 feet wide. Wastewater enters the tank, flows up through the media and is discharged through an effluent pipe at an elevation just above the top of the media. Bacteria attach to the media and remove BOD as the water moves through the media. The system includes an aeration blower, blower piping and a small FRP enclosure. The blower is used to provide air to the bacteria in the media.

The FAST® system is a one-pass through system without recycle. A FAST® has been installed for Total N removal at six locations in Minnesota.
For Total Nitrogen (Total N) removal, additional treatment units are added to those described above. Total nitrogen removal first requires removal of ammonia (by conversion to nitrate using aeration) and then removal of nitrate (conversion of nitrate to nitrogen gas) in a non-aerated tank. The second step is referred to as denitrification. To achieve the total N, a nitrification tank (to change ammonia to nitrate), a denitrification tank (to change nitrate to nitrogen gas), and a polishing tank (to remove residual BOD) would be added. Denitrification usually requires addition of a carbon source (methanol or other commercial product) to help feed the bacteria that perform this step. Thus, an above ground building with a chemical storage tank and chemical feed pumps would also be required.

2. BioClere® system

The BioClere® system consists of septic tanks for removal of solids followed by the BioClere® units. These systems are manufactured in England. These units are cylindrical vessels with a cone bottom, which are partially buried in the ground. They are essentially small trickling filters. Effluent from the septic tank(s) flows to a baffled section in the bottom cone clarifier section. The wastewater is pumped by dosing pumps (activated by timers) to the top of the filter media and distributed with spray nozzles. The wastewater then trickles down through the media where treatment by fixed film bacteria occurs. After passing through the filter the wastewater enters the bottom cone clarifier where sloughed bacterial solids are removed. A pump at the bottom of the cone pumps sludge solids back to the septic tank. An air fan at the top of the unit draws outside air into the filter to provide aerobic conditions. Effluent from the cone clarifier flows out by gravity to a below ground pipe. The BioClere® system is a one-pass through system without effluent recycle. However, there is a sludge recycle flow. This type of system has been installed for small sub-divisions in Pallisade and Effie, Minnesota.

For Total Nitrogen removal, additional treatment units are added to those described above. These include an aerated tank in front of the standard BioClere tank for initial BOD removal. The BioClere tank is then used for nitrification. Following the BioClere tank, a pump station and denitrification (anoxic) tank would be added. The tank contents would be mixed but not aerated. A carbon feed source would also added to the denitrification tank. Thus, an above ground building with a chemical storage tank and chemical feed pumps would also be required. A final polishing tank and dosing tank would complete the system.

3. Advantex system (by Orenco)

The Advantex system is similar to the other systems except that it relies on recirculation of the wastewater and does not provide forced air blower into the treatment unit but instead relies more on a more passive ventilation type system. The system consists of the septic tanks, recirculation tank and pumps, and a series of plastic pods (~ 16'L x 8'W x 3.5' high) that contain a textile media suspended from hangers, much like files in a filing cabinet. The pods are typically buried only one foot and soil is mounted around them above the natural ground surface.

Wastewater is pumped from the recirculation tank to nozzles above the textile media in each pod and the water flows through the media and is collected at the bottom of the pods. Flow is returned to the discharge splitter valve where a portion is sent out to the effluent pipe and a larger portion returned to the recirculation tank. The water level in the pods is maintained low at the bottom of the pods to maintain aerobic conditions. To ensure air is brought into the pods, inlet vents are provided for the pods and a fan assembly is provided on the discharge piping to draft air into the pods. The Advantex® system is a multiple pass system so that wastewater is recirculated at a rate of 4:1 to 5:1 as in the RSF system.

For Total Nitrogen removal, additional anoxic treatment pod(s) are added to those described above. These would include an anoxic (denitrification) tank, BOD polishing pod, and final dosing tank. A carbon feed source would also be added to the denitrification tank. Thus, an above ground building with a chemical storage tank and chemical feed pumps would also be required.

C. Fixed Film Treatment System Evaluation

A comparison of the alternatives from both a monetary and non-monetary standpoint is presented. From the monetary standpoint, the alternatives are compared by conducting a cost-effective analysis to determine their relative present worth costs. Due to the preliminary nature of these cost estimates, alternatives having a present worth within 10% of one another are considered equal.

Non-monetary differences are more difficult to evaluate, since they cannot be easily quantified. The more significant non-monetary differences are identified in this section, with some discussion regarding their relative impacts. Based on the cost-effective analysis and the discussion of non-monetary differences, a recommended plan for providing wastewater treatment facilities is presented.

1. Cost-Effective Analysis

The method of cost-effective analysis used was the total present worth method. The total present worth of a wastewater treatment facility is the amount of money needed now in order to build, operate, and maintain the system over a specified planning period. For the purposes of this amendment, the planning period has been specified as 20 years. A discount rate of 4.875% was used to convert future (replacement) costs and annual (operation and maintenance) costs to present worth costs.

Detailed cost estimates for the various alternatives are included in **Appendix G**. The capital costs for each alternative contain an allowance for capital contingency and an allowance for project engineering, legal, and administrative costs. **Costs presented are the best estimates at this time and must be updated after detailed (final) design.** Note that the individual homeowner or business would be responsible for power costs for the grinder or STEP systems. The power costs for the grinder or STEP systems are typically minor (~ $5 to $10/month).

The estimated costs for the treatment alternatives are summarized in **Table 7-1.**

Table 7-1
Total Estimated Alternative Costs

Alternative	Capital Cost	WWTF O&M Cost (1)	20-Year Present Worth
Alternative 1			
Standard FAST Unit	$375,000	$12,000	$510,000
Including Total N removal	$540,000	$20,000	$780,000
Alternative 2:			
Standard BioClere Unit	$375,000	$12,500	$520,000
Including Total N	$548,000	$21,000	$810,000
Alternative 3:			
Standard Advantex	$425,000	$13,000	$580,000
Including Total N	$569,000	$18,000	$790,000

(1) O&M costs include an estimate for administrative costs.

Alternatives that have present worth costs within 10 percent of each other are considered to be equal in cost. The present worth costs for all three alternatives are within 10% of each other and thus all are considered approximately equivalent in cost.

It is clear that treatment for total nitrogen (Total N) increases the system cost substantially.

2. Non-Monetary Differences

Significant differences, which cannot be quantified in terms of dollars, exist between the various treatment alternatives. The primary differences are related to the method in which treatment is provided and the degree of treatment required. Factors considered important when evaluating treatment alternatives from a non-monetary standpoint are:

Ease of operation
Treatment performance
Mechanical reliability
Ease of construction
Ease of expansion

Non-monetary factors are evaluated below for each of the alternatives.

a) Ease of Operation

The FAST system is considered easier to operate as it is a single pass system with no recycle flows. Dosing pumps from the equalization tanks are controlled by a timer to accomplish a semi-steady flow rate to the treatment units. The blowers are typically set to supply a constant supply of air to the BOD and nitrification units. There are few valves to adjust. The total N removal system requires two additional tanks, and chemical feed rate adjustment and monitoring are required.

The Bioclere system is also a single pass system. However, there is a sludge recycle flow from the BioClere unit back to the septic tank that has to be monitored. For the total N system, there are four tanks added. Two of these tanks have floating media which needs to be monitored periodically and mixed with mechanical mixers. Chemical feed rate adjustment and monitoring are also required.

The Advantex® system has recycle flows, splitter valves and automatic distribution valves and is thus more complex than the other systems. The operator has to choose an appropriate recycle rate. There is a ventilation fan to monitor and the pumping rate is more complicated to set than for the other two systems. For total N removal, an anoxic tank and additional pod is added. The recycle system becomes more complicated. Chemical

feed rate adjustment and monitoring are also required. One significant advantage of this system is if flow decreases in the winter, it is possible to take one of the pods off-line.

Overall the FAST® system is considered the easiest to operate. The total N removal is more complex than the standard FAST® system.

b) Treatment Performance

It is estimated that without chemical feed addition, all three of the package system options could produce a 20 mg/L nitrate level in the effluent. Chemical addition will be required for any of the systems to meet a total N limit of 10 mg/L. The MPCA has approved the FAST system for total N removal based on performance in the State of Minnesota. The BioClere units have been effective in at least two applications in Minnesota. The performance of the Advantex system for total N removal has not been tested in Minnesota based on discussions with the equipment representative. Overall, each of these systems would be expected to meet the 10 mg/L limit, however the FAST unit is easier to operate and has state approval and is considered to have an advantage over the other two systems as a result.

c) Mechanical Reliability

The FAST unit has the fewest moving parts. The blowers and dosing pumps used are common brand units and considered reliable. The dosing pumps operate by timers and a simple float system. The media is fixed in the tank and will not typically need cleaning. The addition of total N treatment adds the chemical feed system requirement, but not other mechanical equipment.

The BioClere unit has a sludge recycle pump in addition to the dosing pumps and thus is more complicated than the FAST unit. The addition of total N treatment requires addition of mixers and plastic media adding more moving parts. The chemical feed system would be the same as for the FAST unit. Overall, there are more parts to maintain for the BioClere unit.

The long-term operating history of Advantex® system is not as well known. Reliability of the textile material in the fixed film system is not known with certainty. The operating life of the fixed film textile material before replacement is needed is not well known. The potential for

clogging of the textile material is a concern for this option. The ability to pressure wash the fixed film media is in question and would require a water source. Thus, it may be necessary to pump solids out of the RSF tank more often with the Advantex® system. The reliability of the system is lower because there are more valves, splitter basins and pumping and drain lines to monitor than the other systems.

d) Ease of Construction

All of the alternatives have six to seven tanks/process units to install. All system would be installed below ground and would require excavation and gravel bedding. The Advantex and BioClere units are package units and come fully assembled. The FAST system requires installation of the media in standard pre-cast tanks. The Advantex system offers the greatest flexibility in arrangement of the units. The BioClere unit requires the deepest excavation and requires a concrete base underground for support.

Overall, there is not a significant advantage for one system versus the others for installation.

e) Ease of Expansion

It is not expected that this system would require significant expansion. The site may not have sufficient space for expansion of the drainfield system. For all these alternatives, expansion would require addition of a parallel treatment train. Overall, there is not a significant advantage for one system versus the others for expansion.

If the system is initially installed for just BOD removal and then later required to meet a total N limit, then the FAST unit would be the easiest to expand of the three treatment options.

3. Summary

Based on a cost and non-monetary evaluation, the FAST fixed film treatment system is selected as the wastewater treatment system for this project.

VIII. RECOMMENDED PLAN

A. Recommended Plan

Based on the cost and non-monetary considerations, the recommended alternative is a pressure sewer system and a FAST wastewater treatment system with discharge of effluent to subsurface trenches. A summary of the design criteria is listed in **Table 8-1. Appendix H contains preliminary drawings for the pressurized collection system and treatment site area and information on both types of FAST units that could be used for this project.** A description of the systems for BOD only and Total N removal are detailed below.

For Standard BOD Treatment:

- Clearing trees on approximately 1.0 acre of the treatment site for system installation.
- Pressurized sewer system with 34 grinder pump stations. New gravity laterals, pressurized lateral, and main line pressurized pipe would be installed. The mainline pressure sewer would be installed along Birch Point Road.
- One 9,000 gallon concrete settling (septic) tank:
- One 9,000 gallon equalization tank with two pumps run on a cycle timer;
- One FAST treatment unit, 9,000 gallon size tank. During final design, the use of two 4,500 gallon tanks (versus one 9,000 gallon tank) for the BOD treatment may also be considered to account for lower winter flows.
- One 5,000 gallon effluent dosing tank.
- Effluent subsurface pressure distribution system with dosing pumps, pressure main, distribution piping, control equipment and six subsurface cells (~ 160’ x 10’ x 1’ deep each).
- Gravel access road to the treatment system site.
- Site fence around the wastewater treatment system

For Total N Treatment:

- Clearing trees on approximately 1.0 acre of the treatment site for system installation.
- Pressurized sewer system with 34 grinder pump stations. New gravity laterals, pressurized lateral, and main line pressurized pipe would be installed. The mainline pressure sewer would be installed along Birch Point Road.
- One 9,000 gallon concrete settling (septic) tank:
- One 9,000 gallon equalization tank with two pumps run on a cycle timer;

- Four FAST treatment units, 9,000 gallon size tanks for BOD and nitrification, 5,000 gallon size tank for denitrification and 2,500 gallon tank for final polishing tanks. During final design, the use of two 4,500 gallon tanks (versus one 9,000 gallon tank) for the BOD treatment may also be considered to account for lower winter flows.
- One 5,000 gallon effluent dosing tank.
- Effluent subsurface pressure distribution system with dosing pumps, force main, distribution piping, control equipment and six subsurface cells (~ 160' x 10' x 1' deep each).
- Building (minimum 15' x 10') for storage of chemicals and chemical metering pumps and control panels.
- Gravel access road to the treatment system site.
- Site fence around the wastewater treatment system

The proposed locations of the six new subsurface effluent dispersal cells are shown in **Appendix H** on preliminary drawings G-2 and G-5. On G-2, the closest private wells to the proposed subsurface cells are at 6058 Birch Point Road. The closest well is approximately 150 feet away from the closest proposed subsurface cell. As indicated earlier in this report, the surficial water flow direction is primarily horizontal due to a less permeable layer located approximately 4 feet below the ground surface. For the majority of the site upper zone water flow will be towards the northwest. Test pit data indicates that the deeper soils become less and less permeable with a very low vertical conductivity (~5 x 10^{-6} cm/sec). MSA is currently working with the Minnesota Department of Health to determine if there is well construction data indicating the well depth for the closest private wells.

Table 8-1
Recommended Alternative –Design Parameters

Design Flow	8,700 gpd
Number of Residential Connections	34
New Pressure Sewer	
Estimated number of new grinder stations	34
Estimated pressure lateral length	8,000 ft
Estimated pressure main	4,000 ft
Wastewater Treatment System (Total N)	
Septic Tank	9,000 gallons
Equalization Tank	9,000 gallons
Fixed Film Aerated Tank (BOD)	9,000 gallons
Fixed Film Aerated Tank (Nitrification)	9,000 gallons
Fixed Film Aerated Tank (Denitrification)	5,000 gallons
Fixed Film Aerated Tank (BOD Polishing)	2,500 gallons
Dosing Tank	5,000 gallons
Wastewater Treatment System (BOD only)	
Septic Tank	9,000 gallons
Equalization Tank	9,000 gallons
Fixed Film Aerated Tank (BOD)	9,000 gallons
Dosing Tank	5,000 gallons
Subsurface Effluent Disposal System	
No. of Trenches	6
Size of Trench	160’L x 10’L

IX. IMPLEMENTATION OF THE RECOMMENDED PLAN

A. Future Operator Requirements

Wastewater treatment facilities are classified according to Minnesota R. 9400.0500. This rule lists points for various components of a wastewater treatment plant to classify the facilities as Class A, B, C, or D. Any treatment system utilizing fixed film aeration and bacteria for treatment is considered a Class C Facility by the MPCA. Thus, the FAST UNIT treatment system is considered a Class C Facility and will required operation by a Class C licensed operator.

B. Public Participation

A public hearing to discuss the content of this report and the anticipated effect on sewer user charges will be held. A notice for the Public Hearing will be mailed to the homeowners. The minutes of this meeting and the public comments generated at the meeting will be submitted to the MPCA.

C. Easements/Permitting

In addition to gaining regulatory approvals from the County and PFA for the collection and treatment system, easements to place grinder stations and pressure lateral sewer would be required for each property. There is also some indication that portions of Birch Point Road may actually be located off the platted right of way. Thus, easements may also be required for portions of the collection mains along Birch Point Road.

The Minnesota Department of Health (MDH) codes require that sewer lateral and grinder stations should be located 50 lineal feet from a private well. Based on house surveys and topographic surveys to date, approximately thirteen properties would not meet the separation distance criteria (see Appendix D and H). The MDH has granted variances on other projects for this separation distance and a variance application and approval would be necessary for this project.

D. Project Financing

This project is being funded through the Minnesota Public Facilities Authority (PFA) and the Minnesota Pollution Control Agency (MPCA) Small Community Assistance Program. The program provides funding to help communities replace non-complying septic systems and straight pipes with new individual or cluster subsurface sewage treatment systems (SSTS) that will be publicly owned,

operated and maintained. The PFA has provided a technical assistance (TA) grant to the Birch Point Road residents for this project. The Community Assessment Report (CAR) is being funded through this grant. Through the MPCA Community Assistance Program, it is anticipated that future grant money will pay for approximately 50% of the construction cost for this project. Engineering design fees are not eligible for grant funding per the PFA/MPCA grant program.

Approximately 50 percent of the construction cost and all of the engineering design cost would need to be covered by a long-term loan with debt repayments. For the purposes of this CAR, it has been assumed the loan portion will be available through the Minnesota Public Facilities Authority (PFA) loan program. Typically, this program utilizes a 20 or 30 year loan period and an interest rate of 2.0 %. It is assumed that the revenue to pay off the loans and pay for operation and maintenance of the collection and treatment system will be generated with new user rate fees charged to the residents served by the system. For the purposes of this CAR, it is assumed that all 34 residences will generate an equivalent volume of wastewater for calculating purposes. It is also assumed that special assessments will not be charged.

Assuming a 50% grant and a 30-year PFA loan, an interest rate of 2.0 % and that a total N system would be required for the grant program, an estimated debt service requirement was calculated as follows:

Debt Service	
Construction Cost	
Collection System	$690,000
FAST Treatment System	$470,000
Approximate Total Construction Cost:	$1,160,000
Engineering/Administration Cost	$170,000
Total Capital Cost	$1,330,000
Grant amount (@~ 50% of Construction)	$580,000
Net Loan amount	$750,000
Interest Rate	2.0%
Annual Debt Service Increase	
Assume: 2 Payments per year	
20 Year Term	
40 Total Payments	
Total Annual Debt Service	**$33,500**

E. Estimated Future User Rates

The determination of user rates for the Birch Point Road area is dependent on the number of users and the relative split between grant and loan financing. Currently, the type of loan and the split between grant versus loan financing is unknown. For the purposes of this CAR, it will be assumed that an PFA grant and loan funding will be used. It is also assumed that financing for the sewer fund would be through user rates only (no generally tax revenue, special assessments, etc).

Based on implementing the recommended plan, obtaining a 50% grant (covering construction), and a debt service coverage factor of 1.05, the future revenues required would be as follows:

New Debt Service	$33,500
	x 1.05
	$35,000
O&M	+ $20,000
Future Required Revenues	$55,000/yr.

Based on connection identified in Figure 6-1, there will be 34 users in the Birch Point area service area. Based on these users, the estimated future sewer user rates are listed in **Table 9-1**. For comparison purposes, **Table 9-1** lists the project user rates with and without Total N removal. Also listed is potential cost savings if two residences share a grinder station.

Table 9-1
Estimated Average Monthly User Charges (RD Loan with Grant)(1)

User	Estimated User Rate, $/mo 50% Grant
Average User Rate for standard system	$106
Average User Rate for Total N Treatment System	$138

(1) 30-year loan @ 2.0% interest rate

At this point, the values in bold in **Table 9-1** would be the new user rates. **This assumes a grant amount of 50% of the construction cost.** Installation of a

system for total N removal adds over $30 per month to the user rates for the system. Thus, a regulatory requirement for total N removal has a significant impact on the user rates. **If shared grinders are used it is estimated the project cost can be reduced by approximately $180,000 and the user rate reduced by approximately $11/month.**

Final user rates cannot be determined until all funding sources and grant amounts are determined and the construction project is bid.

F. Project Implementation Schedule

The project implementation schedule is tentative at this point because the funding sources have not all been determined. The target schedule will be to have this report approved by MPCA in January 2012. Topographic and house surveys have already been conducted using TA grant funding. Once design funding is secure, the design can proceed. Assuming design funding is secured in January 2012, design could begin in February with completion by early May with bid opening in early June 2012. It is estimated that construction of the pressure collection system and the treatment system could be completed in one construction season by November or December 2012.

Appendix A
Grant Assistance Scoring Sheet

Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Project Priority List (PPL)

Projects in Unsewered Areas Scoring Worksheet
Minnesota Rule Chapter 7077.0118

Office use only

Project Number
Staff Engineer
Total Points
Date

Facility Information (please print)

Grand Lake Township

Project name: Caribou Lake (Birch Point Rd)

Applicant name (if different):

Contact name: Brett McLean / Steve Torgeson Title: resident / townboard

E-mail address: Phone:

Instructions

This worksheet is used to score all requests for state financial assistance for wastewater improvement projects in unsewered areas. Scoring is based on the environmental criteria contained in Minnesota Rule Chapter 7077. The result of scoring is a ranked list called the Project Priority List (PPL) from which projects will be selected for funding.

Applicants must complete their sections of the worksheet and submit it with their requests for placement on the PPL. As part of completing the worksheet, the applicant must provide sufficient documentation to support the award of points. Complete application information is located on the Minnesota Pollution Control Agency (MPCA) Web site at www.pca.state.mn.us/water/wpcrf-psource.html.

Complete this form if your proposal includes new or improved wastewater facilities within an unsewered area.

NOTE: Round up calculated point value for each of the questions 105 – 115 and 125 to the next whole number (e.g., 4.1 = 5).

NOTE: Subsurface Sewage Treatment System (SSTS)

Applicant completes questions 105 - 140; MPCA completes questions 145 - 150 — Points

Required submittals include:

1) State Revolving Fund Project Priority List, Part 1: Unsewered Area Needs Documentation for questions 105, 110, 115, 120 and 125. Form is located at http://www.pca.state.mn.us/publications/wq-wwtp2-10.doc.
2) Provide a scaled map showing locations of existing Subsurface Sewage Treatment System (SSTS) as supporting documentation for questions 120, 125 and 130.

[105] Existing SSTS systems discharges posing threat to public health or safety [subp. 1]

Existing SSTS systems that have the potential to immediately and adversely affect or threaten public health or safety. At a minimum, this includes ground surface or surface water discharges of untreated or partially treated wastewater and sewage backup into a dwelling or other establishment. (Minn. R. 7080.0020, subpart 19a)

105.1 How many total structures with SSTS systems are included in the project? **34**

105.2 How many structures with SSTS systems are posing a threat to public safety? 1/34 ×45 = **1**

(45) x (total number of failures calculated in 105.2) / (total number of waste discharging structures105.1) = **2**

[110] Existing SSTS systems with failure to protect ground water [subp. 2] 29/34 ×15 =

110.1 How many structures with SSTS systems or other systems (not counted in question 105.1 above) in the proposed project area that have one or more sewage tanks which obviously leak below the designated operating level or have less than the required vertical separation (Minn. R. 7080.0060, subpart 3, item B)? **29**

(15) x (total number of failures to protect ground water in 110.1) / (total number of waste discharging structures 105.1) = **13**

I might go to 2 after TA ... one ... ok ... immin ... health threat

Project Name:

Points

[115] Existing SSTS systems with properties that cannot conform to setback requirements [subp. 3]

115.1 Remaining number of structures discharging wastewater in the proposed project area (not counted in 105.2 and 110.1), that because of property size or configuration, *do not* conform to setback requirements as they apply to one or more of the following:

$5 \times \frac{16}{34} = 2.35$ (3) ? TA grant will finish 16 ths.

Water supply wells	
Buried water lines	
Buildings	
Property lines	
Ordinary high water level of public waters	16

(5) x (total number of setback failures115.1) / (total number of waste discharging structures 105.1) = 3

[120] Existing discharge near impaired water or outstanding resource value water (ORVW) [subp. 4]

120.1 Does one or more of the existing SSTS discharge within 500 feet of an impaired water or ORVW? ☐ Yes ☑ No

If Yes, enter 5 points 0

[125] Failed SSTS near impaired water or ORVW [subp. 5]

125.1 How many failed SSTS, that meet the definition of failure under numbers 105.2 or 110.1 above, have wastewater discharge areas within 500 feet of an impaired water or ORVW? NA

(5) x (number of failed SSTS within 500 ft. of an impaired water or ORVW in 125.1) / (total number of waste discharging structures) = 0

[130] Existing impact density of SSTS systems [subp.6]

Provide a scale map which contains all existing structures which generate wastewater and the "Impact Zone" identified. The Impact Zone is defined as the smallest possible circle drawn around the area that encompasses 90 percent of the structures discharging wastewater in the proposed project area.

130.1 How many acres is the impact zone (area of drawn circle) of the proposed project service area? ~~40 +-~~ 102.56 ac

130.2 How many structures discharge wastewater within the impact zone of the proposed project? ~~34~~ 30

130.3 **Number of structures within the impact zone/area (acres) of impact zone = impact density** ~~0.85~~ 0.3 ($\frac{30}{102.56} = 0.$)

Get map or see attached

If density is less than 0.25 enter 0 points

If density is 0.25-0.5 enter 10 points 10

If density is 0.5-1.0 enter 20 points ~~20~~

If density is greater than 1.0 enter 30 points

[135] Proposed land (including sub-surface) discharge [subp. 7]

135.1 Does the proposed project call for consumptive use (nitrogen or volume) spray irrigation or land disposal systems, which are required by permit to denitrify (nitrate limit)? ☑ Yes ☐ No

If Yes, enter 20 points 20

[140] Proposed project implements corrective measures *(Effluent Limits Coordinator)* [subp. 8]

140.1 Will this project implement corrective measure(s) for problems identified in a diagnostic study such as Clean Water Partnership Phase 1, TMDL assessment, MPCA approved Watershed Restoration Action Strategy or equivalent study such as a County Water Plan? ☑ Yes ☐ No

2000 St. Louis Cty Water Plan

If Yes, enter 5 points 5

Type of Study: *Attach supporting documentation and identify relevant sections.* ☐ Yes ☐ No

Project name: **Points**

[145] Project helps meet a total maximum daily load (TMDL) for receiving water *(Effluent Limits Coordinator)* [subp. 9]

145.1 Does this project contribute to the achievement of a TMDL by being designed to reduce the discharge of pollutants as required by an Agency approved TMDL implementation plan or does the project require an National Pollutant Discharge Elimination System (NPDES) Permit or a State Disposal System (SDS) Permit that will require the reduced discharge of pollutants based on a TMDL? ☐ Yes ☒ No

If Yes, enter 20 points 0

[150] Proposed project points reduction for new/expanded discharges into specified water *(Effluent Limits Coord.)* [subp. 10]

150.1 Does the proposed project involve a new discharge to one or more of the following waters: ☐ Yes ☒ No

a) Outstanding Resource Value Waters (Minn. R. 7050.0180)

b) Impaired waters (Section 303(d)) of the Clean Water Act

c) Classification 2A, lake, or wetland that exceeds 200,000 gallons per day

If Yes, enter minus 5 points 0

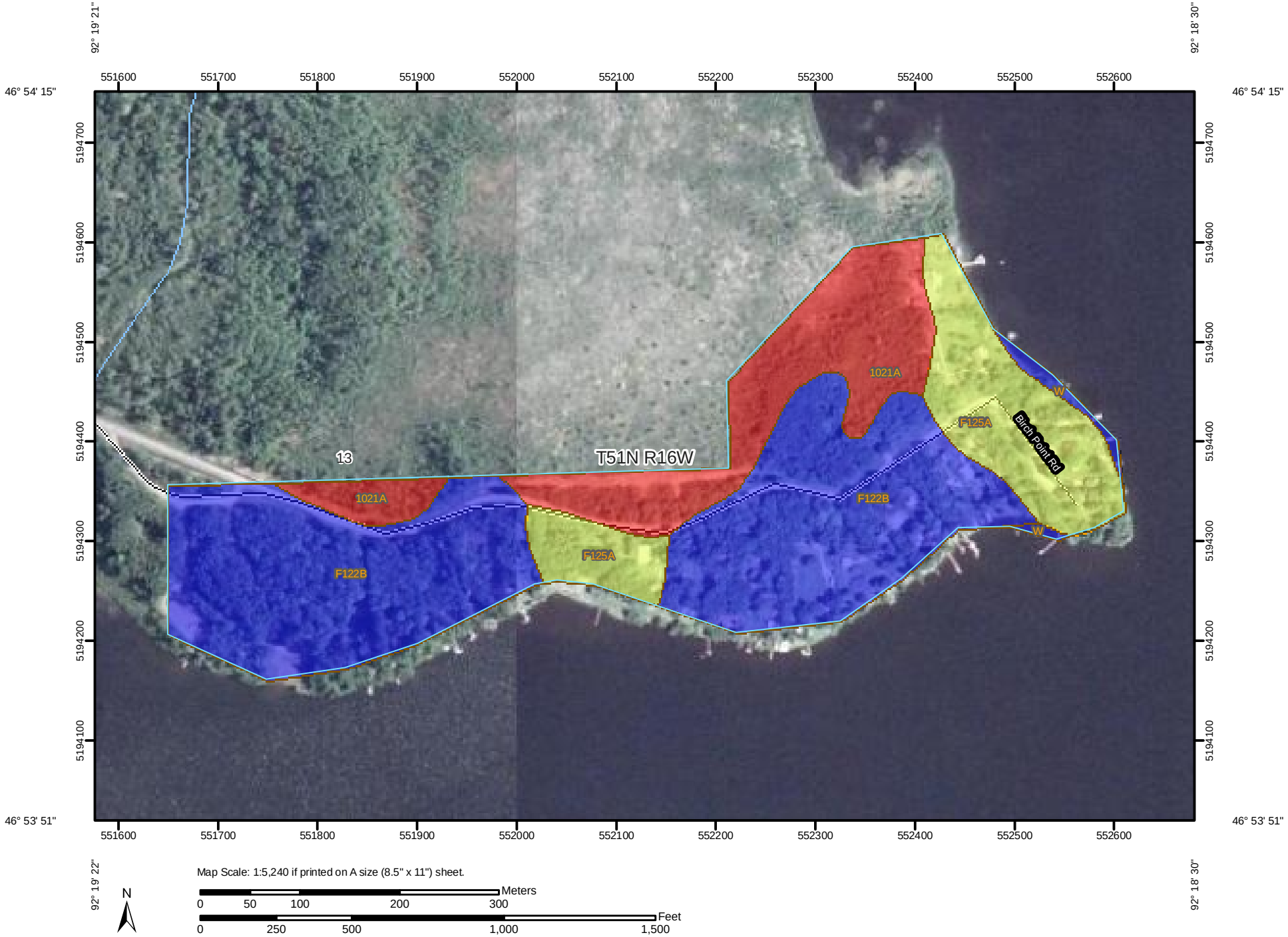
Total 60 53

For more information, contact:

Bill Dunn, Clean Water Revolving Fund Coordinator at 651-757-2324, Fax 651-297-8676 or bill.dunn@state.mn.us

Appendix B
Groundwater and Soil Series Maps

Depth to Water Table—St. Louis County, Minnesota, Duluth Part
(Birch Point Road)



MAP LEGEND

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

Soils
- Soil Map Units

Soil Ratings
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

Political Features
- Cities
- PLSS Township and Range
- PLSS Section

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:5,240 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

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, Duluth Part
Survey Area Data: Version 6, Sep 3, 2009

Date(s) aerial images were photographed: 6/15/2003

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

Depth to Water Table

Depth to Water Table— Summary by Map Unit — St. Louis County, Minnesota, Duluth Part				
Map unit symbol	**Map unit name**	**Rating (centimeters)**	**Acres in AOI**	**Percent of AOI**
1021A	Rifle soils, 0 to 1 percent slopes	0	10.1	21.7%
F122B	Aldenlake-Pequaywan complex, pitted, 0 to 8 percent slopes	>200	27.0	57.9%
F125A	Pequaywan fine sandy loam, 0 to 3 percent slopes	76	9.0	19.2%
W	Water	>200	0.6	1.2%
Totals for Area of Interest			**46.6**	**100.0%**

Description

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: centimeters

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Lower

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

Interpret Nulls as Zero: No

This option indicates if a null value for a component should be converted to zero before aggregation occurs. This will be done only if a map unit has at least one component where this value is not null.

Beginning Month: January

Ending Month: December

Soil Map—St. Louis County, Minnesota, Duluth Part
(Birch Point Road)

Map Scale: 1:5,250 if printed on A size (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1,000 1,500

MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities
- PLSS Township and Range
- PLSS Section

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:5,250 if printed on A size (8.5" × 11") sheet.

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

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

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Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

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, Duluth Part
Survey Area Data: Version 6, Sep 3, 2009

Date(s) aerial images were photographed: 6/15/2003

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

Map Unit Legend

St. Louis County, Minnesota, Duluth Part (MN615)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1021A	Rifle soils, 0 to 1 percent slopes	8.1	18.1%
F122B	Aldenlake-Pequaywan complex, pitted, 0 to 8 percent slopes	26.9	59.9%
F125A	Pequaywan fine sandy loam, 0 to 3 percent slopes	9.1	20.2%
W	Water	0.8	1.8%
Totals for Area of Interest		**44.9**	**100.0%**

Appendix C
Income Survey

Task Summary

Property owners along Birch Point Road on the north side of Caribou Lake in Grand Lake Township are planning to install a wastewater system. Previous attempts to move forward have been unsuccessful due to the high cost of the project.

There is a grant opportunity that could offset up to 50% of the project's costs. The grant would come from the State of Minnesota's Small Community Wastewater Treatment Program, which is administered by the Minnesota Public Facilities Authority (MN PFA).

A critical requirement for grant eligibility is whether the median gross household income (MGHI) of the 34 families involved in the project is below the state's MGHI. In March 2011 Grand Lake Township commissioned The Northspan Group, Inc. of Duluth to obtain directly from each family this confidential information along with the number of individuals (population) in each household.

Methodology

The methodology used to obtain this information included the Township sending a letter (Exhibit A) to each household informing them of the opportunity for a grant, describing the importance of their assistance in determining eligibility, introducing them to Northspan, and ensuring each property owner that information they provide Northspan will be kept confidential and used only to determine eligibility. The letter also encouraged each family to contact Northspan directly.

A reminder letter was sent out to each household a week later. In week three Northspan staff began calling each household that had not yet responded. When requesting information Northspan emphasized the information being provided will be handled with strict confidence, would not be shared with the Township or any other entity, and would only be used to determine eligibility.

Since 2010 Census data are not yet available, Northspan requested a clarification from the state granting agency (MN PFA) on what number best represents the State of Minnesota's MGHI. After conferring with the state demographer, the MN PFA agreed to use information from the U.S. Census Bureau's American Community Survey (see Exhibit B), which is the best available data between each decennial Census. MN PFA also determined that gross household income should be defined as the federal adjusted gross income reported on each household's 2010 federal income tax return. (see Exhibit C)

Results

Northspan obtained household information for 31 of 34 families. One household did not have any contact information and two declined providing information. Based on what was provided, the total population is 62. The median gross household income is $55,500.

Information obtained will remain in a confidential file, on hand at Northspan offices for State verification as necessary. Information will be destroyed at the end of three years, April 28, 2014.

EXHIBIT A

18 March 2011

Dear,

Grand Lake Township is pleased to inform you that the Township has the opportunity to apply for a state grant to offset up to 50% of the costs for the proposed sewer project along Birch Point Road on the north side of Caribou Lake. The grant would come from the state's Small Community Wastewater Treatment Program, which is administered by the Minnesota Public Facilities Authority.

A critical requirement for grant eligibility is to identify the median gross household income of the 34 families involved in the project. We will need your assistance in determining eligibility. ***It's imperative that ALL households respond*** by answering two basic questions:

1. How many individuals live in your household?
2. What is your household gross income?

We have commissioned The Northspan Group, Inc. of Duluth to obtain this confidential information. Northspan will compile responses from each of the 34 households and verify the project's eligibility directly with the state granting agency. The Township will not be involved or have access to this information.

We encourage you to contact Lisa Bonow of Northspan directly with answers to both questions by Monday March 28th. Her direct dial is 218.529.7560 or email her at lbonow@northspan.org.

We assure you that all responses to this survey will be held in strict confidence by Northspan and will only be used to determine grant eligibility.

Cordially,

Brooke Shannon, Town Clerk
Grand Lake Township

c: Lisa Bonow, The Northspan Group

EXHIBIT B

FACT SHEET

Minnesota

2005-2009 American Community Survey 5-Year Estimates - what's this?
Data Profile Highlights:

Note: The following links are to data from the American Community Survey and the Population Estimates Program.

NOTE: Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities and towns and estimates of housing units for states and counties.

Social Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error	
Average household size	2.45	(X)	2.60	+/-0.01	map
Average family size	3.02	(X)	3.19	+/-0.01	
Population 25 years and over	3,403,202			+/-1,101	
High school graduate or higher	(X)	91.1	84.6%	(X)	map
Bachelor's degree or higher	(X)	31.2	27.5%	(X)	map
Civilian veterans (civilian population 18 years and over)	400,974	10.2	10.1%	+/-2,750	map
With a Disability	(X)	(X)	(X)	(X)	
Foreign born	339,119	6.5	12.4%	+/-4,168	map
Male, Now married, except separated (population 15 years and over)	1,128,704	55.1	52.3%	+/-6,976	
Female, Now married, except separated (population 15 years and over)	1,104,348	52.6	48.4%	+/-6,168	
Speak a language other than English at home (population 5 years and over)	464,353	9.6	19.6%	+/-4,591	map
Household population	5,045,541			*****	
Group quarters population	(X)	(X)	(X)	(X)	

Economic Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error	
In labor force (population 16 years and over)	2,901,801	71.2	65.0%	+/-5,304	map
Mean travel time to work in minutes (workers 16 years and over)	22.2	(X)	25.2	+/-0.1	map
Median household income (in 2009 inflation-adjusted dollars)	57,007	(X)	51,425	+/-210	map
Median family income (in 2009 inflation-adjusted dollars)	70,887	(X)	62,363	+/-278	map
Per capita income (in 2009 inflation-adjusted dollars)	29,431	(X)	27,041	+/-115	
Families below poverty level	(X)	6.4	9.9%	+/-0.2	
Individuals below poverty level	(X)	10.0	13.5%	+/-0.2	map

Housing Characteristics - show more >>	Estimate	Percent	U.S.	Margin of Error	
Total housing units	2,301,307			+/-4,446	
Occupied housing units	2,061,882	89.6	88.2%	+/-8,291	
Owner-occupied housing units	1,543,424	74.9	66.9%	1543424	
Renter-occupied housing units	518,458	25.1	33.1%	+/-2,928	
Vacant housing units	239,425	10.4	11.8%	+/-4,442	
Owner-occupied homes	1,543,424			+/-8,193	map
Median value (dollars)	207,000	(X)	185,400	+/-431	map
Median of selected monthly owner costs					
With a mortgage (dollars)	1,526	(X)	1,486	+/-4	map
Not mortgaged (dollars)	430	(X)	419	+/-2	

ACS Demographic Estimates - show more >>	Estimate	Percent	U.S.	Margin of Error	
Total population	5,188,581			*****	
Male	2,579,512	49.7	49.3%	+/-893	
Female	2,609,069	50.3	50.7%	+/-893	

Chris Maddy EXHIBIT C

From: Johnson, Nancy (DEED) [nancy.lc.johnson@state.mn.us]
Sent: Thursday, April 28, 2011 2:07 PM
To: Chris Maddy
Subject: RE: Grand Lake Township Grant Request

Hi Chris,
As we discussed, PFA approved the use of the federal adjusted gross income as the definition for gross household income. After you raised the issue, I spoke with Terry Kuhlman, Executive Director of PFA, and he concurred with the decision.

PFA will be using updated census information from the US Census Bureau via the American Community Survey. We will likely implement the use of the data for projects on the 2012 Intended Use Plan/Project Priority List. Tom Gillaspy, State Demographer, indicated the US Census Bureau will release a report for the period 2006-2010 in November 2011 and that is probably the report we will use but then update those numbers annually thereafter.

Thanks again for raising the census data issue, Chris. We look forward to getting a copy of the survey.

Nancy Johnson

From: Chris Maddy [mailto:cmaddy@northspan.org]
Sent: Thursday, April 28, 2011 11:44 AM
To: Johnson, Nancy (DEED)
Subject: Grand Lake Township Grant Request

Good morning Nancy,

We are preparing our grant eligibility report for Grand Lake Township's sewer project and we would like to include a couple decisions you made in regard to the methodology we used. The first is the decision to use federal adjusted gross income as the definition for gross household income. The second is the determination by the PFA that you will be using new Census information from the U.S. Census Bureau's American Community Survey starting with the report covering 2006-2010, which will be issued in November 2011.

It has been a pleasure working with you on this project. We appreciate your assistance.

Chris

Chris Maddy
Director
Northland Connection
The Northspan Group, Inc.
221 West First Street
Duluth, MN 55802-1909
218.529.7564 direct
218.591.3455 cell
cmaddy@northspan.org

Appendix D
Summary of House Survey Results

Birch Point Service District

	Parcel Code	Owner	Taxpayer	Mailing Address	City	ST	ZIP	Property Address	Phone	Phone2	Email	Winter Address	SEPTIC SYSTEM	OUTHOUSE	WELL VARIANCE DIST	NOTE
1	380-0050-00780	Berhnt E. Eid		2535 Medicine Ridge Rd	Plymouth	MN	55441	5957 Birch Point Rd	763-543-8210				X			
	380-0050-00790	Berhnt E. Eid		2535 Medicine Ridge Rd	Plymouth	MN	55441	5957 Birch Point Rd	-							
2	380-0050-00620	Daniel S. Glibbery	Dan (Molly)	2331 Whitter St	Duluth	MN	55803	5958 Birch Point Rd	218-525-6961	218-464-2301		720 Haggerty Lane #207 Bozeman, MT 59715	X		30'	
3	380-0050-00770	William V. Angst		5959 Birch Point Rd	Saginaw	MN	55779	5959 Birch Point Rd	218-729-5297				X			
4	380-0050-00760	Donald S. Bodin ETUX	Mark & Allyson Bergman	12437A Flanders Court NE	Blaine	MN	55449	5963 Birch Point Rd	651-216-4556				X		25'	
5	380-0050-00740	Thomas & Janine Marchand		5965 Birch Point Rd	Saginaw	MN	55779	5965 Birch Point Rd	218-729-4549		tmarcha@msn.com	*	X		25'	SAND FILTER
6	380-0050-00730	Thomas E. Seymour	Thomas & Lori Seymour	5969 Birch Point Rd	Saginaw	MN	55779	5969 Birch Point Rd	218-729-7523				X			
7	380-0010-02676	Douglas E. Malnati		5971 Birch Point Rd	Saginaw	MN	55779	5971 Birch Point Rd	218-729-9240					X	30'	
	380-0050-00710	Douglas E. Malnati		5971 Birch Point Rd	Saginaw	MN	55779	5971 Birch Point Rd	-							
	380-0050-00720	Douglas E. Malnati		5971 Birch Point Rd	Saginaw	MN	55779	5971 Birch Point Rd	-							
8	380-0010-02675	Lynn Slordal		5977 Birch Point Rd	Saginaw	MN	55779	5977 Birch Point Rd	218-729-5772				X			
	380-0050-00705	Lynn Slordal		5977 Birch Point Rd	Saginaw	MN	55779	5977 Birch Point Rd	-							
	380-0050-00715	Lynn Slordal		5977 Birch Point Rd	Saginaw	MN	55779	5977 Birch Point Rd	-							
9	380-0050-00605	William A. Jopke		5978 Birch Point Rd	Saginaw	MN	55779	5978 Birch Point Rd	218-729-7526				X			
	380-0050-00610	William A. Jopke		5978 Birch Point Rd	Saginaw	MN	55779	5978 Birch Point Rd	-							
10	380-0010-02672	Daniel J. Thompson ETUX		5979 Birch Point Rd	Saginaw	MN	55779	5979 Birch Point Rd	218-729-6306		DRETMIN@earthlink.net		X			NEW MULTI-MOUND
11	380-0050-00590	Gary A. Lane		5980 Birch Point Rd	Saginaw	MN	55779	5980 Birch Point Rd	218-729-8216				X			
12	380-0010-02677	James V. Freeman		120 Zapata LN	Minooka	IL	60447	5982 Birch Point Rd	815-467-8574				X			HOLDING TANK
	380-0050-00580	James V. Freeman		120 Zapata LN	Minooka	IL	60447	5982 Birch Point Rd	-							
	380-0050-00700	James V. Freeman		120 Zapata LN	Minooka	IL	60447	5982 Birch Point Rd	-							
13	380-0050-00570	Dennis A. Anderson ETAL		145 E. Toledo St	Duluth	MN	55811	5984 Birch Point Rd	218-728-2305					X		
14	380-0050-00560	James Doyle Jr.		4715 W 7th St	Duluth	MN	55807	5986 Birch Point Rd	218-624-1606				X			
15	380-0050-00550	Michael W. Nash	Billy E Nash	5988 Birch Point Rd	Saginaw	MN	55779	5988 Birch Point Rd	218-729-8662				X			
16	380-0050-00540	Richard A.& Barbara A. Resch		5990 Birch Point Rd	Saginaw	MN	55779	5990 Birch Point Rd	218-729-5977	239-561-2085		9107 Shadow Glen Way Ft. Myers, FL 33913	X			
17	380-0050-00520	Mark E. Boben	Mark & Linda Boben	3543 Greysolon Rd.	Duluth	MN	55804	5992 Birch Point Rd	218-724-4608	218-355-1349	greysolon2010@gmail.com	OLD: 1900 Burton Ave Orange, TX 77630	X			
	380-0050-00530	Mark E. Boben	"	3543 Greysolon Rd.	Duluth	MN	55804	5992 Birch Point Rd	-							
18	380-0050-00505	Richard J. Plys	Richard J & Cathy S. Plys	5994 Birch Point Rd	Saginaw	MN	55779	5994 Birch Point Rd	763-370-4872		gpbooga@aol.com	1737 132nd Ave NW Coon Rapids, MN 55448	X			
19	380-0050-00490	James A. Hodge	James A. & Joan Hodge	5998 Birch Point Rd	Saginaw	MN	55779	5998 Birch Point Rd	218-624-9564				X			ADVANCED SYSTEM
20	380-0050-00470	Jeanne R. Pearson		2621 W. 13th St	Duluth	MN	55806	6000 Birch Point Rd	218-727-2262		jeannepea@yahoo.com	(Don)		X	20'	
	380-0050-00480	Jeanne R. Pearson		2621 W. 13th St	Duluth	MN	55806	6000 Birch Point Rd	-							
21	380-0050-00450	Cade W. Ledingham		6002 Birch Point Rd	Saginaw	MN	55779	6002 Birch Point Rd	218-729-7992				X		30'	PEAT FILTER
22	380-0050-00410	Mark Melander		5221 Birchcrest Dr	Edina	MN	55436	6014 Birch Point Rd	952-220-9964				X		25'	
23	380-0050-00440	Thomas P. Kurtovich ETUX	Tom (Barb)	6004 Birch Point Rd	Saginaw	MN	55779	6004 Birch Point Rd	218-729-9726		kb0lss@gmail.com		X		20'	
24	380-0050-00415	Brett Mclean	Brett & Leah E. Mclean	6010 Birch Point Rd	Saginaw	MN	55779	6010 Birch Point Rd	218-729-6544		mcleanclan@q.com		X		25'	
25	380-0050-00400	James T. Sodeman		6016 Birch Point Rd	Saginaw	MN	55779	6016 Birch Point Rd	415-585-3057				X			
26	380-0050-00370	Eric Rustad		6020 Birch Point Rd	Saginaw	MN	55779	6020 Birch Point Rd	218-729-9962				X			
27	380-0050-00311	Kirk C. Gallup		508 Wood Duck Trail	Lino Lakes	MN	55014	6026 Birch Point Rd	651-784-3969				X		40'	
	380-0050-00312	Kirk C. Gallup		508 Wood Duck Trail	Lino Lakes	MN	55014	6026 Birch Point Rd	-							
	380-0050-00313	Kirk C. Gallup		508 Wood Duck Trail	Lino Lakes	MN	55014	6026 Birch Point Rd	-							
	380-0050-00314	Kirk C. Gallup		508 Wood Duck Trail	Lino Lakes	MN	55014	6026 Birch Point Rd	-							
	380-0050-00315	Kirk C. Gallup		508 Wood Duck Trail	Lino Lakes	MN	55014	6026 Birch Point Rd	-							
	380-0050-00316	Kirk C. Gallup		508 Wood Duck Trail	Lino Lakes	MN	55014	6026 Birch Point Rd	-							
28	380-0050-00280	Carol E. Anderson		6036 Birch Point Rd	Saginaw	MN	55779	6036 Birch Point Rd	218-729-5897		RWATWIG@callja.com		X			
29	380-0050-00270	Gordon R. Beier	Gordon R. & Tammi D. Beier	4899 Miller Trunk Hwy	Hermantown	MN	55811	6040 Birch Point Rd	218-729-0466				X			
30	380-0050-00256	Marilyn E. Morris (Trustee)		4650 Decatur Ave N.	New Hope	MN	55428	6044 Birch Point Rd	763-533-8847					X		
31	380-0050-00245	Alan G. Adams		36 E. Faribault St.	Duluth	MN	55803	6048 Birch Point Rd	218-724-7010		alarchitect1@qwestoffice.net		X		20'	
32	380-0050-00226	Jim N. Samargia		6050 Birch Point Road	Saginaw	MN	55779	6050 Birch Point Rd	218-780-5037		jnsamargia@gmail.com			X	20'	
33	380-0050-00215	Donna M. Frisk	James Anderson (Lorraine)	19 E. Buffalo St.	Duluth	MN	55811	6054 Birch Point Rd	218-724-5056				X			
	380-0050-00200	Donna M. Frisk	"	19 E. Buffalo St.	Duluth	MN	55811	6055 Birch Point Rd	-							
34	380-0050-00185	David L. Erickson	Dorothy L. Erickson	2528 Trinity Rd #304	Duluth	MN	55811	6058 Birch Point Rd	763-670-3289				X		40'	
													29	5	13	

Updated 11/11/2011

Appendix E
Land Transfer Resolution and
Site Dispersal Capacity Evaluation

Land Transfer Resolution

Resolution
of the
Board of County Commissioners
St. Louis County, Minnesota
Adopted on: March 20, 2007 *Resolution No. 144*
Offered by Commissioner: Sweeney

WHEREAS, the County owns 8 lots in Grand Lake Township that include property used by the public as a beach and recreation area described as "Lots 10 Through 17, Block 1, Caribou Lake Tracts, Town of Grand Lake"; and

WHEREAS, said lots have not been maintained or used by the County in many years; and

WHEREAS, Grand Lake Township wishes to obtain said parcels for a public use pursuant to Minnesota Statutes, Section 465.035.

NOW, THEREFORE, BE IT RESOLVED, pursuant to Minnesota Statutes, Section 465.035, the St. Louis County Board authorizes the appropriate County officials to prepare the necessary documents to transfer County fee land for a public use, described as "Lots 10 Through 17, Block 1, Caribou Lake Tracts, Town of Grand Lake," to Grand Lake Township for a fee of $500.

RESOLVED FURTHER, the $500 land transfer administrative fee will be directed into the County's General Fund (Fund 100, Agency 128014, Object 583100).

RESOLVED FURTHER, that Resolution No. 06-672, dated December 19, 2006, is hereby rescinded.

Commissioner Sweeney moved the adoption of the Resolution and it was declared adopted upon the following vote:
Yeas - Commissioners Fink, O'Neil, Forsman, Sweeney, Nelson, Raukar, and Chair Kron - 7
Nays - None

STATE OF MINNESOTA
Office of County Auditor, ss.
County of St. Louis

I, **DONALD DICKLICH**, Auditor of the County of St. Louis, do hereby certify that I have compared the foregoing with the original resolution filed in my office on the 20th day of March, A.D. 2007, and that this is a true and correct copy.

WITNESS MY HAND AND SEAL OF OFFICE at Duluth, Minnesota, this 20th day of March, A.D., 2007

DONALD DICKLICH, COUNTY AUDITOR

By _____
Deputy Auditor/Clerk of County Board

QUIT CLAIM DEED
Corporation, Partnership or Limited Liability Company to Corporation, Partnership or Limited Liability Company

Form No. 31-M

Minnesota Uniform Conveyancing Blanks (1/15/97)

(Top 3 Inches Reserved for Recording Data)

DEED TAX DUE: $ _____

Date: _____

FOR VALUABLE CONSIDERATION, the County of St. Louis,

a body politic and corporate under the laws of the State of Minnesota,

Grantor, hereby conveys and quitclaims to Grand Lake Township,

Grantee, a _____ under the laws of _____,

real property in St. Louis County, Minnesota, described as follows:

Lots 10 through 17, Block 1, Caribou Lake Tracts, Town of Grand Lake.

Said legally described property herein shall revert to St. Louis County upon the event said property ceases to be utilized for public use within the meaning of Minnesota Statutes Section 465.035.

St. Louis County reserves to itself all iron ore and all other valuable minerals in and upon the lands, with right to explore for, mine and remove the iron ore and other valuable minerals in accordance with Minnesota Statutes Section 373.01.

together with all hereditaments and appurtenances.

Check box if applicable:

- ☒ The Seller certifies that the Seller does not know of any wells on the described real property.
- ☐ A well disclosure certificate accompanies this document.
- ☐ I am familiar with the property described in this instrument and I certify that the status and number of wells on the described real property have not changed since the last previously filed well disclosure certificate.

Affix Deed Tax Stamp Here

By _____
William Kron, Chair of County Board

By _____
Donald Dicklich, County Auditor

STATE OF MINNESOTA }
COUNTY OF ST. LOUIS } ss.

This instrument was acknowledged before me on April 11, 2007 (Date),

by William Kron and Donald Dicklich,
the Chair of the County Board and County Auditor
of St. Louis County, a body politic and corporate
under the laws of the State of Minnesota, on behalf of the County of St. Louis.

NOTARY PUBLIC - MINNESOTA (BLANK)

PAUL L. TYNJALA
NOTARY PUBLIC - MINNESOTA
My Commission Expires Jan. 31, 2010

_____
SIGNATURE OF NOTARY PUBLIC OR OTHER OFFICIAL

Check here if part or all of the land is Registered (Torrens) ☐

THIS INSTRUMENT WAS DRAFTED BY (NAME AND ADDRESS):

Timothy A. Tysdal
Assistant St. Louis County Attorney
St. Louis County Courthouse
100 North 5th Avenue West, #501
Duluth, MN 55802
(218) 726-2323

Tax Statements for the real property described in this instrument should be sent to (include name and address of Grantee):

Grand Lake Township
Grand Lake Town Hall
P.O. Box 1023
Twig, MN 55791

Site Dispersal Capacity Evaluation

August 11, 2010

Ms. Brooke Shannon, Clerk
Grand Lake Township
P.O. Box 1023
Twig, MN 55791

Re: Onsite Wastewater Treatment and Dispersal Capability Evaluation
Birch Point Road Cluster Wastewater System Site, Grand Lake Twp., St. Louis Co., MN

Dear Ms. Shannon:

MATRIX Soils & Systems was retained to evaluate wastewater treatment and dispersal capability of a site on township property adjacent to Caribou Lake being considered for use to serve residents of the Birch Point Road area. This letter presents results and conclusions regarding the evaluation.

The Birch Point Road area is comprised of 34 rural residences in Grand Lake Township of St. Louis County, Minnesota. Because the area is rural, dwelling water supply and wastewater systems are provided on site. A number of the wastewater systems have been found to not be compliant with current code requirements, and because area density is somewhat high and soil conditions in places unfavorable for wastewater treatment and dispersal, replacement of the systems on site is generally infeasible, or difficult at best. As a result and because of the availability of the township property in proximity to the area, property owners are interested in pursuing a cluster-type off-site solution. To accomplish first step in the wastewater system planning and implementation process, MATRIX Soils & Systems was retained to evaluate site and soil conditions sufficiently to determine acceptable treatment and dispersal loading rates and feasibility of using the property for a wastewater system to serve the area.

Property being considered for wastewater treatment and dispersal is a mostly undeveloped 5-½-acre parcel, southern quarter of which is being used as a public beach, located in part of the northwest ¼ of the southwest ¼ of Section 13, Township 51 North, Range 16 West, Grand Lake Township of St. Louis County, Minnesota. Caribou Lake borders southern side of the parcel, and the Birch Point Road right-of-way the northern side. Property along western side of the parcel is used for public boating access to the lake. To the east is one of the residences to be served. An approximate 100-foot wide area of wetland lies within the parcel, extending from its center in the western portion to the southeastern corner. An unnamed stream, which flows northward for approximately two miles discharging into Fish Lake Reservoir, is located approximately 500 feet to the west. (See the attached Figure 1.) Current area development consists of year-round and seasonally-used single family dwellings one of which has four bedrooms, two of which have three bedrooms, and 31 of which have two bedrooms.

Evaluation of site and soil conditions occurred during several visits: July 9th; 14th, 15th, and 17th through the 19th, 2010. Twenty two soil test pits were excavated by backhoe within various

MATRIX Soils & Systems, Inc.
3990 Fairview Road, Duluth, MN 55803-2708
(218)390-2869, FAX (888)771-5135
e-mail: rwwhitmyer.matrixss@charter.net

landscape positions throughout the site and saturated hydraulic conductivity (k_{sat}) measured, both to collect information for determining wastewater treatment and dispersal capability. The observed soil profiles were described using U.S. Department of Agriculture (USDA) nomenclature. k_{sat} was measured at 19 locations within three general horizon groupings using a compact constant head permeameter and methods outlined by Amoozegar and Warrick (1986).[1] Locations of the test pits and conductivity measurements are shown in the attached Figure 2. Ground surface elevations at the test pits were measured relative to the lake surface elevation using a hand level.

The single treatment and dispersal site, located at western end of the approximately 3,000-foot long Birch Point Road area, is wooded with complex topography comprised of a large knoll in the eastern half and smaller knoll in the western half. Aspect and degree of site slope varies with an average 12 percent southwesterly component and 20 percent northerly component in the western three-quarters, and average 14 percent northerly and southerly aspects in the eastern quarter. Ground surface elevations vary from 10 feet to 46 feet above the lake surface. Cross-slope distances available for treatment and dispersal along the southwestern and southern sides are approximately 400 feet and 65 feet, respectively; along the northern side, 315 feet. Average width throughout most of the site is 175 feet widening to around 340 feet in the eastern portion. The wetland previously mentioned, which formed in an area likely to have been an additional direction of drainage when lake surface levels were higher during end of the last glacial period, borders southwestern side of the site. A gravel drive for access to the beach area separates the site and wetland, crossing the wetland on long-ago placed fill approximately 130 west of the eastern property boundary. Current surface topography of the wetland and bordering fill for drives and roadway suggest movement of water from the wetland is primarily from evapotranspiration and subsurface flow. Closest water supply well to the site is an estimated 140 feet to the southeast (see attached Figure 3). Closest water supply well listed in the Minnesota Department of Health County Well Index is approximately 350 feet to the east.

Soils of the site formed in coarse loamy glacial outwash material overlying finer, poorly-structured loamy glacial till material. Typically surface horizons are strongly structured sandy loams; subsoils are unstructured loamy sands to sandy loams and overlie unstructured sand and loamy sand substrates, which tend to be missing from northeastern portion of the site. Underlying these horizons are platy-structured loamy substrate materials that are periodically saturated as evidenced by the presence of redoximorphic soil mottling. Portions of these horizons are dense as evidenced by the observed firm consistence. Relative elevations of the upper surface of these horizons slope west-northwestward in western portion of the site and northerly and southerly in the eastern portion. Depth of consistently unsaturated permeable soil varies between averages of 69 inches within much of interior portion of the site to 45 inches

[1] Amoozegar, A. and A.W. Warrick. 1986. Hydraulic conductivity of saturate soils: Field methods. pp. 735 - 770. *In* A. Klute (ed.) Methods of Soil Analysis Part 1, Physical and Mineralogical Methods, 2nd Ed. ASA/SSSA, Madison, WI.

along the southwestern boundary to 38 inches in the eastern portion. Detailed soil profile descriptions observed in the test pits are attached.

The observed soil conditions are similar to that mapped by the United States Department of Agriculture Natural Resources Conservation Service. Mapping unit series labeled for the area in which the site is located is an Aldenlake-Pequaywan complex (see attached Figure 4). Soils of the treatment and dispersal site mostly resemble the Aldenlake sandy loam series as gravelly coarse sand was only observed in one test pit, TP13. Nevertheless, the observed redoximorphic features and platy-structured loamy substrate underlying the upper sandy horizons of site soils are not typical of either series as described in the official series descriptions.

Saturated hydraulic conductivity of the subsoil, and sandy and loamy substrates horizons of the site was measured. Within the subsoil horizons, measurements ranged from 1 feet per day (ft/day) to 23 ft/day, which equals 10 gallons per day per square foot (gpd/ft^2) to 170 gpd/ft^2. In the sandy substrate horizons, measurements ranged from 0.6 ft/day to 34 ft/day (4 gpd/ft^2 to 250 gpd/ft^2). In the loamy substrate horizons, measurements ranged from 0.01 ft/day to 3 ft/day (0.08 gpd/ft^2 to 21 gpd/ft^2). Geometric averages of the measurements are 4 ft/day (32 gpd/ft^2), 7 ft/day (55 gpd/ft^2), and 0.4 ft/day (3 gpd/ft^2), respectively.

Site soil conditions are suitable for subsurface treatment and dispersal: of residential-strength septic tank effluent within portions of the site having greater than four feet of consistently unsaturated permeable soil, which is the predominant condition in western portion of the site; and additionally pretreated septic tank effluent throughout the site, but required within portions having less than three feet of consistently unsaturated permeable soil.

Flow of soil water from the site has vertical and horizontal components. Within the consistently unsaturated permeable loamy and sandy surface, subsoil, and substrate horizons, vertical flow predominates. Immediately above and within the platy-structured loamy substrate horizons, soil water movement is primarily horizontal, particularly during wet periods, due to both the almost 20-fold greater average conductivity of the overlying horizon and structure of the platy-structured loamy substrate. In addition, there is some indication that density of the platy-structured loamy substrate increases with depth as k_{sat} measurements two feet to three feet into the horizon were slower than those measured near top of the horizon by up to three degrees. Considering this in light of horizon topography, wastewater discharged within western three-quarters of the site will flow horizontally in a generally west-northwesterly direction, and southwesterly and northerly only should sufficient mounding (a three-foot to five-foot rise) occur. In eastern portion of the site horizontal flow in a northerly or southerly direction would occur depending on side of the knoll to which the wastewater would be discharged. Nevertheless, some vertical leakage within the underlying platy-structured loamy substrate will also occur, albeit at a rate likely to be in the range of less than or equal to 0.1 gpd/ft^2.

Site loading rates will be dependent on soil conditions and type of wastewater discharged to the soil. Assuming septic tank effluent will be additionally pretreated to minimize area required

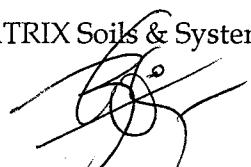
for treatment and dispersal, loading rates for such effluent and typical construction practices would limit site capability. For soil conditions observed in the upper horizons, an infiltrative surface loading rate of 1.0 gpd/ft² and maximum areal loading rate of 0.4 gpd/ft² would be acceptable. On these bases and providing sufficient area for installation of two systems (initial and replacement), maximum average treatment and dispersal capability of western portion of the site would be approximately 9,400 gpd. Should mounding be sufficient to force effluent to flow laterally to the southwest and north, contour loading rate would be the factor limiting site capability in this portion. A contour loading of 14 gpd/ft in both directions is the projected maximum acceptable rate based on k_{sat} measurements. On this basis without considering expected leakage into the underlying platy-structured loamy substrate at a 0.1-gpd/ft² rate, site dispersal capability would be 9,100 gpd. Within eastern portion of the site, contour loading rate would also be the factor limiting site capability. Discharging effluent 12 inches below existing grade, a contour loading rate of 6 gpd/ft would be the maximum acceptable rate resulting in a total additional dispersal capability of approximately 800 gpd. Therefore, total site treatment and dispersal capability ranges from 9,500 gpd to 9,800 gpd. Based on current development, i.e. 72 bedrooms, required treatment and dispersal capacity including estimated collection system inflow and infiltration is 7,400 gpd to 7,800 gpd, which is less than projected site treatment and dispersal capability and means site use for a wastewater system to serve the area is feasible.

Note to minimize site disturbance and accommodate the complex site topography, dispersal of additionally pretreated septic tank effluent via drip dispersal using pressure compensating emitters is recommended. Standard methods of dispersal, e.g. pressure distribution trenches may be feasible, but will be much more challenging to layout and simply operate.

This letter should provide the information needed to continue with wastewater system planning. If you or anyone else has further questions about site treatment and dispersal capability, please call me at (218)390-2869.

Sincerely,

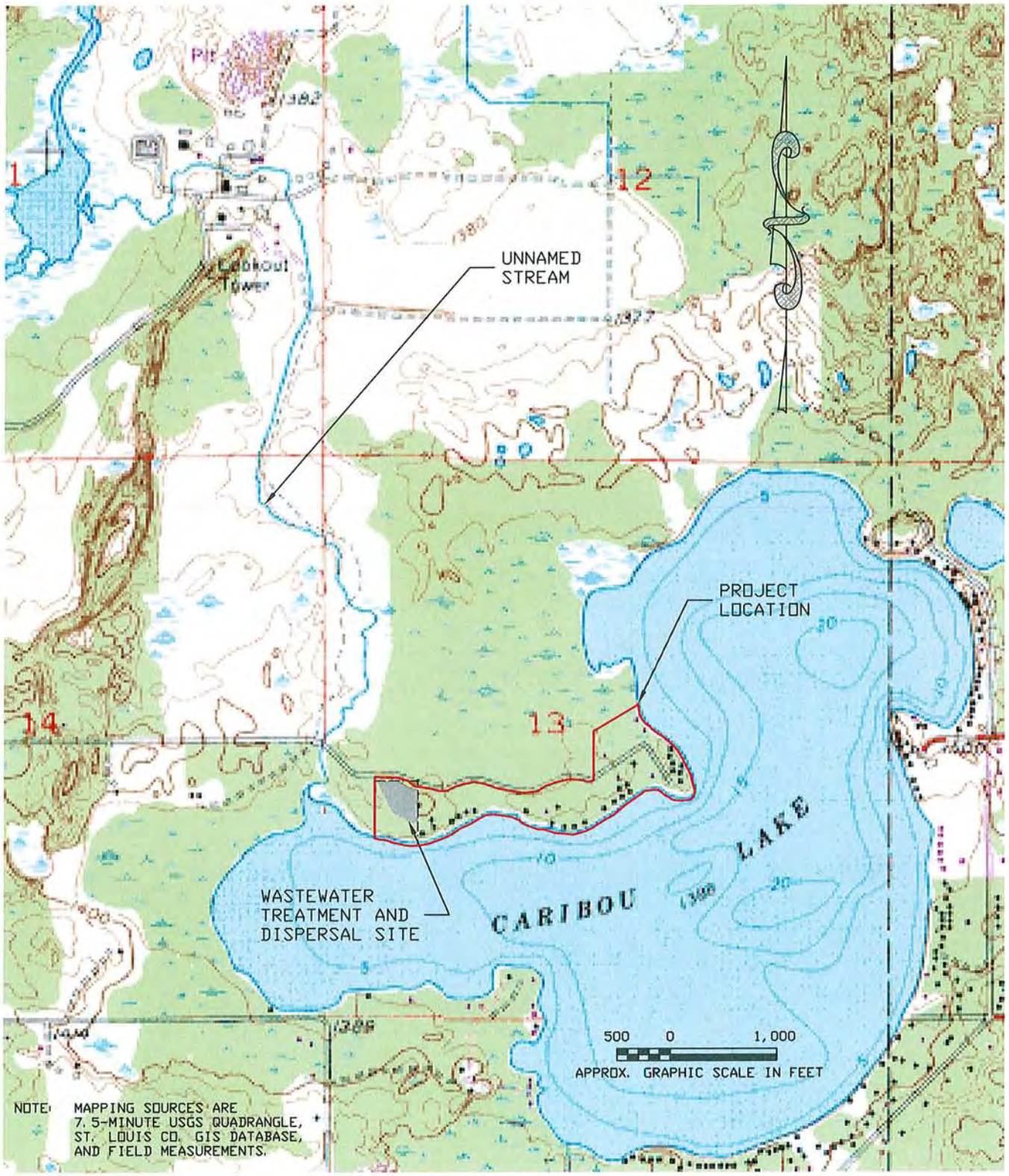
MATRIX Soils & Systems, Inc.



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

Attachments

cc: Tom Kurtovich
Peter Weidman, MSA, Professional Services
Jeff Crosby, St. Louis County Environmental Services Department - Duluth
Brett Ballavance, Minnesota Pollution Control Agency



DRAWN					
RWW	AREA MAP	AS SHOWN	0	AREA PROXIMAL TO SITE	08/13/10
		SCALE	REV.	DESCRIPTION	DATE

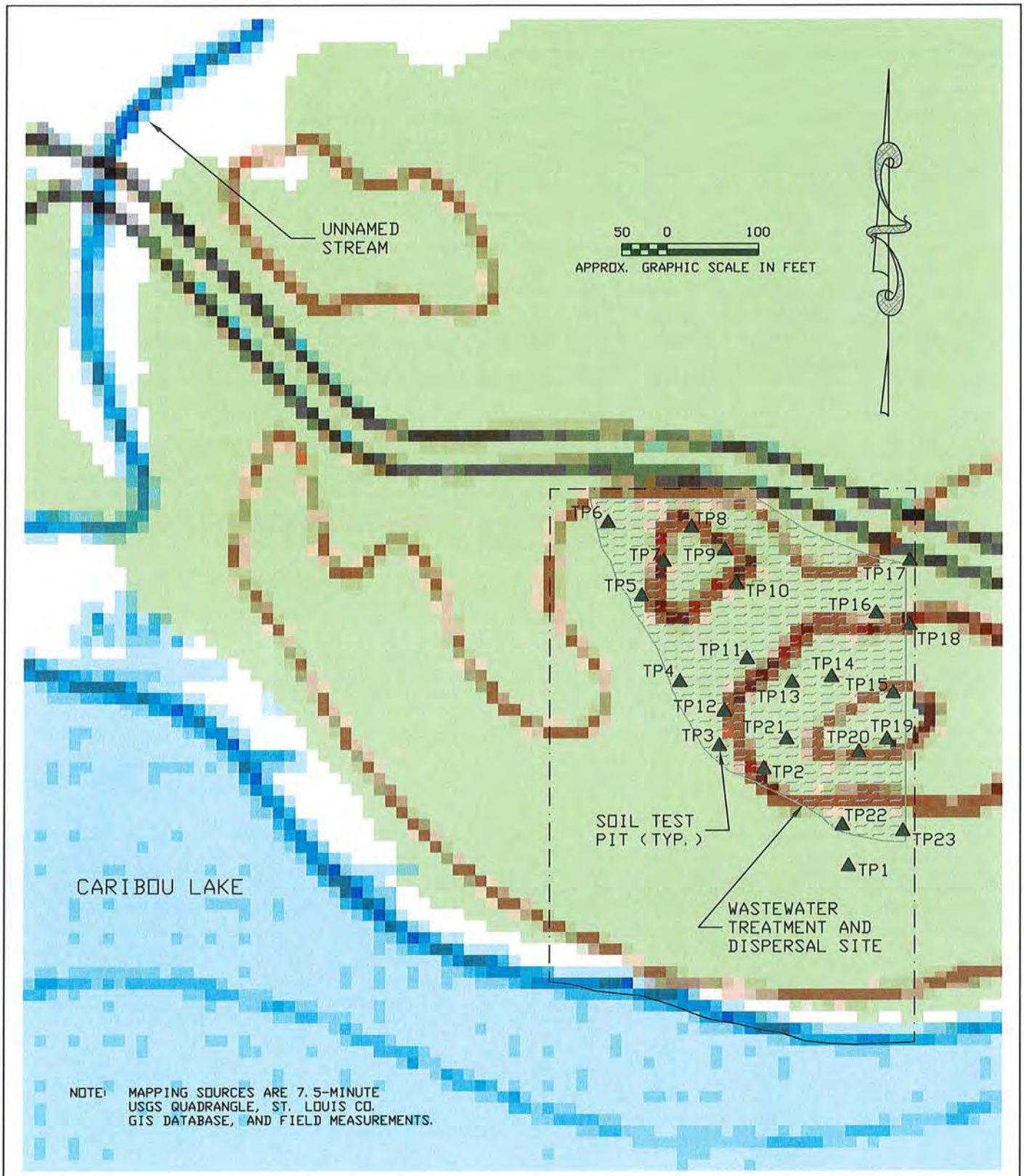
MATRIX Soils & Systems

BIRCH POINT ROAD AREA

SEC. 13, T51N, R16W

GRAND LAKE TWP., ST. LOUIS CO., MN

FIGURE 1



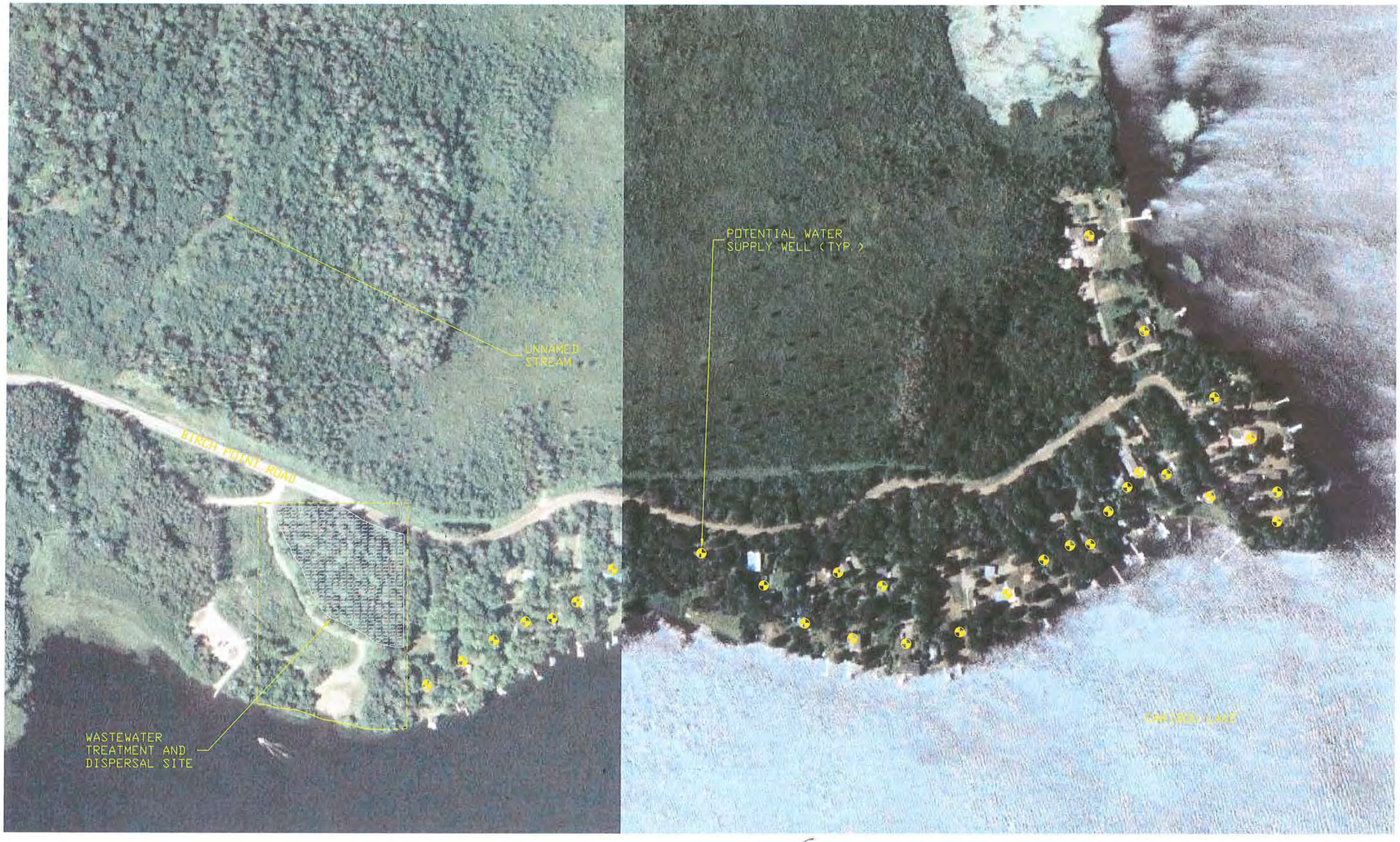
DRAWN					
RWW	SITE MAP	AS SHOWN	0	WASTEWATER SYSTEM SITE	08/13/10
		SCALE	REV.	DESCRIPTION	DATE

MATRIX Soils & Systems

BIRCH POINT ROAD AREA

Pt. NW 1/4 SW 1/4, SEC. 13, T51N, R16W
GRAND LAKE TWP., ST. LOUIS CO., MN

FIGURE 2



NOTES

1. WASTEWATER TREATMENT AND DISPERSAL SITE AND POTENTIAL WATER SUPPLY WELL LOCATIONS ARE APPROXIMATE. EXISTENCE AND SPECIFIC LOCATION OF WELLS HAVE NOT BEEN CONFIRMED.
2. MAPPING SOURCES ARE MAPTECH 7/11/09 ORTHOPHOTO, AND FIELD MEASUREMENTS AND OBSERVATIONS.

100 0 200
APPROXIMATE SCALE IN FEET

REV. DATE 08/13/10	SITE MAP	AS SHOWN	0	POTENTIAL WATER SUPPLY WELL LOCATIONS
DRAWN BY: RWW		SCALE	REV.	DESCRIPTION
DATE 08/03/10	MATRIX Soils & Systems	BIRCH POINT ROAD AREA Pt. NW 1/4 SW 1/4, SEC. 13, T51N, R16W GRAND LAKE TWP., ST. LOUIS CO., MN		FIGURE 3

SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP1
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 16% linear, concave foot-slope @ 112.8 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	loamy fine sand; < 5% gravel	moderate, fine granular; very friable, moist		many very fine, common fine and medium, and few coarse roots; clear wavy boundary	0.40§
Bw	9 – 17	7.5YR 4/4	loamy fine sand; 5-10% gravel and cobbles	moderate, medium subangular blocky; very friable, moist		common very fine, fine, and medium, and few coarse roots; gradual wavy boundary	0.40§
C	16 – 36	7.5YR 4/3	loamy sand; 5-10% gravel and cobbles	single grain; loose, moist		common very fine and fine roots; very abrupt wavy boundary	0.54§
2C	36 – 42	7.5YR 4/3	loam to silt loam; 5-10% gravel	massive; very friable, very moist	common, fine, distinct 7.5YR 5/6, oval rings of Fe concentration surrounding common, medium, distinct 7.5YR 5/3, oval Fe depletions		NP‖
	42					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

§ Provisional rate, i.e. rate that is or would be acceptable with an underlying 3 feet of consistently unsaturated, permeable soil.

‖ Discharge of STE to this horizon is not permitted.

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP2
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 19% linear, linear back-slope @ 115.4 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 8	7.5YR 3/2	loamy sand to sandy loam; 5-10% gravel	moderate, fine granular; very friable, moist		many very fine, and common fine, medium, and coarse roots; abrupt wavy boundary	0.47§
Bw	8 – 28	7.5YR 4/6	sand; 10-15% gravel and cobbles	single grain; loose, dry to moist		common very fine and fine, and few medium roots; very abrupt wavy boundary	0.54§
2C	28 – 45	7.5YR 4/3	loam to silt loam	moderate, medium platy; friable, moist to very moist	few, fine, distinct 7.5YR 4/6, round Fe concentrations	common very fine and fine, and few medium roots	NP‖
	45					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP3
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 4% concave, concave foot-slope @ 110.9 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 8	7.5YR 3/2	sandy loam; < 5% gravel and cobbles	strong, medium granular; friable, moist		many very fine, common fine and medium, and few coarse roots; abrupt wavy boundary	0.40§
Bw	8 – 23	7.5YR 4/6	loamy sand	single grain; loose, dry to moist		many very fine, common fine, and few medium and coarse roots; abrupt wavy boundary	0.54§
C	23 – 32	7.5YR 4/4	loamy sand	massive; friable, moist		few very fine, fine, and medium roots; very abrupt wavy boundary	0.47§
2C	32 – 47	5YR 4/3	loam	weak, coarse platy; friable to very friable, very moist	few, fine, prominent 7.5YR 5/8, round Fe concentrations; and few, fine, distinct 5YR 5/3, round Fe depletions	few very fine, fine, and medium roots	NP‖
	47					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP4
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 6% linear, concave foot-slope @ 109.6 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 8	7.5YR 3/2	sandy loam; < 5% gravel	moderate to strong, fine subangular blocky; friable, moist		many very fine and fine, and few medium and coarse roots; clear wavy boundary	0.40§
Bw1	8 – 18	7.5YR 4/4	loamy sand; < 5% gravel and cobbles	weak, medium granular; very friable to loose, moist		many very fine, common fine, and few medium and coarse roots; abrupt wavy boundary	0.54§
Bw2	18 – 21	7.5YR 4/6	fine sand; < 5% gravel	single grain; loose, moist		many very fine, common fine, and few medium roots; abrupt wavy boundary	0.40§
2C1	21 – 41	7.5YR 4/4	loam to fine sandy loam	moderate, medium platy; friable, moist	common, fine, faint 7.5YR 4/6, round Fe concentrations	few very fine and fine roots; very abrupt wavy boundary	NP‖
2C2	41 – 52	5YR 4/3	sandy loam	moderate, coarse platy; firm, moist	many, fine, distinct 5YR 4/6, round Fe concentrations; and many, medium, distinct 5YR 4/2, round Fe depletions		NP
	52					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP5
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 6% convex, convex back-slope @ 112.6 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	sandy loam; < 5% gravel and cobbles	strong, fine subangular blocky; friable, moist to dry		many very fine, common fine and medium, and few coarse roots; clear wavy boundary	0.40
Bw1	9 – 16	7.5YR 4/6	loamy fine sand; < 5% gravel and cobbles	moderate, medium subangular blocky; very friable, moist to dry		common very fine and fine, and few medium and coarse roots; gradual wavy boundary	0.40
Bw2	16 – 32	7.5YR 4/4	sandy loam; < 5% gravel and cobbles	massive to weak, coarse subangular blocky; friable, moist		common very fine and few fine roots; abrupt wavy boundary	0.27
2C1	32 – 44	5YR 4/4	loamy sand; 10-15% gravel and cobbles	single grain; friable to very friable, moist		few very fine, fine, and medium roots; abrupt wavy boundary	0.47
2C2	44 – 89	7.5YR 4/3	loamy sand; 5-10% gravel and cobbles	single grain; very friable, moist		few very fine and fine roots	0.54§
	89					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP6
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 13% convex, convex shoulder-slope @ 110.3 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	loamy sand; < 5% gravel and cobbles	moderate, fine granular; very friable, moist		many very fine and fine, common medium, and few coarse roots; abrupt wavy boundary	0.54
Bw	9 – 23	7.5YR 4/6	sand; 5-10% gravel and cobbles	single grain; loose, moist		common very fine, fine, and medium, and few coarse roots; abrupt wavy boundary	0.54§
BC1	23 – 44	7.5YR 4/4	fine sand; < 5% gravel	massive; very friable, moist		few very fine, fine, medium, and coarse roots; abrupt wavy boundary	0.40§
BC2	44 – 56	7.5YR 4/4	loamy sand; 5-10% gravel and cobbles	weak, medium subangular blocky; very friable, moist		few very fine and fine roots; very abrupt wavy boundary	0.54§
C1	56 – 72	7.5YR 4/3	fine sand to very fine sand	massive; very friable, very moist	few, medium, faint 7.5YR 4/4, round Fe concentrations	few very fine and fine roots; clear wavy boundary	NP‖
C2	72 – 90	7.5YR 4/3	sand; 5-10% gravel and cobbles	single grain; loose, moist to very moist		few very fine and fine roots; abrupt wavy boundary	NR¶
	90					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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¶ Discharge of STE to this horizon is not recommended.

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP7
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 7% concave, concave foot-slope @ 111.0 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 - 7	7.5YR 3/2	sandy loam; < 5% gravel	moderate, fine subangular blocky; very friable, moist		many very fine and fine, common medium, and few coarse roots; clear wavy boundary	0.40§
Bw	7 - 27	7.5YR 4/6	loamy sand; 5-10% gravel, cobbles, and stones	moderate, medium granular; very friable to loose, moist		many very fine, common fine, and few medium and coarse roots; abrupt wavy boundary	0.54§
C1	27 - 44	7.5YR 4/3	sand; 10-15% gravel and cobbles	weak, coarse platy; friable to firm, moist	common, fine, distinct 7.5YR 4/6, round Fe concentrations; and few, medium distinct 7.5YR 4/6, rings of Fe concentration surrounding few, medium, distinct 7.5YR 5/2, round Fe depletions	few very fine and fine roots; very abrupt wavy boundary	NP‖
C2	44 - 68	7.5YR 4/3	loamy sand; 10-15% gravel, cobbles, and stones	single grain; loose, moist to very moist		few very fine, fine, and medium roots; abrupt wavy boundary	NR¶
2C	68 - 84	7.5YR 4/3	sandy loam; 5-10% gravel and cobbles	massive; very friable, wet	common, medium, distinct 7.5YR 4/6, round Fe concentrations; and common, medium, distinct 7.5YR 6/1, round Fe depletions		NP
	84					END OF EXCAVATION	

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SOIL PROFILE DESCRIPTION (continued)

PROJECT Birch Point Road **TEST PIT*** TP7

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
	84					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP8
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† ≥10% convex, concave saddle summit-slope @ 114.4 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 7	7.5YR 3/2	sandy loam; < 5% gravel	strong, medium granular; friable, moist		many very fine and fine, common medium, and few coarse roots; abrupt wavy boundary	0.40
Bw	7 – 18	7.5YR 4/6	sand; 5-10% gravel and cobbles	weak, coarse granular; very friable, moist		common very fine, fine, and medium, and few coarse roots; abrupt wavy boundary	0.54
C1	18 – 35	7.5YR 4/4	sand; 5-10% gravel and cobbles	massive; slightly hard to soft, dry to moist		few very fine, fine, medium, and coarse roots; abrupt wavy boundary	0.40§
C2	35 – 50	7.5YR 4/4	sand; 5-10% gravel and cobbles	weak, medium to coarse platy; very friable to friable, moist		few very fine and fine roots; very abrupt wavy boundary	0.40§
C3	50 – 65	7.5YR 4/4	sand; < 5% gravel and cobbles	single grain; loose, moist		few very fine and fine roots; clear wavy boundary	0.54§
C4	65 – 97	7.5YR 4/3	sand; < 5% gravel and cobbles	single grain; loose, moist	few, coarse, distinct 7.5YR 4/6, Fe concentrations in root channels	few very fine and fine roots; abrupt wavy boundary	NP‖
C5	97 – 107	7.5YR 4/3	sand; < 5% gravel and cobbles	single grain; loose, moist to very moist			NR¶

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SOIL PROFILE DESCRIPTION (continued)

PROJECT Birch Point Road **TEST PIT*** TP8

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
	107					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP9
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 11% convex, convex knoll summit slope @ 118.9 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 7	7.5YR 3/2	loamy sand; 5-10% gravel and cobbles	moderate, fine granular; very friable, moist		many very fine and fine, common medium, and few coarse roots; clear wavy boundary	0.54
Bw	7 – 24	7.5YR 4/6	sand; 10-15% gravel, cobbles, stones, and boulders	weak, coarse granular; very friable to loose, moist		many very fine and fine, and few medium and coarse roots; abrupt wavy boundary	0.54
C1	24 – 76	7.5YR 4/4	sand; 10-15% gravel, cobbles, stones, and boulders	single grain; loose, moist		common very fine, fine, and medium roots; abrupt wavy boundary	0.54§
C2	76 – 99	7.5YR 4/4	sand; 10-15% gravel, cobbles, and stones	single grain; loose, moist		few very fine, fine, and medium roots	0.54§
	99					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP10
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 4% linear, linear saddle summit-slope @ 110.8 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 6	7.5YR 3/2	loamy sand; < 5% gravel and cobbles	moderate, fine granular; very friable, moist		many very fine and fine, and few medium and coarse roots; clear wavy boundary	0.54
Bw	6 – 27	7.5YR 4/6	sand; 10-15% gravel and cobbles	single grain; loose, moist		many very fine and fine, and few medium roots; very abrupt wavy boundary	0.54
C1	27 – 80	7.5YR 4/4	sand; 15-20% gravel and cobbles	single grain; very friable to loose, moist		few very fine and fine roots; very abrupt wavy boundary	0.54§
C2	80 – 87	7.5YR 4/3	sand; 10-15% gravel and cobbles	single grain; loose, very moist	common, coarse, faint 7.5YR 4/2, round Fe depletions		NP‖
	87					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP11
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 3% convex, convex shoulder-slope @ 115.5 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	fine sandy loam; < 5% gravel	moderate, fine subangular blocky; very friable, moist		many very fine, common fine, and few medium and coarse roots; abrupt wavy boundary	0.40
Bw1	9 – 16	7.5YR 4/6	loamy fine sand; < 5% gravel	weak, fine subangular blocky; very friable to loose, moist		common very fine and fine, and few medium and coarse roots; clear wavy boundary	0.40
Bw2	16 – 25	7.5YR 4/6	loamy sand; 5-10% gravel and cobbles	single grain; loose, moist		common very fine and fine roots; abrupt wavy boundary	0.54
C1	25 – 71	7.5YR 4/4	sand; 10-15% gravel and cobbles	single grain; loose, moist		few very fine, fine, and medium roots; abrupt wavy boundary	0.54§
C2	71 – 85	7.5YR 4/4	loamy sand; 10-15% gravel and cobbles	single grain; loose, moist to very moist			0.54§
	85					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP12
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 10% linear, linear back-slope @ 114.2 ft
DATE 7/14/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 8	7.5YR 3/2	loamy fine sand; < 5% cobbles	moderate, fine granular; very friable, moist		many very fine, common fine, and few medium and coarse roots; clear wavy boundary	0.40
Bw1	8 – 16	7.5YR 4/6	loamy fine sand; < 5% gravel and cobbles	weak, medium granular; very friable to loose, moist to dry		many very fine, common fine, and few medium and coarse roots; clear wavy boundary	0.40
Bw2	16 – 25	7.5YR 5/4	loamy fine sand; < 5% gravel and cobbles	massive; very friable, moist		common very fine and fine, and few medium roots; abrupt wavy boundary	0.40
BC	25 – 35	7.5YR 4/4	loamy sand; 5-10% gravel	weak, medium subangular blocky; very friable, moist		common very fine and fine roots; very abrupt wavy boundary	0.54
C	35 – 81	7.5YR 4/4	sand; 5-10% gravel and cobbles	single grain; loose, moist		very abrupt wavy boundary	0.54§
2C	81 – 87	7.5YR 4/3	fine to very fine sand; < 5% gravel	massive; very friable, moist to very moist	common, medium, distinct 7.5YR 4/6, rings of Fe concentration; and few, medium, faint 7.5YR 5/3, round Fe depletions		NP‖

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SOIL PROFILE DESCRIPTION (continued)

PROJECT Birch Point Road **TEST PIT*** TP12

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
	87					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

§ Provisional rate, i.e. rate that is or would be acceptable with an underlying 3 feet of consistently unsaturated, permeable soil.

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP13
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 23% convex, convex back-slope @ 118.8 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 10	7.5YR 3/2	sandy loam; < 5% gravel	strong, fine granular; friable, moist		common very fine, fine, and medium, and few coarse roots; clear wavy boundary	0.54
Bw	10 – 28	7.5YR 4/6	loamy sand; 5-10% gravel and cobbles	single grain; loose, moist		common very fine and fine, and few medium and coarse roots; abrupt wavy boundary	0.54§
C1	28 – 46	7.5YR 4/4	sand; 15-20% gravel and cobbles	single grain; loose to very friable, moist to dry		common very fine and fine, and few medium and coarse roots; very abrupt wavy boundary	0.54§
C2	46 – 64	7.5YR 3/3	very coarse sand; 15-20% gravel and cobbles	single grain; loose, dry to moist		few very fine and fine roots; very abrupt wavy boundary	NP‖
C3	64 – 70	7.5YR 4/3	sand; < 5% gravel	single grain; loose, moist		very abrupt wavy boundary	0.54§
C4	70 – 91	7.5YR 3/3	coarse sand; 5-10% gravel	single grain; loose, moist to dry		very abrupt wavy boundary	NP
2C	91 – 99	5YR 4/4	loamy sand; < 5% gravel	weak to moderate, medium platy; very friable to friable, moist			0.47§
	99					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP14
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 16% convex, convex back-slope @ 128.9 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 10	5YR 2.5/1	loamy sand; < 5% gravel and cobbles	strong, fine granular; friable, moist		many very fine and fine, and common medium and coarse roots; abrupt wavy boundary	0.54
Bw	10 – 34	7.5YR 4/6	sand; 5-10% gravel and cobbles	single grain; loose, moist to dry		many very fine and fine, common medium, and few coarse roots; abrupt wavy boundary	0.54§
C	34 – 54	7.5YR 4/4	loamy sand; 10-15% gravel and cobbles	single grain; loose, moist to dry		common very fine and fine roots; very abrupt wavy boundary	0.54§
2C	54 – 75	7.5YR 4/3	loamy very fine sand	strong, fine platy; friable to very friable, moist	few, medium, distinct 7.5YR 4/6, round Fe concentrations		NP‖
	75					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP15
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† knoll summit @ 146.5 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 8	7.5YR 3/2	loamy fine sand; < 5% gravel	moderate, fine granular; very friable, moist		many very fine and fine, and few medium and coarse roots; abrupt wavy boundary	0.40
Bw	8 – 17	7.5YR 5/4	fine sand; < 5% gravel	moderate medium subangular blocky; very friable to loose, moist		common very fine and fine, and few medium and coarse roots; very abrupt wavy boundary	0.40
C1	17 – 26	7.5YR 4/3	loamy sand; 10-15% gravel and cobbles	massive; firm to friable, moist		few very fine and fine roots; very abrupt wavy boundary	0.40§
C2	26 – 59	7.5YR 4/4	sand to loamy sand; 5-10% gravel and cobbles	single grain; loose, moist		few very fine, fine, medium, and coarse roots; very abrupt wavy boundary	0.47§
2C	59 – 78	7.5YR 4/3	fine to very fine sand	massive; very friable, very moist to moist	common, medium, distinct 7.5YR 4/6, rings of Fe concentration surrounding common, medium, distinct 7.5YR 5/2, round Fe depletions	few fine roots	NP‖
	78					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP16
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 25% linear, linear back-slope @ 124.6 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 7	7.5YR 3/2	sandy loam	strong, fine subangular blocky; friable, moist		common very fine and fine, and few medium and coarse roots; clear wavy boundary	0.40§
Bw	7 – 17	7.5YR 4/6	loamy sand to sandy loam; < 5% gravel and cobbles	single grain to weak, medium subangular blocky; very friable to loose, moist		common very fine and fine, and few medium and coarse roots; clear wavy boundary	0.47§
BC	17 – 27	5YR 5/3	sandy loam	moderate to weak, medium subangular blocky; friable, moist		common very fine, and few fine and medium roots; clear wavy boundary	0.40§
C	27 – 75	5YR 5/3	sandy loam	moderate, fine platy; friable, moist	common, fine, distinct 5YR 4/6, round Fe concentrations	few very fine, fine, and medium roots	NP‖
	75					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP17
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 25% convex, linear back-slope @ 121.4 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	sandy loam; < 5% gravel	strong, fine subangular blocky; friable, moist		common very fine and fine, and few medium and coarse roots; clear wavy boundary	0.40§
Bw	9 – 16	7.5YR 4/6	loamy sand; 5-10% gravel and cobbles	single grain; loose, moist		common very fine and fine, and few medium and coarse roots; clear wavy boundary	0.54§
BC	16 – 27	5YR 4/3	sandy loam; < 5% gravel	moderate, medium subangular blocky; friable, moist		common very fine, fine, and medium, and few coarse roots; clear wavy boundary	0.40§
C	27 – 57	5YR 4/3	sandy loam; < 5% gravel	weak to moderate, fine platy; friable to very friable, moist to very moist	few, medium, faint 5YR 4/4, round Fe concentrations	common very fine and fine, and few medium roots; abrupt wavy boundary	NP‖
2C	57 – 68	7.5YR 4/3	loamy sand; 5-10% gravel and cobbles	weak, coarse platy; very friable, moist	few, fine, distinct 7.5YR 4/6, round Fe concentrations		NP
	68					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP18
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 13% linear, linear back-slope @ 137.0 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 8	7.5YR 3/2	loamy sand to sandy loam	moderate, medium granular; very friable, moist		common very fine, fine, and medium, and few coarse roots; clear wavy boundary	0.47
Bw1	8 – 14	7.5YR 4/6	loamy sand; 5-10% gravel and cobbles	single grain; very friable, moist		common very fine, fine, and medium, and few coarse roots; abrupt wavy boundary	0.54§
Bw2	14 – 29	7.5YR 4/6	sand; < 5% gravel	single grain; loose, moist to dry		common very fine and fine, and few medium roots; abrupt wavy boundary	0.54§
BC	29 – 44	7.5YR 4/3	sandy loam to loam; < 5% gravel and cobbles	moderate, medium subangular blocky; friable to very friable, moist		common very fine and fine roots; abrupt wavy boundary	0.40§
C	44 – 55	7.5YR 4/3	loam to silt loam	massive; friable to very friable, moist	common, medium, distinct 7.5YR 4/6, round Fe concentrations		NP‖
	55					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP19
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 19% convex, convex back-slope @ 138.3 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 8	7.5YR 3/2	sandy loam to loamy sand; < 5% gravel and cobbles	strong, medium granular; very friable, moist		many very fine and fine, and few medium and coarse roots; clear wavy boundary	0.47
Bw1	8 – 14	7.5YR 4/3	sandy loam; 5-10% gravel	moderate fine subangular blocky; very friable, moist		common very fine and fine, and few medium and coarse roots; clear wavy boundary	0.40§
Bw2	14 – 36	7.5YR 4/6	loamy sand; 10-15% gravel, cobbles, and stones	single grain; loose, moist		common very fine and fine, and few medium roots; very abrupt wavy boundary	0.54§
C	36 – 48	7.5YR 4/4	sand; 15-20% gravel and cobbles	single grain; very friable to loose, moist		few very fine, fine, and medium roots; very abrupt wavy boundary	0.54§
2C	48 – 61	5YR 4/3	loam; < 5% gravel	moderate, fine platy; very friable, moist	few, fine, faint 5YR 4/4, round Fe concentrations	few very fine, fine, and medium roots	NP‖
	61					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP20
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 25% convex, convex back-slope @ 132.2 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	loamy sand to sand; < 5% gravel	weak, medium granular; very friable to loose, moist		common very fine and fine, and few medium and coarse roots; abrupt wavy boundary	0.54
Bw1	9 – 21	7.5YR 4/6	sand; < 5% gravel and cobbles	single grain; loose, moist		common very fine and fine, and few medium and coarse roots; abrupt wavy boundary	0.54§
Bw2	21 – 34	7.5YR 4/6	sand; < 5% gravel and cobbles	massive; loose to friable, moist to dry		few very fine, fine, and medium roots; very abrupt wavy boundary	0.47§
C	34 – 48	7.5YR 4/4	sand	single grain; loose to very friable, moist		common very fine and fine, and few medium roots; very abrupt wavy boundary	0.54§
2C	48 – 64	5YR 4/3	sandy loam	weak to moderate, fine platy; friable, moist	common, fine, faint 5YR 4/4, round Fe concentrations	common very fine and fine roots to 53 in.	NP‖
	64					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP21
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 6% linear, convex back-slope @ 120.3 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	loamy sand; < 5% gravel and cobbles	strong, medium granular; friable, moist to dry		many very fine, common fine and medium, and few coarse roots; abrupt wavy boundary	0.54
Bw	9 – 19	7.5YR 4/6	loamy sand; 5-10% gravel and cobbles	weak, medium subangular blocky; very friable, moist		common very fine and fine, and few medium and coarse roots; gradual wavy boundary	0.54
C1	19 – 35	7.5YR 4/4	sand; 5-10% gravel and cobbles	single grain; loose, moist to dry		common very fine and fine, and few medium and coarse roots; gradual wavy boundary	0.54
C2	35 – 64	7.5YR 4/4	sand; 10-15% gravel and cobbles	single grain; loose, dry to moist		few very fine and fine roots; abrupt wavy boundary	0.54
C3	64 – 86	7.5YR 4/4	loamy sand; < 5% gravel and cobbles	single grain; very friable, moist		few very fine and fine roots; abrupt wavy boundary	0.54§
C4	86 – 100	7.5YR 4/4	sand; 5-10% gravel and cobbles	single grain; loose, moist			0.54§
	100					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP22
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 5% linear, linear back-slope @ 120.2 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 9	7.5YR 3/2	sandy loam; < 5% gravel and cobbles	strong, fine granular; friable, moist		common very fine, fine, and medium, and few coarse roots; clear wavy boundary	0.40§
Bw1	9 – 17	7.5YR 4/4	sandy loam; 5-10% gravel and cobbles	moderate, medium subangular blocky; very friable, moist		common very fine and fine, and few medium and coarse roots; gradual wavy boundary	0.40§
Bw2	17 – 25	7.5YR 4/6	sandy loam; < 5% gravel and cobbles	moderate, medium subangular blocky; very friable, moist		common very fine and fine, and few medium roots; very abrupt wavy boundary	0.40§
BC	25 – 34	7.5YR 4/3	sandy loam	weak, medium angular to subangular blocky to massive; friable, moist		few very fine and fine roots; clear wavy boundary	0.34§
C	34 – 41	7.5YR 4/3	loam	massive; friable to very friable, moist	common, fine, distinct 5YR 4/6, round Fe concentrations		NP‖
	41					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

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SOIL PROFILE DESCRIPTION

PROJECT Birch Point Road
TEST PIT* TP23
DESCRIPTION BY R.W. Whitmyer, CPSS, PSS, AD/I, SP

SCOPE Site Evaluation
LOCATION† 7% concave, convex foot-slope @ 114.9 ft
DATE 7/15/10

HORIZON	DEPTH (in.)	MATRIX COLOR	TEXTURE	STRUCTURE-CONSISTENCE	REDOXIMORPHIC FEATURES	OTHER	STE LOADING RATE (gpd/ft²)‡
A	0 – 10	5YR 2.5/1	loamy sand	strong, coarse granular; friable to very friable, moist		common very fine, fine, and medium, and few coarse roots; clear wavy boundary	0.54§
Bw	10 – 33	7.5YR 4/6	sand; < 5% gravel and cobbles	single grain; loose, moist		common very fine and fine, and few medium and coarse roots; very abrupt wavy boundary	0.54§
2C	33 – 44	5YR 4/4	very fine sandy loam; < 5% gravel and cobbles	moderate, coarse angular to subangular blocky; friable, moist	common, fine, distinct 5YR 5/8, round Fe concentrations	few very fine and fine roots; few 7.5YR 7/1 silt coats on ped faces	NP‖
	44					END OF EXCAVATION	

* Backhoe excavated.

† Degree of slope for down- and cross-slope shapes at indicated position and elevation relative to benchmark (lake surface = 100.0 ft).

‡ Loading rate in gpd/ft² (gallons per day per square foot) for projected average flows of residential strength STE (septic tank effluent).

§ Provisional rate, i.e. rate that is or would be acceptable with an underlying 3 feet of consistently unsaturated, permeable 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, Duluth, MN 55803-2708
(218)390-2869, FAX (888)771-5135, e-mail: rwwhitmyer.matrixss@charter.net

Map Unit Legend

St. Louis County, Minnesota, Duluth Part (MN615)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1020A	Bowstring and Fluvaquents, loamy, 0 to 2 percent slopes, frequently flooded	5.2	6.1%
1021A	Rifle soils, 0 to 1 percent slopes	27.6	32.2%
F122B	Aldenlake-Pequaywan complex, pitted, 0 to 8 percent slopes	35.9	41.8%
F125A	Pequaywan fine sandy loam, 0 to 3 percent slopes	10.7	12.4%
W	Water	6.4	7.5%
Totals for Area of Interest		**85.8**	**100.0%**

MAP LEGEND

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

Soils
- Soil Map Units

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
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:6,020 if printed on A size (8.5" × 11") sheet.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

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, Duluth Part
Survey Area Data: Version 6, Sep 3, 2009

Date(s) aerial images were photographed: 6/15/2003

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

REV. DATE 08/13/10	SITE MAP	N. T. S.	0	USDA NRCS SOIL MAPPING
DRAWN BY: RWW		SCALE	REV.	DESCRIPTION
DATE 08/03/10	MATRIX Soils & Systems	BIRCH POINT ROAD AREA Pt. NW 1/4 SW 1/4, SEC. 13, T51N, R16W GRAND LAKE TWP., ST. LOUIS CO., MN		FIGURE 4

Appendix F
Pressure Sewer Collection System Cost Estimate

TABLE F-1 Grinder Station Collection System
Birch Point Road Sanitary District

CONSTRUCTION COST ESTIMATE

No.	Item	Quantity		Unit Price		Total Item Cost
1	Mobilization, Bonds, Insurance (7%)	1	L.S.	$38,000	/L.S.	$38,000
2	Clearing and Grubbing	0.5	Ac.	$3,000	/L.S.	$1,500
3	1.25" Pressure HDPE forcemain	0	L.F.	$12	/L.F.	$0
4	2" Pressure HDPE forcemain	300	L.F.	$13	/L.F.	$3,900
5	3" Pressure HDPE forcemain	0	L.F.	$14	/L.F.	$0
6	4" Pressure HDPE forcemain	3,500	L.F.	$15	/L.F.	$52,500
7	6" Pressure HDPE forcemain	0	L.F.	$26	/L.F.	$0
8	1.25" HPDE Service Connection Pressure Pipe	8,000	LF	$14	/EA.	$112,000
9	4" Private PVC Laterals	34	EA.	$800	/EA.	$27,200
10	Collection System Valves	3	EA.	$1,300	/EA.	$3,900
11	Air Release Manholes	1	EA.	$9,000	/EA.	$9,000
12	Flushing Connections	4	EA.	$6,000	/EA.	$24,000
13	1.25" Curb Stop	34	EA.	$200	/EA.	$6,800
14	Tracer Wire Terminal Box	0	EA.	$100	/EA.	$0
15	Grinder Stations - Residential	34	EA.	$6,500	/EA.	$221,000
16	Grinder Stations - Commercial	0	EA.	$7,500	/EA.	$0
17	Street Restoration	0	SY	$35	/EA.	$0
18	Fusing Pit Restoration	8	EA.	$700	/EA.	$5,600
19	Service Connection Restoration	34	EA.	$800	/EA.	$27,200
20	Septic Tank Abandonment	34	EA.	$700	/EA.	$23,800
21	Electrical Connections	34	EA.	$500	/L.S.	$17,000
22	Erosion Control	1	L.S.	$5,000	/L.S.	$5,000
23	Traffice Control	1	L.S.	$1,000	/L.S.	$1,000
Total						**$579,000**
	Capital Contingencies (20%)					$116,000
Subtotal						**$695,000**
	Engr,Insp,Admin. (15%)					$104,000
Total Estimated Capital Cost						**$800,000**

TABLE F-2 Shared Grinder Station Collection System
Birch Point Road Sanitary District

CONSTRUCTION COST ESTIMATE

No.	Item	Quantity		Unit Price		Total Item Cost
1	Mobilization, Bonds, Insurance (7%)	1	L.S.	$29,000	/L.S.	$29,000
2	Clearing and Grubbing	0.5	Ac.	$3,000	/L.S.	$1,500
3	1.25" Pressure HDPE forcemain	0	L.F.	$12	/L.F.	$0
4	2" Pressure HDPE forcemain	500	L.F.	$13	/L.F.	$6,500
5	3" Pressure HDPE forcemain	0	L.F.	$14	/L.F.	$0
6	4" Pressure HDPE forcemain	3,500	L.F.	$15	/L.F.	$52,500
7	6" Pressure HDPE forcemain	0	L.F.	$26	/L.F.	$0
8	1.25" HPDE Service Connection Pressure Pipe	6,000	LF	$14	/EA.	$84,000
9	4" Private PVC Laterals	20	EA.	$800	/EA.	$16,000
10	Collection System Valves	3	EA.	$1,300	/EA.	$3,900
11	Air Release Manholes	1	EA.	$9,000	/EA.	$9,000
12	Flushing Connections	4	EA.	$6,000	/EA.	$24,000
13	1.25" Curb Stop	22	EA.	$200	/EA.	$4,400
14	Tracer Wire Terminal Box	0	EA.	$100	/EA.	$0
15	Grinder Stations - Residential	22	EA.	$6,500	/EA.	$143,000
16	Grinder Stations - Commercial	0	EA.	$7,500	/EA.	$0
17	Street Restoration	0	SY	$35	/EA.	$0
18	Fusing Pit Restoration	8	EA.	$700	/EA.	$5,600
19	Service Connection Restoration	22	EA.	$800	/EA.	$17,600
20	Septic Tank Abandonment	34	EA.	$700	/EA.	$23,800
21	Electrical Connections	22	EA.	$500	/L.S.	$11,000
22	Erosion Control	1	L.S.	$5,000	/L.S.	$5,000
23	Traffice Control	1	L.S.	$1,000	/L.S.	$1,000
Total						**$438,000**
	Capital Contingencies (20%)					$88,000
Subtotal						**$526,000**
	Engr,Insp,Admin. (17%)					$89,000
Total Estimated Capital Cost						**$615,000**

Appendix G
Wastewater Treatment Alternative Cost Estimates

TABLE G-1
ALTERNATIVE 1: FAST SYSTEM WASTEWATER TREATMENT (BOD Treatment)
Birch Point Road Sanitary District

Capital Costs

Item				Capital Cost	Design Life	Replace. Cost	Salvage Value
New FAST Wastewater Treatment System							
Clearing and Grubbing, ` 1.0 acres				$2,000			
New Power supply				$10,000			
FAST BOD				$37,000			
Pre-cast Concrete Tanks				$42,000			
SepticTank (9,000 gallons)							
Equalization Tank (9,000 gallons)							
Microfast Tank (9,000 gallon capacity)							
Drainfeild Dose Tank (5,000 gallon capacity)							
Installation							
Excavation	5	ea	$1,500	$7,500			
Setting of Tanks, crane rental	16	hrs	150	$2,400			
Piping Installation	40	hrs	150	$6,000			
Gravel tank base, 1 ft thick stone	48	c.y.	30	$1,440			
Imported washed sand fill	180	c.y.	$10	$2,000			
Equipment Installation in tanks	10	hrs	$150	$1,500			
Fiberglass Control Building							
Building, $175/sq ft, 15 x 10				$26,250	40		$13,125
Subsurface Disposal System Cost	1	ea	$63,000	$63,000			
WWTF Subtotal Cost				**$201,000**			
Site Work & Grading (5% of subtotal)				$10,000			
Yard Piping & Metals (2% of subtotal)				$4,000	40		$2,000
Electrical (10% of subtotal)				$20,000	20		
WWTF Subtotal				**$235,000**			
Wetlands delineation study				$2,000			
Fencing and Entrance Gate, 100 x 25	240	LF	$20	$5,000			
Mob./Demob., Bonding/Ins. (7%)				$17,000			
Subtotal				**$259,000**			$15,000
Capital Contingencies (20%)				$52,000			
Subtotal				**$311,000**			
Engr,Insp,Admin. (20%)				$62,000			
Total Estimated Capital Cost				**$373,000**			

Operation and Maintenance Costs	Units	$/units	Annual Cost
Labor: hours/week	4	25	$5,200
Laboratory testing			$2,600
Supplies			$1,500
Annual Power Cost, $/month	12	175	$2,100
Septic Tank pump out (once/year)	1	250	$250
Annual O & M Cost			$11,700

20 Year Present Worth	Actual Cost	Present Worth
Initial Capital Cost	$373,000	$373,000
Replacement Cost (15 year)		
Annual O & M Cost	$11,700	$147,000
Salvage Value	$15,000	($6,000)

TOTAL ESTIMATE OF PRESENT WORTH	**$514,000**

Note: Present Worth estimated using discount rate 4.875%

TABLE G-2
ALTERNATIVE 1: FAST SYSTEM WASTEWATER TREATMENT (Total N Treatment)
Birch Point Road Sanitary District

Capital Costs

Item				Capital Cost	Design Life	Replace. Cost	Salvage Value
New FAST Wastewater Treatment System							
Clearing and Grubbing, ` 1.5 acres				$3,000			
New Power supply				$10,000			
FAST BOD, Nitrification, and Denit Equipment				$118,000			
Pre-cast Concrete Tanks				$55,000			
SepticTank (8,500 gallons)							
Equalization Tank (8,500 gallons)							
Microfast Tank (9,000 gallon capacity)							
Nitrification Tank (9,000 gallon capacity)							
Denitrification Tank (5,000 gallon capacity)							
Polishing Tank (2,250 gallons)							
Drainfeild Dose Tank (5,000 gallon capacity)							
Installation							
Excavation	7	ea.	$1,500	$10,500			
Setting of Tanks, crane rental	16	hrs	150	$2,400			
Piping Installation	40	hrs	150	$6,000			
Gravel tank base, 1 ft thick stone	41	c.y.	30	$1,000			
Imported washed sand fill	180	c.y.	$10	$1,800			
Equipment Installation in tanks	10	hrs	$150	$1,500			
Fiberglass Chemical/Final Pump Building							
Building, $175/sq ft, 15 x 10				$26,250	20		
Chemical Feed and Storage Tank Equipment				$5,000			
Subsurface Disposal System Cost		1 ea.	65000	$65,000			
WWTF Subtotal Cost				**$305,000**			
Site Work & Grading (5% of subtotal)				$15,000			
Yard Piping & Metals (2% of subtotal)				$6,000	20		
Electrical (10% of subtotal)				$30,500	20		
WWTF Subtotal				**$357,000**			
Wetlands delineation study				$2,000			
Fencing and entrance gate, 140 x 25	330	LF	$20	$7,000			
Mob./Demob., Bonding/Ins. (7%)				$25,000	20		
Subtotal				$391,000			
Capital Contingencies (20%)				$78,000			
Subtotal				**$469,000**			
Engr,Insp,Admin. (15%)				$70,000			
Total Estimated Capital Cost				**$539,000**			

Operation and Maintenance Costs	Units	$/units	Annual Cost
Labor: hours/week	6	25	$7,800
Laboratory testing			$2,900
Supplies			$1,500
Annual Power Cost, $/month	12	400	$4,800
Chemical Supplies (denitrification), Acetic acid, gallons	365	6	$2,200
Septic Tank pump out (once/year)	1	250	$250
Annual O & M Cost			$19,500

20 Year Present Worth	Actual Cost	Present Worth
Initial Capital Cost	$539,000	$539,000
Replacement Cost (15 year)		
Annual O & M Cost	$19,500	$246,000
Salvage Value		

TOTAL ESTIMATE OF PRESENT WORTH	**$785,000**

Note: Present Worth estimated using discount rate 4.875%

TABLE G-3
ALTERNATIVE 2: BIOCLERE SYSTEM WASTEWATER TREATMENT (BOD Treatment)
Birch Point Road Sanitary District

Capital Costs

Item				Capital Cost	Design Life	Replace. Cost	Salvage Value
New FAST Wastewater Treatment System							
Clearing and Grubbing, ` 1.0 acres				$1,000			
New Power supply				$10,000			
BioClere BOD unit				$50,000			
Pre-cast Concrete Tanks				$32,000			
SepticTank (10,000 gallons)							
Equalization Tank (9,000 gallons)							
Drainfeild Dose Tank (5,000 gallon capacity)							
Installation							
Excavation	5	ea	$1,500	$7,500			
Setting of Tanks, crane rental	16	hrs	150	$2,400			
Piping Installation	40	hrs	150	$6,000			
Concrete Pad for Bioclere Unit, 8' x 8' x 10" thick	2	c.y.	600	$1,200			
Gravel tank base, 1 ft thick stone	41	c.y.	30	$1,230			
Imported washed sand fill	180	c.y.	$10	$2,000			
Equipment Installation in tanks	10	hrs	$150	$1,500			
Fencing, 60 x 20	250	LF	$16	$4,000			
Fiberglass Control Building							
Building, $175/sq ft, 15 x 10				$26,250	40		$13,125
Subsurface Disposal System Cost	1	ea	$63,000	$63,000			
WWTF Subtotal Cost				**$208,000**			
Site Work & Grading (5% of subtotal)				$10,000			
Yard Piping & Metals (2% of subtotal)				$4,000	40		$2,000
Electrical (10% of subtotal)				$21,000	20		
WWTF Subtotal				**$243,000**			
Wetlands delineation study				$2,000			
Mob./Demob., Bonding/Ins. (7%)				$17,000			
Subtotal				$262,000			$15,000
Capital Contingencies (20%)				$52,000			
Subtotal				$314,000			
Engr,Insp,Admin. (18%)				$60,000			
Total Estimated Capital Cost				**$374,000**			

Operation and Maintenance Costs	Units	$/units	Annual Cost
Labor: hours/week	4	25	$5,200
Laboratory testing			$3,000
Supplies			$1,500
Annual Power Cost, $/month	12	200	$2,400
Septic Tank pump out (once/year)	1	250	$250
Annual O & M Cost			$12,400

20 Year Present Worth	Actual Cost	Present Worth
Initial Capital Cost	$374,000	$374,000
Replacement Cost (15 year)		
Annual O & M Cost	$12,400	$156,000
Salvage Value	$15,000	($6,000)
TOTAL ESTIMATE OF PRESENT WORTH		**$524,000**

Note: Present Worth estimated using discount rate 4.875%

TABLE G-4
ALTERNATIVE 2: BIOCLERE SYSTEM WASTEWATER TREATMENT (Total N Treatment)
Birch Point Road Sanitary District

Capital Costs

Item				Capital Cost	Design Life	Replace. Cost	Salvage Value
New BioClere Wastewater Treatment System							
Clearing and Grubbing, ` 2.5 acres				$2,500			
New Power supply				$10,000			
Bioclere BOD, Nitrification, and Denit Equipment				$115,000			
Pre-cast Concrete Tanks				$37,000			
SepticTank (10,00 gallons)							
Equalization Tank (3,000 gallons)							
Aerobic MBBR Reactor Tank (3,000 gallon capacity)							
Lift Tank (500 gallon)							
Anoxic MBBR tank (1,500 gallons)							
Drainfeild Dose Tank (5,000 gallon capacity)							
Installation							
Excavation	7	ea.	$2,500	$17,500			
Setting of Tanks, crane rental	16	hrs	150	$2,400			
Piping Installation	40	hrs	150	$6,000			
Gravel tank base, 1 ft thick stone	56	c.y.	30	$2,000			
Concrete Pad under Bioclere Tank	3	c.y.	600	$2,000			
Imported washed sand fill	180	c.y.	$10	$1,800			
Equipment Installation in tanks	20	hrs	$150	$3,000			
Fencing and entrance gate	360	LF	$17	$6,000			
Fiberglass Chemical Buildings							
Buildings, $150/sq ft, 10 x 10	2	each	15000	$30,000	40		$15,000
Chenmical Feed and Storage Tank Equipment	1	ea	5000	$5,000			
Subsurface Disposal System Cost	1	ea.	65000	$65,000			
Water Supply Well	1	ea.	25000	$25,000			
WWTF Subtotal Cost				**$305,000**			
Site Work & Grading (5% of subtotal)				$15,000			
Yard Piping & Metals (3% of subtotal)				$9,000	20		
Electrical (10% of subtotal)				$30,500			
WWTF Subtotal				**$360,000**			
Wetlands delineation study				$2,000			
Fencing and entrance gate, 140 x 25	330	LF	$20	$7,000			
Mob./Demob., Bonding/Ins. (7%)				$25,000			
Subtotal				$394,000			$15,000
Capital Contingencies (20%)				$79,000			
Subtotal				$473,000			
Engr,Insp,Admin. (18%)				$85,000			
Total Estimated Capital Cost				**$558,000**			

Operation and Maintenance Costs	Units	$/units	Annual Cost
Labor: hours/week	6	25	$7,800
Laboratory testing			$3,100
Supplies			$1,500
Annual Power Cost, $/month	12	350	$4,200
Chemical Supplies (denitrification), Acidic acid, gallons	365	11	$4,015
Septic Tank pump out (once/yr)	1	150	$150
Annual O & M Cost			$20,800

20 Year Present Worth	Actual Cost	Present Worth
Initial Capital Cost	$558,000	$558,000
Replacement Cost (15 year)		
Annual O & M Cost	$20,800	$262,000
Salvage Value	$15,000	($6,000)

TOTAL ESTIMATE OF PRESENT WORTH	**$814,000**

Note: Present Worth estimated using discount rate 4.875%

TABLE G-5
ALTERNATIVE 3: ADVANTEX SYSTEM (BOD Treatment)
Birch Point Road Sanitary District

Capital Costs

Item				Capital Cost	Design Life	Replace. Cost	Salvage Value
Clearing and Grubbing				$2,000			
New Power supply				$10,000			
New Large Septic Tanks							
Septic Tank (18,000 gallons)	1	ea.	$25,000	$25,000			
Filter for septic tank effluent	1	ea.	$1,500	$1,500			
New Orenco Advantex							
Advantex equipment	1	ea.	$30,000	$30,000			
Control panel	1	ea.	$10,000	$10,000			
Recirc pumps	6	ea.	$3,000	$18,000			
Ventilation fan assembly	1	ea.	$2,500	$2,500			
Recirc. Tank, 9000 gallon	1	ea.	$15,000	$15,000			
Installation							
Excavation	3	ea.	$1,500	$4,500			
Setting of Tanks, crane rental	8	hrs	150	$1,200			
Piping Installation	30	hrs	150	$4,500			
Gravel tank base, 1 ft thick stone	36	c.y.	30	$1,080			
Imported washed sand fill	135	c.y.	$10	$1,000			
Equipment Installation in tanks	10	hrs	$150	$1,500			
Fiberglass Chemical/Final Pump Building							
Building, $175/sq ft, 15 x 10				$26,250	40		$13,125
Chemical Feed and Storage Tank Equipment				$5,000			
Subsurface Disposal System Cost		1 ea.	65000	$65,000			
WWTF Subtotal Cost				**$224,030**			
Site Work (5% of subtotal)				$11,202			
Yard Piping & Manholes (5% of subtotal)				$11,202	40		$5,601
Electrical (10% of subtotal)				$22,403			
WWTF Subtotal				**$269,000**			
Wetlands delineation study				$2,000			
Fencing and entrance gate	240	LF	$20	$5,000			
Mob./Demob., Bonding/Ins. (7%)				$19,000			
Subtotal				$295,000			$19,000
Capital Contingencies (20%)				$59,000			
Subtotal				$354,000			
Engr,Insp,Admin. (20%)				$71,000			
Total Estimated Capital Cost				**$425,000**			

Operation and Maintenance Costs	Units	$/units	Annual Cost
Labor: hours/week	5	25	$6,500
Laboratory testing			$2,300
Supplies			$1,500
Annual Power Cost, $/month	12	200	$2,400
Septic Tank pump out (once/year)	1	250	$250
Annual O & M Cost			$13,000

20 Year Present Worth	Actual Cost	Present Worth
Initial Capital Cost	$425,000	$425,000
Replacement Cost (15 year)		
Annual O & M Cost	$13,000	$164,000
Salvage Value	$19,000	($7,000)
TOTAL ESTIMATE OF PRESENT WORTH		**$582,000**

Note: Present Worth estimated using discount rate 4.875%

TABLE G-6
ALTERNATIVE 3: ADVANTEX SYSTEM (Total N removal)
Birch Point Road Sanitary District

Capital Costs Item				12,000 gpd Phase 1 Capital Cost	Design Life	Replace. Cost	Salvage Value
Clearing and Grubbing				$2,000			
New Power supply				$10,000			
New Large Septic Tanks							
Septic Tank (36,000 gallons)	1	ea.	$50,000	$50,000			
Filter for septic tank effluent	1	ea.	$1,500	$1,500			
New Orenco Advantex							
Advantex equipment	1	ea.	$50,000	$50,000			
Advantex polishing unit	1	ea.	$15,000	$15,000			
Control panel	1	ea.	$10,000	$10,000			
Recirc pumps	6	ea.	$3,000	$18,000			
Ventilation fan assembly	1	ea.	$2,500	$2,500			
Recirc. Tank, 9000 gallon	1	ea.	$15,000	$15,000			
Anoxic Tank 9000 gallon	1	ea.	$15,000	$15,000			
Installation							
Excavation	5	ea.	$1,500	$7,500			
Setting of Tanks, crane rental	12	hrs	150	$1,800			
Piping Installation	40	hrs	150	$6,000			
Gravel tank base, 1 ft thick stone	48	c.y.	30	$1,440			
Imported washed sand fill	180	c.y.	$10	$2,000			
Equipment Installation in tanks	10	hrs	$150	$1,500			
Fiberglass Chemical/Final Pump Building							
Building, $175/sq ft, 15 x 10				$26,250	40		$13,125
Chemical Feed and Storage Tank Equipment				$5,000			
Subsurface Disposal System Cost	1	ea.	65000	$65,000			
WWTF Subtotal Cost				**$305,490**			
Site Work (5% of subtotal)				$15,275			
Yard Piping & Manholes (5% of subtotal)				$15,275	40		$7,637
Electrical (10% of subtotal)				$30,549			
WWTF Subtotal				**$367,000**			
Wetlands delineation study				$2,000			
Fencing and entrance gate	380	LF	$17	$6,000			
Mob./Demob., Bonding/Ins. (7%)				$26,000			
Subtotal				$401,000			$21,000
Capital Contingencies (20%)				$80,000			
Subtotal				$481,000			
Engr,Insp,Admin. (18%)				$87,000			
Total Estimated Capital Cost				**$568,000**			

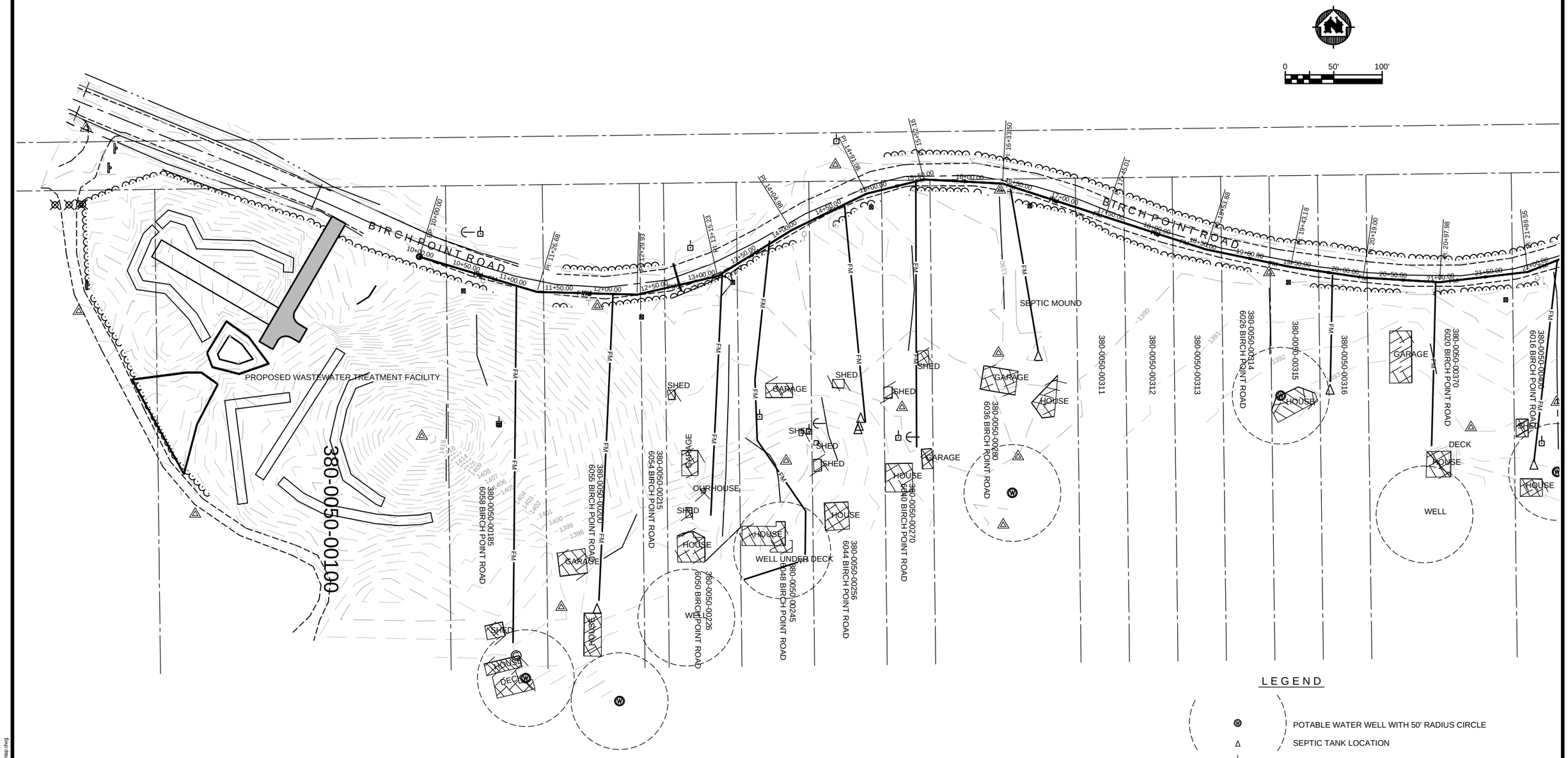
Operation and Maintenance Costs	Units	$/units	Annual Cost
Labor: hours/week	6	25	$7,800
Laboratory testing			$2,900
Supplies			$1,500
Annual Power Cost, $/month	12	275	$3,300
Chemical Supplies (denitrification), Mico C Product, gallons	365	6	$2,200
Septic Tank pump out (once/year)	2	250	$500
Annual O & M Cost			$18,200

20 Year Present Worth	Actual Cost	Present Worth
Initial Capital Cost	$568,000	$568,000
Replacement Cost (15 year)		
Annual O & M Cost	$18,200	$229,000
Salvage Value	$21,000	($8,000)

TOTAL ESTIMATE OF PRESENT WORTH	**$789,000**

Note: Present Worth estimated using discount rate 4.875%

Appendix H
Preliminary Design Information



LEGEND

- POTABLE WATER WELL WITH 50' RADIUS CIRCLE
- SEPTIC TANK LOCATION
- POWER POLE
- POWER POLE GUY
- TELEPHONE PEDESTAL
- SURVEY CONTROL POINT
- APPROXIMATE PROPERTY LINE
- FM — PROPOSED FORCEMAIN OR SERVICE PIPE

PROJECT NO.: 8812001	SCALE: AS SHOWN	NO.	DATE	REVISION		BY
PROJECT DATE: XX/XX/XXXX	DRAWN BY: RWM					
CHECKED BY: CWS						
PLOT DATE:						

Preliminary

MSA PROFESSIONAL SERVICES
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301 West First Street Duluth, MN 55802
218-722-3915 1-800-777-7380 Fax: 218-722-4548
Web Address: www.msa-ps.com

PRELIMINARY WASTEWATER COLLECTION SYSTEM PLAN

BIRCH POINT ROAD SANITARY DISTRICT
CARIBOU LAKE, ST LOUIS COUNTY, MINNESOTA

FILE NO. 8812001
SHEET G-2

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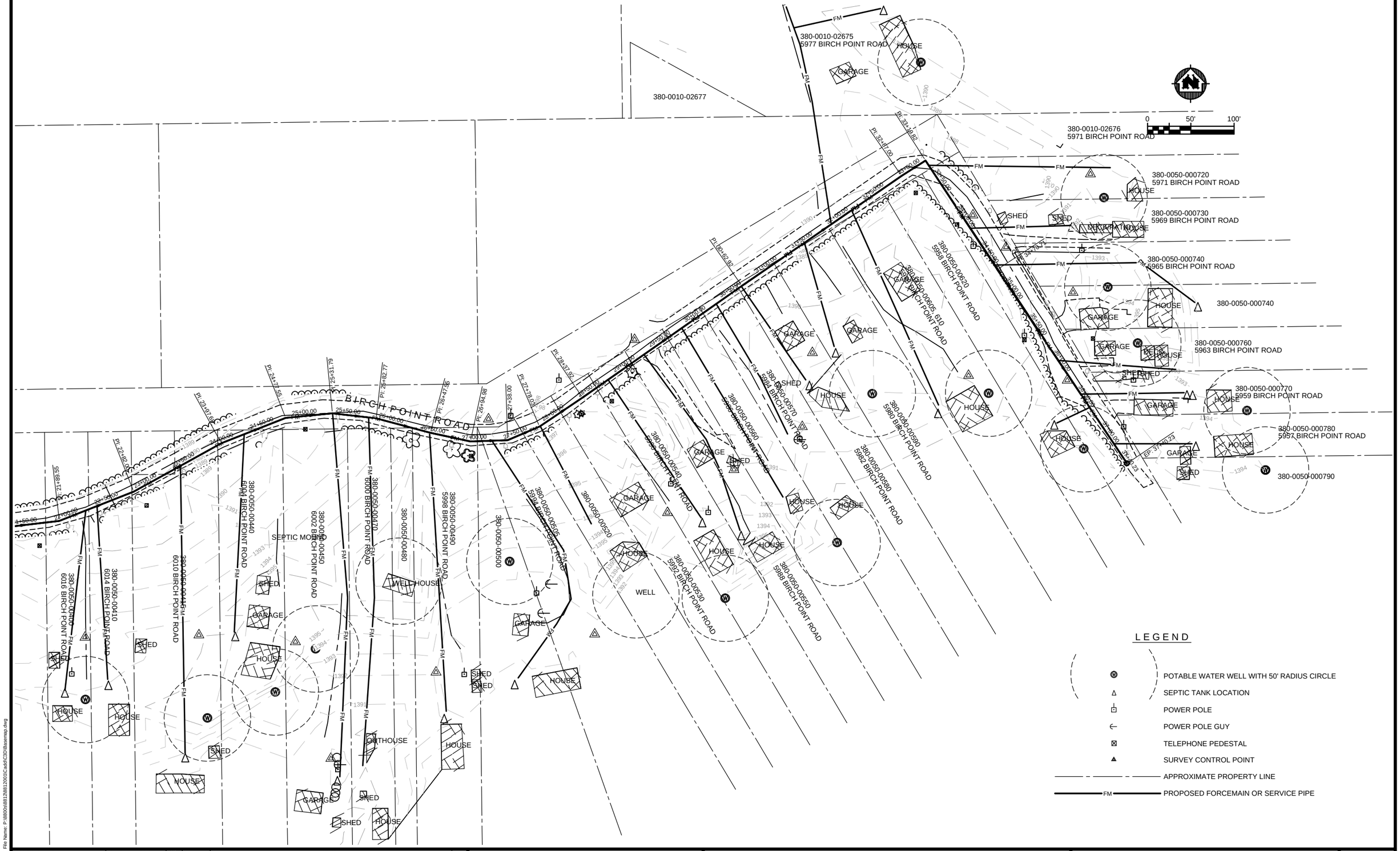

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PROJECT DATE: XXXXXXXXX	DRAWN BY: RWM				
CHECKED BY: CWS					
PLOT DATE:					

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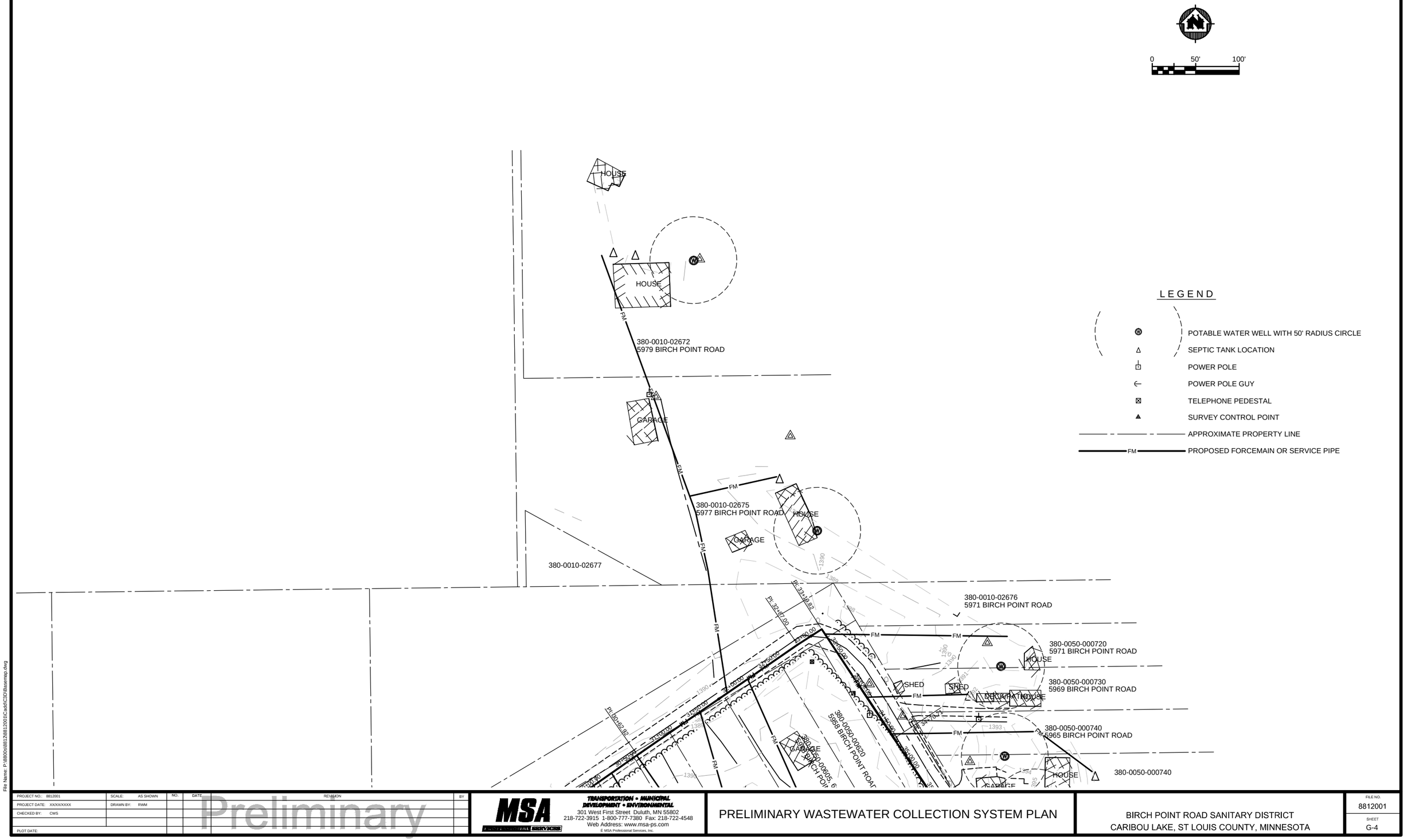
PRELIMINARY WASTEWATER COLLECTION SYSTEM PLAN

BIRCH POINT ROAD SANITARY DISTRICT
CARIBOU LAKE, ST LOUIS COUNTY, MINNESOTA

FILE NO. 8812001

SHEET G-3



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PROJECT DATE: XX/XX/XXXX	DRAWN BY: RWM				
CHECKED BY: CWS					
PLOT DATE:					

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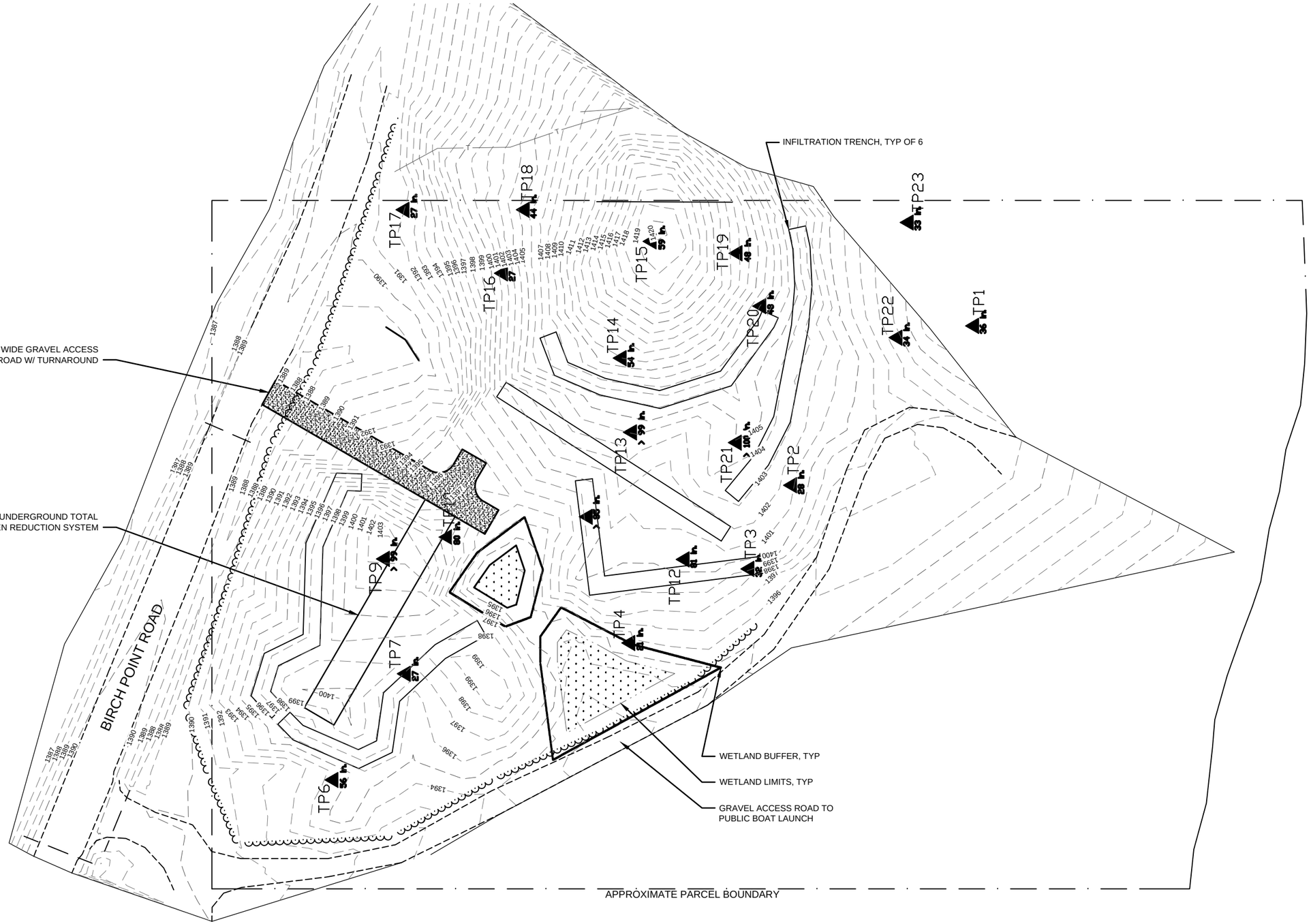
PRELIMINARY WASTEWATER COLLECTION SYSTEM PLAN

BIRCH POINT ROAD SANITARY DISTRICT
CARIBOU LAKE, ST LOUIS COUNTY, MINNESOTA

FILE NO. 8812001
SHEET G-4



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PROJECT NO.: 8812001	SCALE: AS SHOWN	NO.	DATE	REVISION	BY
PROJECT DATE: XXXX/XXXX	DRAWN BY: RWM				
CHECKED BY: CWS					
PLOT DATE:					

Preliminary

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PRELIMINARY WWTF SITE LAYOUT

BIRCH POINT ROAD SANITARY DISTRICT
CARIBOU LAKE, ST LOUIS COUNTY, MINNESOTA

FILE NO. 8812001
SHEET G-5

Petersen Supply

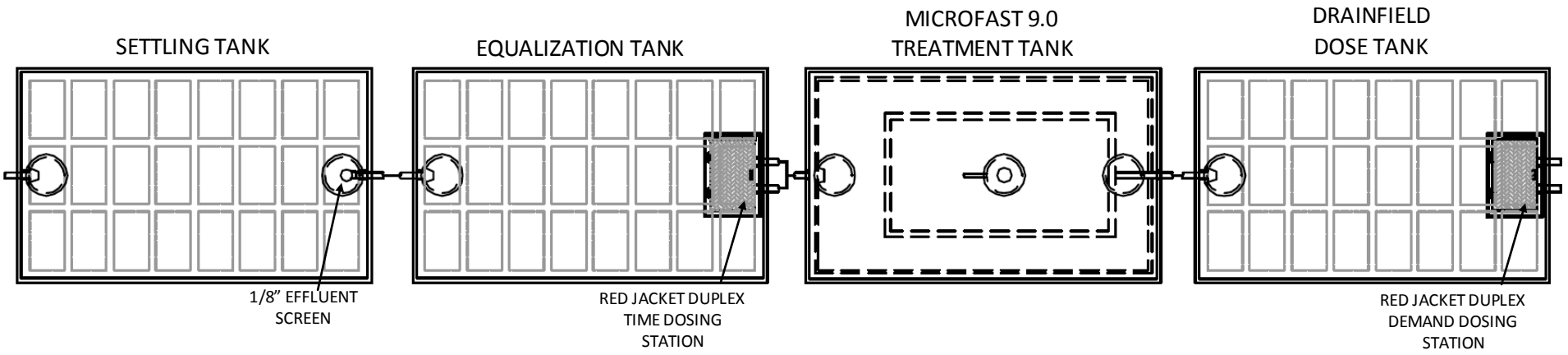
BIO MICROBICS™ 8500 GPD – MicroFAST 9.0

PRESENTED TO

CARL SCHARF

MSA Professional Services

CARIBOU LAKE COMMUNITY:	
Design Flow:	8500 GPD
Design BOD:	220 mg/L
Design Organic Loading:	16 lbs of BOD/day



Suggested Treatment Train:

- Settling tank sized for 24 hours flow (8500 Gallons min), gravity flow to,
- An Equalization Tank sized for 24 hrs flow (8500 gallon min.) with a pumping system that will time dose to,
- One (1) 8500 gallon (min) tank, containing one (1) MicroFAST 9.0, which will gravity flow to,
- Drain Field Dosing Tank

We at Petersen pride ourselves in giving our customers all the attention they need to assure the success of the systems we provide. We are a 24 hours a day, 7 day a week, service minded company. Please do not hesitate to call whenever a question or concern arises.

Petersen Supply

BIO MICROBICS™ 8500 GPD Total Nitrogen Reduction System

PRESENTED TO

CARL SCHARF

MSA Professional Services

CARIBOU LAKE COMMUNITY:

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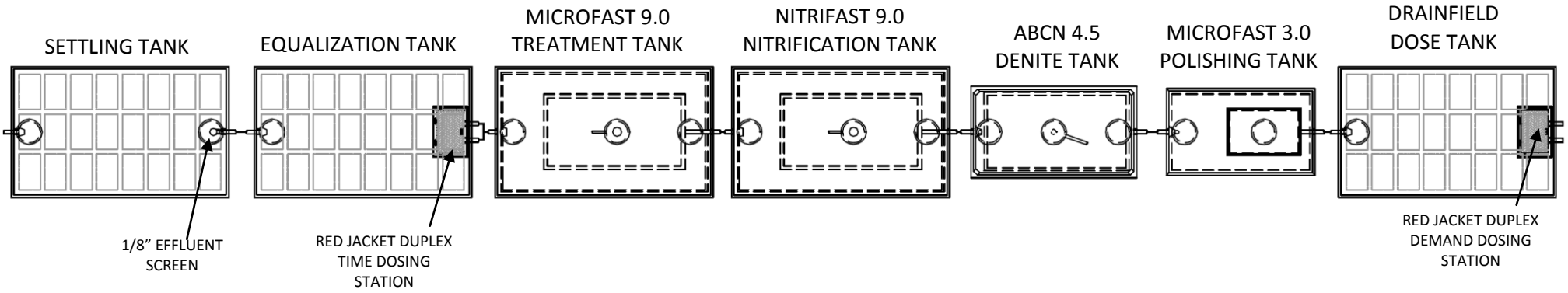

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- Settling tank sized for 24 hours flow (8500 Gallons min), gravity flow to,
- An Equalization Tank sized for 24 hrs flow (8500 gallon min.) with a pumping system that will time dose to,
- One (1) 8500 gallon (min) tank, containing one (1) MicroFAST 9.0, which will gravity flow to,
- One (1) 8500 gallon (min) tank, containing one (1) NitriFAST 9.0, which will gravity flow to,
- One (1) 5000 gallon (min.) tank containing one (1) ABC-N 4.5 unit, which will gravity flow to,
- One (1) 2250 gallon (min) tank, containing one (1) MicroFAST 3.0, which will gravity flow to,
- Drain Field Dosing Tank

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